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IMPROVE

Unfolding next generation demand-side
information (DSI) models for energy bills



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1 Résumé

En Suisse, la plupart des informations relatives à la consommation d'énergie disponibles sur les factures énergétiques correspondent aux exigences légales minimales imposées par les réglementations nationales. Par conséquent, les factures suisses sont souvent très similaires en termes de contenu et de présentation avec un tableau de données. Ils ne contiennent pratiquement jamais de point de comparaison avec laquelle la consommation du ménage pourrait être comparée.

Ce manque d'information n'aide pas les clients à évaluer leur niveau de consommation d'énergie et donc ne les encourage pas à changer leur comportement afin de réduire, pour le même confort, leurs besoins énergétiques, comme requis par la stratégie énergétique 2050 fixée par le Conseil fédéral suisse.

L'objectif du projet IMPROVE est de collecter et d'identifier les meilleures pratiques en matière de factures énergétiques suisses et étrangères, d'élaborer différentes présentations de ces factures et d'évaluer l'intérêt des consommateurs resp. des fournisseurs d'énergie, à recevoir et à mettre en œuvre des améliorations possibles sur les factures.

Pour atteindre cet objectif, plusieurs activités ont été menées, telles qu'une recherche bibliographique, la collecte et l'analyse de 91 factures de services énergétiques suisses et de 175 factures de services énergétiques étrangers, ou l'organisation d'entretiens et d'ateliers avec certains de ces fournisseurs. Sur la base des résultats, différentes propositions d'amélioration des factures énergétiques ont été élaborées.

Un premier sondage national a été mené, pour analyser la perception qu'ont les consommateurs suisses de leur facture énergétique actuelle, pour évaluer leur intérêt à recevoir des informations supplémentaires concernant leur consommation énergétique sur leur facture et également pour avoir leur avis sur de nouvelles propositions d'améliorations de leur facture. Puis, un second sondage national a été mené pour évaluer l'intérêt des fournisseurs d'énergie ainsi que les avantages et inconvénients (coût, disponibilité des données, etc.) de la mise en œuvre de chacune des factures énergétiques améliorées conçues dans le cadre du projet IMPROVE.

Enfin, une liste de recommandations a été élaborée, tenant compte des idées et suggestions des consommateurs et des fournisseurs énergétiques, indiquant les voies possibles pour une évaluation à grande échelle de leur efficacité en terme de mesure d'économie d'énergie.



2 Zusammenfassung

In der Schweiz entsprechen die meisten auf den Energierechnungen verfügbaren energiebezogenen Informationen den gesetzlichen Mindestanforderungen. Dadurch gleichen sich die Rechnungen hinsichtlich Inhalt und werden meist in Form einer Datentabelle erstellt. Fast nie enthalten sie Benchmark-Werte, mit denen der Haushaltsverbrauch verglichen werden kann.

Diese fehlenden Informationen behindern eine Beurteilung und Optimierung des Energiebedarfs durch die Verbraucher. Damit tragen die Energierechnungen auch nicht dazu bei, die vom Bundesrat festgelegte Energiestrategie 2050 zu erreichen.

Ziel des IMPROVE-Projekts war es, vorbildliche Ansätze bei Energierechnungen von Schweizer und ausländischen Energieversorgern zu sammeln und zu analysieren, verschiedene Layouts von Rechnungen zu entwickeln und die Interessen von Nutzern und Energiewerken bezüglich Verbesserungspotentialen auf den Rechnungen zu erheben.

Als Beitrag zu diesem Ziel wurde eine Literaturrecherche durchgeführt, 91 Rechnungen von Schweizer und 175 Rechnungen von ausländischen Versorgern gesammelt und analysiert sowie Interviews und Workshops mit einigen Schweizer Energieversorgern durchgeführt. Basierend auf den Ergebnissen wurden verschiedene Vorschläge zur Verbesserung der Energierechnungen entwickelt.

Anschließend wurde eine erste nationale Umfrage durchgeführt, um die Wahrnehmung von Verbrauchern ihrer heutigen Energierechnungen zu analysieren. Ebenfalls wurde erhoben, ob die Verbraucher Interesse an zusätzlichen energiebezogenen Informationen auf ihrer Rechnung haben und wie sie die Vorschläge des Projektes IMPROVE dazu beurteilen. In einer zweiten Umfrage wurden die Interessen der Energieversorger und ihre Beurteilung der Projekt-Vorschläge zur Verbesserung der Energierechnungen abgefragt. Der Fokus lag dabei unter anderem auf den Kosten und der Daten-Verfügbarkeit bei einer allfälligen Umsetzung.

Abschließend wurde eine Liste mit Empfehlungen erstellt, in der die Rückmeldungen und Vorschläge von Kunden und Versorgungsunternehmen berücksichtigt wurden. Diese beinhaltet die Angabe möglicher Wege für eine umfassendere Bewertung ihrer Effizienz als Energiesparmaßnahme.



3 Abstract

In Switzerland, most of the energy related information available on the energy bills corresponds to the minimum legal requirements imposed by national regulations. Consequently, Swiss bills are often very similar in terms of contents and presentation with a table of data. They barely ever include a benchmark against which the household consumption could be compared.

This lack of information does not help consumers to evaluate their level of energy consumption and makes an energy bill not particularly supportive of behaviour change to reduce, for the same confort, their energy needs, which is required to achieve the Energy Strategy 2050 set by the Swiss Federal Council.

The aim of the IMPROVE project was to collect and identify best practices in Swiss and foreign energy bills, to develop different energy bill's layouts and to evaluate consumers' and utilities' interest to receive and implement possible enhancement to energy bills.

To achieve this goal, several activities were conducted such as a literature review, collecting and analysing 91 bills from Swiss utilities and 175 from foreign utilities, or undertaking interviews and workshops with some Swiss utilities. Based on the findings different proposals of energy bill enhancements were developed.

Then a first national survey was conducted to analyse the Swiss energy consumers' perception of their current energy bill and to gauge their interest to receive additional energy related information on their bill and their acceptance of the proposed energy bill's layouts. A second national survey was conducted to assess utilities' interest and the advantages and drawbacks (cost, data availability, etc.) to implement each of the enhanced energy bill's layouts designed during the IMPROVE project.

Finally, a list of recommendations was elaborated, taking into account insights and suggestions from both customers and utilities, indicating possible pathways for a large scale assessment of their efficiency as an energy saving measure.



4 Introduction

The Swiss Energy Strategy 2050 aims to increase the use of renewable energy and the energy efficiency of buildings, mobility, industry and appliances (Swiss Federal Office Of Energy, 2017). An additional important element of this strategy is the reduction of the energy demand in Swiss households, which requires a change in energy consumption behaviour. Consumer behaviour is also one of the main topics within the research program “Energy in Buildings” of the Swiss Federal Office of Energy (SFOE). The consumers are affecting the energy demand of modern buildings more than the construction quality. However the research of the relation between consumption behaviour and possible influences are still at the beginning.

An important driver for promoting the change of energy consumption behaviour of private households can be seen in the information available for the consumers on his energy consumption. This information can rise the consumer’s awareness on his level of energy consumption and, to encourage him to find information on how to reduce his energy consumption and at the end to target the most efficient measures he can enforce.

Before to go further, it is relevant to clarify the two following important concepts for a better understanding of the current report.

- The *demand-side information* (DSI): energy DSI is defined as information about customers’ use of energy (Ford, 1990). It includes any possible mean to provide this information, including the energy bill, smart-meter reading, webportal recording the household energy consumption history, a dedicated smartphone app, etc.
- The *demand-side management* (DSM): DSM is defined as planning, implementation, and monitoring of those utility activities designed to influence customer use of energy in ways that will produce desired changes in the utility’s load shape, i.e., changes in the time pattern and magnitude of a utility’s load (Gellings, 1985). For the consumers, it correspond as any information (leaflet, webpage, etc.) that could suggest a solution to reduce the energy consumption.

As DSI and DSM measures are mostly applied mutually, in some cases it is challenging to distinguish between these two concepts. In the IMPROVE project the considered DSI is the energy bill, as the invoice is the principal source of information for the consumers and any consumers received an invoice at a regular time step. In addition any enhancement of the energy bill information, will be visible for all consumers. This is not the case for other DSI or DSM, which requires a conscious desire for information seeking, and an addition physical action to get the information (connection to a webportal, access the smart-metering, consult a smartphone to access a dedicated application, ...). These additional actions to access the information requires additional infrastructure and are interesting for people who are sensitive to energy efficiency.

Figure 1 illustrates the distinction between DSI and DSM and used in the IMPROVE project. The DSI should raise the awareness of the consumer regarding tits energy consumption and the DSM will help the consumers to target possible solution that he can apply in his daily life based on addition information provided by utilities (DSM).

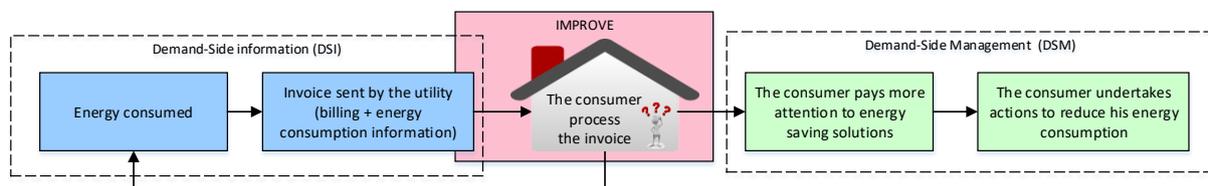


Figure 1: Distinction between DSI and DSM.

Research on ways to enhance the utility bill so as to give customers more control over their energy use has been going on since at least the 1980s, when utility companies first introduced Demand-Side Management (DSM) programmes which aimed at stimulating customers to modify their consumption patterns, both in the period of the day time and in the overall amount of energy consumed (Gellings and Chamberlin, 1988). Such DSM programmes have recently been regarded as even more valuable and powerful tools, now that it is widely acknowledged that the society as a whole, and therefore customers as well, play a role towards carrying out the energy transition and achieving international climate and environmental protection goals.



Since the scope for motivating households to change their energy consumption through informative billing can depend on national legislation and technology level, it is important to conduct country-specific analyses in order to develop tailored recommendations. Against this background, the potential of low cost, quickly realisable measures to improve information on energy bills in order to motivate households to reduce their energy consumption has been assessed for the Swiss context. As an outlook, some ideas of what the trends of digitalization and market evolution might imply for demand-side information (DSI) measures in general and energy billing in particular need to be clarified.

5 Goals of the project

The point of departure of the IMPROVE project is the information gap between utilities and their customers: the utilities possess more and more detailed energy metering data, out of which only a minor part is provided to the customers through billing. They also provide more and more DSM to help consumers to reduce their energy consumption. On the one hand customers strive for simplicity and transparency but do not want to be overloaded with the information regarding their own consumption in too much detail. However, by deploying appealing visual elements, designs and taking advantage of new IT and metering technologies it becomes possible to present a large quantity of information in a simple, transparent and appealing way, which could increase perceptiveness of the customers and possibly motivate them to rethink their energy-related behaviour.

In order to get an overview of the state of the art in the demand-side information (DSI) field in Switzerland and abroad and to identify improvement potentials, the project IMPROVE has been initiated by four Swiss universities of applied sciences: HES-SO, SUPSI, FHNW and ZHAW. This project also includes eleven energy utilities disseminated around Switzerland, who kindly accepted to share their vision to enhance the information provided on their clients' energy bill and to disseminate a consumers' survey developed during the project to better understand the consumer's expectation in terms of energy related information available on their bill, in the national context.

The objectives of the IMPROVE project is to assess the interest of enhancing the information available on the energy bill (DSI) of the Swiss households as a trigger to rise their awareness on their energy consumption level and to encourage them for changing their behaviour by applying energy efficient solutions provided by the energy utilities (DSM). Therefore, it becomes essential understanding if and how utility companies are providing customers with information on their energy consumption patterns or if the way such information is provided is effective in increasing customer awareness and in motivating them to engage in energy-saving actions. It is therefore relevant to gain a broader insight into the information contents and design elements of energy bill currently provided by energy utilities in Switzerland, Europe and overseas, in order to allow the identification and categorization of existing practices. This review of existing energy bill practice, will then be used to evaluate the potential of creating consumer's awareness regarding its level of energy consumption. Based on these results, different DSI for energy bills will be proposed and submitted to a panel of consumers to evaluate their relevance. The results of the consumers' survey will be used to support the elaboration of recommendations for energy utilities.

The present report is divided into the following chapters:

- The chapter 6 presents a literature review on the important factors affecting the energy consumers' behaviour, including different approaches (models) developed to better evaluate the connection between the level of information and the consumer's attitude in the energy context.
- The chapter 7 aims to analyze the DSI practice on energy utilities' bill in Switzerland. In order to identify and characterize DSI practice in Switzerland, a literature review, an online survey for energy utilities finally some interviews with decision makers in energy utilities have been carried out. This allowed to identify a set of indicators used in the energy bills and to make a categorization of proposed energy related information, as a frame of reference to assess energy bills.
- The chapter 8 presents DSI practice from on energy utilities' bill from European and overseas countries. First, a literature review was carried out, in order to identify practices and elements characterizing DSI practice. This allowed to identify a set of indicators used in the energy bills and to make a categorization of proposed energy related information, as a frame of reference to assess energy bills. In parallel, the data collection was also performed with an online survey questionnaire



targeting European and overseas utility companies, an Internet search on utility companies' websites and an informal collection of energy bills from the networks of personal contacts of the researchers involved in the IMPROVE projects.

- The aim of the chapter 9 is to develop different information layout to be displayed on energy bill to help consumers to have a better evaluation of their energy consumption level. To achieve this sensitive goal, several activities have been performed. First, a literature review has been undertaken on energy-related behaviour, behaviour change models and energy feedback in order to better understand which elements constitute an effective DSI for energy consumers and their relative importance from the scientific point of view. Secondly, a complementary desk (analysis of DSI pilot projects) and field (expert interviews with representatives of two utilities from north-eastern Switzerland) has been conducted. Finally all the previous findings have been used to suggest five different enhanced energy related information for energy bill. The consumers' interest in these solutions has been evaluated in the customer satisfaction survey (chapter 6)
- The chapter 10 presents the procedure and the results of a national survey that was conducted to gauge energy users' opinion on the type of energy related information currently available in their energy bill. The survey aims also to evaluate consumers' interest to improve knowledge and behaviours towards their energy consumption. The focus is both on electricity and on heating consumption information as evidence suggests that little effort has been made to improve household heating information due to difficulties in getting appropriate feedback. In addition, the survey gathers views on medium and mode of presentation preferences of consumers as research indicated that most experimental studies do not seem to reflect these aspects.
- The chapter 11 aimed to frame utilities' needs and concerns in the context of enhanced energy billing and possible recommendations to be made to Swiss utilities for future improvements of DSI. Thus, an online survey was launched involving a wide network of Swiss utilities to explore their position in regards to the feasibility, data availability, potential costs and benefits related to the implementation of the six IMPROVE Solutions proposed within this research project as possible approaches to improve energy billing information. In total, 48 energy utilities from all over Switzerland replied to the survey, making it possible to gather some useful insights on the matter. This input was further enriched with feedback gathered from specific workshops hosting those energy utilities officially collaborating as partners in the research project. In this occasion, a more in-depth discussion of the IMPROVE Solutions occurred and results gathered from the customers' perspective (chapter 10) were also presented and integrated. This enabled the elaboration of final recommendations, which take into account both customers' and utilities' insights and suggestions.
- The final chapter 12 aims to suggest some pathways in order to develop, implement and test advanced DSI in Switzerland, based on the results collected in the present project. Regarding DSI and future possible implementation, both applications (electricity and thermal) have been considered. Based on an identification of the key aspects to consider when developing DSI approach for energy, two possible implementation ways have been proposed regarding 1) electricity and 2) thermal energy consumption. It describes why thermal energy DSI might be harder to implement since it requires to collect and process more data while it also requires to interact with more stakeholders and heterogeneity of situations. Conversely, DSI related to electricity appear to be "simpler" to implement even if it requires to deal with more constrained communication's channel (billing format constrained also). Both implementations are of interest and could be tested as depicted in this final chapter.

All these chapters are detailed here after.



6 Energy consumers behaviour

The energy consumption behaviour of consumers is determined by a complex interaction of different influencing factors. Behavioural models can help to deal with this complexity and accordingly to understand why consumers act as they do. Selected models and applied approaches are shown in the following sections for giving an insight of what determines energy consumption behaviour and how behaviour change can be initiated.

In many behaviour change models information is an important factor. As in the below shown model of pro-environmental behaviour, these models are linear: Information generates knowledge, knowledge forms attitudes, attitudes trigger behaviours (Kollmuss and Agyeman, 2002). The popular AIDA model in marketing theory (Awareness, Interest, Decision, Action) is another example of such an information-based rational choice model (Darnton, 2008).

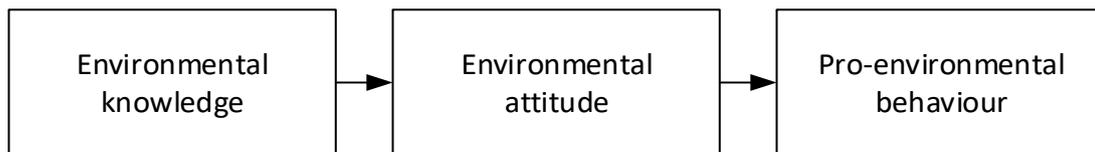


Figure 2: model of pro-environmental behaviour (Kollmuss and Agyeman, 2002).

In practice, information alone is insufficient to lead to an action. Also, the relationship between attitudes and behaviour is often less strong. Usually attitudes affect the behaviour, but sometimes it seems to be the other way around. This can exemplarily be observed in environmental issues. As an example: "...why, if people care about polar bears, they still drive SUVs" (Monroe et al., 2008). The "Value Action Gap" describes this difference between attitudes and behaviour. Therefore, other models are used in social-psychology, which consider the "Value Action Gap" and other factors determining the behaviour (Darnton, 2008). A widely used social-psychological model is the "Theory of Planned Behaviour" (TPB), illustrated in Figure 3. It states that not only the attitude towards the behaviour but the subjective norms and perceived behavioural control as well, influence behavioural intention and behaviour. The attitudes toward the behaviour are shaped by the beliefs about the outcomes and their evaluation. The relative importance of the attitude and the norm is further influencing the behavioural intention, which leads to behaviour (Ajzen, 1991).

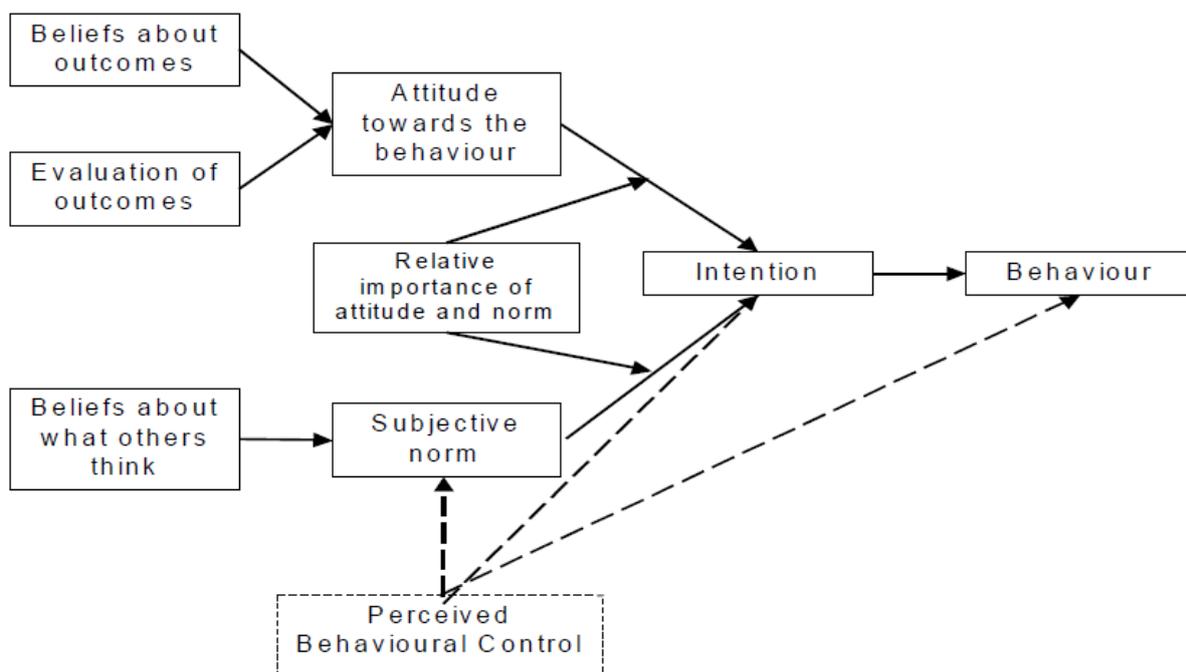


Figure 3: Theory of Planned Behaviour (TPB) (Darnton, 2008).



Due to their strong focus on psychological factors, most of the social-psychological models such as the TPB do not include external factors. However, to describe the energy consumption behaviour of household consumers, external factors can play a considerable role. Therefore, the European Environment Agency adapted the “Needs Opportunities Abilities” model of consumer behaviour (Gatersleben and Vlek, 1998) for the use in the energy consumption context.

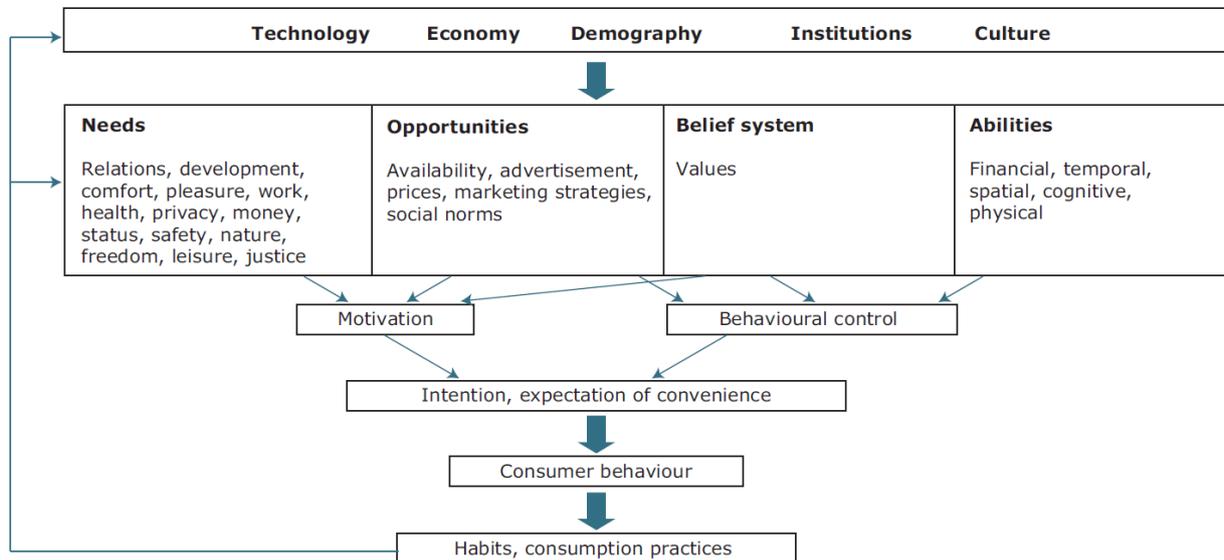


Figure 4: Main factors influencing consumer behaviour and emergence of consumption (European Environment Agency, 2013).

This model includes external factors in addition to behavioural determinants suggested by the TPB. It states that the relationships between the various factors influencing behaviour and consumption practices are dynamic. They change over time and are somewhat irrational and to some extent unpredictable (European Environment Agency, 2013).

A different approach is suggested by the Norm Activation Model. This model acknowledges that in order to sustain pro-environmental behaviour, consumers need to be motivated by normative reasons instead of incentives to prevent reversal to the original behaviour (De Young, 2000). As illustrated in Figure 5, the model suggests that information influences personal norms and values. These are weighted in conjunction with other motivational factors, such as social norms and values and external incentives. This weighting process results in a decision, which in turn leads to action.

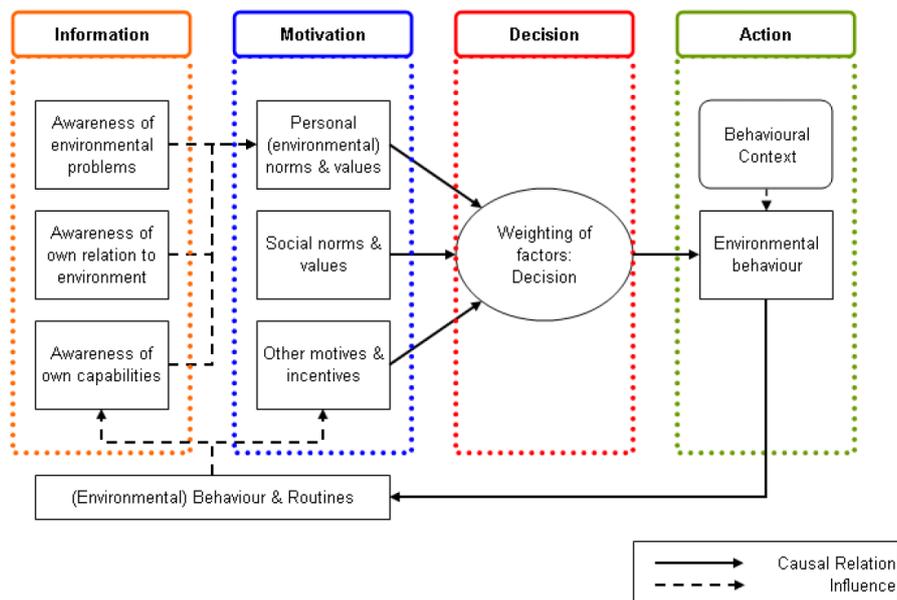


Figure 5: Norm activation model, interpreted by Hemmes et al. (2012).



As it can be seen, social science models like these can improve our understanding of individual and societal responses to behaviour change initiatives (European Environment Agency, 2013). These models can be used in the field of energy consumption behaviour for conceiving effective consumer information models. And there will be used in the current project to propose new possible DSI for energy bill, called here after IMPROVE solutions, that has been evaluated with a national survey that was sent by the partner utilities to a panel of consumers.

6.1 Feedback and Demand-Side Information (DSI)

As stated in behavioural models and in behaviour change approaches, information and feedback are important elements to enable behaviour change. Information, as a widely used strategy to promote efficient energy consumption behaviour, can be classified in general information about energy-related problems, or specific information about possible solutions, such as information about possible energy-saving measures (Abrahamse et al., 2005). Information is also necessary to make consumers aware of their current use, link their behaviour and consumption and reduce energy consumption (Matthies, 2005). Therefore feedback is often applied to promote an efficient energy consumption by giving households information about their consumption or energy savings (Abrahamse et al., 2005). In accordance with a study of the European Environment Agency (Darby, 2006), the following main types of feedback can be used to change behaviour.

Direct feedback: available on demand. Learning by looking or paying.

- Self-meter-reading
- Direct display
- Interactive feedback via computer

Indirect feedback: raw data processed by the utility and sent out to customers. Learning by reading and reflecting.

- More frequent bills
- Bills including historical feedback
- Bills including comparative/normative feedback
- Bills including disaggregated feedback

Inadvertent feedback: learning by association.

- With the advent of microgeneration, the home becomes a site for generation
- Community energy conservation projects

Utility controlled feedback

- Via smart meters with a view to better load management

Energy audits

- Undertaken by a surveyor
- On an informal basis by using a software (e.g. carbon calculators)

Studies on the effect of feedback on energy consumption behaviour are numerous and differ widely in their methods and results. However, there are a several factors that constantly appear in these studies, despite the different results of the studies regarding their relative importance for an effective energy feedback. Findings regarding these reoccurring factors are summarised in the subsequent assessment based on the analysis of meta-studies.

6.2 Feedback Frequency

It can be stated that the frequency has an impact on the energy consumption behaviour. Most of the studies listed below report a positive effect of a high feedback frequency. A further study in 1995 (Wilhite and Ling, 1995) resulted in energy conservation of 10% after three years, if the bill is sent two-monthly instead of yearly. A shorter period makes energy consumption more visible and increases both the consumer's awareness and his understanding of consumption and costs (Wilhite and Ling, 1995). It can be concluded that frequent information is highly important for an effective DSI.



Study	Findings
Karlin et al. 2015	There is no significant effect apparent.
Erhardt-Martinez et al. 2010	Daily/weekly feedback and real-time plus feedback generates the highest savings per household (“plus” means, that useful details on energy are provided additionally to the consumption).
Neenan 2009	There are little differences in savings between studies using various levels of feedback frequency.
Fischer 2008	Daily or more frequent feedback are associated with the highest savings compared to weekly to monthly and less than monthly.
Darby 2006	Direct feedback provided by the meter or an associated display monitor results in more savings (5-15%) compared to indirect feedback provided by the billing (0-10%).
Abrahamse et al. 2005	The more frequent feedback is given, the more effective it is.

Table 1: The effect of feedback frequency on energy consumption behaviour, literature review.

6.3 Feedback Medium

A further influencing factor of feedback effectiveness is the medium through which the feedback is provided. These mediums can be categorised as utility bill, card (e.g. door hanger), monitor (e.g. electronic device that provides energy information), or computer (e.g. software or web-enabled program) (Neenan, 2009). (Fischer, 2008) states in a meta-analysis that computerised or interactive feedback will be more effective at stimulating behaviour change as it enhances the opportunity for users to engage with feedback. Karlin et al. (2015) on the other hand did not find a significant effect of the medium when comparing billing with door hanger, monitor and online tool/software. However, the advantages of electronic feedback as its flexibility and ability to quickly process and present actual consumption are mentioned. Furthermore, interactive tools may stimulate users' curiosity. Based on these findings it can be concluded, that the effect of the medium on the effectiveness of a DSI is existing, although not highly important.

6.4 Feedback Content

All of the analysed studies provide information about both energy consumption and costs, so that a differentiation between these two aspects is not possible. An effect of additional environmental information is either not found (Fischer, 2008; Karlin et al., 2015) or not clear (Abrahamse et al., 2005). A possible reason might be target-group specific differences in responsiveness to different feedback contents. The knowledge about energy consumption and energy-saving possibilities can be already present to some households. In this situation, additional information may cause an information overload. Moreover, the usefulness of information depends strongly on how it is presented and whether it is specific to the needs of the target group (Fischer, 2008).

6.5 Comparison

Comparison can be divided in three basic types. Historical comparison relates actual to prior consumption. Normative comparison compares consumption to that of other households (e.g. regional average, households in the neighbourhood, similar households). Goal based comparison compares the consumption to a defined consumption goal. Comparison may stimulate specific motives for energy conservation (e.g. competition and ambition) and may reveal whether the consumption in a certain period is “out of the norm” (Fischer, 2008). Normative comparisons may be problematic because the consumers may be unhappy with the comparison group they are assigned in or do not accept being compared with others (Darby, 2006). It is also questionable, whether the consumers would be motivated to reduce consumption further if they are already consuming less than the comparison group. The study review below shows ambiguous results regarding the effect of different comparison forms on energy consumption.



Study	Findings
Karlin et al. 2015	Goal based comparison has a significant and positive effect on energy consumption. There is no significant effect of historical and normative comparison.
Fischer 2008	There is no effect of normative comparison. A conclusion regarding historical comparison is not possible since all studies include them.
Darby 2006	Historical feedback is more effective than goal based comparison.
Abrahamse et al. 2005	There is no difference between the effect of comparative and individual feedback.

Table 2: The effect of comparison on energy consumption behaviour, literature review.

6.6 Aggregation

Providing disaggregated information, for example for specific rooms, appliances or times of the day is almost the only way of providing a direct link between action and result (Fischer, 2008). As it can be seen in Table 3, most studies reported a positive effect of disaggregated information.

Study	Findings
Karlin et al. 2015	There is no significant effect apparent.
Neenan 2009	Appliance level information shows a positive effect.
Fischer 2008	Evidence for a positive effect.
Darby 2006	“is seen as useful by customers”

Table 3: The effect of aggregation of information on energy consumption behaviour (literature review).

6.7 Feedback Duration

The findings concerning feedback duration state, that after an initial learning phase, user stops engaging with the feedback and the energy conservation decreases (Karlin et al., 2015) However, feedback which is given over a longer time may result in persistent effects because new habits can be created during that time (Fischer, 2008). The findings regarding feedback duration vary (Table 4) and the applicability to billing DSI is limited since billing is continuous per definition.

Study	Findings
Karlin et al. 2015	The effect is marginally significant and follows a U-type curve. The minimum of the effect is situated at a duration of the feedback of 3-12 months. The effect is higher for a feedback duration of less than 3 months and more than 12 months.
Erhardt-Martinez et al. 2010	Shorter studies tend to be associated with more savings than the longer ones. However, this is more likely due to ignoring seasonal differences than due to higher effectiveness of short term feedback.
Fischer 2008	There is no clear indication that long term feedback lead to more savings than short term.
Darby 2006	Feedback is more effective, if it is provided over a period longer than 3 months.

Table 4: The effect of feedback duration on energy consumption behaviour (literature review).

In summary, it can be acknowledged that the feedback frequency is a highly important determinant for effective DSI models. Moreover, there is also a strong evidence for the positive effect of providing



disaggregated information, preferably at the appliance level. Potential of computerised and interactive elements could be also considered as rather high as well as target-group-specific tailoring of feedback content. Finally, despite the undeniable potential of comparisons (historical, normative or goal-based) arising from theoretical literature, empirical evidence of their effect on energy consumption is still ambiguous, resulting at least partly from differing quality and limited number and comparability of existing evaluation studies.

Finally, it has to be highlighted that, although insightful, the findings from the meta-studies on energy feedback have to be interpreted with some caution. The reasons for this lie primarily in the limited number of evaluation studies, variety of different approaches and consequently limited comparability as well as in some cases sub-optimal experimental designs not allowing to distinguish between a pure feedback effect and the effect of other applied intervention strategies such as goal setting, general information, financial incentives etc.

These factors will be taken into account during the different activities undertaken within the framework of the IMPROVE project to have a better understanding of their influences in the national context.



7 Existing DSI in Switzerland

The energy sources considered in the Improve project - electricity, gas and district heating - are supplied in Switzerland by a large number of energy utilities. The supply situation for private households differs greatly from the European and global environment in terms of the density and size of energy utilities (electricity supply in 2016 with 645 electricity network operators (EiCom, 2016), including many very small suppliers) and the market situation (no free choice of supplier for consumers under 100 MWh/a (StromVG, 2015). chapter 7 of the project therefore separately examines billing by Swiss energy utilities; the situation outside Switzerland is considered in chapter 8.

The objective of this chapter is to describe the current format of the energy bills, sent by Swiss energy utilities to private households. The following factors in particular have been taken into account:

- Information content
- Presentation of information (type and location)
- Billing (delivery method, billing interval, type of payment)
- Examples of best practice
- Possibilities for further improvements

7.1 Approach and Methodology

The study of current billing by energy utilities in Switzerland is divided into the following steps:

- 1. Basic principles:** analysis of the informative elements and invoice procedures commonly applied to energy bills
First, existing properties of bills (information content, presentation and billing) that are used in Switzerland are explored. Special attention is also paid to the specific Swiss market situation, the legal requirements, the technical (information available) and legal (e.g. information usable with regard to data protection) framework conditions. The basis for this is a literature review and a first review of bills, which are personally collected in the circle of acquaintances. In step 3, further bills are collected via the Energy utilities.
- 2. Survey of energy utilities via online survey**
Based on the previously defined characteristics, a survey was developed, which contained further questions (e.g. type and frequency of bills, other sources of information, use of additional consumer information, etc.) to complete the picture and gather more in-depth information from Swiss energy utilities. Participants to the survey were asked to provide also a bill sample from their company, if possible.
The survey was translated (de, fr, it) and distributed by the academic partners in cooperation with the partner energy utilities to a total of 185 Swiss energy utilities via e-mail.
- 3. Collection of bills from energy utilities**
Bills were collected on the websites of the energy utilities, among friends and colleagues (step 1) and via the online survey. A total of 91 bills have been collected from 47 different energy utilities. This provides a reasonable overview of current energy bills in Switzerland.
- 4. Evaluation and results**
The responses to the survey and evaluation of the collection of bills are statistically evaluated and compared. Excerpts from bills (good practice) are shown for illustration.



7.2 Basic principles: analysis of the informative elements and invoice procedures commonly applied to energy bills

The analysis of the informative elements and invoice procedures commonly applied to energy bills developed are based on a literature review and are supplemented by a random check of already personally collected bills. The literature review aims at elaborating the following topics within the context of energy billing practices:

- General studies on energy bills
- Factors influencing information-induced changes with regard to increased household efficiency
- Energy-saving potentials of households and information required for presentation
- Legal basis of energy billing
- Special characteristics of the Swiss market

The last two points focus on the supply of households with electricity.

Greater focus is placed on household electricity consumption (excluding heat generation) than the supply of gas and district heating in this work for the following reasons:

- Household energy consumption depends very much on the user (Frequency of use, but also on the quality of the installed devices). The strong influence of the user can be seen, for example, in the fact that inefficient single-family houses consume up to 14 times more household electricity than efficient ones (Gasser, 2014).
- In addition to user behaviour, heating consumption depends mainly on the quality of the building envelope (thermal insulation) and building technology (e.g. comfort ventilation with heat recovery) and can therefore only be influenced to a limited extent by the user.
- Heat generation with electricity (heat pumps) is increasingly replacing fossil fuels, and district heating is often only widely available in densely populated areas.

The result of the review is a catalogue of content elements and billing procedures, which are used as the basis for the survey and analysis of the collected bills.

For this purpose, the content elements and billing procedures are divided into the following groups:

- Energy sources
- Billing
- Statutory requirements
- Comparative values
- Potential savings
- Environmental impact
- Tips and recommendations
- Billing explanations
- Presentation
- Technical requirements
- Additional information about customers
- Additional information for customers
- Energy utilities in Switzerland

7.2.1 Energy sources

The energy sources of electricity, gas and district heating are considered. Some questions are only useful for one or two energy sources or must be formulated differently. Information on the quantity of energy supplied per energy source allows a statement to be made about the representativeness of the energy utilities in comparison with the Swiss market structure (cf. section 7.2.13.2).



7.2.2 Billing

Billing is relevant for the options for presenting information, determining its delivery and frequency, as well as for its perception by the customer.

7.2.2.1 Billing format

In this context, format refers to the medium of presentation and delivery.

With regard to the format, the following features are taken into account (Karlin et. al., 2015 and Duscha et. al., 2007):

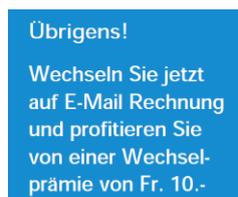
- Colours used. Colors can help to understand more easily diagrams and other data presentation. (due to printing costs, paper bills are usually two-colour, see chapter 11)
- Printing resolution used. Higher printing resolution helps to read characters more easily and makes it more appealing for the recipient to read. However often printers are used with lower printing resolution.
- Static/interactive presentation (static: all necessary information is presented invariantly, interactive: consumption can e.g. be presented in real time, detailed information is presented on request, etc.)
- The technical options open to the recipient (not every customer has an email account or can handle an application)
- The option to collect specific customer data and thus to generate specific comparisons (with online accounts and applications specific data can be collected, cf. also section 7.2.12). It is to be assumed that energy utilities can use the data collected in this way and thus create a motivation to offer corresponding options.
- Costs (postage costs, online portals generate more maintenance costs than email mailing lists, etc.)

The most common formats and properties important for presentation are shown in Table 5.

Description	Specifications
Paper bill with postage	For cost reasons black and white only, shipping costs are incurred, static presentation, possible for all customers
Email with attachment (PDF)	Static presentation, email account required
E-bill (e-banking, postal finance)	Static presentation, details usually visible in attached PDF, e-banking required
Online account	Interactive, collection of customer data possible, Internet access required
App on mobile device	As with online account

Table 5: Format and properties for billing

Some energy utilities are increasingly interested in encouraging customers to switch to online bills (e.g. by charging for postage or with premiums switching, as shown in Figure 6).



“Switch now to online bills and receive a 10.- CHF bonus”

Figure 6: Excerpt from EKZ bill, 2016, page 2



7.2.2.2 Payment method

The payment method is relevant for the perceptibility of information presented on the bill (see Table 6).

Description	Perception of presented information
Normal bill (payment slip)	Direct perception of energy and total costs, information visible, as bills usually have to be browsed through (payment slip often at the end)
E-bill (e-banking, postal finance)	Direct perception of total costs, bill details do not have to be viewed (PDF available, but must be opened)
Direct debit procedure	Automatic payment, no perception of costs or bill details
Pre-paid counter	Direct perception of costs, further information only observable under certain conditions

Table 6: Payment methods

7.2.2.3 Payment type

The payment type is relevant for the frequency of the bills and the amount charged per bill, as well as the information presented on the bill. Since only part of the total bill amount is charged per bill for advance payments, changes (for example, due to an increase in consumption) to the total amount on the individual bill result in a smaller change and are therefore less noticeable.

The three most common payment types are shown in

Description	Specifications
Normal bill	Regular billing in the accounting period. Consumption is presented, and information based on it can be presented
Advance payment (payment on account)	Regular prepayment of a fixed amount. Effective consumption and values based on it are only visible in the final bill
Pre-Paid	Advance payment with irregular frequency, according to current consumption, current consumption can be presented, additional information based on this only under certain conditions

Table 7: Payment type

Description	Specifications
Normal bill	Regular billing in the accounting period. Consumption is presented, and information based on it can be presented
Advance payment (payment on account)	Regular prepayment of a fixed amount. Effective consumption and values based on it are only visible in the final bill
Pre-Paid	Advance payment with irregular frequency, according to current consumption, current consumption can be presented, additional information based on this only under certain conditions

Table 8: Payment type

From the energy utilities' point of view, it is probably not the frequency of billing of the various payment methods that is decisive, but rather whether and how reliably customers settle their bills or not.



7.2.2.4 Frequency

As found in Artho et. al. (2012), Wilhite and Ling (1995) and Suter (2017) information provided more frequently leads to a greater change in behaviour, and thus to greater energy savings as when information is provided rarely.

Frequency is influenced by the payment type, which each energy utility can freely choose, and the reading interval, which is influenced by the meter used. Meters with remote reading can be read more often due to the lower degree of effort required, and offer better conditions for more frequent billing.

7.2.3 Statutory requirements

7.2.3.1 Consumption and costs

Billing in Switzerland is regulated by EICOM (EICOM, 2014), at least for electrical utilities. The following minimum requirements for information presented must be observed (see Figure 7).

A. Netznutzung (inkl. Systemdienstleistungen) Grundtarif Netznutzung (falls vorhanden) Leistungstarif Netznutzung (falls vorhanden) Arbeitstarif Netznutzung	in CHF/Monat in CHF/kW in Rp./kWh	Total CHF Total CHF Total CHF
B. Energielieferung Grundtarif Energie (falls vorhanden) Leistungstarif Energie (falls vorhanden) Arbeitstarif Energie	in CHF/Monat in CHF/kW in Rp./kWh	Total CHF Total CHF Total CHF
C. Abgaben und Leistungen an Gemeinwesen	in Rp./kWh	Total CHF
D. Bundesabgaben zur Förderung erneuerbarer Energien sowie zum Schutz der Gewässer und Fische	in Rp./kWh	Total CHF
E. Bezeichnung des Messpunktes (z.B. CHXXXXX012345000000000000XXXXX)		in Zahlen

Figure 7: Minimum billing requirements (EICOM, 2014)

According to Laurich and Lamieri (2008), much of the information that is required by law is of little interest to the customer (cf.

Figure 8).

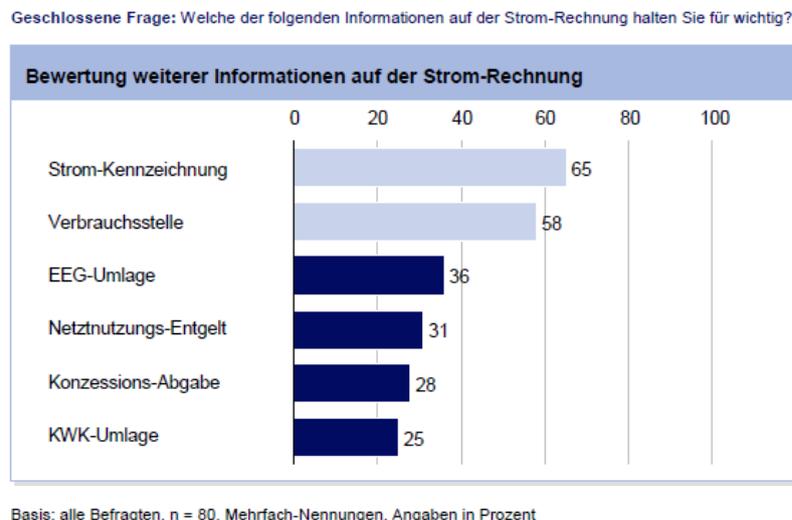


Figure 8: Importance of further information on the bill (Laurich and Lamieri, 2008)



7.2.3.2 Energy mix (electricity labelling)

In addition, requirements for Fuel Mix Disclosure must be met (UVEK, 2016). In accordance with the Energy Act (EnG) and the Energy Ordinance (EnV), all end-users must be informed at least once per year about the percentage shares of the energy sources used and the origin of the electricity. In addition to the content of a declaration, also minimum requirements are defined for the format (table format) cf.

Figure 9.

Stromkennzeichnung		
Ihr Stromlieferant:	EVU ABC (Bsp.)	
Kontakt:	www.evu-abc.ch, (Bsp.), Tel. 099 999 99 99	
Bezugsjahr:	2010	
Der gesamthaft an unsere Kunden gelieferte Strom wurde produziert aus:		
in %	Total	aus der Schweiz
Erneuerbare Energien	51,0 %	41,0 %
Wasserkraft	50,0 %	40,0 %
Übrige erneuerbare Energien	0,0 %	0,0 %
Geförderter Strom ¹	1,0 %	1,0 %
Nicht erneuerbare Energien	44,0 %	29,0 %
Kernenergie	44,0 %	29,0 %
Fossile Energieträger	0,0 %	0,0 %
Abfälle	2,0 %	2,0 %
Nicht überprüfbare Energieträger	3,0 %	
Total	100,0 %	72,0 %

¹ Geförderter Strom: 45 % Wasserkraft, 7 % Sonnenenergie, 20 % Windenergie, 25 % Biomasse und Abfälle aus Biomasse, 3 % Geothermie

Figure 9: Example of a table for labelling electricity according to the minimum requirements (supplier mix) according to (B. Karlin et. al. , 2015)

7.2.4 Comparative values

Comparisons of one's own consumption are an effective means of initiating behaviour changes (Suter, 2017 and Karlin et. al., 2015). A difficult to grasp unit, e.g. energy (kWh), can be easily understood by comparisons. The essential part is to recognize, if the consumption is high or low, without necessarily understanding what a kWh is.

Comparisons of consumption always require a reference value. Typically, these are the value for one's own consumption in a previous measurement period, standard values (e.g. SIA standards), or statistically collected averages (general, such as e.g. the Swiss average, but also specific, e.g. averages of similar households in the immediate vicinity).

7.2.4.1 Comparison of consumption with one's own consumption from previous periods

Since the energy utility usually knows the consumption of a customer's previous metering periods (or billing periods), this comparison is easy to present.

In order to allow meaningful comparisons, according to Dunnhoff and Palm (2016) and Gallati, M. and Knüsel, P. (2011) following prerequisites must be met, for example:

- No change of measuring point (change of residence)
- Same measuring period
- Same season (if measuring period is less than one year)
- Comparable climatic conditions (e.g. heating degree days for heating consumption)
- Familiar or equal living conditions (number of people in household, etc.)

In Laurich and Lamieri (2008), 30% of respondents stated that they consider the comparison with the previous year's consumption. According to Dunnhoff and Palm (2016), 80% of respondents in Germany considered a comparison with the consumption of a previous period important, although 30% of respondents find this information difficult or impossible to find. The percentage change in consumption, which is also easy to present, can also be helpful.



7.2.4.2 Comparison with other values

As a rule, energy utilities do not have sufficient information about the building type or the household components to be able to make detailed comparisons. According to Danov, et. al. (2015), for example, comparison with similar households is effective and therefore desirable. If additional information is available to the energy utility, it could be analysed to provide more specific comparisons. However, this is complex and requires expertise in energy in buildings and free access to specific household data (e.g.: heating system, number of people etc.).

7.2.5 Savings potential

Savings potential primarily starts with "Can" (Artho et. al., 2012) by showing consumption by other reference groups, and how much it differs from one's own consumption, and how the other reference group can do. More specific savings potentials (comparison with similar households in the immediate vicinity) are more effective than general ones (average consumption of the Swiss resident population).

By showing how much can be saved (e.g. 1 t CO₂ p.a. or CHF 100 p.a.), they also stimulate "Want" (Artho et. al., 2012).

7.2.5.1 Basis for comparison

Savings potential can be calculated based on comparisons. This then makes the information on, for example, how much higher consumption is compared to a similar household, and how much can therefore be saved, more easily accessible to laypeople. As explained in Gallati and Knüsel (2011), the degree of consumer knowledge about saving potentials is very low. The explicit presentation of savings potentials can provide a remedy, and thus generate additional motivation.

7.2.5.2 Unit

Savings potentials can relate to different variables such as energy (kWh), environmental impact (e.g. CO₂ or energy consumed by number of halogen light bulbs, etc.) or financial aspects (CHF). The unit in which saving potential are most appealing depends on the motivation and different sensitivity of each individual customer.

7.2.6 Environmental indicators

Environmental indicators can be used to express variables that are difficult to grasp in terms of clear, measurable alternative variables. The difficult-to-grasp variable "energy" and the environmental effects caused by its use can thus be described in a way that is comprehensible. This lack of transparency ("electricity is invisible and apparently always available") is an obstacle to saving energy (VSE, 2015). A survey by the German Federal Environment Agency shows that more compensation payments were made after these were renamed from "financial compensation (compensation payment) for self-induced greenhouse gases, for example transport" to voluntary compensation payments for carbon dioxide emissions (cf. Umwelt Bundsamt, 2016). Apparently, the term "carbon dioxide emissions" is more comprehensible than "self-induced greenhouse gases".

7.2.7 Tips and recommendations

General energy saving tips and recommendations can include simple behavioural changes (e.g. sudden ventilation instead of tilted windows) or recommendations for action (replacement of incandescent/halogen lamps by LEDs). According to the "Want-Can-Do" action chain (Artho et. al., 2012), the concrete feasibility ("Can") is a compelling prerequisite for it to have an effect.

Although personalised energy-saving tips are rarely found on bills due to the necessary data basis (see section 7.2.11), according to Danov, et. al. (2015) they are very effective. Personalised savings tips are often available in online portals or through personal consultation (by telephone or in the advice centre). According to Artho et. al. (2012), personal energy audits are the most effective measure with regard to increasing efficiency (reduction of up to 20% in electricity consumption).



7.2.8 Billing explanations

Energy bills are often difficult for laypeople to understand; according to one study from Austria, various terms important for understanding energy bills are not comprehensible for large numbers of customers (Bernhard et. al., 2010). Understanding a bill is a prerequisite for changing one's behaviour. The bill can trigger the process by showing the need or the possibility to improve the energy consumption and motivate a "want" to change one's behaviour, according to the socio-psychological mechanisms of deliberate action (Artho et. al., 2012).

7.2.9 Presentation of information

7.2.9.1 Type of presentation

A significant improvement in comprehensibility is achieved by visualising the presented information, e.g. with diagrams (Wilhite and Ling, 1995). According to Danov, et. al. (2015), the visualisation of consumption is an appropriate means of achieving behavioural changes, and therefore highly desirable for improved billing.

7.2.9.2 Scope

An analysis of electricity bills from Germany (Dunnhoff and Palm, 2016) showed that an electricity bill contains on average five pages. If additional services (other forms of energy or water) are charged, the number of pages can easily increase to ten to thirteen. With increasing volume, it becomes increasingly difficult and complex for customers to find relevant information. A short, concise bill is therefore useful.

7.2.9.3 Location of information

According to the principle of the inverted pyramid, important information should be presented first. Essential information - the billed amount - can therefore usually be found on the first page of the bill. According to Laurich and Lamieri (2008), consumers want central information to be placed on the first page so that it can be read quickly.

A representative survey in Germany shows a clear relationship between the importance of information and how easy it is to find it on the bill, which should also be taken into account when improving the bill (

Figure 10).

Angaben auf Stromrechnung

Frage 7: Wie wichtig sind für Sie die folgenden Angaben auf der Stromrechnung?

Frage 6: Wie einfach ist es für Sie, die folgenden Angaben auf der Stromrechnung zu finden?

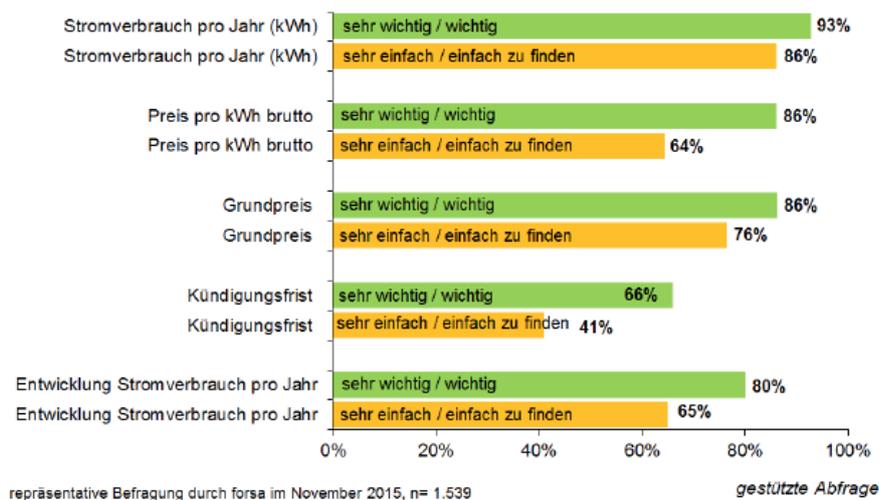


Figure 10: Relationship between importance and findability of information on bills (taken from G. Laurich and L. Lamieri, 2008)

Information should therefore be presented in the order of its importance to the customer.



7.2.10 Technical requirements

Smart meters are measuring devices that allow two-way communication between energy supply companies and customers. One relevant factor in the improvement of billing is the possibility of remote reading, and thus the fine granularity and prompt recording of consumption. This allows the calculation and comparison of any consumption intervals. With appropriate analyses, further information about the customer can also be determined (e.g. electrically controlled heating can be arranged in the event of a strong increase in consumption in winter), which can then be used to personalise the bill. Smart meters thus offer great potential for improving billing and feedback frequency.

7.2.10.1 Current installed meters

As shown in section 7.2.2.4, the frequency of billing is an indicator of the information provided effectiveness. With normal bills, the consumption during the readout period is charged, which is therefore decisive for the frequency. Meters with remote reading allow readings to be taken as often as desired, offering good conditions for frequent billing. Table 9 shows the situation for the most common meters in Switzerland:

Type	Remote reading	Normal readout interval
Analogue	No	1-2 per year
Digital	No	1-2 per year
Digital	Yes	Continuous
Bidirectional*	No	1-2 per year
Smart meter*	Yes	Continuous
Pre-paid counter	No	Variable

Table 9: Most common meters and their readout intervals, *: Electricity only

7.2.10.2 Installation of meters in the medium term

In view of the increase in photovoltaic systems and the resulting changing requirements for the installation of meters (e.g. for private consumption associations according to VSE, 2014 and EnG, SR 730.0 2014), it can be assumed that more smart meters will be installed in the future.

With regard to measuring equipment, the situation changed during the processing phase of this study. With the adoption of the referendum of 21st May 2017 for the implementation of the Federal Energy Strategy 2050 and the adoption of the Energy Ordinance by the Federal Council in November 2017, the share of installed smart meters for electricity metering must be at least 80% by 2027 (BFE, 2017).

7.2.11 Additional customer information

Usually, little information about the end-user is available to energy utilities for more detailed and customized analysis and evaluation of measured consumption (conclusion of interviews with various utilities e.g. EKZ). Such information mostly consists of:

- address (and thus the climatic conditions)
- sometimes the type of heat generation (e.g. if a special heat pump rate applies or gas or district heating is supplied in addition to electricity)
- sometimes information on photovoltaic systems
- sometimes the building category (e.g. several home connections at the same address in a block of flats)
- consumption (time resolution depends on the meter)
- measuring interval (depends on the meter)
- climatic conditions during the measurement period

An in-depth analysis and interpretation is therefore often not possible, although it is an effective measure to stimulate behavioural changes (see Wilhite and Ling, 1995).

For a meaningful interpretation of consumption: building-related and user-related data is useful.



7.2.11.1 Building-related data

It includes data such as:

- building category and condition of building
- energy reference area
- type of heat generation (heating and hot water)
- use of solar energy (photovoltaics, solar thermal energy)
- special (type of energy measurement, storage, etc.)

Since, in addition to the energy reference area, the quality of the envelope has a decisive influence on the heating demand, the use-related influence on consumption cannot be assessed on a sound basis without corresponding supplementary information (see Figure 11).

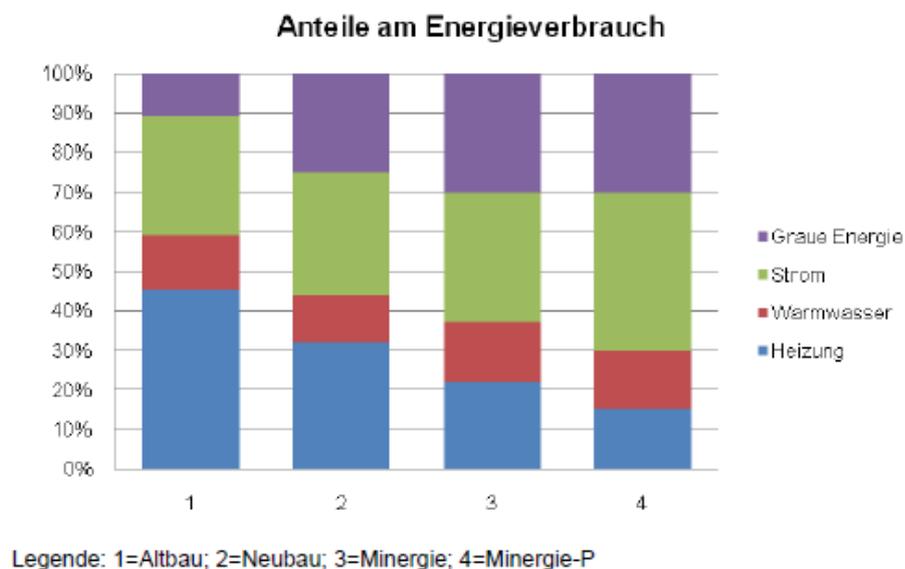


Figure 11: Proportions of heat energy consumption according to different construction standards (source: Faktor 2009)

It is highly desirable to divide total consumption into energy consumption for heat generation and household electricity. It was shown in Wilhite and Ling (1995) that showing the proportion for heating led to a reduction in heating consumption. If it is assumed that the share of consumption required for heat generation is shown, and thus the amount of household electricity becomes calculable, further decisive variables for a meaningful comparison of household electricity are nevertheless missing. Figure 12 illustrates the dependence of energy demand on the number of persons and the building category.

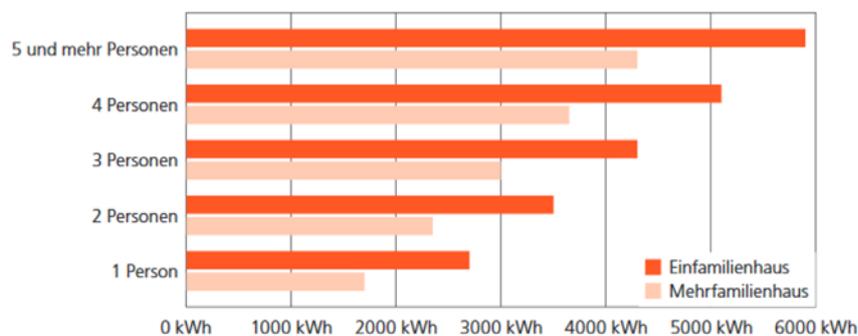


Figure 12: Typical power consumption of Swiss households (as per EnergieSchweiz, 2016)

What follows, is an example of some of the required information needed to obtain this kind of computation.



7.2.11.2 User-related data

It includes data such as

- number of persons in household:
- information on work situation (level of employment, home office, etc.)
- special (e.g. electric car, etc.)

A final list can hardly be defined; Gallati and Knüsel (2011) contains a comprehensive summary of factors relevant to consumption. Essentially, the more information is available, the more detailed and specific the analysis, comparison and information given.

Some of the above information is available to the energy utility depending on the situation (heat generation: e.g. when a special heat pump rate applies or gas is supplied).

Although some further information may be available in principle, the energy utilities are not permitted to use it for assessment due to data protection law. Data on buildings and technology is available, for example, in the Federal Register of Buildings and Housing (GWR), and information on the number of residents is available from local authorities.

Although, this involves a great deal of effort for the energy utility, access to certain data can be made legally permissible with a declaration of consent from the owner or the user. This can also be achieved if a corresponding declaration is requested when opening an online account.

7.2.12 Additional information for customers

General, non-personalised information can be sent in addition to the bill, e.g. as a bill insert, newsletter, or sent by email, or presented on the website. These can contain specific elements if, for example, the average consumption relation to the number of persons and the building type is presented in a table and the customer can read the comparison value relevant to them:

Wenn Sie in einer Wohnung leben (Jahresverbrauch in kWh)

Anzahl Personen	1	2	3	4 und mehr
Tiefer Verbrauch	650	1'250	1'500	1'850
Mittlerer Verbrauch	1'850	2'550	3'400	3'750
Hoher Verbrauch	3'050	3'850	5'300	5'650

Vergleichswerte für den Stromverbrauch in einer Wohnung

Wenn Sie in einem Einfamilienhaus leben (Jahresverbrauch in kWh)

Anzahl Personen	1-2	3 und mehr
Tiefer Verbrauch	2'100	3'050
Mittlerer Verbrauch	4'000	5'200
Hoher Verbrauch	5'900	7'350

Vergleichswerte für den Stromverbrauch in einem Einfamilienhaus

Figure 13: Excerpt from the EKZ website: Compare power consumption (source: EKZ)

Many energy utilities offer applications for mobile devices (e.g. Basil by IWB) or online portals with personal login (e.g. Home Energy by BKW). In doing so, the consumer discloses their personal data and thus enables the energy utility to make a personalised assessment of their consumption.

Customers also have the option of interactively assessing their consumption in more detail, even without a personal login. For example, Energybox.ch (www.energybox.ch) or the Energie Uster website (<https://mypower.energieuster.ch/de/services/strombedarf.php>) can be used to calculate a household's electricity requirements in detail. The personal data collected will then not be stored and the customer must themselves make the comparison with their own consumption.



In particular, solutions with personal customer access can be clearly assigned to Demand Side Management (DSM) as a category. For solutions without login, the boundary between DSI and DSM is fluid. As this study focuses on the calculation, the technical possibilities of other media and their potential are not discussed in detail.

7.2.13 Energy utilities in Switzerland

The situation of energy utilities in Switzerland is special in several respects compared to other countries:

- Market situation: the market is not fully liberalised
- Market structure: large number of very small energy utilities
- Many energy utilities have a political or performance mandate
- Comprehensive services offered: district heating, gas, electricity, water, multimedia, or any combination thereof

These peculiarities have an influence on the actions of the energy utilities and their motivation to encourage efficient behaviour on the part of their customers. As the evaluation of the survey and the bills (see chapter 7.4) focuses on billing, these special features are not further investigated.

7.2.13.1 Market situation

In contrast to the greater part of the European countries, the Swiss electricity market is still only partially liberalised. Although large consumers are free to choose their supplier, if they consume less than 100 MWh/a ("private customers"), they must purchase electricity from their local supplier.

The lack of competition and the resulting "secured" customer base of private customers puts less pressure on Swiss energy utilities to retain customers with innovative services (e.g. improved billing) and products (e.g. energy-saving contracts).

7.2.13.2 Market structure

In 2016, electricity was supplied in Switzerland by 645 network operators (EiCom, 2016), plus further suppliers of gas and district heating. Compared with other countries (e.g. Germany 888 network operators, Bundesnetzagentur, 2018)), these include a very large number of small energy utilities (with a market coverage of 58% according to M. Mühlebach (2012): a large proportion of energy utilities supply less than 30 GWh/a, and 12% more than 300 GWh/a.

Figure 14 clearly illustrates the inhomogeneous market structure in Switzerland.

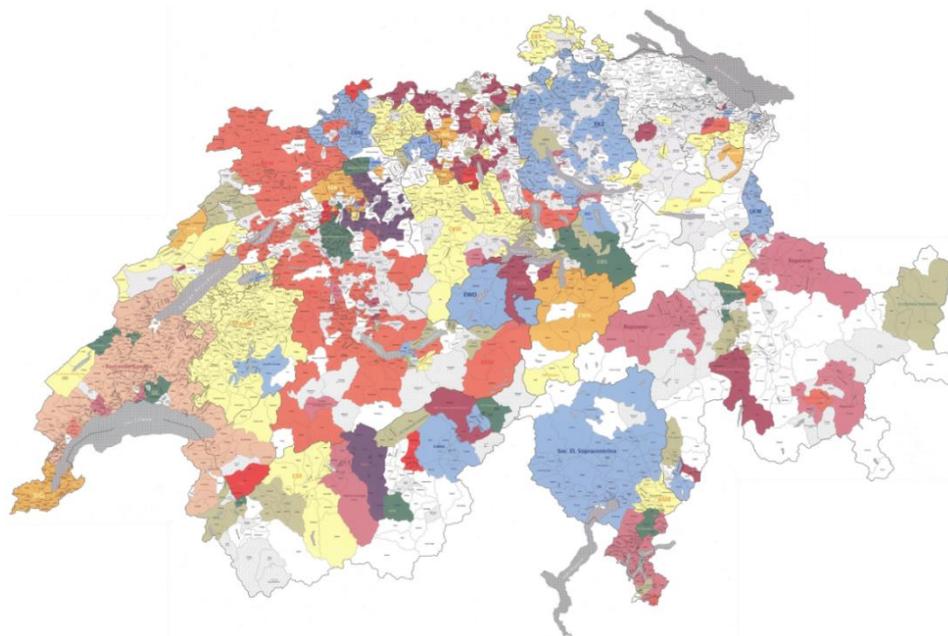


Figure 14: Distribution system operators in Switzerland (2013, source: VSE)



The size of the energy utilities in terms of resources and competencies has a significant influence on bill processing:

- Large energy utilities have the know-how and the necessary resources to improve billing on their own.
- The larger the customer base, the larger the database, which, if required, can only be used for specific analyses and comparisons.
- Many small energy utilities outsource their accounting to external, specialised companies due to a lack of resources or competence. However, this can also be an opportunity, as these entities can sell billing better as a product, and thus benefit several energy utilities and their customers.
- Different motivation depending on the size of the energy utility (cf. section 7.2.13.5).

7.2.13.3 Performance mandate of energy utilities

Around 70% of energy utilities in Switzerland are wholly or partly publicly owned (Municipalities, Cities, Cantons), see Figure 15.

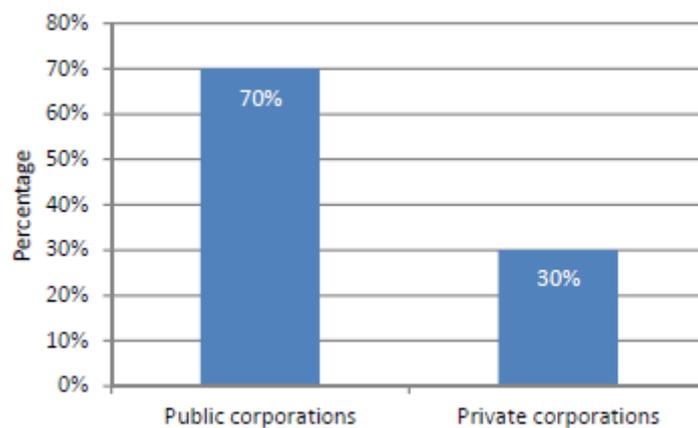


Figure 15: Ownership of Swiss energy utilities (from M. Mühlebach, 2012,2)

According to Zweifel (2012), 67% of central power stations and 50% of municipal energy utilities have a public sector performance mandate (cf. Figure 16), and are thus obliged to commit themselves to energy efficiency.

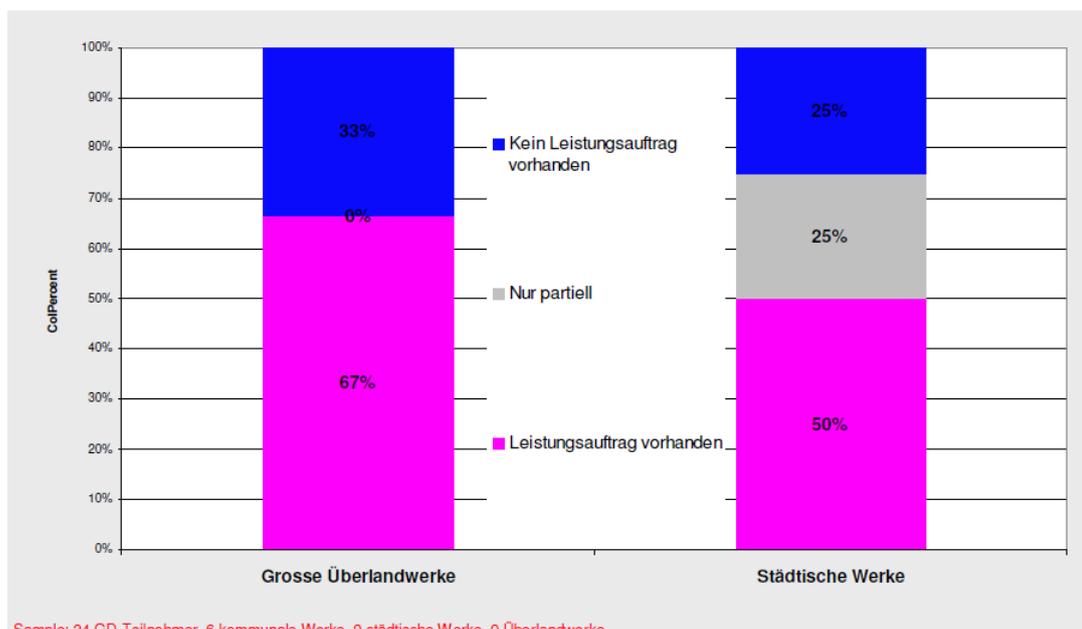


Figure 16: Public sector performance mandate regarding energy efficiency (taken from Zweifel, 2012)



7.2.13.4 Services offered

Regional or locale energy utilities in particular usually offer not only the supply of energy, but also water and/or multimedia services. If all services are billed in one bill, the bill volume increases accordingly and the easiness of finding important information decreases.

According to Dunnhoff and Palm (2016), in Germany, for example, the average page count of an electricity bill is five pages and ten pages if gas, district heating or water is added.

7.2.13.5 Motivation to increase efficiency

According to a survey of Swiss energy utilities (Zweifel, 2012), the extent to which energy efficiency is dealt with and to which business fields it is assigned also depend on their size:

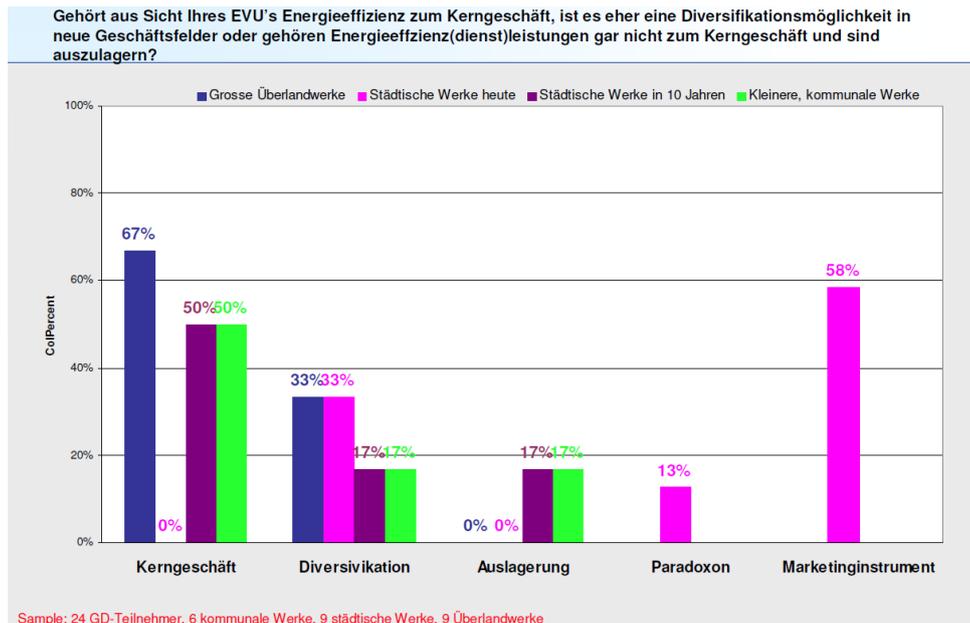


Figure 17: Engagement with energy efficiency (taken from Zweifel, 2012)

According to Zweifel (2012), the primary benefits of energy efficiency for energy utilities can be found in the areas of communication and customer loyalty (see Figure 18).

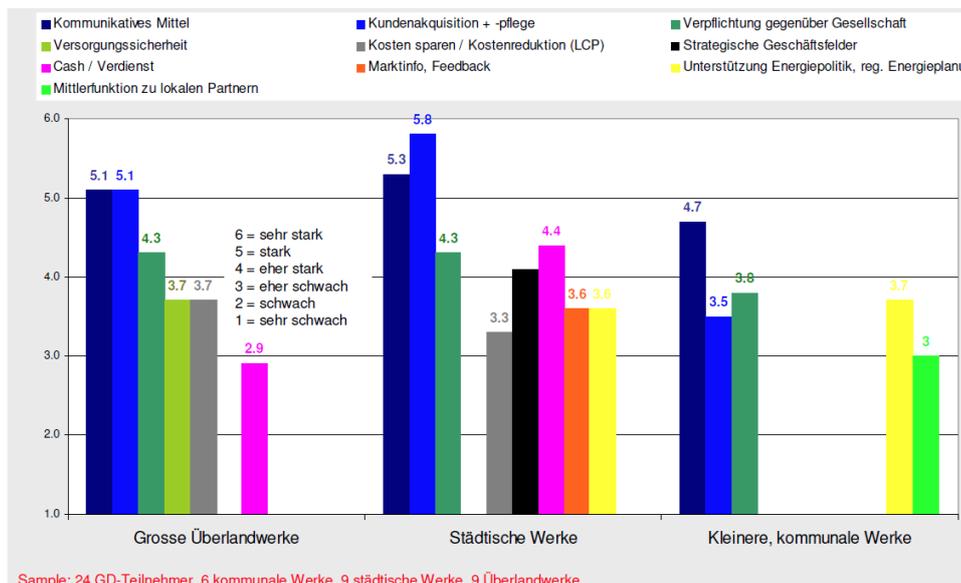


Figure 18: Benefits of energy efficiency for energy utilities (Source: Zweifel, 2012)



7.3 Data collection

7.3.1 Survey

7.3.1.1 Procedure

An invitation to participate in the survey (according to Table 12) was sent via e-mail to at least 185 Swiss energy utilities (see Appendix 2). Surveys were distributed through partner universities in each language region. A short description of the project was added to the invitation (see Appendix 3).

Language region	Partner ESCs	Member of VSE ¹	Personal contacts	Quantity
German	3	134	unknown	min. 137
French	3	34	unknown	min. 37
Italian	5	6	unknown	min. 11
Total				min. 185

Table 10: Recipient questionnaire by language region

The survey asked Swiss energy utilities about their current billing system. In addition to exploring content elements and billing procedure of participating energy utilities (Table 12), supplementary and further questions (e.g. on the type of billing or further information available) can thus be asked.

The survey was translated into three national languages (de, fr, it). The questionnaire with questions for all energy sources is attached in Appendix 1.

A questionnaire must be completed for each form of energy supplied (electricity, gas, district heating); this is selected at the beginning of the survey. The following questions are partially adapted to the previous answers (e.g. no question about smart meters for gas, or no question about the location of the presentation if no environmental impacts are presented). The size of the survey is therefore variable: the survey contains a minimum of 25 pages with 21 questions and a maximum of 36 pages with 32 questions.

At the end of the survey respondents had the option of uploading an example of a current bill.

7.3.1.2 Responses

The survey achieved the following results:

- 137 logins to the survey were registered.
- 89 logins were not considered in the evaluation (no or insufficient answers, test logins, multiple answers from the same person or energy utility ²).
- The questionnaire was completed by 41 energy utilities.
- 6 replies were sent by email (some partner energy utilities also received the questionnaire as a text).

¹ Based on the list of members on the homepage of the VSE [28](VSE, 2017), cf. Appendix 4

² If the questionnaire was completed several times by employees of the same ESC using the same energy source, those answers were counted once. In this way, the number of ESCs can be referred to in the evaluation without it being falsified by multiple answers.



For the analysis, 54 answers were considered (although not all questions were necessarily answered), which corresponds to a response rate of max. 30%. The following number of responses were evaluated per energy source:

- Electricity : 46
- Gas : 7
- District heating : 1

When analysing the survey, each answer was given equal weighting, irrespective of the energy utility's size or number of customers. Multiple responses on the same energy source of the same energy utility were only counted once. Thus, each evaluated answer corresponds to one energy utility or one bill, which is relevant for the evaluation portion per ECU and energy source. Due to the low number of usable responses for district heating, for this energy source no evaluation was carried out.

A brief analysis of the survey was sent to participants on request. This can be found in the Appendix 6.

7.3.2 Bills

To complete the picture, an additional collection of Swiss bills was undertaken in the following ways:

- Website of energy utilities
- Personal contacts
- Upload by energy utilities participating in the survey

The analysis refers to the number of energy utilities or bills, which assumes that only one bill per energy source is recorded per energy utility. This leads to a reduction of the 117 collected bills to 91 bills for use in the analysis (see Table 11).

Source	Quantity	Of which, those used for evaluation	Used for evaluation		
			Electricity	Gas	District heating
Power grid	57	49	35	13	1
Personal contacts	33	17	16	4	0
Survey	25	25	22	3	0
Total	117	91	70	20	1

Table 11: Number of bills collected and used

7.4 Evaluation and findings

Based on chapter 7.2 and 7.3, the informative content elements and billing procedures (Table 12) were defined for the questionnaire and the analysis of the bills.



7.4.1 Overview of indicators used

Area	Number	Indicator	Specification	Application in	
				Survey	Bills
Energy sources	01	Supplied energy ³	1: Electricity 2: Gas 3: District heating	x	x
	02	Quantity of energy supplied	1: GWh/a	x	
Billing	03	Billing format	1: Paper bill 2: Email (with PDF) 3: E-bill 4: Online account 5: Mobile application 6: Other (text input)	x	
	04	Type and percentage of using payment method	1: Payment slip 2: E-bill 3: QR code 4: Direct debit 5: Pre-paid counter 6: Pre-paid online 7: Other (text input)	x	
	05	Type and percentage of using payment method	1: Standard bill 2: Advance payment (on account) 3: Pre-paid 4: Other (text input)	x	x ⁴
	06	Frequency of billing	1: Monthly 2: 4 times per year 3: 2 times per year 4: 1 time per year 5: Irregular 6: Other (text input)	x	x ⁵
Statutory requirements	07	Illustration of consumption	1: Total consumption in kWh 2: Consumption according to tariff levels in kWh		x
	08	Illustration of costs	1: Total consumption in CHF (energy) 2: Consumption according to tariff levels in kWh		x

3 For some questions, it makes sense to differentiate between energy sources. These are indicated with index 1. When analysing bills, a distinction was always made between energy sources.

4 If it was visible on the bill, the option of payments on account was recorded in the analysis of the bills.

5 The number of readout intervals was recorded for bills.



			3: Summary of bill amount 4: Costs per kWh according to tariff levels		
	09	Illustration of energy mix ¹	1: In accordance with statutory requirements 2: Presented 3: For special products 4: When changing products 5: Other (text input)	x	x
Comparative values	10	Illustration ¹	1: Presented	x	x
	11	Own consumption ¹	1: Previous years 2: Previous months	x	x
	12	For other values ¹	1: CH averages 2: More specific values 3: Other (text input)	x	x
Potential savings	13	Presentation	1: Presented	x	x
	14	Basis for comparison	1: General savings potential 2: CH averages 3: More specific values	x	x
	15	Unit of savings	1: Energy (kWh) 2: Money (CHF) 3: Environmental impact 4: Other (text input)	x	x
Environmental impact	16	Illustration ¹	1: Presented	x	x
	17	Reference ¹	1: Own consumption 2: Own consumption when changing product 3: Other (text input)	x	x
Tips and recommendations	18	Availability	1: Available 2: On bill 3: In online account	x	x ⁶
Billing explanations	19	Availability	1: Available 2: On bill 3: Available online 4: Via contact address 5: Elsewhere (text input)	x	x ⁴

⁶ Only recorded if listed on bill



Presentation	20	Type of presentation (numbers and text or graphic)	1: Total consumption 2: Total energy costs 3: Energy mix 4: Comparative values 5: Savings potential 6: Comparative values, costs 7: Environmental impact 8: Energy saving tips	x	x ⁷
	21	Scope (number of pages)	1: Bill 2: Bill appendix	x	
	22	Place of presentation (page 1, 2 or 3)	1: Total consumption 2: Total energy costs 3: Energy mix 4: Comparative values 5: Savings potential 6: Comparative values, costs 7: Environmental impact 8: Energy saving tips	x	x ⁸
Technical requirements	23	Types and proportions of meters installed today ¹	1: Analogue 2: Digital, without remote reading 3: Digital, with remote reading 4: Smart meter ⁹ 5: Other (text input)	x	
	24	Installation of meters in the medium term ¹	1: Analogue 2: Digital, without remote reading 3: Digital, with remote reading 4: Bidirectional, if PV present ⁷ 5: Smart meter, building with PV ⁷ 6: Smart meter, building without PV ⁷ 7: Other (text input)	x	
Additional customer information	25	Application and source	1: Are used 2: Customer must provide information 3: Customer can provide information	x	x ¹⁰

⁷ When analysing bills, the type of presentation (numerical or graphic) was also recorded for the following indicators: consumption according to tariff levels (KWh), energy costs (CHF), composition of bill amount (energy, fees, etc.)

⁸ When analysing bills, the presentation page was recorded for all indicators

⁹ For electricity only

¹⁰ Recorded if printed on bill



			4: Other (text input)		
	26	Further use by energy utility	1: Customer must agree 2: Customer can agree	x	
Additional information for customers	27	Availability and content of additional information in online account	1: Not available 2: Available 3: Content (text input)		
	28	Availability, type and medium	1: Available 2: General information 3: Personalised information 4: Newsletter 5: Email 6: Homepage 7: Other (text input)	x	

Table 12: Summary of indicators

In the following analysis, the results are presented in sequence if the indicators listed in Table 12 were relevant for the questionnaire and the bills. The survey's reached 41 valid energy utility responses within a market of 645 companies. The result points out some trends and anomalies in the observed samples. Where appropriate and relevant, a distinction between energy sources is made. Otherwise, the analysis applies to all three energy sources.

7.4.2 Indicators 01: Energy type

Indicator 01 is not relevant for comprehensibility; rather, it is necessary in order to

- allow differentiation according to energy source when analysing bills.
- differentiate according to the energy source where necessary and to allow the corresponding adaptation of the presented questions while analysing the questionnaires.

7.4.3 Indicators 02: Energy quantity

Indicator 02 enables assessment of the survey's representativeness (comparing size of the recorded energy utilities to the Swiss average). In the survey, delivery quantities were stated according to Table 13.

Energy sources	Energy supplied annually in GWh	CH average ¹¹	Survey	
		Proportion of energy utilities in %	Proportion of energy utilities in %	Quantity of energy utilities
Electricity	0 - 30	48	26	12
	<30 - 100	28	39	18
	<100 - 300	24	24	11
	<300 - 1600		11	5
Gas	0 - 100	29	29	2
	<100 - 300		42	3
	<300 - 4600		29	2

Table 13: Analysis of survey: delivered energy quantities

¹¹ According to M. Mühlebach, (2012,2)



Compared to the market structure, smaller energy utilities tend to be underrepresented compared to the Swiss average. It is not possible to judge whether this is due to the smaller personnel resources of small energy utilities. No statement can be made about the representativeness of the answers given by gas suppliers.

7.4.4 Indicator 03: Billing format

The format of the bill is relevant for the design options and possible influence of the customer on the presentation of information.

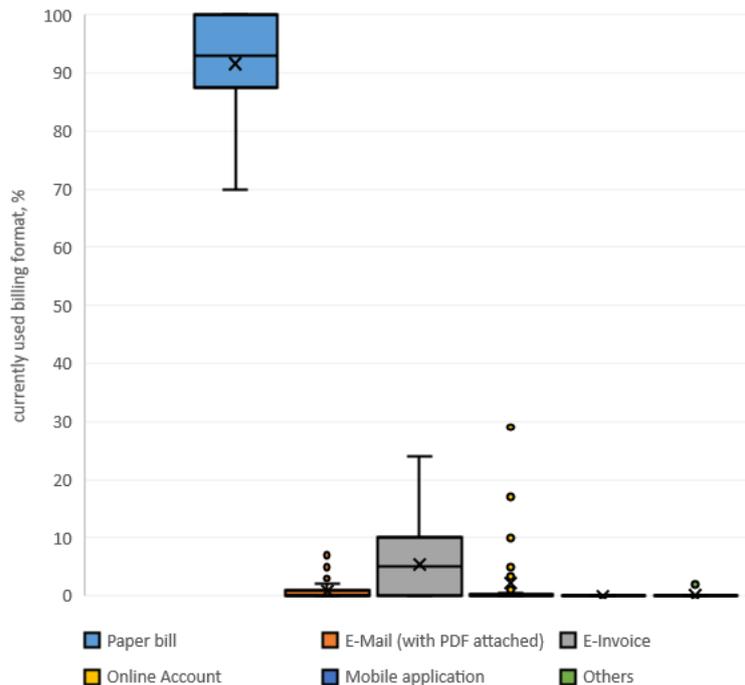


Figure 19: Questionnaire analysis: Format of current billing

The 41 responses show the following distribution (Figure 19, presentation as standard box plot with: average (x), median, 75%,50% and 25% quantile (box) and outliers (circles)), the classic paper bill sent by post is the most common format, with an average proportion of over 90%. Together with the shares of e-bill and email, over 95% of customers receive their bills as fixed, printed documents. E-bills account for an average of around 5%, although individual energy utilities already send just under 25% of all bills in this format. Interactive options such as mobile apps are hardly used. Billing via online account is also poorly represented, with an average of 2.3% (9 energy utilities offer this option); here, it is remarkable that one energy utility sends 30% of all bills via online account.

As a result, improvements should initially be aimed at the classic paper bill, and they should therefore be presentable in two colours and with low resolution (lower printing costs). In the future, bills will increasingly be sent by email or presented online. This development will not be discussed further, but it must be taken into account with a view of improving billing in the medium term.



7.4.4.1 Indicator 04: invoice settlement

Whether a bill is viewed by the customer strongly depends on the payment option used, and is an important factor impacting the way the information is perceived by the end-user.

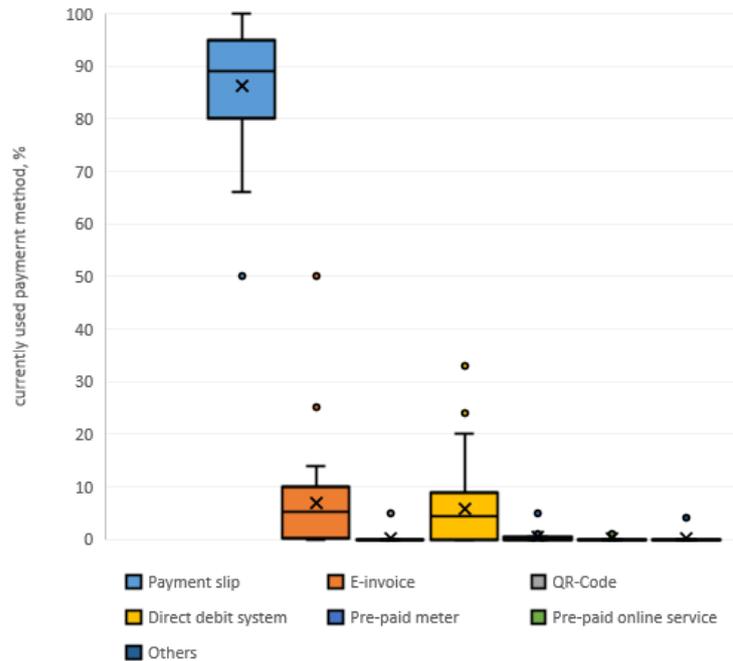


Figure 20: Questionnaire analysis: invoice settlement

Figure 20 shows that in almost 95% of cases (payment slip and e-bill together), the customer explicitly perceives the bill amount (and thus any changes in consumption) and further information contained in the bill is accessible to the customer without additional effort. It is noteworthy that 50% of one energy utility's bills are paid by e-bill. In the direct debit procedure (6% of all bills, in exceptional cases more than 30% of an energy utility's bills), additional information can be viewed by the customer only with additional effort. Changes in costs (and thus in consumption) are presumably only perceived above a certain level.

It was shown that, in practice, information contained in current bills can reach the customer, who can perceive it without being hindered by any additional effort. An improvement of the printed bill reaches a large proportion of customers, and therefore makes sense.

7.4.4.2 Indicator 05: Payment method

In addition to the frequency of billing, the amount of the billed amount is influenced by the payment type - the more often bills are issued, the smaller the billed amount and the smaller the changes made (e.g. as an indicator for the increase in consumption).

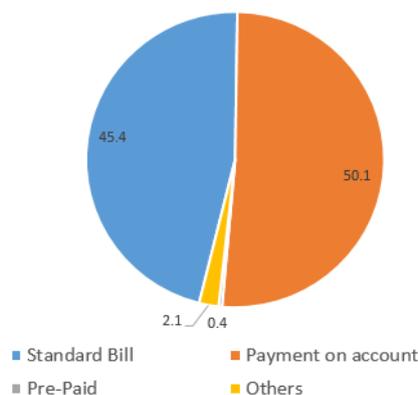


Figure 21: Payment method's share of the energy bill in Switzerland



Figure 21 shows that, according to the survey's results, either one bill is issued for the entire accounting period or payments on account are made in almost equal proportions. Other payment methods are barely relevant.

The analysis of the collected bills shows a slightly different picture - 67% of advance payments are made for electricity and 65% for gas (see Figure 22). For the portion designated as "unknown", an advance payment is not mandatory; based on the analysed bill, payment on account is merely not explicitly listed.

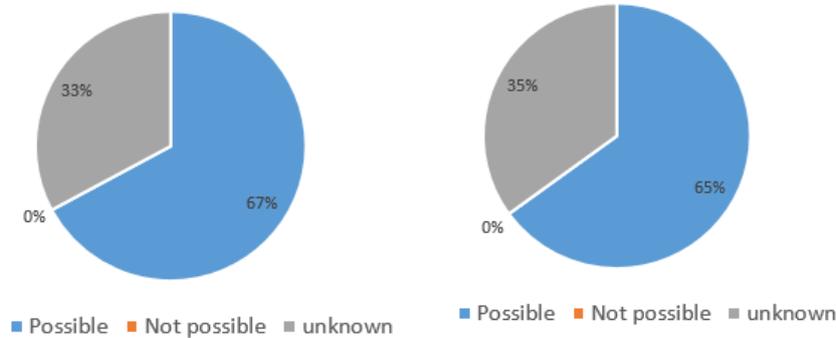


Figure 22: Collected bills: share of bills with payments on account, % (left for electricity, right for gas)

7.4.4.3 Indicator 06: Frequency of billing

The bill can contain additional information as energy usage and comparison. To trigger a behaviour change in energy consumption it is relevant how often this information is presented to the customer. Consequently, the frequency of how often the customer receives the bill is important in terms of behavioural change potential.

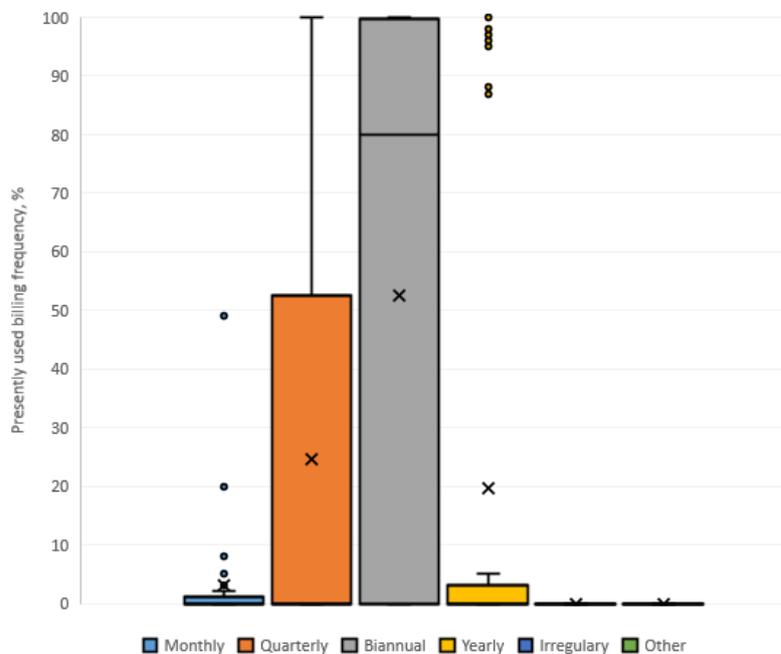


Figure 23: Questionnaire analysis (49 responses): Frequency of billing

It turns out (cf. Figure 23) that in more than 50% of all cases energy utilities bill their customers twice a year on average. With an average of 25% or 20%, quarterly and annual bills almost make up the remainder. It is interesting to note that some energy utilities issue annual bills to more than 85% of their customers.



The results of the survey are confirmed by the analysis of the collected bills ran alongside (cf. Figure 23).

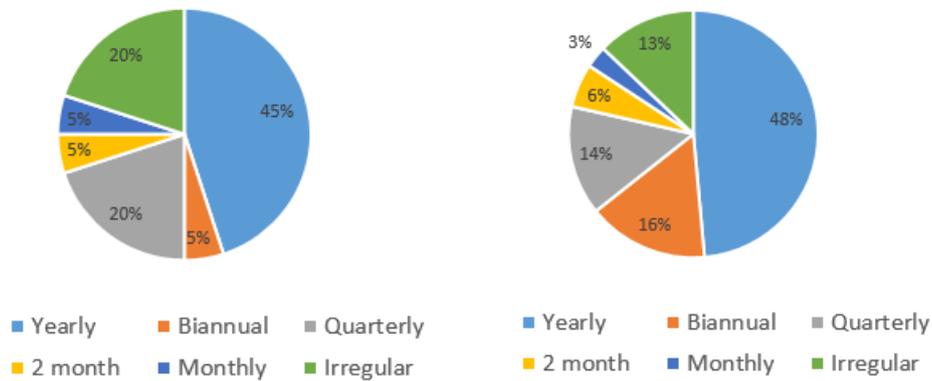


Figure 24 : Analysis of bills: Frequency of bill delivery, % (left: electricity, right: gas)

The majority receives the bill on an annual basis as shown in Figure 24.

7.4.5 Indicators 07 to 09: Statutory requirements

According to section 7.2.3, the minimum requirements for the information presented are clearly defined. There is a scope for the type (numerical or graphic) and location (on which page) of the presentation of relevant indicators according to section 7.2.9.1 and section 7.2.9.3.

Figure 25 shows that, according to the survey, consumption according to tariff levels (according to statutory requirements) is (almost) always presented numerically, while graphically on less than 5% of bills. Total consumption is presented numerically in slightly more than 60% of bills and graphically in approximately 10% of bills. Tariffs are presented numerically in almost 100% of bills, but graphically only in less than 5% of bills. Graphic representation of costs is rare and, if available, it is often linked to representation of the proportions of fees, energy costs, grid usage, etc.

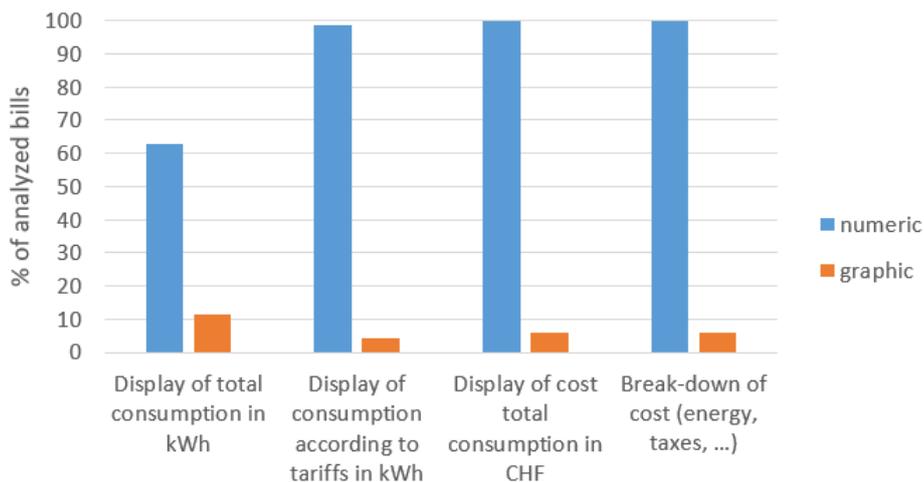


Figure 25: Analysis of bills: presented values (electricity)

7.4.5.1 Indicator 07: Representation of consumption

Consumption during the measurement period can be presented either as total consumption or according to rate levels (high and low rate). When comparing total consumption, only one value needs to be compared, and general and specific comparisons usually refer to total consumption. When comparing



according to rate levels, it is easier to limit changes in terms of time (e.g. an increase in the low rate means a change in behaviour at night or on public holidays).

The evaluation of the collected bills shows that in most cases the total consumption of the measuring period in kWh is presented on the second page. The total consumption (electricity) is graphically presented on about 10% of bills, whereby the presentation of the total consumption is always part of a consumption comparison (cf. Chap.7.2.4). For gas, the rate level is the standard rate (price per m³). This is usually shown (over 50%) on page 2, and graphically on just under 5% of collected bills (as a comparison of consumption).

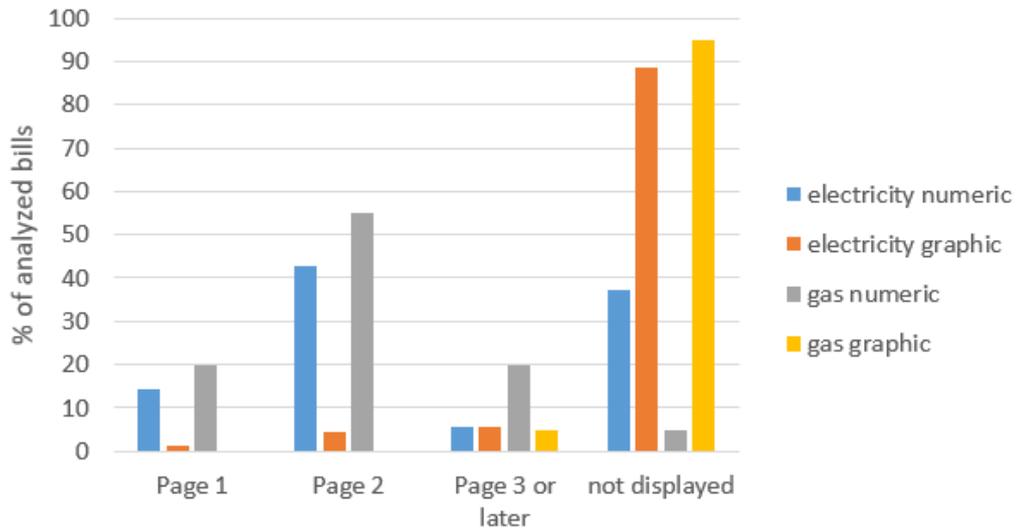


Figure 26: Analysis of bills: Location and distribution of the presentation of total consumption in kWh

The location and frequency of the presentation of consumption according to tariff levels (high and low tariff or unit tariff for gas) can be seen in Figure 27.

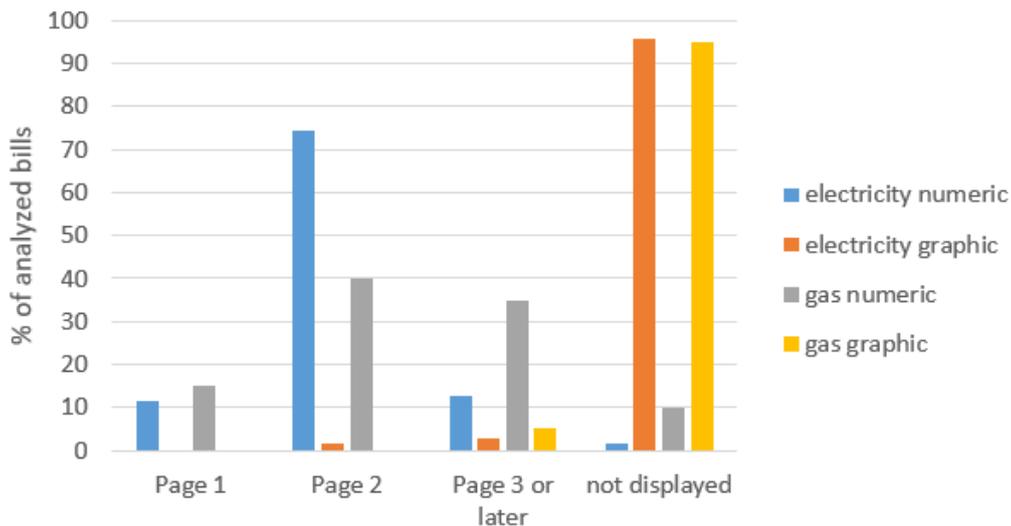


Figure 27: Analysis of bills: Location and distribution of consumption by tariff levels

The analysis of the survey shows that the self-perception of the energy utilities differs slightly from the analysis of the bills: around 17% of energy utilities (47 relevant responses) state that the total consumption is presented graphically, which is a higher proportion than was determined during the analysis of the bills.

Figure 26 shows for the survey, on which page the energy consumption is presented. In accordance with the analysis of the bills, consumption is usually presented on page 2 of the bill.

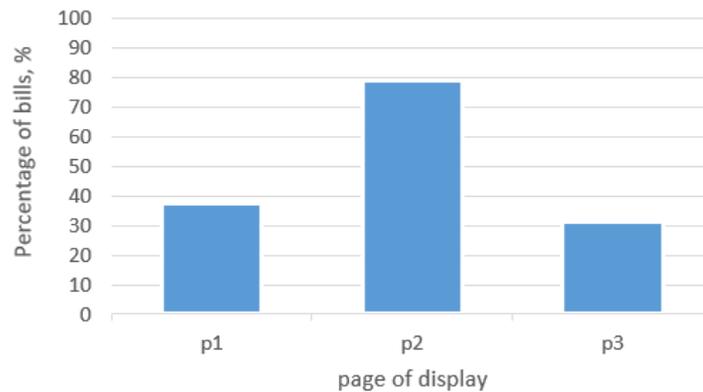


Figure 28: Analysis of survey (48 responses): Presentation of consumption

The survey shows significantly higher proportions for the presentation of energy consumption on page 2 (80%) than the analysis of the collected bills (more than 40%). The numerical values of the results are only partially comparable. On the one hand, in the analysis of the survey only responses are considered, which responded on that question (100% of respondents, with 48 bills). On the other hand, in the survey, the question on which page the consumption is stated is not posed precisely. Because the respondent can answer according to the place of total consumption and or consumption according to tariff levels. Consequently, this leads to different results in the analysis of the survey and bills.

A graphic comparison of total annual consumption is shown in the calculation of Gruyère Energie SA GESA (Figure 29).

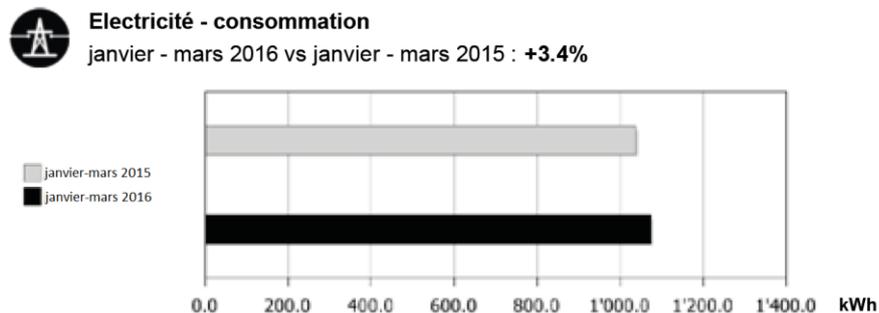
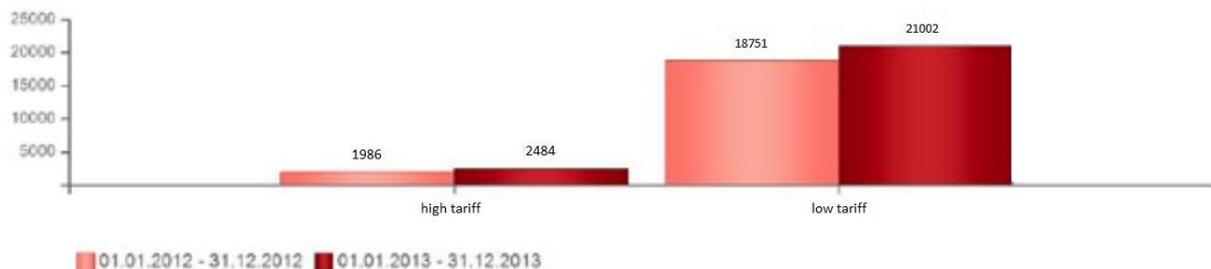


Figure 29: Excerpt of GESA (electricity) bill graphic, 2016, page 2

An example of numerical and graphic presentation of consumption according to tariffs is shown in the bill from Technische Betriebe Glarus TGB ().



Betragsermittlung	Menge	Ansatz	Dauer	Betrag CHF exkl.	MwSt Satz	Betrag CHF inkl.MwSt
Netznutzung						
Netznutzung Standard						
Hochtarif (I)	2'484 kWh	Rp. 6.50		161.46	8.00	174.38
Niedertarif (II)	21'002 kWh	Rp. 4.50		945.09	8.00	1'020.70

Figure 30: Excerpt from TBG (electricity) bill, 2013, page 2



Prominent presentation of consumption on the front pages is desirable and useful. The proportion of graphs is small, and when used as part of a comparison, it contributes to understanding one's own consumption. A combination of total consumption and consumption according to tariff levels can contain additional information and may be useful.

7.4.5.2 Indicator 08: Presentation of costs

The allocation of costs (in energy costs, fees, levies, etc.) is prescribed by law according to section 7.2.3. Presentation of a large amount of additional information makes comprehensibility and clarity difficult (Figure 7).

As the most important information on the bill, the total energy costs are shown numerically on the first page in over 50% and on page 2 in over 30% of the electricity bills. For gas bills, the total energy costs are slightly more often shown on page 2 (see Figure 31).

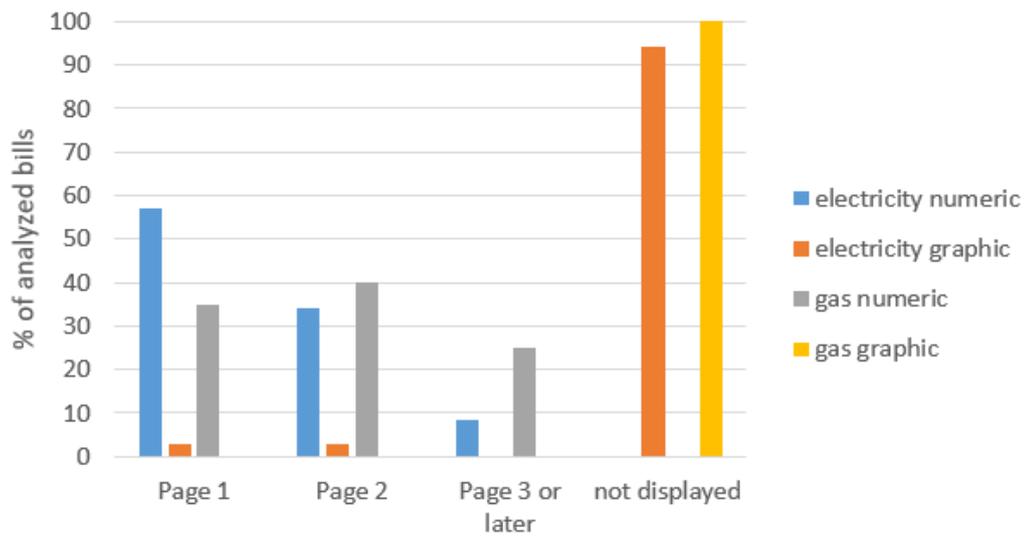


Figure 31: Analysis of bills, presentation of total cost

The composition of costs (energy, fees, charges, etc.) is usually shown numerically on the first two pages of electricity bills. In the case of gas bills, the proportion shifts slightly to the third page (cf. Figure 32).

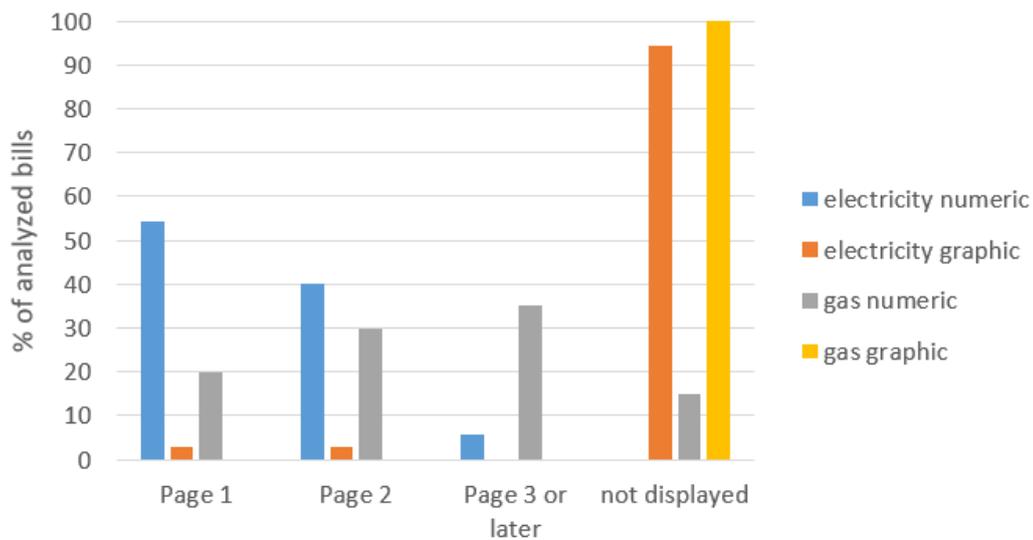


Figure 32: Analysis of bills, Presentation of cost composition



The analysis of the survey (Figure 33) shows that over 90% of the bills show the costs on the first page (over 50% on page 2) and over 15% on the third page. The bills may repeat the total costs on several pages, consequently is the sum of the proportion higher than 100%.

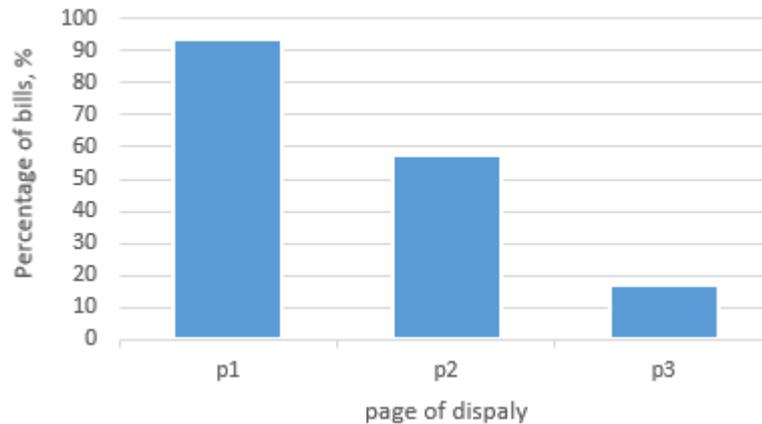


Figure 33: Analysis of survey (47 responses): Presentation of costs

Since only answers that specified the location, where the costs are presented (100% = 47 bills), were evaluated in the survey, the result is significantly higher than in the analysis of the collected bills. The analysis of the bills also differentiated between energy costs (= share of energy in total costs) and total bill amount (=energy costs plus charges, fees, etc.); the survey asked for costs that were not further specified.

A graphic breakdown of the individual cost proportions appears to be particularly helpful here, but according to the survey it is only shown for electricity on about 5% of the bills (cf. Figure 25). An example of graphic presentation can be found, for instance, in the bill of Romande Energie as shown in Figure 34.

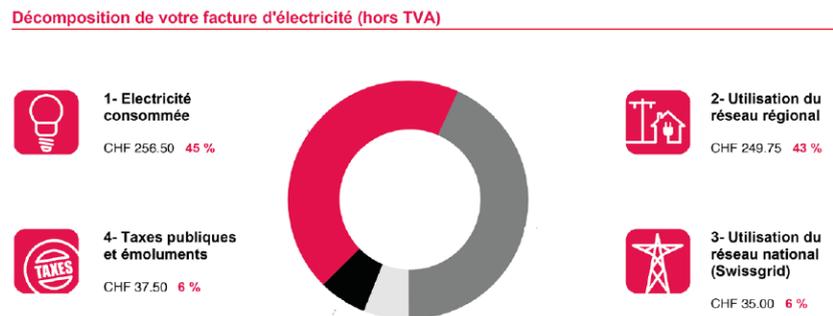


Figure 34: Excerpt from a Romande Energie Commerce SA bill (electricity), 2015, page 2

The analysis of the survey is well in line with the separate analysis of the bills with regard to the way costs are presented: just under 5% of energy utilities out of 47 state that costs are also presented graphically.

With regard to increasing efficiency, knowledge of cost components is barely relevant and information about them does not meet any customer needs. Bills can be improved by presenting relevant information more prominently and by moving this information to the back pages, which are given less attention.

7.4.5.3 Indicator 09: Energy mix

In accordance with the requirements for electricity labelling (cf. Chap. 7.2.3), customers must be informed at least once a year about the origin of the electricity supplied. As shown in

Figure 35, this labelling is rarely printed on the bill. Some energy utilities offer different, more sustainable products, e.g. "ewz solartop" electricity or "IWB Biogas Plus" gas. In just under 5% of bills (electricity), electricity labelling is then presumably presented somewhat more frequently for marketing reasons (cf. Figure 39 **Erreur ! Source du renvoi introuvable.**).

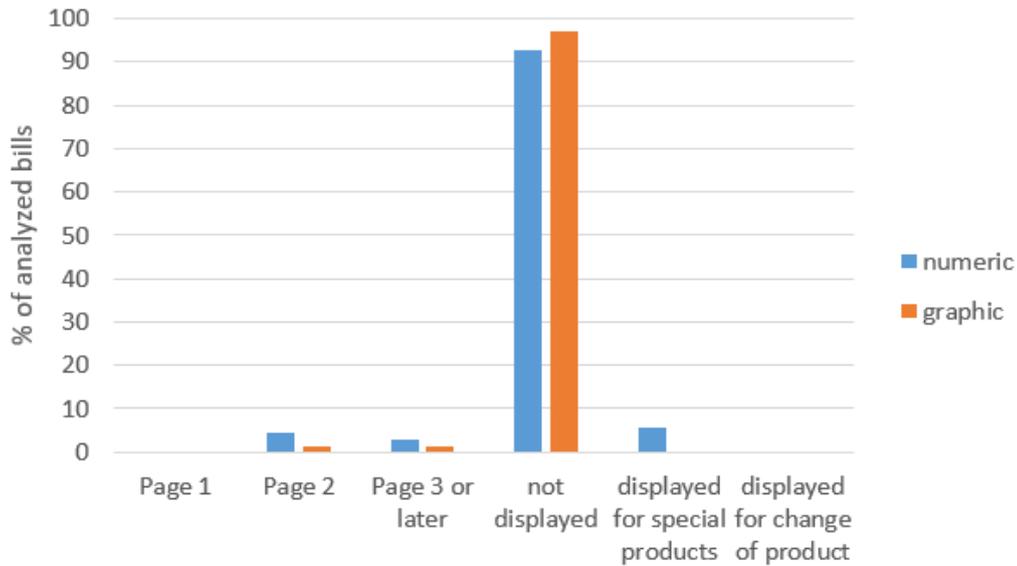


Figure 35: Analysis of collected bills, Electricity production's mix

The analysis of the survey for electricity shows a somewhat different picture (Figure 36), according to the responses, the energy mix should be shown on around 30% of the electricity bills. The random comparison of answers and bills from the same energy utilities suggests that the question in the survey may have been misunderstood by the utilities or that self-perception may differ from reality.

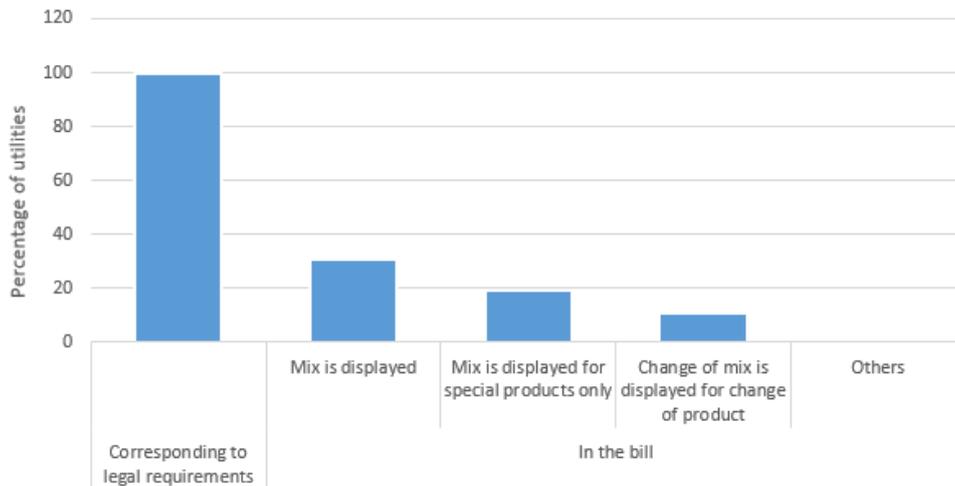


Figure 36: Analysis of survey (36 responses): Electricity production's mix

Due to the small number of usable responses (2 or 1), no analysis of the survey for gas and district heating was carried out.

When asked about the representation of the energy mix, 84% of energy utilities stated that they presented it numerically (graphic presentation: 18%). And 12% of energy utilities reported energy mix information on the first page, and the remaining show the energy mix on the second or third page on equal proportion.

In view of the differing results of the separate bill analysis and the questionnaire, it can be assumed that the questionnaire answers refer to the availability of information (e.g. incl. website, or also to rate levels) and not only, as intended, to the information on electricity labelling shown on the bill (electricity labelling).

Figure 37 shows an example for the numerical and graphic presentation of special products of the energy mix.

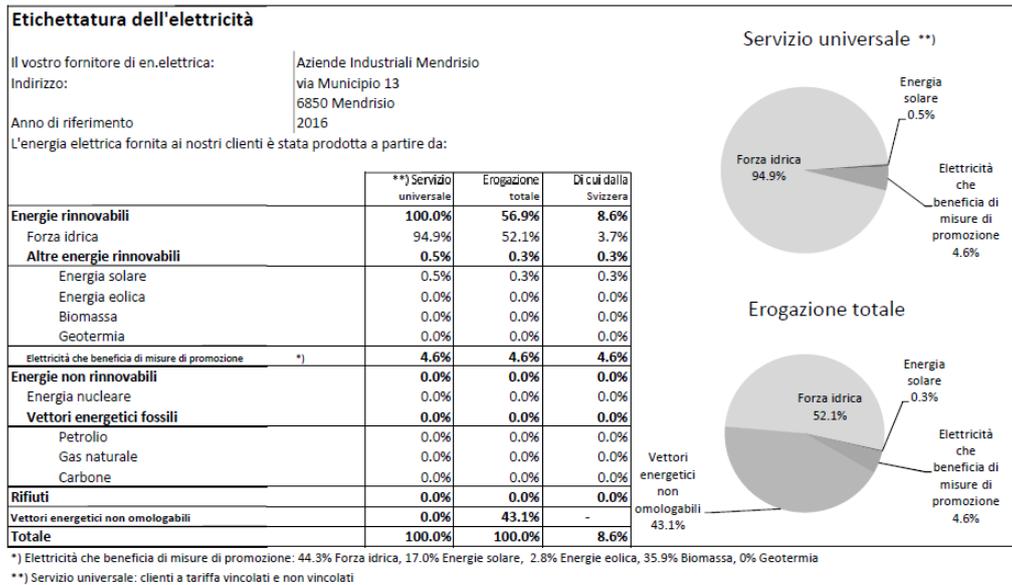


Figure 37: Excerpt from GESA (electricity) bill, 2016, page 3

The bill of Repower allocates consumption to products purchased (Figure 38). The electric energy, the tariff and the total costs are listed according to the energy products derived from hydro power systems (Aquapower), mixed ecological power systems (Purepower) and solar power systems (Solarpower) dependent on day- and night- time.

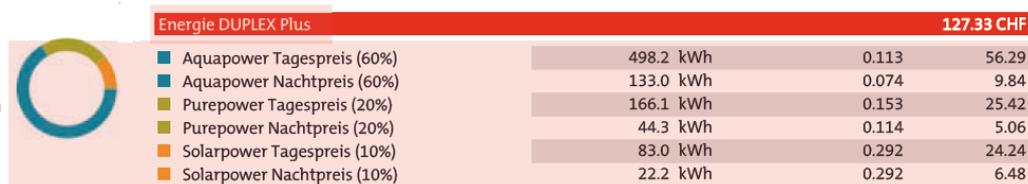


Figure 38: Excerpt from Repower (electricity) bill, 2015, page 2

If the energy utilities has a higher gain margin on eco products then it can be of interest that the costumers switches the energy product to such one. Some energy utilities deliver comparison and estimations how much the additional costs are (cf. Figure 39 **Erreur ! Source du renvoi introuvable.**) or by pointing to an improvement in the customer's own ecological assessment (cf. Figure 40), if switched to an eco product to trigger a consideration.

Welchen Aufpreis zahle ich im Monat für ein Ökoprodukt?

Machen Sie sich eine ungefähre Vorstellung:

Die hier verwendeten Angaben sind Richtwerte und sind abhängig von Ihrem persönlichen Verbrauchsverhalten.

	Wasser Fr./Monat	Natur Fr./Monat	Sonne Fr./Monat
2-Zimmer Wohnung Verbrauch 1'600 kWh	1.35	4.00	6.65
4-Zimmer Wohnung Verbrauch 4'500 kWh	3.75	11.25	18.75
Einfamilienhaus Verbrauch 7'500 kWh	6.25	18.75	31.25
Grosses Einfamilienhaus Verbrauch 25'000 kWh	20.85	62.50	104.15
Kleiner Gewerbebetrieb Verbrauch 30'000 kWh	25.00	75.00	125.00

Figure 39: Excerpt from bill insert 4_2016 of the Nidwalden cantonal power station



Produkt

IWB Bio-Erdgas

Unser Standardprodukt IWB Bio-Erdgas enthält einen Anteil von 3% Biogas aus erneuerbaren Quellen. Mit dem zusätzlichen Bezug von IWB Biogas Plus liesse sich der Biogasanteil bis zu 100% erhöhen und damit die persönliche Ökobilanz verbessern.

Figure 40: Excerpt from IWB (gas) bill; 2016, switch to biogas to improve personal ecological assessment, page 3

If information on the energy mix is presented more frequently and ideally also graphically on bills, this can increase the customer's motivation to change their behaviour. If this results in a change to another product, this can also be financially interesting for the energy utility.

7.4.6 Indicators 10 to 12: Comparative values

The comparison of one's own consumption is a useful mean of classifying one's own consumption, and thus identifying any potential savings (see section 7.2.4). A comparison with one's own consumption in past periods is easy to present; comparison with e.g. Swiss average values, or more specific values such as e.g. consumption by similar households, is more complex.

The analysis of the bills shows accordingly that, in over 50% of bills (electricity), the comparison with the customer's own historical consumption is presented (Figure 41), whereby more than 10% of electricity bills also opt for graphic presentation (derived from section 7.4.5.1).

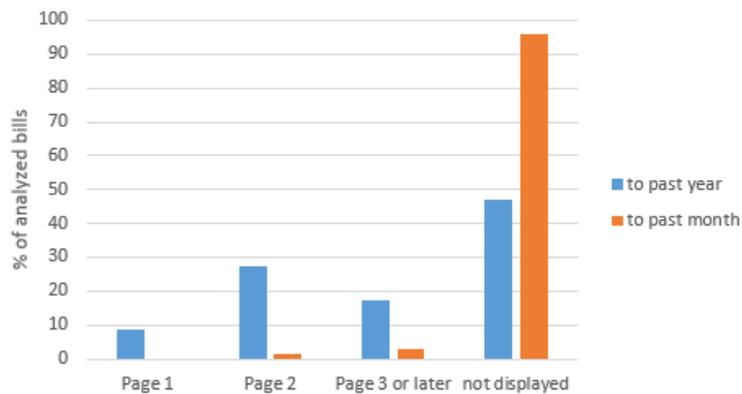


Figure 41: Analysis of collected bills: Historical comparison with customer's own consumption (electricity)

However, none of the analysed bills compare the customer's own consumption with Swiss averages or more specific values. This essentially corresponds to the results' analysis of the survey (cf. Figure 42).

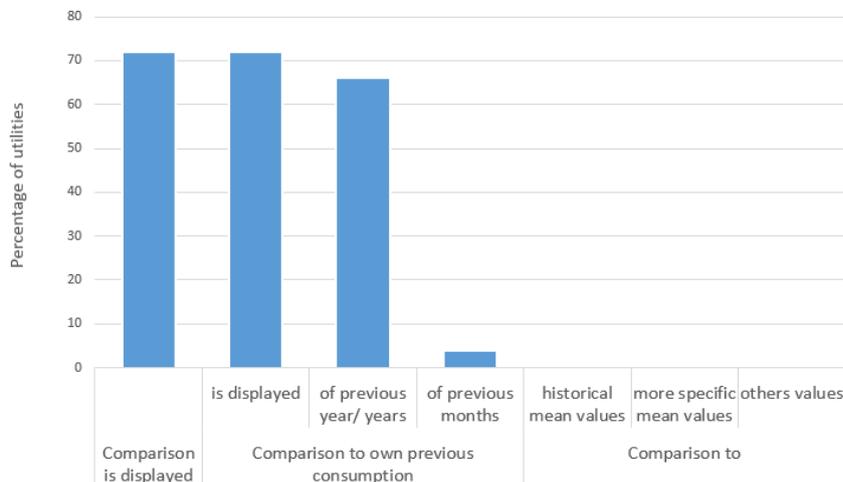


Figure 42: Analysis of survey (50 responses): Comparison with customer's own consumption (electricity)



The analysis of the location of comparative value presentation follows a similar tendency as the analysis of bills, but the proportions are somewhat higher as shown in Figure 43.

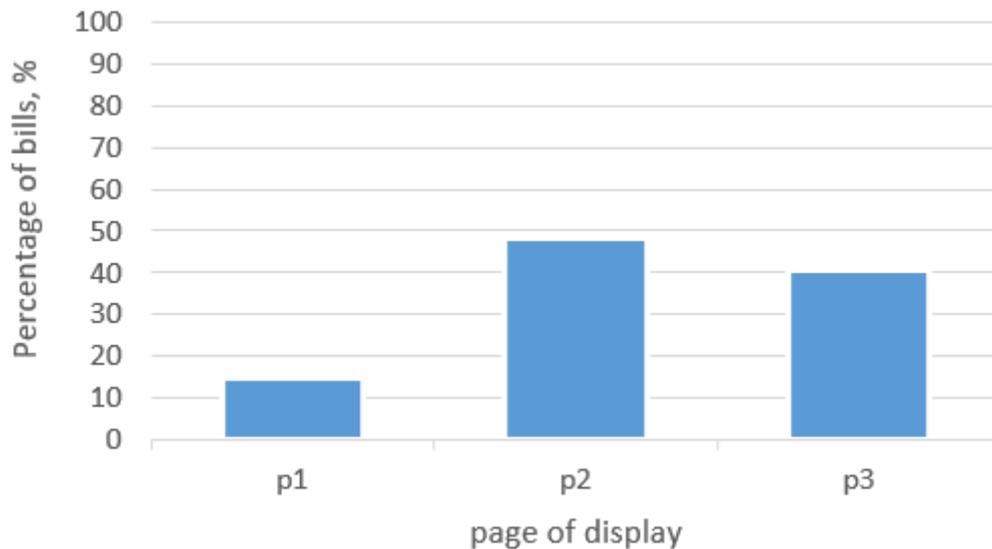


Figure 43: Analysis of survey (27 responses): Presentation of comparative values

Example of comparison of the customer's own consumption with consumption in previous periods are shown in section 7.4.5.1.

The Industrielle Werke Basel (IWB) bill shows the difference to consumption in the previous year as a percentage and (although the basis for the assessment is unclear) indicates whether the change lies within the "tolerance range" or gives a reason for an in-depth analysis (Figure 44). For example, according to a study from Sweden, 80% of households want to be warned, if their electricity consumption suddenly rises (Duscha et. al., 2007).

Verbrauchsvergleich

Bezeichnung	Abrechnungsperiode	durchschnittlicher Tagesverbrauch
Strom	01.02.2015 – 31.01.2016	19.9231 kWh
Strom	01.02.2016 – 31.01.2017	19.8035 kWh
Minderverbrauch		-0.60%

■ Ihr veränderter Stromverbrauch liegt im Toleranzbereich. Ziel der IWB ist es, den effizienten Einsatz von Energie zu fördern und damit den Stromverbrauch pro Kunde langfristig zu reduzieren. Falls Sie Fragen zur Verbesserung der Energieeffizienz haben, unterstützen wir Sie gerne mit Informationen und Ratschlägen.

Figure 44: Excerpt from IWB (electricity) bill, 2017, page 4

The comparison of consumption with previous periods is useful and desired by the customer and is easy to include in a bill by simply entering the percentage change. Please note the comparable reference basis (reference period, climatic conditions, etc.). Even better are comparisons with other reference values, which allow a classification of one's own consumption in comparison to other customers. Comparisons should be presented more graphically to improve comprehensibility, and placed on the first pages for good visibility.

7.4.7 Indicators 13 to 15: Savings potential

Only one of the analysed bills provides some general savings potential tips, cf. Figure 45. More specific potentials, e.g. compared to the Swiss average or more specific values, or as cost savings or environmental impacts, are never stated.



ecoConseils : Comment réduire votre consommation d'énergie?

Consommons moins et mieux! Groupe E vous aide à faire la chasse aux kilowattheures (kWh). Voici une sélection de conseils faciles et efficaces pour une famille:

- < Un pommeau de douche avec limiteur de débit, brise-jet et touche éco permet d'économiser jusqu'à 50% d'eau, soit environ autant d'énergie.
- < Réglez la température de votre réfrigérateur sur +5°C. Chaque degré en-dessous équivaut à une augmentation de 5% de la consommation.
- < Si vous utilisez un sèche-linge, il vaut la peine de faire un essorage avec un nombre de tours/minutes élevé. Une lessive mieux essorée réduit l'énergie et les coûts nécessaires pour le séchage.
- < Ne laissez pas ouvertes les fenêtres basculantes de la cuisine, salle de bain ou chambre à coucher en permanence en hiver; c'est 200 litres de mazout consommés par saison pour rien.

Figure 45: Excerpt from group-e (electricity) bill, 2015, page 2

Savings potentials are based on comparisons and simultaneously stimulate the motivational factors of "Can" and "Want". They therefore stimulate a change in behaviour for greater efficiency. An improvement of bills can be achieved by showing more savings potentials, especially if these are graphically presented.

7.4.8 Indicators 16 to 17: Environmental impact

The analysis of the collected bills shows that no environmental impact indicators (e.g. eco-indicator 99, environmental impact point, CO2 emission, etc.) were stated for electricity, gas or district heating.

Due to statutory requirements in Switzerland (ECom, 2016), however, the costs of the CO2 tax are listed for gas bills, which can be understood in a broader sense as an environmental impact.

An example of a general statement on the effect of an energy vector change can be found in the bill presented in Figure 46.

Produkt

IWB Bio-Erdgas

Unser Standardprodukt IWB Bio-Erdgas enthält einen Anteil von 3% Biogas aus erneuerbaren Quellen. Mit dem zusätzlichen Bezug von IWB Biogas Plus liesse sich der Biogasanteil bis zu 100% erhöhen und damit die persönliche Ökobilanz verbessern.

Figure 46: Excerpt from IWB (gas) bill, 2016, page 3

The survey showed that only about 5% of energy utilities include in the bill the environmental impact of customer's own consumption. Due to the small number of responses, the location of the presentation of such information on the bill's pages was not analysed.

As the statement of environmental impact makes the abstract quantity "energy" easier to grasp, its presentation can help customers to understand their own consumption, and thus stimulate a change in behaviour.

7.4.9 Indicator 18: Availability of tips and recommendations

In the separate analysis of bills, general hints and tips were only found in two bills (electricity) (example in Figure 45). Explanations of bills were listed on 20% of bills, on the back pages (cf. Figure 47).

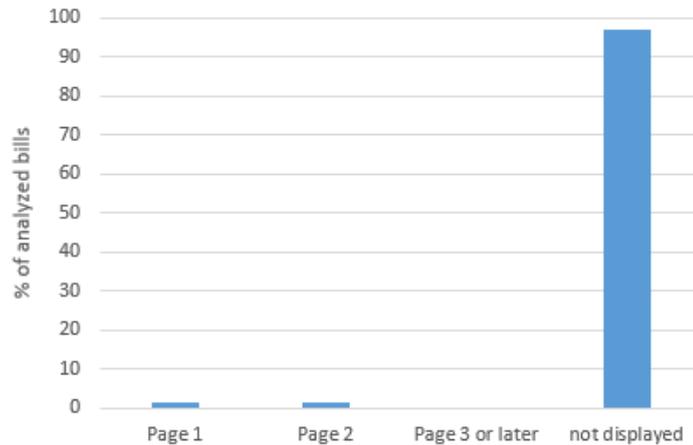


Figure 47: Analysis of bills (electricity), presentation of tips

The analysis of the survey conveys a different picture. According to the responses, energy-saving tips are presented on around 20% of bills, and around 20% of energy utilities offer tips on their websites. The random check showed that the question may have been misunderstood by energy utilities and, for example, bill inserts (additional information on additional paper, supplements) were considered. However, bill inserts are not an integral part of a bill and should not be considered.

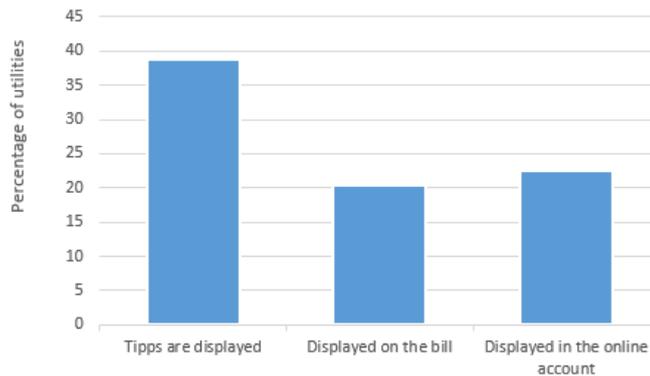


Figure 48: Analysis of survey (49 responses): Presentation of energy-saving tips (electricity)

According to analysis of the survey, tips tend to be shown on page 3 (75%), which corresponds to the analysis of the collected bills (Figure 49).

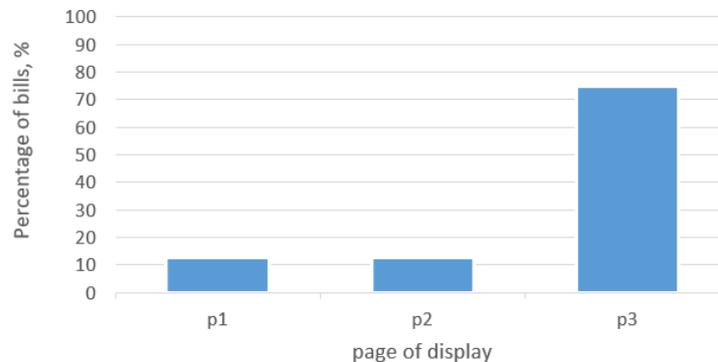


Figure 49: Analysis of the survey (8 responses): Place of presentation of energy-saving tips

General tips can provide impulses and point out motivational possibilities for "Can". An increase in presentation on the consumers' bill is desirable, as this is a way to reach a large number of customers.



7.4.10 Indicator 19: Availability of explanations on bills

According to the analysis of the collected bills, explanations are presented on 20% of bills (Figure 50). This is considerably more than the value determined by the survey (around 5%, cf. Figure 51).

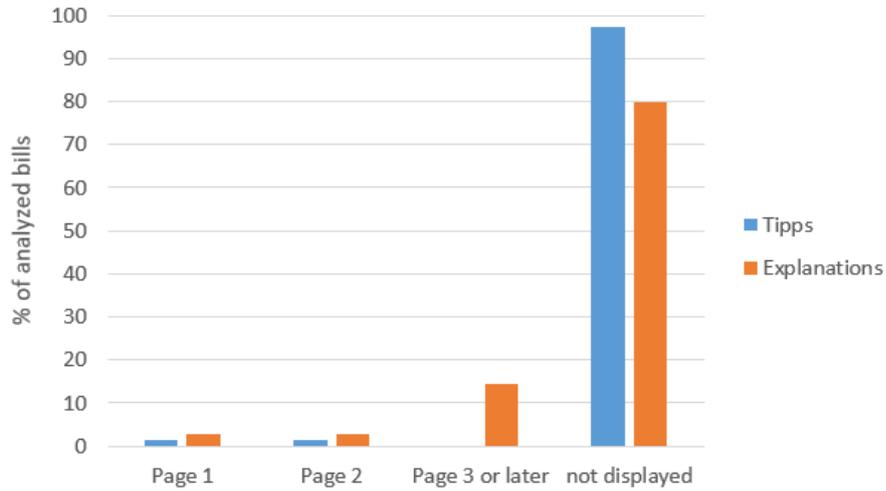


Figure 50: Analysis of bills (electricity): Explanations and tips on the bill

The offer to provide explanations on the website (>60%) or via a contact address (just under 50%) is widespread (cf. Figure 51).

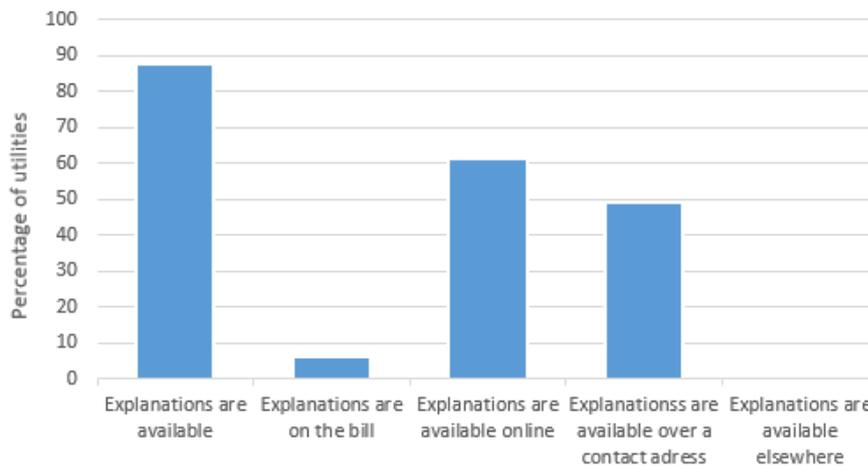


Figure 51: Analysis of survey (49 responses): Presentation of explanations on bills (electricity)

Explanations should be included in bills in order to improve comprehensibility, but can also be presented on the back pages.



7.4.11 Indicator 21: Volume (number of pages)

The analysis of the survey (Figure 52) shows that an average bill contains 2.7 pages, with an additional page as an attachment. The longest bill contains 9 pages, and the shortest a single page. Attachments are not always provided. Attachments contain a maximum of six pages.

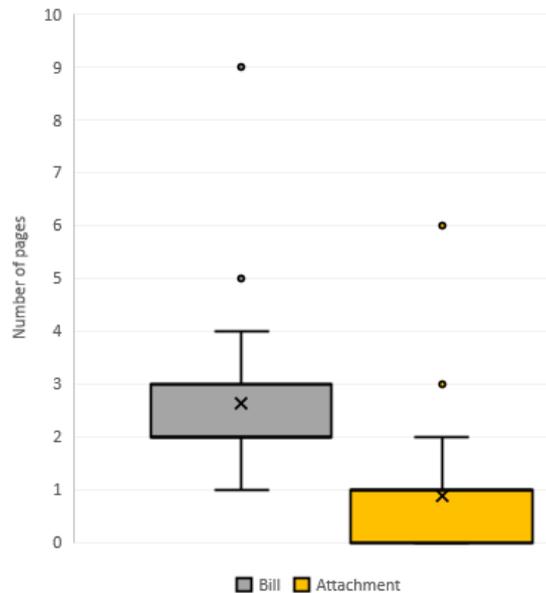


Figure 52: Analysis of survey (48 responses): Number of pages

Essentially, short and concise bills are desirable with regard to the findability of information. Compliance with this requirement is often difficult due to statutory requirements (statement of cost components) and customer needs (e.g. explanations).

7.4.12 Indicator 20, 22: Type of presentation, location of presentation

These indicators are integrated into the other appropriate indicators where they make use of it.

7.4.13 Indicator 23: Installed meters

According to the survey, the following meters are currently installed according to Figure 53.

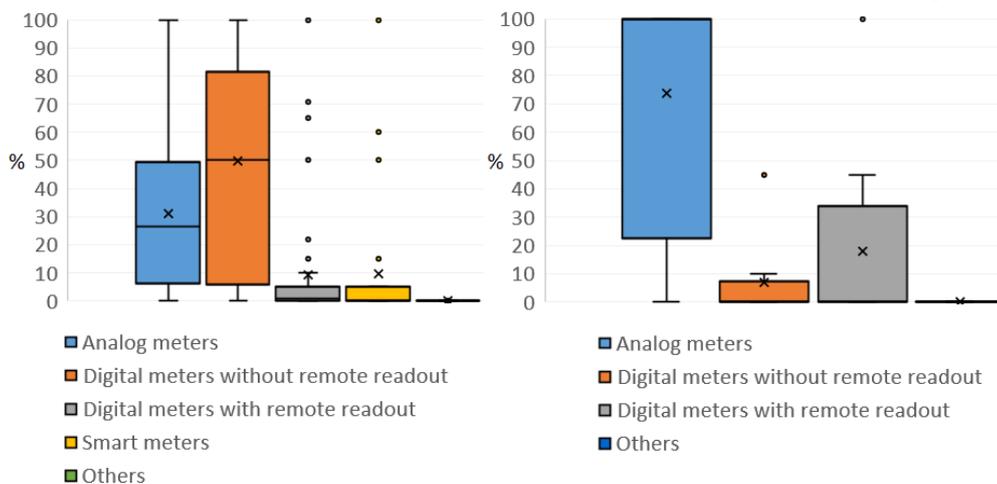


Figure 53: Analysis of survey (44 responses): Meters currently installed (left: electricity, 44 responses, right: gas and district heating, 8 responses)



It can be seen from Figure 53, that more than 90% of the currently installed electricity meters do not allow remote reading. Nevertheless, for some energy utilities, 100% of the devices they operate have remote reading (digital meters or smart meters).

Gas and district heating are always measured using analogue devices. Only one energy utility has installed 45% of digital meters with and without remote reading.

The effort for taking a reading is directly related to the meter. If more frequent readings are possible, the consumption of shorter intervals can be compared.

The example of Repower's bill (Figure 54) shows that consumption can be presented in more detail (monthly and aggregation to quarters (Q)). However, it is not known which type of meters were used.



Figure 54: Excerpt from Repower (electricity) bill, 2015, page 4, reworked

7.4.13.1 Indicator 24: Installation of meters in the medium term

According to the survey, energy utilities will install significantly more meters with remote reading in the medium term. Analogue measuring devices are operated by only 10% of energy utilities and digital measuring devices without remote reading by over 30% of energy utilities (Figure 55).

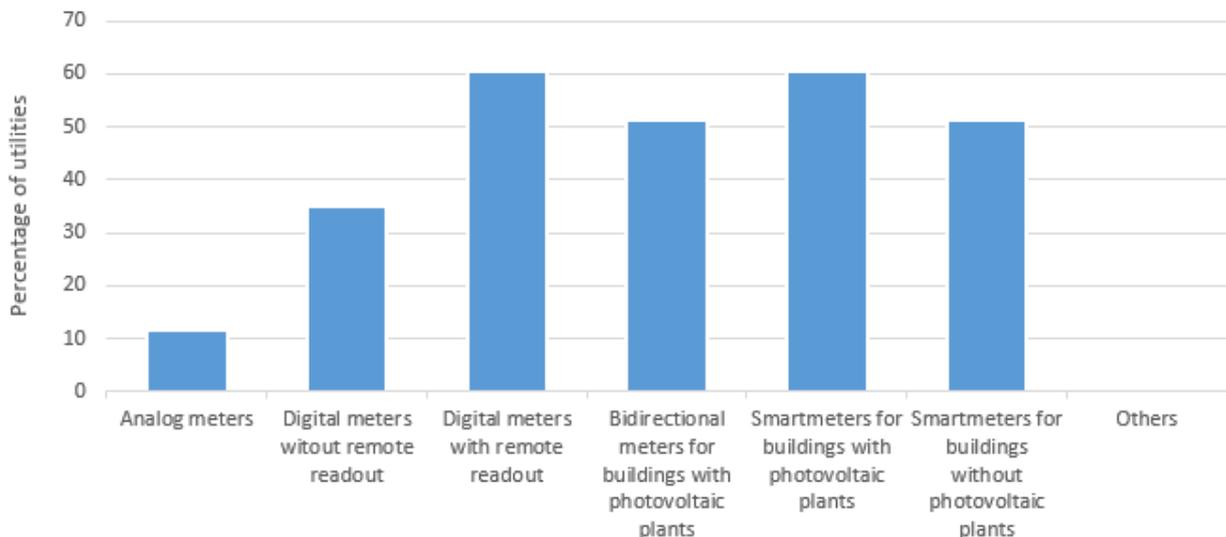


Figure 55: Analysis of the survey (43 responses): Meters installed in the medium term (electricity)

Meters for gas and district heating installed in the medium term (7 responses) will be analogue (almost 30% of energy utilities), digital without remote reading (almost 15%) or digital with remote reading (>70%). Here there is too a trend towards remote reading.

It can be assumed that the proportion of smart meters will increase significantly, as there has been an obligation to increase the roll-out of smart meters since adoption and implementation of the Energy Strategy 2050.



7.4.13.2 Indicators 25 and 26: Additional customer information

Additional information about the customer enables further analysis and evaluation of consumption (see section 7.2.11). The survey's question about additional information on the customer was only answered twice, with one energy utility stating that the customer can provide the information him/herself.

No examples of the inclusion of additional information about the customer were found in the bills. This is probably due to the obstacles linked to obtaining such information and described in section 7.2.11.

In the EKZ bill (cf. Figure 56), the consumption comparison is related to the same historical reference period, it is visualised as a bar chart and the percentage change is also presented. The customer can thus quickly read whether and by how much his/her consumption has changed.



Figure 56: Excerpt from EKZ (electricity) bill, 2016, page 2

The IWB bill (Figure 57) refers to the dependence of heating consumption on climate. However, additional information (e.g. conversion based on publicly available information on the heating degree days of the site) is not used. In the IWB bill (Figure 44), it is also stated whether the change is within normal bounds (although the basis of this statement is unknown).

Verbrauchsvergleich

Bezeichnung	Abrechnungsperiode	durchschnittlicher Tagesverbrauch
Gas	01.10.2014 – 30.09.2015	19.2829 kWh
Gas	01.10.2015 – 30.09.2016	18.7879 kWh
Minderverbrauch		-2.57%

Der Verbrauch von Wärmeenergie ist stark witterungsabhängig. Bei besonders kalter oder warmer Witterung im Vergleich zum Vorjahr ist es möglich, dass der Energieverbrauch deutlich zu- oder abnimmt. Wenn Sie Fragen zum effizienten Einsatz von Wärmeenergie haben, steht Ihnen unsere Energieberatung gerne zur Verfügung. Diese erreichen Sie unter: energieberatung@iwb.ch oder über die IWB-Telefonzentrale: +41 61 275 51 11.

Figure 57: Excerpt from IWB (gas) bill, 2016, page 4

While additional information about the customer should not be presented on an improved bill, its availability is crucial for the energy utility's ability to analyse and present more customized information.



7.4.14 Indicator 27: Online account

Beside of the billing format and energy saving tips 35% of the energy utilities have additional information available on their online accounts (Figure 58).

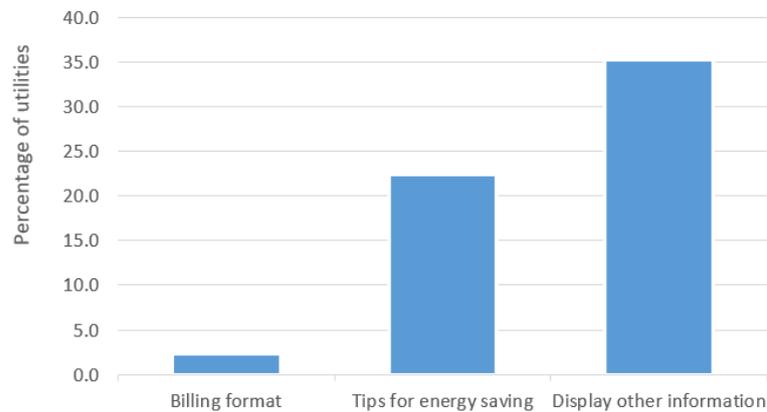


Figure 58: Analysis of survey, information and usage of online accounts

The additional information could be values/information either numerically and/or graphically e.g.:

- Consumption and consumption history
- Efficiency class
- Household comparison
- Comparison with other consumers
- Graphics and information on the payment process
- Benchmarks
- Tariffs

7.4.15 Indicator 28: Availability, type and media

Figure 59 shows that around 80% of energy utilities offer the customer additional information that is not printed on the bill. General information is provided by 40% energy utilities, and personalised information (based on one's own consumption or situation) by just under 20%. These are usually available on the utility's homepage (around 50%) or via newsletter (around 40%). Only in more than 10% of cases are customers informed by email in addition to on their bills. Just under 30% of energy utilities use other means to inform their customers, these usually being customer centres, personal advice services and the online portal.

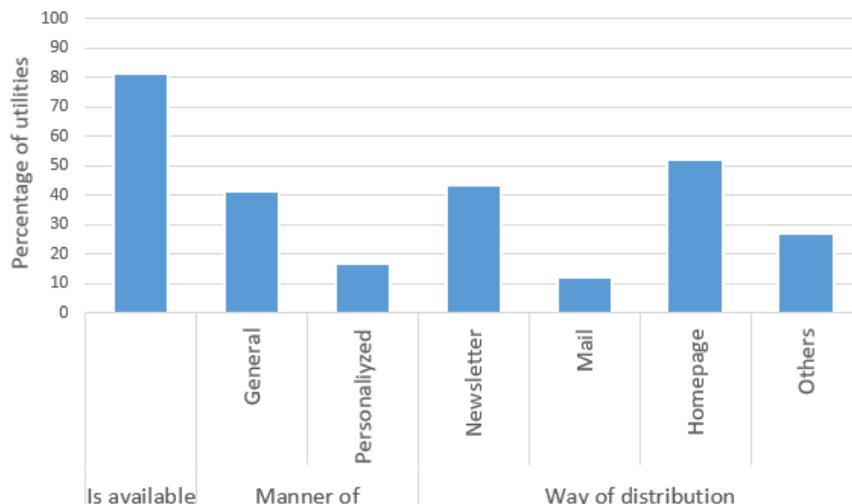


Figure 59: Analysis of survey (48 responses): Type and location of additional information for customers



7.5 Chapter's conclusions

The bills of Swiss energy supply companies are often difficult to understand and unclear for laypeople. The evaluation of 91 bills and 54 (valid) responses (to the survey) shows a great potential for improvement in many areas.

The most widespread type of billing today is paper bill with payment slip. Although other digital delivery methods (online account, e-bill, etc.) are increasingly being used in other markets (e.g. telecommunication). Improving billing with regards to printed bills (paper or in PDF format) is potentially the most effective solution, as over 90% of customers currently receive their bills in this form.

Information about one's own consumption and energy costs is of great interest to the customer, so the actual placement on the first page makes sense. Much of the information provided due to statutory requirements (allocation of costs, consumption according to rate, etc.) is also often presented on the first page, but can also be presented on the back page of the bill, which has received less attention due to the low level of interest shown by customers.

Easy-to-understand graphic presentations are rare and often do not appear on the first pages, where the attention of the customer is higher. The bills contain hardly any information that helps customers to compare their consumption to a reference value and that encourages them to reduce it.

Comparison with one's own previous historical consumption is common, but comparisons that allow a classification of one's own consumption (e.g. with the average Swiss consumption of similar households) are never made. One major obstacle for providing such data by energy utilities is the difficulty in retrieving such additional information about the consumer (e.g. number of persons in the household) or the building (e.g. type of hot water supply).

In particular, graphic comparison with one's own historical consumption is now usually easy to implement by energy utilities, along with information desired by the customer. Today, it is presented on more than half of all bills in numeric form, but in graphic form, on only ca 10% of bills. Helpful information on the correct interpretation of changes, e.g. whether fluctuations, are caused by different climates ("cold winters") or different measuring times, or are within the usual range, is only provided in individual cases.

Further comparisons (to the Swiss average, or more specifically, depending on the building or the number of residents) are not offered (Figure 42) on bills due to a lack of information about the customer. The lack of comparisons is probably also the reason for the complete lack of presenting savings potentials, which are effective in stimulating efficiency increases.

Information on environmental impact that makes it easier to "grasp" the consumption of energy, which is otherwise difficult to understand, is practically never shown on bills, although corresponding information (e.g. CO₂ balance of the consumer mix) is available for energy utilities.

Electricity labelling, as required by law, is used only in individual cases. However, particularly with regard to special products, such as "Nature made" electricity, presentation on the bill makes sense and can also be financially interesting for energy utilities in the event of a consequent product change.

General energy saving tips and recommendations (e.g. intermittent full ventilation instead of tilted windows) are simple and may affect behavioural changes. The bill is an appropriate media to communicate such information and reach a large proportion of customers. This option is rarely used (around 3% according to the analysis of the bills).

Energy utilities with a high proportion of smart meters with remote reading are not increasing the use of electronic bills or online accounts. However, one energy utility with 100% installed smart meters also accounts for, by far, the highest proportion of bills delivered via online account (29%). There is no correlation between the type of meter and the frequency of bills or information on bills.

As many energy utilities seem to be aware that electricity bills are difficult to understand, they offer explanations to bills. Explanations are usually available on energy utilities' websites (60%) or through personal contact (50%), and not on the bill itself. This seems to make sense with regard to the volume of the bill.

Additional information (e.g. graphics and information on the payment process, benchmarks, tariffs...) is offered by many energy utilities (>80%), albeit usually not on the bill, but online (website: 50%), or in



newsletters (40%). In this case, personalised information is provided much less frequently (just under 20%) than general information (more than 40%).

Many energy utilities meet only statutory requirements, but provide hardly any further information. Consequently, bills are often very similar in terms of content and presentation. By adding further information, tips, graphical representation of information etc. the energy utilities can establish customer retention, position themselves and aim at triggering a behavioural change in energy consumption, which can result in energy saving.



8 Existing DSI in foreign countries

Research on ways to improve the utility bill so as to give residential customers more control over their energy use has been going on since at least the 1980s, when utility companies first introduced Demand-Side Management (DSM) programmes aimed at stimulating customers to modify their consumption patterns, both in the period of the day time and in the overall amount of energy consumed (Gellings and Chamberlin, 1988). Such DSM programmes have recently been regarded as even more valuable and powerful tools, now that it is widely acknowledged that the society as a whole, and therefore customers as well, play a role towards carrying out the energy transition and achieving international climate and environmental protection goals.

Thanks to the fast diffusion of Information and Communication Technologies, and the related diffusion of smart metering systems, detailed information on individual consumption patterns is nowadays becoming easily available to utility companies. A basic understanding of individual monthly and possibly daily or even hourly energy consumption would represent a large shift of awareness for private customers, possibly acting as trigger towards energy saving. In fact, many companies started offering innovative DSM programmes for their customers, not only providing them with information on their energy consumption patterns (by means of web and mobile platforms), but also stimulating them to energy saving by means of customized behaviour change programmes and home automation control tools.

In such a framework, in order to build effective DSM programmes, it becomes essential understanding:

- if and how utility companies are providing customers with information on their energy consumption patterns,
- if the way such information is provided is effective in increasing customer awareness and in motivating them to engage in energy-saving activities,
- and identifying possible ways to improve common current little effective practices.

Therefore, the provision of information to customers is referred as “Demand-Side Information (DSI) programmes”.

In this document, the results of a comparative analysis on DSI programmes in Europe and overseas are presented; in particular, it has been focused on the most common DSI programme, which is the energy bill itself: a simple, low cost solution, which is provided to the entire customer base (Dromacque et al., 2013), therefore particularly appropriate to a comparison at the international level. Such an analysis was carried out in parallel to a matching analysis performed at the national level, within chapter 7 of the IMPROVE project.

8.1 Methodology

Main aim of this research was to gain a broader insight into the main informative contents and design elements of electricity, gas and district heating DSI programmes currently provided by energy utilities across Europe and overseas, in order to allow the identification of:

- widespread practices, tools and activities,
- possible future trends,

thus supporting elaboration of recommendations for three IMPROVE solutions.

It is important to remark that energy utilities are increasingly promoting and expecting customers to move on-line to access more detailed information about their consumption and bills. In fact, online tools (webportals, smartphone applications, In-Home Displays, etc.) enable the exploitation of (near) real-time consumption data from smart meters and a more personalized monitoring and targeting. In the present research, however, it is not possible to systematically analyze web portal functionalities and electronically-accessed DSI programmes offered by current energy utilities, as these need a personal account and password for access.

Consequently, main focus in this research refers to energy bills, despite the proliferation of smart meters and smartphones, with only marginal and partial analysis of webportals and other DSI programmes. Yet, energy bills still represent a cost-effective feedback device with a broad reach and the principles of information design that make a good energy bill likely also make a good website and webportal.



Also, it has been noticed that the present data collection and assessment intentionally focuses *only* on DSI programmes targeting residential customers, as said with a main focus on their energy bills. Business energy bills and DSI programmes largely differ both in context and in possibilities to save energy, therefore will need further separate investigation.

Collection and analysis of information regarding energy bills was performed according to the methodology summarized in Figure 60. First, a literature review has been carried out, in order to identify general past and present practices and elements characterizing “good” DSI programmes, with a focus on energy bills. This allowed us to identify a set of indicators, as a frame of reference to assess energy bills. Then, in parallel, the following data collection activities has been performed:

- an online survey questionnaire targeting European and overseas utility companies;
- an Internet search on utility companies’ websites directly aimed at collecting demonstration bills and, whenever possible, also information on other DSI programmes they offered;
- an informal collection of bills from the networks of personal contacts of the whole group of IMPROVE researchers.

As a result, a number of energy bills has been collected from utility companies worldwide (in some cases also accompanied by information on their webportals and other DSI tools), which were analysed by means of the set of indicators indicated above. The resulting matrices of assessment allowed us to:

- investigate widespread practices, tools and activities;
- highlight good practices and particularly innovative DSI elements.

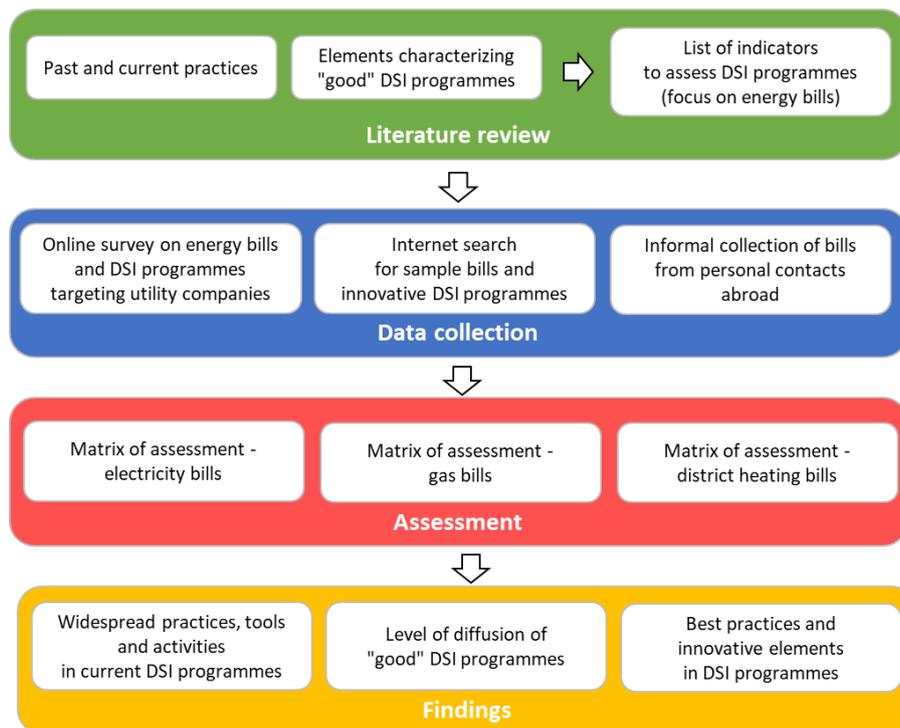


Figure 60 The methodology used to identify and analyze existing DSI programmes abroad, with specific focus on energy bills.

8.2 Literature review

Literature review was performed with the aim of identifying a series of billing content and design elements a «good» Demand-Side Information (DSI) programme should contemplate to encourage also energy-saving and management.



To this purpose, the review took into account:

- legal billing requirements;
- current scientific literature on the efficacy of different energy feedback mechanisms and good practice experiences;
- recommendations, suggested templates, self-regulations etc. elaborated by service providers, national energy regulatory authorities, and consumer protection associations.

In regards to what kind of information the energy bill should provide to their respective consumers, every nation has some kind of regulations in place – from minimum legal requirements or recommendations, to more prescriptive approaches. This depends not only on regulatory traditions, but also on the type and level of energy market development each nation is experiencing.

With the progressive liberalization of the energy market in general, various efforts are being made to create and promote a competitive retail market, as well as to guarantee the protection of consumer interests. This has led to a widespread development of recommendations for consumer-friendly electricity and gas bills. Of course, the ultimate challenge being to strike a balance between too much versus too little information appearing on energy bills. At European level, with the introduction of Directive 2009/72/EC and Directive 2009/73/EC concerning common rules for the internal energy market first, and Directive 2012/27/EU as a follow up on strengthening or providing new measures to improve energy efficiency in energy supply and demand, various efforts have been made to improve informative contents of energy bills, also by means of participatory stakeholder approaches.

For instance, already in 2009, on the basis of recommendations made by a European Commission working group on billing, created in response to the 1st Citizens' Energy Forum, a voluntary "Good Practice Guidance for Billing" was developed (ERGEG, 2010). Even though here improving market transparency remains the focal point, with priority billing items being those referring to accounting details and key information on comparability of offers, secondary billing items actually include also information on (i) evolution of consumption during last year(s), (ii) tips on energy-savings or green tips and (iii) product mix per energy source and global mix of supplier.

8.2.1 A frame of reference to analyze DSI programmes (with a focus on energy bills)

The performed review has confirmed that, next to guaranteeing transparent accounting of charges for obvious retail market reasons and customers' trust-levels, an improved energy bill should also include innovative energy feedback elements such as comparative statistics, information on climate and environmental impacts (eco-feedback), pro-active (possibly personalized) energy-efficiency tips and advices, as well as specific contact information. Availability of such elements is found to be capable of motivating the customer to take concrete action and engage in energy-saving practices at home (Foster & Alschuler, 2011; Dromacque et al., 2013).

Figure 61 summarizes the key categories of DSI elements which characterize effective DSI programmes, and in particular energy bills, as identified in the literature review. They have been used as a frame of reference for classifying energy bills collected during this research.

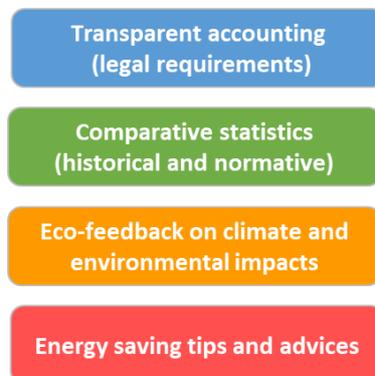


Figure 61 Main categories of DSI elements characterizing effective DSI programmes, in particular energy bills.



More in detail, each category can be split in a number of indicators, which account for specific aspects. The full list of considered indicators is represented in Table 14. As a reference, only the indicators for electricity (E) bills are shown here. Corresponding lists of indicators were considered for gas (G) and district heating (DH) bills, adjusted with minor differences in order to take into account of peculiarities of each form of energy. The full list of indicators is presented in Appendix 5.

Besides the four categories indicated in Figure 61, an additional indicator has been included in order to take into account any innovative DSI element that, though not directly included in the bill, the utility company presents to customers through the bill or the website, such as for example webportals, customer fidelity schemes or home automation programmes.

TRANSPARENT ACCOUNTING

- E01. Meter reading type (estimated or actual)
- E02. Total amount due
- E03. Disaggregation of billing costs (energy usage, taxes, network charges etc.)
- E04. Energy usage in kilowatt-hour [kWh]
- E05. Unit rate of energy [costs/kWh]
- E06. Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
- E07. Other (specify)

COMPARATIVE STATISTICS

- E08. Average daily energy use and costs (over the given billing period)
- E09. Graph of energy use over billing period
- E10. Graph of historical energy use over past 12-14 months
- E11. a - Current energy usage compared to previous month
- E11. b - Current energy usage compared to previous year (same period)
- E12. Current energy usage compared to other similar households
- E13. Current energy usage compared to average consumption of similar households in the same area
- E14. Energy consumption pattern variation according to different seasons
- E15. Correlation between energy consumption and temperature/weather conditions over billing period
- E16. Average account of electricity use by major appliances
- E17. Household specific account of electricity use by major appliances
- E18. Other (specify)

ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

- E19. Breakdown of fuel mix used as energy sources for the given bill
- E20. Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
- E21. Other (specify)

TIPS & ADVICE

- E22. One-size-fits-all, general energy-saving tips and advices
- E23. Customized, actionable insights to manage energy costs & consumption
- E24. Advice on time-of-day tariffs or other dynamic tariffs (e.g. cost of running appliances at different times of day)
- E25. Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
- E26. Contact info on customer service offering customized energy-efficiency specific consultancy
- E27. Other (specify)

INNOVATION

- E28. Innovative approaches

NOTES AND COMMENTS

- E29. General comments
-

Table 14 The list of indicators used to assess energy bills, grouped per category. As an example, only the set of indicators used to assess electricity (E) bills is shown here.



8.3 Data collection

8.3.1 Online survey/questionnaire

The online survey was designed in order to collect information regarding the key elements emerged from the literature review, with specific reference for the indicators shown in Table 14. Actually, three separate online questionnaires were designed, all sharing the same structure and questions, though customized in order to get specific information respectively regarding Electricity, Gas and District Heating bills and the related DSI programmes offered by the company to their customers.

The complete questionnaire is made available in Appendix 6. A few introduction questions asked about billing format (paper bill, electronic bill, webportal, etc.), plan (balanced, pre-paid, etc.), paying scheme (availability of direct debit schemes) and billing frequency (monthly, bi-monthly, irregular, etc.) and the percentages of the residential customers of the company adopting each of them.

Then, the questionnaire asked about feedback elements they offer in bills for residential customers (transparent accounting, comparative statistics, climate and environmental impacts, energy saving tips and advices): do they provide any of the following information? And, if so, how? A set of multiple choice questions were used. Also, possibility to indicate specific information elements they offer was made available by means of an open-ended question. The utility company was also invited to upload an anonymized copy of their residential customer energy bill.

Then, the questionnaire investigated whether the company offers any smart home devices or functionalities, such as webportals/interactive online tools, mobile phone applications or In-Home Displays (IHD) allowing nearly real-time monitoring of energy consumption, or even remote control systems (smart thermostats, smart plugs, lighting or solar production control systems). Again, a set of multiple choice questions was offered, accompanied by an open-end questions allowing the company to present any innovative programmes they are offering to their private customers in order to engage or support them in energy-saving actions at home. In particular, the questionnaire asked to focus on Information/Education campaigns, gamified energy-saving programmes (e.g. utility-sponsored energy competitions for customers, either individually or in teams, games that employ real-time granular data on player's energy use as feedback, quizzes, etc.), and customer fidelity programmes (points and prizes).

Finally, the questionnaire investigated the availability of specific studies and analyses performed by the company to assess effectiveness of any of the energy saving measures they had activated by means of enhanced bills or DSI tools, both from the quantitative point of view (effectiveness in terms of energy saved) and from the qualitative point of view (effectiveness in terms of customer satisfaction and/or customer feedback). Also for such questions, the company was invited to upload any documents available to this purpose.

All in all, the questionnaire was made of twenty questions, requesting around fifteen minutes for completion, provided that the related information was already available to the person charged with providing answers.

To collect answers to the questionnaire, first a general search of utilities on the Internet, mainly throughout Europe, was carried out. Thereupon, the selected utilities were contacted via e-mail and invited to complete the online survey and to provide an anonymized bill sample for assessment. The questionnaire was built in English and then also translated in German, French and Italian. Whenever the questionnaire was available in the official country language, invitation to take part in the survey and questionnaire used the local language; otherwise, both invitation and questionnaire were sent in English.

Unfortunately, without the availability of selected reference persons from back-end offices of foreign energy utilities, the only possible interaction point for launching the online survey was their general customer service, advertised on the utilities' websites. Yet, in many cases, utilities do not even provide a direct e-mail address for contacts on their website, but either request the completion of an online form (with an automated notification system, stating to have received the request and to process it) or provide a customer hotline number with rather long waiting times. Not surprisingly, the online survey did not bring many results. Out of the 200 utilities contacted online via "customer service" (see Table 15 and Appendix 7 for their detailed list), actually no one did answer the survey. So, this activity did not provide us with any bill sample nor data regarding billing information content.



Country	Electricity	Gas	Electricity and Gas	District heating	Electricity and District heating	Electricity, Gas and District heating	Total
Austria	12	1	17			4	34
Belgium			12				12
Denmark	1	3		1			5
France	6	1	6				13
Germany	1		33			1	35
Italy			23				23
Poland			1				1
Portugal	9	4	7				20
Rep. Ireland	3	1	4				8
Spain			4				4
Sweden	3	1		1		4	9
The Netherlands	9		21	1			31
United Kingdom			5				5
Total	44	11	133	3	0	9	200

Table 15 Number of contacted utilities to complete the online survey.

8.3.2 Internet search on utility companies' websites

In parallel to the launch of the online survey, a review of the websites of the 200 foreign utilities contacted was carried out to collect possible standard bill format samples any innovative DSI elements they offered to their customers. For around 60% of such utility websites, it was actually possible to access some form of information and explanation in regards to the general contents and layout of their energy bills. In most cases, the sample bill delivered refers to the annual adjustment balance (subsequent to advanced payment schemes throughout the year). However, some websites only show partial bill samples, usually merely reporting details about the accounting procedure of the bill, but not accessory information on energy consumption and savings. As such, in these particular cases, a more thorough assessment was not possible.

	Electricity	Gas	Electricity and Gas	District heating	Electricity and District heating	Electricity, Gas and District heating	Total
Australia	2	1					3
Austria	14	9	2	4			29
Belgium			2				2
Canada	1						1
Denmark	1	2		1			4
France	2						2
Germany	19	12	4				35
Italy	4	2		1			7
Portugal		1					1
Ireland	2	3	1				6
Spain	1						1
Sweden	2			1		1	4
Turkey	1						1
UK	2	1	8				11
USA	3	2	2				7
Total	54	33	19	7	0	1	114

Table 16 Number of foreign utility websites reviewed showing samples of the energy bill.



Also, as said above, only in some cases information regarding DSI webportals or other innovative tools was available without password restrictions. Despite this, in some cases interesting practices appeared, as documented in section 0.

8.3.3 Informal collection of bills from personal contacts abroad

Next to the collection of bill samples via utilities' websites search, also a more informal gathering system, exploiting the international network of professional contacts, as well as relational (friends, colleagues, family, relatives, etc.) of the whole IMPROVE research team, was adopted. This particular channel contributed to the collection of 67 additional paper bills from all over the world (Table 17).

	Electricity	Gas	Electricity and Gas	District heating	Electricity and District Heating	Electricity, Gas and District heating	Total
Australia	1						1
Austria	1						1
Brazil	1	2					3
Chile	1						1
China	1	1					2
Columbia	1						1
Cyprus	1						1
Czech Republic	3	1					4
Denmark	3						3
Finland	1						1
France	2		2				4
Germany	3	1					4
Greece	1						1
Hungary	1	1					2
Italy	3	3					6
Japan			1				1
Malta	1						1
Netherlands			1		1		2
Norway	2						2
Portugal	5	3	1				9
Ireland	1						1
Romania	1	1					2
Rwanda	1						1
Spain	2	2					4
Sweden	2						2
United Kingdom	2	1	3				6
USA			1				1
Total	41	16	9	0	1	0	67

Table 17 Number of foreign bills collected via friends, family or colleagues abroad.



8.3.4 Limitations of the present data collection and final sample of data

An important limitation in this data collection is represented by the language and/or script barrier existing for some foreign countries. While it was easy to review and retrieve targeted information from utility websites and bills of English-, French-, German-, Italian-, Spanish- and Portuguese-speaking countries, websites and bills from, for example, Scandinavian countries were less accessible, as well as countries using non-Latin script systems (Greece, Cyprus, Turkey, Japan, China, etc.). This has unavoidably led to a bias in the selection of information and of bill samples: the bulk of information collected derives especially from English-, French-, German-, Italian- and Spanish-speaking countries (Italy, Germany, Austria, UK, France, Belgium, Spain).

Moreover, some of the bills received from contacts abroad were of low visual quality and consequently difficult to read and/or assess.

Finally, another important factor affecting the final sample of the analyzed energy bills has a more structural nature: the energy market liberalization, as well as the roll-out timing of smart meters throughout Europe and abroad, has reached different levels and consequently depicts a rather patchy situation also at the retailers' level, as each country approaches these processes in a different way. Consequently, the retail market is very heterogeneous, changing from country to country, offering respectively a higher/lower number of service providers, as well as of service portfolios, infrastructures, legal requirements etc. For this reason, the number of energy bills collected widely differs from country to country.

In conclusion, Table 18 summarizes the sample of energy bills effectively analyzed and assessed.

	Electricity	Gas	Electricity and Gas	District heating	Electricity and District heating	Electricity, Gas and District heating	Total
Australia	3	1					4
Austria	15	9	2	4			30
Belgium			2				2
Brazil	1	2					3
Canada	1						1
Chile	1						1
Columbia	1						1
Czech Republic	3	1					4
Denmark	4	2		1			7
Finland	1						1
France	4		2				6
Germany	22	13	4				39
Hungary	1	1					2
Italy	7	5		1			13
Malta	1						1
Netherlands			1		1		2
Norway	2						2
Portugal	5	4	1				10
Ireland	3	3	1				7
Romania	1	1					2
Rwanda	1						1
Spain	3	2					5
Sweden	4			1		1	6
United Kingdom	4	2	11				17
USA	3	2	3				8
Total	91	48	27	7	1	1	175

Table 18 Number of foreign bills that were effectively analyzed and assessed.



Overall, the following bills have been analyzed:

- 120 bills containing electricity billing data and information;
- 76 bills containing gas data and information;
- 9 bills containing district heating data and information.

Due to the limitations above, the present study is not meant to serve as an extensive, quantitative and representative analysis of the energy billing scenario currently present across Europe and overseas. Rather, it is to be interpreted as a qualitative, spot check and collection of energy billing approaches currently offered outside Switzerland: a starting point for suggesting possible contents and design elements to improve energy billing in Switzerland as a measure to enhance residential customers' energy awareness and motivation towards a more pro-active adoption of energy-efficient practices at home.

8.4 Findings

All the energy bills collected have been analysed on the basis of the indicators shown in Table 14, which resulted in the assessment matrices shown in Appendix 8.

Analysis of such matrices allows us to understand general energy billing tendencies regarding presence and frequency of DSI elements belonging to each of the four categories of indicators (Transparent accounting, Comparative statistics, Eco-feedback on climate and environmental impact, Tips and Advices), together with any other DSI innovative element that the utility company puts into practice.

In particular, it allows us to:

- understand what information is currently commonly included in the energy bill,
- and detect possible innovative, intuitive and user friendly contents and design elements, capable of further motivating residential customers to energy saving.

Hereafter the results obtained are presented, specifically focusing on each category of indicators and each form of energy (electricity, gas and district heating). As indicated above, even though quantitative charts are shown, they cannot be regarded as representative of the whole energy system abroad, and should not be approached from a strict statistical point of view. Rather, they can suggest trends and possible tendencies.

8.4.1 Transparent accounting

Accurate, transparent and understandable accounting is being acknowledged as the primary function of energy bills. In fact, it is the mean by which consumers receive information and understand the price they pay for the service they receive.

Since 2012, in the framework of the respective Energy Efficiency Directive, energy billing is now required to base on real consumption and to provide complementary information on historical energy consumption. However, this latter aspect is being promoted by the European Commission and the Citizens' Energy Forum more specifically at the level of *electronic bills*, considered as an effective tool for both payment control and personal energy data management (see: EC's practical guidelines and Infographs, retrieved online on July 2017 at :

http://ec.europa.eu/consumers/archive/citizen/my_rights/energy_en.htm).

8.4.1.1 Electricity bills

Figure 62 shows the percentage frequency of a series of billing items that have been identified in this study as characterising transparent accounting. Considering the primary accounting function of energy bills, it is not surprising to find that most of the transparent accounting billing items – amount due, disaggregation of billing costs (taxes, network charges, etc.), energy usage in kWh, unit rate (cost/kWh) - are to be found as a regular practice (indicators E02, E03, E04 and E05 are all well above 90%, see list of indicators in Table 14 and Appendix 5). The type of meter reading (indicator E01), i.e. whether estimated or actual, so far prevails in 89% of energy bills assessed. It can surely be considered a common billing feature.

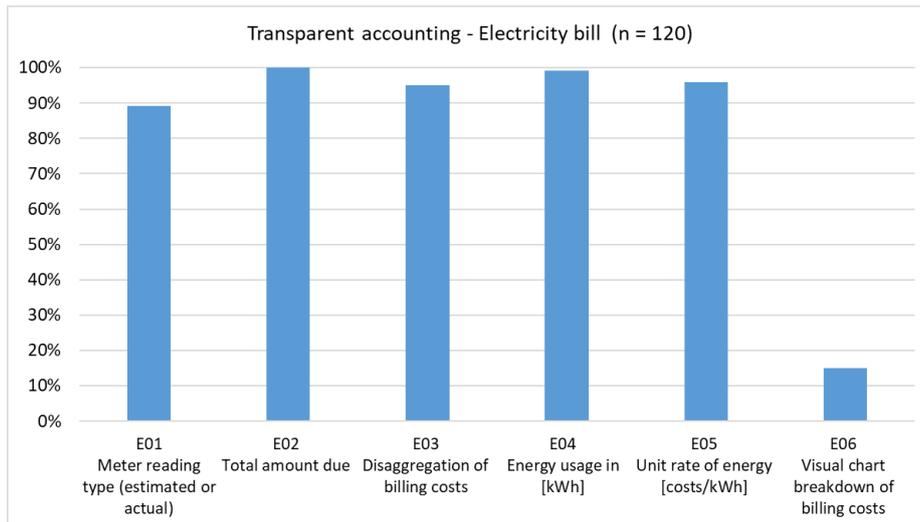


Figure 62 Assessment of electricity bills – Diffusion of “Transparent accounting” elements.

Bearing in mind the many actors taking part in energy distribution and supply and composing the wholesale cost of electricity, an accurate, but numeric disaggregation of billing costs alone, might render electricity bills more complicated and unclear. Thus, considering that visual information can help make energy bills more consumer-friendly and improve understanding, it is interesting to notice that a visual chart breakdown of billing costs emerges as a rather rare and/or innovative practice (indicator E06, only 15%, see list of indicators in Table 14 and Appendix 5). However, some countries (e.g. UK, Italy, Germany and Spain), have made the visual chart breakdown of billing costs a rather mainstream practice, as it is shown in Section 8.4.1.4. In Italy, for example, it was made compulsory since 2016 by a national resolution by the Authority for Electricity Gas and Water, under the so-called “Billing 2.0” framework regulation (AAEG, 2014).

8.4.1.2 Gas bills

Findings for gas bills are similar to those for electricity bills (see Table 14 and the full list of indicators presented in Appendix 5), with the exception that the visual chart breakdown of billing costs is even less practiced here (indicator G06, 10%). This somehow reflects the fact that more innovative elements at first appear in electricity bills and subsequently are replicated in gas bills.

In Germany and the UK, the gas usage is formally converted from m³ into kWh. Accordingly, the accounting section also reports the exact calculations made to reach the energy usage in kWh.

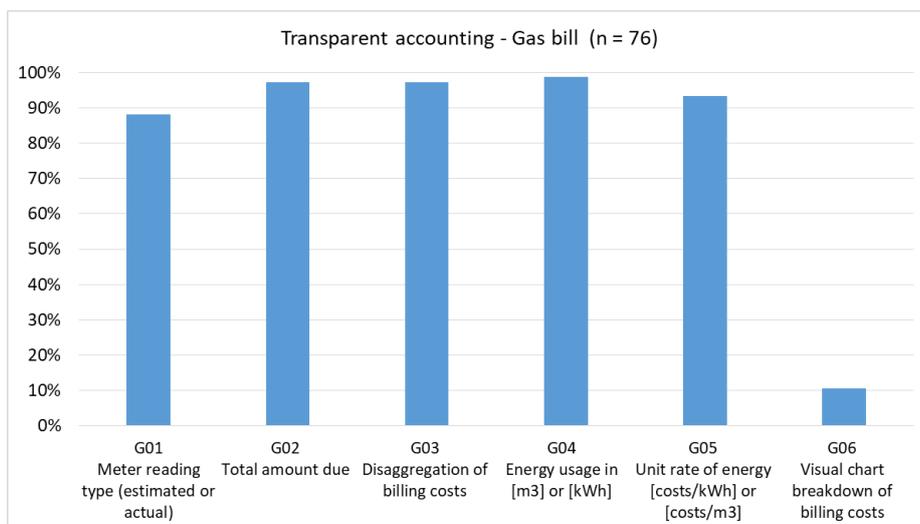


Figure 63 Assessment of gas bills – Diffusion of “Transparent accounting” elements.



8.4.1.3 District heating bills

The number of gathered district heating bills is very low (equal to 9), one reason more not to attribute the data below any representative meaning. Most of the “Transparent accounting” elements are found in 89% of the cases (indicators DH01, DH02, DH03 and DH04, shown in Figure 64; see the full list of indicators presented in Appendix 5). The unit rate of energy costs (indicator DH05) is indicated only in the 78% of the cases. No visual chart breakdown of billing costs has been reported in the district heating billing samples analysed. This is probably due to the lack of distinction between energy and infrastructure and for the lack of specific taxes regarding district heating.

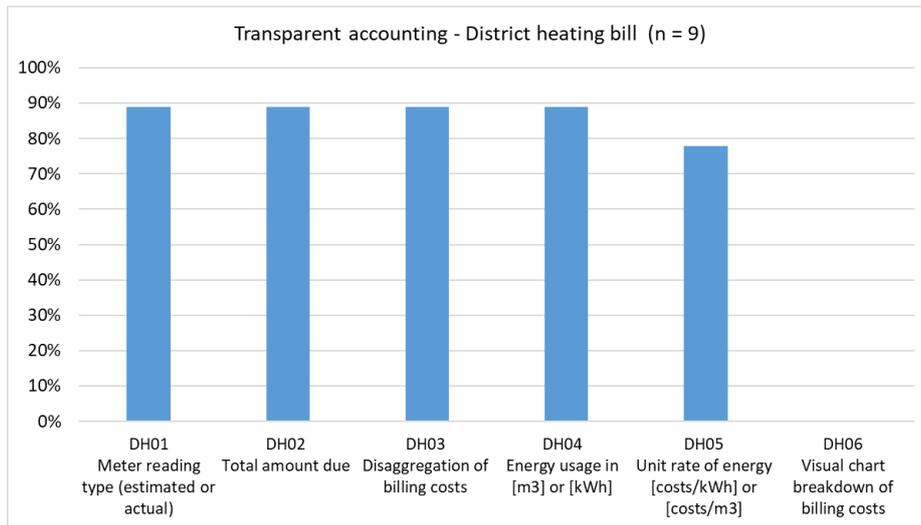


Figure 64 Assessment of district heating bills – Diffusion of “Transparent accounting” elements.

8.4.1.4 Some good practice examples

The aim of this analysis of utility bills was not only to find which elements are currently commonly included in energy bills, but also to identify innovative elements that are expected to trigger changes in households consumption patterns. Thus, for each category of indicators, innovative elements, as “good practice” examples inspiring the IMPROVE solutions are presented.

ENERGY USE IN kWh

Endesa, Spain. Electricity, 2017 (only in the bill of open market electricity customers).

Generally, private customers are not very familiar with energy consumption data expressed in term of physical units of measurement [kWh]. Instead, they are much more familiar with monetary values. To support customers in understanding kWh and assessing their level of consumption, this bills provides some alternative metrics, which are intuitive and easier to be understood. Energy consumption is in fact expressed as number of days of use of light bulbs.

With the aim of also introducing the concept of efficiency as well, three types of bulbs are used as a reference: incandescent bulbs, low consumption bulbs and efficient LED bulbs.



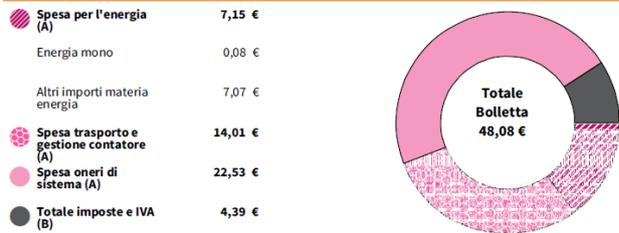


VISUAL CHART BREAKDOWN OF COSTS

Enel Energia, Italy. Electricity bill, 2017

A summary is shown in the first page of the bill.
Customers interested in more details, can find them in the internal pages of the bill.

SINTESI DEGLI IMPORTI FATTURATI

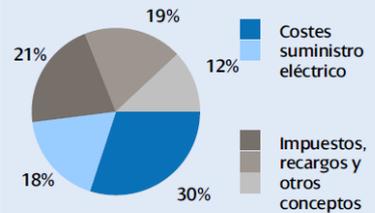


Iberdrola, Spain. Electricity bill, 2017

Not all the charts are equally intuitive: the more the details introduced, the less immediate the charts. This example by Iberdrola is simple and easy to read, since it just focuses on main data.

EL 52% DE SU FACTURA

ESTÁ DESTINADO A IMPUESTOS Y OTROS RECARGOS



Costes suministro eléctrico	18,14 €
Coste de producción de electricidad	11,21 €
Coste de redes de transporte y distribución	6,93 €
Impuestos, recargos y otros conceptos	19,57 €
Impuestos aplicados	8,17 €
Incentivos a las energías renovables, cogeneración y residuos	7,02 €
Otros costes regulados	4,38 €
TOTAL IMPORTE FACTURA	38,38 €

Vattenfall, Germany. Electricity bill, 2017

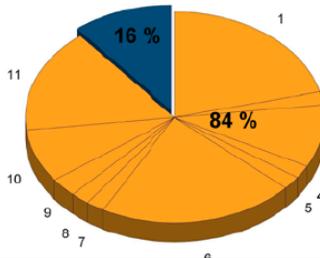
This example by Vattenfall is very detailed, though probably too rich in numbers and percentages to be easily understood by all private customers: there is the risk that they do not even look at the information provided by the chart, considering it too complex.

So setzen sich Ihre Stromkosten zusammen

Ihre Stromkosten
499,51 EUR (100 %)

Ihr Anteil für Strombeschaffung und Stromvertrieb
80,56 EUR (16 %)

Ihr Anteil für Steuern, Abgaben und Netzbetreiber
418,95 EUR (84 %)



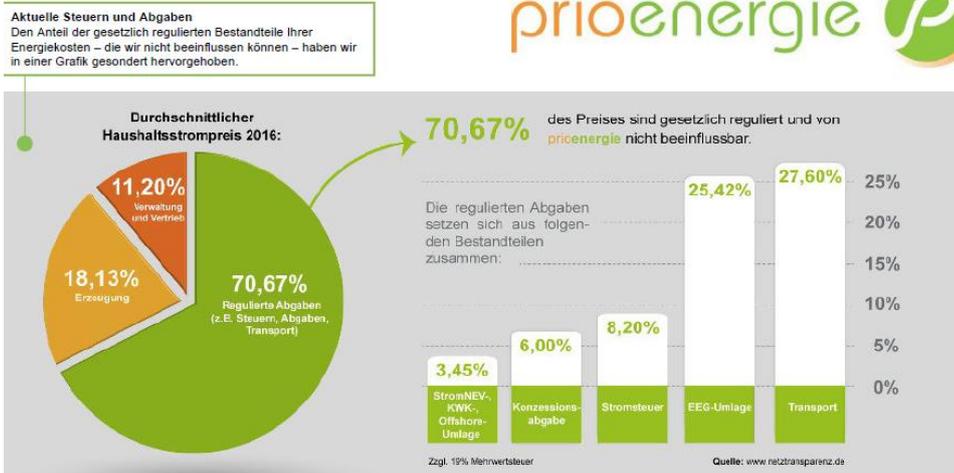
1 EEG-Umlage ¹	105,38 EUR (21,10 %)
2 Offshore-Haftungsumlage ¹	4,99 EUR (1,00 %)
3 Konzessionsabgabe ¹	47,73 EUR (9,55 %)
4 §19 StromNEV-Umlage ¹	6,57 EUR (1,32 %)
5 KWK-Umlage ¹	2,52 EUR (0,50 %)
6 Netznutzungsentgelt ¹	106,44 EUR (21,31 %)
7 Messstellenbetrieb ¹	6,57 EUR (1,32 %)
8 Messungsdienstleistung ¹	3,48 EUR (0,70 %)
9 Abrechnung der Netznutzung ¹	14,58 EUR (2,92 %)
10 Stromsteuer	40,94 EUR (8,20 %)
11 Umsatzsteuer	79,75 EUR (15,97 %)

¹ wird aus Nettobeträgen für Strom abgeführt



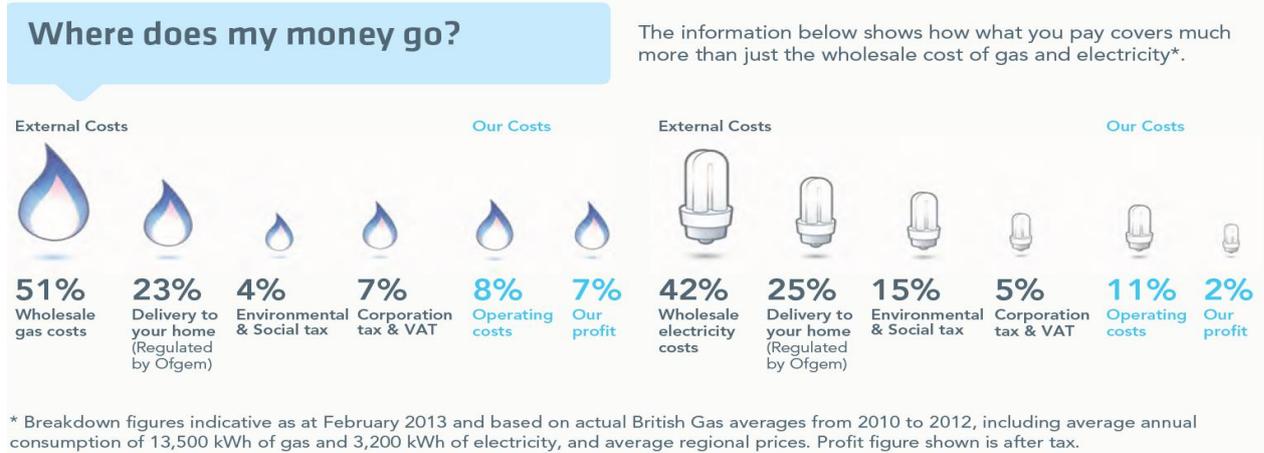
Prioenergie, Germany. Electricity, 2017

With the aim of providing as much information as possible, though maintaining it easy to understand, this utility company opted for splitting the costs breakdown pie chart in two charts: with the main pie chart, the company manages to show that majority of the costs are outside their competence, being imposed by law, and they cannot influence them. With the bar-chart, instead, they provide details on such law-imposed costs.



British Gas, United Kingdom. Electricity and gas bills, 2017

Abandoning the traditional pie chart representation, this utility company opts for a bar-chart style representation of the cost breakdown, making it more user friendly by replacing bars with icons aimed at intuitively representing gas and electricity consumption.



8.4.2 Comparative statistics

Comparative statistics (both historical and normative) provide the consumer with an effective frame of reference in regards to his/her consumption patterns and performance, allowing for self-evaluation and self-improvement (see for example Wilhite and Ling, 1994 and Fischer, 2008). In this context, the EC's working group involved in the drafting of the European Good Practice Guidance for Billing, recommend, for example, the adoption of a clear visual presentation of both (i) how the use of energy has evolved *during the year* and (ii) how the annual consumption *compares to the previous year*, as visual information can help improve understanding. Drawing from social psychology and behavioural science in general, the most innovative approaches, however, also offer comparisons with similar households living in the same region, in order to activate competitive mechanics and motivating customers to energy efficiency.



8.4.2.1 Electricity bills

In regards to the sample of electricity bills analyzed in the present study, a growing practice emerging is that of comparing the electricity consumption of the given billing period with that of the previous year (indicator E11b, 46%, see list of indicators in Table 14 and Appendix 5). Here approaches on the electricity bill vary from providing just a numeric information to that of a graphical visualization (histograms). As for the visual presentation of the energy usage evolution during the year or during the billing period (indicators E09, E10 and E11b), this seems a rather rare occurrence (4 – 24%).

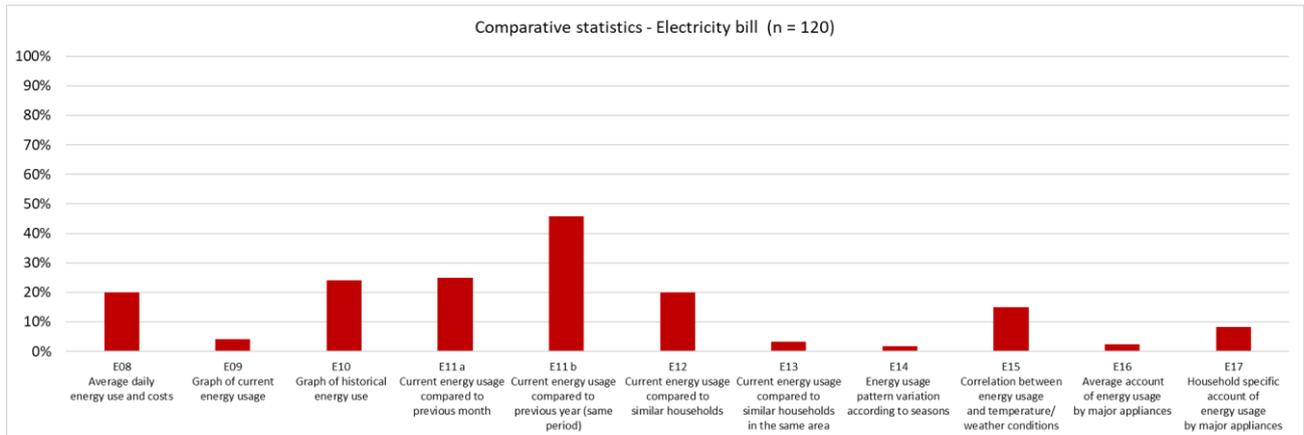


Figure 65 Assessment of electricity bills – Diffusion of “Comparative statistics” elements.

Next, most “popular”, although still rather occasional, comparative items adopted are the presentation of average daily use and cost calculations (indicator E09, 20% of the cases) and the comparison of the customer’s energy usage with that of similar households (indicator E12, 20% of the cases). Indeed, as for the application of normative comparison (peer households) to energy consumption, recent studies on behavioral change have shown it to be a rather effective motivational trigger (Faruqui et al., 2010; Alcott, 2011; Wemyss et al., 2016).

Another interesting element of those of the “Comparative statistics” group is the correlation of consumptions with temperature and weather conditions (indicator E15), that appears in 15% of the analyzed bills. Consumption variations related to the season (indicator E14) and the typical or household-specific energy usage caused by appliances (indicators E16 and E17) are still niche informative elements, which seem to be in their infancy in regards to their integration as an informative element in electricity billing. However, worth noticing is the fact that various energy utilities invite customers to sign up for an online account to access information on historical and monthly energy usage, seasonal variation and real-time consumption data (e.g N-Power – United Kindgom, Enel Energia - Italy, Synergy - Australia).

8.4.2.2 Gas bills

As for the electricity bills, the most common comparative statistics element is the current energy use compared to the consumptions of the last year (indicator G11b, 44% of the cases). It is followed by the historical energy usage over the last year (indicator G10, 26%) and consumptions compared to similar households (indicator G12, 21%), while the average daily energy use and costs (indicator G08) and the current energy usage compared to the previous months (G11a) are respectively indicated in around 11 and 14% of the cases. As for gas bills, surely season, temperature and weather conditions impact much more significantly energy usage. Nevertheless, this kind of information (indicators G14 and G15) does not seem to be at all widespread (1%) and might present margin for improvement.

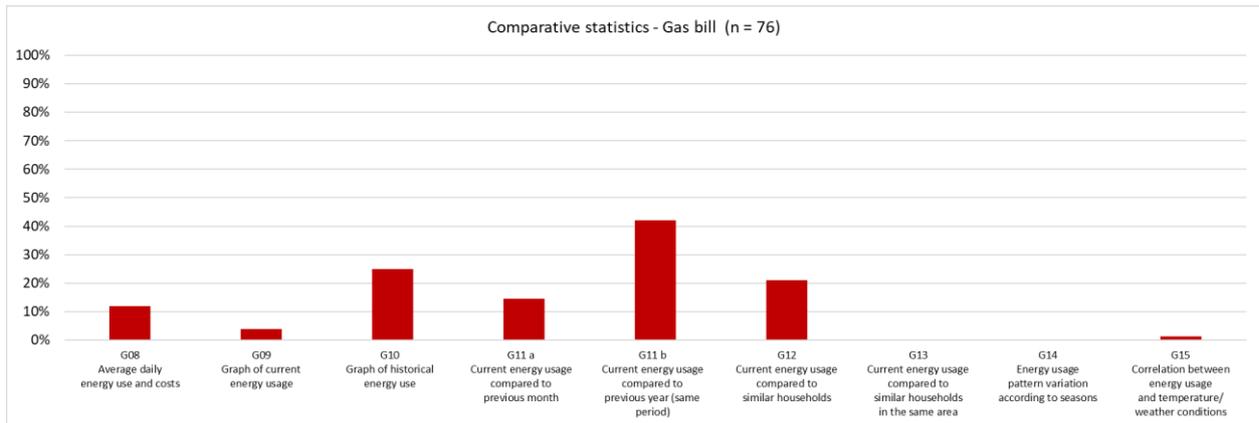


Figure 66 Assessment of gas bills – Diffusion of “Comparative statistics” elements.

8.4.2.3 District heating bills

Respect to electricity and gas bills, district heating bills contain less comparative statistic information, mainly focusing on the historic consumptions over the last year and the current energy usage compared to the previous month and year (indicators DH10, DH11a and DH11b, all registered in 22% of the cases analyzed). Furthermore, average daily energy use and costs (indicator DH08) and current energy usage compared to similar households (indicator DH12) are indicated in 11% of the district heating bills analyzed.

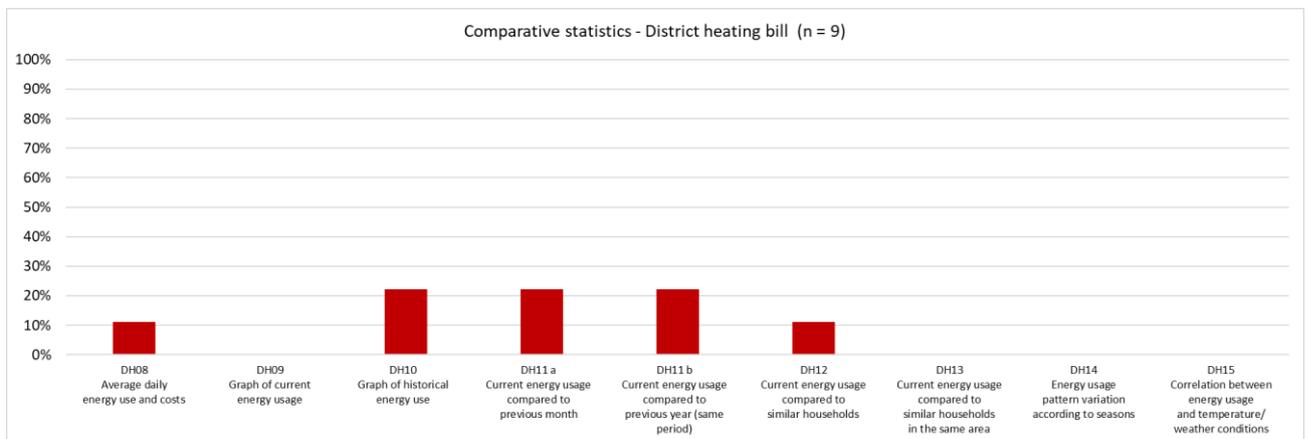


Figure 67 Assessment of district heating bills – Diffusion of “Comparative statistics” elements.



8.4.2.4 Some good practice examples

AVERAGE DAILY ENERGY USE AND COST

Origin Energy, Australia. Sample electricity bill, retrieved online 2017

AVERAGE DAILY ELECTRICITY

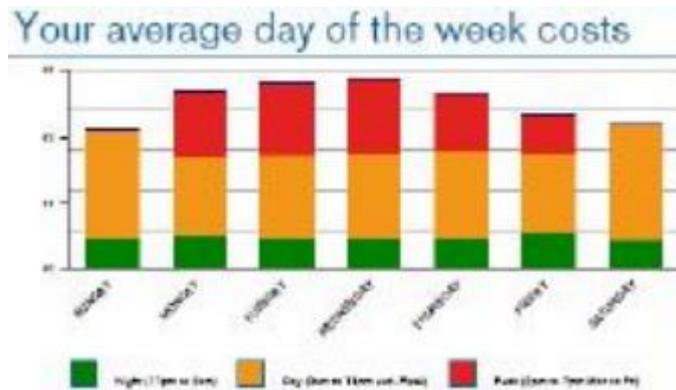
Here is the average daily electricity usage costs (excluding GST) for your supply address - this doesn't include any discounts and supply charges.



Customers receive information on their average daily usage costs, broken down by tariffs: peak and off peak tariff. (respectively, circle on the left and circle on the right).

Ireland, sample electricity bill used in a large-scale consumer behavior trial, 2011 (CER, 2011a)

These pictures are not taken from actual energy bills used by a company, but were used in a large scale electricity consumer behavior trial in Ireland in 2011, involving more than 4'000 residential customers. Besides the traditional electricity bill, the trial customers also received information on their average daily consumption patterns, in terms of average cost of the electricity they consumed, per day of the week and hourly tariff. To better understand differences in electricity cost according to the time of the day, customers were also provided with a fridge sticker of the chart represented below on the right, which intuitively shows how hourly tariffs evolve throughout the day.



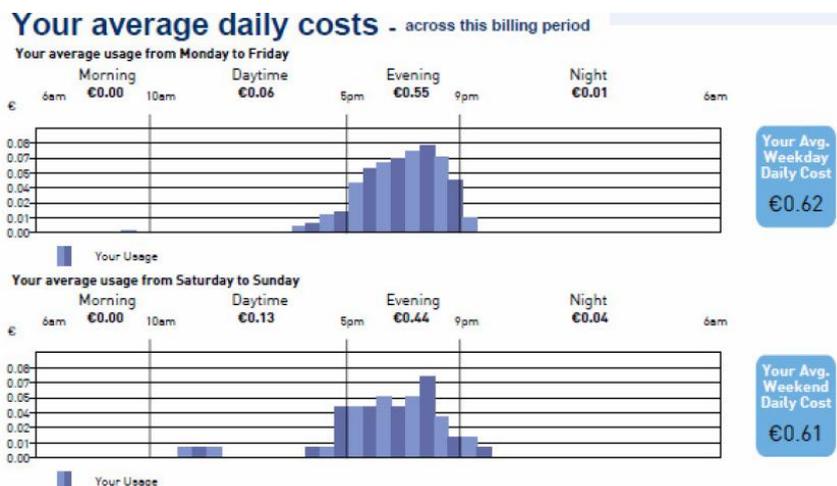
Different times, different prices

DAY 6am - 5pm	PEAK 5pm - 7pm	DAY 7am - 11pm	NIGHT 11pm - 6am
14c	20c	14c	12c

* Peak rate applies Monday to Friday only excluding Public Holidays. Time of use pricing will apply from 1st January 2010. Prices may be subject to change in line with ESI Customer Supply tariff changes. Prices exclude VAT.

Ireland, sample gas bill used in a large-scale consumer behavior trial, 2011 (CER, 2011b)

These pictures are not taken from actual energy bills used by a company, but were used in a large scale gas consumer behavior trial in Ireland in 2011, involving around 2'000 residential customers. Besides the traditional gas bill, in the trial customers also received information on their average hourly consumption patterns (average cost of the gas they consumed), per hour of the day, for average week and weekend days.



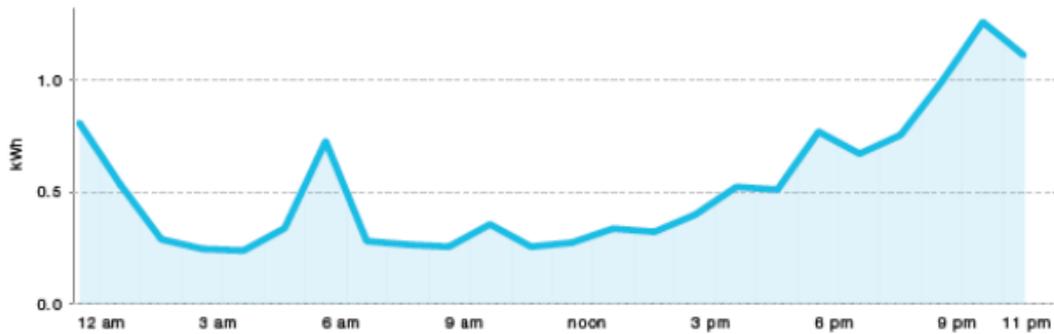


AEP, Ohio (USA). Electricity, 2011 (based on OPower Home Energy Report)

This chart shows average daily electricity consumption patterns [kWh]. The chart is also accompanied by a comment indicating the period of the day when consumption is higher, with the goal of stimulating customer awareness (“think of what uses electricity during this time”) and motivating them to energy saving.

An Average Day Last Month

On average, you used the most from 10 pm – 12 am. Think about what uses electricity during this time.

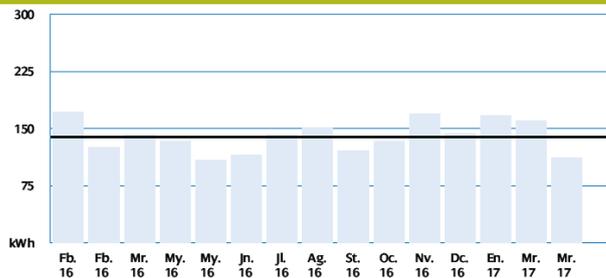


Do you use more on weekdays or weekends? Visit gridSMARTOhio.com/go/reports to find out.

CONSUMPTION EVOLUTION DURING THE BILLING PERIOD

Iberdrola, Spain. Electricity, 2017

EVOLUCIÓN DE CONSUMO



The chart shows monthly electricity consumptions [kWh] over the last 14 months, also representing their average value. Also, it indicates the corresponding average daily electricity cost and provides the customer with basic explanations to grasp the meaning of the unit of measurement of electricity consumption [kWh], by referring it to consumption of a bulb.

Este gráfico muestra la evolución de su consumo.
Su consumo medio diario en este último periodo facturado ha sido: 1,53 €
Su consumo medio diario en los últimos 14 meses ha sido: 1,69 €
1 kilovatio-hora (kWh) equivale al consumo de una lámpara de 100 vatios funcionando durante 10 horas.



Endesa, Spain. Electricity, 2017

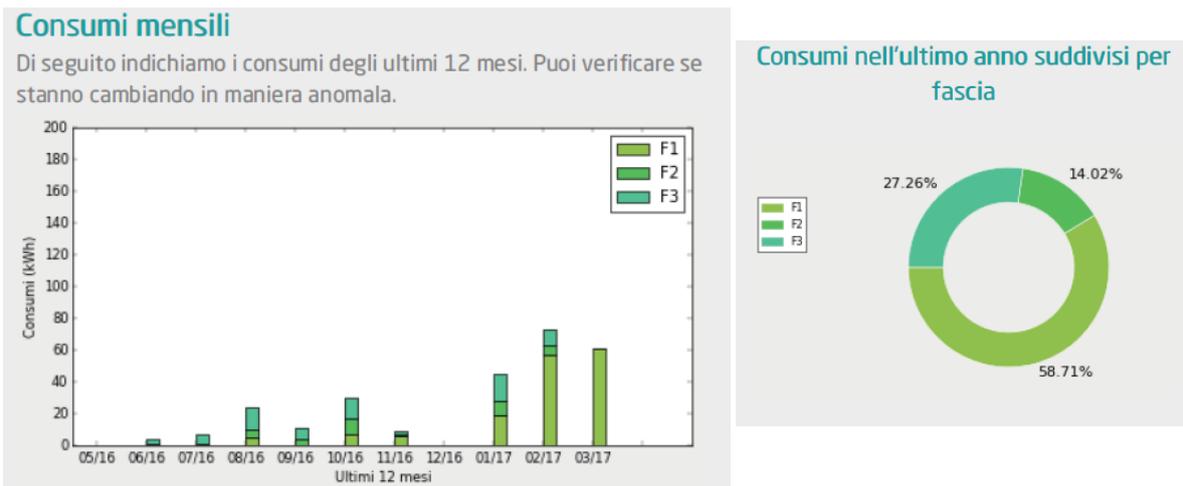
The chart shows monthly energy consumptions [kWh] over the last 14 months, also indicating the total breakdown values per time band and related tariff (peak hour 18-22, off-peak hour 22-8, intermediate peak 8-18).



Su consumo medio diario en el periodo facturado ha sido de 02,11 €. Su consumo medio diario en los últimos 14 meses ha sido de 40,50 €. Su consumo acumulado del último año ha sido de 300,21 kWh.

è nostra, Italy. Electricity, 2017

The chart on the left shows monthly energy consumptions [kWh] in the last 12 months, directly breaking them down per time band and related tariff. The chart on the right shows breakdown of total electricity consumption in the last 12 months, per time band and related tariff.





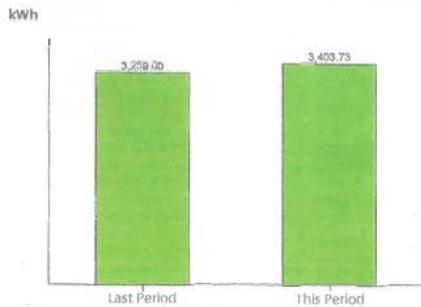
CONSUMPTION COMPARED TO PREVIOUS YEAR

Scottish Power, United Kingdom. Electricity and gas, 2017

Your electricity usage summary

- Your previous 12 months usage: 3403.73 kWh
- Your previous 12 months total cost: £591.81
- The graph below shows your usage for the period 6 February 2016 to 5 February 2017 and compares it with the same period for the year before.

Your Electricity Summary

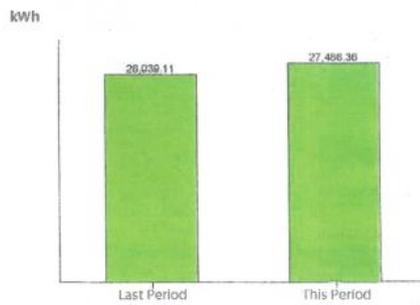


Your personal projection for the next 12 months is £599.48 (based on your estimated consumption, tariff prices, discounts and VAT).
As you are on a standard tariff, prices can change at any time.

Your gas usage summary

- Your previous 12 months usage: 27486.36 kWh
- Your previous 12 months total cost: £1087.89
- The graph below shows your usage for the period 6 February 2016 to 5 February 2017 and compares it with the same period for the year before.

Your Gas Summary



Your personal projection for the next 12 months is £1096.84 (based on your estimated consumption, tariff prices, discounts and VAT).
As you are on a standard tariff, prices can change at any time.

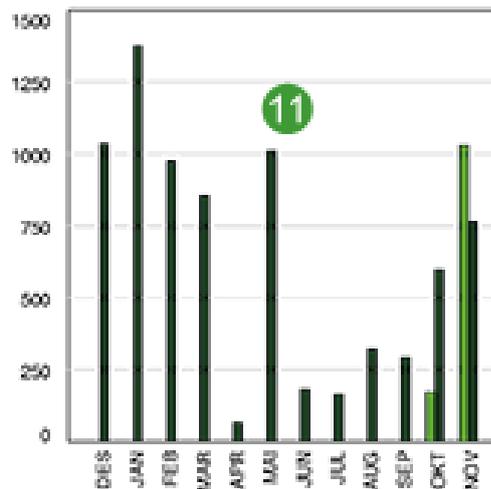
The charts provide energy consumption values both in physical [kWh] and in monetary [£] units of Measurement.

Lyse, Norway. Electricity, 2017

This bill shows electricity consumptions on a monthly basis (dark green bars), comparing them with consumptions registered the previous year in the same month (light green bars). The dark green bars show the last twelve months, and the light green bars show consumption from two years ago. Interestingly, focus of this information is on energy-saving activities: instead of neutrally reporting consumptions compared with the previous year, the chart explicitly titles "Have you saved electricity?", thus stimulating customers to get aware of their consumption level and engage in energy-saving practices.

Har du spart strøm?

kWh ■ Forrige år ■ Siste år





Endesa, Spain. Electricity, 2017 (only in the bill of open market electricity customers).

Red box at top left: The chart shows both monthly evolution of electricity consumption [kWh] over the year and a comparison with the monthly evolution in the twelve previous months.

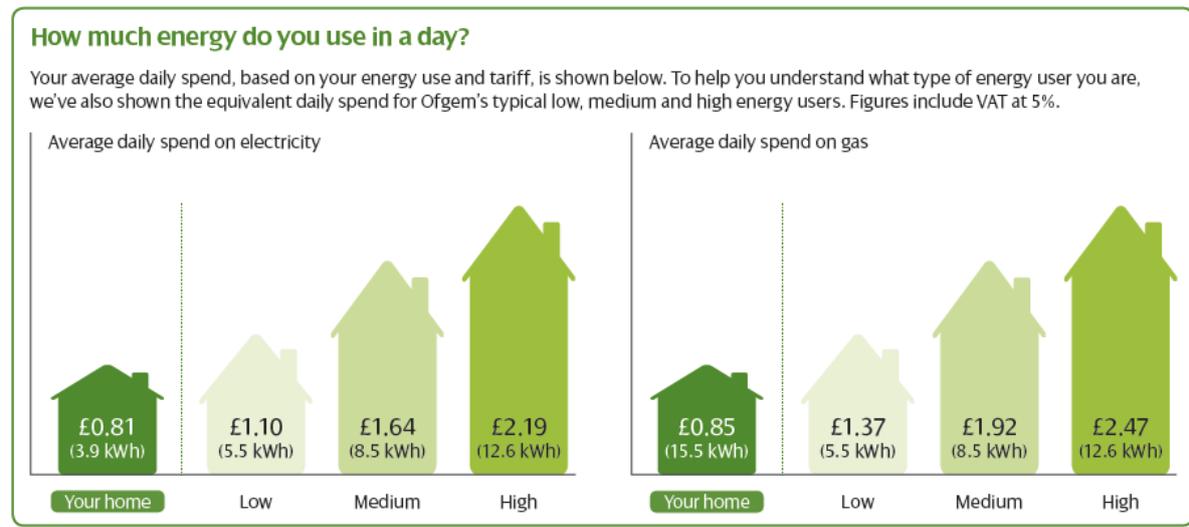
Red box at bottom right: the bill also offers an aggregate indicator to assess evolution over the seasons (increase or decrease of consumption respect to the previous year and the same billing period in the previous year).



COMPARISON WITH SIMILAR HOUSEHOLDS

Scottish Power, United Kingdom. Electricity and gas, 2017

The chart compares average daily energy consumption respect to similar households, both in physical [kWh] and monetary [£] units of measurement. It also provides a scale to support customers in assessing their consumption level (high, medium, low consumption). As for identifying similar households: they are those with the same tariff plan.

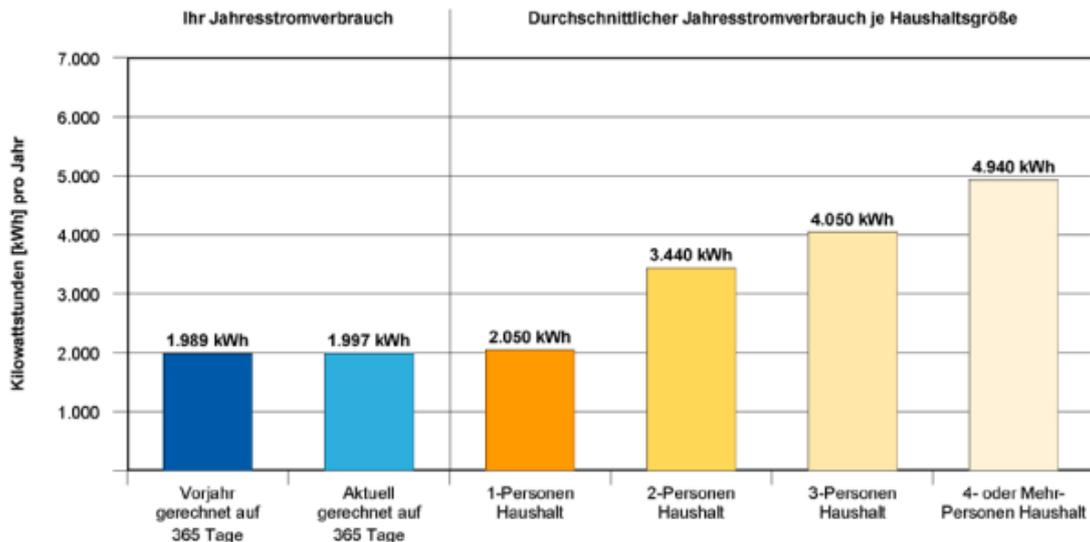




Vattenfall, Germany. Electricity, 2017

The chart shows two types of comparison at the same time: on the left, it shows the comparison with the household total electricity consumption in the previous year. On the right, it provides average values of electricity yearly consumption of households, based on their size (number of persons living in the household). Instead of providing an assessment on the level of consumption (high/medium/low), it provides customers with more detailed information to identify "similar" households; then, customers are asked to indirectly assess by themselves whether their level of consumption is higher or lower than similar households.

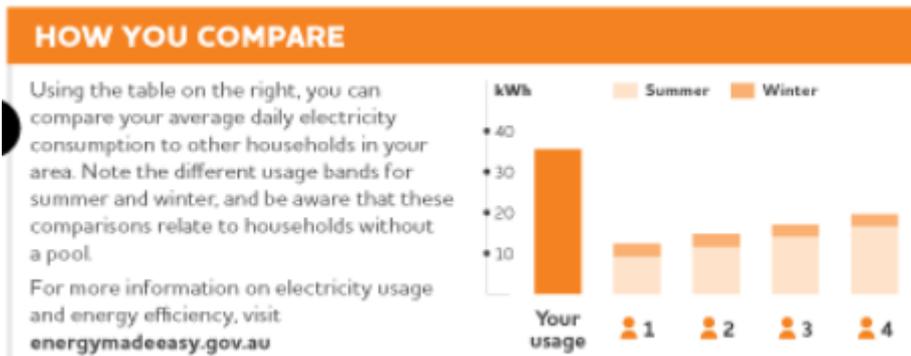
14 Ihr Stromverbrauch im Vergleich mit Haushalten in Deutschland



Quelle: Erhebung Bundesverband der Energie- und Wasserwirtschaft und Fachgemeinschaft für effiziente Energienutzung

Origin Energy, Australia. Electricity, 2017

Like the example above, this bill compares the household electricity consumption with that of other households in the same area, based on their size (number of persons living in the household). In addition, here also a disaggregation between Summer and Winter consumptions is offered.

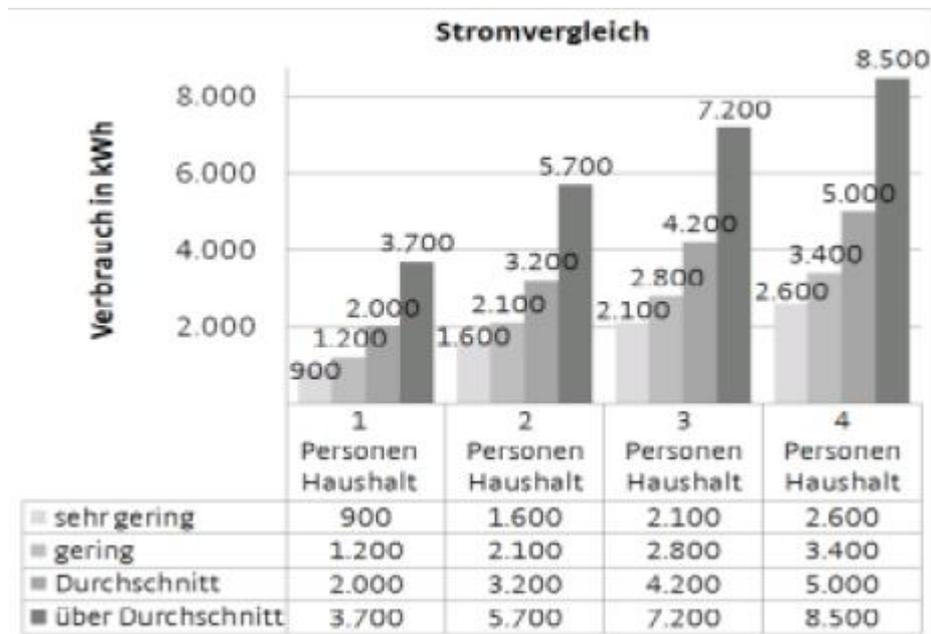




Stadtwerke Düsseldorf, Germany. Electricity, 2017

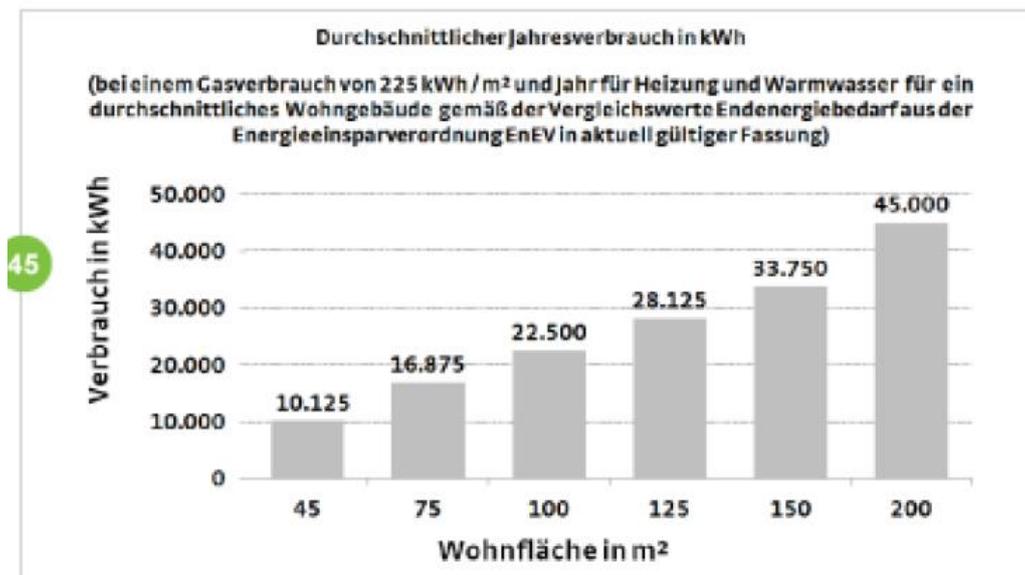
This utility company wants to provide customers with further information, by showing average electricity consumptions per household size (number of persons) and also per level of consumption (very low, low, average and above average).

The resulting chart should however be improved in readability, in order to stimulate more customers to actively engage with the information it provides.



Stadtwerke Düsseldorf, Germany. Gas, 2017

Since gas is often used for heating purposes, for gas bills an effective comparison with similar households can be based on the surface of their home, in square meters. This utility company provides customers with average gas consumption values for six different home sizes, which they can use to indirectly assess their level of energy consumption.



45

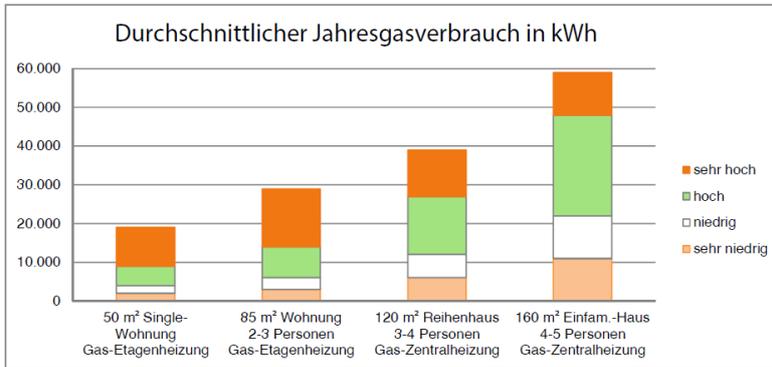


Prioenergie, Germany. Gas, 2017

This utility company opted for providing as information as possible: customers are provided with average gas consumption values which consider both average household size (expressed by both the square meters of the home and the number of persons) and levels of consumption (very high, high, low and very low). Charts are easier to read and more attractive, but probably they are not fully understandable yet, since in any case they include a lot of numbers. Also, comparison with the customer's own consumption is not provided, being left to the customer, who might not like to engage in such an activity.

6. Durchschnittlicher Jahresgasverbrauch entsprechend den Haushaltsgrößen

Untenstehende Durchschnittsdaten können als Orientierung verwendet werden.



	50 m² Single-Wohnung Gas-Etagenheizung	85 m² Wohnung 2-3 Personen Gas-Etagenheizung	120 m² Reihenhaus 3-4 Personen Gas-Zentralheizung	160 m² Einfam.-Haus 4-5 Personen Gas-Zentralheizung
sehr hoch	> 9.000	> 14.000	> 27.000	> 48.000
hoch	bis 9.000	bis 14.000	bis 27.000	bis 48.000
niedrig	bis 4.000	bis 6.000	bis 12.000	bis 22.000
sehr niedrig	bis 2.000	bis 3.000	bis 6.000	bis 11.000

Hinweis : Die aufgeführten Gasverbräuche für unterschiedliche Gebäude bzw. Gebäudegrößen sind Orientierungswerte. Sie gelten für das Heizen mit Gas inkl. Warmwasserzubereitung bei Privathaushalten bei unterschiedlichem Gebäudezustand, typischem Verbrauchsverhalten und einem durchschnittlichen Temperaturverlauf eines Jahres. Zudem wurde ein verringerter Endenergiebedarf aufgrund der Bauform berücksichtigt. Sie sind damit nicht allgemeingültig.

Uon, The Netherlands. Electricity and District heating, 2017

This bill is pretty interesting, since it adopts a different approach respect to the dominant one: instead of charts, the bill opts for a plain text, accompanied by a table. The result is a pretty informative element, since text is very simple and easy to understand.

The text indicates the present consumption and compares it with the year before, also indicating the expected cost of the bill, in case the same level of consumption of the previous year is maintained. Interestingly, here monetary costs are given as well: this is meant to raise the interest in customers with low environmental awareness – which are the majority of them.

Uw stroomverbruik

U heeft 5.335 kWh stroom verbruikt. Dit verbruik beïnvloedt uw kosten voor levering van stroom, energiebelasting, opslag duurzame energie en de btw over deze onderdelen. Het totaal van deze kosten is € 1.035,19. Uw verbruikspatroon is ongeveer gelijk gebleven met dat van vorig jaar. Uw verbruikskosten zijn hierdoor ongeveer gelijk gebleven. Vergelijk in onderstaande tabel uw verbruik met het landelijk gemiddelde.

Aantal personen in huishouden	Gemiddeld verbruik in kWh per jaar*	Kosten per maand in euro's
1	2.010	38
2	3.340	63
3	4.120	78
4	4.580	86
5	5.450	103
Gemiddeld	3.360	55

Bedragen zijn inclusief energiebelasting, ODE en 21% btw.
* Gebaseerd op: HOME 2012, RVO, bewerking Nibud 2015

Uw warmteverbruik

U heeft 39,89 GJ warmte verbruikt. Dit verbruik beïnvloedt uw kosten voor levering van warmte inclusief de btw. Het totaal van deze kosten is € 865,50. Als uw verbruikspatroon gelijk was gebleven met dat van vorig jaar, dan had u € 213,10 meer moeten betalen. Vergelijk in onderstaande tabel uw verbruik met het landelijk gemiddelde.

Woningtype	Gemiddeld verbruik in GJ per jaar*	Kosten per maand in euro's
Flat	24	49
Tussenwoning	32	74
Hoekwoning	37	87
2 onder 1 kap	39	92
Vrijstaand	49	122
Gemiddeld	34	79

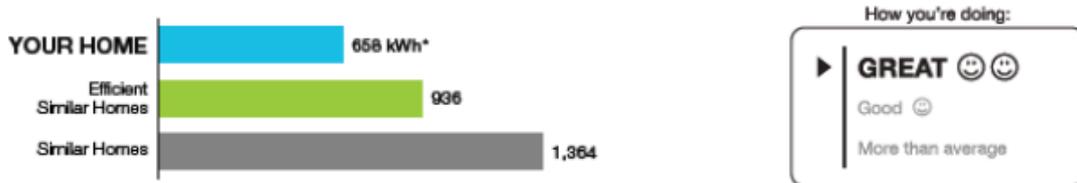
Bedragen zijn inclusief 21% btw.
* Gebaseerd op: HOME 2012, RVO, bewerking Nibud 2014



AEP Ohio, USA. Electricity, 2011 (based on OPower Home Energy Report)

This chart shows electricity consumption in the billing period comparing it with both similar households in general and “efficient” similar households. In this case, the comparison with the customer’s own consumption value is directly provided in the bill, by a simple bar-chart. Such a chart is also accompanied by a congratulation message (in case the user consumes less electricity than average or average efficient households), or an encouragement message to improve performances by saving energy in the next billing period (in case the user consumes more energy than average). Such a message is essential in order to avoid rebound effects which might happen by just showing that a customer is more efficient than average.

Last 2 Months Household Comparison | You used **30% LESS** electricity than efficient similar homes.



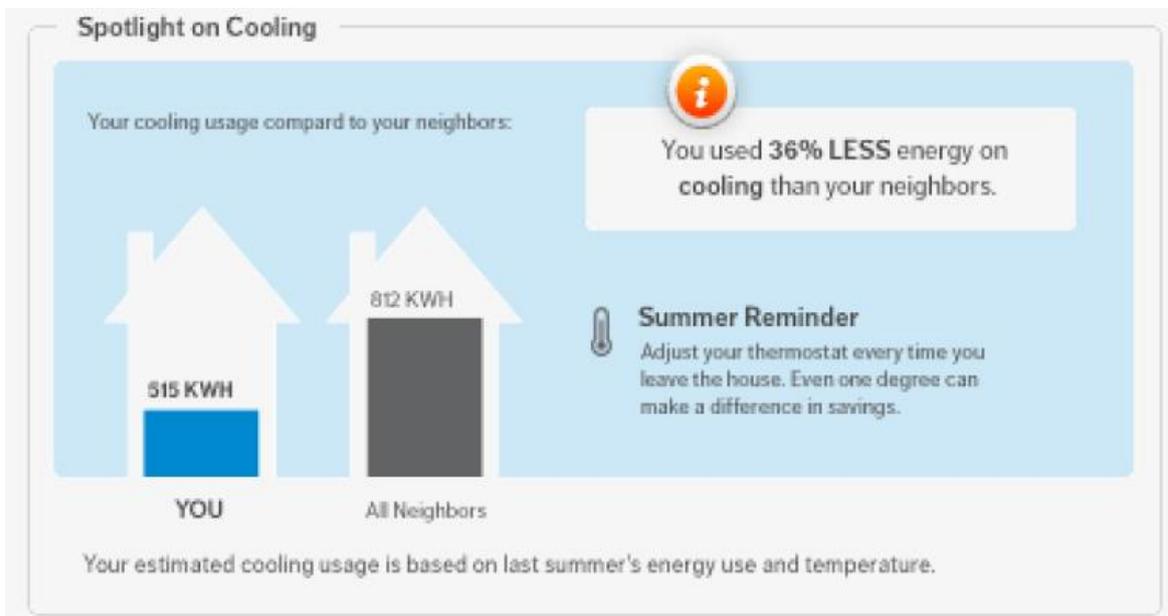
* kWh: A 100-Watt bulb burning for 10 hours uses 1 kilowatt-hour.

- **Similar Homes:** Approximately 100 occupied, nearby homes (avg 0.09 miles away)
- **Efficient Similar Homes:** The most efficient 20 percent of similar homes

Is your home compared correctly?
Tell us more about your home:
gridSMARTohio.com/go/reports

OPower Home Energy Report sample bill, USA. Electricity, 2011

Besides providing the customer with overall electricity consumption values during the billing period, estimates of disaggregation of consumptions per type of electric appliance/use could be made. In this example, based on external temperature data and energy consumption values and a comparison with the previous year, customers are provided with an estimate of their electricity consumption for cooling and with a comparison with similar households living in the same area.



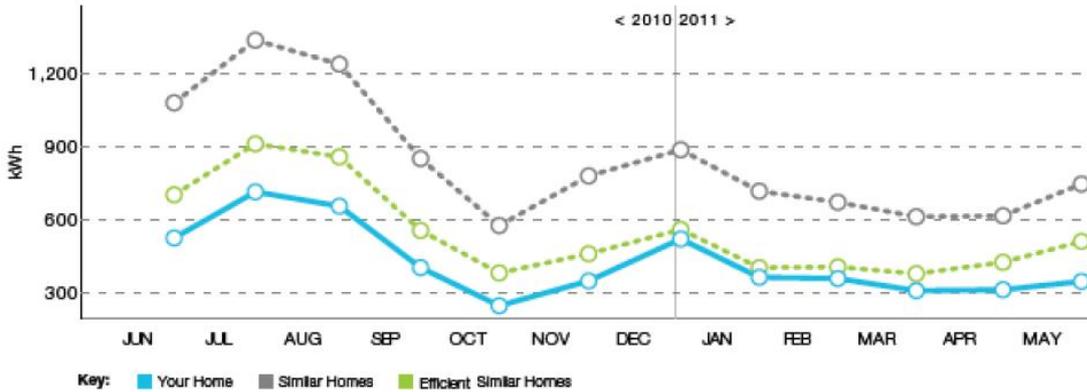


AEP Ohio, USA. Electricity, 2011 (based on OPower Home Energy Report)

Besides providing total electricity consumption values [kWh] during the billing period, this bill also shows evolution of consumption over time [kWh], on a monthly basis. Interestingly, again a comparison with “similar” and “efficient similar” households is offered. Also, a message indicates the amount of electricity saved respect to similar households, expressing it as money saved as well.

Last 12 Months Household Comparison

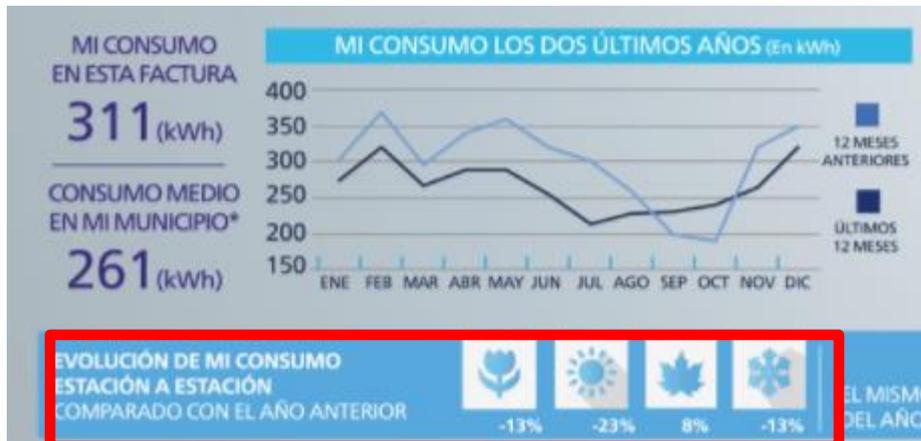
You used **50% LESS** electricity than similar homes.
This saves you about **\$591** per year.



VARIATIONS WITH SEASON, TEMPERATURE, WEATHER

Endesa, Spain. Electricity, 2017 (only in the bill of open market electricity customers).

Besides a chart showing the evolution of the household consumption over time (both the last twelve months and also the other previous twelve months), the bill shows aggregate indicators assessing overall evolution of consumption over the seasons: in fact, it shows percentage differences between seasonal electricity consumption (Spring, Summer, Autumn and Winter) in the billing year and seasonal electricity consumption in the previous year.





HOUSEHOLD TYPICAL USE OF APPLIANCES

Scottish Power, United Kingdom. Electricity and gas, 2017

This bill provides handy examples of everyday energy costs due to the use of at home appliances [£], together with the indication of the related energy consumption in physical units of measurement [kWh].

Here's some typical examples of how energy is used each day:

1. Tumble Dryer
One hour cycle:
21p (1.5kWh)



2. Washing Machine
One wash:
10p (0.7kWh)
(40° cycle)



3. Dishwasher
One load:
18p (1.25kWh)
(65° cycle)



4. Mobile devices
12 hour overnight charge:
1p (0.06kWh)



5. Laptop
Two hours use:
1p (0.09kWh)



6. Games Console
Two hours play:
4p (0.28kWh)



Note: Costs shown are based on an average of our Standard tariff Monthly Direct Debit unit rates for Single Rate electricity and include VAT at 5%. Energy use figures were provided by ONZO who undertook appliance research in May 2016 (onzo.com).

8.4.3 Eco-feedback on climate and environmental impact

National regulations in many cases require energy companies to explicitly indicate the fuel mix of the energy consumed, and to compare it with average fuel mix at the national level. Indirectly, this information relates to the climate and environmental impacts that the household produces when consuming energy. In some cases, bills explicitly indicate CO₂ emissions or other environmental impacts, such as for example nuclear wastes. However, if they are just communicated as bare numbers in their physical units of measurement (e.g. tons of CO₂ or g/kWh of nuclear wastes), there is the risk that they are not meaningful to the majority of average household customers, who are not familiar with them.

8.4.3.1 Electricity bills

As the elements of eco-feedback on climate and environmental impact elements, the indication of the breakdown of the fuel mix and the alternative metrics of the consumptions (e.g. CO₂ equivalent emissions, carbon footprint, etc.) have been analyzed.

In 46% of the analyzed electricity bills the breakdown of fuel mix is indicated, either in table or graph form (indicator E19). In some countries, such as for example Germany and Ireland, in fact it is a requirement for electricity bills to indicate the fuel mix of the given energy utility in comparison to the average national fuel mix used to produce electricity.

Electricity bills from both Austria and Germany, all display information on the production of both CO₂ and radioactive waste as a formal requirement of electricity billing. In addition, some particularly green, 100% renewable energy utilities from Germany go a step further, indicating the CO₂ emissions saved, compared to conventional energy mix provision. In 21% of the analyzed bills electricity consumptions or CO₂ emissions are “converted” to other measurement forms, for a better understanding of the environmental or climatic impact (indicator E20): only a few energy utilities provide customers with an equivalent eco-feedback of the numerical value of achieved annual CO₂ savings or emissions. Interesting examples relate consumption to the kilometers driven with a small car (e.g. 7'932 km) or a number of planted trees (101 pine trees). This type of alternative eco-feedback provides an important frame of reference for customers, as it helps them to better contextualize abstract parameters such as CO₂ emissions or savings – a practice that might need future improvement and a more widespread application. Worth noting is the fact that many of the green energy utilities (e.g. Greenpeace, Naturstrom, Lekker) that base their supply on 100% renewable energy resources, do not at all reflect this environmentally, pro-active approach on their bills, except for mandatory information on energy mix. This attitude seems to reflect a rather passive approach, triggered most probably by the fact that their customers are already a selected group of environmentally sensitive people. However, a more pro-active approach may still be beneficial, as these energy utilities represent pioneers and could be of example to others.

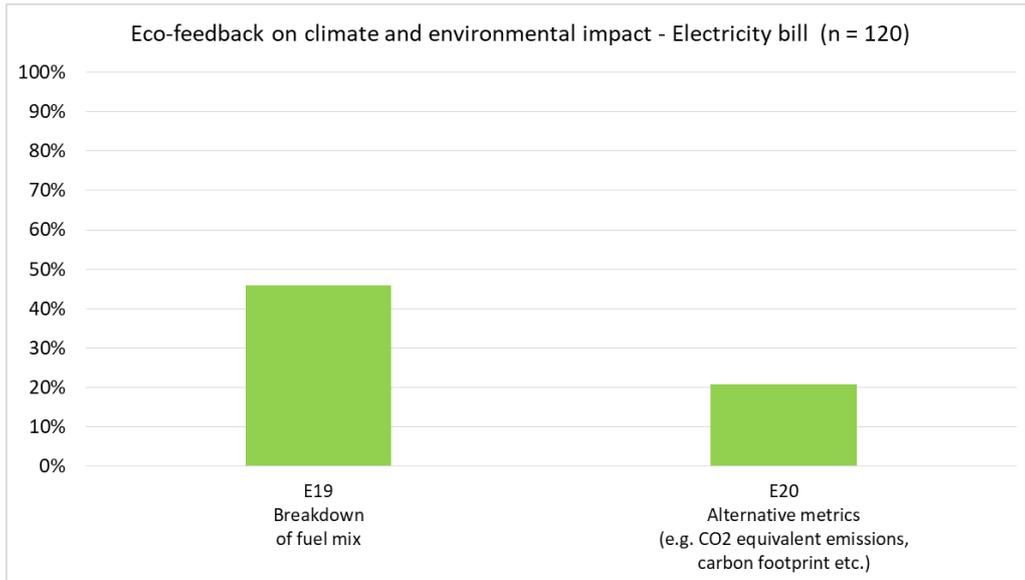


Figure 68 Assessment of electricity bills – Diffusion of “Eco-feedback on climate and environmental impact” elements.

8.4.3.2 Gas bills

For gas, the only assessed indicator refers to the availability of alternative metrics for CO₂ emissions, which only appear in 4% of the cases: rare elements for electricity are even rarer for gas.

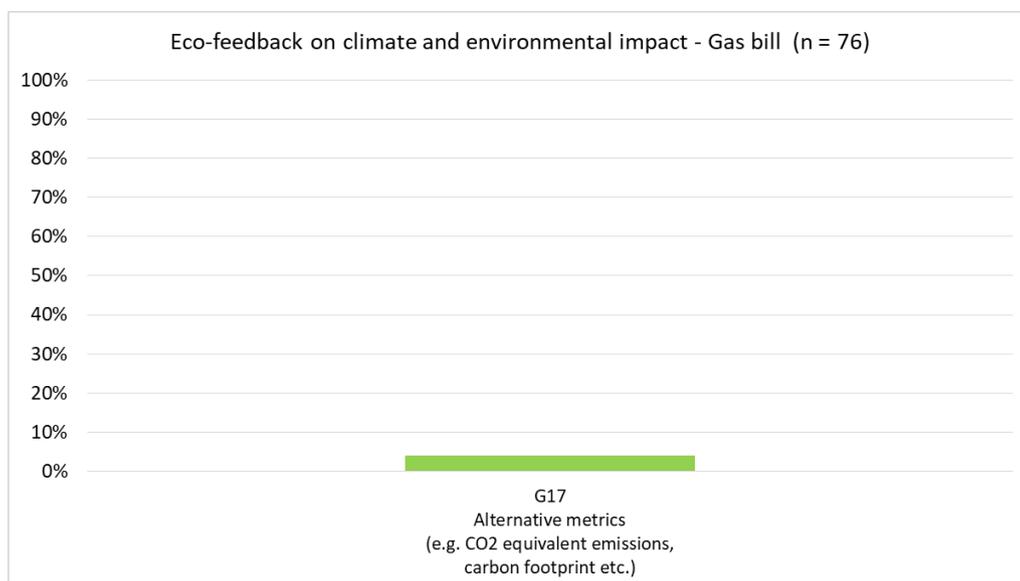


Figure 69 Assessment of gas bills – Diffusion of “Eco-feedback on climate and environmental impact” elements.

8.4.3.3 District heating bills

Of the nine district heating bills that has been analyzed, no bills included eco-feedback elements on climate and environmental impact.

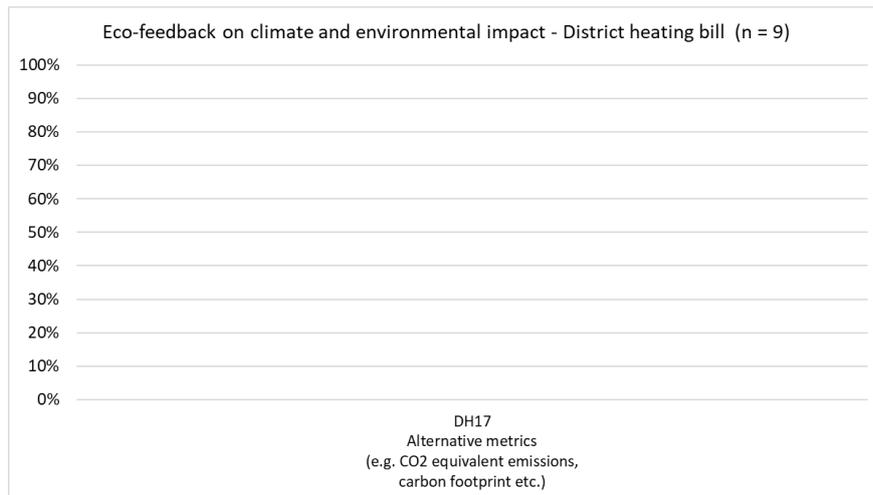


Figure 70 Assessment of district heating bills – Diffusion of “Eco-feedback on climate and environm. impact” elements.

8.4.3.4 Some good practice examples

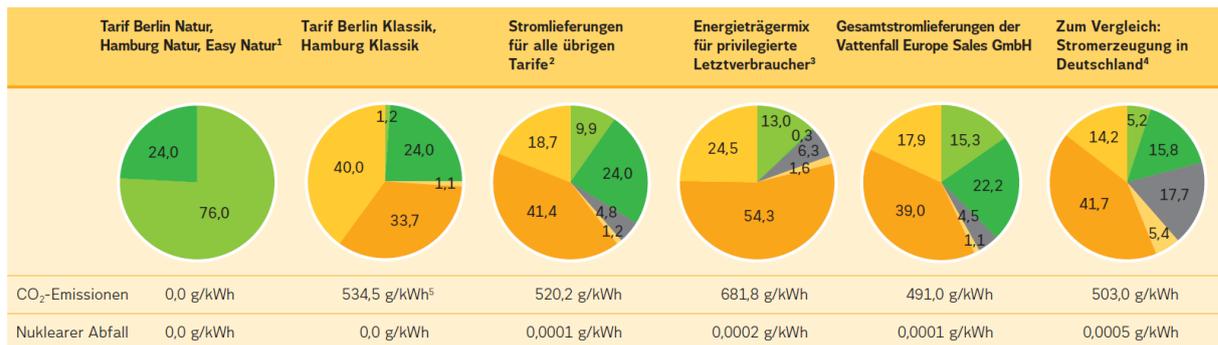
FUEL MIX BREAKDOWN

Vattenfall, Germany. Electricity, 2017

The bill shows the composition of the electricity mix consumed, according to the tariff plans offered by the energy company, and compared to average electricity mix at the national level. Besides the fuel mix breakdown, the bill provides customers with the indication of the tons of CO₂ and grams of nuclear wastes that are produced by each fuel mix (values in physical units of measurement).

Kennzeichnung der Stromlieferungen

der Vattenfall Europe Sales GmbH (Basis: Werte von 2011)



Regenerative Energien:
 Erneuerbare Energie gefördert nach dem Erneuerbare-Energien-Gesetz
 Sonstige erneuerbare Energien

Fossile Energien:
 Sonstige fossile Energieträger
 Kohle
 Erdgas

Kernenergie:
 Kernenergie

¹Weitere Tarife sind Berlin Kompakt, Hamburg Kompakt, ÖkoPur, Hamburg Newpower Gewerbe, Wärmepumpe Natur, AutoStrom Box, AutoStrom Station, Business Strom Klima, Sonderprodukte Geschäftskunden und seit 2012 auch die Tarife E-Mobil Natur und E-Mobil Natur Ladekarte.

²Alle nicht separat dargestellten Tarife haben diese Zusammensetzung.

³Ausschließlich für Vattenfall Europe Sales Geschäftskunden relevant.

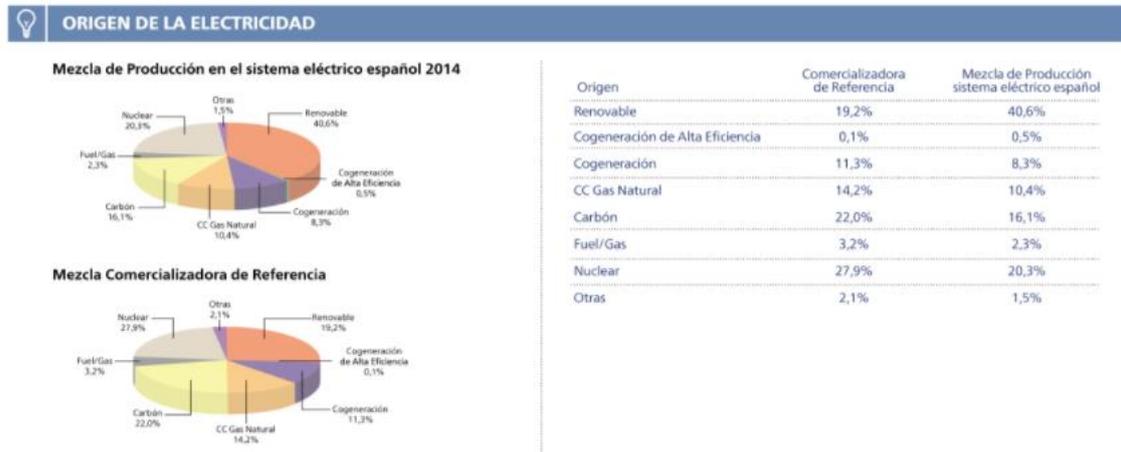
⁴Allgemeine Versorgung und private Einspeiser (Quelle: BDEW).

⁵Dieser Strom stammt aus Berliner Kraft-Wärme-Kopplungs(KWK)-Anlagen. Die gekoppelte Produktion von Strom und Wärme führt zu quantifizierbaren CO₂-Einsparungen, die allerdings nach den Richtlinien der AGFW (Arbeitsgemeinschaft für Wärme und Heizkraftwirtschaft e.V) dem Bereich Wärme und nicht dem Stromvertrieb angerechnet werden.



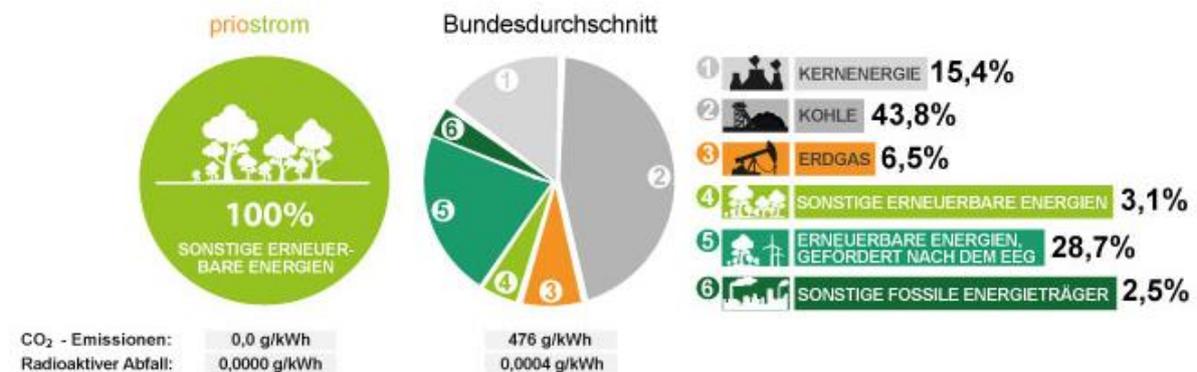
Endesa, Spain. Electricity, 2017

This example shows an attempt to provide both a pie chart and a table representation, in order to satisfy more segments of customers (those who prefer intuitive charts and those who are interested in numerical values). Also, it just offers two elements for the comparison (the company's fuel mix and the average national one), thus reducing the amount of information at the same time offered to the customer.



Prioenergy, Germany. Electricity, 2017

This example shows an attempt to make pie charts a bit more user friendly than plain technical charts.

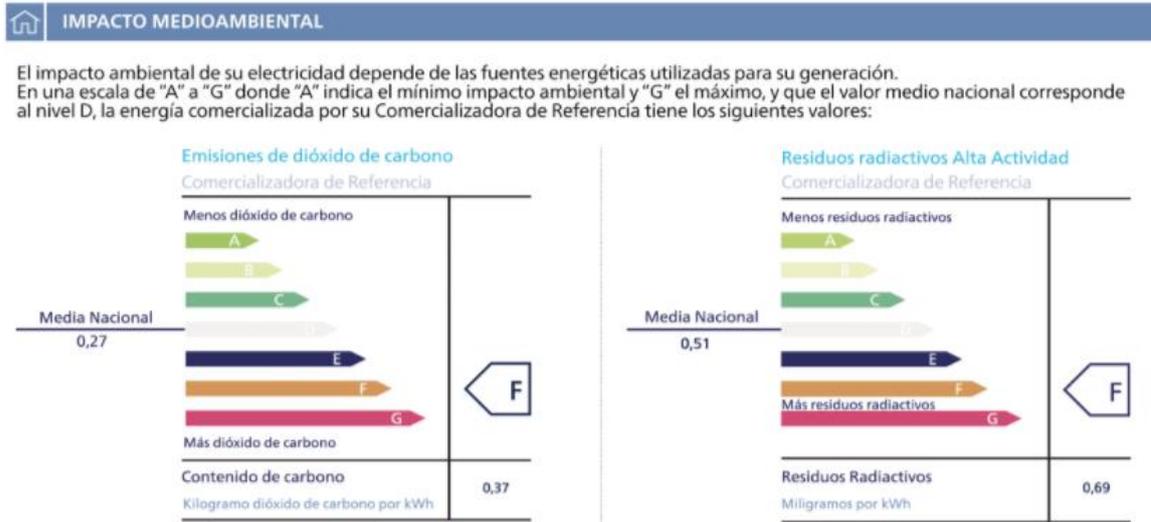




ALTERNATIVE METRICS

Iberdrola, Spain. Electricity, 2017

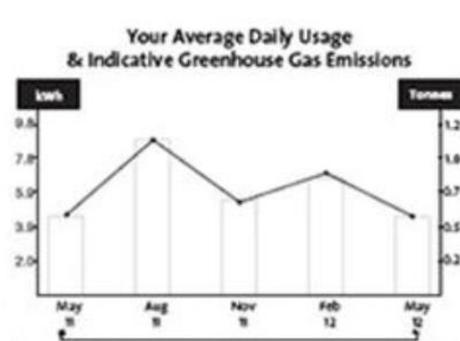
This chart goes beyond pure indication of the climate and environmental impact of the electricity consumed, expressed in physical units of measurement, such as tons of CO₂ or grams of nuclear wastes per kilowatt-hour. An assessment scale like the one of the “Energy label”, which is familiar to private customers since it has been used for years for electrical appliances and also for cars, supports customers in understanding the intensity of their climate and environmental impact when consuming electricity.



Fuente: CNMC (Comisión Nacional de los Mercados y Competencia), <http://gdo.cnmc.es/CNE/resumenGdo.do?>

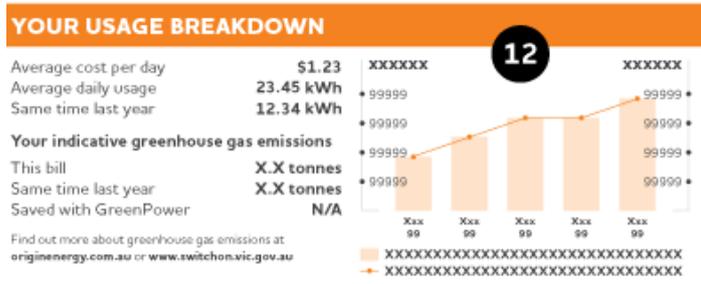
ESTIMATE OF EMISSIONS

Origin Energy, Australia. Electricity, 2013 (on the left) and 2017 (on the right)



Average Cost Per Day:	\$x.xx
Average Daily Usage:	x.xx kWh
Same Time Last Year:	x.xx kWh
Indicative Greenhouse Gas Emissions (Tonnes)	
Generated This Account:	x.xT
Same Time Last Year:	x.xT
Saved With a Green Product:	N/A

The chart on the right (2017) is an evolution of the information elements already included in the electricity bill in 2013: it is clearly more communicative, thanks to graphical improvements, however it lacks details such as the units of measurement and the legend. For this reason, both versions have been included.



These charts show monthly electricity consumptions during the billing period and the related CO₂ emissions. There is a comparison with emissions produced in the same period during the previous year and, interestingly, also the indication of the avoided emissions, respect to average national emissions, thanks to consumption of “GreenPower”, that is renewable electricity sold by the company.



ESTIMATE OF AVOIDED EMISSIONS

è nostra, Italy. Electricity, 2017

This utility company only sells 100% renewable electricity, that is a fuel mix that does not produce direct CO₂ emissions or air pollution. In such a case, they opted for reporting the avoided emissions, respect to average national electricity mix, instead of just reporting that consumed electricity produces zero emissions: this is probably more effective from the communication point of view.



8.4.4 Energy-saving tips and advice

The provision of energy-saving tips and advices may help stimulate pro-active energy-efficient behavior in households. The more customized and actionable, the better.

8.4.4.1 Electricity bills

Findings from our data collection show that including general energy tips and advices on the electricity bill is not at all a common practice (indicator E22, 3% of the analyzed bills). It is more widespread that utilities dedicate a separate section to these tips and advices on their websites, in a non-personalized form. German electricity bills tend to simply refer to general websites on national policies towards energy efficiency, i.e. a very formal, not very appealing and communicative act.

It is even rare that electricity utilities include customized, actionable energy-tips (indicator E23, 1% of the analyzed electricity bills) in their bills if not on their webportal, entering by one's personal account. It is not surprising as customized tips require additional information than just the consumptions.

In 10% of the considered bills utilities help understanding the voices of the bill by explaining the key terms connected to energy usage (for eg. kWh, m³, surcharges, etc.) (indicator E25), while giving advice on time-of-day-tariffs or other dynamic tariffs (indicator E24, 2%) or indicating contact information for customer service offering customized energy-efficiency specific consultancy (indicator E26, 5%) is still quite rare.

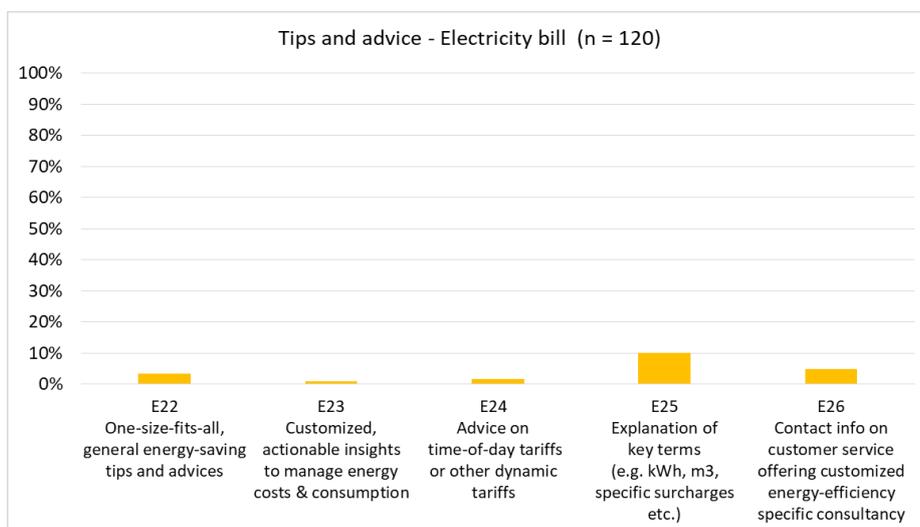


Figure 71 Assessment of electricity bills – Diffusion of “Energy-saving tips and advice” elements.



8.4.4.2 Gas bills

As for electricity bills, gas bills also lack tips and advice on energy consumptions. The most common element appearing in the bills is the explanation of the key terms connected to energy usage (e.g. kWh, m³, surcharges, etc.), that appear in 25% of the analyzed bills (indicator G22). Contact information for customer service offering customized energy-efficiency specific consultancy was indicated in 8% of the gas bills (indicator G23), while general energy-saving tips and customized, actionable energy-tips (indicators G19 and G20) are only shown in 3% and less than 1% of the gas bills.

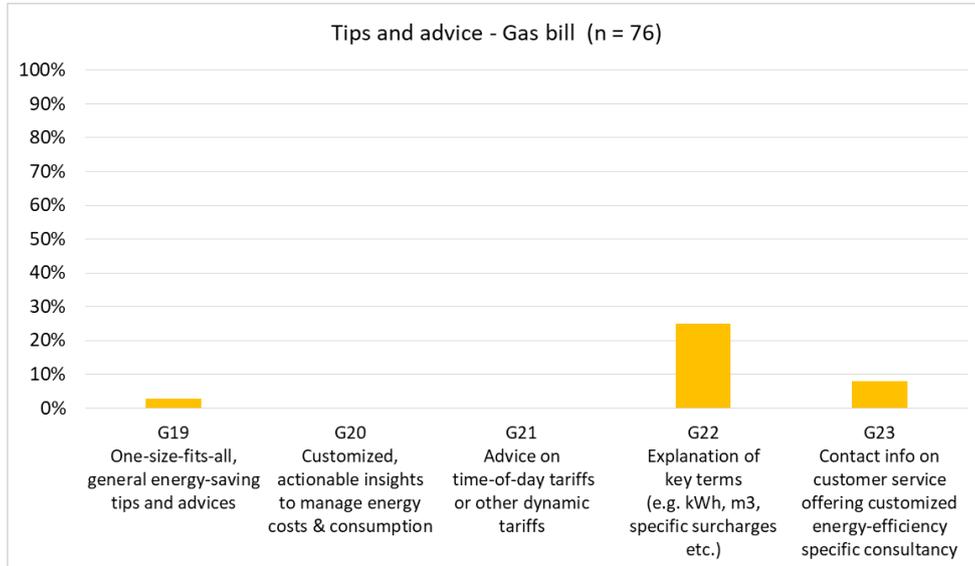


Figure 72 Assessment of gas bills – Diffusion of “Energy-saving tips and advice” elements.

8.4.4.3 District heating bills

The analyzed district heating bills do not include any energy-saving tips and advices. Only contact information for customer service offering customized energy-efficiency specific consultancy (indicator DH23) and explanation of the key terms connected to energy usage (for eg. kWh, m³, surcharges, etc., indicator DH22) appear in the analyzed bills, both in 11% of them.

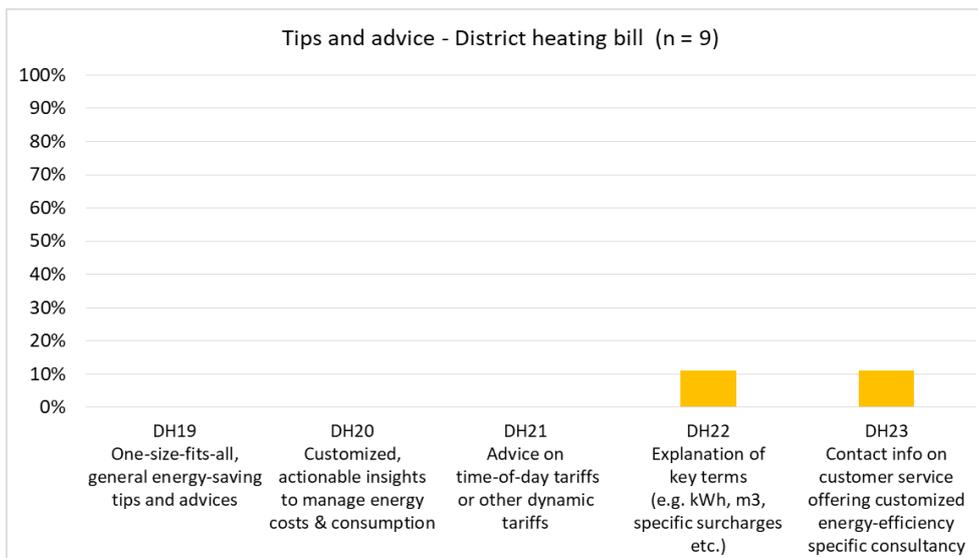


Figure 73 Assessment of district heating bills – Diffusion of “Energy-saving tips and advice” elements.



8.4.4.4 Some good practice examples

GENERAL TIPS & ADVICES

Scottish Power, United Kingdom. Electricity, 2017

The bill provides specific contacts for customers interested in energy saving measures, which can range from changing behavior and lifestyle to refurbishing their home.

Energy Efficiency Advice line

For energy saving advice, please visit scottishpower.co.uk or call 0800 332233. Lines open Monday to Friday 8.30am – 4.45pm.

Iberdrola, Spain. Electricity, 2017

This bill provides customers with one-size-fits-all general electricity-saving tips. Main communication message refers to pro-environmental behavior and values.

LA ELECTRICIDAD DE IBERDROLA PROCEDE EN SU MAYOR PARTE DE FUENTES RENOVABLES Y ES RESPETUOSA CON EL MEDIO AMBIENTE.

TUS GESTOS AHORRAN ENERGÍA Y CUIDAN DEL PLANETA

Cada vez consumimos más energía y los recursos para generarla no son infinitos. Por eso, pequeños gestos pueden disminuir tu consumo manteniendo el nivel de confort. Así, conseguirás un ahorro y estarás cuidando del planeta que nos proporciona esa energía.

- Las lámparas LED, además de proporcionar una luz de calidad, proporcionan una gran cantidad de luz con un consumo reducido. Son la tecnología actual más eficiente del mercado, y además las que tienen una mayor duración (siempre y cuando sean de calidad).
- El frigorífico es normalmente el electrodoméstico que más energía consume a lo largo del año en un hogar. Ajusta la temperatura para que no enfríe de forma excesiva, y cuando vayas a meter o sacar algo, intenta que la puerta esté abierta el menor tiempo posible.
- Siempre que puedas, utiliza el lavavajillas y la lavadora al máximo de su capacidad, seleccionando la menor temperatura de lavado que sea posible. De esta forma, ahorras energía, agua y detergente, y alargas la vida del electrodoméstico.
- Tapa los recipientes mientras cocinas. Así consumirás menos energía, al lograr un calentamiento más rápido.
- El aire acondicionado gasta entre un 4% y un 6% más de energía por cada grado que se baja la temperatura. Úsalo con moderación.

Puedes encontrar más consejos en www.iberdrola.es/consejosdeahorro



British Gas, United Kingdom. Gas, 2017

Besides indicating contacts to get a support on energy efficiency, this bill provides customers with energy-saving tips. Interestingly, the utility company opted for appealing to monetary issues, instead of referring to energy-saving per se or to recalling environmental or climatic problems. This message aims at capturing the large share of customers with low environmental awareness, who are more interested in monetary aspects than in pro-environmental behaviour and values.

Can I save some money?

For more information on energy efficiency, to track your energy usage, or have a live online chat with one of our Energy Consultants, visit: britishgas.co.uk/energysaving

1. Insulation

9 out of 10 homes that need loft and cavity wall insulation will now get it for free.* Check if you're eligible today by calling 0800 107 8499 or visiting britishgas.co.uk/eco

If you don't qualify for free insulation, you might be able to access a loan for energy saving improvements via the government's 'Green Deal', which you pay back through your energy bill. For more information on the 'Green Deal', visit: britishgas.co.uk/greendeal

2. Be energy aware

One of the best ways to reduce your bill is to use less energy. At British Gas, we want to help you get on top of your energy usage and are happy to provide advice about where to start and the tools you need to make a change. For top tips on saving energy in your home, visit: britishgas.co.uk/energysaving

*British Gas installs in mainland Great Britain only. Free installations are through the Energy Company Obligation and are subject to assessment, technical survey and eligibility criteria. The funding available is to cover insulation and if needed extra specialist equipment i.e. scaffolding and vents. Some properties require more specialist equipment which cannot always be covered, if you need more, you have the option to pay the extra. Tenants must seek landlords permission.

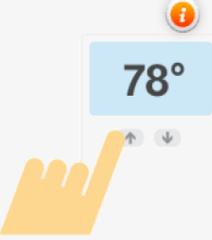


AEP Ohio and SMUD, California (USA). Electricity, 2011 and 2013 (based on OPower Home Energy Report)

Action Steps | Personalized tips chosen for you based on your energy use and housing profile

<p>Quick Fix Something you can do right now</p> <p><input type="checkbox"/> Raise your thermostat setting By setting your thermostat appropriately in the summer, you can stay cool and save energy. You can save 3-5% on cooling costs for each degree you increase the temperature.</p> <p>Set the thermostat to 78°F or higher when you are awake and home, and use fans to stay comfortable.</p> <p>When you leave home, change the thermostat to an energy saving level — a 10°F adjustment is a good rule of thumb.</p> <p>SAVE UP TO \$120 PER YEAR</p>	<p>Great Investment A big idea for big savings</p> <p><input type="checkbox"/> Choose an efficient room air conditioner In the summer, air conditioning can account for a significant portion of your home's energy bill.</p> <p>When you decide to replace your old room air conditioner, invest in an efficient, ENERGY STAR® qualified unit to lower your cooling costs.</p> <p>We're offering a \$25 mail-in rebate when you recycle your old, working room air conditioner and purchase an ENERGY STAR qualified model May 1, 2011 through August 31, 2011.</p> <p>SAVE UP TO \$20 PER YEAR</p>	<p>Quick Fix Something you can do right now</p> <p><input type="checkbox"/> Keep out the sun's heat Sunlight passing through windows can heat up your home and make your air conditioner work extra hard.</p> <p>Keep blinds or draperies closed on sunny days to block this heat. You can also purchase and install shade screens, which are another affordable and effective way to keep out the sun's heat.</p> <p>Blocking sunlight from entering your home will help you stay comfortable and save on cooling costs.</p> <p>SAVE UP TO \$10 PER YEAR</p>
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Energy Saving Tips for the Hot Summer



Overall, move your thermostat up 2°.
You won't feel the temperature difference, and you could save up to 16% on your electricity bill.

When you're away, set it higher.
When you leave home or go to bed, turn your thermostat up 10°.

Consider a programmable thermostat.
You can automatically increase and decrease the temperature of your home according to the time of day. Programmable thermostats costs less than \$50 and are easy to install.

These utility companies provide customers with personalized, actionable tips, based on their electricity use and the household profile. Though such tips still maintain a pretty general appeal and actual personalization is still far-off, this is definitely the direction for the future.

Note that tips in the figure on the left basically propose the same measures as the tips on the top. However, they were re-designed in order to enhance communication: they are more direct and immediate, which increases chances that they are put into practice. Finally, also these utility companies opted for focusing on monetary aspects, as figures indicating potential money savings, indicating in large characters, show: they were favoured respect to indication of reduction in CO2 emissions.



TIME OF DAY TARIFF ADVICE

Ireland, sample electricity bill used in large-scale consumer behavior trial, 2011 (CER, 2011a)

Tips and advice not only refer to energy-saving measures but also to load shifting to off-peak periods. This example, which comes from a bill used in a large scale consumer behavior trial in Ireland, presents colorful charts and pictures to stimulate off-peak electricity consumption, by highlighting differences in electricity tariffs (monetary motivational aspect). Customers are also provided with awareness on how much on average they are currently paying for common domestic activities, such as showering or washing clothes, and indications on the potential money saving they would get in case they perform the same activities in off-peak periods of the day.

Energy awareness



Typical cost of running various appliances over a full year*

Main household appliances (excl. Electric Oven)	NIGHT RATE	DAY RATE	PEAK RATE
Washing machine	€41	€57	€174
Tumble dryer	€137	€181	€579
Dishwasher	€55	€76	€232
Immersion - 6 months only	€152	€211	€641

*Average usage: 1 cycle per day, 5 days a week for a full year. Immersion: 1 use per day 6 months only.

Hints and Tips

- Money Down the Drain - During the peak period (5pm to 7pm) an instantaneous electric shower running for 15 minutes costs you €217.17 per year. At day rates it would cost you €71.44 per year.
- Beat the Peak. Machine washing a full load on peak rate will cost you €179.74 per year; on the day rate it would cost you €57.15 per year.
- Off peak costs less, but it still costs you. Remember it is important to be energy efficient outside of peak hours.

8.4.5 Other innovative DSI elements

When analyzing the energy bills collected, other interesting DSI elements were found, which were not directly accounted for by the indicators above. Whenever when any of them is founded, it has been registered under the "Innovative approaches" indicator. Such an indicator was used in a qualitative way: instead of presenting quantitative charts, for this indicator only good practice examples are shown, as suggestions for future activities.



PARTICIPATORY PROCESSED TO CO-DESIGN THE ENERGY BILL

è nostra, Italy. Electricity, 2017

This small cooperative company, only selling renewable electricity, decided to define bill contents in direct collaboration with their customers. It is a good example for implementing a participatory approach, as they invited the interested customers to co-design bill contents and graphical look, with the aim of making it easier to be understood and to include the specific information customers are looking for. The picture shows an excerpt from a newsletter of the company, by which they invited citizens to join the participatory design of the bill.

FACCIAMO INSIEME LA NUOVA BOLLETTA

Abbiamo già predisposto una bozza avanzata di bolletta tutta nuova, con tanto di emissioni e di polveri sottili evitate. Ma la versione definitiva la vogliamo costruire insieme a voi soci, per essere sicuri che sia leggibile, esaustiva e che incontri le vostre esigenze e la vostra sensibilità, non solo quelle della normativa o del mercato.

Se sei interessato, e non hai già provveduto, ti invitiamo a comunicare il tuo interesse scrivendo a info@enostra.it. Coordinerà il Gruppo Bolletta il nostro Gianluca Ruggieri, consigliere di *ènostra*, Ricercatore dell'Università dell'Insubria. L'attività partecipata di messa a punto del nuovo layout durerà dal 15 al 25 luglio, con l'obiettivo di utilizzare la nuova configurazione già dall'autunno.

DESIGN AND AESTHETICS OF THE BILL

Nuon, The Netherlands. Electricity and district heating, 2017

Increasingly, bills are moving from black and white documents filled with numbers and long, small written, technical and bureaucratic texts, to colored, appealing and engaging documents with pictures and charts. The following example, containing two pages taken from an electricity bill, shows a different type of innovative bill: there is more text than tables and charts. It's very easy to read, since a plain, non-technical language is used. In some cases, for example regarding the composition of the fuel mix, the company chose not to provide all the information directly on the bill, indicating though links to their website, where interested customers can find more details.

Kopie

Uw energienota – Uitleg
periode: 30 november 2015 – 12 december 2016
bladzijde 2 van 4

voor
leveringsadres

factuurnummer
factuurdatum

Overheidsheffingen
Energiebelasting is een milieubelasting van de overheid op het gebruik van stroom en gas. Daarnaast betaalt u per 1 januari 2013 de heffing 'opslag duurzame energie'. Deze opslag van de overheid betaalt u voor het stimuleren van duurzame energie. De hoogte van de belasting en opslag is een vast bedrag per kubieke meter gas en per kilowattuur stroom. Het berekende bedrag hangt da's ook samen met uw verbruik. Wil u hier meer over weten? Kijk dan op www.nuon.nl/energiebelastingen

Vermindering energiebelasting
U ontvangt een teruglage op de energiebelasting. U heeft hier recht op omdat uw stroomaansluiting zich bevindt in een pand of object dat voldoet aan de voorwaarde: het pand dient om te wonen, te werken of op een andere manier te verblijven.

Nettoheffingen
Dit zijn de kosten voor uw aansluiting op het energienet, het transport van energie en de meetdiensten. Dit is een vast tarief, gebaseerd op de capaciteit van uw aansluiting. Alle tarieven die een netbeheerder hanteert voor de aansluiting, het transport en de meter zijn door de AOW/energiekamer vastgesteld per kalenderjaar. Meer informatie over nettoheffingen kunt u bij uw netbeheerder opvragen.

Contractantoverzicht
Stroom: Nuon Stroom
Warmte: Aanzwelling: Nuon Bijven Loost

Kopie

Uw energienota – Service
periode: 30 november 2015 – 12 december 2016
bladzijde 4 van 5

voor
leveringsadres

factuurnummer
factuurdatum

Nuon Bijven Loost
U ontvangt met Nuon Bijven Loost 15% korting op de variabelere leveringskosten van stroom, energiebelasting, opslag duurzame energie en de btw over deze onderdelen. Het totaal van deze kosten is € 1.319,19. Uw verbruikspatru is ongeveer gelijk gebleven met dat van vorig jaar. Uw verbruikskosten zijn hierdoor ongeveer gelijk gebleven. Vergelijk in onderstaande tabel uw verbruik met het landelijk gemiddelde.

Woningtype	Gemiddeld verbruik (in GJ per jaar)*	Kosten per maand in euro's
Flats	76	63
Tussenwoning	82	74
Woonwoning	87	87
2 of meer woonwoning	89	92
Wijkgebouw	93	122
Gemiddeld	84	79

Bedrag zijn inclusief energiebelasting, O&E en 21% btw. * Gebaseerd op: H&M 2012, R&G, bewerking N&L&D 2015

Uw warmteverbruik
U heeft 39,9 GJ warmte verbruikt. Dit verbruik betaalt u kosten voor levering van warmte inclusief de btw. Het totaal van deze kosten is € 865,50. Als uw verbruikspatruon gelijk was gebleven met dat van vorig jaar, dan had u € 21,30 meer moeten betalen. Vergelijk in onderstaande tabel uw verbruik met het landelijk gemiddelde.

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Wijkgebouw	93	122
Gemiddeld	84	79

Bedrag zijn inclusief 21% btw. * Gebaseerd op: H&M 2012, R&G, bewerking N&L&D 2015

Uw stroomverbruik
U heeft 3.333 kWh stroom verbruikt. Dit verbruik betaalt u kosten voor levering van stroom, energiebelasting, opslag duurzame energie en de btw over deze onderdelen. Het totaal van deze kosten is € 1.319,19. Uw verbruikspatru is ongeveer gelijk gebleven met dat van vorig jaar. Uw verbruikskosten zijn hierdoor ongeveer gelijk gebleven. Vergelijk in onderstaande tabel uw verbruik met het landelijk gemiddelde.

Woningtype	Gemiddeld verbruik (in kWh per jaar)*	Kosten per maand in euro's
Flats	2.000	58
Tussenwoning	2.760	63
Woonwoning	4.120	79
2 of meer woonwoning	4.500	86
Gemiddeld	3.360	55

Bedrag zijn inclusief energiebelasting, O&E en 21% btw. * Gebaseerd op: H&M 2012, R&G, bewerking N&L&D 2015

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Bedrag zijn inclusief energiebelasting, O&E en 21% btw. * Gebaseerd op: H&M 2012, R&G, bewerking N&L&D 2015

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ENHANCED, CUSTOMIZED INFORMATION VIA WEBPORTALS OR APPS

Enel Energia, Italy. Electricity and gas, 2017

The majority of companies are now offering detailed information on energy consumptions via webportals or smartphone apps, on whom customers are invited to create an account and frequently log. Usually, webportals allow online consultation of the bills; increasingly, they are offering additional data (such as possibilities to compare consumptions with longer series of data respect to the bill) or customized comparison with other "similar" customers. In fact, webportals allow interaction with the customer: simple questions can be made to the customers, when they access the portal, in order to keep the set of their personal information updated. Moreover, questions on energy consumption patterns might be asked as well. The elements gathered this way can be related to energy consumption data provided by the smart meters, so to identify the specific consumption profile of the customer and to provide her with even more customized energy-saving suggestions.

This portal (Enel Energia, My Energy webportal) asks the customer if she wants to better understand her energy consumptions. To this purpose, she is invited to answer a few simple questions regarding her household (number of persons, type of home, size of the home, type of heating system and electric appliances generally used), directly interacting with the website.

CONFRONTATI CON LE PERSONE SIMILI A TE

Come sto consumando rispetto a...

Qui puoi effettuare un confronto per area geografica e unità abitative tra i tuoi consumi e quelli degli altri clienti di Enel Energia con la tua stessa offerta. Compilando il questionario e rispondendo ad alcune semplici domande sulla tua abitazione, puoi anche confrontare i tuoi consumi con quelli di persone che hanno le tue stesse caratteristiche abitative. I confronti si basano sulla media dei tuoi consumi degli ultimi 6 mesi.

I TUOI CONSUMI DA OTTOBRE 2016 A MARZO 2017 A CONFRONTO CON PERSONE CON CARATTERISTICHE SIMILI ALLE TUE

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I TUOI CONSUMI DA OTTOBRE 2016 A MARZO 2017 A CONFRONTO CON PERSONE CON CARATTERISTICHE SIMILI ALLE TUE



Confronta i tuoi consumi

Quante persone, incluso te, vivono abitualmente nell'abitazione?

1 2 3 4+

Questa domanda è obbligatoria. Per cortesia fornisci una risposta.

Di che tipo di abitazione si tratta?

Appartamento Bifamiliare Unifamiliare Altro

Questa domanda è obbligatoria. Per cortesia fornisci una risposta.

Quale è la superficie dell'abitazione?

< 50 mq 50 - 100 mq 100 - 150 mq >150 mq

Questa domanda è obbligatoria. Per cortesia fornisci una risposta.

Once the customer has answered, immediately a comparison chart is updated, highlighting consumptions of similar households at the national level (based on the size of the house and the number of persons, on the type of heating system and on the main electric appliances used). The customer is also allowed to select similar households by considering only those living in the same area (same city or geographical location in Italy: Northern, Central or Southern), and the chart updates accordingly.

In the case of this utility company, who sells both electricity and gas, data regarding all types of energy consumption in the household (electricity and heating) are available, thus offering a global overview of the energy performances of the customer.

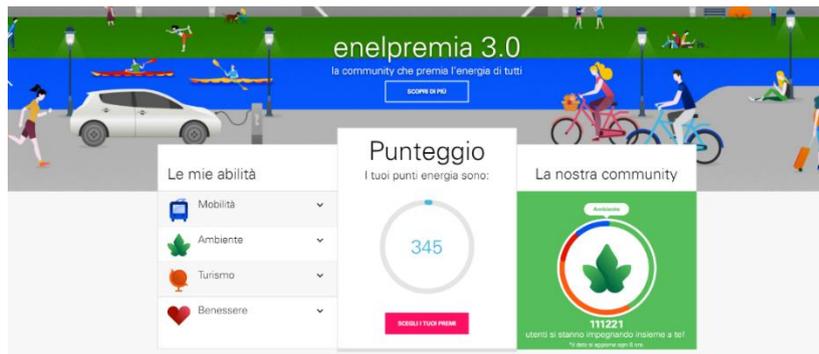


CUSTOMER FIDELITY PROGRAMMES

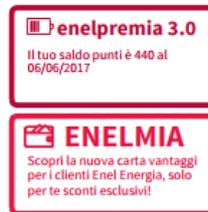
Enel Energia, Italy. Electricity and gas, 2017

In a liberalized energy market, maintaining and acquiring customers has become a priority for utility companies. For this reason, besides operating on the energy tariffs and on marketing aspects, they also activated customer fidelity programmes, offering tangible prizes to their customers. For example, this utility company developed a programme of quests, resulting in point acquisition, that the customer can then redeem with real life prizes (Enelpremia 3.0).

Points can be obtained by completing some basic operations related to bill (such as for instance, regularly paying them, or sending self-reading data of their consumptions), and by answering to quizzes offered in the customer section of the webportal.



Total points obtained are indicated in the first page of the energy bill; more details are given if the customer logs in to the utility company webportal.



Pagina 1



Comportamenti virtuosi

Puoi accumulare punti energia non solo divertendoti con le nostre attività, ma anche attraverso i tuoi comportamenti! Scopri qui sotto tutte le modalità.

Autolettura	0 punti	Bolletta web	0 punti
Puntualità pagamento annuale	0 punti	Acquisto prodotti Enel Energia	0 punti
RID	60 punti	acquisto con i nostri partner abilità	0 punti

Migliora le tue abilità con le nostre attività.

Divertiti a scoprire tanti modi per fare del bene sia a te stesso che all'intera comunità attraverso le nostre iniziative. Potrai specializzarti sulle tue abilità preferite e accumulare tanti punti energia!





EVN, Austria. Electricity and gas, 2017

This company offers a customer fidelity programme by which customers get points by simply consuming energy: as soon as they consume 10 kWh of electricity or 50 kWh of gas, they obtain one point. If the energy they consumed was an ecological one (depending on the energy product they chose to buy), they get a double number of points. Additional points can be earned by taking part in promotions offered by the company or in exploiting additional services they offer.

Points can be redeemed in selected partner shops, who offer energy efficient appliances(A++).

Note however that such a programme can produce rebound effects, since it stimulates customers to increase their consumptions, in order to get additional points.

Bonuspunkte für EVN Strom und/oder Gas

Mit Bezug von EVN Strom & EVN Gas automatisch sammeln:



für den Bezug von EVN Strom und EVN Gas der folgenden Tarife:

- Optima Natur (Eco)
- Garant Natur (Eco)
- Float Natur (Eco)
- Float Cap Natur (Eco)
- Optima BioGas

für den Bezug von EVN Strom und EVN Gas der folgenden Tarife:

- Optima (Eco)
- Float Cap (Eco)
- Garant (Eco)
- Optima Gas
- Optima Gas Float Cap
- Gas Garant

Oekostrom AG, Austria. Electricity and gas, 2017

Customers are offered an online shop where they can buy energy-efficient products (from led bulbs, portable solar rechargers and smart plugs, to larger appliances such as washing machines) and increase their awareness on savings potential and climate protection. For every product available in the shop, in fact, they get the information on how much energy they would save and how many CO₂ emissions they would avoid. Also, the more the products they buy, the more the points they earn, to be redeemed with further energy-saving products.

oekostrom AG

Warenkorb
0 Artikel
Zwischensumme: 0,00 €
Mein Konto Anmelden

bonuspunkteprogramm

- Energiespar-Shop
- LED Lampen & Spots
- Strom sparen
- Heizkosten sparen
- Wasser sparen
- Ressourcen schonen
- Solar
- Sonderangebote
- Smart Home
- Solar Fidelity

willkommen

Gemeinsam mit Ihnen macht sich oekostrom AG für den Klimaschutz stark und unterstützt Sie beim Energiesparen.

Im Energiespar-Shop können Sie energieeffiziente Produkte kaufen und sich direkt über Ihr Einsparpotential informieren.

Jetzt Punkte sammeln und sparen

gesamtersparnis bisher

1945738 Euro* 7673670 kg CO₂*



HOME AUTOMATION PROGRAMMES

Enel Energia, Italy. Electricity and gas, 2017

Webportals and smartphone apps allow fully exploitation of the power of smart meters: customers can read their energy consumption in (nearly) real time, and thus increase their energy awareness. Building on such information, utility companies can then offer additional services.



Box e Rilevatore Consumi

1x Sensore Porta/Finestra

2x Smart Plug



For example, this utility company offers a smart kit that integrates the smart meter (InHome display, sensors and smart plugs). Thanks to disaggregation algorithms and smart plugs, the company is able to estimate disaggregated electricity consumptions per appliance. Once customers get to understand how their electricity consumptions are structured, by means of an app they can activate automatic rules and consumption thresholds for remote control of lightings, electric appliances and alarm systems. The app also gives feedback on real time consumption and allows to set energy-

saving goals and check their level of achievement.

Also, the company offers additional services, useful when customers are outside their house, such as information on public transport strikes, shopping from home facilities, meteorological previsions and navigation system. Since uptake of such services is still limited among customers, to promote them the company also offers a dedicated customer fidelity programme (goal setting, quests, challenges, points), which again adopts a gamification approach, that rewards customers based on their level of activity with the app.



Bene! Hai mappato quattro elettrodomestici



Hai impostato il tuo primo obiettivo energetico



Hai esplorato la sezione casa



Hai completato la tua missione! Scegli il tuo premio.



8.5 Chapter's conclusions

This chapter summarizes the analysis that was carried out on DSI (Demand Side Information) programmes existing abroad, with a specific focus on energy bills. Aim of such analyses was to understand how utility companies provide their customers with information on their energy consumptions.

Based on an online questionnaire targeting utility companies themselves, on a web search and on personal contacts abroad of the partners of the present project, it was possible to analyze a sample of energy bills for electricity (120 bills), gas (76 bills) and district heating (9 bills). Such bills were assessed by means of a set of indicators mainly identified by a literature review in this field. Such indicators aimed at assessing the level of effectiveness of energy bills in providing DSI information of the four following categories:

- Transparent accounting;
- Comparative statistics;
- Eco-feedback on climate and environmental impact;
- Energy-saving tips and advice.

Though based on a structured set of indicators, it has been not consider such an analysis as a purely quantitative one: in fact, the energy bills collection process could not follow a systematic rationale, and does not allow representativeness for every country. In many cases, in fact, accessing a bill from a specific country merely happened by chance, depending on personal contacts abroad. For this reason, even though it has been possible to quantitatively assessed values of the indicators and elaborated numerical charts. It has been agreed to mainly focus on the qualitative suggestions that can be extracted from such analysis, in particular understanding general trends and good practices regarding energy bills and, more in general, DSI elements provided by utility companies.

In general, it has been acknowledge there is a need to rethink and improve billing information, if the role of energy bills is to change from purely representing a transparent accounting tool to one also contributing to raise household customer's energy awareness and possibly triggering pro-active motivation to save energy. This general concept is already being put into practice by many utility companies, especially those selling electricity. In particular, many of them started introducing comparisons, mainly comparisons with the past consumptions registered by the same customer household. Innovative companies are also offering comparisons with other households, even though this kind of information is definitely rarer. Even more uncommon is finding alternative metrics aiming at supporting customers in understanding their level of energy consumption or CO₂ emissions. Energy-saving tips are popular, even though usually they are still general, one-size-fits-all, non-customized tips. Diffusion of ICT technologies (smart metering, smart plugs/sensors and smart disaggregation algorithms) will swiftly favour higher customization. Considering the present diffusion of webportals and online tools, it can be expected that more customization will increasingly be offered online, instead of traditional energy bills. Webportals and online tools, in fact, guarantee easier and faster possibilities of interaction with the customer, thus facilitating customer segmentation and greater customization. Also, with the introduction of gamification schemes and attribution of points when certain types of actions are performed, through webportals utility companies can increase the chance that customers actually access the information they are offering them – which cannot be taken for granted with traditional bills, since customers might not even open them, in case they have activated automatic direct debit systems.

An element that is still lacking in our analysis is the assessment of the effectiveness of the DSI elements in stimulating actual behavior change in customers' energy consumption patterns. Apart for quantitative assessments regarding more informative energy bills in general [Wilhite and Ling, 1995], and comparison of consumptions with similar households (use of social norms, [Alcott, 2011] and reports produced by OPower for the utility companies which exploited their Home Energy Reports), in fact no other systematic assessments of the effectiveness of DSI tools introduced has been found. When launching DSI programmes, utility companies should also sustain them by large-scale analyses to assess their effectiveness over time, for example by means of randomized controlled trials.



9 From the best practices into IMROVE solutions

The Swiss Energy Strategy 2050 aims to increase the use of renewable energy and the energy efficiency of buildings, mobility, industry and appliances [1]. An additional important element of this strategy is the reduction of the energy demand in Swiss households, which requires a change in energy consumption behaviour. Consumer behaviour is also one of the main topics within the research program “Energy in Buildings” of the Swiss Federal Office of Energy (SFOE). The consumers are affecting the energy demand of modern buildings more than the construction quality. However the research of the relation between consumption behaviour and possible influences are still at the beginning [2].

An important driver for promoting the change of energy consumption behaviour of private households can be seen in demand-side information (DSI). In order to get an overview of the state of the art in the DSI field in Switzerland and abroad and to identify improvement potentials, the project “IMPROVE – Unfolding next generation demand-side information (DSI) models” has been initiated by 4 Swiss universities of applied sciences: HES-SO, SUPSI, FHNW and ZHAW.

The point of departure of the IMPROVE project is the information gap existing between utilities and their customers: The utilities possess the information needed to allow customers to make the connection between energy usage and the amount due, as well as to possibly help manage it better. Yet, overly detailed information increases the risk of reducing bill comprehension, since customers strive for simplicity, transparency or are simply not interested to be overloaded with the information regarding their own consumption in much detail. However, by deploying appealing visual elements, designs and taking advantage of new IT and metering technologies it becomes possible to present a large quantity of information in a simple, transparent and appealing way, which could increase perceptiveness of the customers and possibly motivate them to rethink their energy-related behaviour.

Against this background, the present chapter focuses on:

- reviewing literature on energy-related behaviour, its determinants, behaviour change models and energy feedback in order to better understand which elements constitute an effective DSI measure and their relative importance from the scientific point of view (introduction chapter to the main body of the final report)
- conducting complementary desk (analysis of DSI pilot projects) and field (expert interviews with representatives of two utilities from north-eastern Switzerland) research to chapters 7 and 8 (review of best DSI practices in Switzerland and abroad) with the focus on north-eastern Switzerland due to the regional expertise (section 9.2)
- synthesising these findings as well as the findings of chapters 7 and 8 into six IMPROVE solutions, that are enhanced and synthetic layouts for energy bill, that will be used in the customers’ satisfaction survey conducted in chapter 10 (section 9.3).

9.1 Method

In addition to reviewing, chapters 7 and 8 reports dealing with best practices in Switzerland and abroad respectively, own desk and field research was conducted within the chapter 9. The research included in particular: 1) analysis of utilities’ websites; 2) detailed analysis of selected DSI-related pilot projects; 3) expert interviews. The findings from this research together with the insights from chapters 7 and 8 reports served as a basis for the development of the first draft of IMPROVE solutions within an internal workshop with the ZHAW project team. These draft solutions were then further developed together with project partners from HES-SO, FHNW and SUPSI in an iterative process that was started with a joint workshop and continued through an intensive e-mail exchange. The process resulted in six visual IMPROVE solutions which were included in the customer satisfaction survey (chapter 10) in order to get feedback on them from the customers’ point of view.



9.1.1 Detailed analysis of selected Swiss and foreign DSI-related pilot projects

The review of best documented DSI-related projects is based on web and literature research as well as on expert interviews. Each model was analysed in a standardised template. The structure of the template is outlined in Appendix 9. Based on information collected in the template, clustering of the analysed best practices was conducted within an internal workshop with the ZHAW project team.

9.1.2 Analysis of utilities' websites in north-eastern Switzerland

The analysis of websites included all utilities which are active in the north-eastern part of Switzerland according to the SFOE (Elcom, 2015) and focused on applied cases, studies, initiatives and tools. In addition to the research conducted within chapter 7 with the focus on energy bills, this analysis includes also other DSI and DSM measures often conveyed on new digital media, since from those pilot project it can be learned a lot how to enhance energy bills.

9.1.3 Expert Interviews (from Switzerland)

For getting an insight in how utilities are dealing with DSI, qualitative guideline interviews with experts of two partner utilities from north-eastern Switzerland were hold. The interview guideline was organised around the following questions:

- Which DSI models are used?
- Which are the objectives in applying specific DSI models?
- Which information about the energy consumption of consumers is available?
- What is the motivation of the utility and the consumers to improve energy efficiency?
- What are the consumers' actual and future needs for information?
- What kind of ideas and projects related to DSI are pursued at the utility?
- Which objectives are pursued by applying enhanced DSI models?

The findings out of the interviews were integrated in the analysis of the existing DSI models and were further used as inputs for the development of enhanced DSI models.

9.2 Results

Around 650 utilities are responsible for the electricity supply in Switzerland (S.A.F.E., 2005). For the analysis in north-eastern Switzerland, all utilities which are active in the cantons of Appenzell, Glarus, Graubünden, St. Gallen, Schaffhausen, Schwyz, Thurgau, Uri, Zug and Zurich have been included. In total 309 utilities are included in the analysis of the DSI and DSM models.

9.2.1 Detailed analysis of selected Swiss and foreign DSI-related pilot projects

The assessment contains 27 different DSI or DSM models. A detailed documentation is available in the Appendix 10. The evaluated models can be clustered as illustrated in Figure 74. The numbers are referring to the list in the detailed documentation. Only the invoice can be stated as a DSI solution referring to the definition within the IMPROVE project (see introduction chapter to the main body of the final report). All other cluster categories also include DSM elements. In what follows, the clustering of the assessed models is determined and the main strengths and weaknesses of the assessed DSI/DSM models are outlined. The cluster "invoice" is thereby enriched by the findings of the chapter 8 regarding the best invoicing practices abroad.

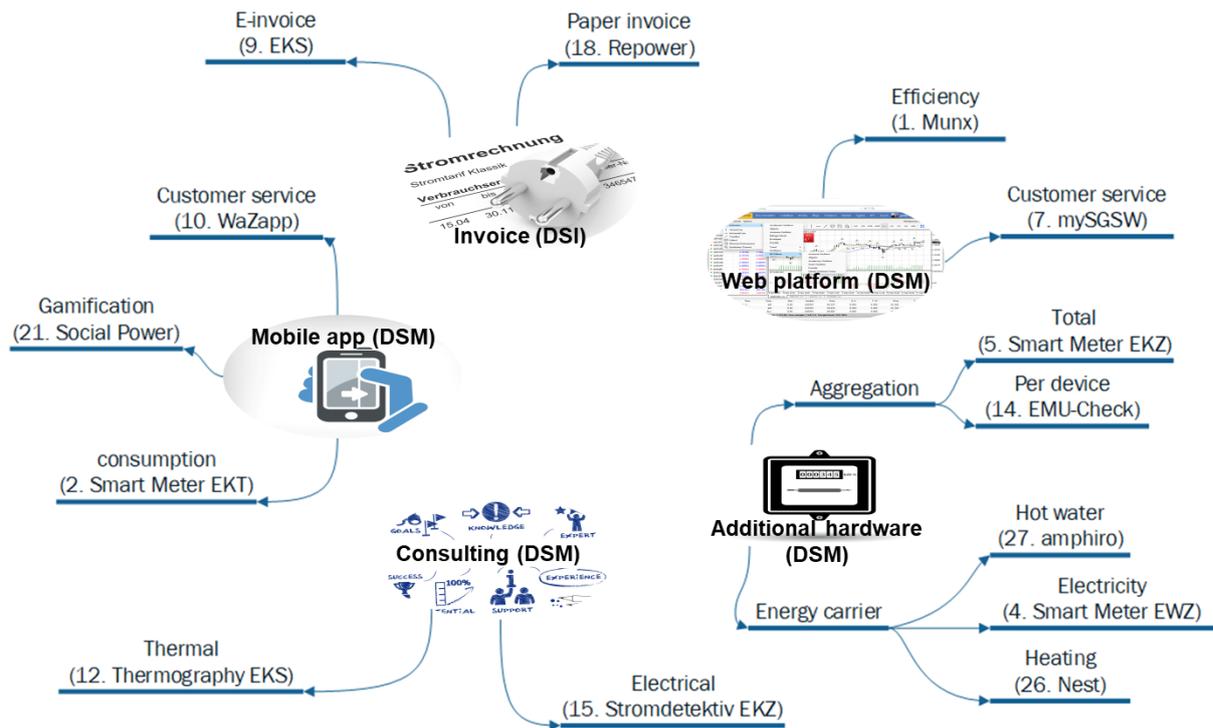


Figure 74 Cluster of existing and collected DSI/DSM models.

9.2.1.1 Invoice

Two main types of billing models can be distinguished. The paper invoice is the actual market standard for informing consumers about the energy consumption and costs and for charging the consumption. For the paper invoice, it is not distinguished between an invoice by post and an invoice by e-mail as they only differ in the distribution channel. The second possible type of charging the energy is e-invoicing. The e-invoice has to be differentiated from the paper invoice due to the fact that it is possible to pay the invoice without having a look at the detailed invoice. In this case, the consumer only notices the costs of the energy in total and no detailed information, as for example the consumption in kilowatt-hours. It needs more effort to open the detailed invoice in this approach. The detailed information can be seen by opening the e-invoice on the e-banking account and then additionally opening the detailed invoice. The content of an e-invoice is mostly identical to the paper invoice. A strength of e-invoicing is that the information is received on the e-banking platform which is used by the customers for all payment transactions. Therefore no additional platform is used and the consumers are accustomed to the use of it.

Most of the utilities invoice one time a year with a different number of payments in account. The paper invoice of repower (Repower, 2017) is delivered DSM two times a year with additional four times a payment on account. Current consumption is graphically compared with the historical one and costs are also graphically split up into different services as grid costs, taxes, legal fees or high- and low-rate energy. This gives a visual overview and makes the invoicing transparent. A weakness of the nowadays DSI by invoice models is the use of static consumption information. For consumers, it is difficult to attribute their consumption to the behaviour if they get one or two invoices per year.

More specific feedback is provided in several invoicing models in foreign countries by illustrating the average costs and consumption per month or per hour of the day (Endesa, 2017). Figure 75 (in Spanish) shows an example which combines historical and normative comparison (with the average consumption of the city) with a more disaggregated (seasonal and monthly) consumption.

Furthermore, individual energy conserving advices are made, for example how many days a LED lamp could be operated with the amount of electricity of this invoice. This advice helps consumers to understand what the number of kilowatt-hours represents.



Figure 75 Energy info by Endesa [7].

The same utility in Spain provides a comparison by classifying the consumer's consumption with an energy label (Endesa, 2017). With this illustration (Figure 76), the consumer is able to evaluate his energy efficiency.

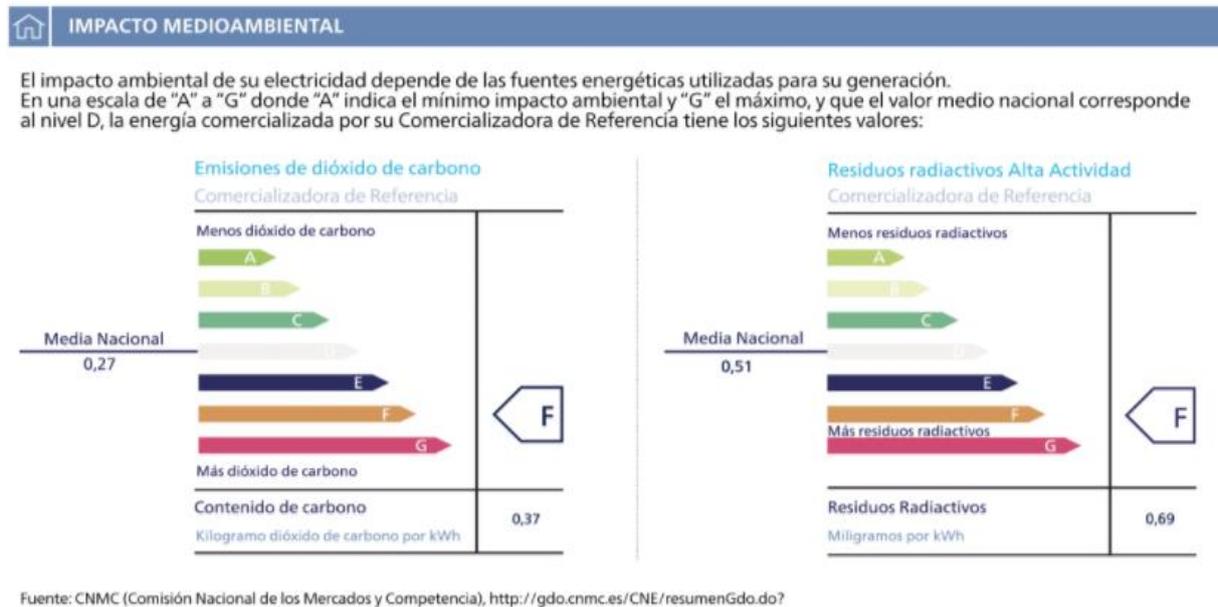


Figure 76 Energy label by Endesa [7].

Further information on the invoice about the environmental impact such as the CO₂ emissions or nuclear waste (see Origin Energy, 2017) caused by the own consumption can initiate behaviour change of environmentally-conscious consumers. It is also possible to additionally provide an appreciation notice if the energy efficiency of the consumer is high.



9.2.1.2 Web Platform

Online efficiency and customer service platforms can be aggregated to the term “web platform”. As web platforms provide more than DSI, for example the possibility to change the tariff, it is classified as a DSM.

On the online efficiency platform “Munx” (Repower, 2017), the consumer receives a specific feedback about his consumption. The self-metering process can increase the awareness for energy consumption but also present a barrier. It is a very simple method of tracking electricity consumption because no installation is needed. The knowledge of the consumer about energy is improved with quizzes in a playful way and the behaviour change is initiated also with material incentives. The tool is interactive and contains also normative comparison (to neighbours). A weakness of this efficiency platform is that it is not connected to the online customer service platform and therefore there is no link to the invoicing process. Furthermore, the normative comparison can have a negative effect. If a consumer sees that others consume more than himself, his motivation for saving energy may decrease.

“MySGSW” (St.Galler Stadtwerke, 2017) is an online customer service platform that includes all customer services which are available online on a single point of contact. All information such as consumption, costs or purchased products are available simultaneously. The platform enables a bidirectional communication between consumers and the utility. Service requests as a relocation announcement or the choice of another electricity product can be conducted online. With an online customer service platform, DSI can be combined with DSM and customer service processes. Due to the fact that the mentioned platform uses the same static consumption information as used in paper invoices, the feedback is not particularly specific.

Web platforms are solutions which can only be applied for a part of the consumers because not all consumers are able to use it (e.g. they do not have an internet connection or do not dispose of a high digital literacy). As a further weakness, it can be pointed out that the consumer has to be active in order to get the information.

9.2.1.3 Additional Hardware

Models which are applied by implementing additional hardware (e.g. smart meters) can be classified by the level of break down (aggregation) or the energy carrier on which the model is based.

Smart meters, as they are used in the Smart Metering study (EKZ, 2011), provide aggregated information about the total energy consumption in a household with a periodicity of 15 minutes. The consumption can be displayed on an in-home display. In this case, the consumption is available for the consumer while using energy. If the information is published on a web platform, it is additionally retrievable at every time and everywhere. The smart meter data can also be used for providing more detailed information in the paper invoice (e.g. consumption per day or hour with the highest consumption).

Disaggregated information regarding the energy consumption of specific appliances are available with the “EMU check USB” energy meter (EW Höfe, 2008). The energy meter has to be plugged in between the power socket and the specific device (e.g. television). The energy meter logs detailed real-time information about the power, the current and the consumed energy. The information can be displayed on the energy meter or can be analysed with a software. Additional available information are the calculated costs and CO₂ emissions (calculated with a static factor). As the energy meters have to be plugged in per analysed device, a high number of energy meters would be needed to equip a single household. Furthermore, the information can only be retrieved at the energy meter actively.

“Amphiro” (Fischli et al., 2011) is an intelligent display which provides live energy and water consumption feedback when taking a shower. The device has to be plugged in manually between the showerhead and the water pipe. It provides a direct feedback when energy is used. The consumer is thus able to immediately check the impact of the behaviour on the energy consumption. Also, a gamification element is included by showing a polar bear on a melting ice floe. If more hot water is used, the floe is melting. The information is only retrievable directly on the display.



“Nest” (Nest Labs, 2015) is another energy-carrier-specific DSM model. It is a smart home device which controls the room temperature automatically based on weather forecast and further collected data. The thermostat provides continuous feedback on the heating energy. The information is available on a mobile app on which historical comparison is possible as well. The device has to be manually installed in every room. Applying additional hardware is always related with either manual installation or an installation by a professional. The need of investments in hardware and data security is unavoidable.

9.2.1.4 Consulting

Energy consulting services can be classified in thermal or electrical. The advantage of thermography is the possibility to depict the energy. It is simply understandable for consumers if a picture of the house is presented with the illustrated energy consumption by different colours. Consulting services provide a personal interaction between the consumer and energy experts. In personal interaction, it is simpler to understand consumer needs. The advices are provided directly from experts and are further personalised. The weakness lies on the high costs and the fact that consulting services are time consuming. The necessity of an appointment could build an entrance barrier. Furthermore, the feedback is not continuous.

9.2.1.5 Mobile App

Mobile applications vary dependent on the focussed topic. The focus by implementing mobile apps can be set on customer service, gamification elements or on information about the consumption. Customer service mobile apps such as “WaZapp” (Werke am Zürichsee, 2016) show the same strengths and weaknesses as online customer service platforms. Push-notifications are additionally possible with mobile apps. The consumer has thereby not to be active to receive information. A weakness is the necessity of an installation on the mobile device of the consumer.

9.2.2 Analysis of utilities’ websites in north-eastern Switzerland

Figure 77 shows that most of the utilities do not provide any information about DSI or DSM measures online. A significant share of the utilities (9%) is not present online. As the invoice by post is provided by every utility, this form of DSI is not included in the rough analysis. The following lines offer a short evaluation of analysed model categories.

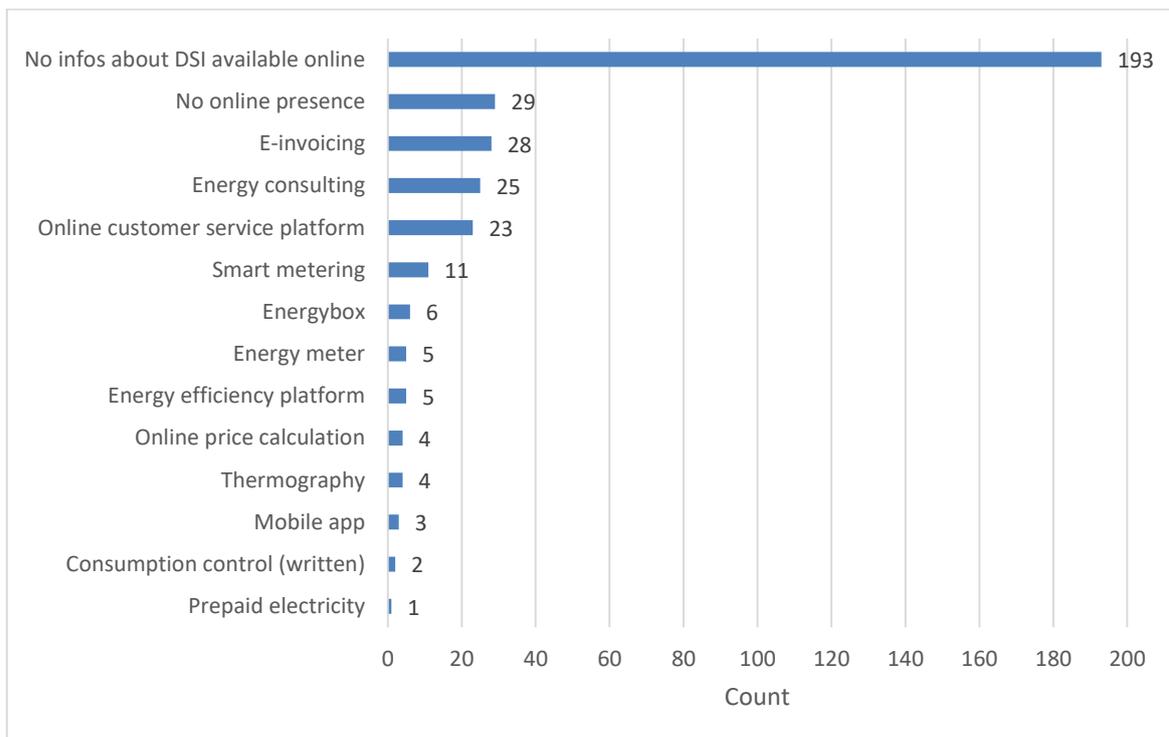


Figure 77: Existing DSI/DSM measures in the northeast of Switzerland (N=309, multiple entry possible, data source: online presence of the utilities).



E-Invoicing

The most used form of billing beside paper bill is e-invoicing. E-invoicing usually involves replacing invoicing by post by sending the invoice to the e-banking platform of the customer's bank. The invoice is thereby available online and replaces the paper form. The content on the e-invoice is mostly identical to the paper invoice.

Energy Consulting

25 out of 309 utilities provide a certain form of energy consulting services. The consulting services differ widely and can be characterised with the parameters and forms listed below.

Parameter	Form			
Place	At home	Online	At the utility	By telephone
Price	Free of charge	At cost	Blanket	Modular
Measurements	None	Standby consumption	Individual appliances	All appliances
Delivery	Verbal	Report		

Table 19: Characteristics of energy consulting.

Possible contents of the energy consulting services are an efficiency rating, building information, appliance selection or consumption behaviour.

Online Customer Service Platform

An online platform on which the customers can receive any type of services is regarded as online customer service platform. The platform can provide information about the invoices, contracts, consumption and costs or the possibility to announce relocations, report meter readings or to choose another electricity product. 23 customer service platforms of utilities are online in the northeast of Switzerland.

Smart Metering

A share of 4% (11 utilities) is already using smart meters and provides information concerning the application online.

Energybox

“Energybox” is an online-based energy calculator for households. With this tool, it is possible for customers to analyse the energy consumption of the household on their own by filling out a questionnaire (S:A:F:E., 2005). It is possible for utilities to label the “Energybox” and provide it to their customers, which is actually done by 6 utilities.

Energy Meter

In this category, energy meters which are additionally available to the obligatory energy meter of the household are counted. The energy meters mostly show the actual electricity consumption of the household or a specific appliance on a display. It is possible to store the consumption data and analyse it with a software. Five of the analysed utilities sell or lease energy meters, or provide them for free.

Energy Efficiency Platform

An energy efficiency platform aims to improve the energy efficiency of the consumers by different measures (e.g. interactive learning, energy challenges, social comparisons, goal-setting, incentives etc.). Mostly the customers are asked to enter metering data periodically (e.g. weekly) and learn something about their own consumption and energy conservation possibilities (Schneiker, 2015). It differs from the “Energybox” by the interactivity. There are five energy efficiency platforms of utilities online in the northeast of Switzerland.



Online Price Calculation

Four utilities provide an online tool for calculating the energy price for the household with different energy products.

Thermography

Thermography includes services, as provided by four utilities, in which infra-red pictures of the building are recorded. Thermography recordings can indicate bad heat insulation on houses. The recordings are mostly assessed by experts and a report is handed out to the customer.

Mobile App

Three utilities use mobile apps for the consumers, available for mobile devices as smartphones. In particular, mobile apps include similar services as an online customer service platform. Furthermore, for example push notifications can be received by the consumers on the mobile device.

Consumption Control (written)

Two utilities provide a paper form for controlling the own energy consumption. Meter readings can be reported manually by the consumer and so a possible change in consumption over time is visible.

Prepaid Electricity

Prepaid electricity is similar to the prepaid model in telecommunications. In this model, it is only possible to use the electricity if it is paid in advance. If the amount of purchased electricity is used, the power supply of the household is switched off. The model is used by one utility in the Northeast of Switzerland.

9.2.3 Expert Interviews (from Switzerland)

In the following lines, main findings from the expert interviews with the representatives of the two partner utilities from north-eastern Switzerland are presented. Although these qualitative findings provide valuable insights regarding the utilities' perspective on DSI, they cannot have any pretence regarding generalisability for Switzerland. In the following, the main findings are pointed out. Detailed answers to the asked questions and the interview guideline are enclosed in the Appendix 11.

9.2.3.1 What Utilities Aim with DSI

For the interviewees, the primary goal of DSI is to satisfy the needs of the consumers. Utilities want to deliver transparent information and still possess an efficient invoicing process. They also have to comply legal requirements. Further the marketing effect is mentioned as an important goal by applying DSI. Energy efficiency is regarded as secondary.

9.2.3.2 Available DSI

Actually, there is not much information available from the demand-side. Meter readings once a year are usual. The only information about the consumed energy is the yearly consumption and the purchased energy product (for example solar electricity or water electricity). Projects for smart metering are ongoing in some extent, but not yet realised. Further on, the utilities do not hold information about needs and expectations of the consumers.

9.2.3.3 The Customer Viewpoint

Household consumers seem not to be willing to engage themselves in detail with the topic of energy. The energy efficiency is secondary and it is important for the consumers, that their comfort is not restricted by energy conservation. The profile of household customers of utilities differ widely. Some of the consumers are driven by an ideological view regarding the environment. Others can be motivated by applying new technologies. It was also mentioned that despite the influence of information and education on raising customers' awareness, the last step for a decision will be made by financial considerations.



9.2.3.4 Requirements of Effective DSI

A DSI model has to be realisable for the utility. The consumer should be able to monitor the energy consumption in real-time, individualised and disaggregated (on appliance level). The required periodicity of the information depends on the consumer. The invoice has to be transparent and it should be possible to get the desired information by low effort. Many consumers claim that there is too much information on the bill. Therefore, the information should be provided in stages, so that the essential information is on the top and interested consumers have the possibility to inform themselves in detail by moving on to the next stages. On a long term, the information should make consumers aware of the topic of energy and the efficient use of it.

9.2.3.5 Solution Ideas

An interviewee conceives a mobile app which combines different services for the everyday life with the topic of energy. For example, a sharing platform within the neighbourhood could be combined with the washing plan of the house, a notice board and information concerning energy consumption. The app thereby has to be detached from firms so that it is not an advertising platform.

Another idea mentioned is to send push notifications to the consumers individually and at the right time. So, consumers could benefit by paying less for the energy or consuming less by a more efficient use.

It can be concluded, that the main goal of an effective DSI is to inform consumers in a transparent way without obstructing an efficient invoicing process. The information should be available at the right time and meet the consumers' needs. A customer segmentation seems to be useful. Therefore, it would be necessary to get more information about the consumers, for example regarding interests or preferred channels of information. Further, more detailed DSI regarding the consumed energy (disaggregated and with a higher periodicity) would be valuable.

9.3 Towards the IMPROVE solutions

From the results in section 9.2 it is evident that some utility initiatives in the field of interaction with customers combine DSM with DSI measures. The obligatory invoice is the only pure DSI model which is available for all household consumers within the field of study. Comparing the invoices of Swiss utilities with foreign countries and approaches in the literature, a substantial potential for improvement becomes evident, mainly in the frequency of the feedback and the aggregation. The findings of the Swiss expert interviews show furthermore a potential in improving the informative content and in providing segment-oriented or personalised feedback in invoices. Moreover, information provided in stages could meet better the different needs of consumers. The first stage should contain only the most important information in very concise form for those who are not particularly interested in energy issues. In addition, in the first stage a short reference should be made to the next stages providing more detailed information for those who want to know more. Thereby, the stages can be the different pages of the paper bill as well as different elements of the app or web portal. By applying enhanced invoices, it is important to consider the fact that the dissemination of e-invoicing will continue. Thus, the risk of unread invoices and consequently not perceived energy feedbacks increases. The reason is that in the case of e-invoicing interested customers have to open a PDF attachment for any information going beyond the mere payment details and are consequently forced to execute an "additional click".

Online customer service platforms are a viable form of DSI because feedback about the energy consumption can be provided combined with customer services, DSM measures and gamification elements (e.g. efficiency competitions) on a single point of contact. Thereby, it has to be ensured that there is no entrance barrier for the consumer to get the information. Mobile apps provide the possibility to lower this entrance barrier by push-notifications. For providing disaggregated and more specific feedback it is unavoidable to invest in additional hardware for collecting the required data. These data require increased diffusion of new metering technologies such as smart meters.



Against this background, three possible approaches for development of IMPROVE solutions can be deduced. Since classical paper bill is presumably going to continue to play a role in the near future, the first IMPROVE solutions could focus on combining the best Swiss and international practices of designing an energy bill. Two additional approaches could then address two major developments with high influencing potential for DSI: 1) increased roll-out of smart meters allowing for more real-time data and more customization; 2) market liberalization leading to more pressure for utilities to satisfy different needs of different consumer segments having presumably as a consequence increased segmentation in communication and marketing strategies including DSI. These could be particularly interesting for the utilities seeing themselves as pioneers in altered political and market conditions associated with the Energy Strategy 2050 in Switzerland.

9.3.1 Three possible approaches for development of IMPROVE solutions

9.3.1.1 Optimised Invoice with historical overview of the consumption

The optimised invoice is charged monthly with consumption data, so that the consumer is informed frequently about his consumption. In addition, each consumer receives a reduction goal (e.g. 2% less energy consumption compared to the previous-year value). The content of the invoice is divided in two levels of informative content. The first level contains consumption, costs, payment period and payment information as for example the pay-in slip (see Figure 78 element 1&2, in German).

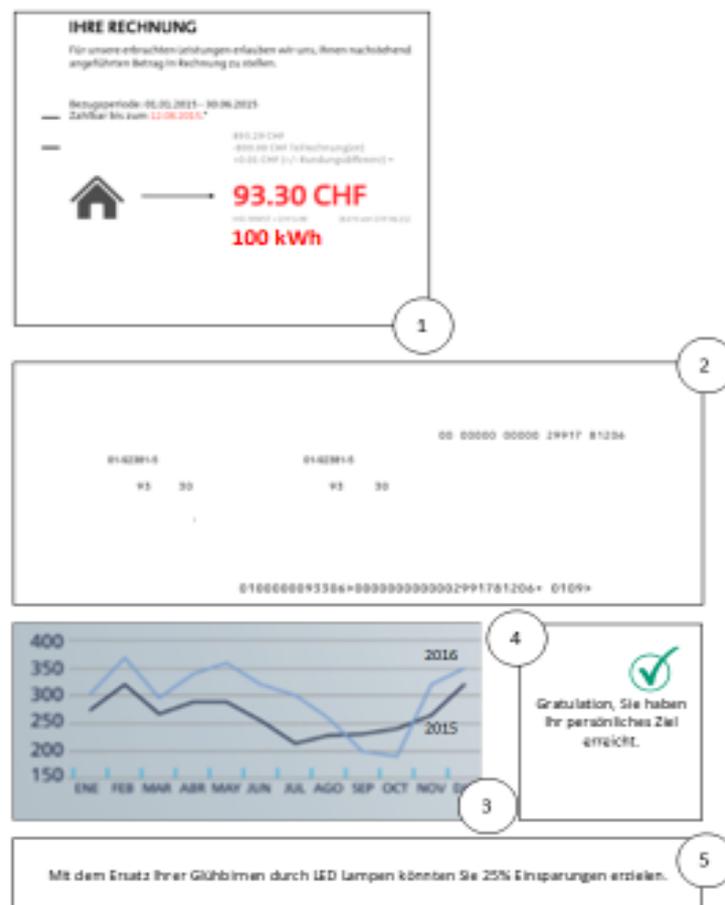


Figure 78: First level information of an optimised invoice, own illustration based on documents (Repower, 2017 and Endesa, 2017).



Additional information on the first level is the history of the consumption in a time diagram, which shows the continuous graph (updated monthly) of the actual consumption compared to the same graph of the last year (see Figure 78, element 3). With this diagram, current month consumptions can be compared simultaneously to the previous month consumptions as well to the consumption level of the corresponding month in the previous year. A further element of the first level information is a normative message in form of a tick mark, a smiley or a traffic light (see Figure 78, element 4, in German). Herewith, the achievement of the target is rewarded. The last first level information is a personalised energy saving advice (see Figure 78, element 5, in German).

On the second level, detailed information concerning the consumption (e.g. cost-sharing, tariff-sharing, meter readings) are listed. Not well-known terms are explained or there exists a link to the explanation on the web. Then, the reduction goal is explained in detail and smart meter information such as energy peaks are showed if they are available.

In the case of e-invoicing, the “optimised invoice” is sent by e-mail additionally to the publication on the e-banking account. This approach reduces the risk of unread invoices.

The approach “optimised invoice” is an indirect feedback model (see introduction chapter to the main body of the final report) which is mainly based on nowadays available information. Only the monthly consumption data has to be collected additionally, if it is not already available for the utility. Therefore, it is possible to implement this two-level-information-based optimised invoice with low effort. This DSI model is suitable for an immediate and cost-effective improvement of the existing invoicing model, which is regulated by law.

9.3.1.2 Online Customer Platform

The second enhanced solution is based on an interactive web platform. Each customer possesses his personal account on the utility’s platform. The invoices are available on the platform monthly. For this, the consumer receives an e-mail including a link to the invoice on the platform. That way, every consumer has to enter the platform for paying the invoice. The invoice itself is reduced to the minimum of information which is legally prescribed. All additional information is provided on the platform. The consumption is illustrated in an interactive time diagram (Figure 79).

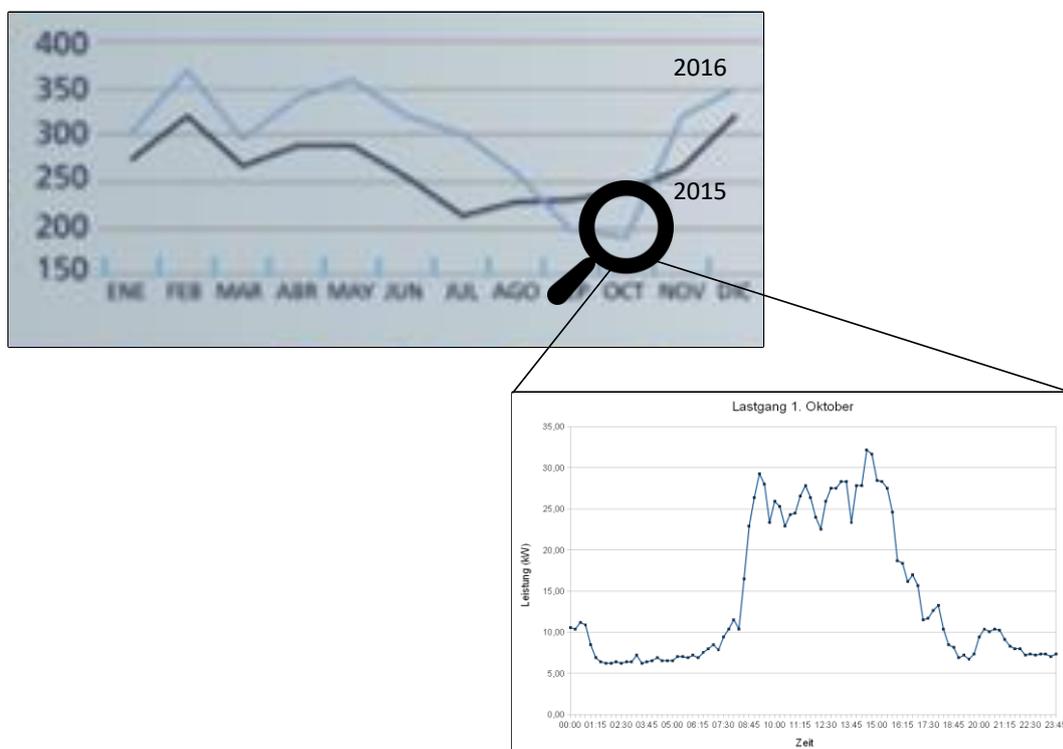


Figure 79: Interactive energy consumption diagram, own illustration based on documents (Endesa, 2017 and Umweltschulen, 2017).



The diagram shows the continuous graph of the actual consumption compared to the graph of the past year. It can be zoomed in and out to gather more fine-grained information about the consumption and conduct more specific historical comparisons. Individual power peaks can be recognised for example by zooming in on a one-day zoom-level. Personalised energy conservation advices are provided and personalised reduction goals can be optionally set by consumers. Explanations concerning the invoicing or the used terms, as well as the tutorials regarding energy efficiency are available on the platform in different forms of presentation (e.g. video, interactive illustrations, questionnaires). Herewith, the informative content can be increased and learning effects can be obtained. Additionally, customer services as used in today's online customer service platforms can be implemented. By combining the platform with a mobile app, push notifications can be provided additionally.

The "Online customer platform" is based on existing web technologies and smart meters. Therefore, investment in smart meters and in development of the platform is necessary. Internet access and e-mail are further mandatory requirements for this DSI model. As 90% of the Swiss population uses the internet (BFS, 2016), this is not a considerable weakness. With that, feedback can be provided individually, in a timely manner and in an interactive form. The platform can be combined with customer services and form the single point of contact for the consumers. It is a future-oriented and expandable approach, which could replace the commonly used paper invoice as the main source of information.

9.3.1.3 Segment-Oriented Customer Information

Another approach which can be used to enhance DSI is segment-orientated customer information, which is likely going to become increasingly important with the market liberalisation and the corresponding increased competition for customers. With segment-oriented information, the risk of information overload can be reduced and the feedback content can be specified to the needs of the consumers.

In (Klößner, 2015), four basic segmentation approaches are identified: demographic, geographic, behavioural and psychometrical. While the main advantage of demographic and geographic approach is the high accessibility of data, they serve normally only as proxies for the actual segmentation criterion, so that segmentation accuracy is sometimes challenged. On the other hand, behavioural and psychometrical approaches are proximate to or match exactly the segmentation criterion. However, they are associated with costly data collection efforts, since they require very detailed personal data. Examples for psychometrical segmentation approach include value-based segmentation, personality-based segmentation, lifestyle-based segmentation or stage-of-behaviour-change-based segmentation according to Bamberg's stage model of behaviour change (Bamberg, 2013).

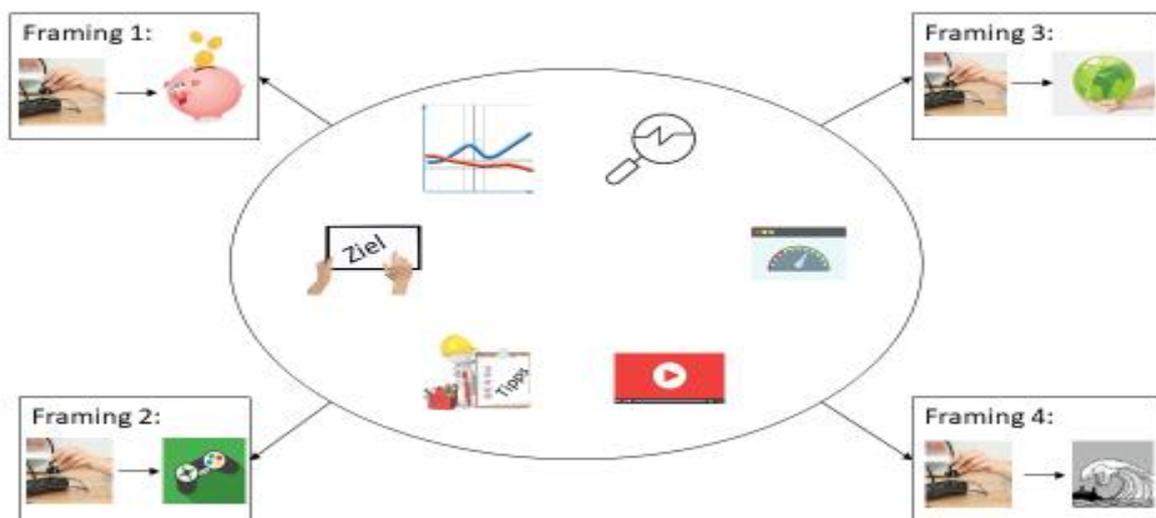


Figure 80: Value-based segmentation approach inspired by the Theory of Basic Human Values ([20]) and its applications in environmental psychology (e.g. [21], [22], [23])



In Figure 80, a value-based psychometric segmentation approach based on the Theory of Basic Human Values (Schwartz, 1992) is illustrated. It shows four basic human values commonly considered as the most relevant for energy-related behaviour as well as their respective implications for the DSI framing. Thereby, Framing 1 corresponds to egoistic values, Framing 2 to hedonic, Framing 3 to biospheric and finally Framing 4 to altruistic ones. Two DSI features, where value-based framing can be well applied are DSI content and design. For example, DSI for the “egoistic segment” could be framed like it currently is in the common energy bill in Switzerland, where consumers are informed regarding the costs of their energy consumption and the consumed energy quantity. “Biospheric segment” could be informed additionally about the CO₂ emissions or nuclear waste provided by the own energy consumption. DSI for the “altruistic segment” could remind the customer that every CHF saved on energy consumption could otherwise be donated to a charity organization in addition to standard information about energy costs and quantity. Finally, DSI for the “hedonic segment” could be addressed through an appealing design focusing on fun and pleasure no matter what information is included.

The purpose of the above example is just to illustrate how a specific segmentation approach can be applied to DSI and not to suggest any specific segmentation concept to the utilities. As already mentioned above, there is always a certain trade-off between segmentation accuracy and costs. Hence, which approach is chosen by a certain utility will depend on its specific goals as well as available data and resources. Moreover, which segmentation approach is chosen also depends on the characteristics of the customer base, which additionally leads to differential approaches chosen by different utilities.

9.3.2 Development of the first visual drafts

The three approaches for the development of the IMPROVE solutions described in the previous section served as a basis for drafting specific designs jointly with the project partners from HES-SO, SUPSI and FHNW. In an iterative process which started in a workshop with all project partners and continued via e-mail exchange, the decision was made to substantially narrow the focus on:

- (1) easy-to-implement, low-cost solutions (implementable as of tomorrow);
- (2) solutions, which do not involve any loss of information if provided in form of conventional, black-and-white paper bill;
- (3) helping customers to rank their consumption (rather high, rather low, rather “normal”) without necessarily specifying what is the baseline (an issue to deal with in consecutive working packages and possibly in a follow-up project);

Pursuing this narrower focus resulted in 6 visualisations presented in Figure 81 to Figure 86 to be included in the consumer survey conducted in chapter 10 in order to get customers feedback on them.

Solution 1 presents the typical paper bill commonly deployed by most Swiss utilities having as the main goal complying with national legislation. The idea behind it is to find out the level of customer satisfaction with the current solution and to give the customers a reference point for evaluating other, more advanced solutions.



Energy	Quantity	Unit price CHF	Amount CHF (No VAT)	% VAT
<i>Billing period</i>				
Rainbow electricity	2'500	0.10260	256.50	8.0
Mean national energy consumption	2'320			
Subtotal energy (excl. VAT)			256.50	

Distribution	Quantity	Unit price CHF	Amount CHF (No VAT)	% VAT
<i>Billing period</i>				
Rainbow electricity	2'500	0.07350	183.75	8.0
Rainbow abonnement		5.50000	66.00	8.0
Subtotal distribution (excl. VAT)			249.75	

Swissgrid	Quantity	Unit price CHF	Amount CHF (No VAT)	% VAT
<i>Billing period</i>				
Rainbow electricity	2'500	0.01400	35.00	8.0
Subtotal Swissgrid (excl. VAT)			35.00	

Taxes & fees	Quantity	Unit price CHF	Amount CHF (No VAT)	% VAT
<i>Billing period</i>				
Federal tax	2'500	0.00600	15.00	8.0
Cantonal tax	2'500	0.00180	4.50	0.0
Cantonal fees	2'500	0.00020	0.50	8.0
Communal fees	2'500	0.00700	17.50	8.0
Subtotal taxes (excl. VAT)			37.50	
Total (excl. VAT)			578.75	

Figure 81: Solution 1

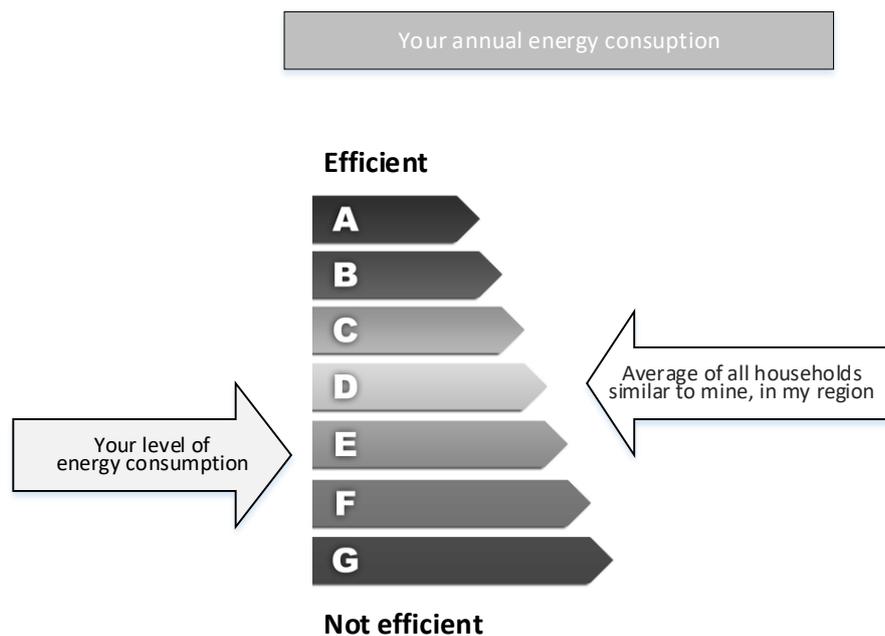


Figure 82: Solution 2



Solution 2 depicts the customer's consumption level on the energy efficiency level and compares it with the consumption level of average similar household without explicitly specifying how the "similar household" is defined. The focus here is to get a very simple and fast overview of the own consumption including a normative message without going much into the detail.

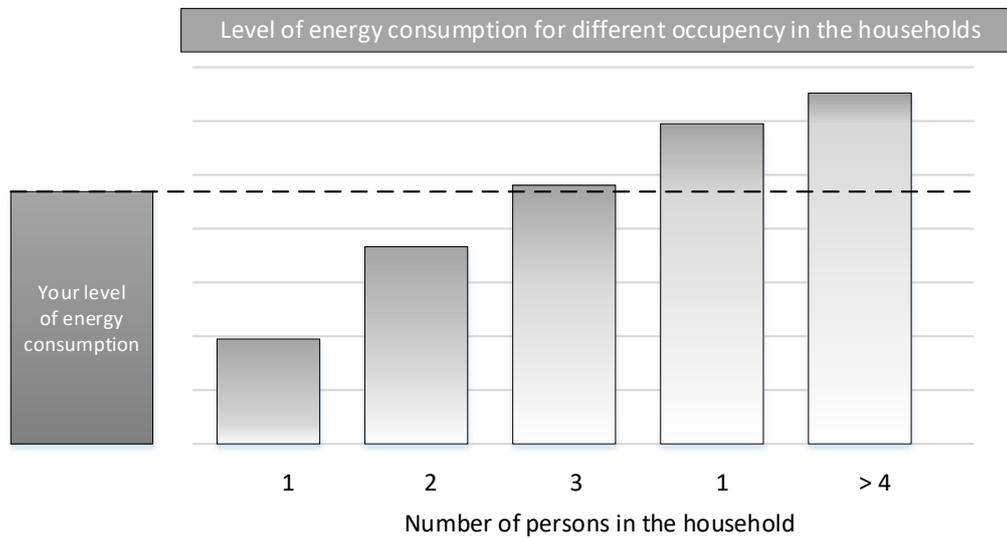


Figure 83: Solution 3

Solution 3 offers a visual comparison of the own energy consumption with the average consumption of household with different household sizes, as the number of occupants is a private information that utilities are not able to have (privacy laws). This solution thus specifies what is meant by "similar households": household with the same household size. It contains more information for the customer and simultaneously requires less data on customers from the utility, since the utility doesn't need to know how large the household is.

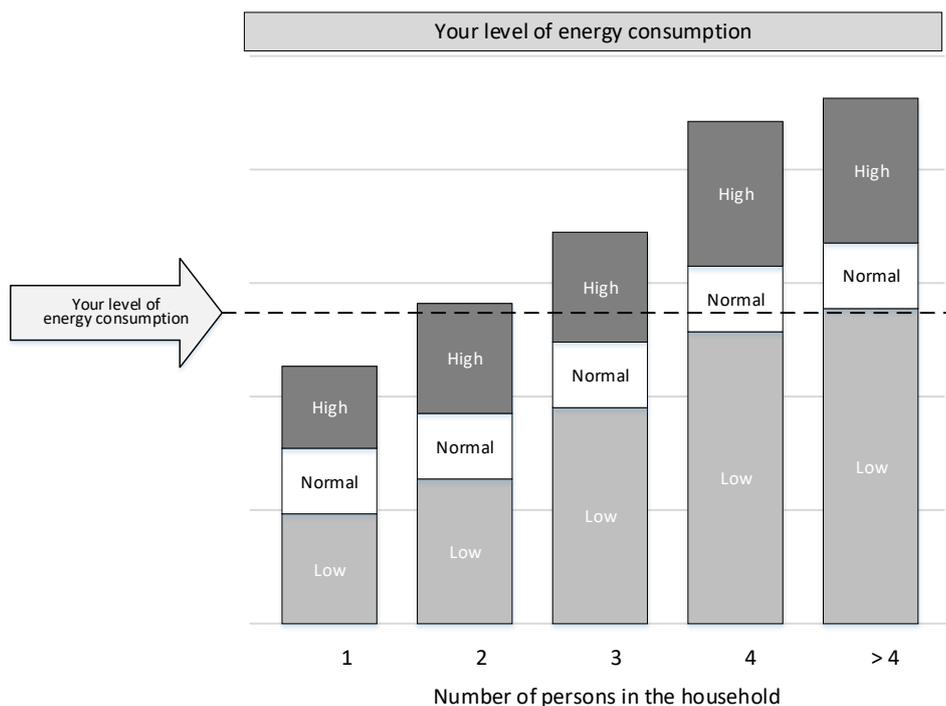


Figure 84: Solution 4



Solution 4 builds on the previous two solutions and provides even more information. In addition to solution 3 it includes not only information on consumption of an average household for a given household size, but depicts also the consumption level of an average “low consumption household” and an average “high consumption household” defined in relative terms based on the utility’s customer base.

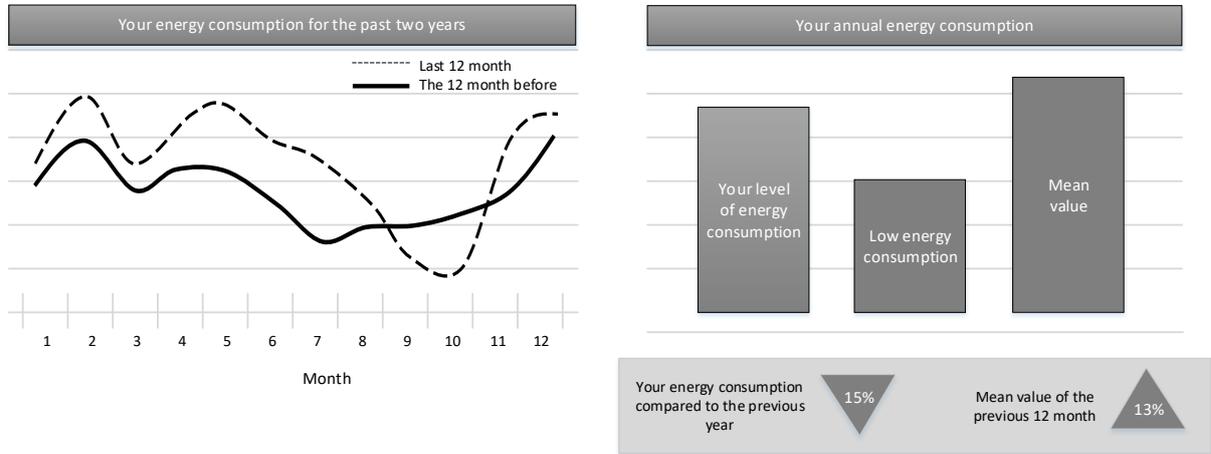


Figure 85: Solution 5

Even more information is included in solution 5. In addition to providing similar type of comparison as in the previous solutions (however more simple – without taking account of different household sizes – and introducing the new reference category – “efficient households” – to be defined by the utility) it provides historical overview of the consumption. This is done in two ways: (1) a really short indication of how the own consumption and the average overall consumption has changed compared to the previous billing period and (2) consumption evolution for two consecutive years allowing to compare the consumption of each month with the one of the same month previous year (for those who are interested in more detailed information). The idea behind this solution is to evaluate the interest of the customers in more complex, combined DSI measures.

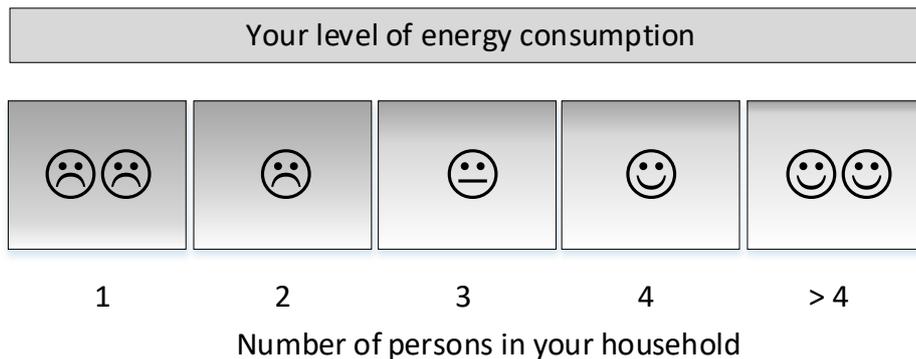


Figure 86: Solution 6

Finally, solution 6 provides pretty much the same type of comparison as solution 3, however with different design (smilies) and with less accuracy (without any quantitative information on the distance to the lower/upper evaluation point). Here too, the idea is to provide very simple and intuitive feedback about how the customer is doing regarding to his energy consumption without going much into detail in explaining what is exactly the baseline/reference.



9.4 Chapter's conclusions

Behaviour change models from the field of behavioural economics and social-psychology illustrate how behaviour change in energy consumption can be achieved through behavioural interventions. One of the intervention strategies is energy feedback, whose effectiveness depends mainly on its frequency, informative content, specificity, comparison, interactivity and customization. The analysis of utilities in the Northeast of Switzerland shows that the potential for improved DSI models is existent mainly in relation to feedback frequency, level of specificity, market structure and roll-out of smart meters.

Based on the list of criteria defined within the study, three possible approaches for the development of enhanced DSI models were drafted. The three approaches are not meant as substitutes: on the contrary, they could be perfectly combined. The optimised invoice is an effective approach to enhance today's energy invoices by more frequent invoicing and by providing stage-based information as well as specific feedback. Interactive feedback and different modes of presentation are used on the online customer platform. With the possibility of bidirectional communication, the platform builds a single point of contact for the household consumers to the utility. Another possibility to improve the effectiveness of a DSI model is to provide segment-oriented information. Within this approach, framed information and feedback is provided, dependent on the consumers' characteristics.

The above approaches together with the feedback from project partners served as viable guidelines for developing specific visualisations of DSI models for the IMPROVE project. In the next project steps, these visualisations will be verified by Swiss household consumers within a survey and then further discussed with partner utilities. The last step includes formulating recommendations for the potential implementation of the most promising approaches within a larger pilot study to be considered as a potential follow-up project.



10 Consumer satisfaction survey

Improving consumption information to energy users could potentially lead to a decrease in household energy consumption and ultimately in overall energy savings (Dromacque C. *et al.*, 2013; Fischer, 2008). Surveys on energy users' knowledge and understanding of present energy information offer some insights on *what energy information users currently have and what could be improved*. The evidence is that energy users have incomplete information for making energy choices (Burger, 2017; Castri *et al.*, 2017; National Research Council (US), 1984)

Saving energy and energy efficiency measures have been of interest to researchers since the 1970s oil price crisis, when energy conservation programs were conducted to encourage consumers to reduce their energy consumption (Martiskainen, 2007). Numerous experimental studies have shown that improved delivery of information could certainly speed the rate of adoption of sustainable consumption behaviours. For example, feedback and more informative billing studies have shown an average of 5 -10% energy savings at least in the short-term, some of which without any investment in technology (Martiskainen, 2007; National Research Council (US), 1984).

However, it is recognised that energy use in the home is, most of the time, invisible to consumers and that energy consuming behaviours are based on routine and habit (Fischer, 2008; Torriti, 2016). Research conducted in the 1990s found that, in general, people fail to link their everyday actions to their energy consumption pattern and this trend is still true today. For a review of the literature please refer to (Martiskainen, 2007). Today, to make energy use visible, improvement of the energy consumption feedback to the user must be considered.

Despite being complex and difficult to change, behaviours can still be influenced with the aim of reducing energy consumption. Several studies that look at the impact of various intervention measures including improved feedback through better and more informative bills, suggest that this latter has great potential to influence household energy consumption behaviours. A comprehensive review of feedback measures and their impacts is given in (Martiskainen, 2007).

However, existing research fails also to provide a clear evidence on which measure or combination of measures is most effective in changing energy consuming behaviours and provide largest and long-term energy savings. Today the key question is *how to make energy use visible to the householder so they can consume less*. The evidence from various studies is that making energy information available to people is not enough (National Research Council (US), 1984).

According to (Fischer, 2008), better information on billing, through increased feedback frequency, historical consumption data and the provision of appropriate benchmarks is thought to make a difference if it is presented in an understandable and appealing format, if it is available through several media and if it comes from a trusted source. In this review, a highly motivating design bill, as a carrier of feedback information, could result in considerable savings with little implementation effort. In addition, the bill could be designed to be a long-term tool in reinforcing energy-conscious habits over time and consequently changing users' energy wasting behaviour to more positive behaviour (Fischer, 2008). This points out the potential of improved billing information in providing more meaningful energy feedback to the consumer.

It is the purpose of this chapter to conduct a national survey to gauge energy users' opinion on the type of information currently available in their energy bill and their interest to improve knowledge, attitudes and behaviours towards energy consumption. The focus is both on electricity and on heating consumption information as evidence suggests that little effort has been made to improve household heating information due to difficulties in getting appropriate feedback. In addition, the survey gathers views on medium and mode of presentation preferences of consumers as research indicated that most experimental studies do not seem to reflect these aspects (Fischer, 2008).

This document presents the data analysis of the responses obtained in this survey that was undertaken from October 2017 until the end of January 2018. From this survey, information was gathered on:

- what and how energy consumption information is available to Swiss energy customers
- consumer satisfaction regarding the current information received from the utilities about their energy consumption
- consumer level of understanding of current energy consumption information
- consumer level of interest in more effective presentation mode solutions on energy consumption



10.1 Methodology

10.1.1 The survey contents

The survey contains a maximum of 71 questions, which focus on:

- information available on household electricity consumption
- information available on household heating consumption
- customers' preferences regarding six different energy consumption displays for the energy bill
- social and demographic information of respondents

The recorded social and demographic data includes gender, age profile, employment status, education level, type of dwelling, annual household income, household type, canton and postcode.

A total of 1937 energy consumers completed this survey.

10.1.2 Data collection procedure

To reach as much Swiss energy consumers as possible and avoid any misunderstandings due to language barriers, the questionnaire was available in the three official Swiss languages: German, French and Italian, see Appendix 12 for the French version, as an example.

The questionnaire was implemented in SurveyMonkey (SurveyMonkey Inc., 2018), a low cost online survey service offering easy question implementation, the ability to collect data in a consistent and quick manner and with mobile-friendly capabilities. To maximise response rate and reliability of answers, the online questionnaire was designed with three type of questions: multiple-choice, close questions and open questions.

Communication and promotion of the survey was made via emails, advertised in newsletters and embedded in the energy bills, in partnership with the utility partners through their extensive customer network. The survey was also available in the websites of some utility partners, inviting in this way website visitors to complete the survey. The survey was equally announced in the social media and networks for further visibility. To improve response rate, participants were given the opportunity to win CHF150.- in a random draw.

10.1.3 The sample description

The sample is not representative of the Swiss population because it was not randomly selected nor divided into homogenous groups. In this study, the respondents do not represent the real proportion of each Swiss region, see Figure 87.

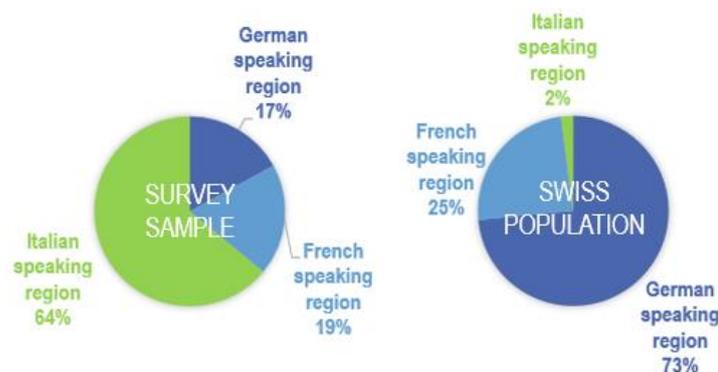


Figure 87 Survey sample versus Swiss population

This is one of the major drawbacks of online surveys as no master list of email addresses or contacts is available for the entire Swiss energy consumer population, not to mention those with no access to the internet. This type of survey is based on participant self-report and no control is possible over the sample selection. It is also acknowledged that the sample here corresponds to consumers who decide voluntarily to take part in the survey. These are likely to be more interested or enthusiastic about this topic, therefore more willing to complete the survey. For all these reasons, the results of this analysis are biased.



Nevertheless, in reality completely unbiased, independent samples are hard to find and results can still reveal interesting trends on the type of information currently available in the energy bill of Swiss consumers and their interest to improve knowledge, attitudes and behaviours towards energy consumption.

10.1.4 The data cleaning process

Statistical analysis requires a so-called data processing step to obtain quality data that can provide relevant results and consequently generate sound evidence. In this study, the three datasets, one for each Swiss region, were integrated and translated into one English dataset to finally undergo a manual cleansing process that dealt with missing values and noisy elements. In addition, the data was fitted into specific tabular formats for subsequent analysis. This pre-processing task corresponds to more than 70% of the overall analysis work.

10.1.5 Data analysis

In this study, data exploration uses mostly a combination of summary data (percentages) and visualisation graphs (bar chart). The analysis was performed with R, a language and tool dedicated for statistical analysis (The R Project for Statistical Computing).

The data analysis was performed using plain descriptive analysis and a multiple correspondence analysis (MCA). This latter allows investigating patterns of relationships of several dependent variables.

10.1.5.1 The descriptive statistics method

Descriptive statistics is a method that helps to quantitatively describe and summarise data in a simple and meaningful way. It allows a simpler interpretation of the data by looking at its distribution and spread parameters. The outcome of this analysis is presented in a combination of percentages and bar charts.

10.1.5.2 The Multiple Correspondence analysis method

The Multiple Correspondence Analysis (MCA) is a statistical approach to describe qualitative data. It is used to identify underlying structures in the dataset.

MCA is a generalisation of Principal Component Analysis when the variables to be analysed are categorical (classes) instead of quantitative. In MCA, the categorical variables assessed are represented as a point in a low-dimensional orthogonal space (generally 2 dimensions) with a maximum of inertia i.e. the largest variability in the data is captured in the first dimension, the next largest variability in the second dimension.

MCA allows assessing the links and intensity between several categorical dependent variables. It allows to visualise the relationships among categorical elements (classes) of variables. Based on this, it is thus possible to identify clusters of respondents as well as categorical elements (classes) that “drive” to an answer (for example, the class “Bachelor Degree and higher” of the variable “Education level” could lead to a more positive or negative appreciation of one of the IMPROVE solutions). More details on the MCA method can be read in (Baccini, 2010).

Within this chapter, MCA will be applied for all the solutions regarding the two questions “level of understanding” and “level of interest”. Then, based on these results, clusters of respondents will be proposed in order to identify if, for some visual solutions, part of the respondent with specific socio-demographic classes would have a more positive or negative perception of the solutions. However, prior to apply MCA to our survey answers, some of the classes with too few answers were merged to make the assessment more clear. Thus, by merging the classes, the following socio-demographic categories were retained for the MCA assessment:

- Gender: **2 classes** (male, female)
- Age profile: **3 classes** (18-35 years old, 36-55 years old, 56 years or older)
- Employment status: **2 classes** ("Employed", "Not Employed")
- Education level: **3 classes** ("Technical training", "Bachelor degree and higher", "Primary school or High school graduate")
- Dwelling type: **2 classes** (MFH, SFH)
- Household type: **3 classes** ("1 person", "2 persons", "Above 2 persons")
- Household annual income: **3 classes** ("less than 80'000 CHF", "btw. 80'000 et 99'999 CHF", "over 100'000 CHF")



The number of observations per classes is more homogenous, however, for some of them, there is still a small sample size. However, it is not possible to merge more classes without losing too much information. In addition to these modifications related to socio-demographic attributes, the answers related to the attractiveness of each IMPROVE solution have been organised as followed:

- Level of understanding of the visual solutions: 3 classes (“Good”, “Neutral”, “Not Good”)
- Interest for the visual solutions: 4 classes (“Interest”, “Neutral”, “No Interest”, “No Opinion”)

These simplifications were made for better understanding of the socio-demographic classes influences on the IMPROVE proposals. Ideally, it would be necessary to get higher answer rates per classes (or at least more homogenous rates) in order to get a better representativeness of the MCA for the sample of respondents. However, the proposed method should give a global vision of the influence of the socio-demographic classes on the perception (understanding and interest) of the six IMPROVE solutions.

From the MCA, two types of results are displayed:

- MCA graphics representing data as points in a low-dimensional Euclidean space with a maximum of inertia. In this representation, the categorical variables are displayed according to the principle axis (2 dimensions here) enabling to identify the association between the categories.
- Table results of the questions related to the IMPROVE solutions for clusters defined via the MCA. The clusters represent sub-samples with relatively homogeneous compartments.

10.2 Results and discussion

The purpose of this section is to explore the data to discover useful information in order to meet the goal of providing conclusions and supporting decision-makers to improve the consumption information available on the energy bill. Hereafter, the results of the survey are presented, starting with the demographic profile of respondents and followed by the responses to the three other sections of the survey. Results are given in terms of the whole sample. Overall, no significant differences were observed between the three Swiss regions.

10.2.1 Social demographic profile

Figure 88 presents the social demographic profile of the survey’s participants

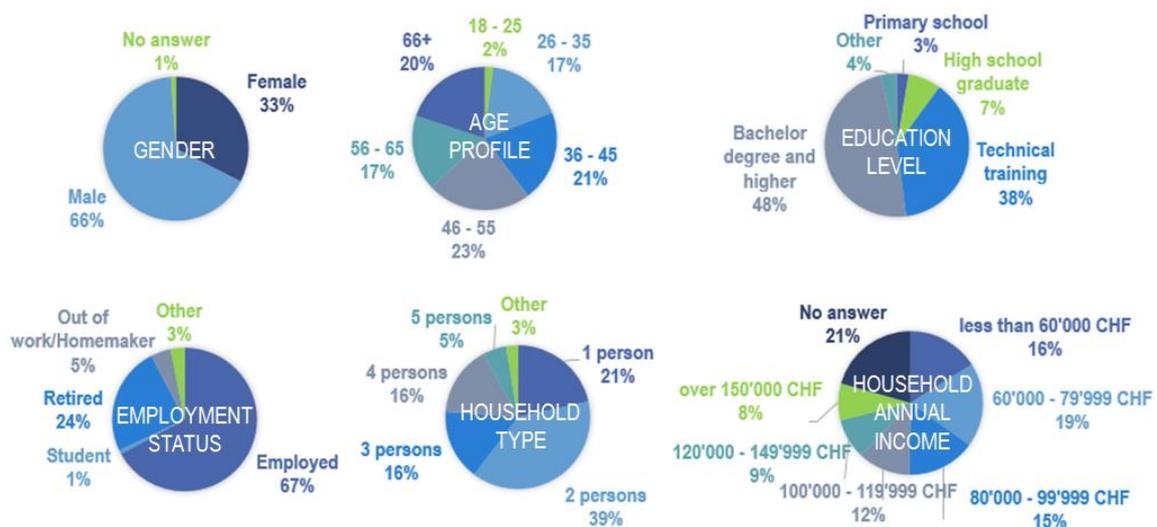


Figure 88 Demographic breakdown

Typical respondents of the survey are male (66%), older than 25 years (98%), employed or retired (91%). Nearly half of the respondents (48%) report to have a high level of education (bachelor degree and higher) in accordance with the actual Swiss situation which points for an even balance (45%) between secondary and tertiary education (Office Fédéral de la Statistique, 2017). The majority of respondents live in multi-family houses (52%) with mostly 1 to 2 persons per household (60%) with an annual income lower than 100'000 CHF (50%).



10.2.2 The electricity bill – general information

The objective here is to get information on the main informative contents of current Swiss electricity bills. This includes the following aspects of the bill: format, frequency, time spending reading and overall understanding.

Figure 89 indicates that almost three quarter (77%) of respondents receive a paper bill by mail and half of the respondents, 52%, receive the electricity bill three times a year.

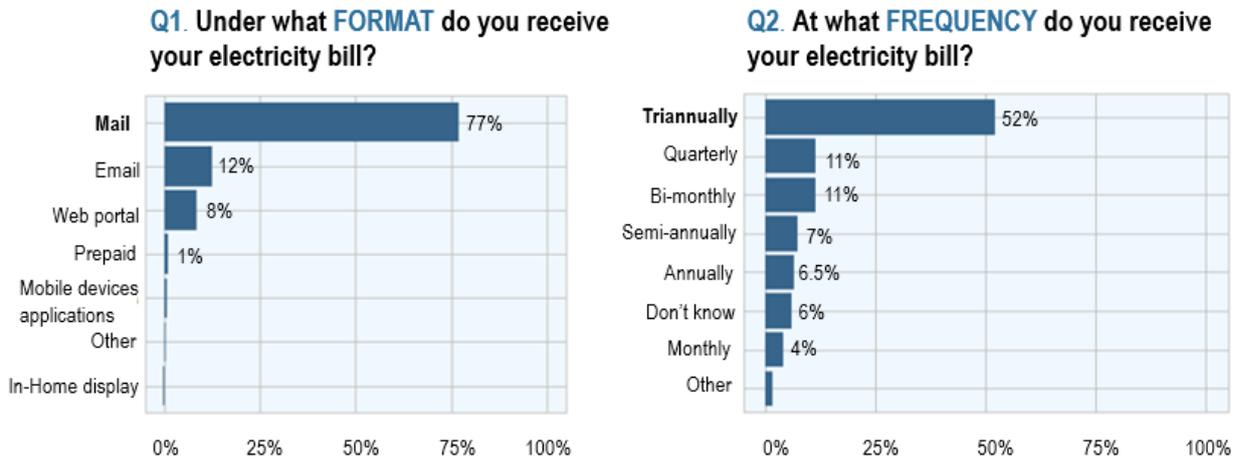


Figure 89 Electricity billing format and frequency

Figure 90 shows that 55% of respondents spend less than five minutes reading the bill while 32% indicate to spend between 5 to 10 minutes. As for the comprehension of the bill, 40% of respondents refer to have a good level of understanding. That is to say, they manage to find their way around even if they do not understand everything.

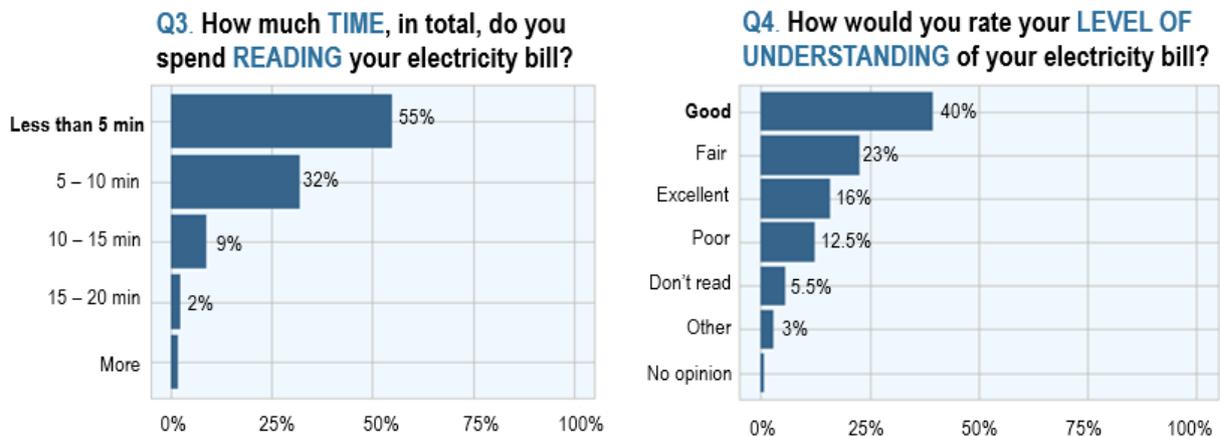


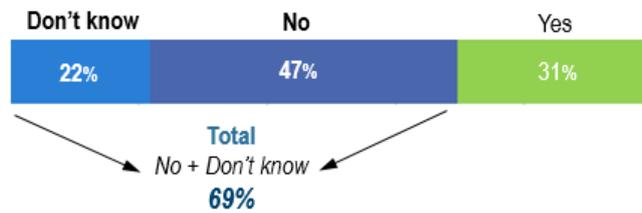
Figure 90 Electricity billing: time spending reading and level of understanding

10.2.3 The electricity bill – consumption level information

The objective here is to get information on the kind of consumption level information currently available in the Swiss electricity bills. Figure 91 shows that about one third of respondents receive some kind of information to enable the evaluation of their electricity consumption. Among the 69% remaining respondents, which do not receive any information or do not know if they receive, 90% indicate to be interested in getting this kind of information.



Q6. Do you receive QUALITATIVE AND/OR QUANTITATIVE INFORMATION from your electricity supplier enabling you to position your electricity consumption level (low, medium, high)?



Q7. Would you be INTERESTED in such information?



Figure 91 Qualitative or quantitative information on electricity consumption level

Figure 92 shows the type of information that might interest consumers. More than 80% of the respondents would be interested or very interested to get a comparison of their energy consumption with an average household. However, no further details could be obtained regarding the type of desired information, as the level of interest between the three proposed options are nearly identical.

Q8. What KIND OF INFORMATION would you be interested in?

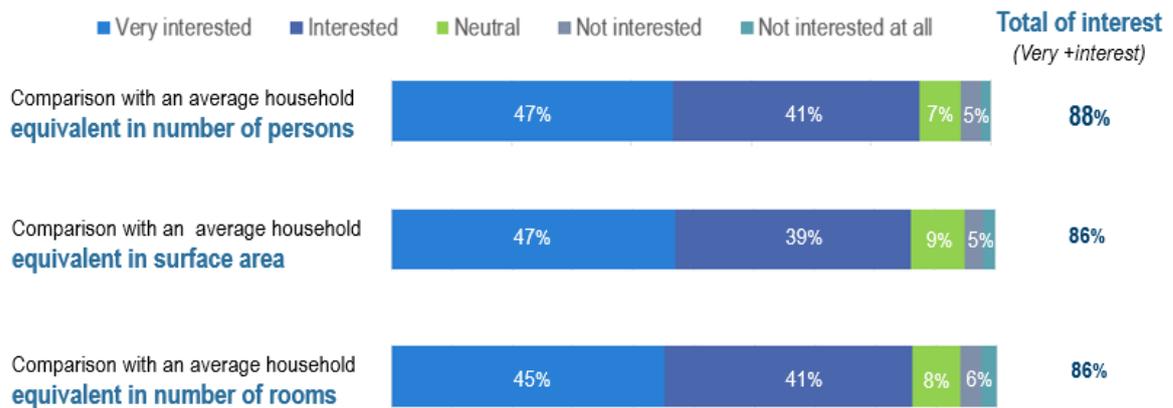


Figure 92 Information of interest expected in the electricity bill

In any case, as shown in Figure 93, nearly 60% of respondents prefer an energy consumption comparisons at local level, typically against the neighbourhood average with a marked decline of interest for comparisons at larger scales: cantonal and national.

Q9. How would you like TO RECEIVE this information? MOST INTERESTING OPTION

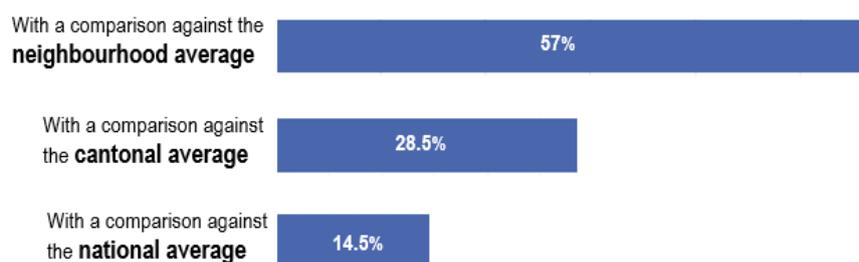


Figure 93 Comparison preferences for the electricity bill



For respondents interested to get more information, nearly 90% would be encouraged to implement energy saving actions if aware that they are above the average, see Figure 94.

Q10. If this information shows that you are consuming more energy than the average, would it ENCOURAGE you to IMPLEMENT ENERGY-SAVING ACTIONS?



Figure 94 Encouragement to implement energy-saving actions through improve electricity bill contents

For respondents currently receiving additional information on their energy bill, the specific type of information is very heterogeneous, with the category *Other* standing out first, 28.5%, as shown in Figure 95. Comparison with an equivalent household are next with 21% while 20% of respondents indicate not understanding the information received.

Q12. What TYPE OF INFORMATION do you receive?

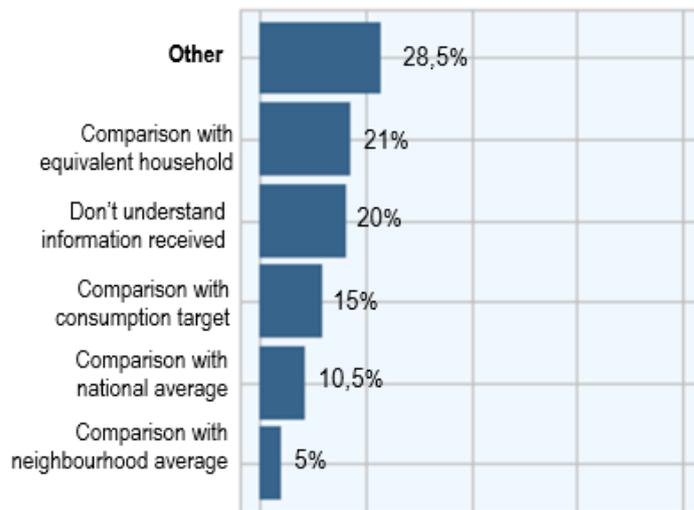


Figure 95 Type of consumption level information received on the electricity bill

The information received is reported to encourage 66% of respondents to reduce consumption, as shown in Figure 96. Among the remaining participants, 26% indicate that the main reasons for not reducing their energy consumption is that their consumption is already below average and for 25% they have no information on how to do better.

Q13. Did the INFORMATION provided INCITE you to reduce consumption?



Q15. Why?



Figure 96 Incitation to reduce electricity consumption

Clearly, respondents wait for guidance from electricity providers to help them to reduce their consumption.



10.2.4 The heating bill

In this section, the heating bill will be studied. The analysis was divided into tenants and homeowners, as the availability of information to these two categories is rather different. Approximately 42% of tenants and 57% of owners are recorded in the survey.

10.2.4.1 Heating bill of tenants

The objective here is to get information on the main informative contents and level of understanding of current tenants' heating bills. The questions formulated resemble those formulated in the electricity bill section. Figure 97 shows that two thirds of tenants have the heating bill included in the rent.

Q17. How do you pay your HEATING COSTS?

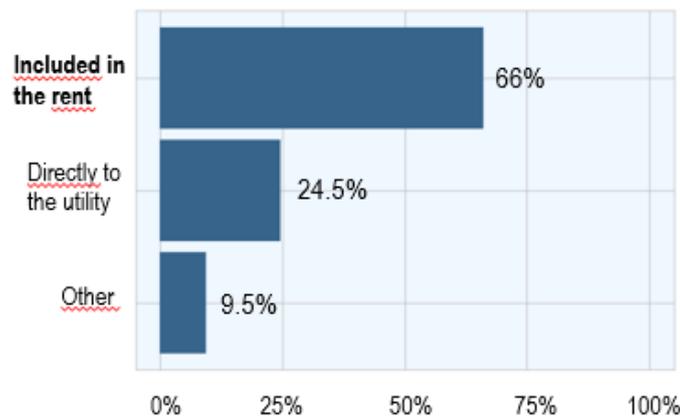
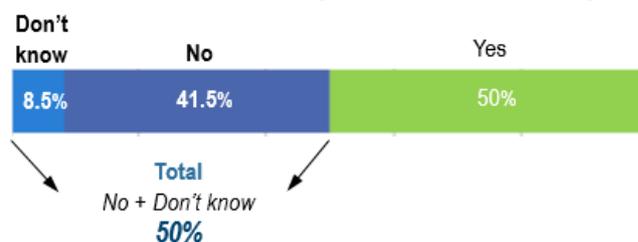


Figure 97 Tenants heating bill

Half of these indicate to receive some kind of information regarding heating consumption, see Figure 98. Over 80% of the remaining, half are interested in getting this kind of data.

Q18. Do you receive INFORMATION from your homeowner about your heating consumption?



Q19. Would you be INTERESTED in such information?

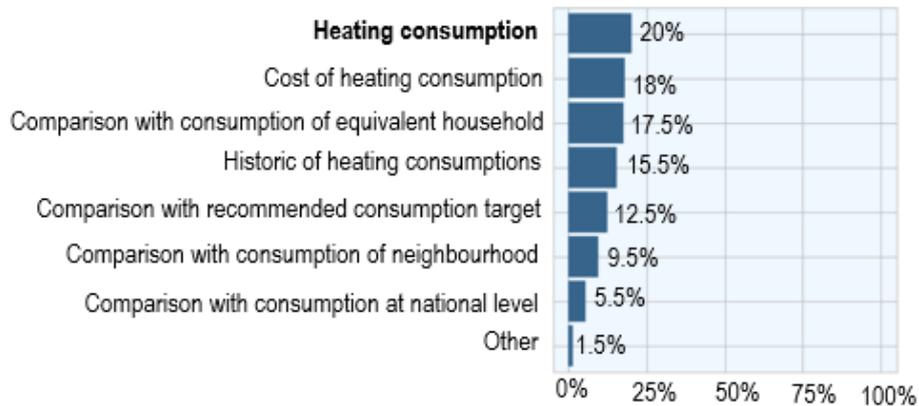


Figure 98 Tenant information on heating consumption level

The type of information for which respondents seem to have an interest is very heterogeneous as shown in Figure 99. It starts from simple heating consumption information, through cost of consumption to comparisons of different kinds. As for the electricity bill, nearly 90% report that they would be more encouraged to implement energy-saving actions if better informed.



Q20. What KIND OF INFORMATION would you be interested in?



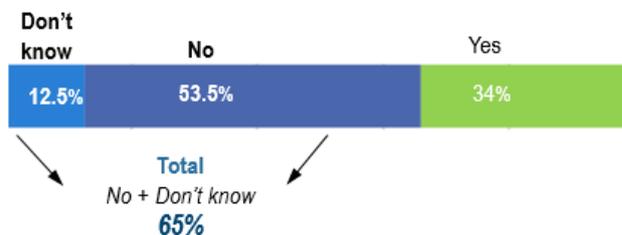
Q21. If this information shows that you are consuming more energy than the average, would it ENCOURAGE you to IMPLEMENT ENERGY-SAVING ACTIONS?



Figure 99 Information of interest expected by tenants in the heating bill

In terms of heating consumption level, it is clear from Figure 100 that nearly two thirds of tenants do not get enough information to allow an evaluation of their level of consumption. From these two thirds, about 90% indicate an interest to get this information.

Q23. Does the INFORMATION PROVIDED allow you to know your heating consumption level?



Q24. Would you be INTERESTED in such information?



Figure 100 Information on heating consumption level

As far as getting some kind of comparison with an average household, Figure 101 shows that more than 80% of tenants are clearly interested.



Q25. What KIND OF INFORMATION would you be interested in?

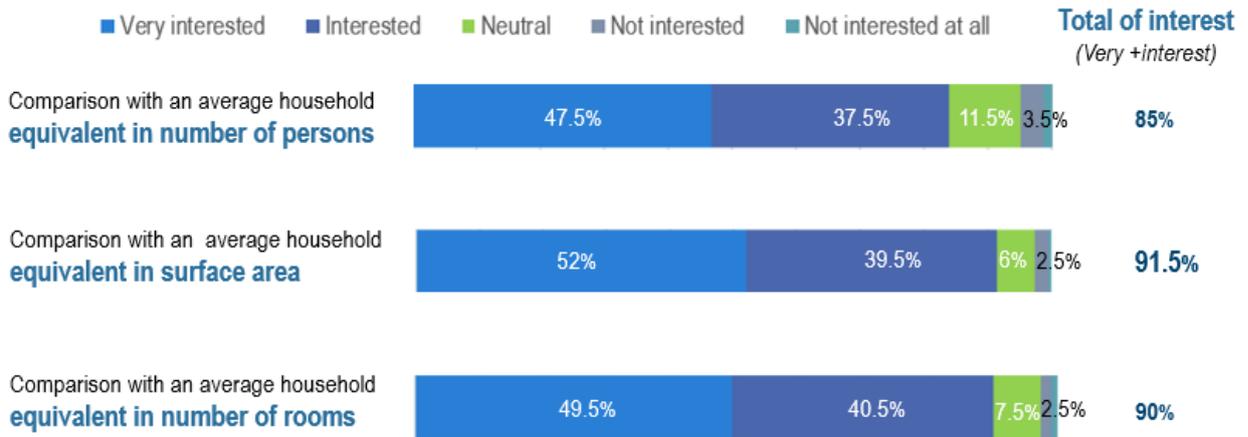
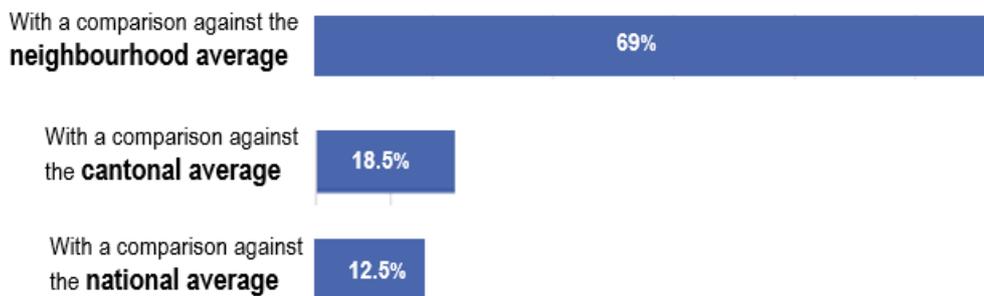


Figure 101 Information of interest expected in the tenant heating bill

Tenants prefer to have a comparison of their energy consumption at local, neighbourhood level and report a declining interest in cantonal or national comparison levels. 90% of tenants report that this kind of information would encourage them to implement energy-saving actions, see Figure 102.

Q26. How would you like TO RECEIVE this information? MOST INTERESTING OPTION



Q27. If this information shows that you are consuming more energy than the average, would it ENCOURAGE you to IMPLEMENT ENERGY-SAVING ACTIONS?

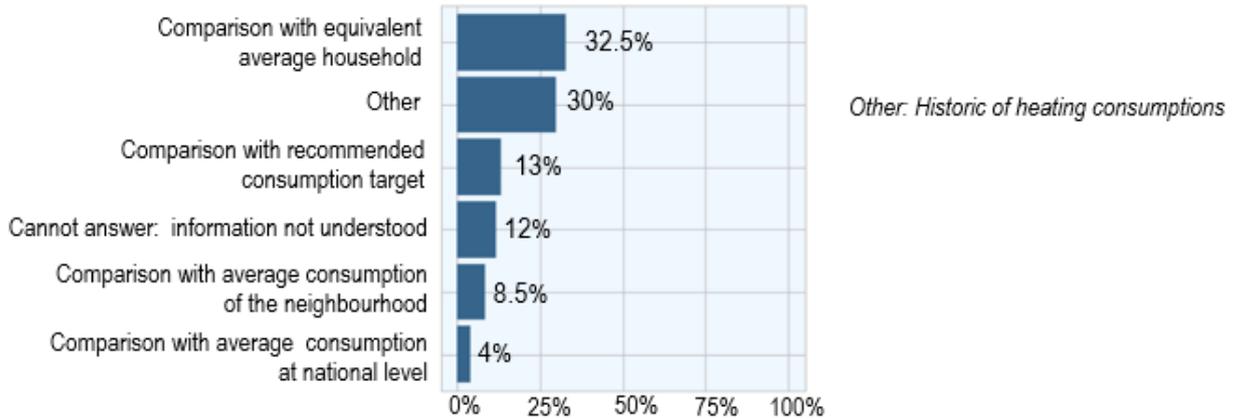


Figure 102 Comparison preferences in the tenant heating bill

For the 34% of tenants currently receiving some sort of consumption level data (c.f. Figure 100), comparisons with an equivalent average household stands as the first type of information received followed by historic comparisons, as shown in Figure 103. 60% of tenants report that this information has encouraged them to implement energy-saving actions.



Q29. What TYPE OF INFORMATION do you receive?



Q30. Did the information provided INCITE you to reduce your consumption by IMPLEMENTING ENERGY-SAVING ACTIONS?

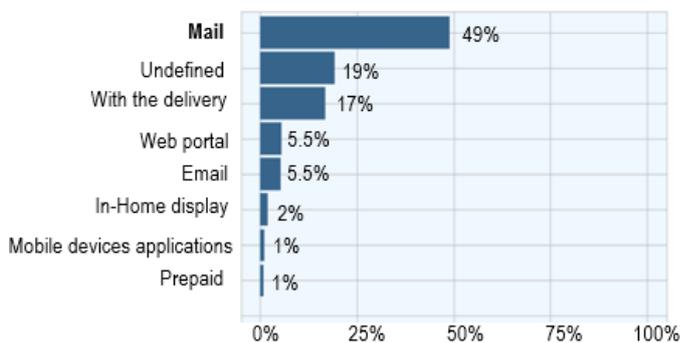


Figure 103 Type of consumption level information received on the tenant heating bill

10.2.4.2 Heating bill of homeowners

Figure 104 shows that, as for electricity billing, the paper bill dominates and annual billing concerns nearly 40% of homeowners.

Q34. Under what FORMAT do you receive your heating bill?



Q35. At what FREQUENCY do you receive your heating bill?

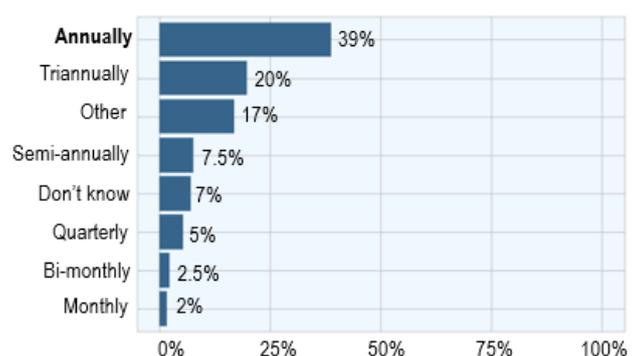
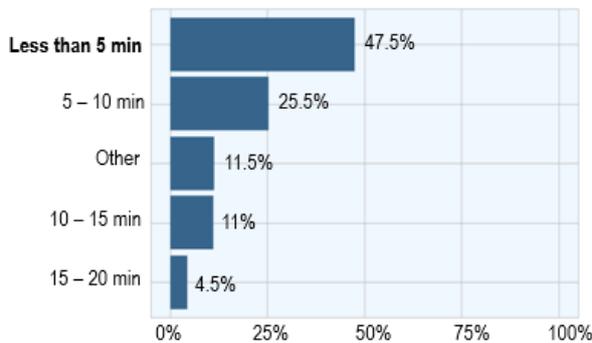


Figure 104 Home owner heating billing format and frequency

About 50% of homeowners spend less than 5 minutes reading the bill. The level of understanding is reported to be good to excellent for over 50% of them, see Figure 105.



Q36. How much TIME, in total, do you spend READING your heating bill?



Q37. How would you rate your LEVEL OF UNDERSTANDING of your heating bill?

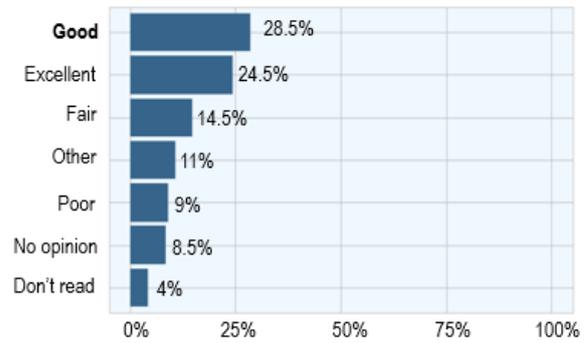
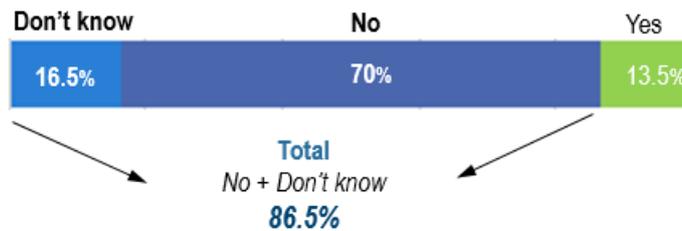


Figure 105 Homeowner heating billing: time spending reading and level of understanding

As far as the consumption level information is concerned, findings for the heating bills are similar to those of electricity bills, except that the breakdown of costs is even less stated. This seems to reflect the fact that heating bills do not yet have such a detailed and standardised format in place as electricity bills for displaying informative contents.

In Figure 106 less than 15% of homeowners receive some kind of information enabling the evaluation of their heating consumption. 75% of the remaining respondents, that do not receive information or do not know if they receive it, indicate to be interested in getting this information.

Q39. Do you receive QUALITATIVE AND/OR QUANTITATIVE INFORMATION from your energy supplier enabling you to position your heating consumption level (low, medium, high)?



Q40. Would you be INTERESTED in such information?



Figure 106 Qualitative or quantitative information on heating consumption level

As for electricity billing, interest from respondents to get comparisons with an average household are evident but little detail could be obtained from the responses, as the level of interest between the three proposed options remains quite close, see Figure 107. Yet, a slight advantage for comparisons in terms of equivalent surface area is observed.



Q41. What KIND OF INFORMATION would you be interested in?

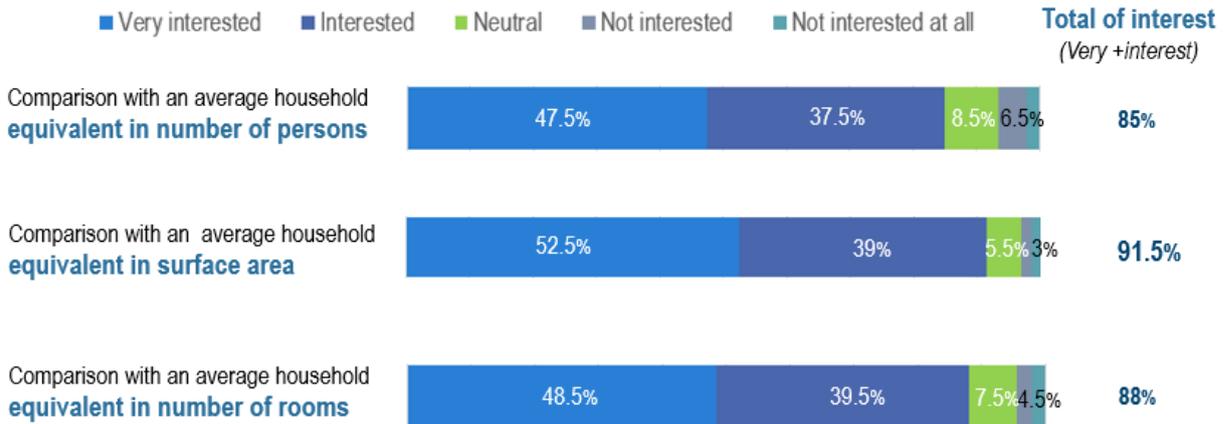


Figure 107 Information of interest expected in the heating bill

In any case, over 60% of respondents prefer comparisons at local level, typically against the neighbourhood average with a marked decline of interest for comparisons at larger scales: cantonal and national, see Figure 108.

Q42. How would you like TO RECEIVE this information? MOST INTERESTING OPTION

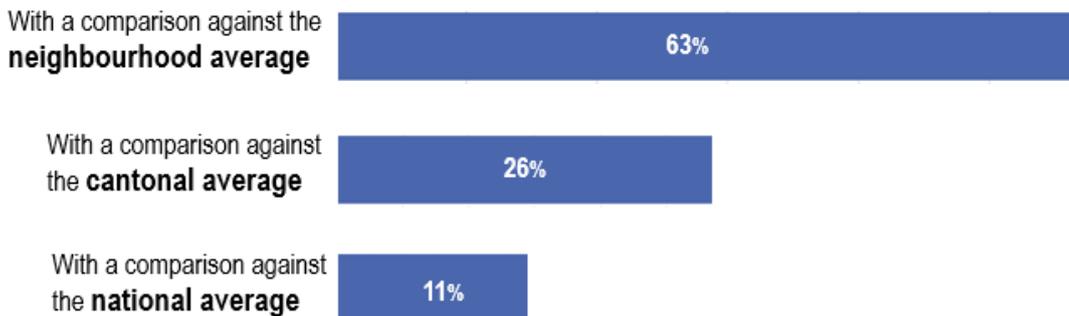


Figure 108 Comparison preferences for the heating bill

For respondents interested to get information, nearly 90% would be encouraged to implement energy saving actions if aware that they are above the average, see Figure 109.

Q43. If this information shows that you are consuming more energy than the average, would it ENCOURAGE you to IMPLEMENT ENERGY-SAVING ACTIONS?



Figure 109 Encouragement to implement energy-saving actions through improve heating bill contents



10.2.5 Consumer visual preferences

The aim of this survey was not only to assess Swiss energy users' opinion on the type of information currently available in their energy bill and their interest to improve knowledge, attitudes and behaviours towards energy consumption. It was also to gather views on improved displays for the energy billing information, in order to make the customer more aware of his level of energy consumption.

Thus, the six IMPROVE display proposals, as defined in chapter 9 of the current project, were included in the survey and compared. The proposals consist of one table format (proposal 1), four graphical formats (proposals 2 to 5) and one emoticon label (proposal 6) as shown in Appendix 13.

10.2.5.1 Descriptive analysis results

In terms of overall understanding of the proposals, Figure 110 indicates that proposals 1 and 6 received 70% or less of "good to excellent" level of understanding. All other four options get more than 85% of "good to excellent" understanding score. In order to better assess responses, the understanding scales were ranking from Excellent (1) to No opinion (5). The idea is to put into evidence excellent and good scores in the overall analysis. Based on this ranking, the weighted mean is calculated along with the standard deviation (SD) that indicates the data spread.

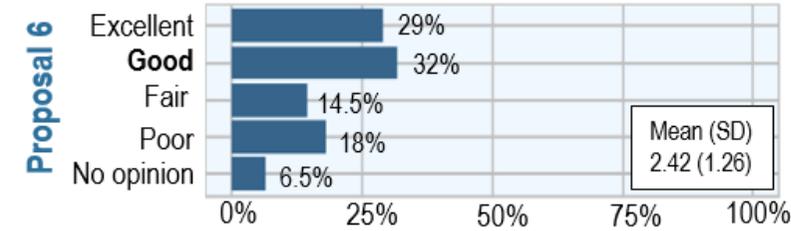
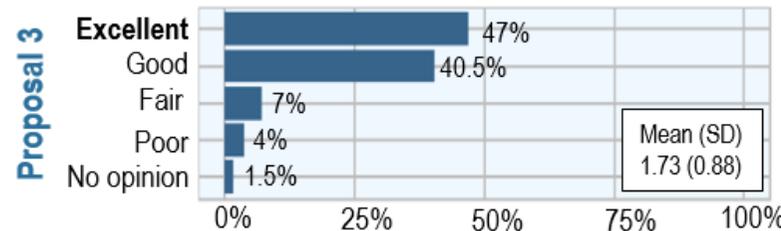
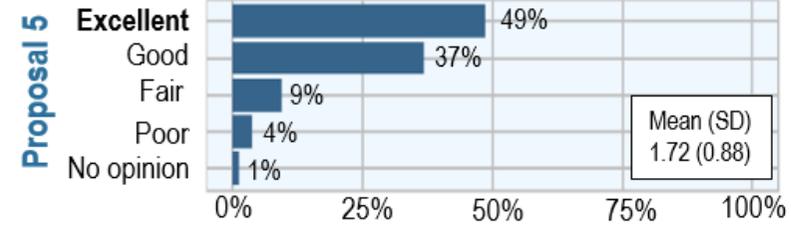
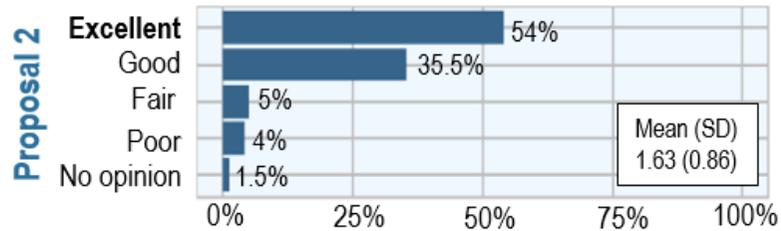
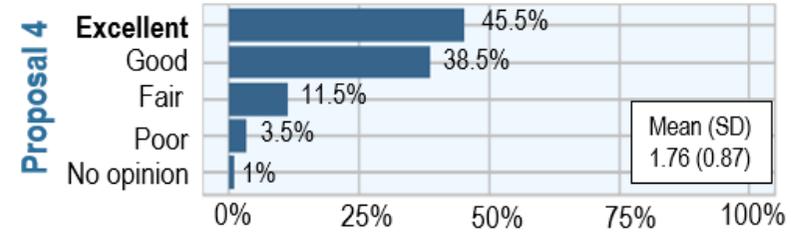
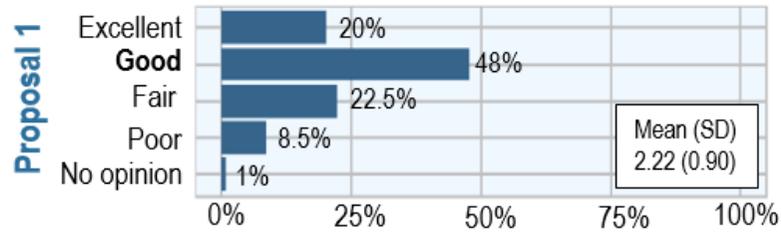
Results from this simple descriptive analysis show that, on average, proposals 1 and 6 obtain a good to fair understanding score while the other proposals obtain, on average, excellent to good. It also reveals a slight advantage for proposal 2, closely followed by proposals 3 to 5 that are nearly identical in terms of SD and mean and cannot be really differentiated. This seems to point out that despite a good understanding of the table display, as currently found, for instance, in most Swiss electricity bills (proposal 1), the informative contents could be improved by using more graphical elements.

As for the interest in receiving these visualisation proposals in their bills, results shows that none of the proposals receives the very interested score and only proposal 6 was clearly of no interest at all for respondents, see Figure 111. As before, a ranking scale was applied to the proposed interest categories, with values ranging from Very interested (1) to No opinion (6). The calculated weighted mean and SD indicate that, on average, energy consumers appreciate better proposals 1 to 5 with a slight preference for proposals 2 to 5. These latter present nearly identical mean and SD and cannot be differentiated at this point.

In all cases, consumers wish to receive this kind of information with the energy bill. No significant differences were observed between the sample results and the data derived from the three Swiss regions.



How would you rate your **LEVEL OF UNDERSTANDING** of these proposals?



Excellent (1): I understand everything

Good (2): I manage to find my way around even if I don't understand everything

Fair (3): I struggle to understand some bill elements

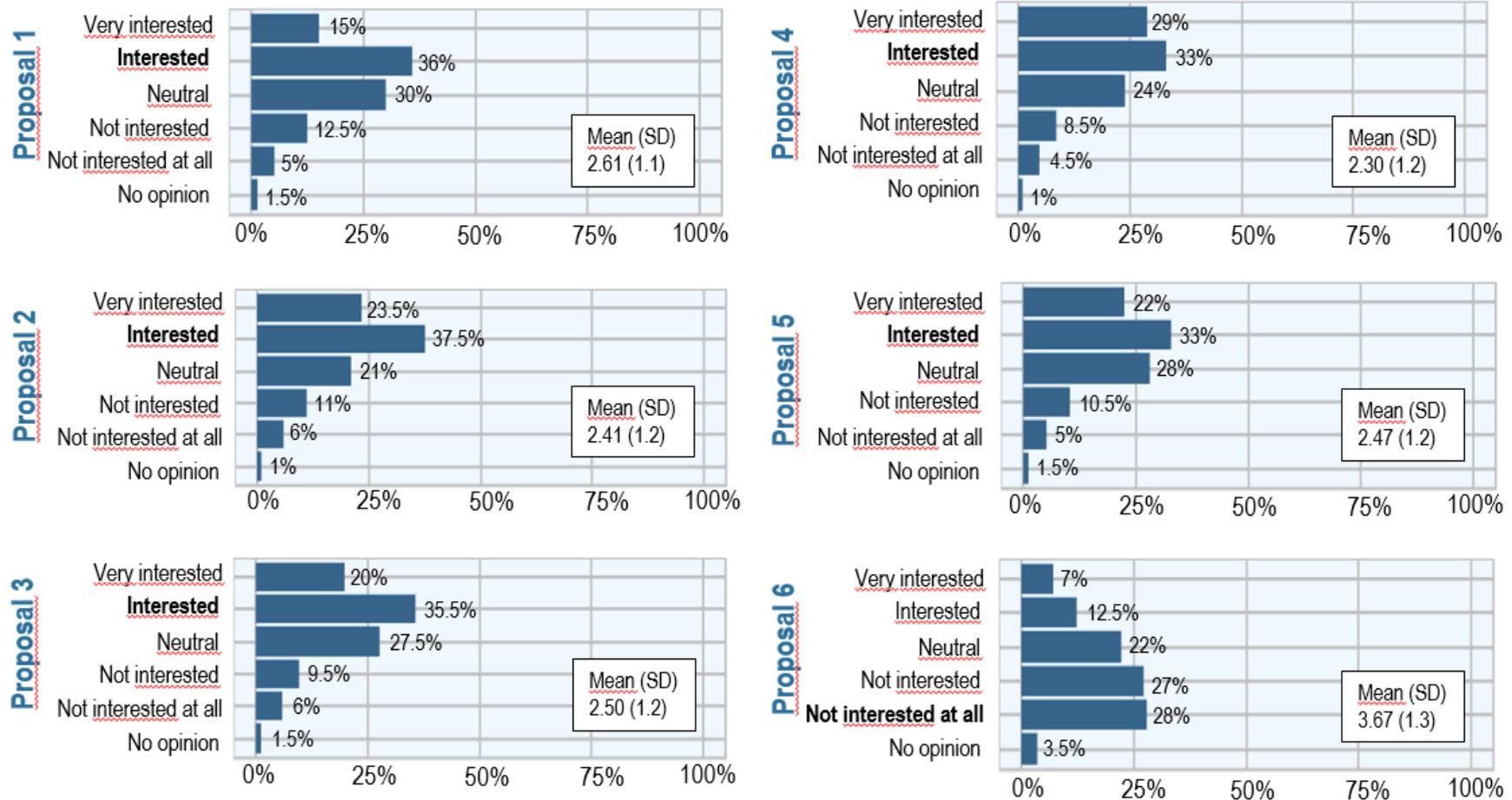
Poor (4): I don't understand the information stated

No opinion (5)

Figure 110 Level of understanding of the visualisation proposals



Describe your **INTEREST IN RECEIVING** this visual format to position your energy consumption?



Very interested (1) Interested (2) Neutral (3) Not interested (4) Not interested at all (5) No opinion (6)

Figure 111 Level of interest in receiving the visualisation proposals



10.2.5.2 Multiple correspondence analysis results

In order to identify potential associations between the visualisation results and socio-demographic factors, a multiple correspondence analysis was performed. The aim is to verify if certain groups of respondents present similar profiles in their responses to the questions.

Within the consumer survey, six different visual solutions were proposed to the respondents. For each of them, two questions were asked:

- How would you rate the level of understanding of proposals?
 - 5 possible answers (levels): "Poor", "Fair", "Good", "Excellent", "No opinion"
- Describe your interest in receiving this visual format?
 - 6 possible answers (levels): "Not interested at all", "Not interested", "Neutral", "Interested", "Very interested", "No opinion"

The previous chapters that described the survey results showed that among the six visual solutions:

- proposal 1 (table format) was less understood than the others and interest was lower than proposals 2 to 5
- proposal 6 (emoticon label) was also not really understood
- all other proposals were interesting and understood.

In addition to this global analysis, an additional assessment of the evaluation of the six visual solutions has been undertaken in order to deepen the analysis based on the respondents' socio-demographic attributes. The following seven attributes, named later variables, have been used with, for each of them, different classes:

- Gender: 3 classes (male, female, do not want to answer)
- Age profile: 6 classes (18-25 years, 26-35 years, 36-45 years, 46-55 years, 56-65 years, 66 years or older)
- Employment status: 5 classes ("Employed", "Out of work/Homemaker", "Retired", "Other, "Student")
- Education level: 5 classes ("Technical training", "Bachelor degree and higher", "High school graduate", "Other", "Primary school")
- Dwelling type: 3 classes (MFH, SFH, other)
- Household type: 6 classes ("1 person", "2 persons", "3 persons", "4 persons", "5 persons", "Other")
- Household annual income: 7 classes ("less than 60'000 CHF", "btw. 60'000 et 79'999 CHF", "btw. 80'000 et 99'999 CHF", "btw. 100'000 et 119'999 CHF", "btw. 120'000 et 149'999 CHF", "over 150'000 CHF", "Do not want to answer")

With the help of these different variables, it is possible to refine the answers related to the IMPROVE solutions in correspondence with these socio-demographic attributes.

Results are presented in a combination of tables and factor maps that show a global pattern within the data. Grey points represent individual answers while socio-demographic categories are coloured words. In the factor map, grey points with similar profiles are closed and variable categories with similar profiles are grouped together. The first axis (x-axis) represents the maximum of inertia and the second axis (y-axis) represents the second principal component (lower inertia than x-axis). In order to interpret a MCA plot:

- Regarding the points (individual answers):
 - The distance between points is related to their homogeneity. Two points close will have similarities in their profiles.
- Regarding the variable:
 - Classes that are farther away from the origin indicate categories that are more influential.
 - Among one variable, two classes on opposite sides of the plot indicate that a component contrasts these classes.

Based on these two interpretations, cluster will then be defined and represent sub-sample with homogeneous behaviour regarding the IMPROVE solutions.

A. MCA for Proposal 1 Proposal 1 in the survey corresponds to the table format already provided by the Swiss utilities on the electricity bill. The MCA results are presented in Figure 112 and Figure 113.

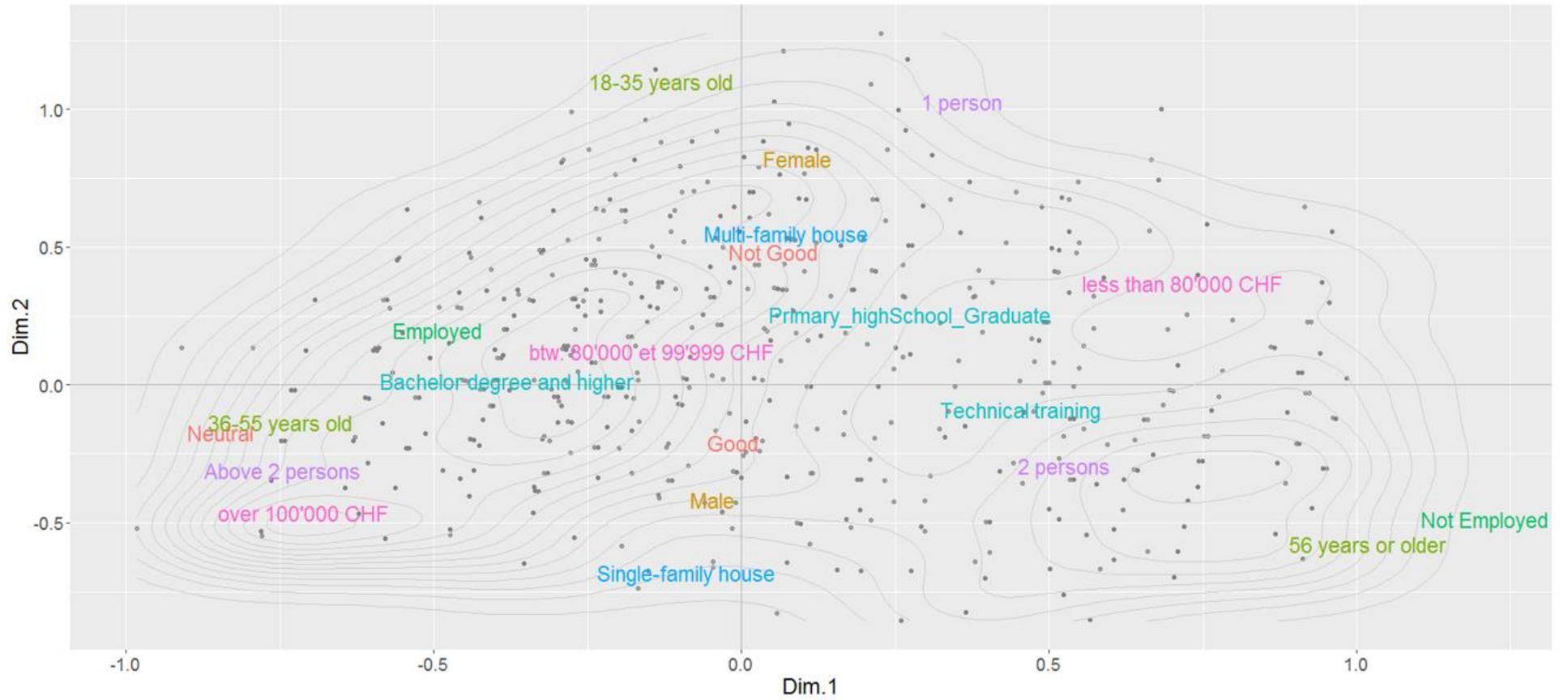


Figure 112 MCA, understanding of proposal 1

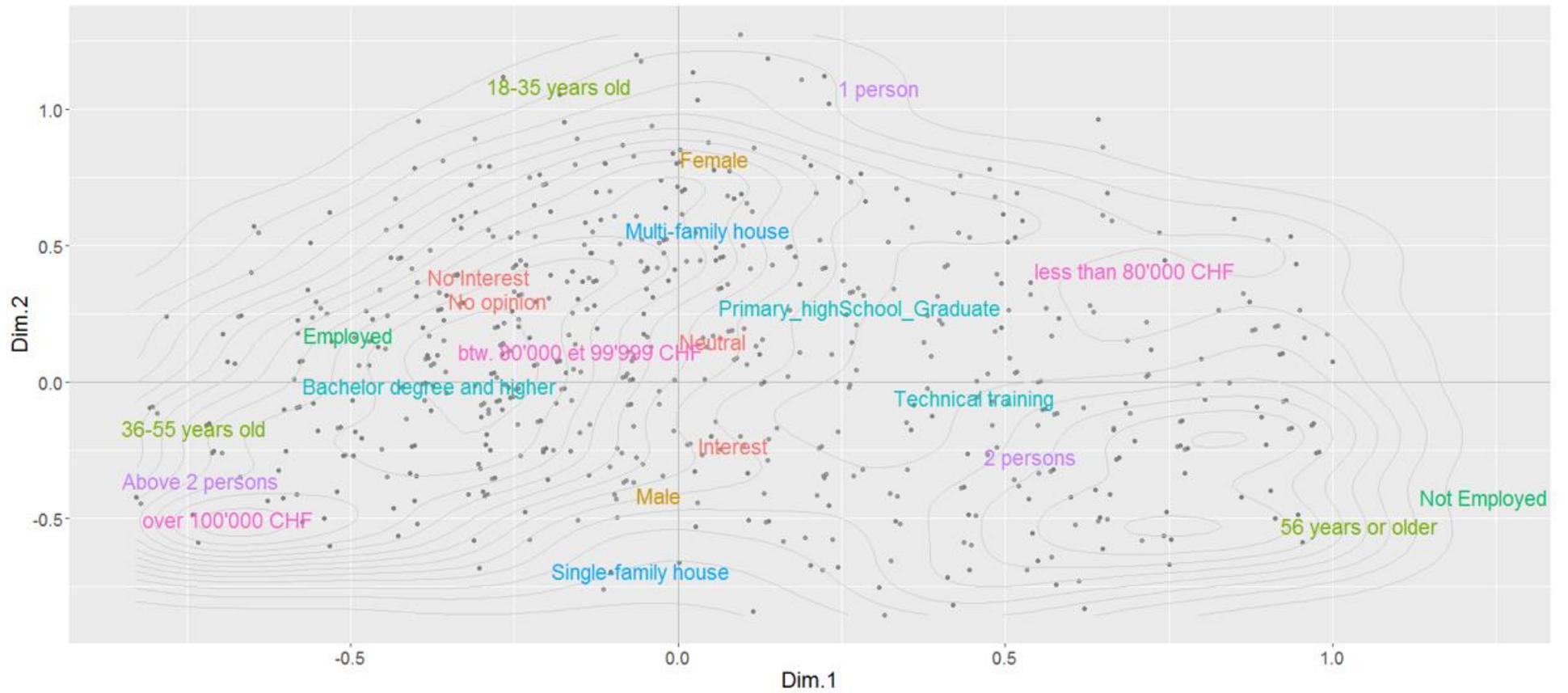


Figure 113 MCA, interest for proposal 1



It can be seen that some levels of the variable influence the answer. For example, it appears that people living in MFH buildings understand less the IMPROVE proposal 1 (MFH level close to “Not good” level). Younger people (18 to 35 years old) are also less interested or have less understanding of proposal 1 than others have.

Based on these results and for each question (level of understanding and interest) two clusters of respondents were defined. The level of understanding’s percentage as well as the socio-demographic structure are presented in the Table 20:

		Cluster "Understand less"	Cluster "Understand more"	All sample
Level of understanding	Not Good	45,9%	23,5%	30,4%
	Good	54,1%	75,4%	68,9%
	Neutral	0,0%	1,0%	0,7%
Gender	Female	56,9%	23,3%	33,6%
	Male	43,1%	76,7%	66,4%
Age profile	18-35 years old	67,1%	3,8%	23,2%
	36-55 years old	24,9%	50,3%	42,5%
	56 years or older	8,0%	45,9%	34,3%
Employment status	Employed	91,8%	61,8%	70,9%
	Not Employed	8,2%	38,2%	29,1%
Education level	Bachelor degree and higher	56,9%	50,2%	52,2%
	Primary_highSchool_Graduate	11,3%	9,1%	9,8%
	Technical training	31,8%	40,7%	38,0%
Dwelling type	Multi-family house	83,8%	42,8%	55,3%
	Single-family house	16,2%	57,2%	44,7%
Household type	1 person	50,4%	10,4%	22,6%
	Above 2 persons	15,3%	48,5%	38,3%
	2 persons	34,4%	41,1%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	23,1%	17,4%	19,1%
	less than 80'000 CHF	56,7%	35,8%	42,2%
	over 100'000 CHF	20,2%	46,8%	38,7%
Sample size		425	965	1390

Table 20 Level of understanding of proposal 1 by clustering the sample via MCA

In the cluster “Understand more”, the appreciation “Good” represents 75.4% of the answers while in the cluster “Understand less”, the appreciation “Good”, only represents 54.1%. By looking at the socio-demographic characteristics, it can be seen that the cluster “Understand less” has a bigger proportion of young single people (18-35 years old, one person per household), living in MFH with smaller incomes. Obviously, these observations are coherent with the results of Figure 112 since the clusters were defined according to the MCA. It is also possible that older people categories (who understands more the solution) are more used to this type of table format and reflect a rather conservative attitude, more reluctant to change. The gender and the activity status variables are also different in percentage between the two clusters. Thus, it seems that, according to the socio-demographic levels among each variable, the level of understanding for proposal 1 varies.

By looking at the level of interest of proposal 1, clusters were also defined according to the MCA (Figure 113), the results are provided in the Table 21.



		Cluster "Less interest"	Cluster "Most interest"	All sample
Level of interest	Interest	36,4%	57,4%	51,2%
	Neutral	35,9%	26,7%	29,4%
	No Interest	26,9%	14,7%	18,3%
	No opinion	0,7%	1,2%	1,1%
Gender	Female	56,1%	24,1%	33,6%
	Male	43,9%	75,9%	66,4%
Age profile	18-35 years old	71,1%	3,0%	23,2%
	36-55 years old	21,4%	51,4%	42,5%
	56 years or older	7,5%	45,6%	34,3%
Employment status	Employed	91,7%	62,2%	70,9%
	Not Employed	8,3%	37,8%	29,1%
Education level	Bachelor degree and higher	56,3%	50,5%	52,2%
	Primary_highSchool_Graduate	10,9%	9,3%	9,8%
	Technical training	32,8%	40,2%	38,0%
Dwelling type	Multi-family house	82,5%	43,9%	55,3%
	Single-family house	17,5%	56,1%	44,7%
Household type	1 person	49,3%	11,3%	22,6%
	Above 2 persons	16,3%	47,6%	38,3%
	2 persons	34,5%	41,0%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	20,9%	18,4%	19,1%
	less than 80'000 CHF	58,0%	35,5%	42,2%
	over 100'000 CHF	21,1%	46,1%	38,7%
Sample size		412	978	1390

Table 21 Level of interest of proposal 1 by clustering the sample via MCA

As for the level of understanding, the younger age category, living in MFH with lower level of income is less interested in this solution. One possible explanation for these important differences between the clusters in terms of understanding and interest might be the level of complexity and low attractiveness of this visual solution. Indeed, among the six proposed IMPROVE solutions, proposal 1 (which corresponds to an improved version of the actual information provided on the bills) is rather difficult to interpret with the level of consumption (low, average or high) appearing as a very hidden element. Thus while most respondents understand the solution, some socio-demographic categories are less interested in it.

From this assessment, it is possible to confirm that the level of understanding and interest related to the IMPROVE proposal 1 is not homogeneous among the sample and the socio-demographic variables. It seems that there is not one single homogeneous visual solution able to please all energy consumers.

B. MCA for Proposals 2 and 3

In here, the same procedure as presented for the proposal 1 was applied. Since the results were similar between the two solutions, it has been decided to present them together. The level of understanding and the interest is presented in the Table 22 and Table 23:



		Proposal 2			Proposal 3		
		Cluster "Understand less"	Cluster "Understand more"	All sample	Cluster "Understand less"	Cluster "Understand more"	All sample
Level of understanding	Not Good	9,3%	8,4%	9,1%	11,7%	9,9%	10,9%
	Good	89,3%	91,6%	89,9%	87,2%	88,7%	87,8%
	Neutral	1,4%	0,0%	1,1%	1,1%	1,4%	1,2%
Gender	Female	29,1%	48,6%	33,6%	39,9%	24,7%	33,6%
	Male	70,9%	51,4%	66,4%	60,1%	75,3%	66,4%
Age profile	18-35 years old	0,0%	99,7%	23,2%	39,1%	0,7%	23,2%
	36-55 years old	55,4%	0,0%	42,5%	10,1%	88,4%	42,5%
	56 years or older	44,6%	0,3%	34,3%	50,9%	10,9%	34,3%
Employment status	Employed	64,8%	91,3%	70,9%	52,8%	96,5%	70,9%
	Not Employed	35,2%	8,7%	29,1%	47,2%	3,5%	29,1%
Education level	Bachelor degree and higher	48,4%	65,0%	52,2%	46,9%	59,7%	52,2%
	Primary_highSchool_Graduate	10,1%	8,7%	9,8%	10,1%	9,4%	9,8%
	Technical training	41,5%	26,3%	38,0%	43,0%	30,9%	38,0%
Dwelling type	Multi-family house	48,9%	76,5%	55,3%	63,6%	43,6%	55,3%
	Single-family house	51,1%	23,5%	44,7%	36,4%	56,4%	44,7%
Household type	1 person	19,4%	33,1%	22,6%	33,2%	7,6%	22,6%
	Above 2 persons	41,9%	26,6%	38,3%	17,0%	68,6%	38,3%
	2 persons	38,7%	40,2%	39,1%	49,9%	23,8%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	18,7%	20,7%	19,1%	17,6%	21,4%	19,1%
	less than 80'000 CHF	40,1%	48,9%	42,2%	59,6%	17,5%	42,2%
	over 100'000 CHF	41,2%	30,3%	38,7%	22,9%	61,1%	38,7%
Sample size		1067	323	1390	814	576	1390

Table 22 Level of understanding of proposals 2 and 3 by clustering the sample via MCA



		Proposal 2			Proposal 3		
		Cluster "Less interest"	Cluster "Most interest"	All sample	Cluster "Less interest"	Cluster "Most interest"	All sample
Level of understanding	Interest	59,5%	62,9%	61,4%	54,0%	57,1%	55,7%
	Neutral	21,9%	22,4%	22,2%	28,0%	28,1%	28,1%
	No Interest	17,9%	14,5%	16,0%	16,9%	14,1%	15,4%
	No opinion	0,6%	0,3%	0,4%	1,1%	0,7%	0,9%
Gender	Female	30,8%	35,9%	33,6%	30,2%	36,5%	33,6%
	Male	69,2%	64,1%	66,4%	69,8%	63,5%	66,4%
Age profile	18-35 years old	0,2%	42,2%	23,2%	0,2%	42,7%	23,2%
	36-55 years old	91,3%	2,1%	42,5%	89,2%	2,8%	42,5%
	56 years or older	8,6%	55,7%	34,3%	10,6%	54,5%	34,3%
Employment status	Employed	95,9%	50,3%	70,9%	96,7%	49,0%	70,9%
	Not Employed	4,1%	49,7%	29,1%	3,3%	51,0%	29,1%
Education level	Bachelor degree and higher	57,0%	48,3%	52,2%	58,4%	47,0%	52,2%
	Primary_highSchool_Graduate	10,0%	9,6%	9,8%	9,9%	9,7%	9,8%
	Technical training	33,0%	42,1%	38,0%	31,8%	43,3%	38,0%
Dwelling type	Multi-family house	48,3%	61,2%	55,3%	48,5%	61,1%	55,3%
	Single-family house	51,7%	38,8%	44,7%	51,5%	38,9%	44,7%
Household type	1 person	15,9%	28,2%	22,6%	15,8%	28,4%	22,6%
	Above 2 persons	63,0%	17,9%	38,3%	61,3%	18,8%	38,3%
	2 persons	21,1%	53,9%	39,1%	22,8%	52,9%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	21,0%	17,6%	19,1%	20,8%	17,7%	19,1%
	less than 80'000 CHF	23,8%	57,4%	42,2%	22,7%	58,7%	42,2%
	over 100'000 CHF	55,2%	25,0%	38,7%	56,5%	23,6%	38,7%
Sample size		630	760	1390	639	751	1390

Table 23 Level of interest of proposals 2 and 3 by clustering the sample via MCA



For the two solutions, the MCA gave the same conclusion. The level of understanding was not significantly driven by any of the socio demographic categories or classes. In other words, it seems that the entire sample had a good understanding of these two solutions. Indeed, by looking at the value among the level of understanding for the two clusters, the percentage of answers “good” and “not good” is very close. Thus, it appears that these two solutions might be the widely understood solutions for the sample.

Regarding the level of understanding, the same trend is observed. The interest rates are close among the clusters for each solutions, thus the socio-demographic variables are not driving this question. However, proposal 3 seems to have a lower interest level for respondents.

Among the six proposed IMPROVE solutions, proposals 2 and 3 are relatively simple to understand but not simplistic. Moreover, proposal 2 is a well-known solution since it has a design close to the energy labelling of electric appliances on which respondents might be used to interpret. Proposal 3 is also simple but not simplistic as it provides the information about the consumption level without requiring a time consuming interpretation.

Thus, from the MCA, it can be concluded that these two solutions (and proposal 2 in particular) are solutions not significantly driven by the socio-demographic attributes and should be further developed to be proposed as one IMPROVE solution to consumers.

C. MCA for proposals 4 and 5

Regarding proposals 4 and 5, the socio-demographic characteristics were found to have a significant influence on the questions and thus clusters were created.

Indeed, for proposal 4 a good understanding of this solution, as well as an interest on receiving, is driven by:

- The higher salary classes;
- Bachelor or higher diploma;
- Age class between 36 and 55 years, employed;
- Household size above 2 persons;

On the opposite, older or younger respondents with lower incomes and technical training are less interested in this solution.

Regarding proposal 5, it appears that a good level of understanding and an interest in the solution are only slightly influenced by the socio-demographic classes. Regarding the “good” understanding, the same trend as for proposal 4 is observed.

The lower level of understanding (i.e. “not good”) and “neutral” level of interest are more driven by the socio-demographic classes and mostly by older age categories and technical training with lower incomes. By clustering the sample into two categories, it is possible to confirm these perceptions for proposals 4 and 5, see Table 24 and Table 25:



		Proposal 4			Proposal 5		
		Cluster "Understand less"	Cluster "Understand more"	All sample	Cluster "Understand less"	Cluster "Understand more"	All sample
Level of understanding	Not Good	19,2%	14,4%	15,9%	13,3%	12,7%	13,0%
	Good	79,7%	84,7%	83,2%	85,8%	86,3%	86,0%
	Neutral	1,2%	0,8%	0,9%	0,9%	0,9%	0,9%
Gender	Female	27,3%	36,5%	33,6%	36,5%	30,2%	33,6%
	Male	72,7%	63,5%	66,4%	63,5%	69,8%	66,4%
Age profile	18-35 years old	0,0%	33,6%	23,2%	42,7%	0,0%	23,2%
	36-55 years old	4,8%	59,6%	42,5%	2,9%	89,5%	42,5%
	56 years or older	95,2%	6,8%	34,3%	54,4%	10,5%	34,3%
Employment status	Employed	18,0%	94,9%	70,9%	49,1%	96,9%	70,9%
	Not Employed	82,0%	5,1%	29,1%	50,9%	3,1%	29,1%
Education level	Bachelor degree and higher	33,9%	60,5%	52,2%	46,9%	58,5%	52,2%
	Primary_highSchool_Graduate	10,4%	9,5%	9,8%	9,7%	9,9%	9,8%
	Technical training	55,7%	30,0%	38,0%	43,4%	31,6%	38,0%
Dwelling type	Multi-family house	49,0%	58,2%	55,3%	61,1%	48,4%	55,3%
	Single-family house	51,0%	41,8%	44,7%	38,9%	51,6%	44,7%
Household type	1 person	24,5%	21,7%	22,6%	28,4%	15,7%	22,6%
	Above 2 persons	13,4%	49,6%	38,3%	19,0%	61,3%	38,3%
	2 persons	62,1%	28,6%	39,1%	52,7%	23,0%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	15,5%	20,8%	19,1%	17,9%	20,6%	19,1%
	less than 80'000 CHF	65,8%	31,5%	42,2%	58,6%	22,6%	42,2%
	over 100'000 CHF	18,7%	47,8%	38,7%	23,5%	56,8%	38,7%
Sample size		433	957	1390	754	636	1390

Table 24 Level of understanding of proposals 4 and 5 by clustering the sample via MCA



		Proposal 4			Proposal 5		
		Cluster "Less interest"	Cluster "Most interest"	All sample	Cluster "Less interest"	Cluster "Most interest"	All sample
Level of understanding	Interest	56,4%	64,4%	61,9%	54,0%	60,1%	55,4%
	Neutral	24,7%	23,6%	24,0%	29,9%	26,6%	29,1%
	No Interest	18,0%	11,3%	13,4%	15,2%	12,7%	14,6%
	No opinion	0,9%	0,7%	0,8%	0,9%	0,6%	0,9%
Gender	Female	27,3%	36,5%	33,6%	29,1%	48,6%	33,6%
	Male	72,7%	63,5%	66,4%	70,9%	51,4%	66,4%
Age profile	18-35 years old	0,0%	33,6%	23,2%	0,0%	99,7%	23,1%
	36-55 years old	4,8%	59,6%	42,5%	55,4%	0,0%	42,6%
	56 years or older	95,2%	6,8%	34,3%	44,6%	0,3%	34,4%
Employment status	Employed	18,0%	94,9%	70,9%	64,8%	91,3%	70,9%
	Not Employed	82,0%	5,1%	29,1%	35,2%	8,7%	29,1%
Education level	Bachelor degree and higher	34,2%	60,4%	52,2%	48,4%	65,0%	52,2%
	Primary_highSchool_Graduate	10,2%	9,6%	9,8%	10,1%	8,7%	9,8%
	Technical training	55,7%	30,0%	38,0%	41,5%	26,3%	38,0%
Dwelling type	Multi-family house	49,4%	58,0%	55,3%	48,9%	76,5%	55,3%
	Single-family house	50,6%	42,0%	44,7%	51,1%	23,5%	44,7%
Household type	1 person	24,5%	21,7%	22,6%	19,4%	33,1%	22,6%
	Above 2 persons	12,7%	49,9%	38,3%	41,9%	26,6%	38,4%
	2 persons	62,8%	28,3%	39,1%	38,7%	40,2%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	15,5%	20,8%	19,1%	18,7%	20,7%	19,1%
	less than 80'000 CHF	65,1%	31,8%	42,2%	40,1%	48,9%	42,1%
	over 100'000 CHF	19,4%	47,4%	38,7%	41,2%	30,3%	38,7%
Sample size		433	957	1390	1067	321	1388

Table 25 Level of interest of proposals 4 and 5 by clustering the sample via MCA



Regarding the proposal 4, the two clusters for the level of understanding and the level of interest are driven by the socio-demographic factor. For proposal 5, the clusters do not give any difference for the level of understanding (i.e. this level is not driven by socio-demographic attributes) while the level of interest seems to be slightly influenced by the socio-demographic attributes. Both solutions, are well understood and of interest according to the sample. The level of complexity of the visual solutions, as well as the amount of information provided, can be a possible explanation of this difference.

Indeed, compared to proposals 2 and 3, proposal 5 is a little bit more complex since the consumers should look at their consumption level and interpret it as a function of their household size. This additional step for interpreting solution 5 might be a reason why respondents understand the solution at the same level as solutions 2 and 3 (with no influence of the socio-demographic attributes) but, when looking on the level of interest, the socio-demographic attributes induce sensible differences.

The influence of the level of complexity is more sensitive for proposal 4 between the two clusters. Indeed, solution 4 can be seen as more complex than solution 5 since there are two graphics and statistics on the consumption (time series and bar plot). Thus, since proposal 4 tends to be more detailed (and/or complex) than 5, the differences between the two clusters on the level of understanding as well as the level of interest are more important.

It seems thus possible to assume that the level of complexity is a factor of differentiation between the clusters and the socio-demographic classes. This observation was also made when looking at solution 1. Globally, i.e., at the level of the respondents' sample, solution 4 has the highest interest level compared to all other solutions. However, from the MCA, it is observed that this level of interest is quite dependant of the socio-demographic variables linked to the sample and might represent a limitation for using this solution. Indeed, the IMPROVE project aims at finding a visual representation that is suitable for a large audience, i.e., all the customers receiving an energy bill. Thus, it would be of interest to have a visual solution that is not influenced (or as little as possible) by the socio-demographic characteristics (consensual solution).

D. MCA for proposal 6

MCA results for proposal 6 are presented in Figure 114 and Figure 115:

From these figures, it is possible to observe a clear differentiation of the level of understanding and the level of interest due to the socio-demographic classes. Indeed, in Figure 114, the level of understanding is clearly influenced on the first principal axis. The left part of the graphic presents respondents who do not understand the solution while the right part of the graphic presents respondents who understand it. Among this segmentation, the socio-demographic classes are also spread.

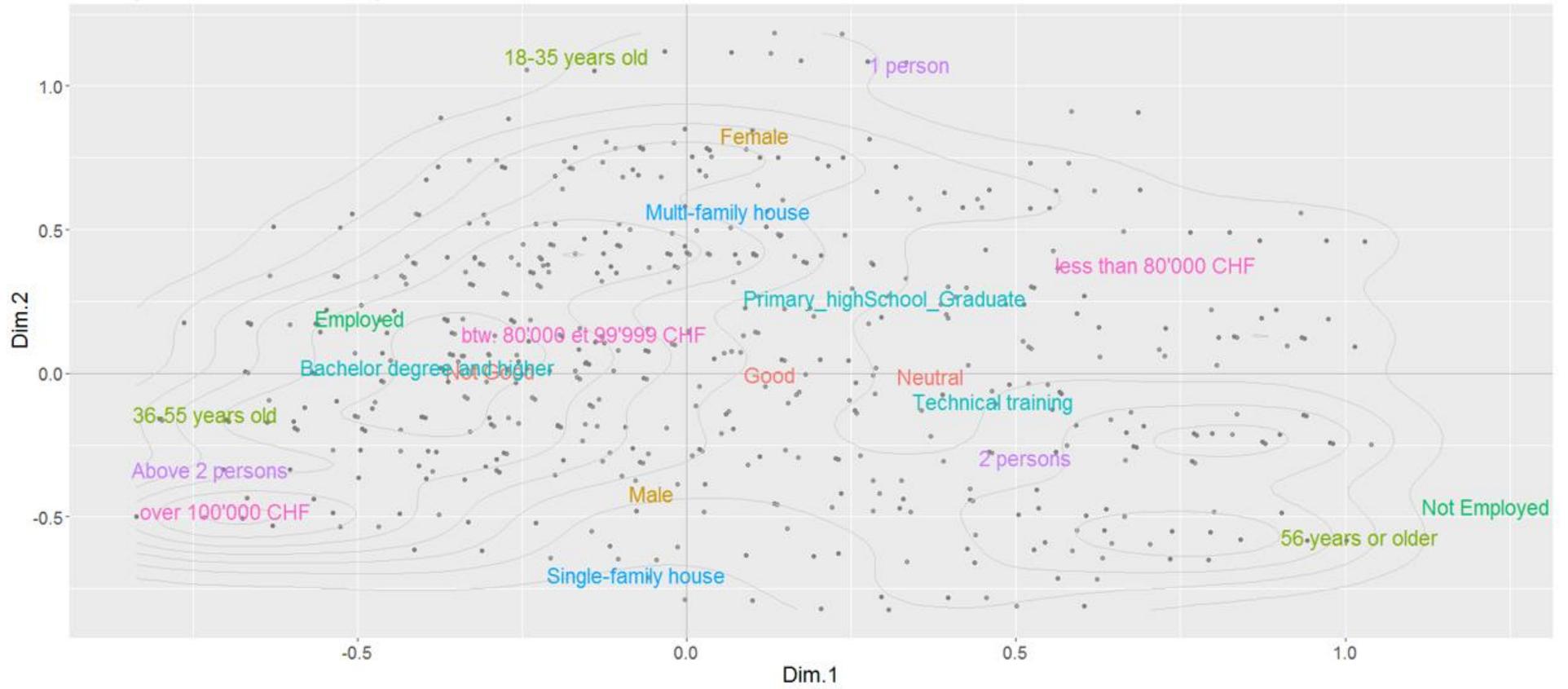


Figure 114 MCA, understanding of proposal 6

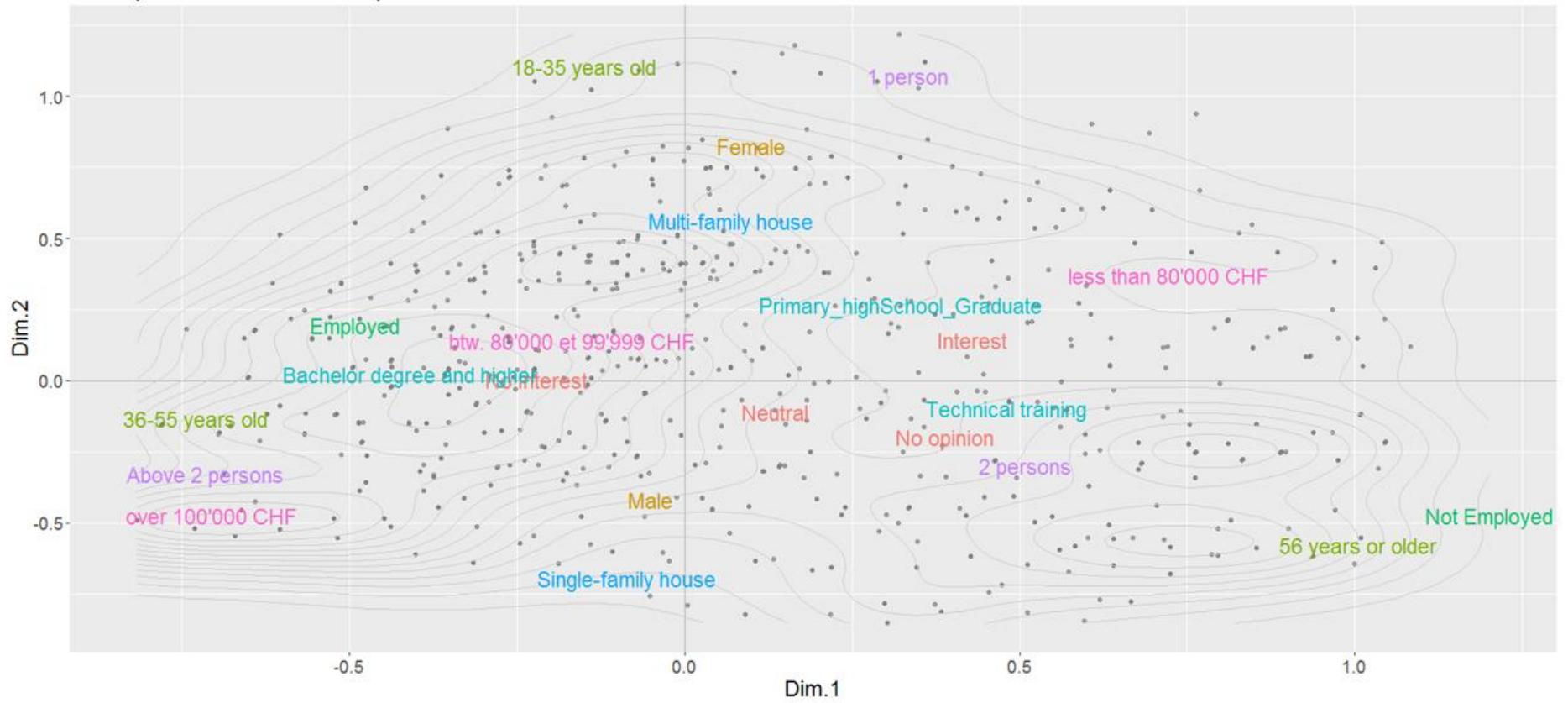


Figure 115 MCA, interest of proposal 6



On the right part, the classes shown are related to older respondents, with technical training, lower incomes and two persons in the household. Conversely, on the left part, younger age classes with bachelor or higher degree and higher incomes. The same trend is observed in Figure 115. Based on these observations, it has been possible, again, to separate the respondents into two clusters, see Table 26 and Table 27:

		Cluster "Understand less"	Cluster "Understand more"	All sample
Level of understanding	Not Good	37,0%	23,4%	32,7%
	Good	58,1%	69,7%	61,7%
	Neutral	4,9%	6,9%	5,5%
Gender	Female	36,5%	27,3%	33,6%
	Male	63,5%	72,7%	66,4%
Age profile	18-35 years old	33,8%	0,0%	23,2%
	36-55 years old	59,7%	4,8%	42,5%
	56 years or older	6,5%	95,2%	34,3%
Employment status	Employed	94,9%	18,6%	70,9%
	Not Employed	5,1%	81,4%	29,1%
Education level	Bachelor degree and higher	60,3%	34,6%	52,2%
	Primary_highSchool_Graduate	9,6%	10,1%	9,8%
	Technical training	30,1%	55,3%	38,0%
Dwelling type	Multi-family house	57,8%	50,0%	55,3%
	Single-family house	42,2%	50,0%	44,7%
Household type	1 person	21,7%	24,5%	22,6%
	Above 2 persons	50,1%	12,6%	38,3%
	2 persons	28,2%	62,8%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	20,8%	15,6%	19,1%
	less than 80'000 CHF	31,9%	64,7%	42,2%
	over 100'000 CHF	47,4%	19,7%	38,7%
Sample size		954	436	1390

Table 26 Level of understanding of proposal 6 by clustering the sample via MCA

		Cluster "Less interest"	Cluster "Most interest"	All sample
Level of interest	Interest	17,3%	24,3%	19,5%
	Neutral	20,6%	25,2%	22,0%
	No Interest	60,0%	47,0%	56,0%
	No opinion	2,1%	3,5%	2,5%
Gender	Female	36,3%	27,5%	33,6%
	Male	63,7%	72,5%	66,4%
Age profile	18-35 years old	33,6%	0,0%	23,2%
	36-55 years old	59,5%	4,9%	42,5%
	56 years or older	6,9%	95,1%	34,3%
Employment status	Employed	94,9%	17,8%	70,9%
	Not Employed	5,1%	82,2%	29,1%
Education level	Bachelor degree and higher	60,4%	34,0%	52,2%
	Primary_highSchool_Graduate	9,6%	10,2%	9,8%
	Technical training	30,0%	55,8%	38,0%
Dwelling type	Multi-family house	57,8%	49,8%	55,3%
	Single-family house	42,2%	50,2%	44,7%
Household type	1 person	21,7%	24,5%	22,6%
	Above 2 persons	49,9%	12,7%	38,3%
	2 persons	28,4%	62,7%	39,1%
Shousehold annual income	btw. 80'000 et 99'999 CHF	20,8%	15,5%	19,1%
	less than 80'000 CHF	31,7%	65,3%	42,2%
	over 100'000 CHF	47,5%	19,2%	38,7%
Sample size		958	432	1390

Table 27 Level of interest of proposal 6 by clustering the sample via MCA



The cluster “understand less” and “less interest” is composed accordingly to the MCA results of the younger respondents with bachelor or higher education levels and higher incomes. In this cluster, the level of understanding is “good” for 58.1% and the interest is 17.3%. For the second cluster, made of older respondents with technical training and lower incomes, the level of understanding is “good” for 69.7% and the interest is 24.3%. In both cases, while the level of understanding is above 50% (although significantly lower than other solutions), the interest for this solution is rather low.

From this assessment, it is possible to conclude that there is indeed a different global perception of this solution as a function of the socio-demographic classes involved, but, globally, both categories are less enthusiastic about this solution. When compared to the other solutions that were discriminated by the socio-demographic classes (proposals 1 and 5), it seems that proposal 6 presents a too simplistic and/or less clear visual illustration. Thus, while it provides information about the consumption level, it is judged as not clear enough and is of low interest.

Synthesis

In order to summarize the results presented above, a qualitative table is proposed regarding the level of understanding, the level of interest as well as the influence of the socio-demographic variables, see

TABLE 28:

	Level of understanding	Level of interest	Influence of socio demographics variables
Proposal 1	Correct	Moderate	Important for both aspects
Proposal 2	Very good	Good	Small for both aspects
Proposal 3	Very good	Moderate to Good	Small for both aspects
Proposal 4	Good	Good	Moderate for both aspects
Proposal 5	Very good	Moderate to Good	Small for level of understanding, moderate for level of interest
Proposal 6	Correct	Low	Important for both aspects

Table 28 Qualitative summary of the survey and MCA results

The level of understanding is, in general, relatively high. However, among the high percentage of answers corresponding to “good”, there are differences among the proposals:

- 1 and 6 are less understood
- 2,3 and 5 are highly understood
- 4 has a smaller level of understanding compared to 2,3 and 5 but higher than 1 and 6

For the level of interest, the results are more spread:

- 6 is not interesting for the respondents
- 1 is moderately interesting
- 2 and 4 are of interest
- 3 and 5 are less interesting compared to 2 and 4

Regarding the socio-demographic aspects, differences are also observed:

- 1 and 6 are influenced by the classes
- 2 and 3 are less influenced by the classes
- 4 is moderately influenced by the socio-demographic classes
- 5 is not influenced by the socio-demographic classes for the level of understanding but moderately influenced for the level of interest

Based on the sample assessment, it seems that the level of understanding as well as the level of interest are a function of the level of complexity of the visual solutions. The more visually complex, the less a proposal will be of interest and understood. Conversely, a too simple solution (simplistic) such as proposal 6 is also not appreciated. Between the simplistic and the complex solutions, proposals 2 and 3 are seen as intermediate, thus well understood, and considered as interesting. It is possible, regarding solution 2, that respondents are used to this representation of energy labelling creating thus a good perception of it.



Last, but not least, in some cases the level of understanding and interest seems also to be influenced by the socio-demographic background of the recipient. Considering that the IMPROVE projects aims to find a possible low cost solutions to all for a higher aggregated result in enhancing the understanding of energy bills, another possible approach in selecting viable solutions could be that of choosing those that are less bound to socio-demographic aspects. Or else, propose the contrary: introduce different segment-oriented solutions, depending on the different socio-demographic classes being addressed. However, this latter option becomes more complex to implement in practice.

Since proposals 2 and 3 seem to obtain good results from the survey in terms of understanding, interest and influence from socio-demographic variables, it should be necessary to investigate more in depth these solutions in order to confirm these trends and maybe identify which one could be implemented in the energy bills.

10.3 Key findings

The key findings of this survey are summarised here.

10.3.1 Electricity bill

Responses reveal that Swiss electricity consumers:

- receive bill most frequently by mail, three times a year
- spend less than 5 minutes to read it
- manage to find their way around the bill even if they don't understand everything
- do not receive much information from the provider to evaluate their consumption level
- would like more information
- wish to compare their consumption with equivalent households of the neighbourhood
- are willing to put into place energy-saving actions if their consumption is above average

10.3.2 Heating bill of tenants

Responses reveal that for Swiss tenants:

- heating costs are usually included in the rent
- receive some information but clearly incomplete to determine consumption level
- wish more information enabling them to compare with equivalent households of the neighbourhood
- are willing to put into place energy-saving actions if their consumption is above average

10.3.3 Heating bill of homeowners

Responses reveal that Swiss homeowners:

- receive heating bill most frequently by mail, once a year
- spend less than 5 minutes to read it
- manage to find their way around the bill even if they don't understand everything
- do not receive much information from the provider to evaluate their consumption level
- would like more information
- wish to compare their consumption with equivalent households of the neighbourhood
- are willing to put into place energy-saving actions if their consumption is above average



10.3.4 Visualisation preferences

The descriptive analysis reveal that Swiss energy users:

- have a good understanding of proposals 1 (table format) and 6 (emoticon label)
- have an excellent understanding of proposals 2 to 5 (graphical format)
- slight advantage for proposal 2 in terms of understanding, followed by 5, 3 and 4
- are interested in receiving proposals 1 to 5
- are not particularly interested in proposal 6
- slight advantage for proposal 4 in terms of interest, followed by 2,5 and 3

The MCA analysis reveals that results are correlated with socio-demographic aspects:

- 1 and 6 are influenced by the classes
- 2 and 3 are less influenced by the classes
- 4 is moderately influenced by the socio-demographic classes
- 5 is not influenced by the socio-demographic classes for the level of understanding but moderately influenced for the level of understanding

so that proposal 4 has a smaller level of understanding compared to 2,3 and 5 and that proposal 2 and 3 seem to present a more consensual opinion among respondents.

10.4 Chapter's conclusions

This chapter has presented the results of a national survey conducted to evaluate energy consumers' opinion on the type of information currently available in their energy bill and their interest to improve knowledge, attitudes and behaviours towards energy consumption.

The survey indicates that the paper bill is still the main communication tool between the energy utilities and the consumer. Still, most energy consumers spend less than five minutes to read it. The majority of energy consumers do not receive energy consumption information from the provider to evaluate their consumption level and many tenants do not know their actual energy consumption. Most consumers wish to compare energy consumption with equivalent households of the neighbourhood and are willing to put into place energy-saving actions if their consumption is above average.

To comply with current legislation, Swiss electricity bills contain obligatory information in table format. However, obligatory content in heating bills still lacks and efforts are necessary to regulate them if improved billing content is sought. The level of understanding of the current energy bill is considered good by both electricity and heating consumers. However, it could clearly be improved with the use of charts instead of tables.

Overall, the survey indicates that there is a great potential to improve energy bills and billing content in Switzerland. A more consumer-friendly bill could turn a traditional bill into an important communication vehicle to influence household energy consuming behaviours.



11 Recommendation for Utilities

To date, the energy bill still represents the most common channel used by utilities to provide customers with information about their energy usage. Nevertheless, in this context, very often the bill has acted primarily as an accounting and payment tool and its potential implications in giving customers better control over their energy use and to support utilities' goals for more actively engaging customers, are frequently overlooked (Foster & Alschuler, 2011).

As a result, in the past, the informative content of the energy bill has often tended to be shaped primarily by mandatory legal requirements – focusing on improving transparency on rate structure and charges - on one hand, and the utility's more specific billing system requirements on the other. Instead of making energy bills more user-friendly, unfortunately this kind of approach has often contributed to the proliferation of line items (different taxes, facilities' charges, energy generation and transmission costs, etc.) provided in a mainly "tabular format" to better trace computations, though adding frequently more complexity and confusion to the bill than understanding (EC, 2016).

It should though always be kept in mind that utilities and customers have both ingrained interests in enhancing the design and informative content of current energy bills. Even though goals might seem slightly different, they nevertheless intersect in regard to the following aspects:

- bill payment;
- customers' understanding of how charges are calculated;
- meaningful information to better manage and even reduce energy consumption;

Ultimately, the energy bill also represents a viable mean for improving utility-customer relations. Thus, any future bill redesign and enhancement should take into account needs and requirements of both consumers and utilities.

Yet, the generation of the energy bill involves and impacts significantly the operations of a variety of different units and departments within a utility, from the customer service, to the accounting and data processing IT department etc. Thus, making changes to the current energy bill design and content implies willingness to activate decision-making and overcoming operational barriers by the energy utilities, as well as to provide sufficient and adequate human, financial and technical resources.

In order to favour a more strategic way of handling possible improvements to future energy bills by utilities, the main aim of the present work is to get hold of utilities' point of view in this matter as to understand possible drivers and barriers and to formulate useful recommendations for utilities in the context of currently evolving concepts of demand-side information (DSI) in the energy billing scenario.

In particular, the present analysis aims to explore:

- main factors and motivations pushing Swiss energy utilities to improve the informative content of residential customers' energy bills;
- utilities' current availability of a series of raw data items to possibly enhance and customise billing information. This type of data is not strictly limited to information regarding customers' energy usage over time, but extends also to other information fields, such as, for example, sourcing meteorological data, profiling the existing building stock, the heating systems employed by households for both space heating and hot water, the numerical composition of households and goes even as far as categorizing the type of electrical appliances equipment provided in the different residential households;
- utilities' feasibility to organise and process such raw data, in order to be able to work out and provide more targeted information such as the disaggregation of consumption data for electrical appliances for instance, introduce comparative statistics, provide more segment-oriented information in regard to energy consumption levels, make correlations between meteorological data and energy consumption etc.;
- possible barriers in the implementation of the six IMPROVE solutions provided as a conceivable approach to enhance energy billing information;
- utilities' perceived difference in related costs and benefits in regard to the implementation of a more traditional tabular bill format and a more innovative, graphical format of presenting energy-related data.

The feedback presented in this report has been gathered from a wide network of Swiss utilities by means of an online survey. In total, 48 out of 185 energy utilities from all over Switzerland answered.



11.1 Methodology

11.1.1 Online survey

At the beginning of the present research activity, all the Swiss energy utilities that had already taken part in the previous survey of the IMPROVE Project aimed to explore the current state of the art of DSI models in Switzerland (see chapter 7), and that had acknowledged their availability to take part in a second project survey as planned, were contacted via e-mail. Thus 185 energy utilities (see Appendix 15) were invited to complete an online survey containing mainly close-ended questions and the possibility to add some open comments in regard to the six IMPROVE solutions elaborated within this research project in order to enhance energy billing. The survey content can be found in Appendix 16.

The survey was subdivided into the following 7 sections:

1. General information
2. Motivations for improving information for residential households
3. What data is available?
4. General assessment of the six IMPROVE solutions
5. Cost evaluation of the IMPROVE solutions
6. Benefit evaluation of the IMPROVE solutions
7. Final evaluation

Table 29 reports the survey response rate recorded, both in total numbers and differentiated per language region. Out of the 185 energy utilities contacted, 42 completed the survey, 6 replied partially to the survey.

Language region	Surveys sent	Reply complete	Reply partial	Response rate
German	141	28	4	23%
French	34	8	2	29%
Italian	10	6	-	60%
TOTAL	185	42	6	26%

Table 29 Survey response rate.

11.1.2 Workshops involving partner utilities

Beside gathering general feedback from a wider network of Swiss energy utilities in regard to the six proposed IMPROVE solutions, the present analysis also took into account a more in-depth input on the matter by discussing it directly with partner energy utilities during a workshop (the second and final workshop of the whole IMPROVE project). This final workshop was organized in all three language regions.

Main aim of these workshops was to present to the involved utility project partners the results of the earlier project activities and to discuss with them more in-depth the main findings emerging from both the customers' and utilities' surveys. In particular, this helped to gather more accurate and operational suggestions, direct in-depth comments and concrete insights in regard to the strengths, weaknesses, opportunities and risks of enhanced DSI from a utility's perspective. This qualitative analysis subsequently allowed to elaborate some general "Recommendations for utilities" regarding the implementation of enhanced DSI models in the near future.



11.2 Findings from the online survey

11.2.1 General information about the participating energy utilities

Nearly half (46%) of the energy utilities participating in this survey supply exclusively electricity as a service to residential customers (see Table 30).

Energy services provided	
Electricity (only)	46%
Electricity + gas	12%
Electricity + district heating	19%
Electricity + gas + district heating	23%

Table 30 Utilities' service profile.

The size of the energy utilities varies greatly (see Table 31). This reflects the heterogeneity of the Swiss energy market, which is characterized by utilities of different sizes, ranging from small municipal utilities supplying single communities to larger, even internationally operating companies (see chapter 6). In the present survey sample, the two largest energy utilities report to be supplying respectively approx. 300'000 and 350'000 households with electricity. Both of them do not supply gas, nor provide any major district heating service.

Those energy utilities in the sample supplying also gas, next to electricity, again, involve rather small numbers of households, ranging from approx. 400 to 10'000 customers. As for district heating, the largest energy utility supplies approximately 30'000 households, next to the 170'000 customers provided with electricity.

No. of households served	Min.	Max.
Electricity	300	350'000
Gas	400	10'678
District heating	20	30'000

Table 31 Range of household nos. served per energy service.

11.2.2 Motivations for improving information for residential households

Table 32 shows the motivational factors for a possible improvement in the provision of energy consumption data provided to residential households. The highest overall rating was assigned to the factor "Customer satisfaction", followed by "Need for transparency", "Promotion of utility's energy consulting services" and "Reduction of energy consumption". "Compliance with federal legal requirements" received a slightly higher rating than "Reduction of energy consumption", however, the standard deviation in the sample is higher and thus, less univocal.



MOTIVATIONS	MEAN	ST. DEV
Customer satisfaction	4.08	0.92
Need for transparency	4.04	0.90
Promotion of utility's energy consulting services	3.83	0.86
Compliance with federal legal requirements	3.69	1.24
Reduction of energy consumption	3.65	0.93
Marketing strategy and customer fidelity programmes	3.54	1.15
Profiling of customers' consumption patterns	3.52	1.03
Observance Energy Strategy 2050	3.44	1.07
Promotion of load shifting	3.38	1.00
Compliance with Municipal mandate	3.27	1.27

Table 32 Motivations for improving information for residential households (5= high; 1 = low).

Less priority is given to “Marketing strategies and customer fidelity programmes” and the “Profiling of customers' consumption patterns”, followed by the “Observance of the Energy Strategy 2050” and the “Promotion of load shifting”. “Compliance with Municipal mandate” is the factor associated with the lowest rating. The fact that marketing strategies are associated with a rather low rating may reflect the fact that – contrary to the European Union countries - energy market liberalization in Switzerland is still on the early outset and does not yet represent a compelling circumstance for utilities.

“Observance of the Energy Strategy 2050” has been rated as slightly more motivating for encouraging improved energy billing than the “Promotion of load shifting”. This latter result might imply that the communicative impact of energy bills in this regard is felt by utilities to be secondary and less important. Indeed, increasingly, load shifting is being dealt by utilities by means of promoting economic incentives such as differentiating tariffs.

Ultimately, all these findings relate motivation for improving energy billing information prevalently to the domain of (i) customer satisfaction, (ii) correct accounting measures (need for transparency, compliance with federal legal requirements) and (iii) energy efficiency measures (reduction of energy consumption and promotion of utility's energy consulting services).

The fact that Customer satisfaction received the lead in motivating Swiss utilities to improve the information provided to residential household customers, implies that - even in the absence of liberalized markets – Swiss utilities are nevertheless driven to enhance their relationship with the customer (satisfaction, consulting services, fidelity programme) as a measure of performance and a sort of loyalty-enhancing strategy, to pave the way for the future market liberalization.

11.2.3 Data availability

11.2.3.1 Raw Data

Raw data - also known as source data or primary data - is unstructured or unformatted repository data that hasn't yet undergone thorough processing, either manually or through automated computer software. The “availability of raw data” is an important prerogative for utilities to be able to extract, analyze and process specific records and be able to draw particular conclusions, make projections and/or extract meaningful information.

Responses to the question on raw data availability (see Table 33) indicate that Annual consumption data is considered as the most easily retrieved data. This is followed by a rather high level of data availability concerning the “Type of building (single house or apartment, etc.)” involved. Information regarding the “Type of heating system used for both hot water” and “Space heating” are rated similarly (middle level of difficulty in obtaining it).

The type of raw data that is rated by utilities rather univocally (84%) as “difficult” to retrieve is “Type of electrical appliances equipment provided”. What follows is “Real-time consumption data”, the “Share of consumption data for hot water” and the “Share of consumption data for space heating”. Here, standard deviation in the sample is rather low, indicating that utilities are all rather in line with this general statement. Finally, also the “Energy reference surface” is considered as a rather difficult type of data to be obtained.



The collection of “Monthly consumption data” is rated as rather difficult. The same is true for retrieving information on the “Number of household members”. Instead, “Meteorological data” and the “Number of rooms” are rated as slightly easier to retrieve. However, standard deviation within the sample is rather high in these cases.

Overall, only two energy utilities report ability to retrieve easily real-time consumption data. Of course, this reflects the fact that there is currently a lack in the provision of smart meter infrastructure across the participating energy utilities. Without smart meters it is rather problematic to retrieve consumption data on a monthly base. This all reflects important limitations both in the “data granularity” (how precise?) and “billing frequency” (how often?) with which energy usage data can be currently provided to residential customers. The former implies limitations in the chronological display of consumption data, thus not allowing for a richer set of data for enhancing customers’ self-monitoring and evaluation. The latter implies limitations in the so-called indirect energy feedback provision (Darby, 2007), a factor that has shown to impact end-users’ energy awareness and enables consumers to better link their energy consumption and expenditures (Dromaque, et al., 2013).

RAW DATA	MEAN	ST. DEV
Annual consumption data	4.76	0.57
Type of building (single house, apartment etc.)	3.53	1.20
Type of heating system for space heating	2.72	1.28
Type of heating system for hot water	2.70	1.33
Meteorological data	2.38	1.42
Number of rooms	2.30	1.38
Number of household members	2.02	1.15
Monthly consumption data	2.00	1.17
Energy reference surface (SRE)	1.83	1.20
Share of consumption data for space heating	1.73	0.94
Share of consumption data for hot water	1.57	0.83
Real-time consumption data	1.52	0.84
Type of electrical appliances equipment provided	1.20	0.50

Table 33 Evaluation of “raw data” availability for residential households in utilities’ supply area (5 = high; 1 = low).

11.2.3.2 Processed data

Processed data is the type of data that is processed from raw data. Generally, it involves the collection, cleaning and transformation of specific data items into a format that can be analyzed and visualized. It thus enables utilities to produce a set of meaningful information.

As for the feasibility of estimating processed data, our findings reveal that for the utilities, the most accessible data is the “Change in energy consumption (%) over a given billing period”, followed by “Energy usage compared to previous months/previous year – same billing period” (see Table 34). The latter record must surely refer to annual rather than monthly data, considering the response given in the previous section on “raw data availability”, where it appears that monthly consumption data is considered to be of rather low availability.



Exploring utilities' feasibility of providing "processed data", the lowest score is associated to information regarding the "Disaggregation of consumption data". This record is followed by the computation of data in regard to the "Profiling of households based on the level of consumption of peers (A-G energy label classes, average/efficient/intensive consumption)" and "Profiling of similar households (no. of occupants, type of building, surface)". Though the processing of these latter two data sets is rated mainly as rather challenging, some utilities do not completely abandon the idea, giving it a middle rating.

Interestingly, there seems to be more confidence by the utilities in calculating the "Correlation between energy consumption and temperature/weather conditions" than profiling households' energy usage: this result may open better accuracy in the future bill enhancement.

PROCESSED DATA	MEAN	ST. DEV
Change in energy consumption (%) over a given billing period	4.19	2.06
Energy usage compared to previous month / previous year – same period	3.93	1.44
Correlation between energy consumption and temperature /weather conditions over billing period	2.23	1.25
Profiling similar households (no. of occupants, type of building, surface)	2.19	1.18
Profiling of households based on level of consumption of peers (A-G energy label classes, average/ efficient/ intensive consumption)	1.95	1.00
Disaggregation of consumption data	1.10	0.30

Table 34 Evaluation of the feasibility of estimating the following "processed data" for residential households in utilities' supply area (5 = high; 1 = low).

Overall, responses of energy utilities to the questions on data availability seem to reflect an initial barrier in retrieving more frequent and segment-oriented energy consumption data. In fact, the provision of more detailed and customized energy usage information would assume, first of all, the availability of smart meters to enhance billing frequency. In addition, there seems to be a rather important difficulty in retrieving and processing the data needed to provide comparative statistics to the end-users. At the moment, comparative statistics seem to be limited to merely historical consumption data of the customer. No peer household comparisons seem to be in place within this sample of utilities. The participating utilities seem to find it easier to collect data regarding meteorological conditions and energy consumption of households than profiling the residential households on the basis of their average energy consumption and building characteristics. Consequently, efforts made to improve billing content in the future might need to explore first the option of providing households with more insights on their own consumption (such as correlating it with external temperature trends) rather than comparisons with similar households.

11.2.4 General assessment of the IMPROVE solutions

As to the questions in the survey related to whether the participating utilities already implement some kind of the six proposed IMPROVE solutions (Table 35), it results that solution 1 is the most widely adopted approach, as confirmed by 52% of the respondents. This result confirms the dominance of a rather traditional, tabular form of illustrating energy consumption data to customers, according to the Swiss regulation in the electricity sector. However, it is not clear whether this response by the involved utilities just plainly refers to the implementation of a "tabular format" (which distinguishes solution 1 from the other IMPROVE solutions, and simply represents today's most common, standard format of displaying energy usage data in general) or whether respondents more correctly caught on the actual innovating aspect of solution 1 (i.e. the integration of information regarding "average consumption of a similar household") and refer to this specific aspect when reporting its implementation.

Such concern arises from the fact that in chapter 11.2.3, utilities actually report problems in retrieving more segment-oriented, comparative energy usage data in general. In terms of comparative statistics, currently, utilities seem to be mainly able to provide historical data (on an annual basis). This reasoning thus also applies to the answers provided by utilities in reference to solutions 2 to 6.



TABULAR	COST ITEM	MEAN	ST. DEV.
	1. Hardware	3.33	1.49
	2. Software	3.12	1.25
	3. Planning	2.88	1.35
	4. Management	2.71	1.22
	5. Human resources	2.52	1.13

Table 36 Cost evaluation of the tabular form of IMPROVE solution 1.

Loking at the cost rating of the graphical way of illustrating energy consumption data, some cost items seem to slightly change in weight and thus in priority (see Table 37).

GRAPHICAL	COST ITEM	MEAN	ST. DEV.
	1. Hardware	4.00	1.10
	2. Planning	3.79	0.90
	3. Software	3.76	0.79
	4. Management	3.33	1.12
	5. Human resources	3.10	1.03

Table 37 Cost evaluation of the graphical form of IMPROVE Solutions 2 to 6.

In the case of implementing a graphical illustration of energy consumption data, utilities rate planning costs as higher than in the tabular illustration, and similar to software costs.

11.2.6 Benefit evaluation of the IMPROVE solutions

In regards to the benefit-analysis run by the participating energy utilities in regards to the six proposed IMPROVE solutions, from the responses given, it results that utilities confer a higher benefit rating in terms of customer satisfaction, fidelity and utility reputation to the graphical illustration form than to the tabular form (see Table 38 and Table 39). In other words, utilities are aware of the fact that a more user-friendly visualization of energy consumption data might grant advantages from a communication point of view between the company and the customer.

In general, the aspect of increasing “Customer fidelity” is seen as the least important element by the participating utilities. In fact, this aspect is associated with a middle rating in both the tabular form and in the graphical form, though the latter seems to be slightly higher than the former (see Table 38 and Table 39).

“Customer satisfaction” and “Utility’s reputation” are rated as slightly more important than “Customer fidelity” in this benefit analysis. Regarding the tabular form these two factors are associated with an extremely similar weighting. In the graphical form, “Customer satisfaction” is slightly more important than “Utility’s reputation”.



TABULAR	BENEFITS	MEAN	ST. DEV.
	1. Customer satisfaction	2.57	1.04
	2. Utility's reputation	2.52	1.02
	3. Customer fidelity	2.40	1.08

Table 38 Benefit analysis of the tabular form of IMPROVE solution 1.

GRAPHICAL	BENEFITS	MEAN	ST. DEV.
	1. Customer satisfaction	3.14	1.18
	2. Utility's reputation	3.02	0.95
	3. Customer fidelity	2.81	1.15

Table 39 Benefit analysis of the graphical form of IMPROVE Solutions 2 to 6.

Overall, from the utilities' point of view, none of the three benefit elements (customer satisfaction, customer fidelity, utility's reputation) seem to particularly stand out as a high advantage resulting from the implementation of the proposed IMPROVE solutions and enhanced energy billing. Nevertheless, the graphical display receives, on average, a higher benefit rating than the tabular form.

It is interesting to compare these findings with those collected in chapter 11.2.2, which aimed at detecting possible motivational triggers for utilities to improve energy billing information for residential households. At first glance, there seems to be some kind of incongruence in the responses given. In fact, in chapter 11.2.2, the one motivational trigger receiving the highest rating by the participating utilities was "Customer satisfaction" (M = 4.08). However, in the benefit analysis, "Customer satisfaction" is associated in both tabular and graphical form with a lower score (M = 2.85). This is an interesting point as it might reflect both a more theoretical position by utilities, where they rate "Customer satisfaction" as an important motivational trigger for inducing change. On the other hand, in practical terms, when confronted with the possible IMPROVE solutions presented in this research project, utilities see a limited impact of these solutions in raising "Customer satisfaction".

Possible reasons for this incongruence could in future be further investigated as it might help to gain a better understanding of utilities' doubts in this regard and ensure a higher implementation possibility for the future. In turn, informing utilities about the fact that their customers assessed the IMPROVE solutions as effective during the Consumer satisfaction survey (chapter 10), might provide some additional information for utilities to rethink their current position.

11.2.7 Open comments in regards to the IMPROVE solutions

Utilities were also requested to provide open comments in regard to the possible needs or constraints precluding the implementation of the IMPROVE solutions presented in Table 35.

In this context, many comments in regard to solution 1 (tabular form) highlight that this approach represents most closely the current status of utilities' energy bills. Some utilities state that in this approach they also include comparison of historical consumption data of the customer. This is thus regarded as rather easy and cheap to implement. The idea of including peer comparative statistics has been appreciated as a neutral, non-judgmental approach for informing customers. However, some utilities point out to the difficulty of (i) how to profile reference households for peer and (ii) how to manage information updating.

Comments provided in regard to solution 2 (energy label model), consider it on the one hand clear and easy-to-understand; on the other hand, it is criticized as being "hackneyed", i.e. overused, trite, and confusing, providing insufficient and insignificant information, since inconsistent with the official energy



label system of electrical appliances. This result contrasts with the results of the consumers' satisfaction survey. Indeed, for consumers, the level of understanding of solution 2 was excellent for 54%, while for solution 1 it was only 20%. However, numerous utilities highlight also in this case a problem in benchmarking and defining the energy classes (A – G). But this kind of objections were also existing when the energy label for electrical appliances or for cars was under development.

As for solution 3, positive remarks emphasize the simple, neutral, non-judgmental character of this resolution. Furthermore, it presents a way of solving the critical problem of classifying households according to the household size (number of occupants). However, a series of critical aspects seem to outweigh the positive ones: for utilities, retrieving information in regard to the number of occupants is difficult due to privacy concerns and to the fact that there is no obligation to register such data. In addition to the problem of profiling households and updating the related information, cross-comparisons might be biased, since each household reports different consumption behavior and possesses different electrical appliances. Finally, it is also not clear whether this data includes also energy consumption for hot water and heating, but this could be clarified in the bill.

Solution 4 is appreciated for its graphical approach and for introducing historical consumption data into the billing content. Most remarks though consider the implementation of this solution as rather critical, in the sense that it is only possible if the utility is equipped with smart metering infrastructure, since monthly reading is required - otherwise reporting will remain annual.

Solution 5 is considered very similar to solution 3 but more detailed. Again, the positive aspect praised by some utilities is the non-judgmental nature of this representation. Yet, most comments highlight the problem of benchmarking energy profiles in order to be able to compare similar households.

Interestingly, most observations regarding solution 6 are negative, defining it as not meaningful, not possible, not effective, confusing and, above all, judgmental towards the customer – an aspect that should be avoided. This outcome seems very much in line with the results gathered in the Consumer satisfaction survey (chapter 10), where 55% of respondents were “not interested” or “not interested at all” in receiving solution 6 as a billing format.

11.3 Final evaluation of the six IMPROVE solutions by utilities

Finally, for each IMPROVE solution, utilities were asked to rate the likelihood with which they would implement each of the six IMPROVE solutions (*Table 40*).

IMPROVE Solutions - Likelihood of being implemented	MEAN	ST. DEV
Solution 1	3.00	1.50
Solution 4	2.69	1.30
Solution 2	2.45	1.19
Solution 5	2.40	1.15
Solution 3	2.33	1.12
Solution 6	2.05	1.23

Table 40 Descending likelihood of implementing the IMPROVE solutions (5 = very likely; 1 = very unlikely).

Solution 1 received the highest likelihood rating from respondents. However, the score corresponds to a “medium” rating and the standard deviation within the sample is also the highest of all. Of course, Solution 1 represents the least extravagant solution, which, according to the cost-benefit analysis ran, implies relatively low implementation efforts.

Solution 4 follows Solution 1. It reports trends in historical consumption data, a format that has been reported to be already in place in 12% of energy utilities surveyed. It is unclear, though, whether utilities would be currently able to implement the more innovative aspects of Solution 4, i.e. the monthly consumption data, the peer comparison statistics and related energy-savings, thus overcoming the difficulties in gathering the needed data highlighted in chapter 11.2.3. Results from the Consumer satisfaction survey (chapter 10), confirm that this format is very appealing to customers: 62% of respondents stated to be “very interested” to “interested” in receiving such billing format.



Solution 2, introducing an energy label to improve the informative content of energy bills, even though very much appreciated by customers (61%), has been rated as a less likely solution to be implemented from a utility's perspective, as it seems to pose implementation problems.

The least likely solution to be implemented is Solution 6. From comments made by the participating utilities, the reason for refusing solution 6 is that it is judgmental towards the customer (displaying a sad or happy emoticon). Interestingly, the same solution has also been refused by customers (55%). As such, in regard to solution 6 both utilities and customers seem to be in line.

Since needs and expectations of customers in regard to energy billing information may differ depending on the customers' socio-demographic and educational background, participating energy utilities were also asked to evaluate the likelihood of providing different graphical billing solutions depending on the customer segment that is being addressed (Appendix 17 – Q7.2). What emerged is that, for the time being, going to provide segment-oriented solutions in the near future, is a rather unlikely implementation scenario for utilities ($M = 2.2.6$; $SD = 1.31$).

11.4 IMPROVE Workshop 2 - insights gained

The present research activity also included the running of a second set of workshops and conducted in the three language regions. These provided an important opportunity for exchange between researchers and utilities. Indeed, these meetings were very useful for collecting more qualitative information in regard to how utilities perceive the question of enhancing billing information to raise customers' energy awareness and what barriers are currently hindering this process in their perception.

Overall, 4 utilities from Ticino (AEM SA; AIL; SES; AMB), 2 utilities from Romandie (SIL; SEY) and 3 utilities from Deutsche Schweiz (EKS; BKW; SGSW) took part in these workshops.

11.4.1 Data availability and customer segmentation

All participating partner utilities expressed interest and acknowledged the importance of proposing more personalized and segment-oriented billing information in future. However, two main critical points were mentioned, currently delaying the achievement of this goal:

- difficulties in defining segmentation criteria and setting a benchmark for different consumer classes, based on their household's structural energy consumption level (e.g. type of building; electrical appliances equipment; type of heating system, etc.);
- difficulties in accessing personal data that falls beyond the mere information of one's household energy consumption (e.g. number of occupants; socio-demographic information; habits; energy awareness, etc.), especially in the context of new privacy data protection regulations;

Indeed, the more data is available to the utility, the more personalized and detailed the informative content of the bill can get. However, this crucial aspect does not depend solely on the utility itself, but also on the willingness of the customer to provide this personal data. This requires pro-active customers who are willing to provide data to the utility for the processing of more personalized information. This latter outlook remains also true in the light of future technological development and a nationwide smart meter roll-out. As one partner utility highlighted, even though smart meters make real-time energy consumption data (every 15 minutes) available, for privacy reasons, customers must still give their consent to use this data. It's the paradox of today's society: a growing number of people seeks to receive services with personalized data, but at the same time, is often not very willing to give consent to the processing of their own data.

Yet, even if the problem of data protection is by-passed, defining customer segments represents probably one of the greatest challenges to utilities. In fact, one big concern of utilities participating in the workshops was that households are too differentiated to be able to correctly profile appropriate energy-related categories and provide peer comparative statistics taking into account all the possible combinations of household types. Just to cite a few examples, the type of electrical equipment held by a household impacts significantly energy consumption. However, as this latter aspect varies significantly from household to household, if comparative statistics are wrongly applied, the risk is that the information provided to the customer is not meaningful.

What has also to be taken into account is the fact that data collection is an investment. First of all, the right data must be collected, then cleaned, then processed and, especially, regularly updated. Thus, implementation costs unavoidably increase and utilities, as suggested by one partner, need to find ways of covering these costs.



11.4.2 Secondary data sources

During the workshops, a series of useful suggestions were made with regard to secondary data sources for defining customer segments based on both non-energy-related, open-access data, and generic energy consumption estimates in order to bypass possible privacy problems in retrieving more segment-oriented data.

11.4.2.1 Energy consumption estimates at Swiss level:

- consult ELCOM¹² standard load profile or VSE table (e.g. the “H4 category” provides indications on the type of building (single-family house versus apartment) and the category of electrical appliances equipment held);

11.4.2.2 Possible open-access data for customizing information:

- consult federal building statistics (indicates the heating system of a building), address real estate brokers, consider a GIS browser (which includes age of the building, heating system etc.), identify the presence of special heat pump tariffs (will disappear in due time in some supply regions) or of separate tariffs for e.g. the electro boiler and basis versus choice tariffs in general;
- provide meteorological /climatic data in conjunction to the energy bill in order to allow customers the identification of possible higher consumption rates due to a higher use of the air conditioner or the heating system, without having to retrieve more precise and personalized data;

Furthermore, it has to be considered that the continuous rise of building digitalization, will help the utilities to collect the secondary data source, over the next decade.

11.4.3 IMPROVE solutions and utilities’ expectations

The time for enhancing billing information seems to be ripe. During the workshops, partner utilities reported about efforts being made to implement changes. Indeed, some partner utilities are currently conducting surveys with customers, others are promoting more ecological services, developing more personalized web portals, planning to improve data availability by means of smart meter installations or adopting more innovative services for marketing reasons to engage also with liberalized energy market needs in Europe.

Consequently, there is an interest in general to integrate graphical and personalized, segment-oriented information into their energy bill. Interestingly, in regard to the six IMPROVE solutions proposed, a solution similar to Solution 5 is soon going to be implemented by one of the contacted utility. Despite recognizing the problematic of accessing household/personal data, Solutions 1, 3 and 4 were also appreciated. Comments in regard to Solution 6 highlighted the negative and judgmental nature of this approach, thus suggesting to opt for more neutral solutions.

In more practical terms, providing a new bill format obviously implies cost investments and efforts that need to be discussed internally (see chapter 7 Existing DSI in Switzerland). Some utilities highlighted the fact that a new paper bill format would interfere with their automatic bill generation tool, something they are reluctant to. In addition, for many utilities a new bill format would imply additional costs since an external, private company is often partially or completely in charge of the billing process. Changing the display of the paper bill would therefore require an additional budget, making the entire process of enhancing bills more complex and expensive. Even the use of colored charts already causes operational problems for some utilities, because files become too “heavy” and lead to additional processing costs. Some utilities highlighted that current paper bills contain too many pages (in order to report all the necessary accounting information). Thus, many efforts are presently being made to shorten the current versions. Even testing a new paper bill format may cause some problems, since this would imply having two formats in place at the same time. Also, customers get used to the information provided on their bill and thus, changing too often information would be counterproductive.

¹² <https://www.strompreis.elcom.admin.ch/Map/ShowSwissMap.aspx>



Nevertheless, in regard to the possible enhancement of future paper bills, partner utilities made the following suggestions:

- if a new bill format is introduced, it would be better to change the bill format for all clients, rather than testing in parallel different billing programmes;
- in regard to a possible enhancement of the paper bill according to the proposed IMPROVE solutions, the use of a supplemental sheet is suggested, since it doesn't underlie regulation and doesn't imply update of billing procedures, which seems to be rather effortful;
- comparison of electricity and gas consumption would be important to highlight the relevance of heating energy consumption;
- in addition, respective energy-saving tips should be provided;

Yet, many utilities remarked that improving the paper bill represents the most expensive and the most limiting option. Instead, the use of an online portal allows to collect data at a lower cost and with fewer management problems. One utility highlighted the fact that with a nationwide roll-out of smart meters, this will automatically become the future billing evolution.

And indeed, some utilities already report that:

- their company's current focus is on developing web portals to provide historical consumption data to customers;
- they have already introduced comparative statistics;
- they have registered an increase in web portal users in the last few years;
- they are engaged in some "Smart City" pilot project involving online digitalization of energy consumption data.

In general, therefore, utilities seemed to be:

- more reluctant to investing into improvements to the paper bill, because it's associated with a series of limitations (space, format, paper printing) and additional, higher costs;
- more eager to promote their web portal, also for marketing purposes.

11.5 Chapter's conclusions

The main aim of this report was to frame and summarize utilities' needs and concerns in the context of enhanced energy billing in general, and of the six IMPROVE solutions proposed within this research project in particular. In regard to the inputs received from partner utilities by means of both the online survey and the IMPROVE workshops, both *general* and more *specific conclusions* (in regard to the IMPROVE solutions) can be summarized as follows:

GENERAL CONCLUSIONS

- utilities seem to agree upon the fact that a more user-friendly, graphical visualization of energy consumption data may be of advantage from the customer's point of view; at the same time a graphical format will imply higher hardware, planning and software costs;
- currently, one of the most pressing problems seems to be utilities' difficulty in retrieving the necessary data to make billing information more personalized and segment-oriented. Indeed, to improve the informative content of energy bills, the data provided to the customer is no longer strictly limited to information regarding customer's energy usage over time, but needs to extend also to other information fields (building type, number of occupants, electrical appliances equipment, heating system, socio-demographic information about the customer, education, energy awareness, etc.).
- for the majority of utilities involved in this study, the availability of high frequency energy data (real-time or monthly interval) is still difficult due to a low smart meter coverage present in the sample. This reflects important limitations to both the "granularity" and "frequency" with which energy usage data can be currently provided to residential customers;
- undeniably, a new customer role is also required, i.e. one of the so-called "active" customer, where the involved person is willing to provide data to the utility for the processing of more personalized information. This latter outlook remains true also in the light of future technological development and a nationwide smart meter roll-out: even though smart meters allow the collection of real-time energy consumption data (every 15 minutes), for privacy reasons, customers must still give their consent in order for utilities to use this data.



- due to the above mentioned methodological and technical barriers in retrieving the necessary data sets, no example of peer household comparison is yet in place or reported by the utilities taking part in the present survey;
- providing historical (annual) consumption data is a practice on the rise in Switzerland;
- focusing on the improvement of the paper bill is being regarded by utilities as the most expensive and most limiting option. Utilities seem to be more open and eager to promote web portals, also for marketing reasons;
- in general, partner utilities reported to be interested in cooperating in possible follow-up activities of the present IMPROVE research project and to be willing to test some enhanced bill version accompanied by scientific evaluation.

SPECIFIC CONCLUSIONS (linked to the IMPROVE Solutions):

- no clear preference for a particular IMPROVE solution resulted. However, Solution 1 has been rated as the most likely to be implemented (easy to update the existing bill format) and Solution 6 as the most unlikely (too judgmental towards the customer).
- Solution 4 is the one IMPROVE solution explicitly reporting also trends in historical consumption data. This approach seems to align demand and supply, since it has been appreciated very much by both customers and utilities. However, the current version (based on monthly consumption data) is yet only feasible in those cases in which utilities are provided with smart meters;
- Solution 2, introducing an energy efficiency label to improve the informative content of energy bills, is very much appreciated by customers (61%), however, from a utility's perspective this approach causes implementation problems and, on average, is rated as a rather "unlikely" Solution to be implemented;
- when confronted with the possible IMPROVE solutions presented in this research project, utilities seem to see a limited impact of these solutions in raising customer satisfaction, even though findings from the (chapter 10) customer survey show that solution 2 and 4 have gained a much higher acceptance compared to the existing tabular format currently used to communicate energy usage information.

Although utilities agree upon the fact that a more user-friendly, graphical visualization of energy consumption data may be of advantage towards their customers, utilities find it difficult to retrieve and process precisely that data needed to profile and consequently differentiate households on the basis of their energy usage levels (real-time data, building type, number of occupants, electrical appliances equipment, heating system, socio-demographic information, etc.). This aspect thus still remains an important challenge.

Due to this methodological and technical barrier, peer household comparison is not yet affirmed as a common practice in Switzerland and some more efforts are needed to be made in this direction.

Overall, the findings allow to identify a series of recommendations to Swiss utilities for future improvements of DSI:

- more efforts are needed to develop a methodology for defining and benchmarking the different possible customer segments based on their household's energy consumption level (e.g. type of building, electrical appliances equipment, type of heating system, number of occupants, socio-demographic information, education, energy awareness, habits, etc.) - one possible solution to overcome this issue could be that the SFOE or FSO provide such reference households' data, which could then be used by utilities;
- more efforts are needed to involve customers as "active players" in this billing enhancement process in order to be able to access personal data that falls beyond the mere information of one's household energy consumption, especially in the light of both new privacy data protection regulations and increased smart meter roll-out;
- it seems that, currently, the easiest data computation for utilities to deliver is the change in energy consumption (%) over a given billing period and historical comparison of annual consumption data. This represents thus a first, possible cost-effective and feasible way of enhancing energy bills;



- at the moment, as utilities seem to be more confident in calculating the correlation between energy consumption and temperature/weather conditions than profiling customer segments based on different energy consumption levels, this latter kind of approach might reflect a viable opportunity of billing enhancement worth investigating further for possible future DSI strategies' development;
- even though implying higher hardware, planning and software costs, the graphical illustration of energy consumption data presented by the IMPROVE solutions seems to be the way forward and has been rated as slightly more beneficial in terms of customer satisfaction, fidelity and utility reputation;
- a monitoring and evaluation process should also be put into place, in order to be able to investigate on the real impact of the enhanced energy bill on energy consumption and energy-saving behavior of customers;
- Utilities need to clarify internally if it is cost-effective and feasible for the company to invest in paper bill enhancement. Currently, the tendency seems to be that of investing in the development of an improved online web portal, which would allow to overcome difficulties of collecting user profiling data, by asking them directly through the web portal. On the other hand, paper (or digital) bills still represent an important contact point between utilities and consumers. Thus, a more in-depth consideration of the matter surely needs to be made.
- considering that the energy bill (paper or digital) is, so far, still the only systematic contact reaching *every* utility's customer, its role as an energy feedback device should not be undermined and should somehow continue to be included into utilities overall strategies. Despite a growing electronically mediated access to energy information, providing additional energy information near the invoice amount, may still rise the consumers' energy awareness and/or be a mean to drive customers to the utility's web portal containing more information and analytical resources.



12 Next Step

The IMPROVE project has studied the concept of applying enhanced Demand Side Information (DSI) elements to energy bills as a way to raise consumer's energy awareness and reduce the energy consumption of Swiss households.

Within the chapter 7 and chapter 8 the existing approaches in Switzerland and abroad have been listed, introduced and characterised. While it has been shown that many advanced DSI approaches are used by energy utilities abroad, it has also been highlighted that only few Swiss utilities are applying such methods to communicate the level of energy consumption to their customers.

Based on the state of the art compiled in chapter 7 and chapter 8, chapter 9 proposed a set of six so-called "IMPROVE" solutions, encompassing the key visual and informative elements highlighted in the previous chapters as to improve energy bill's content. These solutions incorporated various possible elements that could potentially interest customers (energy labelling, historical consumption, peer household comparison, comparison of actual and past consumption, etc.).

These solutions were then proposed to the customers via chapter 9 consumer satisfaction survey, including other key elements about the level of involvement and interest of customers towards their energy consumption. The chapter 10 has shown that customers were mostly interested in receiving more information to position their thermal and electrical energy consumption. While for electricity some efforts were highlighted by the customers regarding the information given by utilities, thermal energy seems to face a lack of equivalent information, especially for decentralised energy carriers (wood, oil). In addition, the survey also indicated that customers were only spending a very limited amount of time in "studying" their energy consumption. Finally, consumers stated that they would be probably more motivated in adopting energy efficient behaviours in case the information provided by the new DSI concept would show that they are consuming more energy than the reference values.

Finally, chapter 11 assessed the motivations and current barriers, from the utilities perspective in implementing additional information in their customers' energy bill. Findings from chapter 11 suggest that the utilities are willing to provide more enhanced energy information to their customers. However, the utilities find it currently difficult to define appropriate segmentation criteria (e.g. building type, number of occupants, electrical appliances equipment, heating system, socio-demographic information etc.), as well as to retrieve and process the corresponding data in order to subsequently group and compare similar households and to be able to set a benchmark for different consumer classes and ultimately characterize households' energy-saving performance (good, average, poor). This aspect thus still remains an important challenge to tackle: how can utilities retrieve the relevant customer data to make informative billing contents more personalised and meaningful?

Thus both customers and utilities expectations and possibilities need to be addressed in order to develop advanced DSI concepts in Switzerland.

All these chapters were performed in order to identify the need to go one step further in implementing advanced DSI in practice for the Swiss customers and to test their impact on the consumers as schematised in Figure :

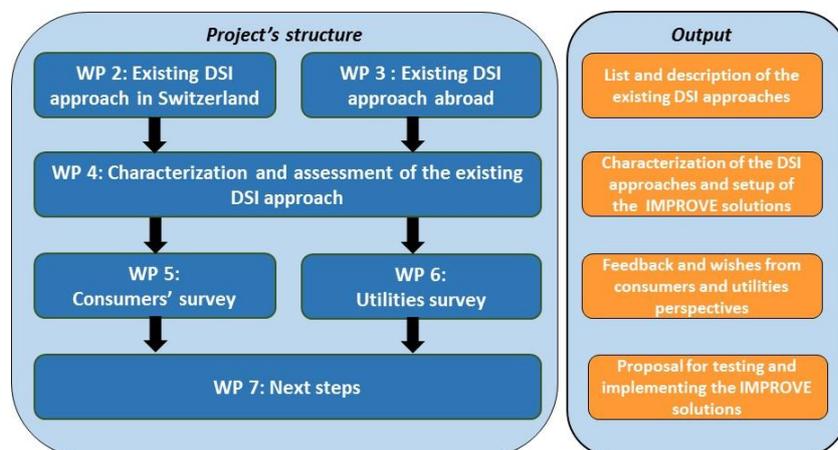


Figure 116 Global structure of the IMPROVE project and chapter 12 positioning



Within the chapter 12 “Next Step”, the IMPROVE partners propose some follow-up pathways in order to develop, implement and test advanced DSI in Switzerland, based on the results of the previous chapter.

In this next step, the focus is put on bill as the vector to disseminate the advanced DSI concept. Indeed, while other solution (dedicated communication on energy of web-based) could be in principle considered, it could either face a lack of interest from the consumers (chapter 10 highlighted the limited time invested regarding document sent by utilities) or either exclude a part of the population which would not be used to internet based solutions. For the following description of the next step, advanced DSI concept refers thus to a solution to be implemented on energy bills.

12.1 Preliminary remarks regarding advanced DSI implementation in Switzerland

The chapter 12 “Next step” proposal is developed based on the findings of the previous chapters. In order to incorporate a more informative and user-friendly content and visual display of household energy consumption in future energy bills, the consumer survey has highlighted several elements to consider in the next project steps focusing on the development of a more enhanced Swiss DSI model:

- The respondents are willing to get more information regarding their energy consumption level;
- This information should allow the consumers to position themselves against a reference group; in addition, the reference group should be as specific and geographically proximate as possible (e.g. neighbourhood);
- The information needs to be rapidly perceived by customers since they spend a very limited time reading their bills;
- The IMPROVE solutions are well understood by and interesting for consumers (see chapter 10 chapter); however, none of them was clearly identified as the solution to be implemented and tested; refining the visual solution to be implemented is thus necessary;
- The current energy information displayed to consumers varies with the type of energy: thermal energy vs. electricity.
- It appears that the owners are by far less informed about their energy consumption level than tenants are.

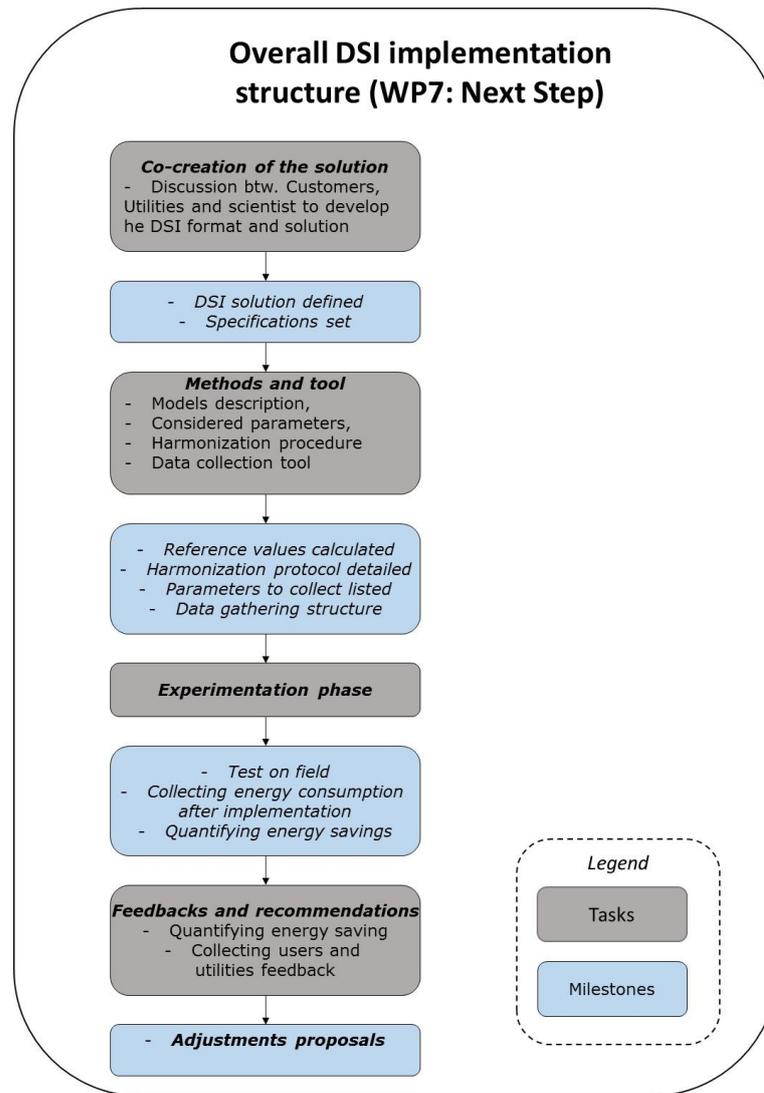
The utilities’ survey and interviews have also highlighted elements to be considered in the next steps proposal:

- Utilities are willing to implement new DSI concepts mainly to address customer satisfaction and to promote new energy services;
- Utilities identify the data collection for creating customer profiles as a major issue when developing new DSI concepts; this is largely due to 1) the low level of smart meter roll-out, which limits the time resolution of the data and 2) possible confidentiality issues regarding the necessary data from the households;
- Developing new DSI concepts requires robust and reliable calculation procedures which are, from the utilities perspective not available yet;
- The cost of developing new billing formats is a major concern for the utilities;
- Utilities are more willing to develop additional web-based solutions to display information related to energy consumption level than improving bill contents.

In addition, the work done and presented in the previous chapters, highlights the needs for improved billing formats (e.g. frequency, format, etc.). For more details, please refer to chapter 7, subchapters 7.2 and 7.3. All these aspects should be considered in the definition of next steps.

12.2 DSI general methodology

Based on the elements highlighted in the previous chapters (briefly summarised above), the general implementation methodology for possible next step to improve the quality of the energy consumption level of the consumers is described in the four following steps which are illustrated in Figure 117.



1. Co-creation phase for the refinement of the information and visual solution to be implemented in the advanced DSI concepts;
 - In this phase the co-creation consist in a joint development of the information and solution to be implemented on the bill. The co-creation consists in workshops (and eventually survey) involving all stakeholders (utilities, real estate companies, households, etc.) in order to propose an acceptable solution for all parties.
2. Design and development of the energy consumption reference value;
 - In this phase, based on the output of the co-creation phase, the calculation procedure that enable positioning the households' energy consumption levels toward reference value will be established. The reference values calculation procedure will also be developed and computed.
3. Experimentation ;
 - In this phase, the procedure developed above will be implemented over a sample of household in order to test the influence of this enhanced information over their energy consumption level.
4. Feedback and evaluation.
 - In this phase, based on the experimentation results, the feedbacks from all stakeholders will be collected in order to identify if the proposed approach is suitable for reducing the households' consumption level. Based on this feedbacks, a complete evaluation of the developed solution will be proposed and finally a set of recommendation will be made.



For each of these steps, a general description as well as the key elements to be considered are provided below. This is followed by the milestones list for each step as well as a descriptive assessment of the risks and opportunities.

It is worth to mention that a critical issue for the application of this framework has to be considered only if at least one utility agrees to develop such advanced DSI concepts. Indeed, it will imply a strong involvement from their side and a real motivation to co-create solutions with their customers.

Hereafter, each of the four phases listed above (see grey boxes) in Figure 117 are presented in more details.

12.2.1 Co-creation phase

The IMPROVE project has provided a strong basis for the development of new possible DSI solutions (format, content, practical needs, etc.). However, as summarised above, results gathered from chapter 10 and chapter 11 have highlighted some critical aspects that will have to be addressed in a follow-up project.

Particularly, it appears that utilities and customers have different expectations in terms of format, content and dissemination means. In addition, the utilities have highlighted a list of operational concerns, in terms of data collection, segmentation criteria, reliable benchmarking methods, costs etc. that need to be considered. At the same time, for innovation to set off in the energy bill panorama, also end-user collaboration and involvement in producing content are essential. Based on these observations, it is necessary to work closely on needs-finding, participatory design, and lead-user involvement to reach an acceptable solution for both parties.

A possible way for reaching an innovative consensus solution is to set up workshops and discussions (online or in real life) including utilities and customers, as well as researchers from various fields (engineering, social sciences, etc.) to exchange ideas about advanced DSI concepts. These open discussions will be used to co-create bill contents including all requirements, expectations and practical limitations. The innovative solution that will emerge from these co-creation workshops will thereafter be tested in a real-world setting with the aim of capturing user behavior.

This participative decision-making approach, named “co-creation step” is of strong interest since it allows a common agreement and development of the proposed solutions by all stakeholders. It also contributes to validating the innovation potential of the proposed solution in a “as-real-life-as-possible” context, ultimately, helping to minimize the high risks, costs and the unpredictability that characterizes in general all innovation processes.

12.2.1.1 Key points to be considered in the “co-creation phase” discussions

First, as stated above, it has been identified within the chapter 10 survey that customers spend a very limited amount of time reading their bills. Thus, it is necessary to ensure that the visual representation of the energy consumption level will be rapidly perceived and understood by the consumer.

The feasibility of this requirement needs to be validated by the utilities for which the billing format has been developed according to legal requirements, communication departments and sometimes externalised to other companies. It is thus necessary to identify if the modification of the bill format can be accepted by the utilities, in terms of cost, legal compliance and involvement to achieve the new bill format.

If it is not possible, it would be the utility’s choice to add the visual representation on an additional page of the bill but it would decrease its impact on the customer’s awareness. In any case (the consumption level representation according to one of the 6 IMPROVE solutions on the 1st page or later in the bill documentation), a description of the representation and how to interpret it should be added to the bill in order to ensure a good level of understanding of the displayed information.

Another important issue to consider, still in line with the time spent by the customer in analysing bills, is related to the bill support. While paper bills come into the mailbox and are, in general, manually opened, e-bills can sometimes appear only in the bank portal and be thus skipped, since the customer only needs to accept the payment. A large communication campaign might be necessary to inform the customers that new information regarding the energy consumption level is now displayed on the bills (specific initial communication per mail for example).



The frequency of the communication needs also to be considered. Indeed, in the previous activities of the present project, it has been identified that this aspect could play a significant role in the customer involvement. So far, when only considering paper bills, many of the utilities provide two types of documents, periodic instalments (prior to the previous year consumption) and once a year, a correction bill with the final account for the real consumption. Thus, the consumption level can only be calculated on an annual measurement basis. This frequency is not sufficient for ensuring the customer involvement in their energy consumption management (Serrenho et al., 2016). Indeed, if customers only receive once a year their consumption level, it might reduce their motivation to implement energy efficiency actions since they will not measure the influence of their efforts in a short-term perspective. In this case, it might be possible, either to increase the frequency of the bills (manually or with smart-meter), to work jointly with utilities that would have a higher frequency for their bills' release or to have a dedicated communication (for example on a monthly basis) on the energy consumption level. However, this dedicated communication plan could face a lack of interest from the customers, depending of the information pathway used and should be already addressed in the co-creation phase and subsequently be tested in the experimental phase.

A possible solution could be to send a monthly notification to the customer (smartphone, computer, etc. ...). The feasibility and interest of such approach should be tackled before implementation, with communication's experts (from the utilities or external professionals) and a panel of consumers. For the time being, the smart meter coverage in Switzerland is relatively low but it can be expected to evolve rapidly in a near future for the progressive replacement of the current metering systems.

12.2.1.2 Risks and opportunities

The risk related to this subtask is to have difficulties in:

- Reaching a common agreement between the involved stakeholders of the co-creation phase regarding the visual representation and final format of the new DSI concepts to be tested in a later phase;
- Implementing the innovative solution in practical terms by the energy utilities. Indeed, while it has been noticed during the project, that the utilities would be motivated in implementing on the bill more information of the consumer's energy consumption the shift between theoretical concepts toward practical execution could be complex since several utilities' departments would be involved with possibly different point of view on the proposed innovative solution.

Indeed, from the utilities survey, it has been identified that advanced DSI concepts, even if of strong interest for the energy provider, may face operational hurdles regarding the modification process of the billing format and the collection of the data, since these modifications imply new operational methods, as well as involve different units/departments of the utility or even support from external companies, as for instance for modifying the bill content and the printing. In any cases, the calculation methods and the data needs will be clearly characterised in the next proposed task.

However, by engaging in an initial co-creation phase involving relevant stakeholders, it is possible to target and tackle these aspects more in-depth and to minimize risks. Thanks to the co-creation approach and the participative decision-making process applied, one can expect to find an acceptable and feasible solution for all involved stakeholders. With utilities and consumers both contributing to the development of the innovation proposal, participation and engagement will be high and solutions will better reflect and mediate stakeholders' actual needs. At the same time, the involved utilities will be highly interested in applying such solution. Thus, the effect of this new DSI concept could be enhanced by this initial step.

12.2.1.3 Milestones

From this first task, the following mandatory milestones are necessary in order to develop a possible implementation phase to improve the information on the bill and test on a large panel of consumers with motivated utilities:

- Selection and commitment of a group of partners, such as energy utilities, customers, psychologists, designers, to be involved in the co-creation group
- Definition of a protocol for collecting background information and insights around the topic and conducting co-creation workshops;
- Benchmark of the "current state" of energy-related behaviour and associated bill information, as to allow the measurement of the potential impact and effects of the subsequent experimentation phase of the possible next step;
- Clear definition of the DSI solution (visual solution and informative content) to be implemented on the bills;
- Characterisation of all bill format specifications (frequency, position on the bill, etc.)



12.2.2 Design and development phase

Once the visual elements and the structure of the new DSI concept, to be implemented with the bills, are fully defined (co-creation phase), the reference values that will be used to position the consumers' energy level, will have to be set. This implies (i) identifying household segmentation criteria and subsequently (ii) setting up a benchmarking process to be able to rank and classify households' energy performance (good, average, poor). To do so, two steps need to be considered:

- Definition of a calculation framework: propose reliable and transparent methods to calculate the reference values with the appropriate parameters influencing the energy consumption
- Collection of data and quality check: collect the parameters to be used for the reference values calculation and ensure their representativeness and quality.

It has to be noticed that these two elements, in order to be reliable, will have to rely on a large number of data to be statistically significant.

The utilities' survey has identified these two elements as the major issues, from their perspective, to implement advanced DSI concepts. The following sections of this chapter will draw the first considerations regarding these subtasks but should not be considered as exhaustive and fully set.

12.2.2.1 Definition of the calculation methods

In Switzerland, internet-based platforms exist and propose energy calculators or reference values for energy consumption of the households (e.g. Romande energie, ESR13, etc.). Sometimes, some information related to the equipment or households profile is asked, the lists of parameters are not fully consistent between platforms and the calculation method does not seem transparent enough.

Thus, it appears that the calculations of the energy reference values are not straightforward. Indeed, it requires to identify the parameters that influence the energy consumption and then to develop methods to adjust the consumption according to these parameters.

Considering electricity and thermal energy, as first insight (to be refined and enhanced in this next step subtask), some elements that drive the energy consumption are given in Table 41.

Factors	Heat consumption	Electricity appliances' consumption
<i>Building / Dwellings related factors</i>	- Building characteristics - Energy carrier	- Density and age of electrical equipment
<i>User-related factors</i>	- Household structure	
<i>Climatic factor</i>	- Meteorological conditions	-

Table 41 Issues to consider for the development of the reference values calculation method

Regarding the building/dwelling related factors, the influence of the building characteristics (insulation level, construction period, etc.) appears to be critical when considering the energy consumption level regarding space heating (Heeren et al., 2009). Thus, in this case it is necessary to get access to the building attributes. For the electricity consumption related to the appliances, the quantity and age of the electrical equipment is also a key element.

Regarding the user-related factors, the household structure (number of occupants, age, etc.) has an influence on the thermal and electric energy consumption (Jones et al., 2015). In addition, Serrenho et al. (2016) have shown that so far this aspect has been slightly neglected when considering energy feedback. Thus, the reference value to be provided to customers should consider these issues.

¹³ <https://www.romande-energie.ch/particuliers/electricite-compte-et-factures/tarifs-et-simulateur/simulateur-facture>
<https://www.esr.ch/fr/calculateur/>



The information regarding meteorological conditions should also be provided to customers, since they may largely affect heating consumptions. Lacking knowledge about them could lead consumers to wrongly assess the differences in their consumption levels between historical periods.

For this non-exhaustive list of factors, reference values should be set in order to finally achieve typical energy consumption levels. In addition to this, harmonisation procedures should be proposed for each of these factors. Indeed, these values have to be tailored to the local conditions or the household profile (to be defined according to the “guideline” provided by the co-creation phase i.e. the previous task). These adjustments would ensure meaningful comparison for the consumers.

For example, regarding thermal energy, adjustment of this needs also considering climate conditions. This climate harmonisation can appear as relatively simple to describe, however, other parameters will need much complex models and assumptions (e.g. construction period of the building and corresponding thermal energy needs).

Finally, once the reference values are defined, it will be necessary, depending of the DSI solution adopted in the co-creation phase, to characterise classes. Indeed, for example, in the IMPROVE solution 2 (energy labelling such as for electric appliances), there are 7 energy categories to be characterised. So depending on the solution agreed upon between consumers and utilities, this aspect will also have to be considered in this step.

12.2.2.2 Data collection for the reference values calculations

Once the parameters to be used for the calculation and the harmonisation methods are defined, it is necessary to characterise and collect them. This part of the new DSI implementation is complex and might be a major issue to solve.

Indeed, the relevant parameters can be numerous and need to be collected among different actors (utilities, households, real estate companies, etc.). The utilities must be able to collect data regarding consumers with a good time resolution. In addition, regarding the reference values calculation, the utilities should assess the feasibility of geo-dependant energy comparison for the energy consumption. This later element is not fixed yet, since the advanced DSI requirements will be set during the co-creation phase. However, it is worth to mention that the results of the consumers’ survey oriented this preference towards a rather local level of comparison. The real estate companies and cooperatives could also be involved in providing data for the reference value calculation. Indeed, they could provide the details regarding the building envelope (e.g. past renovations) and technical installation management. Finally the households would have to agree in providing some data regarding their composition (e.g. number of adults, children) and their electrical equipment. This agreement could be proposed to the consumer via a letter of intend to return if they are willing to participate to the experiment (next project phase).

In addition, the issue regarding willingness to transmit this information from the stakeholders to the utilities and related privacy concerns has to be solved. The polemic of the data collection related to the new “Linky” smartmeter in France¹⁴ is an example of the issues the utilities can face regarding the data collection from the households. In any case, the co-creation task proposed as a first step of the advanced DSI implementation, could facilitate the data collection by offering an acceptable solution for the energy consumers.

In order to ensure the collection of the relevant parameters for the advanced DSI implementation, the energy consumers should agree in providing the data enabling to position their energy consumption level. Based on this agreement, the utilities could setup a platform to collect the data.

Once statistically significant data has been collected, their post-processing will be required. Sets of data will have to be cleaned from incomplete information and possible outliers. Thereafter, a comparative analysis of households’ groups with similar characteristics or with an energy best-practise will need to be run in order to be able to benchmark energy performance and set classification schemes.

12.2.2.3 Risks and opportunities

The implementation of the energy bill improvement aims at providing meaningful information towards households to position their energy consumption. It requires to find the appropriate format for the communication and the information to be displayed (as set, in principle) in the co-creation phase, but it also requires to develop models that provides correct information regarding “typical energy consumption level”. Gathering such values implies a close collaboration between all the stakeholders and especially

¹⁴ https://www.liberation.fr/checknews/2018/03/29/quelles-sont-exactement-les-polemiques-autour-des-compteurs-linky-lesquelles-sont-justifiees_1653329



between the utilities and the households. Without this collaboration and the data exchange, the reference values could be non-representative and thereby difficult if not impossible in influencing the energy consumption level of the households.

The main risk for this step is thus to fail in finding an appropriate way to collaborate between the stakeholders. However, this risk should be overcome by an appropriate selection of partners, motivated to improve the current situation. Indeed, while in the first phase of the proposed “next step”, the stakeholders are involved in the co-creation phase of the DSI concept, in the second phase of methodology development, the same stakeholders could improve the data exchange.

12.2.2.4 Milestones

- Calculation methods for defining the reference values regarding the typical thermal energy and electricity consumption level;
- Identification of the parameters to be collected for the reference value calculation;
- Setup of a data collection protocol agreeable for all stakeholders;
- Comparative analysis of energy use in households with similar characteristics or with a best-practise household obtained from the database created for benchmarking process.

12.2.3 Experimentation phase

The experimental phase consists in the implementation and testing of the enhanced energy bill developed during the two previous phases in a real-life context. The experimentation phase will thus involve:

- An inclusive and representative constituency of end-users in the testing:
 - In this step of the experimentation phase, it would be necessary to constitute the testing group. To do so, it is necessary to identify first one or more utilities that would be willing to modify their bills for some consumers in order to include the co-created concept.
 - Then, it would be necessary to constitute the experimental sample, made of households. Indeed, as the proposed solution has been co-created during the respective workshops by a restricted group of stakeholders, the upscaling, to a representative sample enabling a reliable assessment of the advanced DSI concept, could help to identify some issues regarding the developed structure. The upscaling could be made by involving the stakeholders of the co-creation phase (real estate companies, utilities, consumers), and/or via an advertisement campaign.
- Quantifying the energy-saving effect of enhanced billing/DSI:
 - The households have stated in the IMPROVE project, that they would like to receive information enabling to position their energy consumption level. They also stated that in case this information would show a higher consumption than a reference, it would drive them into a more efficient behaviour. The quantification of the energy saving potential has to be made to confirm the relevance of the developed concept.

12.2.3.1 Structure of the experimental phase

Within the experimental phase, three subtasks are proposed:

- Communication and recruitment of end-users;
 - The utilities involved in this phase should be the communication vector toward the households in order to recruit a sufficiently large number of participants. Based on the IMPROVE project experience, it has been seen that with the help of motivated utilities, it is possible to achieve an important participation rate. Moreover, if real estate companies would be involved within the co-creation phase, it could be possible to communicate via their network about the experimental phase. Finally, advertisement campaign could also be considered;



- Presentation of the new “energy bill prototype” to its users;
 - Once the consumers’ sample have been defined, it would then be necessary to develop a specific initial communication in order to present them the experimentation and also to collect the necessary data to position their energy consumption level. For this later point, a framework specifying the data needs and the confidentiality concerns will have to be specified. This specific communication will have to be discussed by the experiment managers in order to avoid introducing bias over the sample (Hawthorne effect) ;
- Setup of the experimental sample protocol:
 - Within this phase, the characterisation (number, eventually household characteristics) and the identification of the participation group has to be made. The involved utilities would be in charge of the communication towards their customers in order to enrol a large sample of participants;
 - Once the participation group is defined, it will have to be segmented into two homogeneous sub-groups. The first one will be the control group (i.e. still receiving the standard energy bill), and the second will be the test group (i.e. receiving the advanced DSI bill);
 - Moreover, the duration of the experiment will have to be defined in order to measure the energy saving and the persistence over the time regarding the energy saving potential;
- Experiment:
 - Establish a baseline in regard to energy consumption of the experimental groups (treatment and control group) in order to be able to monitor and evaluate changes prior and after the intervention;
 - During the experiment, the household structure could change (e.g. additional children, move into a new dwelling, etc.) thus it will be necessary to ensure a follow up of the participation group in order to adjust the energy consumption reference value and also to capture external factors (i.e. not related to the advanced DSI concept) that could influence the energy consumption level;
- Measurement and monitoring of the energy savings achieved:
 - Energy consumption (kWh) of involved households is recorded pre- and post-intervention in order to assess if the advanced DSI concept over the bills would have an influence on the energy consumption level of households. It might be interesting to have two different consumers’ population. One with and one without smart-meter, to analyse if this technology may influence the consumers behaviour in his energy consumption, due to a better accuracy in recording the energy consumption for short time period billing ;
- Monitoring trough time energy-related behaviour of some households (socio-demographic, psychological) with contextual and structural factors :
 - Elaboration of a questionnaire to be launched for a pre- and post-intervention survey to assess the potential savings as a function of the households attributes could also be investigated in order to identify the population segments that could be more or less sensitive to the DSI communication;

Optionally, it could also be possible to improve or develop new links between the proposed DSI and DSM (i.e. implementation of energy efficiency measures). Indeed, from the survey it has been highlighted that the customers would get information regarding their energy consumption level but they would also eventually get information regarding ways to reducing it. Single information, by itself might be not enough and it could be necessary to offer a “one step further approach” including energy coaching, as it may already exist in some institutional utilities.



12.2.3.2 Risks and opportunities

The involvement of a representative number of participants willing to provide the necessary data to the utilities (to setup the advanced DSI concept) is necessary. The major risks of this step are low level of participation and/or low involvement from the households (required data not provided). However, it has been seen in the IMPROVE project that with the utility's help, it is possible to encourage a significant number of participants to answer the consumers' survey. It is thus possible to expect that, with an appropriate communication scheme and pedagogy and with motivated utilities, these risks may be overcome.

Regarding the field of application of the developed DSI (thermal or electricity), it seems that thermal energy is slightly more complex to address than electricity. Indeed, it requires to collect more data for characterising the energy consumption but also to take into consideration the specific interaction between the various stakeholders. Moreover, the ownership structure makes the application of DSI for thermal energy more complex to implement. This might be the reason why less experiments appear to have been implemented in this domain. While it is challenging, the proposed possible next step could be an interesting opportunity to assess the feasibility and relevance of applying DSI to thermal energy.

Developing such advanced DSI experiments in Switzerland involving the scientific community, utilities and other partners such as real estate companies or public authorities would be a great opportunity to involve the population in the energy transition. Switching from a "top-down" approach (i.e. scientists or utilities developing concepts for energy savings of households) to a "bottom-up" approach (development of concepts considering the households practical expectation) could be an interesting paradigm shift to be tested in Switzerland.

12.2.3.3 Milestones

- Measurement of energy saving impact of the innovative energy bill proposed is assessed for the implemented DSI solution;
- Survey of energy-related behaviour of participating households before and after the introduction of the enhanced bill;
- Comparative analysis (qualitative and quantitative) with the reference control group (receiving the old version of the bill) in terms of:
 - Energy-saving;
 - Energy-related behaviour;

12.2.4 Feedback and evaluation phase

The main aim of this final feedback and evaluation phase is to analyse the energy consumption evolution of the involved consumers over a certain period (at least two years). These results will be analysed with all stakeholders involved and, if needed, it may require to revisit the bill format. This continuous feedback process could be proposed to a reduced sample of participant, to study the influence of the communication on their energy consumption level and also to assess the persistence of this influence over the time. In complement to the continuous feedback process, a general feedback survey should be proposed to all participant at the end of the experiment. This survey, made on consumers which would not have been following during the experimental period would allow to identify the perception over a large sample which has not been disturbed by regular exchange with the experiment managers.

12.2.4.1 Structure of the feedback phase

Based on the experiment results, it would be necessary to collect utilities and households feedback by means of post-intervention interviews and focus groups with end-users and utilities in order to evaluate and validate the tested energy billing innovation solution. This feedback would enable identifying the perception of the participants regarding the new proposed way of communication, through either a survey or specific interviews. Ideally, the feedback would be correlated with the energy saving achieved by the household as well as its socio-demo characteristics. Based on this cross-assessment, it could be possible to propose modifications in the DSI concept in order to increase the energy saving potential. A complete feedback should be collected at the end of the experiment. In addition, during the experiment, it would be necessary to select a reduced sample of participant that could be interviewed periodically (rolling survey) in order to assess their perceptions on the communicated information over the time.



Moreover, ex-post discussions with the utilities should be conducted. These discussions could also highlight some possible improvements and refinements of the tested solution. They could also serve to assess if the visual communication had an influence on the interaction with the customers (increase of questions regarding energy consumption or increase participation to energy efficiency programs).

Developing an advanced DSI concept can hardly be a silver bullet. The collection of feedback could help to identify the weaknesses of the developed solution and improve its reliability and effectiveness towards reduction of the energy consumption. Based on the feedback and the developed methodology (presented above), a guideline with recommendations to synthesize the good practices to apply when developing advanced DSI concepts considering the Swiss context could be published.

12.2.4.2 Milestones

- Feedback from all stakeholders involved in the process;
- Guidelines with recommendations;

12.3 Perspectives: linking DSI to DSM

The IMPROVE project focused its research on Demand Side Information (DSI), especially on improving the information on the consumer's energy bill, to allow him to better evaluate its level of energy consumption. DSI has been identified as an interesting way to increase the consumer awareness about their energy consumption levels.

From previous existing research work, it has been found that DSI can enable reductions in energy consumption since the consumers would have a comparison value and implicitly, an incentive to do better and therefore would be keener for more information on energy efficiency at home. While behavioural change can reduce energy consumption, it will consequently be necessary to link it with Demand Side Management (DSM).

DSM would help the consumers to get a more in depth knowledge on their energy consumption and the possibility to reduce it. It seems highly plausible that DSI will lead to the implementation of DSM concepts. Thus, assuming that the proposed "next steps" are implemented in practice, assessing the perception of the consumers and the utilities on the way to bring these two concepts together consistently will be relevant.

12.4 Chapter's conclusions

The IMPROVE project has addressed several aspects related to Demand Side Information (DSI) on energy consumption. The project paved the way to implement advanced DSI in a test phase. The Chapter 12 "Next Step" proposes a possible way to test new DSI concepts regarding the level of consumption of energy consumers, based on the elements collected in the previous chapter.

It has been identified that advanced DSI concepts strongly rely on the implication of the various stakeholders of the energy field (mainly the utilities and the consumers). Thus, the proposed implementation scheme is based on this observation and requires a collaborative approach. The "co-creation phase" concept is a promising concept to create this synergy and collaboration between the partners. Indeed, this bottom-up concept, while potentially more time consuming than the traditional top-down approach, shows great advantage to bind the partners together and to create a common vision on a given problematic, here the need for more information regarding the energy consumption level.

Based on this central concept of co-creating a solution that would be acceptable for all, the requirements of reliable methods for calculating meaningful energy consumption levels have been discussed. The complementary need of data collection has been discussed. For both aspects, first insights were highlighted and discussed.

Finally, based on the co-creation phase and the reliable methods developed, the experimental phase is considered, representing a first step in the road of success towards a better information given to households.

Developing advanced DSI concepts in Switzerland can appear a complex task, however, it answers a need expressed by both the utilities and the households. All the elements are available to achieve a significant energy savings but further investigation is needed to reach this goal.



13 Conclusion

The Swiss Energy Strategy 2050 aims to increase the use of renewable energy and the energy efficiency of buildings, mobility, industry and appliances. An additional important element of this strategy is the reduction of the energy demand in Swiss households, which requires a change in energy consumption behaviour.

An important driver for promoting the change of energy consumption behaviour of private households can be seen in the information available to the consumer. This information could raise the consumers' awareness on their level of energy consumption and, encourage them to search for tips on how to reduce their energy consumption and to target the most efficient measures they can enforce.

The point of departure of the IMPROVE project is the lack of information, on the energy bill, to help consumers to position their level of energy consumption as a trigger to encourage them for changing their behaviour.

The objectives of the project were to collect best practices on presenting households' consumption in Switzerland and abroad, to assess the consumers' interest on enhancing the information available on the energy bill of the Swiss households, to rank proposals of enhanced energy bills as well as to evaluate their implementation potential with energy utilities. The following activities have been undertaken to meet these objectives:

- A literature review on the important factors affecting the energy consumers' behaviour,
- An assessment of energy bills in Switzerland and abroad, in order to identify and characterise current practices, main informative contents and design elements,
- The development of six different information layouts for improved energy bills, helping consumers to have a better evaluation of their energy consumption level,
- A national survey conducted to evaluate energy users' opinion on the type of information currently available in their energy bill and to gauge their interest among the six enhanced layouts developed previously,
- A survey targeting all Swiss utilities and three workshops involving a selection of them, aimed at exploring their viewpoint on the six enhanced bill layouts, according to a cost-benefit approach and the feasibility of implementation,
- The development of recommendations for the Swiss energy utilities for possible improvements of their energy bill from the customers' point of view, and possible pathways to develop and implement enhanced energy bills and to test their effectiveness in a large scale intervention.

These activities have led to the following main findings:

Consumer's point of view

A national survey conducted to evaluate the consumer's satisfaction regarding the information currently available on their energy bill, has shown that:

- Over 90% of customers currently receive paper bills,
- Almost half of the consumers spend less than five minutes to read their energy bill,
- Only 14% of the consumers receive a qualitative or quantitative information to position their energy consumption. And 75% of the remaining consumers, are interested to receive such additional information,
- Information about one's own consumption and energy costs is of great interest to the customer. Two thirds of the energy consumers wish to compare their energy consumption with equivalent households of the neighbourhood and are willing to put into place energy-saving actions if their consumption is above average,
- Two third of the consumers who would receive additional information regarding their level of energy consumption are incited to reduce their consumption.



In summary, current bills contain hardly any information that could rise customers' awareness on their energy consumption. Despite a good understanding of the current energy bill, consumers are interested in bill's enhancement with more information on their level of energy consumption, including a reference energy consumption, for instance the average energy consumption of their neighbours, , to encourage them to implement energy saving actions.

Utilities point of view

In order to assess the point of view of the Swiss energy utilities, a national survey and workshops were conducted. The aim was to evaluate their motivations and the cost/benefits for enhancing information on their energy bill. The energy utilities' survey has pointed out the following issues:

- The three main motivations to enhance the information in the bill are 1) consumers satisfaction, 2) need for transparency and 3) promotion of utility's energy consulting services.
- Utilities agree on the need for more user-friendly visualisations of energy data (even if associated to higher costs) and segment-oriented, comparative statistics. The graphical illustration of energy data is beneficial in terms of customer satisfaction, fidelity and reputation,
- The availability of high frequency energy data is difficult due to a low smart meter coverage and its slow dissemination. Many years are still required in order to get all Swiss households connected to a smart meter.
- The energy utilities are putting efforts in the development of their web portals and are mostly reluctant to change the bill content, as it is a complex internal process involving different services within the company and has some indirect costs when the bill layout development is outsourced.
- Currently, for energy utilities, the easiest data computation to deliver is the change in energy consumption over a given billing period and historical comparison of annual consumption data.
- The utilities are more confident in taking into account the weather correction than profiling customer segments based on different socio-economics or location.
- Currently, the utility tendency is to invest in the development of their web portal and not to improve the bill layout.

In summary, the energy utilities are aware of the consumers' need for additional energy information on their consumption and are interested in providing them with information allowing comparisons with reference energy consumptions. However, their capability of retrieving the necessary data (e.g. socio-demographic) to make billing information more personalised and segment-oriented is limited due to privacy and the slow diffusion of smart meters.

Whatever the enhancement provided by utilities in the future regarding the billing information, there is a clear need from the consumers' side to have more information on their energy consumption, and the utilities agree upon the fact that a more user-friendly, graphical visualisation of energy consumption data may be of advantage from the customer's point of view. Even if for utilities the cost of enhancing the energy bill may be a barrier, for the national energy policy the potential energy saving might be interesting.

In addition, the slow smart meters rollout along with limitations regarding household data access due to personal privacy are also issues to consider when developing a methodology for defining and benchmarking different customer segments. In contrast, some foreign energy utilities have already overcome these issues and are already offering enhanced information energy bills to allow consumers to compare their level of energy consumption with a reference energy consumption. These examples might lead the Swiss energy utilities to rethink some aspects of their communication strategy, if not business model, and to find rapid solutions for the near future.

The six enhanced energy bill proposals

To evaluate the consumers' interest in additional energy information on the bill, six different layouts have been designed based on best practices observed in the collected bills. The goal was to present a selection of proposals covering a range of different levels of information detail, as well as different possible layouts (e.g. diagram, table, etc.). This led to the following six layouts:



- Proposal 1: corresponds to the minimum legally required tabular format required for the electricity bill, with one additional element corresponding to a reference level of energy consumption.
- Proposal 2: corresponds to a label of energy efficiency classes, currently used for electrical appliances or cars (category A to G). It includes the corresponding energy consumption category of the households and a typical energy consumption reference.
- Proposal 3: presents a bar diagram, with five typical energy consumptions of a household, with one to five occupants, and the household energy consumption.
- Proposal 4: presents the time evolution of the energy consumption of the current and previous year. In addition, the energy consumption of the household is compared with an average energy consumption of households and with a typical household having a low energy consumption.
- Proposal 5: is similar to Proposal 3, however the energy consumption for each number of occupants is further detailed, with a range for low, middle and high energy consumption household.
- Proposal 6: does not provide any data on the energy consumption of the household, but only an emoticon (from very happy to very sad) depending on the number of occupants.

The acceptance of these six proposals have been gauged through a customers' satisfaction survey and the utilities' survey.

From the consumers' point of view, the Proposal 6 (emoticon) and Proposal 1 (tabular format) are the least preferred layouts. While Proposals 2 to 5 present the highest levels of understanding, with a similar percentage of "excellent" and "good" answers. Proposal 4 is associated with the highest rate of consumers "interested" or "very interested" (65%) to help them to position their energy consumption.

From the utilities point of view, the proposal 1 (tabular format) has been rated as the most likely to be implemented, as it requests only a slight modification of the existing layout. Proposal 6 is unlikely to be implemented because is found too judgmental towards the customer. Proposal 4 comes second, although only feasible for utilities providing smart meters, otherwise reporting frequency of the energy consumption has to remain annual.

In summary, the proposal 4 could be a possible layout to help the consumers' and the utilities' interests to converge, especially when smart metering is available. This first viable step to improve consumers' awareness in their energy consumption, would lead to a bill enhancement with a comparison of the past energy consumption over a given period, with a climatic correction for bills, such as the ambient temperature for heating consumption or daylight availability for lighting consumption.

Final consideration

So far, the energy bill (paper or digital) is the only systematic link between customers and their energy utility. Currently, it mostly provides only the mandatory information on their energy bill. Consequently, Swiss bills are often very similar in terms of content and presentation format. However there is a clear demand from the consumers for additional information on their level of energy consumption. Even if the first motivation for the utilities to enhance the bill information is related to the consumers' satisfaction, there is clear gap between what the consumers are expecting in terms of energy related information in the bill and what is currently provided by the energy utilities.

Currently, the tendency among the Swiss energy utilities is to focus on the DSM rather than the DSI. The enhancement of energy bill is not a priority for them, as opposed to their web portal. So, the use of the energy bill to raise consumer's awareness on their energy consumption level and to encourage them to save energy will be difficult to achieve rapidly, due to the reluctance of the energy utilities to change the content of the energy bill.

Therefore, in order to achieve the Swiss Energy Strategy 2050 objectives, the enhancement of the bill's information should be promoted either from the regulatory authorities (such as ELCOM) or might come from the opening of the energy market that will rise the competition between utilities. Indeed, when analysing foreign energy bills, especially in countries with liberalised energy markets, it has been noticed that energy bills are more user-friendly for the consumers (e.g. providing graphical information on the household energy consumption level, overview of consumption evolution, etc.). Indeed, with the rise of the energy cost or when the time of a total liberalised energy market will come, the Swiss utilities providing enhanced energy related information on their bill will be more competitive to retain existing consumers or to gain new ones, especially with respect to foreign energy utilities already providing such enhanced energy bills.



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- Aziende Municipalizzate Bellinzona (AMB),
- Berner Kraftwerke (BKW),
- Elektrizitätswerk des Kantons Schaffhausen (EKS),
- Energies Sion Région (ESR),
- Service de l'Energie d'Yverdon (SEY),
- Services industriels de Lausanne (SIL),
- Società Elettrica Sopracenerina (SES),
- St.Galler Stadtwerke (SGSW).

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Finally, thanks to the kind help of some colleagues and friends abroad, it has been possible to collect 175 energy bills from foreign countries from Canada to Chile and from Brazil to Australia.



15 National collaboration

The present project has involved the following academic partners:

- FHNW : Jürg Bichsel, Bastian Burger, Dominique Kunz
- HES-SO : Stéphane Citherlet, Sara. Eicher, Pierryves Padey.
- SUPSI : Francesca Cellina, Roberta Castri, Roman Rudel
- ZHAW : Vicente Carabias, Uros Tomic, Evelyn Lobsiger

Two workshops have been organised with the following utilities to presents the outcomes of the project, to share their expectation in term of energy bill enhancement and to gather their feedbacks on the project:

Utility name	Canton
AEM – Azienda Elettrica di Massagno	TI
AIL – Azienda Industriali di Lugano	TI
AIM – Aziende Industriali Mendrisio	TI
AMB – Aziende Municipalizzate Bellinzona	TI
BKW – Berner Kraftwerke	BE
EKS – Elektrizitätswerke Schaffhausen	SH
ESR – Energie Sion Région	VS
SES – Società Elettrica Sopracenerina	TI
SEY – Service des Energies d’Yverdon	VD
SGSW – St. Galler Stadtwerke	SG
SiL – Services Industriels de Lausanne	VD

Mutual knowledge exchange with partners from other projects such as SCCER CREST, “Social Power”, “Energy chance” and “Promoting energy-sufficient behaviour in cities” has been continued for the benefit of the project progress.

Finally, the following paper has been submitted and presented:

- IMPROVE - Unfolding next generation demand-side information (DSI) models, 20. Status-Seminar «Forschen für den Bau im Kontext von Energie und Umwelt», Zurich, 6-7 September 2018.



16 International collaboration

The established contact with the operator of the IEA DSM - Task 24 Phase II could be used to gather additional international feedback and insights from related activities. Moreover, the international community in this field is also considered through participation at international conferences, such as ECEEE or ENRI 2017. In addition, ZHAW managed to be organizer of the next year's Behave edition: Behave 2018, the fifth European Conference on Behaviour and Energy Efficiency shall be held from 5th to 7th September 2018 in Zurich, Switzerland at ZHAW Zurich University of Applied Sciences (cf. www.zhaw.ch/behave)

SUPSI is involved in the EU H2020 project enCOMPASS which will implement and validate an integrated socio-technical approach to behavioural change for energy saving, by developing innovative user-friendly digital tools to make energy consumption data available and understandable for different stakeholders.

At the CISBAT international conference (6-8 September 2017, Lausanne) a poster has been displayed by ZHAW, in which the IMPROVE project has been presented in a wider context "PVopti – hourly based energy balance for building design, Bastian Burger (main author), Monika Hall, University of Applied Sciences and Arts of Northwestern Switzerland, Institute Energy in Building"

The paper "How to improve energy billing information to induce energy savings ? - Insights from Switzerland" has been submitted and a poster has been presented at BEHAVE 2018, 5th European Conference on Behaviour and Energy Efficiency, Zurich, 6-7 September 2018.

Finally the paper "IMPROVE - Unfolding next generation demand-side information (DSI) models" has been submitted and a presentation has been given during the 20th Status-Seminar «Forschen Für Den Bau Im Kontext von Energ. Und Umwelt», in Zurich, the 6th September 2018 (Proceedings pp. 260–274).



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Appendix 1. Online survey for Swiss utilities' profile

Demand side information in Switzerland: Questionnaire for utilities

1. About this questionnaire

- To answer the questionnaire will take you about 15 minutes.
- This survey only considers the private sector of your company.
- If your company supplies more than one energy form (electricity, gas or district heating), please fill in one separate survey for each energy form supplied. → Please click again on the internet link we sent you.
- All answers will be treated confidential and anonymous and will not be available to third parties.

2. General information

2.1 About your company

- Company name: _____
- Contact person
 - Name: _____
 - E-Mail: _____
 - Phone number: _____

2.2 Please choose one energy form by declaring which amount of it your company supplies to households. The following questions will refer to this energy form. ¹

Form of energy		Amount of energy supplied per year
Electricity		GWh/year
Gas		GWh/year
District heating		GWh/year

2.3 What percentage of meter types do you use at present (percentage of all meters installed, check all that apply)?

Meter type	Not available	Percentage (%)
Analog meters	<input type="checkbox"/>	
Digital meters without remote readout	<input type="checkbox"/>	
Digital meters with remote readout	<input type="checkbox"/>	
Smart meters ²³	<input type="checkbox"/>	
Others, namely: _____		

¹ If your company supplies more than one energy form (electricity, gas or district heating), please fill in one separate survey for each energy form supplied

² Only for electricity (0)

³ Smart meters allow two-way communication with utility

2.4 What meter types do you plan to install in mid-term future (~5 years) for new installation and / or replacement (check all that apply)?

- Analog meters
- Digital meters (without remote readout)
- Digital meters with remote readout
- Bidirectional meters for buildings with photovoltaic plants⁴
- Smartmeters for buildings with photovoltaic plants (two way communication with utility)⁵
- Smartmeters for buildings without photovoltaic plants (two way communication with utility)⁶
- Others, please specify: _____

3. Billing practice

3.1 What percentage of households receives information about their energy consumption by the following format (check all that apply)?

Energy Information format	Not available	Percentage of households (%)
Paper bill by postage	<input type="checkbox"/>	
E-Mail (with bill as PDF attached)	<input type="checkbox"/>	
E-invoice (directly via e-banking / posfinance)		
Online account (Web portal)	<input type="checkbox"/>	
Mobile application	<input type="checkbox"/>	
Others, please specify: _____		

3.2 What percentage of households uses the following payment method (check all that apply)?

Payment method	Not available	Percentage of households (%)
Standard bill (payment slip)	<input type="checkbox"/>	
E-Invoice (directly via e-banking / posfinance)	<input type="checkbox"/>	
E-invoice with QR-Code		
Direct debit system (LSV)	<input type="checkbox"/>	
Pre-paid meter	<input type="checkbox"/>	
Pre-paid online service	<input type="checkbox"/>	
Others, please specify: _____		

3.3 What percentage of households receives the following billing plan?

Billing plan	Characteristics	Not available	Percentage of households (%)

⁴ Only for electricity (2.2)

⁵ Only for electricity (0)

⁶ Only for electricity (0)

Standard bill	=regular charging frequency of actual consumption	<input type="checkbox"/>	
Payment on account	=regular charging frequency of estimated consumption by means of advance payments and an annual adjustment balance	<input type="checkbox"/>	
Pre-paid ⁷	=irregular charging frequency, depending on actual consumption, paid as-you-go	<input type="checkbox"/>	
Other (please, specify):	_____		

3.4 What percentage of households receives billing information in the following frequency?

Billing frequency	Monthly	Quarterly	Biannual	Yearly	Irregular	Other
Percentage of households (%)						

3.5 What information do you display about the energy mix of the energy supplied (check all that apply)?

- Information about energy mix according to legal requirements
- Information about energy mix (e.g. part of water power, part of solar power, ...) ⁸
- Information about energy mix (e.g. part of natural gas, part of biogas, ...) ⁹
- Information about energy mix (e.g. part of waste combustion, ...) ¹⁰
- Information about energy mix only if a special energy product (e.g. naturemade star) is demanded ¹¹
- Information about energy mix only if a special energy product (e.g. biogas) is demanded ¹²
- Information about energy mix only if a special energy product (e.g. 100% renewable) is demanded ¹³
- Change of energy mix if another energy product would be demanded
- Others, please specify: _____

3.6 Do you display comparative energy consumption values (check all that apply)?

- No
- Actual consumption compared to own consumption of previous periods
 - to previous year/years
 - to previous months
- Comparison to historical mean values (e.g. mean swiss consumption for households)
- Comparison to more specific mean values (e.g. mean consumption of households in the neighborhood, to similar building types like single or multifamily buildings, ...)
- Others, please specify: _____

⁷ A prepaid charging system that gives customers the faculty to decide how much energy to purchase.

⁸ Only for electricity (0)

⁹ Only for gas (0)

¹⁰ Only for district heating (0)

¹¹ Only for electricity (0)

¹² Only for gas (0)

¹³ Only for district heating

3.7 Do you display the energy saving potential (check all that apply)?

- No energy saving potential display
- Energy saving potential (percentage of consumption or kWh) display according
 - to general potential (e.g. by replacing bulbs with LED more than 80% of energy used can be saved, ...) ¹⁴
 - to general potential (e.g. reducing room temperature by one degree in winter time saves about 6% of energy for heating, ...) ¹⁵
 - to mean values for consumption (e.g. mean swiss consumption for households)
 - to more specific mean values (e.g. mean consumption of households in the neighborhood, to similar building types like single or multifamily buildings, ...)
 - others, please specify: _____
- Display of the amount of energy that could be saved
- Display of cost that could be saved
- Display of environmental impacts that could be avoided
- Others, please specify: _____

3.8 Do you display information about the environmental impact (check all that apply)?

- No
- Display of environmental impact of consumption (e.g. CO₂-emission, ...)
- Display of reduction of environmental impact if a specific energy product is supplied (e.g. reduction of CO₂-Emission if electricity "nature made star" instead of "nature made basic" is supplied) ¹⁶
- Display of reduction of environmental impact if a specific energy product is supplied (e.g. reduction of CO₂-Emission if biogas instead of natural gas is supplied) ¹⁷
- Display of reduction of environmental impact if a specific energy product is supplied (e.g. reduction of CO₂-Emission if district heating 100% renewable instead of district heating basic is supplied) ¹⁸
- Others, please specify: _____

3.9 Do you give tips to save energy with the bill (check all that apply)?

- No
- Yes, tips are provided in the bill (or as attachment to the bill)
- Yes, tips are provided in the online account

¹⁴ Only for electricity (0)

¹⁵ Only for gas AND district heating (0)

¹⁶ Only for electricity (0)

¹⁷ Only for gas (0)

¹⁸ Only for district heating (0)

3.10 Do you explain the displayed values (check all that apply)?

- No
- Explanations are added directly to the bill
- Explanations are available online
- Explanations are available only by personal contact (E-Mail address or phone-number)
- Other (please, specify): _____

3.11 Regarding the information provided, what type of display forms do you use? (check all that apply)?

Type of information	Numeric or text display	Graphic display
Own consumption	<input type="checkbox"/>	<input type="checkbox"/>
Cost	<input type="checkbox"/>	<input type="checkbox"/>
Energy mix	<input type="checkbox"/>	<input type="checkbox"/>
Comparative values	<input type="checkbox"/>	<input type="checkbox"/>
Saving potential	<input type="checkbox"/>	<input type="checkbox"/>
Environmental impact	<input type="checkbox"/>	<input type="checkbox"/>

3.12 Please specify the number of pages of the customer's bill:¹⁹

- One page (inkl. Attachments and payment slips)
- Two pages (inkl. Attachments and payment slips)
- If more than 2 pages, please type in the number: _____

How many pages are attachments and payment slips? _____

3.12.1 Please mark on which page of the invoice you display information (check all that apply)²⁰:

Information ²¹	Displayed on		
	Page 1	Page 2	Page 3 or later
Own consumption			
Cost			
Production mix			
Comparative values			
Saving potential			
Comparative values for costs			
Environmental impact			
Tips to save energy			

¹⁹ Only for printed bill or bill as PDF (0), for payment on account: we look at the annual adjustment balance

²⁰ Only if two or more than two pages is ticked in (0)

²¹ Row displayed in the table correspond to the choice 0 -0: if no is ticked, the value will not be displayed in the table

3.13 Do you use information about the customer (additional to metering, e.g. number of persons in the household, living space, type of building services, ...) to display more specific / personalized information?

- No
- Yes

3.13.1 How do you obtain this additional information?²²

- They must be given by customer
- They can be given by customer
- They are available from other sources, namely: _____

3.13.2 Do the customers have to agree to use this additional information for further purposes? ²³

- Yes
- No

3.14 Do you display more information in the online account than on the bill itself?

- No
- Yes, there is additional information, please specify: _____

3.15 Do you provide supplementary information about consumption in addition to the bill (check all that apply)?

- No
- General (not personalized) information is provided (e.g. tips how to save energy)
- Personalized feedback (concerning own consumption or energy demanded) is provided
- General information with printed media is provided (e.g. newsletter)
- Information is provided by e-mail
- Information is provided on the utility's website
- Information is provided on other ways, namely: _____

4. Miscellaneous

4.1 If possible, please send a copy of an anonymized bill

4.2 Feedback (check all that apply)?

- Please send me the analysis of this questionnaire.
- Please send me the link to the final report of the IMPROVE project.
- You may contact me if there are further questions on my answers.

Thank you for your participation!

²² Only if Yes in 0

²³ Only if Yes in 0

Appendix 2. Energy utilities contacted for survey (VSE members)

Deutschschweiz	Elektra Gaiserwald	Elektrizitätswerk Vals
Wasser- & Elektrizitätswerk Walenstadt	EWZ Elektrizitätswerk Zermatt AG	EVS Energieversorgung Schänis AG
Werkbetriebe Frauenfeld	EGW Weiach Elektrizitätsgenossenschaft c/o Genossenschaft	Elektrizitätsversorgung Kaltbrunn AG
Elektrizitätsgenossenschaft Bubikon	EW Wald AG	Elektrizitätsversorgung Altendorf AG
Industrielle Betriebe Kloten AG	Elektrizitäts- und Wasserwerk Wettingen	Elektrizitätswerk Herrliberg
TBS Strom AG	Elektrizitätswerk Ursern	Energie Seeland AG
Technische Betriebe Würenlos	Elektrizitätswerk Uznach AG	EKT AG
Technische Betriebe Kreuzlingen	Elektrizitätswerk Sennwald	Energie AG Sumiswald
TB Gränichen Energie AG	EWS Energie AG	tbgs - Technische Betriebe Glarus Süd
Technische Betriebe Grabs Strom / CATV	Elektrizitätswerk Schmerikon AG	AEK Energie AG
Technische Betriebe Goldach	Elektrizitätswerk Samnaun Gemeindehaus	Elektrizitätsgenossenschaft Lufingen
Elektrizitätswerk der Gemeinde Bergün	Elektrizitätswerk Schwyz AG	Dorfkorporation Weite
eug Elektra Untergäu Genossenschaft	Elektrizitätswerk Rümlang	Wasser- & Elektrizitätswerk Steinhausen
Stadtwerk Winterthur	EW Rothrist AG	Kraftwerk Schaffhausen AG
Gemeindewerke Rüti Elektrizitätsversorgung	Genossenschaft EW Romanshorn	Industrielle Betriebe Kloten AG
Regio Energie Amriswil (REA)	Elektrizitätswerk Obergoms AG	Technische Gemeindebetriebe Hauptwil-Gottshaus
Technische Betriebe Weinfelden AG	Genossenschaft EW Münchwilen (EWM)	Einwohnergemeinde Lengnau Bau- und Werkabteilung
Elektrizitätswerk Vaz/Obervaz	Energie und Wasser Meilen AG	Romandie
Kraftwerk Schaffhausen AG	ewl energie wasser luzern	Services Techniques Tramelan
Arbon Energie AG	EWJR Elektrizitätswerk Jona-Rapperswil AG	Services Industriels Lausanne Service de l'Electricité
Elektrizitätswerk Obwalden	e & w Dussnang	Services industriels de Delémont
Elektrizitätsversorgung Würenlingen	EWD Elektrizitätswerk Davos AG	Services Industriels Lutry
Elektrizitätsversorgung Murgenthal	EWA Energie Wasser Aarberg AG	Services Industriels de Nyon
Kantonales Elektrizitätswerk Nidwalden	Energie- und Wasserversorgung Appenzell	Société des Forces Motrices de Chancy-Pougny SA
Elektrizitätswerk Obwalden	EV Gebenstorf AG	Services Industriels de la Commune de Fully
Liechtensteinische Kraftwerke	Energieversorgung Büren AG	Services Electricité, Energies & Développement Durable (SED2)
Stadtwerke Wetzikon	EV Energieversorgung Biberist	Yverdon-les-bains Energies
Elektrizitätswerke des Kantons Zürich	Energie Uster AG	GESA Gruyère Energie SA
die werke versorgung wallisellen ag	Energie Uetikon AG	L'Energie de Sion-Région SA (esr)
Energie Wasser Bern	Energie Thun AG	Energie Service Biel / Bienne
EBM (Genossenschaft Elektra Birseck)	Energie Pool Schweiz AG	SwissElectricity.com SA
Genossenschaft Licht- und Kraftwerke Glattfelden	Energie Opfikon AG	SWG
Elektrizitätswerk Urnäsch AG	Energie Gossau AG	SPONTIS SA
EW Aadorf	Energie 360° AG	Sinergy Infrastructure SA
ELEKTRA Bözen	Elektra Gams	Sierre-Energie SA
Elektrizitäts- und Wasserwerk der Stadt Buchs	Genossenschaft Elektra, Jegenstorf	Services Industriels de Bagnes
Technische Betriebe Elektrizitätsversorgung	Elektra-Korporation Wolfhalden EKW	Services Industriels Moutier
WWZ Energie AG	Elektrizitätswerk des Kantons Schaffhausen AG	Société des Forces Motrices du Châtelot (SFMC) c/o Groupe E SA
Werke am Zürichsee AG (Kuesnacht)	Elektrizitätsgenossenschaft Marthalen	Société Electrique du Val-de-Travers S.A.
Werke Wangen-Brüttisellen	EGH Elektro - Genossenschaft Hünenberg	Société Electrique de la Vallée de Joux SA
Thurwerke AG	Elektrizitätsgenossenschaft Gsteig	Service Electrique Intercommunal SA (SEIC)
Technische Betriebe Wil	EFA Energie Freiamt AG	Société Electrique Intercommunale de la Côte SA
Technische Betriebe Glarus Nord	EE-ENERGIA ENGIADINA	Société Electrique des Forces de l'Aubonne (SEFA)
tba energie ag	ebs Energie AG	Services Techniques de la Municipalité de St-Imier
St. Moritz Energie	Axpo Power AG	Romande Energie SA
SN Energie AG	Arosa Energie	Ville de Pully Direction des travaux et des services industriels
SH POWER	AEW Energie AG	EnAlpin AG
SATOM SA	a.en Aare Energie AG	Eli10 S.A.
St. Gallisch-Appenzellische Kraftwerke AG	Licht- und Wasserwerk Adelboden AG	Service de l'Electricité SEB Administration Communale
rwT Regionalwerk Toggenburg AG	Technische Betriebe Glarus	FMV SA
WERKE Rheineck Elektrizitäts- u. Wasserversorgung	Gemeindewerke Stäfa energie und wasser	Rhonwerke AG c/o FMV SA
ReLL Regionale energie Lieferung Leuk AG	IB Langenthal AG	Services Industriels de La Neuveville
Regionalwerke AG Baden	Infrastruktur Männedorf Elektrizitätswerk	Electricité de la Lienne S.A.
Regio Energie Solothurn	AG Elektrizitätswerk Maienfeld Stadtverwaltung	Bielerssee Kraftwerke AG (BIK)
Rabiosa Energie	Gemeindewerke Horgen	Société des Forces Electriques de La Goule
Gemeindebetriebe Elektrizitätswerk	Gemeindewerke Dietlikon	Suizzera italiana
Martin Zeller AG Flums Elektrizitätswerk	Technische Betriebe Kemmental (Gemeindezentrum)	acqua gas elettrica SA
Licht- und Wasserwerk Adelboden AG	Technische Betriebe Flawil Elektrizität	AEC Airolo
Industrielle Betriebe Interlaken	Elektra Leibstadt	Cooperativa Elettrica di Faido
Industrielle Betriebe Huttwil AG	Elektrizitätsversorgung der Gemeinde Saas-Fee	AEC Stabio
IBC Energie Wasser Chur	Elektrizitätswerk der Gemeinde Samedan	AEC Bedretto
Gemeindewerke Pfäffikon	Elektrizitäts- & Wasserwerk Mels	AEC Ascona
Gemeindewerke Arth	Elektrizitätswerk der Gemeinde Lindau	
Glattwerk AG	Elektrizitäts- und Wasserwerk Windisch	

1. Figure 1: Energy utilities contacted (members of VSE)

Appendix 3. Project information to participate in the survey

IMPROVE – unfolding next generation demand-side information models

What is the aim of the IMPROVE-Project?

Improving energy efficiency is of increasing importance, which is why energy utilities try to reduce their customer's energy consumption. One of the keys to this could be achieved through better informed consumers.

Consequently, the project IMPROVE analyses what information about energy consumption Swiss and European energy utilities currently provide to their residential customers, which is called the billing DSI (Demand-side information). Based on this study, new approaches for future DSI will be proposed considering the needs and requests from both utilities and consumers.

The aim is to provide recommendations for utilities on how to enhance billing information in order to allow consumers to have a better understanding of their energy use and to increase their engagement in energy efficiency.

How do we proceed?

In a first phase (Jun. – Sept. 2017), an overview on existing DSI approaches in Switzerland and abroad is performed through an energy supplier survey and literature research. Based on the evaluation of existing approaches, three Improve-solutions for future DSI will be proposed.

In a second phase (Oct. 2017), a consumer survey is used to evaluate what information energy users get and their expectations with regards to better energy information. Customer feedback regarding the three proposed Improve solutions will be carried out.

In a third phase (Mar – Jun 2018), a feedback about constraints, motivation and risks from the utility point of view will be assessed through another energy supplier questionnaire. This input will be used to elaborate recommendations of future DSI for utilities.

Finally, recommendations for proposal implementation will be outlined.

Who collaborates and how is the project funded?

The project is a collaboration of four universities of applied science representing each Swiss language region:

- La haute Ecole Spécialisée de Suisse occidentale (HES-SO / HES_VD)
- Fachhochschule Nordwestschweiz (FHNW)
- Scuola universitaria professionale della Svizzera italiana (SUPSI)
- Zürcher Hochschule für Angewandte Wissenschaften (ZHAW)

The project is funded by these universities and the Swiss Federal Office of Energy SFOE, several Swiss utilities are project partners and support the project with their advice and time investment.

Contact

For further information please contact us under:

(Contact depending on language region).....



Appendix 4. Results of the utilities' survey for participants

Analysis of the survey among Swiss utilities

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1 General

The aim of work package 2 of the IMPROVE project is to get an overview over demand-side-information (DSI) in Switzerland. Therefore an online survey has been developed and disseminated among Swiss utilities. This report addresses the participants who liked to get the analysis of the survey. This analysis is no representative for all Swiss utilities but shows trends and can indicate usual practice in Switzerland.

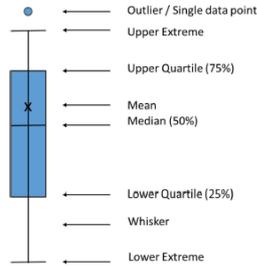
2 Analysis

2.1 Number of feedbacks and analyzed answers

From 143 feedbacks (any response or login to survey or to survey, even without answers), 54 answers (feedbacks that can be analyzed because of a minimum of answers responded) have been analyzed (46 for electricity, 7 for gas and 1 for district heating). As some of these answers did not respond to all questions (as it was possible to skip questions), the number of analyzed answers for each question is noted in brackets in the title of each diagram.

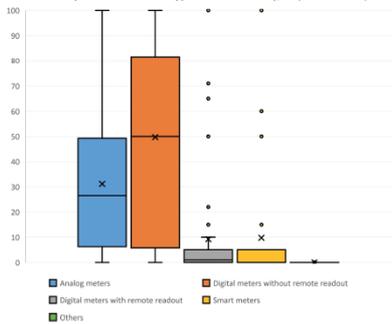
As for some questions the answers depend on the chosen primary energy source. For these questions the analysis has been split and energy sources with similar answers have been analyzed together.

2.1.1 Explanation for boxplot

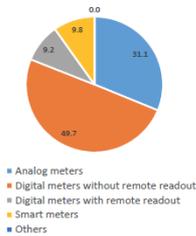


2.2 Presently installed meter types

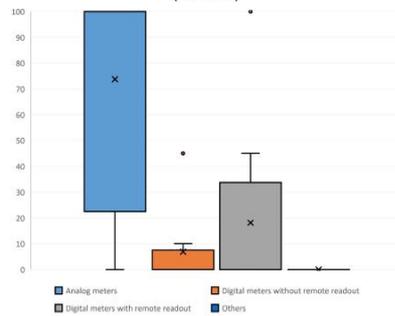
Presently installed meter types for electricity, % (44 answers)



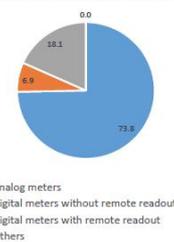
Mean value of installed meter types for electricity, % (of 44 answers)



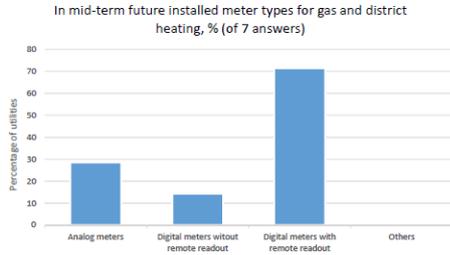
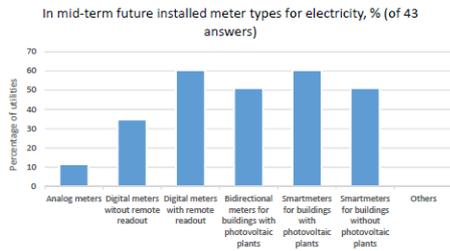
Presently installed meter types for gas and district heating, % (8 answers)



Mean value of installed meter types for gas and district heating, % (of 8 answers)

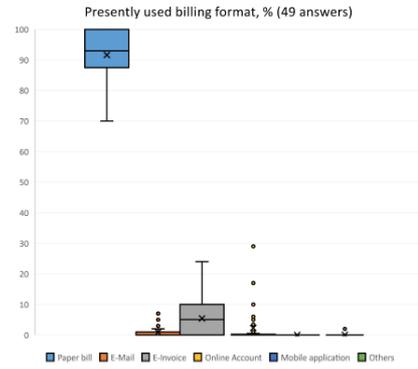


2.3 In mid-term future installed meter types

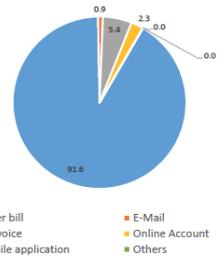


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2.4 Presently used billing format

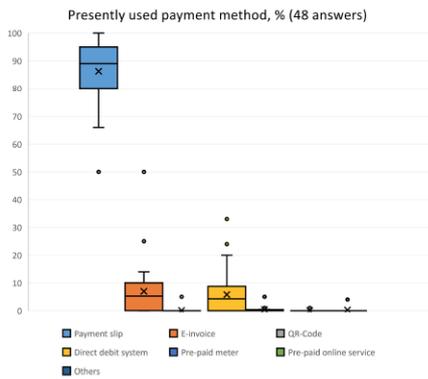


Mean value of presently used billing format, % (of 49 answers)

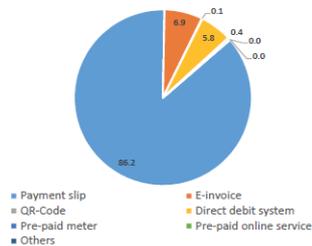


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2.5 Presently used payment method

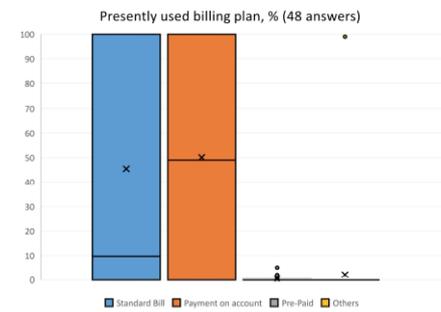


Mean value of presently used payment method, % (of 48 answers)

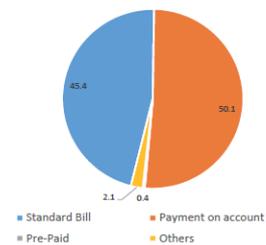


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2.6 Presently used billing Plan

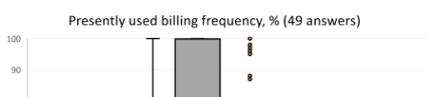


Mean value of presently used billing plan, % (of 48 answers)



Seite 8/14

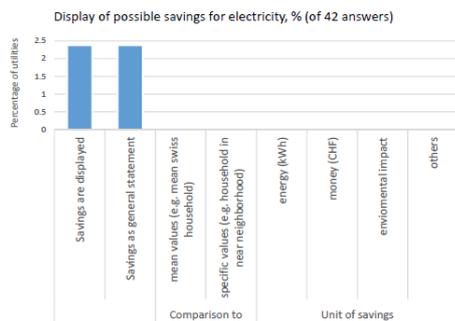
2.7 Presently used billing frequency



2.8 Presently displayed information about primary energy mix

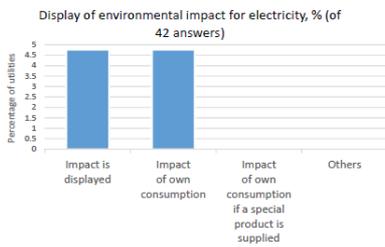


2.10 Display of possible savings



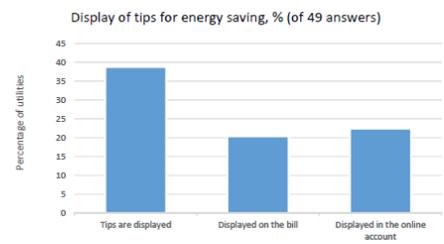
- For gas or district heating, none of asked utilities displays possible savings.

2.11 Display of environmental impacts



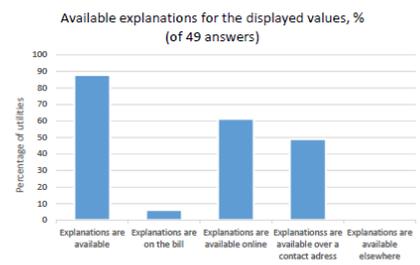
- For gas or district heating, none of asked utilities displays environmental impacts.

2.12 Tips for energy saving

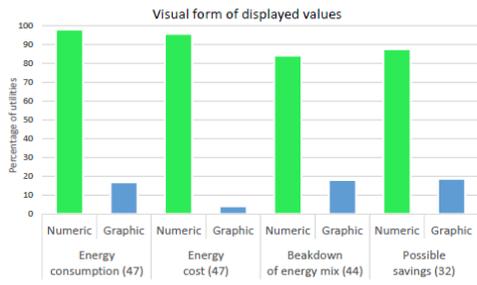


- Regarding the question for possible savings (see 2.10), savings as a general statement would correspond to tips for energy saving. Because of the gap between the answers, there must be an inconsistency in the answers.

2.13 Available explanation for displayed values

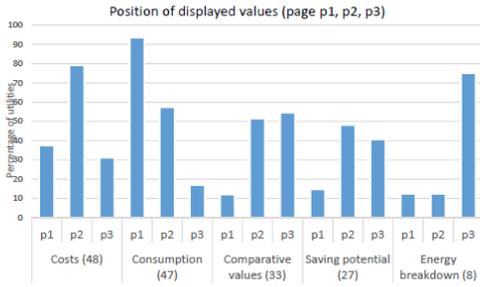


2.14 Visual form of displayed values



- Because of little number of answers, the visual form for environmental impacts (one answer) and comparative values (two answers) are not displayed.

2.15 Position of displayed values

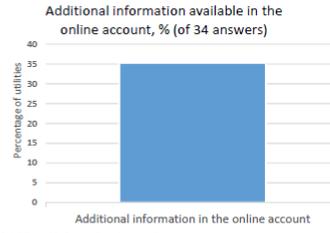


- Because of little number of answers, the position for comparison of costs (one answer), environmental impacts (two answers) an energy saving tips (two answers) are not displayed.

2.16 Additional information about customer

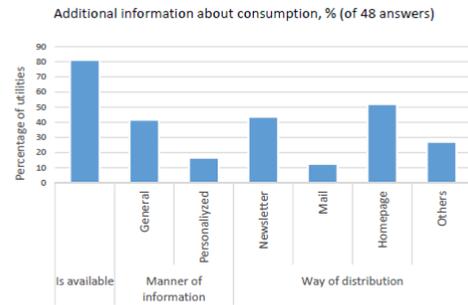
Only two utilities are using additional information about their customers. For the customer it is optional to give the information.

2.17 Additional information available in the online account



- Additional information is mostly
- history of own consumption (graphic display)
 - information about tariffs
 - comparison to other consumption

2.18 Additional information about consumption



Appendix 5. List of indicators used to assess energy bills

A) Electricity

The full list of indicators used to assess electricity (E) bills.

TRANSPARENT ACCOUNTING

- E01. Meter reading type (estimated or actual)
- E02. Total amount due
- E03. Disaggregation of billing costs (energy usage, taxes, network charges etc.)
- E04. Energy usage in kilowatt-hour [kWh]
- E05. Unit rate of energy [costs/kWh]
- E06. Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
- E07. Other (specify)

COMPARATIVE STATISTICS

- E08. Average daily energy use and costs (over the given billing period)
- E09. Graph of energy use over billing period
- E10. Graph of historical energy use over past 12-14 months
- E11. a - Current energy usage compared to previous month
- E11. b - Current energy usage compared to previous year (same period)
- E12. Current energy usage compared to other similar households
- E13. Current energy usage compared to average consumption of similar households in the same area
- E14. Energy consumption pattern variation according to different seasons
- E15. Correlation between energy consumption and temperature/weather conditions over billing period
- E16. Average account of electricity use by major appliances
- E17. Household specific account of electricity use by major appliances
- E18. Other (specify)

ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

- E19. Breakdown of fuel mix used as energy sources for the given bill
- E20. Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
- E21. Other (specify)

TIPS & ADVICE

- E22. One-size-fits-all, general energy-saving tips and advices
- E23. Customized, actionable insights to manage energy costs & consumption
- E24. Advice on time-of-day tariffs or other dynamic tariffs (e.g. cost of running appliances at different times of day)
- E25. Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
- E26. Contact info on customer service offering customized energy-efficiency specific consultancy
- E27. Other (specify)

INNOVATION

- E28. Innovative approaches

NOTES AND COMMENTS

- E29. General comments
-

B) Gas

The full list of indicators used to assess gas (G) bills.

TRANSPARENT ACCOUNTING

- DH1. Meter reading type (estimated or actual)
 - DH2. Total amount due
 - DH3. Disaggregation of billing costs (energy usage, taxes, network charges etc.)
 - DH4. Energy usage in cubic meter [m³] or kilowatt-hour [kWh]
 - DH5. Unit rate of energy [costs/kWh]
 - DH6. Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
 - DH7. Other (specify)
-

COMPARATIVE STATISTICS

- DH8. Average daily energy use and costs (over the given billing period)
 - DH9. Graph of energy use over billing period
 - DH10. Graph of historical energy use over past 12-14 months
 - DH11. a - Current energy usage compared to previous month
 - G11. b - Current energy usage compared to previous year (same period)
 - G12. Current energy usage compared to other similar households
 - G13. Current energy usage compared to average consumption of similar households in the same area
 - G14. Energy consumption pattern variation according to different seasons
 - G15. Correlation between energy consumption and temperature/weather conditions over billing period
 - G16. Other (specify)
-

ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

- G17. Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
 - G18. Other (specify)
-

TIPS & ADVICE

- G19. One-size-fits-all, general energy-saving tips and advices
 - G20. Customized, actionable insights to manage energy costs & consumption
 - G21. Advice on time-of-day tariffs or other dynamic tariffs
 - G22. Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
 - G23. Contact info on customer service offering customized energy-efficiency specific consultancy
 - G24. Other (specify)
-

INNOVATION

- G25. Innovative approaches
-

NOTES AND COMMENTS

- G26. General comments
-

C) District Heating

The full list of indicators used to assess district heating (DH) bills.

TRANSPARENT ACCOUNTING

- DH1. Meter reading type (estimated or actual)
 - DH2. Total amount due
 - DH3. Disaggregation of billing costs (energy usage, taxes, network charges etc.)
 - DH4. Energy usage in cubic meter [m³] or kilowatt-hour [kWh]
 - DH5. Unit rate of energy [costs/kWh]
 - DH6. Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
 - DH7. Other (specify)
-

COMPARATIVE STATISTICS

- DH8. Average daily energy use and costs (over the given billing period)
 - DH9. Graph of energy use over billing period
 - DH10. Graph of historical energy use over past 12-14 months
 - DH11. a - Current energy usage compared to previous month
 - DH11. b - Current energy usage compared to previous year (same period)
 - DH12. Current energy usage compared to other similar households
 - DH13. Current energy usage compared to average consumption of similar households in the same area
 - DH14. Energy consumption pattern variation according to different seasons
 - DH15. Correlation between energy consumption and temperature/weather conditions over billing period
 - DH16. Other (specify)
-

ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

- DH17. Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
 - DH18. Other (specify)
-

TIPS & ADVICE

- DH19. One-size-fits-all, general energy-saving tips and advices
 - DH20. Customized, actionable insights to manage energy costs & consumption
 - DH21. Advice on time-of-day tariffs or other dynamic tariffs
 - DH22. Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
 - DH23. Contact info on customer service offering customized energy-efficiency specific consultancy
 - DH24. Other (specify)
-

INNOVATION

- DH25. Innovative approaches
-

NOTES AND COMMENTS

- DH26. General comments
-

Appendix 6. Online survey for foreign utilities

A) THE RESIDENTIAL ELECTRICITY BILL

This survey is part of a research project called “IMPROVE: Unfolding next generation demand-side information models”, funded by the Swiss Federal Office for Energy (SFOE) in collaboration with four Universities of Applied Sciences from Switzerland (HES-SO, FHNW, SUPSI and ZHAW).

The aim of the survey is to capture the current demand-side information (DSI) models used by energy utilities worldwide to enhance the electricity bill and to provide better indirect feedback to residential customers .

We would be glad if you could support us by answering the following questions and, if possible, attaching an anonymized copy of a current residential paper bill. Answering this survey will take around 20 minutes.

Deadline: 30th of June 2017 .

Thank you for your collaboration!

For any queries, please, contact roberta.castri@supsi.ch or francesca.cellina@supsi.ch

Institute of Applied Sustainability to the Built Environment ISAAC - Department for
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Campus Trevano

CH-6952 Canobbio (TI)

Switzerland

www.supsi.ch/isaac

There are 34 questions in this survey

GENERAL INFORMATION

1 [11] Utility name

Please write your answer here:

2 [12] Address / Location

Please write your answer here:

3 [13] Country

Please write your answer here:

4 [14] Contact person

Please write your answer here:

5 [15] E-mail address

Please write your answer here:

INFORMATION ON ELECTRICITY CONSUMPTION

6 [21] Total number of residential electricity customers served by utility

Please write your answer here:

7 [22] What percentage of your households receives information about their energy consumption the following formats (may total more than 100%)?

Please write your answer(s) here:

Paper bill

Electronic bill

Web portal

Smartphone application

In-Home Display

Pre-paid meter

Other (please, specify type and percentage):

6 [21] Total number of residential gas customers served by your utility

Please write your answer here:

7 [22] What percentage of your residential gas customers receives information about their energy use in the following formats (may total more than 100%)?

Please write your answer(s) here:

Paper bill

Electronic bill

Web portal

Smartphone application

In-Home Display

Pre-paid meter

Other (please, specify type and percentage):

ELECTRICITY BILLING PLAN

8 [31] What percentage of your households receives the following billing plan ?

Please write your answer(s) here:

Standard

(regular charging frequency of estimated or actual consumption)

Balanced or leveled

(regular charging frequency of a fixed payment amount)

Pre-paid

(irregular charging frequency, depending on actual consumption, paid-as-you-go)

Other (please, specify):

DIRECT DEBIT PAYMENT SCHEME

9 [41] What percentage of your residential electricity customers has chosen Direct Debit as their payment scheme?

Please write your answer here:

ELECTRICITY BILLING FREQUENCY

10 [51] What percentage of your residential electricity s receives billing information in the customer following frequency?

Please write your answer(s) here:

Monthly

Bi-monthly

Quarterly

Yearly Irregular

Other

FEEDBACK TYPE USED ON THE PAPER OR ELECTRONIC BILL

11 [611]

Which of the following TRANSP ARENT ACCOUNTING features do you currently provide on your residential customer electricity bill?

Please choose all that apply:

- Meter reading type (estimated or actual)
- Total amount due
- Disaggregation of billing costs (energy usage, taxes, network charges etc.)
- Energy usage in kilowatt-hour (kWh)
- Unit rate of energy (costs/kWh)
- Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
- Other (please, specify)::

12 [612]

Which of the following COMP ARATIVE STATISTICS do you currently provide on your residential customer electricity bill?

Please choose all that apply:

- Average daily energy use and costs (over the given billing period)
- Graph of energy use over billing period
- Graph of historical energy use over past 12-14 months
- Current energy usage compared to previous month / previous year (same period)
- Current energy usage compared to other similar households
- Current energy usage compared to average consumption of similar household in your residential town
- Energy consumption pattern variation according to different seasons
- Correlation between energy consumption and temperature/weather conditions over billing period
- Average account of electricity use by major appliances
- Household specific account of electricity use by major appliances
- Other (please, specify)::

13 [6123]

Current energy usage compared to:

Only answer this question if the following conditions are met:

Answer was at question '12 [612]' (Which of the following COMPARATIVE STATISTICS do you currently provide on your residential customer electricity bill?)

Please choose all that apply:

- Previous month
- Previous year (same period)

14 [613]

Which of the following features on ENVIRONMENTAL IMPACT do you currently provide on your residential customer electricity bill?

Please choose all that apply:

- Breakdown of fuel mix used as energy sources for the given bill
- Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
- Other (please, specify)::

15 [614]

Which of the following TIPS & ADVICE do you currently provide on your residential customer electricity bill?

Please choose all that apply:

- One-size-fits-all, general energy-saving tips and advices
- Customized, actionable insights to manage energy costs & consumption
- Advice on time-of-day tariffs or other dynamic tariffs (e.g. cost of running appliances at different times of day)
- Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
- Contact info on customer service offering customized energy-efficiency specific consultancy
- Other (please, specify)::

16 [62] Please upload an anonymized copy of your current residential customer paper bill or indicate a link to download it.

Kindly attach the aforementioned documents along with the survey

17 [63] In case no upload is possible, please indicate a link where we can download it:

Please write your answer here:

SMART HOME DEVICES & FUNCTIONALITIES FOR ELECTRICITY CUSTOMERS

18 [71] For what percentage of your residential electricity customers do you have access to smart cust metering data?

Please write your answer here:

19 [72] Where applicable, are you offering one or more of these additional retail- and consumer-friendly functionalities or devices, based on smart-metering data (check all that apply)?

Please choose the appropriate response for each item:

	No	Service for free	Service on payment	Service promoted by incentives
Web portals / Interactive online tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile phone applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Traditional In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepayment In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remote temperature control system (smart thermostats)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remote appliances control system (smart plugs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remote lighting control system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar energy production control system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20 [721] Other , please, specify:

Please write your answer here:

OTHER INNOVATIVE PROGRAMMES FOR ELECTRICITY CUSTOMERS

21 [81]

Is your utility currently running (or has terminated or is planning in the near future) any innovative pilot project or service to engage and support residential customers in energy-saving actions at home?

Please choose all that apply:

- Information/ Education campaigns
- Gamified energy-saving programmes (e.g. utility-sponsored energy competitions for customers, either individually or on teams; games that employ real-time granular data on player's energy use as feedback, quizzes, etc.)
- Customer fidelity programmes (points and prizes)
- Other (please, specify):

22 [82]

Please, provide the name of the most relevant initiative(s) and a link to access related information:

Please write your answer(s) here:

Name of initiative (1):

Link (1)

Name of initiative (2):

Link (2)

23 [83]

May we contact a reference person for a follow-up in this regards ?

Please choose only one of the following:

- Yes
- No

24 [831] Contact person

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

25 [832] E-mail address

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

26 [833] Phone (please insert phone number in format "country code, prefix and phone number")

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

BILL DESIGN EVALUATION

27 [91] Has your utility conducted research addressing enhanced billing and user-friendly bill design related to electricity bills in the last 5 years?

Please choose only one of the following:

- Yes
- No

28 [92]Did this involve customer participation / feedback?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to electricity bills in the last 5 years?)

Please choose only one of the following:

- Yes
- No

29 [93]

Has your utility performed analyses on the results you obtained, in terms of energy savings produced by enhanced billing and user-friendly bill design?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to electricity bills in the last 5 years?)

Please choose only one of the following:

- Yes
 No

30 [94] Please outline briefly the evaluation research :

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to electricity bills in the last 5 years?)

Please write your answer here:

31 [95] May we contact you for follow-up in this regards?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to electricity bills in the last 5 years?)

Please choose only one of the following:

- Yes
 No

32 [951] Name

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

33 [952] E-mail address

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

34 [953] Phone (please insert phone number in format "country code, prefix and phone number")

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

B) THE RESIDENTIAL GAS BILL

This survey is part of a research project called “IMPROVE: Unfolding next generation demand-side information models”, funded by the Swiss Federal Office for Energy (SFOE) in collaboration with four Universities of Applied Sciences from Switzerland (HES-SO, FHNW, SUPSI and ZHAW). The aim of the survey is to capture the current demand-side information (DSI) models used by energy utilities abroad to enhance the gas bill and to provide better indirect feedback to residential customers.

We would be glad if you could support us by answering the following questions and, if possible, attaching an anonymized copy of a current residential paper bill. Answering this survey will take around 20 minutes.

Deadline: 30th of June 2017 .

Thank you for your collaboration!

For any queries, please, contact roberta.castri@supsi.ch or francesca.cellina@supsi.ch

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CH-6952 Canobbio (TI)
Switzerland
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There are 34 questions in this survey

GENERAL INFORMATION

1 [11] Utility name

Please write your answer here:

2 [12] Address / Location

Please write your answer here:

3 [13] Country

Please write your answer here:

4 [14] Contact person

Please write your answer here:

5 [15] E-mail address

Controllare il formato della risposta.

Please write your answer here:

INFORMATION ON GAS CONSUMPTION

6 [21] Total number of residential gas customers served by your utility

Please write your answer here:

7 [22] What percentage of your residential gas customers receives information about their energy use in the following formats (may total more than 100%)?

Please write your answer(s) here:

Paper bill

Electronic bill

Web portal

Smartphone application

In-Home Display

Pre-paid meter

Other (please, specify type and percentage):

GAS BILLING PLAN

8 [31]What percentage of your residential gas customers receives the following billing plan?

Please write your answer(s) here:

Standard

(regular charging frequency of estimated or actual consumption)

Balanced or leveled

(regular charging frequency of a fixed payment amount)

Pre-paid

(irregular charging frequency, depending on actual consumption, paid-as-you-go)

Other (please, specify):

DIRECT DEBIT PAYMENT SCHEME

9 [41] What percentage of your residential gascustomers has en Direct Debit as their payment chos scheme?

Please write your answer here:

GAS BILLING FREQUENCY

10 [51] What percentage of your residential gas customers following frequency? receives billing information in the

Please write your answer(s) here:

Monthly

Bi-monthly

Quarterly

Yearly

Irregular

Other

GAS BILLING FEEDBACK TYPE USED ON THE PAPER OR ELECTRONIC BILL

11 [611]

Which of the following TRANSPARENT ACCOUNTING features do you currently provide on your residential customer gas bill?

Please choose all that apply:

- Meter reading type (estimated or actual)
- Total amount due
- Disaggregation of billing costs (energy usage, taxes, network charges etc.)
- Energy usage in cubic meters (m³) or kilowatt-hour (kWh)
- Unit rate of energy (costs/kWh or costs/m³)
- Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
- Other (please, specify):

12 [612]

Which of the following COMPARATIVE STATISTICS do you currently provide on your residential customer gas bill?

Please choose all that apply:

- Average daily energy use and costs (over the given billing period)
- Graph of energy use over billing period
- Graph of historical energy use over past 12-14 months
- Current energy usage compared to previous month / previous year (same period)
- Current energy usage compared to other similar households
- Current energy usage compared to average consumption of similar household in your residential town
- Energy consumption pattern variation according to different seasons
- Correlation between energy consumption and temperature/weather conditions over billing period
- Other (please, specify):

13 [6123]

Current energy usage compared to:

Only answer this question if the following conditions are met:

Answer was at question '12 [612]' (Which of the following COMPARATIVE STATISTICS do you currently provide on your residential customer gas bill?)

Please choose all that apply:

- Previous month
- Previous year (same period)

14 [613]

Which of the following features on ENVIRONMENTAL IMPACT do you currently provide on your residential customer gas bill?

Please choose all that apply:

- Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
- Other (please, specify):

15 [614]

Which of the following TIPS & ADVICE do you currently provide on your residential customer gas bill?

Please choose all that apply:

- One-size-fits-all, general energy-saving tips and advices
- Customized, actionable insights to manage energy costs & consumption
- Advice on time-of-day tariffs or other dynamic tariffs (e.g. cost of running appliances at different times of day)
- Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
- Contact info on customer service offering customized energy-efficiency specific consultancy
- Other (please, specify):

16 [62] Please upload an anonymized copy of your current residential customer paper bill or indicate a link to download it.

Kindly attach the aforementioned documents along with the survey

17 [63] In case no upload is possible, please indicate a link where we can download it:

Please write your answer here:

SMART HOME DEVICES & FUNCTIONALITIES FOR GAS CUSTOMERS

18 [71] For what percentage of your residential gas customers you have access to smart do metering data?

Please write your answer here:

19 [72] Where applicable, are you deploying smart metering together with one or more of these additional retail- and consumer-friendly functionalities (check all that apply)?

Please choose the appropriate response for each item:

	No	Service for free	Service on payment	Service promoted by incentives
Web portals / Interactive online tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile phone applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Traditional In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepayment In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remote temperature control system (smart thermostats)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20 [721] Other, please, specify:

Please write your answer here:

OTHER INNOVATIVE PROGRAMMES FOR GAS CUSTOMERS

21 [81] Is your utility currently running (or has terminated or is planning in the near future) any innovative pilot project or service to engage and support residential gas customers in energy-saving actions at home?

Please choose all that apply:

- Information/ Education campaigns
- Gamified energy-saving programmes (e.g. utility-sponsored energy competitions for customers, either individually or on teams; games that employ real-time granular data on player's energy use as feedback, quizzes, etc.)
- Customer fidelity programmes (points and prizes)
- Other (please, specify):

22 [82] Please, provide the name of the most relevant initiative information: (s) and a link to access related

Please write your answer(s) here:

Name of initiative (1):	<input type="text"/>
Link (1)	<input type="text"/>
Name of initiative (2):	<input type="text"/>
Link (2)	<input type="text"/>

23 [83]

May we contact a reference person for a follow-up in this regards ?

Please choose only one of the following:

- Yes
- No

24 [831] Contact person

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

25 [832] E-mail address

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Controllare il formato della risposta.

Please write your answer here:

26 [833] Phone (please insert phone number in format "country de, prefix and phone number")

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

BILL DESIGN EVALUATION

27 [91]

Has your utility conducted research addressing enhanced billing and user-friendly bill design related to gas bills in the last 5 years?

Please choose only one of the following:

- Yes
 No

28 [92] Did this involve customer participation / feedback?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to gas bills in the last 5 years?)

Please choose only one of the following:

- Yes
 No

29 [93]

Has your utility performed analyses on the results you obtained, in terms of energy savings produced by enhanced billing and user-friendly bill design?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to gas bills in the last 5 years?)

Please choose only one of the following:

- Yes
- No

30 [94] Please outline briefly the evaluation research :

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to gas bills in the last 5 years?)

Please write your answer here:

31 [95]

May we contact you for follow-up in this regards?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to gas bills in the last 5 years?)

Please choose only one of the following:

- Yes
- No

32 [951] Name

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

34 [953] Phone (please insert phone number in format "country de, prefix and phone number")

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

Thank you for your collaboration!

For any queries, please, contact roberta.castri@supsi.ch or francesca.cellina@supsi.ch

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Campus Trevano

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Switzerland

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31/08/2017 – 00:00

Submit your survey.

Thank you for completing this survey

C) THE RESIDENTIAL DISTRICT HEATING BILL

This survey is part of a research project called “IMPROVE: Unfolding next generation demand-side information models”, funded by the Swiss Federal Office for Energy (SFOE) in collaboration with four Universities of Applied Sciences from Switzerland (HES-SO, FHNW, SUPSI and ZHAW). The aim of the survey is to capture the current demand-side information (DSI) models used by energy utilities abroad to enhance the district heating bill and to provide better indirect feedback to residential customers.

We would be glad if you could support us by answering the following questions and, if possible, attaching an anonymized copy of a current residential paper bill. Answering this survey will take around 15 minutes.

Deadline: 30th of June 2017 .

Thank you for your collaboration!

For any queries, please, contact roberta.castri@supsi.ch or francesca.cellina@supsi.ch

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There are 34 questions in this survey

GENERAL INFORMATION

1 [11] Utility name

Please write your answer here:

2 [12] Address / Location

Please write your answer here:

3 [13] Country

Please write your answer here:

4 [14] Contact person

Please write your answer here:

5 [15] E-mail address

Please write your answer here:

INFORMATION ON DISTRICT HEATING CONSUMPTION

6 [21] Total number of residential district heating customers served by your utility

Please write your answer here:

7 [22] What percentage of your residential district heating customers receives information about their energy use in the following formats (may total more than 100%)?

Please write your answer(s) here:

Paper bill

Electronic bill

Web portal

Smartphone application

In-Home Display

Pre-paid meter

Other (please, specify type and percentage):

DISTRICT HEATING BILLING PLAN

8 [31] What percentage of your residential district heating customers receives the following billing your plan?

Please write your answer(s) here:

Standard

(regular charging frequency of estimated or actual consumption)

Balanced or leveled

(regular charging frequency of a fixed payment amount)

Pre-paid

(irregular charging frequency, depending on actual consumption, paid-as-you-go)

Other (please, specify):

DIRECT DEBIT PAYMENT SCHEME

9 [41] What percentage of your residential district heating customers has chosen Direct Debit as their payment scheme?

Please write your answer here:

DISTRICT HEATING BILLING FREQUENCY

10 [51] What percentage of your residential district heating customers receives billing information in the following frequency?

Please write your answer(s) here:

Monthly

Bi-monthly

Quarterly

Yearly

Irregular

Other

BILLING FEEDBACK TYPE USED ON THE PAPER OR ELECTRONIC BILL

11 [611]

Which of the following TRANSP ARENT ACCOUNTING features do you currently provide on your residential customer district heating bill?

Please choose all that apply:

- Meter reading type (estimated or actual)
- Total amount due
- Disaggregation of billing costs (energy usage, taxes, network charges etc.)
- Energy usage in cubic meters (m³) or kilowatt-hour (kWh)
- Unit rate of energy (costs/m³ or costs/kWh)
- Visual chart breakdown of billing costs into its different components (retailer, state taxes, distribution system operators, etc.)
- Other (please, specify)::

12 [612]

Which of the following COMP ARATIVE STATISTICS do you currently provide on your residential customer district heating bill?

Please choose all that apply:

- Average daily energy use and costs (over the given billing period)
- Graph of energy use over billing period
- Graph of historical energy use over past 12-14 months
- Current energy usage compared to previous month / previous year (same period)
- Current energy usage compared to other similar households
- Current energy usage compared to average consumption of similar household in your residential town
- Energy consumption pattern variation according to different seasons
- Correlation between energy consumption and temperature/weather conditions over billing period
- Other (please, specify)::

13 [6123]

Current energy usage compared to:

Only answer this question if the following conditions are met:

Answer was at question '12 [612]' (Which of the following COMPARATIVE STATISTICS do you currently provide on your residential customer district heating bill?)

Please choose all that apply:

- Previous month
- Previous year (same period)

14 [613]

Which of the following features on ENVIRONMENTAL IMPACT do you currently provide on your residential customer district heating bill?

Please choose all that apply:

- Alternative metrics (e.g. CO₂ equivalent emissions, carbon footprint or other eco-feedback) based on current billing period
- Other (please, specify):

15 [614]

Which of the following TIPS & ADVICE do you currently provide on your residential customer district heating bill?

Please choose all that apply:

- One-size-fits-all, general energy-saving tips and advices
- Customized, actionable insights to manage energy costs & consumption
- Advice on time-of-day tariffs or other dynamic tariffs
- Explanation of key terms (e.g. kWh, m³, specific surcharges etc.)
- Contact info on customer service offering customized energy-efficiency specific consultancy
- Other (please, specify):

16 [62] Please upload an anonymized copy of your current residential customer paper bill or indicate a link to download it.

Kindly attach the aforementioned documents along with the survey

17 [63] In case no upload is possible, please indicate a link where we can download it:

Please write your answer here:

SMART HOME DEVICES & FUNCTIONALITIES FOR DISTRICT HEATING CUSTOMER

18 [71] For what percentage of your residential district heating customers do you have access to smart metering data?

Please write your answer here:

19 [72]

Where applicable, are you deploying smart metering together with one or more of these additional retail- and consumer-friendly functionalities (check all that apply)?

Please choose the appropriate response for each item:

	No	Service for free	Service on payment	Service promoted by incentives
Web portals / Interactive online tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile phone applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Traditional In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepayment In-Home Display (IHD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remote temperature control system (smart thermostats)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20 [721] Other , please, specify:

Please write your answer here:

OTHER INNOVATIVE PROGRAMMES FOR DISTRICT HEATING CUSTOMERS

21 [81] Is your utility currently running (or has terminated or is planning in the near future) any innovative pilot project or service to engage and support residential district heating customers in energy-saving actions at home?

Please choose all that apply:

- Information/ Education campaigns
- Gamified energy-saving programmes (e.g. utility-sponsored energy competitions for customers, either individually or on teams; games that employ real-time granular data on player's energy use as feedback, quizzes, etc.)
- Customer fidelity programmes (points and prizes)
- Other (please, specify):

22 [82] Please, provide the name of the most relevant(s) and a link to access related initiative information:

Please write your answer(s) here:

Name of initiative (1):

Link (1)

Name of initiative (2):

Link (2)

23 [83]

May we contact a reference person for a follow-up in this regards?

Please choose only one of the following:

- Yes
- No

24 [831] Contact person

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

25 [832] E-mail address

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Controllare il formato della risposta.

Please write your answer here:

26 [833] Phone (please insert phone number in format "country de, prefix and phone number")

--

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '23 [83]' (May we contact a reference person for a follow-up in this regards?)

Please write your answer here:

BILL DESIGN EVALUATION

27 [91]

Has your utility conducted research addressing enhanced billing and user-friendly bill design related to district heating bills in the last 5 years?

Please choose only one of the following:

- Yes
 No

28 [92]

Did this involve customer participation / feedback?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to district heating bills in the last 5 years?)

Please choose only one of the following:

- Yes
 No

29 [93]

Has your utility performed analyses on the results you obtained, in terms of energy savings produced by enhanced billing and user-friendly bill design?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to district heating bills in the last 5 years?)

Please choose only one of the following:

- Yes
- No

30 [94] Please outline briefly the evaluation research :

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to district heating bills in the last 5 years?)

Please write your answer here:

31 [95]

May we contact you for follow-up in this regards?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '27 [91]' (Has your utility conducted research addressing enhanced billing and user-friendly bill design related to district heating bills in the last 5 years?)

Please choose only one of the following:

- Yes
- No

32 [951]Name

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

33 [952]E-mail address

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Controllare il formato della risposta.

Please write your answer here:

34 [953]Phone (please insert phone number in format "country code, prefix and phone number")

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '31 [95]' (May we contact you for follow-up in this regards?)

Please write your answer here:

Appendix 7. Foreign utilities contacted to join the survey

ID	Utility name	Country	Energy source
1	Acea Energia	Italy	Electricity & Gas
2	Agsm Energia	Italy	Electricity & Gas
3	AIM Energy	Italy	Electricity & Gas
4	Ascopiave	Italy	Electricity & Gas
5	Pasubioservizi	Italy	Electricity & Gas
6	Bluenergy Group	Italy	Electricity & Gas
7	E.ON Energia	Italy	Electricity & Gas
8	Enel Energia	Italy	Electricity & Gas
9	ENERcom	Italy	Electricity & Gas
10	Eni	Italy	Electricity & Gas
11	Enerxenia	Italy	Electricity & Gas
12	E-nostra	Italy	Electricity & Gas
13	Estra	Italy	Electricity & Gas
14	Europe Energy	Italy	Electricity & Gas
15	EVIVA	Italy	Electricity & Gas
16	Gas Natural	Italy	Electricity & Gas
17	Green Network	Italy	Electricity & Gas
18	Metaenergia	Italy	Electricity & Gas
19	Optima Italia	Italy	Electricity & Gas
20	Sorgenia	Italy	Electricity & Gas
21	Trenta	Italy	Electricity & Gas
22	Unogas Energia	Italy	Electricity & Gas
23	Wekiwi	Italy	Electricity & Gas
24	Endesa Energia	Spain	Electricity & Gas
25	Iberdrola	Spain	Electricity & Gas
26	Unión Fenosa	Spain	Electricity & Gas
27	Gas Natural	Spain	Electricity & Gas
28	Coopérnico - CRL	Portugal	Electricity
29	Elusa Comercialização de Eletricidade	Portugal	Electricity
30	Elygas Power, S.L.	Portugal	Gas
31	Enat – Energias Naturais, Lda.	Portugal	Electricity
32	Endesa – Endesa Energia Sucursal Portugal	Portugal	Electricity & Gas
33	ENFORCESCO, SA	Portugal	Electricity
34	Galp Power S.A.	Portugal	Electricity & Gas
35	GOLD ENERGY – Comercializadora de Energia, S.A.	Portugal	Electricity & Gas
36	HEN - Serviços Energéticos, Lda.	Portugal	Electricity
37	Iberdrola Clientes Portugal, Unipessoal, Lda.	Portugal	Electricity & Gas
38	Jafplus Energia	Portugal	Electricity
39	Logica Energy	Portugal	Electricity
40	LUZBOA - Comercialização de Energia, Lda.	Portugal	Electricity
41	LUSIADAENERGIA, S.A.	Portugal	Electricity & Gas
42	PH Energia, Lda.	Portugal	Electricity
43	Rolear - Automatizações, Estudos e Representações	Portugal	Electricity & Gas
44	Union Fenosa Comercial, S.L. – Suc. Em Portugal	Portugal	Electricity & Gas
45	Energia Simples	Portugal	Gas
46	Investigacion, Criogenia y Gas, S.A. - sucursal	Portugal	Gas
47	Molgas, Energia Portugal S.A.	Portugal	Gas

48	British Gas	UK	Electricity & Gas
49	E.ON	UK	Electricity & Gas
50	EDF	UK	Electricity & Gas
51	Npower	UK	Electricity & Gas
52	SSE	UK	Electricity & Gas
53	Bord Gáis Energy	Rep. Ireland	Electricity & Gas
54	Energia	Rep. Ireland	Electricity & Gas
55	Electric Ireland	Rep. Ireland	Electricity & Gas
56	SSE Airtricity	Rep. Ireland	Electricity & Gas
57	Pinergy	Rep. Ireland	Electricity
58	PrePayPower	Rep. Ireland	Electricity
59	Panda Power Ltd	Rep. Ireland	Electricity
60	Flogas Natural Gas Ltd	Rep. Ireland	Gas
61	Allure Energie	The Netherlands	Electricity & Gas
62	Anode Energie	The Netherlands	Electricity
63	Budget Energie	The Netherlands	Electricity & Gas
64	De Groene Belangenbehartiger	The Netherlands	Electricity
65	De Vastelastenbond	The Netherlands	Electricity & Gas
66	easyEnergy	The Netherlands	Electricity & Gas
67	Endesa	The Netherlands	Electricity & Gas
68	EnergieFlex	The Netherlands	Electricity & Gas
69	Engie	The Netherlands	Electricity & Gas
70	Essent	The Netherlands	Electricity & Gas
71	Fenor BV	The Netherlands	Electricity & Gas
72	Greenchoice	The Netherlands	Electricity & Gas
73	Greenfoot Energy	The Netherlands	Electricity
74	Huismerk Energie	The Netherlands	Electricity
75	Homestrom	The Netherlands	Electricity & Gas
76	HVC	The Netherlands	Electricity & Gas
77	InEnergie	The Netherlands	District heating
78	Leon	The Netherlands	Electricity
79	Main Energie	The Netherlands	Electricity & Gas
80	Nedergie	The Netherlands	Electricity & Gas
81	Noordelijk Lokaal Duurzaam	The Netherlands	Electricity
82	Nuon	The Netherlands	Electricity & Gas
83	Powerpeers	The Netherlands	Electricity & Gas
84	Pure Energie	The Netherlands	Electricity & Gas
85	Qwint	The Netherlands	Electricity
86	Robin energie	The Netherlands	Electricity & Gas
87	Sepa green	The Netherlands	Electricity & Gas
88	United Consumers	The Netherlands	Electricity & Gas
89	Vandebron	The Netherlands	Electricity
90	Vrijopnaam	The Netherlands	Electricity & Gas
91	Windunie	The Netherlands	Electricity
92	GÖTEBORG ENERGI AB	Sweden	Electricity & Gas & District heating
93	VASTRA ORUSTS ENERGITJANST EK.FOREN	Sweden	Electricity
94	ÖRESUNDS KRAFT AB	Sweden	Electricity & Gas & District heating
95	FILIPSTAD ENERGINAT AB	Sweden	Electricity
96	OSKARSHAMN ENERGI NAT AB	Sweden	Electricity & Gas & District heating
97	LULEA ENERGI AB	Sweden	Electricity & Gas & District heating
98	VARBERGSORTENS ELKRAFT EK.FOR.	Sweden	Electricity
99	EMMABODA ELNAT AB	Sweden	District heating

100	AGA GAS AB	Sweden	Gas
101	Coretec Energy	Poland	Electricity & Gas
102	DGD Dansk Gas Distribution	Denmark	Gas
103	HMN Naturgas	Denmark	Gas
104	NGF Natur Energy Distribution A/S	Denmark	Gas
105	HOFOR	Denmark	District heating
106	DONG Energy A/S	Denmark	Electricity
107	Sibelga	Belgium	Electricity & Gas
108	Power Online (Mega)	Belgium	Electricity & Gas
109	OCTA+	Belgium	Electricity & Gas
110	Luminus	Belgium	Electricity & Gas
111	Lampiris (Total gas & power)	Belgium	Electricity & Gas
112	Essent Belgium (RWE)	Belgium	Electricity & Gas
113	ENI Gas & Power	Belgium	Electricity & Gas
114	ENGIE Electrabel	Belgium	Electricity & Gas
115	Eneco België	Belgium	Electricity & Gas
116	Elexys	Belgium	Electricity & Gas
117	Elegant	Belgium	Electricity & Gas
118	Direct Energie Belgium (Poweo)	Belgium	Electricity & Gas
119	Alterna	France	Electricity & Gas
120	Direct Énergie	France	Electricity & Gas
121	Enercoop	France	Electricity
122	Lampiris	France	Electricity
123	Planète Oui	France	Electricity
124	Eni	France	Gas
125	Engie	France	Electricity & Gas
126	Proxelia	France	Electricity & Gas
127	Enalp	France	Electricity
128	Lucia Énergie	France	Electricity
129	Energem	France	Electricity & Gas
130	Selia	France	Electricity
131	Ekwateur	France	Electricity & Gas
132	E.ON	Germany	Electricity & Gas
133	EnBW AG	Germany	Electricity & Gas
134	Vattenfall Europe AG	Germany	Electricity & Gas
135	123energie	Germany	Electricity & Gas
136	Die Energieversorger GmbH	Germany	Electricity & Gas
137	Energy2day GmbH	Germany	Electricity & Gas
138	energieGUT GmbH	Germany	Electricity & Gas
139	ENSTROGA AG	Germany	Electricity & Gas
140	ENTEKA Energie GmbH	Germany	Electricity & Gas
141	eprimo GmbH	Germany	Electricity & Gas
142	e-regio GmbH & Co. KG	Germany	Electricity & Gas
143	E wie Einfach	Germany	Electricity & Gas
144	EVD GmbH	Germany	Electricity & Gas
145	Grünwelt Energie	Germany	Electricity & Gas
146	Greenpeace Energy eG	Germany	Electricity & Gas
147	Hitenergie	Germany	Electricity & Gas
148	Hamburg Energie	Germany	Electricity & Gas
149	Innogy SE	Germany	Electricity & Gas
150	lekker Energie GmbH	Germany	Electricity & Gas
151	LichtBlick SE	Germany	Electricity & Gas

152	Montana Voller Energie	Germany	Electricity & Gas
153	Naturstrom	Germany	Electricity & Gas
154	NaturEnergiePlus	Germany	Electricity & Gas
155	Nord Stadtwerke	Germany	Electricity & Gas
156	Priostrom	Germany	Electricity & Gas
157	Pfalzwerke DE	Germany	Electricity & Gas
158	Rheinenergie	Germany	Electricity & Gas
159	Stadtwerke Düsseldorf AG	Germany	Electricity & Gas
160	Stromio GmbH	Germany	Electricity
161	Süwag	Germany	Electricity & Gas
162	Switch GmbH	Germany	Electricity & Gas
163	SWK ENERGIE GmbH	Germany	Electricity & Gas & District heating
164	SWU Energie GmbH	Germany	Electricity & Gas
165	wemio.de	Germany	Electricity & Gas
166	Yello Strom GmbH	Germany	Electricity & Gas
167	AAE Naturstrom	Austria	Electricity
168	Elektrizitätswerk der Gemeinde Gries am Brenner	Austria	Electricity
169	Enamo Oekostrom	Austria	Electricity
170	Energie AG Vertrieb GmbH & Co KG	Austria	Electricity & Gas & District heating
171	Energie Burgenland	Austria	Electricity & Gas & District heating
172	EKG - Energie Klagenfurt	Austria	Electricity & Gas & District heating
173	EVN	Austria	Electricity & Gas
174	gasdiskont.at	Austria	Gas
175	Goldgas	Austria	Electricity & Gas
176	IKB - Innsbrucker Kommunalbetriebe	Austria	Electricity
177	KELAG - Kärntner Elektrizitäts-Aktiengesellschaft	Austria	Electricity & Gas
178	LINZ AG für Energie	Austria	Electricity & Gas
179	MONTANA Energie-Handel AT GmbH	Austria	Electricity & Gas
180	MyElectric Energievertriebs- und -dienstleistungs	Austria	Electricity & Gas
181	Naturkraft	Austria	Electricity
182	oekostrom AG	Austria	Electricity & Gas
183	Ökoenergie Tirol GmbH	Austria	Electricity
184	Salzburg AG	Austria	Electricity & Gas
185	Salzburg Ökoenergie	Austria	Electricity
186	Schlaustrom	Austria	Electricity & Gas
187	Stadtwerke Fürstenfeld	Austria	Electricity
188	Stadtwerke Hartberg	Austria	Electricity
189	Stadtwerke Kapfenberg	Austria	Electricity & Gas
190	Stadtwerke Mürzzuschlag	Austria	Electricity & Gas
191	Stadtwerke Voitsberg	Austria	Electricity
192	Steirische Gas-Wärme	Austria	Electricity & Gas & District heating
193	Stromdiskont	Austria	Electricity
194	Switch	Austria	Electricity & Gas
195	TIWAG-Tiroler Wasserkraft AG	Austria	Electricity
196	Unsere Wasserkraft GmbH & Co KG	Austria	Electricity & Gas
197	Verbund	Austria	Electricity & Gas
198	VKW - Vorarlberger Kraftwerke AG	Austria	Electricity & Gas
199	Voltino Gastino	Austria	Electricity & Gas
200	Wien Energie	Austria	Electricity & Gas

Appendix 8. Matrices of Assessment of energy bills

A) Electricity bills

a. TRANSPARENT ACCOUNTING

RESIDENTIAL ELECTRICITY BILL - TRANSPARENT ACCOUNTING													
ID	Utility name	Country	Analyzed (1: yes / 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	E01 Meter reading type (estimated or actual)	E02 Total amount due	E03 Disaggregation of billing costs	E04 Energy usage in [kWh]	E05 Unit rate of energy [costs/kWh]	E06 Visual chart breakdown of billing costs	E07 Other
1	Momentum Energy	Australia	1	2	1	2	1	1	1	1	1	0	0
2	Origin	Australia	1	2	1	2	1	1	1	1	1	0	0
3	Synergy	Australia	1	1	1	2	1	1	1	1	1	0	0
4	AAE Naturstrom	Austria	1	2	1	2	0	1	1	1	1	0	0
5	EKG - Energie Klagenfurt	Austria	1	2	1	1	1	1	1	1	1	0	0
6	Enamo Oekostrom	Austria	1	2	1	1	1	1	1	1	1	0	0
7	Energie Burgenland	Austria	1	2	2	1	1	1	1	1	1	0	0
8	Energie Steiermark	Austria	1	2	1	1	1	1	1	1	1	0	0
9	EVN	Austria	1	2	1	1	1	1	1	1	1	0	0
10	IKB - Innsbrucker Kommunalbetriebe	Austria	1	2	1	1	1	1	1	1	1	0	0
11	Linz AG Strom	Austria	1	2	1	1	1	1	1	1	1	0	0
12	MONTANA Energie-Handel	Austria	1	2	1	1	1	1	1	1	1	0	0
13	MyElectric	Austria	1	2	2	2	1	1	1	1	1	0	0
14	Oekostrom AG	Austria	1	2	1	2	1	1	1	1	1	0	0
15	Salzburg AG	Austria	1	2	1	1	1	1	1	1	1	0	0
16	Stadtwerke Judenburg AG	Austria	1	1	1	2	1	1	1	1	1	0	0
17	Switch Energievertrieb	Austria	1	2	1	1	1	1	1	1	1	0	0

18	TIWAG-Tiroler Wasserkraft AG	Austria	1	2	1	1	1	1	1	1	1	0	0
19	Unsere Wasserkraft GmbH	Austria	1	2	1	1	1	1	1	1	1	0	0
20	VKW Strom	Austria	1	2	1	1	1	1	1	1	1	0	0
21	ENI Gas & Power	Belgium	1	2	2	2	1	1	1	1	1	0	0
22	Luminus	Belgium	1	2	2	1	1	1	1	1	1	1	0
23	CEB Distribuicao	Brazil	1	1	1	2	1	1	1	1	0	0	0
24	Hydro Québec	Canada	1	2	1	2	1	1	1	1	1	0	0
25	Superintendencia de Electricidad	Chile	1	1	1	2	1	1	1	1	1	0	0
26	UNKNOWN UTILITY	China	2	1	1								
27	Codensa SA	Columbia	1	1	1	2	1	1	1	1	1	0	0
28	Electricity Authority of Cyprus	Cyprus	2	1	1								
29	Bohemia Energy	Czech Republic	1	1	1	2	1	1	0	1	1	0	0
30	Fonergy	Czech Republic	1	1	1	1	0	1	1	1	1	0	0
31	Statni Energeticka Inspekce	Czech Republic	1	1	1	2	1	1	1	1	1	0	0
32	Dong Energy	Denmark	1	1	1	2	1	1	1	1	1	0	0
33	SE Energi & Klima	Denmark	1	2	1	2	1	1	1	1	1	0	0
34	SEAS NVE	Denmark	1	1	1	2	1	1	1	1	1	0	0
35	SK Forsyning	Denmark	1	1	1	2	1	1	1	1	1	1	0
36	Caruna	Finland	1	1	1	2	1	1	1	1	1	0	0
37	Direct Energie	France	1	1	2	2	1	1	1	1	1	0	0
38	EDF	France	1	1	1	2	1	1	1	1	1	0	0
39	EnerCOOP	France	1	1	1	2	1	1	1	1	1	0	0
40	Engie	France	1	1	2	2	1	1	1	1	1	0	0
41	Proxelia	France	1	2	1	2	1	1	1	1	1	0	0
42	Selia	France	1	2	1	2	1	1	1	1	1	0	0
43	Badenova	Germany	1	1	1	2	1	1	1	1	1	0	0
44	BS Energy	Germany	1	2	2	2	1	1	1	1	1	0	0
45	Discounter-Energie	Germany	1	2	1	2	1	1	1	1	1	0	0
46	E.ON Energie	Germany	1	2	1	1	1	1	1	1	1	1	0
47	Eins - Energie in Sachsen	Germany	1	2	1	2	0	1	1	1	1	0	0
48	EnBW	Germany	1	2	1	1	0	1	1	1	1	0	0
49	Enstroga AG	Germany	1	2	1	1	0	1	1	1	1	0	0

50	Entega	Germany	1	2	2	1	0	1	1	1	1	0	0
51	Eprimo GmbH	Germany	1	2	1	2	1	1	0	1	1	0	0
52	EVO	Germany	1	2	1	1	0	1	1	1	1	0	0
53	EWE	Germany	1	2	1	1	1	1	1	1	1	0	0
54	Goldpower	Germany	1	1	1	1	0	1	1	1	1	0	0
55	Greenpeace Energy AG	Germany	1	2	1	1	1	1	1	1	1	0	0
56	Hamburg Energie	Germany	1	2	1	2	1	1	1	1	1	0	0
57	Lekker.de	Germany	1	2	1	1	0	1	1	1	1	0	0
58	Mainova	Germany	1	2	1	1	1	1	1	1	1	0	0
59	MONTANA Energie-Handel	Germany	1	2	2	1	1	1	0	1	1	0	0
60	Naturstrom	Germany	1	1	1	1	1	1	1	1	1	0	0
61	Prioenergie	Germany	1	2	1	1	1	1	1	1	1	1	0
62	Rheinenergie	Germany	1	2	1	1	0	1	1	1	1	0	0
63	Stadtwerke Düsseldorf	Germany	1	2	1	1	1	1	1	1	1	0	0
64	Switch	Germany	1	2	1	2	1	1	1	1	1	0	0
65	SWK	Germany	1	2	2	1	0	1	1	1	1	1	0
66	TEAG	Germany	1	2	1	1	1	1	1	1	1	0	0
67	Vattenfall	Germany	1	2	1	1	0	1	1	1	1	1	0
68	Voltera	Germany	1	2	1	2	1	1	1	1	1	0	0
69	Watt + Volt	Greece	2	1	1								
70	E.ON	Hungary	1	1	1	2	1	1	1	1	1	0	0
71	A2A	Italy	1	2	1	2	1	1	1	1	1	1	0
72	Dolomiti Energia	Italy	1	2	1	2	1	1	1	1	1	0	0
73	È nostra	Italy	1	1	1	2	1	1	1	1	1	1	0
74	Enel Energy	Italy	1	1	1	2	1	1	1	1	1	1	0
75	Enerxenia	Italy	1	2	1	2	1	1	1	1	1	0	0
76	Hera Comm	Italy	1	2	1	2	1	1	1	1	1	0	0
77	Servizio Elettrico Nazionale	Italy	1	1	1	2	1	1	1	1	1	1	0
78	Tokyo Gas	Japan	2	1	2								
79	Automated Revenue Management Services Limited	Malta	1	1	1	2	1	1	1	1	1	0	0
80	Essent	Netherlands	1	1	2	1	1	1	1	1	1	0	0
81	Nuon	Netherlands	1	1	3	1	1	1	1	1	0	0	0
82	Lyse	Norway	1	1	1	2	1	1	0	1	1	0	0
83	Norges Energi	Norway	1	1	1	2	1	1	1	1	1	0	0

84	Coopernico	Portugal	1	1	1	2	1	1	1	1	1	0	0
85	EDA	Portugal	1	1	1	2	1	1	1	1	1	0	0
86	EDP	Portugal	1	1	1	2	1	1	1	1	1	0	0
87	Endesa	Portugal	1	1	1	2	1	1	1	1	1	1	0
88	Galp on	Portugal	1	1	2	2	1	1	1	1	1	0	0
89	Gas Natural Fenosa	Portugal	1	1	1	2	1	1	1	1	1	0	0
90	Bord Gàis Energy	Rep. Ireland	1	2	1	2	1	1	1	1	1	0	0
91	Electric Ireland SmarterLiving	Rep. Ireland	1	1	1	2	1	1	1	1	1	0	0
92	Energia Switched On	Rep. Ireland	1	2	1	2	1	1	1	1	1	0	0
93	SSE Airtricity	Rep. Ireland	1	2	2	2	1	1	1	1	1	0	0
94	Enel	Romania	1	1	1	2	1	1	1	0	0	0	0
95	UNKNOW UTILITY	Rwanda	1	1	1		0	1	0	1	0	0	0
96	Endesa	Spain	1	2	1	2	1	1	1	1	1	1	0
97	Iberdola	Spain	1	1	1	2	1	1	1	1	1	1	0
98	Som Energia	Spain	1	1	1	2	1	1	1	1	1	1	0
99	BestEl	Sweden	1	2	1	2	1	1	1	1	1	0	0
100	E.ON	Sweden	1	1	1	1	1	1	1	1	1	0	0
101	öresunds Kraft AB	Sweden	1	2	7	2	1	1	1	1	1	0	0
102	Oskarshamn Energi	Sweden	1	2	1	2	1	1	1	1	1	0	0
103	Skanska	Sweden	1	1	1		1	1	1	1	1	0	0
104	Yagmur Group	Turkey	2	2	1	2							
105	Bristol Energy	UK	1	2	2	2	1	1	1	1	1	0	0
106	British Gas	UK	1	2	2	2	1	1	1	1	1	1	0
107	Coop energy	UK	1	2	2	1	1	1	1	1	1	0	0
108	E.ON	UK	1	1	2	2	1	1	1	1	1	0	0
109	Ecotricity	UK	1	2	2	2	1	1	1	1	1	0	0
110	EDF	UK	1	1	2	3	1	1	1	1	1	0	0
111	First Utility	UK	1	2	2	2	1	1	1	1	1	0	0
112	GB Energy Supply	UK	1	1	1	2	1	1	1	1	1	0	0
113	iSupply Energy	UK	1	2	1	3	1	1	1	1	1	1	0
114	Npower	UK	1	2	2	3	1	1	1	1	1	0	Visual breakdown of energy costs is on the utilities website
115	OVO Energy	UK	1	1	2	2	1	1	1	1	1	0	0
116	Scottish Power	UK	1	1	1	3	1	1	1	1	1	1	0

117	So Energy	UK	1	2	2	2	1	1	1	1	1	0	0
118	Spark Energy	UK	1	2	2	2	1	1	1	1	1	0	0
119	SSE	UK	1	2	1	2	1	1	1	1	1	0	0
120	AEP Ohio	USA	1	2	1	2	1	1	0	1	0	0	0
121	Con Edison	USA	1	2	2	2	1	1	1	1	1	0	0
122	Memphis Light, Gas and Water	USA	1	1	2	2	1	1	1	1	1	0	Visual breakdown of energy costs is on the utilities website
123	National Grid	USA	1	2	1	2	1	1	1	1	1	0	0
124	PECO Energy Company	USA	1	2	2	2	1	1	1	1	1	0	0
125	SMUD (Sacramento Muni. Utility Dist.)	USA	1	2	1	2	1	1	1	1	1	1	0

b. COMPARATIVE STATISTICS

RESIDENTIAL ELECTRICITY BILL - COMPARATIVE STATISTICS																		
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	E08 Average daily energy use and costs	E09 Graph of current energy usage	E10 Graph of historical energy use	E11 a Current energy usage compared to previous month	E11 b Current energy usage compared to previous year (same period)	E12 Current energy usage compared to similar households	E13 Current energy usage compared to similar households in the same area	E14 Energy usage pattern variation according to seasons	E15 Correlation between energy usage and temperature/ weather conditions	E16 Average account of energy usage by major appliances	E17 Household specific account of energy usage by major appliances	E18 Other
1	Momentum Energy	Australia	1	2	1	2	1	0	1	1	1	1	0	1	1	0	1	1
2	Origin	Australia	1	2	1	2	1	0	1	0	1	0	1	1	0	0	0	0
3	Synergy	Australia	1	1	1	2	1	0	1	0	1	1	1	0	1	0	1	0
4	AAE Naturstrom	Austria	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
5	EKG - Energie Klagenfurt	Austria	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
6	Enamo Oekostrom	Austria	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7	Energie Burgenland	Austria	1	2	2	1	0	0	0	0	1	0	0	0	0	0	0	0
8	Energie Steiermark	Austria	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
9	EVN	Austria	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
10	IKB	Austria	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
11	Linz AG Strom	Austria	1	2	1	1	0	0	1	0	1	0	0	0	0	0	1	0
12	MONTANA Energie-Handel	Austria	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
13	MyElectric	Austria	1	2	2	2	1	0	0	0	1	0	0	0	1	0	0	0
14	Oekostrom AG	Austria	1	2	1	2	1	0	0	0	1	0	0	0	1	0	0	0
15	Salzburg AG	Austria	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
16	Stadtwerke Judenburg AG	Austria	1	1	1	2	1	0	0	1	0	0	0	0	0	0	0	0
17	Switch Energievertrieb	Austria	1	2	1	1	1	0	0	0	0	0	0	0	1	0	0	0
18	TIWAG-Tiroler Wasserkraft AG	Austria	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
19	Unsere Wasserkraft GmbH	Austria	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
20	VKW Strom	Austria	1	2	1	1	0	0	1	0	1	0	1	0	0	0	1	0
21	ENI Gas & Power	Belgium	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
22	Luminus	Belgium	1	2	2	1	0	0	1	0	1	0	0	0	0	0	0	0
23	CEB Distribuicao	Brazil	1	1	1	2	0	0	0	1	1	0	0	0	0	0	0	0
24	Hydro Québec	Canada	1	2	1	2	1	0	0	1	0	0	0	0	0	0	0	0
25	Superintendencia de Electricidad	Chile	1	1	1	2	0	0	1	1	1	0	0	0	0	0	0	0
26	UNKNOWN UTILITY	China	2	1	1													
27	Codensa SA	Columbia	1	1	1	2	0	0	1	1	1	0	0	0	0	0	0	0
28	Electricity Authority of Cyprus	Cyprus	2	1	1													
29	Bohemia Energy	Czech Republic	1	1	1	2	0	0	0	1	1	0	0	0	0	0	0	0

30	Fonergy	Czech Republic	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0
31	Statni Energeticka Inspekce	Czech Republic	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0
32	Dong Energy	Denmark	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
33	SE Energi & Klima	Denmark	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
34	SEAS NVE	Denmark	1	1	1	2	0	0	0	0	1	0	0	0	0	0	0	0
35	SK Forsyning	Denmark	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
36	Caruna	Finland	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0
37	Direct Energie	France	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
38	EDF	France	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
39	EnerCOOP	France	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
40	Engie	France	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
41	Proxelia	France	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
42	Selia	France	1	2	1	2	0	0	0	1	0	0	0	0	0	0	0	0
43	Badenova	Germany	1	1	1	2	0	0	0	1	0	1	0	0	0	0	0	0
44	BS Energy	Germany	1	2	2	2	0	0	0	0	1	1	0	0	0	0	0	0
45	Discounter-Energie	Germany	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
46	E.ON Energie	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
47	Eins - Energie in Sachsen	Germany	1	2	1	2	0	0	0	0	0	1	0	0	0	0	0	0
48	EnBW	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
49	Enstroga AG	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
50	Entega	Germany	1	2	2	1	0	0	0	0	1	1	0	0	0	0	0	0
51	Eprimo GmbH	Germany	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
52	EVO	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
53	EWE	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
54	Goldpower	Germany	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0
55	Greenpeace Energy AG	Germany	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0
56	Hamburg Energie	Germany	1	2	1	2	1	0	0	0	0	1	0	0	0	0	0	0
57	Lekker.de	Germany	1	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0
58	Mainova	Germany	1	2	1	1	0	0	0	0	0	1	0	0	0	0	0	0
59	MONTANA Energie-Handel	Germany	1	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
60	Naturstrom	Germany	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0
61	Prioenergie	Germany	1	2	1	1	0	0	0	0	0	1	0	0	0	0	0	0
62	Rheinenergie	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
63	Stadtwerke Düsseldorf	Germany	1	2	1	1	0	0	0	0	1	1	0	0	0	0	0	0
64	Switch	Germany	1	2	1	2	1	0	0	0	1	0	0	0	1	0	0	0
65	SWK	Germany	1	2	2	1	0	0	0	0	0	1	0	0	0	0	0	0
66	TEAG	Germany	1	2	1	1	0	0	0	0	0	1	0	0	0	0	0	0
67	Vattenfall	Germany	1	2	1	1	1	0	0	0	1	1	0	0	1	0	0	0
68	Voltera	Germany	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
69	Watt + Volt	Greece	2	1	1													
70	E.ON	Hungary	1	1	1	2	0	0	0	0	1	1	0	0	0	0	0	0
71	A2A	Italy	1	2	1	2	0	1	1	1	1	0	0	0	0	0	0	0
72	Dolomiti Energia	Italy	1	2	1	2	0	0	1	1	0	0	0	0	0	0	0	0
73	È nostra	Italy	1	1	1	2	0	1	1	1	1	0	0	0	0	0	0	0
74	Enel Energy	Italy	1	1	1	2	0	0	1	1	1	0	0	0	0	0	0	0

75	Enerxenia	Italy	1	2	1	2	0	0	1	1	0	0	0	0	0	0	0	0
76	Hera Comm	Italy	1	2	1	2	0	0	1	0	0	0	0	0	0	0	0	0
77	Servizio Elettrico Nazionale	Italy	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0
78	Tokyo Gas	Japan	2	1	2													
79	Automated Revenue Management Services Limited	Malta	1	1	1	2	1	0	1	0	0	0	0	0	1	0	1	0
80	Essent	Netherlands	1	1	2	1	0	0	0	1	1	1	0	0	0	0	0	0
81	Nuon	Netherlands	1	1	3	1	0	0	0	1	0	1	0	0	0	0	0	0
82	Lyse	Norway	1	1	1	2	0	0	1	1	1	0	0	0	0	0	0	0
83	Norges Energi	Norway	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0
84	Coopernico	Portugal	1	1	1	2	0	0	1	1	0	0	0	0	0	0	0	0
85	EDA	Portugal	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0
86	EDP	Portugal	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
87	Endesa	Portugal	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0
88	Galp on	Portugal	1	1	2	2	0	0	1	1	0	0	0	0	0	0	0	0
89	Gas Natural Fenosa	Portugal	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
90	Bord Gàis Energy	Rep. Ireland	1	2	1	2	1	0	0	0	0	0	0	0	1	0	0	0
91	Electric Ireland SmarterLiving	Rep. Ireland	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
92	Energia Switched on	Rep. Ireland	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
93	SSE Airtricity	Rep. Ireland	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
94	Enel	Romania	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
95	UNKNOW UTILITY	Rwanda	1	1	1		0	0	0	0	0	0	0	0	0	0	0	0
96	Endesa	Spain	1	2	1	2	1	0	1	1	0	0	0	0	0	0	0	0
97	Iberdola	Spain	1	1	1	2	0	0	1	1	0	0	0	0	0	0	0	0
98	Som Energia	Spain	1	1	1	2	0	0	1	1	0	0	0	0	0	0	0	0
99	BestEI	Sweden	1	2	1	2	0	0	0	1	1	0	0	0	0	0	0	0
100	E.ON	Sweden	1	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0
101	öresunds Kraft AB	Sweden	1	2	7	2	0	0	0	0	0	0	0	0	0	0	0	0
102	Oskarshamn Energi	Sweden	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
103	Skanska	Sweden	1	1	1		0	0	0	0	0	0	0	0	0	0	0	0
104	Yagmur Group	Turkey	2	2	1	2												
105	Bristol Energy	UK	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
106	British Gas	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0	0	0
107	Coop energy	UK	1	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
108	E.ON	UK	1	1	2	2	0	0	0	0	1	0	0	0	0	0	0	0
109	Ecotricity	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0	0	0
110	EDF	UK	1	1	2	3	0	0	0	0	1	0	0	0	0	0	0	0
111	First Utility	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0	0	0
112	GB Energy Supply	UK	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
113	iSupply Energy	UK	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0
114	Npower	UK	1	2	2	3	1	0	0	0	1	0	0	0	1	0	0	0
115	OVO Energy	UK	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
116	Scottish Power	UK	1	1	1	3	0	0	0	0	1	0	0	0	0	0	0	0
117	So Energy	UK	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
118	Spark Energy	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0	0	0
119	SSE	UK	1	2	1	2	0	0	0	0	1	0	0	0	0	0	0	0

120	AEP Ohio	USA	1	2	1	2	1	0	1	0	0	0	1	0	0	0	0	
121	Con Edison	USA	1	2	2	2	0	1	1	0	0	0	0	0	0	1	1	0
122	Memphis Light, Gas and Water	USA	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	
123	National Grid	USA	1	2	1	2	1	0	1	1	1	0	0	0	1	0	1	1
124	PECO Energy Company	USA	1	2	2	2	0	0	1	1	1	0	0	0	0	0	1	1
125	SMUD	USA	1	2	1	2	1	1	1	1	1	0	0	0	1	1	1	1

C. ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

RESIDENTIAL ELECTRICITY BILL -ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT									
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	E19 Breakdown of fuel mix	E20 Alternative metrics (e.g. CO ₂ equivalent emissions, carbon footprint etc.)	E21 Other
1	Momentum Energy	Australia	1	2	1	2	1	1	0
2	Origin	Australia	1	2	1	2	0	0	0
3	Synergy	Australia	1	1	1	2	1	1	1
4	AAE Naturstrom	Austria	1	2	1	2	0	0	0
5	EKG - Energie Klagenfurt	Austria	1	2	1	1	0	0	0
6	Enamo Oekostrom	Austria	1	2	1	1	0	0	0
7	Energie Burgenland	Austria	1	2	2	1	1	0	0
8	Energie Steiermark	Austria	1	2	1	1	1	0	0
9	EVN	Austria	1	2	1	1	1	0	0
10	IKB	Austria	1	2	1	1	1	0	0
11	Linz AG Strom	Austria	1	2	1	1	1	0	0
12	MONTANA Energie-Handel	Austria	1	2	1	1	1	0	0
13	MyElectric	Austria	1	2	2	2	1	0	0
14	Oekostrom AG	Austria	1	2	1	2	1	0	0
15	Salzburg AG	Austria	1	2	1	1	1	0	0
16	Stadtwerke Judenburg AG	Austria	1	1	1	2	0	0	0
17	Switch Energievertrieb	Austria	1	2	1	1	0	0	0
18	TIWAG-Tiroler Wasserkraft	Austria	1	2	1	1	0	0	0
19	Unsere Wasserkraft GmbH	Austria	1	2	1	1	0	0	0

20	VKW Strom	Austria	1	2	1	1	1	0	1
21	ENI Gas & Power	Belgium	1	2	2	2	0	0	0
22	Luminus	Belgium	1	2	2	1	1	0	0
23	CEB Distribuicao	Brazil	1	1	1	2	0	0	0
24	Hydro Québec	Canada	1	2	1	2	0	0	0
25	Superintendencia de	Chile	1	1	1	2	0	0	0
26	UNKNOWN UTILITY	China	2	1	1				
27	Codensa SA	Columbia	1	1	1	2	0	0	0
28	Electricity Authority of	Cyprus	2	1	1				
29	Bohemia Energy	Czech	1	1	1	2	0	0	0
30	Fonergy	Czech	1	1	1	1	0	0	0
31	Statni Energeticka Inspekce	Czech	1	1	1	2	0	0	0
32	Dong Energy	Denmark	1	1	1	2	0	0	0
33	SE Energi & Klima	Denmark	1	2	1	2	0	0	0
34	SEAS NVE	Denmark	1	1	1	2	0	0	0
35	SK Forsyning	Denmark	1	1	1	2	0	0	0
36	Caruna	Finland	1	1	1	2	0	0	0
37	Direct Energie	France	1	1	2	2	0	0	0
38	EDF	France	1	1	1	2	0	0	0
39	EnerCOOP	France	1	1	1	2	0	0	0
40	Engie	France	1	1	2	2	1	0	0
41	Proxelia	France	1	2	1	2	0	0	0
42	Selia	France	1	2	1	2	0	0	0
43	Badenova	Germany	1	1	1	2	1	0	0
44	BS Energy	Germany	1	2	2	2	1	1	0
45	Discounter-Energie	Germany	1	2	1	2	0	0	0
46	E.ON Energie	Germany	1	2	1	1	1	1	0
47	Eins - Energie in Sachsen	Germany	1	2	1	2	0	1	0
48	EnBW	Germany	1	2	1	1	1	1	0
49	Enstroga AG	Germany	1	2	1	1	1	1	0
50	Entega	Germany	1	2	2	1	1	1	0
51	Eprimo GmbH	Germany	1	2	1	2	0	0	0
52	EVO	Germany	1	2	1	1	1	1	0
53	EWE	Germany	1	2	1	1	1	1	0

54	Goldpower	Germany	1	1	1	1	1	1	0
55	Greenpeace Energy AG	Germany	1	2	1	1	1	0	0
56	Hamburg Energie	Germany	1	2	1	2	1	0	0
57	Lekker.de	Germany	1	2	1	1	1	0	0
58	Mainova	Germany	1	2	1	1	0	1	0
59	MONTANA Energie-Handel	Germany	1	2	2	1	0	0	0
60	Naturstrom	Germany	1	1	1	1	1	1	0
61	Prioenergie	Germany	1	2	1	1	0	1	0
62	Rheinenergie	Germany	1	2	1	1	1	1	0
63	Stadtwerke Düsseldorf	Germany	1	2	1	1	1	1	0
64	Switch	Germany	1	2	1	2	1	0	0
65	SWK	Germany	1	2	2	1	0	1	0
66	TEAG	Germany	1	2	1	1	0	1	0
67	Vattenfall	Germany	1	2	1	1	1	1	0
68	Voltera	Germany	1	2	1	2	0	0	0
69	Watt + Volt	Greece	2	1	1				
70	E.ON	Hungary	1	1	1	2	1	1	0
71	A2A	Italy	1	2	1	2	0	0	0
72	Dolomiti Energia	Italy	1	2	1	2	1	0	0
73	È nostra	Italy	1	1	1	2	1	1	0
74	Enel Energy	Italy	1	1	1	2	1	0	0
75	Enerxenia	Italy	1	2	1	2	1	0	0
76	Hera Comm	Italy	1	2	1	2	0	0	0
77	Servizio Elettrico Nazionale	Italy	1	1	1	2	0	0	0
78	Tokyo Gas	Japan	2	1	2				
79	Automated Revenue	Malta	1	1	1	2	0	0	0
80	Essent	Netherlands	1	1	2	1	0	0	0
81	Nuon	Netherlands	1	1	3	1	0	0	0
82	Lyse	Norway	1	1	1	2	0	0	0
83	Norges Energi	Norway	1	1	1	2	0	0	0
84	Coopernico	Portugal	1	1	1	2	1	0	0
85	EDA	Portugal	1	1	1	2	0	0	0
86	EDP	Portugal	1	1	1	2	1	0	0
87	Endesa	Portugal	1	1	1	2	1	1	0

88	Galp on	Portugal	1	1	2	2	0	0	0
89	Gas Natural Fenosa	Portugal	1	1	1	2	0	0	0
90	Bord Gàis Energy	Rep.	1	2	1	2	0	0	0
91	Electric Ireland	Rep.	1	1	1	2	0	0	0
92	Energia Switched On	Rep.	1	2	1	2	0	0	0
93	SSE Airtricity	Rep.	1	2	2	2	0	0	0
94	Enel	Romania	1	1	1	2	0	0	0
95	UNKNOW UTILITY	Rwanda	1	1	1		0	0	0
96	Endesa	Spain	1	2	1	2	1	1	0
97	Iberdola	Spain	1	1	1	2	1	0	0
98	Som Energia	Spain	1	1	1	2	1	0	0
99	BestEl	Sweden	1	2	1	2	0	0	0
100	E.ON	Sweden	1	1	1	1	1	0	0
101	öresunds Kraft AB	Sweden	1	2	7	2	0	0	0
102	Oskarshamn Energi	Sweden	1	2	1	2	0	0	0
103	Skanska	Sweden	1	1	1		0	0	0
104	Yagmur Group	Turkey	2	2	1	2			
105	Bristol Energy	UK	1	2	2	2	0	0	0
106	British Gas	UK	1	2	2	2	1	0	0
107	Coop energy	UK	1	2	2	1	0	0	0
108	E.ON	UK	1	1	2	2	1	0	0
109	Ecotricity	UK	1	2	2	2	1	0	0
110	EDF	UK	1	1	2	3	1	0	0
111	First Utility	UK	1	2	2	2	1	0	0
112	GB Energy Supply	UK	1	1	1	2	0	0	0
113	iSupply Energy	UK	1	2	1	3	0	0	0
114	Npower	UK	1	2	2	3	1	0	0
115	OVO Energy	UK	1	1	2	2	0	0	0
116	Scottish Power	UK	1	1	1	3	1	0	0
117	So Energy	UK	1	2	2	2	0	0	0
118	Spark Energy	UK	1	2	2	2	1	0	0
119	SSE	UK	1	2	1	2	1	0	0
120	AEP Ohio	USA	1	2	1	2	0	0	0
121	Con Edison	USA	1	2	2	2	0	0	0

122	Memphis Light, Gas and Water	USA	1	1	2	2	0	0	0
123	National Grid	USA	1	2	1	2	1	0	0
124	PECO Energy Company	USA	1	2	2	2	1	0	0
125	SMUD (Sacramento Municipal Utility District)	USA	1	2	1	2	1	0	0

d. TIPS & ADVICES

RESIDENTIAL ELECTRICITY BILL - TIPS & ADVICES												
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7: electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	E22 One-size-fits-all, general energy-saving tips and advices	E23 Customized, actionable insights to manage energy costs & consumption	E24 Advice on time-of-day tariffs or other dynamic tariffs	E25 Explanation of key terms (e.g. kWh, m ³ , specific surcharges etc.)	E26 Contact info on customer service offering customized energy-efficiency specific consultancy	E27 Other
1	Momentum Energy	Australia	1	2	1	2	1	1	0	1	1	A link on the bill is indicated, referring to energy-saving tips on the utility's website
2	Origin	Australia	1	2	1	2	0	0	0	0	0	0
3	Synergy	Australia	1	1	1	2	0	1	0	1	0	0
4	AAE Naturstrom	Austria	1	2	1	2	0	0	0	0	0	0
5	EKG - Energie Klagenfurt	Austria	1	2	1	1	0	0	0	0	0	0
6	Enamo Oekostrom	Austria	1	2	1	1	0	0	0	0	0	0
7	Energie Burgenland	Austria	1	2	2	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website
8	Energie Steiermark	Austria	1	2	1	1	0	1	0	0	0	0
9	EVN	Austria	1	2	1	1	0	1	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website
10	IKB - Innsbrucker Kommunalbetriebe	Austria	1	2	1	1	0	1	0	0	0	0
11	Linz AG Strom	Austria	1	2	1	1	0	0	0	1	0	0

12	MONTANA Energie-Handel	Austria	1	2	1	1	0	1	0	0	0	0
13	MyElectric	Austria	1	2	2	2	0	1	0	0	0	0
14	Oekostrom AG	Austria	1	2	1	2	0	1	0	0	0	A link on the bill is indicated, referring to a point collection programme to buy energy-saving appliances
15	Salzburg AG	Austria	1	2	1	1	0	1	0	0	0	0
16	Stadtwerke Judenburg AG	Austria	1	1	1	2	0	0	0	0	0	0
17	Switch Energievertrieb	Austria	1	2	1	1	0	1	0	0	0	0
18	TIWAG-Tiroler Wasserkraft AG	Austria	1	2	1	1	0	0	0	0	0	0
19	Unsere Wasserkraft GmbH	Austria	1	2	1	1	0	0	0	0	0	0
20	VKW Strom	Austria	1	2	1	1	0	0	0	1	0	A link on the bill is indicated, inviting to switch to the online bill in order to receive more detailed energy consumption info
21	ENI Gas & Power	Belgium	1	2	2	2	0	0	0	0	0	0
22	Luminus	Belgium	1	2	2	1	0	0	0	0	0	0
23	CEB Distribuicao	Brazil	1	1	1	2	0	0	0	0	0	0
24	Hydro Québec	Canada	1	2	1	2	0	0	0	0	0	0
25	Superintendencia de Electricidad	Chile	1	1	1	2	1	0	0	0	0	0
26	UNKNOWN UTILITY	China	2	1	1							
27	Codensa SA	Columbia	1	1	1	2	0	0	0	1	0	0
28	Electricity Authority of Cyprus	Cyprus	2	1	1							
29	Bohemia Energy	Czech Republic	1	1	1	2	0	0	0	0	0	0
30	Fonergy	Czech Republic	1	1	1	1	0	0	0	0	0	0
31	Statni Energeticka Inspekce	Czech Republic	1	1	1	2	0	0	0	0	0	0
32	Dong Energy	Denmark	1	1	1	2	0	0	0	0	0	0
33	SE Energi & Klima	Denmark	1	2	1	2	0	0	0	0	0	0
34	SEAS NVE	Denmark	1	1	1	2	0	0	0	0	0	0
35	SK Forsyning	Denmark	1	1	1	2	0	0	0	0	0	0
36	Caruna	Finland	1	1	1	2	0	0	0	0	0	0
37	Direct Energie	France	1	1	2	2	0	0	0	0	0	0
38	EDF	France	1	1	1	2	0	0	0	0	0	0
39	EnerCOOP	France	1	1	1	2	0	0	0	0	0	0
40	Engie	France	1	1	2	2	0	0	0	0	0	0

41	Proxelia	France	1	2	1	2	0	0	0	0	0	0
42	Selia	France	1	2	1	2	0	0	0	0	0	0
43	Badenova	Germany	1	1	1	2	0	0	0	0	0	0
44	BS Energy	Germany	1	2	2	2	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
45	Discounter-Energie	Germany	1	2	1	2	0	0	0	0	0	0
46	E.ON Energie	Germany	1	2	1	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
47	Eins - Energie in Sachsen	Germany	1	2	1	2	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
48	EnBW	Germany	1	2	1	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency (www.enbw.com/edl-g)
49	Enstroga AG	Germany	1	2	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
50	Entega	Germany	1	2	2	1	0	0	0	0	0	0
51	Eprimo GmbH	Germany	1	2	1	2	0	0	0	0	0	0
52	EVO	Germany	1	2	1	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
53	EWE	Germany	1	2	1	1	0	0	0	0	0	0
54	Goldpower	Germany	1	1	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
55	Greenpeace Energy AG	Germany	1	2	1	1	0	1	0	0	0	0
56	Hamburg Energie	Germany	1	2	1	2	0	0	0	1	1	0
57	Lekker.de	Germany	1	2	1	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website
58	Mainova	Germany	1	2	1	1	0	0	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
59	MONTANA Energie-Handel	Germany	1	2	2	1	0	0	0	0	0	0
60	Naturstrom	Germany	1	1	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency

61	Prioenergie	Germany	1	2	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
62	Rheinenergie	Germany	1	2	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
63	Stadtwerke Düsseldorf	Germany	1	2	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
64	Switch	Germany	1	2	1	2	0	1	0	0	0	-
65	SWK	Germany	1	2	2	1	0	0	0	0	0	0
66	TEAG	Germany	1	2	1	1	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
67	Vattenfall	Germany	1	2	1	1	0	1	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
68	Voltera	Germany	1	2	1	2	0	0	0	0	0	0
69	Watt + Volt	Greece	2	1	1							
70	E.ON	Hungary	1	1	1	2	0	0	0	0	0	0
71	A2A	Italy	1	2	1	2	0	0	0	0	0	0
72	Dolomiti Energia	Italy	1	2	1	2	0	0	0	0	0	0
73	È nostra	Italy	1	1	1	2	0	0	0	0	0	0
74	Enel Energy	Italy	1	1	1	2	0	0	0	0	0	0
75	Enerxenia	Italy	1	2	1	2	0	0	0	0	0	0
76	Hera Comm	Italy	1	2	1	2	0	0	0	0	0	0
77	Servizio Elettrico Nazionale	Italy	1	1	1	2	0	0		0	0	0
78	Tokyo Gas	Japan	2	1	2							
79	Automated Revenue Management Services Limited	Malta	1	1	1	2	0	1	0	1	0	
80	Essent	Netherlands	1	1	2	1	0	0	0	0	0	0
81	Nuon	Netherlands	1	1	3	1	0	0	0	1	1	0
82	Lyse	Norway	1	1	1	2	0	0	0	0	0	0
83	Norges Energi	Norway	1	1	1	2	0	0	0	0	0	0
84	Coopernico	Portugal	1	1	1	2	0	0	0	0	0	0
85	EDA	Portugal	1	1	1	2	0	0	0	0	0	0
86	EDP	Portugal	1	1	1	2	1	0	0	0	0	0
87	Endesa	Portugal	1	1	1	2	0	0	0	0	0	0
88	Galp on	Portugal	1	1	2	2	0	0	0	0	0	0
89	Gas Natural Fenosa	Portugal	1	1	1	2	0	0	0	0	0	0
90	Bord Gàis Energy	Rep. Ireland	1	2	1	2	0	1	0	0	0	0

91	Electric Ireland SmarterLiving	Rep. Ireland	1	1	1	2	0	0	0	0	0	0
92	Energia Switched On	Rep. Ireland	1	2	1	2	0	0	0	0	0	0
93	SSE Airtricity	Rep. Ireland	1	2	2	2	0	0	0	0	0	0
94	Enel	Romania	1	1	1	2	0	0	0	0	0	0
95	UNKNOW UTILITY	Rwanda	1	1	1		0	0	0	0	0	0
96	Endesa	Spain	1	2	1	2	1	0	0	0	0	0
97	Iberdola	Spain	1	1	1	2	0	0	0	0	0	0
98	Som Energia	Spain	1	1	1	2	0	0	0	0	0	0
99	BestEI	Sweden	1	2	1	2	0	0	0	0	0	0
100	E.ON	Sweden	1	1	1	1	0	0	0	0	0	0
101	öresunds Kraft AB	Sweden	1	2	7	2	0	0	0	0	0	0
102	Oskarshamn Energi	Sweden	1	2	1	2	0	0	0	0	0	0
103	Skanska	Sweden	1	1	1		0	0	0	0	0	0
104	Yagmur Group	Turkey	2	2	1	2						
105	Bristol Energy	UK	1	2	2	2	0	0	0	0	0	0
106	British Gas	UK	1	2	2	2	0	0	0	0	0	0
107	Coop energy	UK	1	2	2	1	0	0	0	0	0	0
108	E.ON	UK	1	1	2	2	0	0	0	0	0	0
109	Ecotricity	UK	1	2	2	2	0	0	0	0	0	0
110	EDF	UK	1	1	2	3	0	0	0	0	0	0
111	First Utility	UK	1	2	2	2	0	0	0	0	0	0
112	GB Energy Supply	UK	1	1	1	2	0	0	0	0	0	0
113	iSupply Energy	UK	1	2	1	3	0	0	0	0	0	0
114	Npower	UK	1	2	2	3	0	1	0	0	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website
115	OVO Energy	UK	1	1	2	2	0	0	0	0	0	0
116	Scottish Power	UK	1	1	1	3	0	0	0	0	0	0
117	So Energy	UK	1	2	2	2	0	0	0	0	0	0
118	Spark Energy	UK	1	2	2	2	0	0	0	0	0	0
119	SSE	UK	1	2	1	2	0	0	0	0	0	0
120	AEP Ohio	USA	1	2	1	2	0	1	0	0	0	0
121	Con Edison	USA	1	2	2	2	0	0	1	1	0	0
122	Memphis Light, Gas and Water	USA	1	1	2	2	0	0	0	0	0	0
123	National Grid	USA	1	2	1	2	0	1	0	1	1	0
124	PECO Energy Company	USA	1	2	2	2	0	0	0	1	1	0
125	SMUD	USA	1	2	1	2	0	1	1	1	1	0

B) Gas bills

a. TRANSPARENT ACCOUNTING

RESIDENTIAL GAS BILL- TRANSPARENT ACCOUNTING													
ID	Utility name	Country	Analyzed (1: yes, / 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	G01 Meter reading type (estimated or actual)	G02 Total amount due	G03 Disaggregatio n of billing costs	G04 Energy usage in [kWh]	G05 Unit rate of energy [costs/kW h]	G06 Visual chart breakdow n of billing costs	G07 Other
1	Momentum Energy	Australia	1	2	4	2	1	1	1	1	1	0	0
2	EKG - Energie Klagenfurt	Austria	1	2	4	1	1	1	1	1	1	0	0
3	Energie AG	Austria	1	2	4	1	1	1	1	1	1	0	0
4	Energie Burgenland	Austria	1	2	2	1	1	1	1	1	1	0	0
5	Energie Steiermark	Austria	1	2	4	1	1	1	1	1	1	0	0
6	EVN	Austria	1	2	4	1	1	1	1	1	1	0	0
7	Linz AG	Austria	1	2	4	1	1	1	1	1	1	0	0
8	MONTANA Energie- Handel	Austria	1	2	4	1	1	1	1	1	1	0	0
9	MyElectric	Austria	1	2	2	2	1	1	1	1	1	0	0
10	Oekostrom AG	Austria	1	2	4	2	1	1	1	1	1	0	0
11	Switch Energievertrieb	Austria	1	2	4	1	1	1	1	1	1	0	0
12	Unsere Wasserkraft GmbH	Austria	1	2	4	1	1	1	1	1	1	0	0
13	ENI Gas & Power	Belgium	1	2	2	2	1	1	1	1	0	0	0
14	Luminus	Belgium	1	2	2	1	1	1	1	1	1	1	0
15	GasNatural Fenosa	Brazil	1	1	4	2	1	1	1	1	0	0	0
16	SuperGasBras	Brazil	1	1	4	2	1	1	0	1	0	0	0
17	UNKNOWN UTILITY	China	2	1	4								
18	Prazska Plynarenska	Czech Republic	1	1	4	1	0	1	1	1	1	0	0

19	DGD Danks Gas Distribution	Denmark	1	2	4	1	1	1	1	1	1	0	0
20	HMN Naturgas	Denmark	1	2	4	2	1	1	1	1	1	0	0
21	Direct Energy	France	1	1	2	2	1	1	1	1	1	0	0
22	Engie	France	1	1	2	1	1	1	1	1	1	0	0
23	BS Energy	Germany	1	2	2	2	1	1	1	1	1	0	0
24	Eins - Energie in Sachsen	Germany	1	2	4	2	0	1	1	1	1	0	0
25	Entega	Germany	1	2	2	1	0	1	1	1	1	0	0
26	Eprimo	Germany	1	1	4	1	1	0	1	1	1	0	0
27	EVO	Germany	1	2	4	1	0	1	1	1	1	0	0
28	EWE	Germany	1	2	4	1	1	1	1	1	1	0	0
29	Greenpeace Energy	Germany	1	2	4	1	1	1	1	1	1	0	0
30	Hamburg Energie	Germany	1	2	4	1	0	1	1	1	1	0	0
31	Lekker.de	Germany	1	2	4	1	0	1	1	1	1	0	0
32	MAINOVA	Germany	1	2	4	1	1	1	1	1	1	0	0
33	MONTANA Energie-Handel	Germany	1	2	2	1	1	1	1	1	1	0	0
34	Naturstrom Biogas	Germany	1	2	4	1	1	1	1	1	1	0	0
35	Prioenergie	Germany	1	2	4	1	1	1	1	1	1	1	0
36	Rheinenergie	Germany	1	2	4	1	0	1	1	1	1	0	0
37	Stadtwerke Düsseldorf	Germany	1	2	4	1	1	1	1	1	1	0	0
38	SWK	Germany	1	2	2	1	0	1	1	1	1	1	0
39	TEAG	Germany	1	2	4	1	1	1	1	1	1	0	0
40	Fogaz	Hungary	1	1	4	3	1	1	1	1	1	0	0
41	A2A Energia	Italy	1	2	4	2	1	1	1	1	1	1	0
42	Dolomiti Energia	Italy	1	2	4	2	1	1	1	1	1	0	0
43	Enel Energy	Italy	1	1	4	2	1	1	1	1	1	1	1
44	Enerxenia	Italy	1	1	4	2	1	1	1	1	1	0	0
45	Eni spa	Italy	1	1	4	2	1	1	1	1	1	0	0
46	Tokyo Gas	Japan	2	1	2								
47	Essent	Netherlands	1	1	2	1	1	1	1	1	1	0	0
48	EDP	Portugal	1	1	4	2	1	1	1	1	1	1	0
49	Endesa	Portugal	1	2	4	2	1	1	1	1	1	1	0

50	Galp Energia	Portugal	1	1	4	2	1	1	1	1	1	0	0
51	Galp on	Portugal	1	1	2	2	1	1	1	1	1	0	0
52	Gascan	Portugal	1	1	4	2	1	1	1	1	0	0	0
53	Bord Gàis Energy	Rep. Ireland	1	2	4	2	1	1	1	1	1	0	0
54	Electric Ireland SmarterLiving	Rep. Ireland	1	2	4	2	1	1	1	1	1	0	0
55	Energia Switched on	Rep. Ireland	1	2	4	2	1	1	1	1	1	0	0
56	SSE Airtricity	Rep. Ireland	1	2	2	2	1	1	1	1	1	0	0
57	EON	Romania	1	1	4	2	1	1	1	1	1	0	0
58	EDP	Spain	1	1	4	2	1	1	1	1	1	0	0
59	Endesa	Spain	1	1	4	2	1	1	1	1	1	0	0
60	öresunds Kraft AB	Sweden	1	2	7	2	1	1	1	1	1	0	0
61	Bristol Energy	UK	1	2	2	2	1	1	1	1	1	0	0
62	British Gas	UK	1	2	2	2	1	1	1	1	1	0	0
63	Coop energy	UK	1	2	2	1	1	1	1	1	1	0	0
64	E.ON	UK	1	1	2	2	1	1	1	1	1	0	0
65	Ecotricity	UK	1	2	2	2	1	1	1	1	1	0	0
66	EDF	UK	1	1	2	3	1	1	1	1	1	0	0
67	First Utility	UK	1	2	2	2	1	1	1	1	1	0	0
68	iSupply Energy	UK	1	2	4	3	1	1	1	1	1	0	0
69	Npower	UK	1	2	2	3	1	1	1	1	1	1	0
70	OVO Energy	UK	1	1	2	2	1	1	1	1	1	0	0
71	Scottish Power	UK	1	1	4	3	1	1	1	1	1	0	0
72	So Energy	UK	1	2	2	2	1	1	1	1	1	0	0
73	Spark Energy	UK	1	2	2	2	1	1	1	1	1	0	0
74	Con Edison	USA	1	2	2	2	1	1	1	1	1	0	0
75	Memphis Light, Gas and Water	USA	1	1	2	2	1	1	1	1	1	0	0
76	National Grid	USA	1	2	4	2	1	1	1	1	1	0	0
77	PECO Energy Company	USA	1	2	2	2	1	1	1	1	1	0	0
78	SMUD	USA	1	2	4	2	1	1	1	1	1	0	0

b. COMPARATIVE STATISTICS

RESIDENTIAL GAS BILL - COMPARATIVE STATISTICS																
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7: electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	G08 Average daily energy use and costs	G09 Graph of current energy usage	G10 Graph of historical energy use	G11 a Current energy usage compared to previous month	G11 b Current energy usage compared to previous year (same period)	G12 Current energy usage compared to similar households	G13 Current energy usage compared to similar households in the same area	G14 Energy usage pattern variation according to seasons	G15 Correlation between energy usage and temperature/ weather conditions	G16 Other
1	Momentum Energy	Australia	1	2	4	2	1	0	1	0	1	1	0	1	0	0
2	EKG - Energie Klagenfurt	Austria	1	2	4	1	0	0	0	0	0	0	0	0	0	0
3	Energie AG	Austria	1	2	4	1	1	0	0	0	1	0	0	0	0	0
4	Energie Burgenland	Austria	1	2	2	1	0	0	0	0	1	0	0	0	0	0
5	Energie Steiermark	Austria	1	2	4	1	0	0	0	0	1	0	0	0	0	0
6	EVN	Austria	1	2	4	1	1	0	0	0	1	0	0	0	0	0
7	Linz AG	Austria	1	2	4	1	0	0	1	0	1	0	0	0	0	0
8	MONTANA Energie-Handel	Austria	1	2	4	1	1	0	0	0	1	0	0	0	0	0
9	MyElectric	Austria	1	2	2	2	1	0	0	0	1	0	0	0	1	0
10	Oekostrom AG	Austria	1	2	4	2	0	0	0	0	0	0	0	0	0	0
11	Switch Energievertrieb	Austria	1	2	4	1	1	0	0	0	0	0	0	0	0	0
12	Unsere Wasserkraft GmbH	Austria	1	2	4	1	0	0	0	0	0	0	0	0	0	0
13	ENI Gas & Power	Belgium	1	2	2	2	0	0	0	0	0	0	0	0	0	0
14	Luminus	Belgium	1	2	2	1	0	0	1	0	1	0	0	0	0	0
15	GasNatural Fenosa	Brazil	1	1	4	2	0	0	1	0	0	0	0	0	0	0
16	SuperGasBras	Brazil	1	1	4	2	0	0	0	0	0	0	0	0	0	0
17	UNKNOWN UTILITY	China	2	1	4											
18	Prazska Plynarenska	Czech Republic	1	1	4	1	0	0	0	0	0	0	0	0	0	0
19	DGD Danks Gas Distribution	Denmark	1	2	4	1	0	0	0	0	0	0	0	0	0	0
20	HMN Naturgas	Denmark	1	2	4	2	0	0	0	0	0	0	0	0	0	0

21	Direct Energy	France	1	1	2	2	0	0	0	0	0	0	0	0	0	0
22	Engie	France	1	1	2	1	0	0	0	0	0	0	0	0	0	0
23	BS Energy	Germany	1	2	2	2	0	0	0	0	1	1	0	0	0	0
24	Eins - Energie in Sachsen	Germany	1	2	4	2	0	0	0	0	0	1	0	0	0	0
25	Entega	Germany	1	2	2	1	0	0	0	0	1	1	0	0	0	0
26	Eprimo	Germany	1	1	4	1	0	0	0	0	1	1	0	0	0	0
27	EVO	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
28	EWE	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
29	Greenpeace Energy	Germany	1	2	4	1	1	0	0	0	1	0	0	0	0	0
30	Hamburg Energie	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
31	Lekker.de	Germany	1	2	4	1	0	0	0	0	1	0	0	0	0	States the % saved ((or wasted) in regards to past consumption
32	MAINOVA	Germany	1	2	4	1	0	0	0	0	0	1	0	0	0	Comparison of households is based on building type (passive house, refurbished, new etc.) and kWh/m2 consumed
33	MONTANA Energie-Handel	Germany	1	2	2	1	0	0	0	0	0	1	0	0	0	0
34	Naturstrom Biogas	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
35	Prioenergie	Germany	1	2	4	1	0	0	0	0	0	1	0	0	0	Comparison of households is based on building type (single, apartment, duplex etc.) and kWh/m2 consumed
36	Rheinenergie	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
37	Stadtwerke Düsseldorf	Germany	1	2	4	1	0	0	0	0	1	1	0	0	0	0
38	SWK	Germany	1	2	2	1	0	0	0	0	0	1	0	0	0	0

39	TEAG	Germany	1	2	4	1	0	0	0	0	0	1	0	0	0	Comparison of households is based on building type (year of construction, refurbishment, etc.) and kWh/m2 consumed
40	Fogaz	Hungary	1	1	4	3	0	0	0	0	0	0	0	0	0	0
41	A2A Energia	Italy	1	2	4	2	0	1	1	1	1	0	0	0	0	0
42	Dolomiti Energia	Italy	1	2	4	2	0	0	1	1	0	0	0	0	0	0
43	Enel Energy	Italy	1	1	4	2	0	0	1	1	1	0	0	0	0	0
44	Enerxenia	Italy	1	1	4	2	0	0	1	1	0	0	0	0	0	0
45	Eni spa	Italy	1	1	4	2	0	0	1	1	0	0	0	0	0	0
46	Tokyo Gas	Japan	2	1	2											
47	Essent	Netherlands	1	1	2	1	0	0	0	1	1	1	0	0	0	0
48	EDP	Portugal	1	1	4	2	0	0	0	0	0	0	0	0	0	0
49	Endesa	Portugal	1	2	4	2	0	0	1	0	0	0	0	0	0	0
50	Galp Energia	Portugal	1	1	4	2	0	0	1	0	0	0	0	0	0	0
51	Galp on	Portugal	1	1	2	2	0	0	1	1	0	0	0	0	0	0
52	Gascan	Portugal	1	1	4	2	0	0	1	0	0	0	0	0	0	0
53	Bord Gàis Energy	Rep. Ireland	1	2	4	2	0	0	0	0	0	0	0	0	0	0
54	Electric Ireland SmarterLiving	Rep. Ireland	1	2	4	2	0	0	0	0	0	0	0	0	0	0
55	Energia Switched on	Rep. Ireland	1	2	4	2	0	0	0	0	0	0	0	0	0	0
56	SSE Airtricity	Rep. Ireland	1	2	2	2	0	0	0	0	0	0	0	0	0	0
57	EON	Romania	1	1	4	2	0	0	0	0	0	0	0	0	0	0
58	EDP	Spain	1	1	4	2	1	0	1	0	0	0	0	0	0	0
59	Endesa	Spain	1	1	4	2	0	0	1	0	0	0	0	0	0	0
60	öresunds Kraft AB	Sweden	1	2	7	2	0	0	0	0	0	0	0	0	0	0
61	Bristol Energy	UK	1	2	2	2	0	0	0	0	0	0	0	0	0	0
62	British Gas	UK	1	2	2	2	0	0	0	1	0	0	0	0	0	0
63	Coop energy	UK	1	2	2	1	0	0	0	0	0	0	0	0	0	0
64	E.ON	UK	1	1	2	2	0	0	0	0	1	0	0	0	0	0
65	Ecotricity	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0
66	EDF	UK	1	1	2	3	0	0	1	0	1	0	0	0	0	0
67	First Utility	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0

68	iSupply Energy	UK	1	2	4	3	0	0	0	0	0	0	0	0	0	0
69	Npower	UK	1	2	2	3	0	0	0	0	1	0	0	0	0	0
70	OVO Energy	UK	1	1	2	2	0	0	0	0	0	0	0	0	0	0
71	Scottish Power	UK	1	1	4	3	0	0	0	0	1	0	0	0	0	0
72	So Energy	UK	1	2	2	2	0	0	0	0	0	0	0	0	0	0
73	Spark Energy	UK	1	2	2	2	0	0	0	0	1	0	0	0	0	0
74	Con Edison	USA	1	2	2	2	0	1	1	0	0	0	0	0	0	0
75	Memphis Light, Gas and Water	USA	1	1	2	2	0	0	0	0	0	0	0	0	0	0
76	National Grid	USA	1	2	4	2	1	0	1	1	1	0	0	0	0	0
77	PECO Energy Company	USA	1	2	2	2	0	0	1	1	1	0	0	0	0	0
78	SMUD	USA	1	2	4	2	1	1	1	1	1	0	0	0	0	0

C. ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

RESIDENTIAL GAS BILL - CLEAN ENERGY SECTION								
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	G17 Alternative metrics (e.g. CO ₂ equivalent emissions, carbon footprint etc.)	G18 Other
1	Momentum Energy	Australia	1	2	4	2	0	0
2	EKG - Energie Klagenfurt	Austria	1	2	4	1	0	0
3	Energie AG	Austria	1	2	4	1	0	0
4	Energie Burgenland	Austria	1	2	2	1	0	0
5	Energie Steiermark	Austria	1	2	4	1	0	0
6	EVN	Austria	1	2	4	1	0	0
7	Linz AG	Austria	1	2	4	1	0	0
8	MONTANA Energie- Handel	Austria	1	2	4	1	0	0
9	MyElectric	Austria	1	2	2	2	0	0
10	Oekostrom AG	Austria	1	2	4	2	0	0
11	Switch Energievertrieb	Austria	1	2	4	1	0	0
12	Unsere Wasserkraft GmbH	Austria	1	2	4	1	0	0
13	ENI Gas & Power	Belgium	1	2	2	2	0	0
14	Luminus	Belgium	1	2	2	1	1	0
15	GasNatural Fenosa	Brazil	1	1	4	2	0	0
16	SuperGasBras	Brazil	1	1	4	2	0	0
17	UNKNOWN UTILITY	China	2	1	4			
18	Prazska Plynarenska	Czech Republic	1	1	4	1	0	0
19	DGD Danks Gas Distribution	Denmark	1	2	4	1	0	0

20	HMN Naturgas	Denmark	1	2	4	2	0	0
21	Direct Energy	France	1	1	2	2	0	0
22	Engie	France	1	1	2	1	0	0
23	BS Energy	Germany	1	2	2	2	0	0
24	Eins - Energie in Sachsen	Germany	1	2	4	2	0	0
25	Entega	Germany	1	2	2	1	0	0
26	Eprimo	Germany	1	1	4	1	0	0
27	EVO	Germany	1	2	4	1	0	0
28	EWE	Germany	1	2	4	1	0	0
29	Greenpeace Energy	Germany	1	2	4	1	0	0
30	Hamburg Energie	Germany	1	2	4	1	0	0
31	Lekker.de	Germany	1	2	4	1	0	0
32	MAINOVA	Germany	1	2	4	1	0	0
33	MONTANA Energie-Handel	Germany	1	2	2	1	0	0
34	Naturstrom Biogas	Germany	1	2	4	1	0	0
35	Prioenergie	Germany	1	2	4	1	0	0
36	Rheinenergie	Germany	1	2	4	1	0	0
37	Stadtwerke Düsseldorf	Germany	1	2	4	1	0	0
38	SWK	Germany	1	2	2	1	0	1
39	TEAG	Germany	1	2	4	1	0	0
40	Fogaz	Hungary	1	1	4	3	0	0
41	A2A Energia	Italy	1	2	4	2	0	0
42	Dolomiti Energia	Italy	1	2	4	2	0	0
43	Enel Energy	Italy	1	1	4	2	0	0
44	Enerxenia	Italy	1	1	4	2	0	0
45	Eni spa	Italy	1	1	4	2	0	0
46	Tokyo Gas	Japan	2	1	2			
47	Essent	Netherlands	1	1	2	1	0	0
48	EDP	Portugal	1	1	4	2	0	0
49	Endesa	Portugal	1	2	4	2	1	0
50	Galp Energia	Portugal	1	1	4	2	0	0

51	Galp on	Portugal	1	1	2	2	0	0
52	Gascan	Portugal	1	1	4	2	0	0
53	Bord Gàis Energy	Rep. Ireland	1	2	4	2	0	0
54	Electric Ireland SmarterLiving	Rep. Ireland	1	2	4	2	0	0
55	Energia Switched on	Rep. Ireland	1	2	4	2	0	0
56	SSE Airtricity	Rep. Ireland	1	2	2	2	0	0
57	EON	Romania	1	1	4	2	0	0
58	EDP	Spain	1	1	4	2	0	0
59	Endesa	Spain	1	1	4	2	0	0
60	öresunds Kraft AB	Sweden	1	2	7	2	0	0
61	Bristol Energy	UK	1	2	2	2	0	0
62	British Gas	UK	1	2	2	2	0	0
63	Coop energy	UK	1	2	2	1	0	0
64	E.ON	UK	1	1	2	2	0	0
65	Ecotricity	UK	1	2	2	2	0	0
66	EDF	UK	1	1	2	3	0	0
67	First Utility	UK	1	2	2	2	0	0
68	iSupply Energy	UK	1	2	4	3	0	0
69	Npower	UK	1	2	2	3	0	0
70	OVO Energy	UK	1	1	2	2	0	0
71	Scottish Power	UK	1	1	4	3	0	0
72	So Energy	UK	1	2	2	2	0	0
73	Spark Energy	UK	1	2	2	2	0	0
74	Con Edison	USA	1	2	2	2	0	0
75	Memphis Light, Gas and Water	USA	1	1	2	2	0	0
76	National Grid	USA	1	2	4	2	0	0
77	PECO Energy Company	USA	1	2	2	2	0	0
78	SMUD	USA	1	2	4	2	0	0

d. TIPS & ADVICES

RESIDENTIAL GAS BILL - TIPS & ADVICES												
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	G19 One-size- fits-all, general energy- saving tips and advices	G20 Customize d, actionable insights to manage energy costs & consumpti on	G21 Advice on time-of- day tariffs or other dynamic tariffs	G22 Explanatio n of key terms (e.g. kWh, m ³ , specific surcharges etc.)	G23 Contact info on customer service offering customized energy- efficiency specific consultancy	G23 Other
1	Momentum Energy	Australia	1	2	4	2	0	0	0	0	0	0
2	EKG - Energie Klagenfurt	Austria	1	2	4	1	0	0	0	1	0	0
3	Energie AG	Austria	1	2	4	1	0	0	0	0	0	0
4	Energie Burgenland	Austria	1	2	2	1	0	1	0	0	0	0
5	Energie Steiermark	Austria	1	2	4	1	0	0	0	0	0	0
6	EVN	Austria	1	2	4	1	0	0	0	1	1	A link on the bill is indicated, referring to energy-saving tips on the utility's website
7	Linz AG	Austria	1	2	4	1	0	0	0	0	0	0
8	MONTANA Energie- Handel	Austria	1	2	4	1	0	0	0	0	0	0
9	MyElectric	Austria	1	2	2	2	1	0	0	0	1	0
10	Oekostrom AG	Austria	1	2	4	2	0	0	0	1	0	0
11	Switch Energievertrieb	Austria	1	2	4	1	0	0	0	1	0	0
12	Unsere Wasserkraft GmbH	Austria	1	2	4	1	0	0	0	1	0	0
13	ENI Gas & Power	Belgium	1	2	2	2	0	0	0	0	0	0
14	Luminus	Belgium	1	2	2	1	0	0	0	0	0	0
15	GasNatural Fenosa	Brazil	1	1	4	2	0	0	0	0	0	0
16	SuperGasBras	Brazil	1	1	4	2	0	0	0	0	0	0
17	UNKNOWN UTILITY	China	2	1	4							
18	Prazska Plynarenska	Czech Republic	1	1	4	1	0	0	0	0	0	0
19	DGD Danks Gas Distribution	Denmark	1	2	4	1	0	0	0	0	0	0
20	HMN Naturgas	Denmark	1	2	4	2	0	0	0	0	0	0
21	Direct Energy	France	1	1	2	2	0	0	0	0	0	0

22	Engie	France	1	1	2	1	0	0	0	0	0	0
23	BS Energy	Germany	1	2	2	2	0	0	0	0	0	Refers to general websites on national policies towards energy efficiency
24	Eins - Energie in Sachsen	Germany	1	2	4	2	0	0	0	1	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
25	Entega	Germany	1	2	2	1	0	0	0	0	0	0
26	Eprimo	Germany	1	1	4	1	0	0	0	1	1	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
27	EVO	Germany	1	2	4	1	0	0	0	1	1	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
28	EWE	Germany	1	2	4	1	0	0	0	0	0	
29	Greenpeace Energy	Germany	1	2	4	1	0	0	0	0	0	
30	Hamburg Energie	Germany	1	2	4	1	0	0	0	1	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
31	Lekker.de	Germany	1	2	4	1	1	0	0	1	0	A link on the bill is indicated, referring to energy-saving tips on the utility's website
32	MAINOVA	Germany	1	2	4	1	0	0	0	1	1	A link on the bill is indicated, referring to energy-saving tips on the utility's website, as well as to national policies towards energy efficiency
33	MONTANA Energie-Handel	Germany	1	2	2	1	0	0	0	1	0	Refers to general websites on national policies towards energy efficiency
34	Naturstrom Biogas	Germany	1	2	4	1	0	0	0	1	0	Refers to general websites on national policies towards energy efficiency
35	Prioenergie	Germany	1	2	4	1	0	0	0	1	0	Refers to general websites on national policies towards energy efficiency

36	Rheinenergie	Germany	1	2	4	1	0	0	0	1	0	Refers to general websites on national policies towards energy efficiency
37	Stadtwerke Düsseldorf	Germany	1	2	4	1	0	0	0	1	1	Refers to general websites on national policies towards energy efficiency
38	SWK	Germany	1	2	2	1	0	0	0	0	0	0
39	TEAG	Germany	1	2	4	1	0	0	0	1	0	Refers to general websites on national policies towards energy efficiency
40	Fogaz	Hungary	1	1	4	3	0	0	0	0	0	0
41	A2A Energia	Italy	1	2	4	2	0	0	0	0	0	0
42	Dolomiti Energia	Italy	1	2	4	2	0	0	0	0	0	0
43	Enel Energy	Italy	1	1	4	2	0	0	0	0	0	0
44	Enerxenia	Italy	1	1	4	2	0	0	0	0	0	0
45	Eni spa	Italy	1	1	4	2	0	0	0	0	0	0
46	Tokyo Gas	Japan	2	1	2							
47	Essent	Netherlands	1	1	2	1	0	0	0	0	0	0
48	EDP	Portugal	1	1	4	2	1	0	0	0	0	0
49	Endesa	Portugal	1	2	4	2	0	0	0	0	0	0
50	Galp Energia	Portugal	1	1	4	2	0	0	0	0	0	0
51	Galp on	Portugal	1	1	2	2	0	0	0	0	0	0
52	Gascan	Portugal	1	1	4	2	0	0	0	0	0	0
53	Bord Gáis Energy	Rep. Ireland	1	2	4	2	0	0	0	0	0	0
54	Electric Ireland	Rep. Ireland	1	2	4	2	0	0	0	0	0	0
55	Energia Switched on	Rep. Ireland	1	2	4	2	0	0	0	0	0	0
56	SSE Airtricity	Rep. Ireland	1	2	2	2	0	0	0	1	0	0
57	EON	Romania	1	1	4	2	0	0	0	0	0	0
58	EDP	Spain	1	1	4	2	0	0	0	0	0	0
59	Endesa	Spain	1	1	4	2	0	0	0	0	0	0
60	öresunds Kraft AB	Sweden	1	2	7	2	0	0	0	0	0	0
61	Bristol Energy	UK	1	2	2	2	0	0	0	0	0	0
62	British Gas	UK	1	2	2	2	0	0	0	0	0	0
63	Coop energy	UK	1	2	2	1	0	0	0	0	0	0
64	E.ON	UK	1	1	2	2	0	0	0	0	0	0
65	Ecotricity	UK	1	2	2	2	0	0	0	0	0	0
66	EDF	UK	1	1	2	3	0	0	0	0	0	0
67	First Utility	UK	1	2	2	2	0	0	0	0	0	0
68	iSupply Energy	UK	1	2	4	3	0	0	0	0	0	0
69	Npower	UK	1	2	2	3	0	0	0	0	0	0
70	OVO Energy	UK	1	1	2	2	0	0	0	0	0	0
71	Scottish Power	UK	1	1	4	3	0	0	0	0	0	0

72	So Energy	UK	1	2	2	2	0	0	0	0	0	0
73	Spark Energy	UK	1	2	2	2	0	0	0	0	0	0
74	Con Edison	USA	1	2	2	2	0	0	0	0	0	0
75	Memphis Light, Gas and Water	USA	1	1	2	2	0	0	0	0	0	0
76	National Grid	USA	1	2	4	2	0	0	0	0	0	0
77	PECO Energy Company	USA	1	2	2	2	0	0	0	1	0	0
78	SMUD	USA	1	2	4	2	0	0	0	0	0	0

C) District Heating bills

a. TRANSPARENT ACCOUNTING

RESIDENTIAL DISTRICT HEATING BILL - TRANSPARENT ACCOUNTING													
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	DH01 Meter reading type (estimated or actual)	DH02 Total amount due	DH03 Disaggregation of billing costs	DH04 Energy usage in [m3] or [kWh]	DH05 Unit rate of energy [costs/kWh] or [costs/m3]	DH06 Visual chart breakdown of billing costs	DH07 Other
1	EKG - Energie Klagenfurt	Austria	1	2	6	1	1	1	1	1	1	0	0
2	Energie Burgenland	Austria	1	2	6	1	1	1	1	1	1	0	0
3	Energie Steiermark	Austria	1	2	6	1	1	1	1	1	1	0	0
4	Linz AG Wärme	Austria	1	2	6	1	1	1	0	1	1	0	0
5	HOFOR	Denmark	1	2	6	1	0	0	1	0	0	0	0
6	Hera Comm	Italy	1	2	6	2	1	1	1	1	1	0	0
7	Nuon	Netherlands	1	1	3	1	1	1	1	1	0	0	0
8	öresunds_Kraft	Sweden	1	2	7	2	1	1	1	1	1	0	0
9	Oskarshamn Energi	Sweden	1	2	6	2	1	1	1	1	1	0	0

b. COMPARATIVE STATISTICS

RESIDENTIAL DISTRICT HEATING BILL - COMPARATIVE STATISTICS															
ID	Utility name	Country	Analyzed (1: Yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	DH08 Average daily energy use and costs	DH09 Graph of current energy usage	DH10 Graph of historical energy use	DH11 a Current energy usage compared to previous month	DH11 b Current energy usage compared to previous year (same period)	DH12 Current energy usage compared to similar households	DH13 Current energy usage compared to similar households in the same area	DH14 Energy usage pattern variation according to seasons	DH15 Correlation between energy usage and temperature / weather conditions	DH16 Other
1	EKG - Energie Klagenfurt	Austria	1	2	6	0	0	0	0	0	0	0	0	0	0
2	Energie Burgenland	Austria	1	2	6	0	0	0	0	0	0	0	0	0	0
3	Energie Steiermark	Austria	1	2	6	0	0	0	0	0	0	0	0	0	0
4	Linz AG Wärme	Austria	1	2	6	0	0	1	0	1	0	0	0	0	0
5	HOFOR	Denmark	1	2	6	0	0	0	0	0	0	0	0	0	0
6	Hera Comm	Italy	1	2	6	1	0	1	1	1	0	0	0	0	0
7	Nuon	Netherlands	1	1	3	0	0	0	1	0	1	0	0	0	0
8	öresunds_Kraft	Sweden	1	2	7	0	0	0	0	0	0	0	0	0	0
9	Oskarshamn Energi	Sweden	1	2	6	0	0	0	0	0	0	0	0	0	0

C. ECO-FEEDBACK ON CLIMATE AND ENVIRONMENTAL IMPACT

RESIDENTIAL DISTRICT HEATING BILL - CLEAN ENERGY SECTION								
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	DH17 Alternative metrics (e.g. CO ₂ equivalent emissions, carbon footprint etc.)	DH18 Other
1	EKG - Energie Klagenfurt	Austria	1	2	6	1	0	0
2	Energie Burgenland	Austria	1	2	6	1	0	0
3	Energie Steiermark	Austria	1	2	6	1	0	0
4	Linz AG Wärme	Austria	1	2	6	1	0	0
5	HOFOR	Denmark	1	2	6	1	0	0
6	Hera Comm	Italy	1	2	6	2	0	0
7	Nuon	Netherlands	1	1	3	1	0	0
8	öresunds_Kraft	Sweden	1	2	7	2	0	0
9	Oskarshamn Energi	Sweden	1	2	6	2	0	0

d. TIPS & ADVICES

RESIDENTIAL DISTRICT HEATING BILL - TIPS & ADVICES												
ID	Utility name	Country	Analyzed (1: yes, 2: no)	Source (1: personal contacts abroad 2: Internet search)	Consumptions accounted for by the bill (1: electricity 2: electricity-gas 3: electricity-district heating 4: gas 5: gas-district heating 6: district heating 7 : electricity - gas - district heating)	Bill type (1 = annual balance bill; 2 = interim bill; 3 = annual and interim)	DH19 One-size-fits- all, general energy-saving tips and advices	DH20 Customized, actionable insights to manage energy costs & consumption	DH21 Advice on time-of-day tariffs or other dynamic tariffs	DH22 Explanation of key terms (e.g. kWh, m ³ , specific surcharges etc.)	DH23 Contact info on customer service offering customized energy- efficiency specific consultancy	DH24 Other
1	EKG - Energie Klagenfurt	Austria	1	2	6	1	0	0	0	0	0	0
2	Energie Burgenland	Austria	1	2	6	1	0	0	0	0	0	0
3	Energie Steiermark	Austria	1	2	6	1	0	0	0	0	0	0
4	Linz AG Wärme	Austria	1	2	6	1	0	0	0	0	0	0
5	HOFOR	Denmark	1	2	6	1	0	0	0	0	0	0
6	Hera Comm	Italy	1	2	6	2	0	0	0	0	0	0
7	Nuon	Netherlands	1	1	3	1	0	0	0	1	1	0
8	öresunds_Kraft	Sweden	1	2	7	2	0	0	0	0	0	0
9	Oskarshamn Energi	Sweden	1	2	6	2	0	0	0	0	0	0

Appendix 9. Categories of the Analysis Template

Description and summary	Short description of the model with a brief summary
Systems and technologies applied	A description of the used technologies within the model, e.g. mobile app, in-home display
Behavioural change investigated	Which behaviour is mainly addressed, e.g. routine or purchasing behaviour?
Main focus, hypothesis and motivation	What is the main focus of the model, what is the hypothesis of the study and the motivation?
Behavioural change model	Underlying concepts, based on known theories and models (introduction chapter to the main body of the final report)
Key words, tags	e.g. smart meter, bonus system etc.
Source, material and literature	Source of the data used for the analysis
Country	Country in which the model is applied
Geographical scope	Geographical scope in which the model is usable
Monitoring and evaluation metrics	What are the examination units, what is monitored?
Energy carrier	Energy carriers for which the model is used, e.g. oil, gas, electricity, district heating, warm water
Project period	Period in which the model has been applied
Size of utility	Amount of energy, which the utility provides per year
Key lessons learned	Lessons learned mentioned from the initiators or project team
Feedback frequency	Periodicity of the feedback
Feedback duration	Continuous or finite feedback
Feedback content	e.g. costs, consumption
Level of breakdown	Aggregation (e.g. on appliance level)
Medium of presentation	e.g. written, electronic
Mode of presentation	e.g. text, numbers, graphs
Comparison to previous consumption	Historical comparison
Comparison to the consumption of the reference group	Normative comparison
Gamification elements	e.g. tasks, competition
Combination with other DSM instruments	Is the model combined with other measures, e.g. information and financial incentives?
Achieved energy savings	Includes saved kWh or CHF
Affected population share	Potential of the model in terms of affected people
Persistent effect	Is a persistent effect of the findings existing?
Subjective Evaluation	Strengths and weaknesses of the approach are described within this section based on the subjective viewpoint of the analysing researcher. It contains an informed valuation relating to theory.

Appendix 10. Completed Analysis Template of Assessed DSI/DSM Models

General Information I

Example of use (DSI/DSM)	Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
1 The MUNX (Web platform from Repower an international energy company based in Switzerland. It operates along the entire value chain, from generation, trading, transmission and distribution to sales.)	The aim of the website is to show the users their consumption of electric power in an easy way. A possibility of being familiar with the own electricity consumption is to enter the values of the electric power meter weekly into this web platform. The users of this platform enter the meter reading of the electric power meter weekly. They get a feedback of the consumption by comparing it to other households/neighbours. You can also enter other parameters of your flat - for example which energy you use for heating, how big your flat is, how many people live in your flat etc. When you enter these parameters, you will get an energy standard mark (A, B, C etc). You can also do some quiz to learn more about electric power and you get lots of tips about saving energy at home and in the office. You can plan measures to save energy (e.g. plan to buy a new and more efficient wash machine or to take a shower instead of taking a bath). You can also set a reminder (via mail or SMS) for entering the value of the electric meter. For all these things, you can collect points and with the points you can buy devices for saving electric power (e.g. energy saving light bulbs or water reducing valves for the shower).	web-portal	How does the consumption of power change when the users know how much they use; Motivate to purchase energy efficient products	Is there an effect on the consumption of electric power when the user knows his weekly use and can compare it with others?	Behavioural economics: theory of planned behaviour; social comparison, social marketing; behaviour barriers (e.g. knowledge barriers)
2 Smart Metering case study Uttwil (EKT)	Goal of the study: The study is based on accompany research on a comprehensive smart meter rollout in two municipalities in the east of Switzerland. The main goal is to analyse the impact of a real-time feedback system on energy consumption behaviour of pilot households as well as to test several incentive measures. This includes the monitoring of load profiles as well as conducting surveys among participants on a regular basis (N=200). A further aspect of the study was to gain insight in acceptance and perceived benefits of smart meters.	smart meter, mobile app, in-home display (iPod)	The study analyses how information on energy use influences the behaviour of energy consumers in terms of habit change. Furthermore, acceptance and attitudes towards smart meters was evaluated.	How will different kinds of information about energy use affect the behaviour of energy consumers? The following types of information are analysed: Smart meters giving immediate feedback on energy consumption via in-home-display (iPod app), general feedback on savings achieved via newsletter / blog, Information on new technical extensions of smart meter equipment towards smart home use. Further was inquired how a certain level of technology affinity influences the use of the technical feedback equipment as well as energy behaviour changes in general. Not last it was tried to explore patterns of usage and consumption in order to gain a better understanding of how consumers can be grouped in different customer segments.	Information deficit models, value action gap, behaviour barriers (e.g. knowledge barriers)
3 bonus model for energy efficient households (EWZ), research project FP-1.9 platform "www.smart-steps.ch" (mailing, web-portal, newsletter and mobile app)	aim of the project: decrease the total energy consumption of households (heat, electricity and warm water) with IT based information systems. A personalized efficiency platform was developed within the project. On the platform, the interventions can be tested under real conditions. The effect of different incentives (virtual, monetary and material) have been analysed in relation to the motivation of using the platform.	web-portal, mailing, newsletter, mobile app, recommender system REX	The effect of different incentives (virtual, monetary and material) on the motivation of using the platform has been analysed. Furthermore, the change of consumption behaviour was investigated.	How will different types of incentives influence the use of the platform? How does the usage of the platform influence the energy consumption? Which activities should be rewarded for an optimal impact? Is it possible to optimize the probability for realised efficiency measurements by individual recommendation?	behaviour influencing information systems; incentive based motivating; extrinsic and intrinsic motivation; behavioural psychology; information deficit models; social comparison; theory of planned behaviour; behaviour barriers

Example of use (DSI/DSM)		Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
4	Smart Metering case study Zurich (EWZ)	The study analyses electricity consumption over a 15 months period for around 5000 randomly selected households in Zurich. The objective of the study is to assess the role of information on electricity consumption. Information is improved in four different dimensions: (i) continuous and detailed feedback about the electricity consumption by Smart Meters, (ii) expert advice on electricity conservation, (iii) unilateral information about electricity consumption of others (social comparison), and (iv) bilateral information about the electricity consumption of a comparable household (social competition). The design allows to estimate the causal impact of each type of information on behaviour. Surveys before, during and after the field experiment allow to collect information on values, attitudes, and further household characteristics of the participants and to assess the impact of the treatments on outcomes beyond energy consumption, such as awareness of energy conservation potentials, and customer satisfaction with the services provided by EWZ.	smart meter and smart meter display	The study analyses how information on electricity use influences the behaviour of electricity consumers in terms of consumption.	The study analysed the role of information on electricity consumption. How does a continuous and detailed information about the electricity use influence the consumption? Is it possible to decrease the consumption by professional consulting about electricity efficiency? Do people adapt their electricity consumption if they receive information about the consumption of a comparable household (with competition aspect and without)?	behavioural economics: theory of planned behaviour; social norms and social comparison; information deficit models
5	Smart Metering case study (EKZ)	The study analyses electricity consumption over a 24 months period for around 1000 randomly selected households in Dietikon (Switzerland). The objective of the study is to assess the role of information and visualisation on electricity consumption. Visualisation of the energy consumption took place in various ways: (i) continuous and detailed feedback about the electricity consumption by Smart Meters (Ecometer in-home display) (ii) a Smart Meter portal (password-protected) (iii) a monthly electricity bill. This allows estimating the causal impact of each type of visualisation type on behaviour.	smart meter, smart meter portal	The study analyses how information and visualisation of electricity consumption influences the behaviour of electricity consumers.	How are smart electricity meters able to affect the behaviour of electricity consumers? The following types of information are analysed: Smart meters giving immediate and detailed feedback on electricity consumption; Communication and consulting by energy experts; Potential of different feedback systems and their effect in changing the participants behaviour	behavioural economics: theory of planned behaviour; social norms and social comparison; information deficit models
6	eportal repower - online customer portal (swibi)	The eportal is an online-platform for the customers of repower. Information about bills, contracts, historical consumption (visual) and costs are available. It is possible to report meter readings and relocations, chose another electricity product and request a service call. Furthermore, on the energy cockpit the consumption can be compared with the swiss average, an efficiency rating for the household is made, a quiz game can be played and energy saving hints are made by repower.	web-portal	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs. With the costs and consumption comparisons change in routines and habits can be forced.	the main focus is to inform the customers and make processes easier (e.g. purchasing process, relocation process).	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; social norms and social comparison; information deficit models
7	my sgsw - online customer portal (i-web)	The eportal is an online-platform for the customers of sgsw. Information about bills, contracts, historical consumption and costs are available. It is possible to report meter readings and relocations, use online forms and contact the service centre.	web-portal	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs. With the costs and consumption comparisons change in routines and habits can be forced.	the main focus is to inform the customers and make processes easier (e.g. purchasing process, relocation process).	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models
8	energybox EKS (EW Kt. Schaffhausen)	Energy box is an online-platform for energy efficiency in households. The platform is set up by S.A.F.E (Schweizerische Agentur für Energieeffizienz) with "Energie Schweiz" and can be labelled by the utilities. The energy efficiency is analysed by answering different questions about consumption, household appliances and consumption behaviour. While answering, the yearly electricity consumption is counted. The user receives a personal analysis with energy saving potential and different measures. Further functions are a decision guidance for replacing or repairing defect appliances, a decision guidance for replacing lighting and a standby check. In the standby check, the saving potential for turn-off the appliances completely is calculated.	web-portal	Routines and habits are analysed within the online questionnaire. Measures include change of routine and habit, investments and purchasing decisions.	What is the energy efficiency of the households and how can it be improved?	behavioural economics: theory of planned behaviour; social norms and social comparison; information deficit models; social marketing
9	E-Rechnung - EKS	With e-invoicing the invoice is send directly to the e-banking account of the customer instead of delivering by post. After login, the e-invoices can be checked and paid within a few clicks and the invoices can be saved in form of a PDF. The invoice is also sent as a PDF document by mail to the customers. An e-banking account is necessary for using this service.	e-invoicing, e-banking	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs. With the costs and consumption comparisons change in routines and habits can be forced.	The main focus is to offer good customer services and reduce postal charges and print costs. The customer can choose the e-invoice on request. But it is planned to offer this service to more customer in future.	neoclassical economics: rational choice, expected utility theory; information deficit models;

Example of use (DSI/DSM)	Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
10 WaZApp - Werke am Zürichsee	Online services and information are available in this mobile customer portal. The app is available for android and iPhone/iPad. Information about bills, historical consumption (over last 5 years) can be displayed. It is possible to report meter readings and relocations, chose another electricity product and report a malfunction. Further services are a newsletter, energy saving hints, a customer magazine and information about products and tariffs. There are also a call and mail function and push-notifications integrated. A planned enhancement is a print function to generate pdf documents with graphical overviews for properties.	mobile-app	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs. With the costs and consumption comparisons change in routines and habits can be forced.	The main focus is to offer a simple way to access information about energy consumption and costs.	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models
11 tiko power	Tiko is an intelligent electrical heating system network. It is a joint venture between Swisscom and repower. The users contribute to a storage network that reacts to supply fluctuations. The heating system can be controlled and monitored in the mobile app or online. The consumption is displayed and compared to the average of the other Tiko users.	mobile-app, web-portal, control box and communication box	The system can change the habit in heating and therefore the consumption.	The main focus is the contribution to the intelligent energy network by automatically controlling the heating system. The customers can also control their heating system manually and monitor the consumption. Energy can be saved by reducing the heating in absence of the user.	behavioural economics: theory of planned behaviour; social norms and social comparison; information deficit models
12 Thermography - EKS	Infrared records of the buildings indicate bad heat insulation. Heating losses, thermal bridges and leakages on doors and windows are visible. At least six records are made for 150 swiss francs. The pictures are commented by experts and hints for elimination of the weak points are given. The customer receives the results within two weeks after recording.	thermography	Possible investments in buildings for better thermal insulation and therefore less energy consumption for heating	The service focuses on thermal insulation of buildings. The goal is to inform people about heating losses of buildings.	behavioural economics: theory of planned behaviour; information deficit models; social norms; pro-environmental behaviour
13 wattson energy meter - EW Höfe	Wattson is an energy meter which shows the actual electricity consumption on a display. The meter indicates the actual consumption with different colours (blue for low, violet for your average and red for very high electricity consumption). The data is stored for 28 days in an internal memory of the device. It is possible to analyse the data with an additional software "Holmes". In an online community, the data can be shared with friends. The device can be hired for two weeks (200.-) or purchased (350.-).	energy meter, analysis software	The device can change the habit and routines in electricity consumption.	Inform customers about the actual used electrical power.	behavioural economics: theory of planned behaviour; information deficit models; social norms; pro-environmental behaviour
14 EMU check USB energy meter - EW Höfe	EMU check USB is an energy meter for one phase devices which shows the actual electrical power and the consumption on the display. The data of 7 days (1-minute interval) are stored in an internal memory of the device. It is possible to analyse the data with an additional software. The device can be hired for one-week (100.-), an additional analysis of the data can be purchased (35.-).	energy meter, analysis software	The device can change the habit and routines in electricity consumption or can influence a purchasing decision.	Inform customers about the actual electricity power and consumption of one device.	behavioural economics: theory of planned behaviour; information deficit models; social norms; pro-environmental behaviour
15 Stromdetektiv - EKZ (energy consulting)	The energy detective is an energy consulting service of EKZ (Elektrizitätswerke des Kantons Zürich). Within this service an individual consulting of 45 minutes takes place at home. The standby consumption of specific appliances is measured and the bill is analysed. Different LED-lights are shown and specific hints for saving electricity are made by the expert. Furthermore, the customer receives a switched cable "Stromsparmaus" as a present. The costs are 50.- for EKZ customers and 200.- for other people.	standby measurements	With the information of the consulting changes in routine or habit can be forced and purchasing decisions can be influenced.	Inform the customer about the electricity efficiency at home.	behavioural economics: theory of planned behaviour; information deficit models
16 invoice by post - SGSW	every customer receives an invoice with information about the energy consumption and costs. The invoice is obligatory and most of the content is regulated by law (Stromversorgungsgesetz, Weisungen Elcom). The accounting approach of SGSW are five payments on account (every two months) and one final invoice every year (31.12.). Additional to the mandatory elements a comparison to previous energy consumptions is available in a diagram (consumption comparison per tariff and in total per year). On the end of the invoice there is a part for individual text or advertising of the utility. Supplementary there is a booklet available in which the elements of the invoice are explained. The booklet is not delivered with the invoice but is available in the customer service centre or online on the utility website.	paper invoice	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs and comply the regulations. With the costs and consumption comparisons change in routines and habits can be forced.	Invoicing; inform the customer about the energy consumption and costs; inform the customer for which service he has to pay how much.	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models

Example of use (DSI/DSM)	Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
17 invoice by post - EKS	every customer receives an invoice with information about the electricity consumption and costs. The invoice is obligatory and most of the content is regulated by law (Stromversorgungsgesetz, Weisungen Elcom). The accounting approach of EKS are 11 payments on account and one final invoice every year (31.12.). Therefore the customer receives one letter in February with the final invoice and 11 pay in slips. Additional to the mandatory elements a comparison to the previous electricity consumption of the last invoice is available in a table (in total electricity consumption).	paper invoice	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs and comply the regulations. With the costs and consumption comparisons change in routines and habits can be forced.	Invoicing; inform the customer about the electricity consumption and costs; inform the customer for which service he has to pay how much.	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models
18 invoice by post - Repower	every customer receives an invoice with information about the energy consumption and costs. The invoice is obligatory and most of the content is regulated by law (Stromversorgungsgesetz, Weisungen Elcom). The accounting approach of repower are four payments on account (February, may, august, November) and two final invoices every year (31.12. and 30.06.). Additional to the mandatory elements a comparison to previous energy consumptions and costs is available in a diagram (comparison in total for half a year). Furthermore, there is a diagram which shows the relative share of the split costs (e.g. energy, grid fees) and the relative share of the different electricity products and tariffs (e.g. Aquapower day price/night price) in terms of energy and costs.	paper invoice	Behaviour change is not the main focus of this DSI model. The aim is to satisfy customer needs and comply the regulations. With the costs and consumption comparisons change in routines and habits can be forced.	Invoicing; inform the customer about the energy consumption and costs; inform the customer for which service he has to pay how much.	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models
19 energy2click (Swibi and asgal)	energy2click is a module based online-platform. The system combines DSI, DSM and business processes of the utility. Visual real-time data, grid monitoring, service desk, billing, customer data and documents, consulting, control of consumers and monitoring of PV installations are available. Due to the responsive design, it is possible to use the platform on different devices (smartphone, notebook, desktop pc)	web-platform	The combination of real-time data visualisation and consulting can lead to different routines or even investments.	The main goal is to offer an integrated system for the utilities which combines the customer online-platform with the business processes of the utility.	neoclassical economics: rational choice, expected utility theory; behavioural economics: theory of planned behaviour; information deficit models
20 smoope messenger - EWZ	smoope is a B2C-messaging solution which offers "service to go". With the mobile app, it is possible to get in contact with the utility simple and fast. Questions about products and services are answered within the pilot phase. Customer feedback, individual consulting and data sharing are possible too.	mobile-app, instant messenger	the communication channel between the utility and the customer is changed. This can lead to different routines or also purchasing decisions (e.g. purchase of a new energy product with the messenger)	The main goal is to improve the customer service and boost the interaction with the digital generation. The main question within the pilot was "how can smoope be used for the utility?"	behavioural economics: theory of planned behaviour; information deficit models
21 Social Power	Social Power is a joint research project of SUPSI and ZHAW in cooperation with AEM and Stadtwerk Winterthur. It is an innovative app for smartphones and tablets having as a goal to motivate household to save energy. The research interest is the potential of energy feedback, social interactions (e.g. exchange about energy-saving tips) and gamification elements (e.g. cooperative vs. competitive game) in terms of inducing long term behaviour change regarding energy consumption.	App for smartphones and tablets	Both change energy-related routines as well as inducing purchase of energy-saving products	Development of an app with gamification elements providing energy feedback; Conducting a trial during 3 months with 120 households making efforts to reduce their energy consumption in a game setting Developing a social media platform in order to support social interaction among the participants Evaluation of gamification and social interaction effects on the behaviour change and electricity consumption	Influence of energy feedback, gamification, social interaction and improved energy literacy on changing energy-related behaviour
22 optimised self-consumption of solar energy (EKS)	Goal of the study: The study shows if there is a connection between an optimised self-consumption and sufficiency in energy consumption. The study refers to a self-consumption optimising system of Elektrizitätswerke Schaffhausen.	smart meters, mobile app, feedback on electricity consumption EKS installs a full solar energy package including solar panels, inverter, smart meters and a mobile app for smartphones	load shifting, investment behaviour ----> the consumer has first to invest money before he is able to economise its energy consumption	How will information of self-consumption influence total energy consumption? Is it possible, that users could reduce their energy consumption by being vigilant with full-time monitoring on control devices?	behavioural economics ----> economic incentives

Example of use (DSI/DSM)	Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
23 EKT (Energie Kanton Thurgau) energy efficiency support program	"Thurgauer Energie- Fitness" support program is a program of the EKT. The programme includes about 90 enterprises, which are located in Thurgau or are consumers of EKT energy. Goal of the program is to save 15% of a company's energy consumption each year during a span of 3 years. The programme is aligned to enterprises, which consume over 100'000 kWh of electricity or over 1'000'000 kWh of thermic energy.	After a year the companies have to give a feedback to the EKT about their energy consumption. If the energy consumption didn't decrease, the EKT supports the companies with strategies to save more energy.	The study takes a closer look at the energy consumption of the companies and provides several strategies to be more efficient in saving energy.	How can we reduce the energy consumption in the canton of Thurgau to reach our energy strategy until 2020? With incentives for the biggest companies in Thurgau, which have to reach the goal of 15% less energy consumption over three consecutive years. With this method, the EKT and the canton of Thurgau can calculate their savings much better and know, how much they still have to save to reach their energy strategy.	Every year the EKT will give advices in an obligate half day workshop to the consumers, how to save energy. The companies have to reach universal energy saving goals which are written in a contract. The goals are based on the energy consumption analysis of Cleantech and EnAW. Additionally, the support program rewards companies which have increased their energy efficiency within three successive years with a support amount of 3.5 swiss centime per kWh a year. It would be a maximum of 50,000 CHF over three years.
24 "Meter to Cash" case study elog Energielogistik AG (elog)	Since 2008 elog offers professional consulting and flexible services within the entire value chain of the energy market processes. Together with customers and partners, elog meets the requirements of the liberalized electricity market. Everyday a team of experienced employees deals with the systems. Thanks to this, the customers receive not only software, but also solid know-how, years of experience and working solutions. Elog offers six difference services: a) smart power management b) energy data management c) calculation and clients management d) Portfolio management e) energy efficiency management f) advice and engineering.	smart meters, feedback on electricity consumption, data analysis and data management	The company provide information on energy consumption and gives solution to the customers to minimize the costs. This system influences automatically the behaviour of energy consumers.	How will detailed information and analysis of energy usage increase the consumers energy efficiency and lastly reduce costs? Smart meters give a daily feedback on energy consumption to elog. This feedback analyses the information and then gives a monthly solution to the customers with the purpose of increasing energy efficiency and reducing costs.	A behaviour is going to be changed if a person decides to live with a lower consumption of energy. In this case there are two kinds of improvements: 1) optional behavioural change, which includes an increased awareness, a high individual responsibility. 2) economical "profit", which means minor expense.
25 Innovative services with smart meters (Energie Thun)	Smart meters can measure specific electricity consumption to provide detailed information about the energy use of different households. The data can be used to deliver individual and personal recommendations regarding energy savings. For this reason, Energie Thun AG and the ETH developed a study about innovative services with smart meters. Therefore, standby and cooling device consumptions were investigated with specific algorithms. For this study six employees of Energie Thun AG participated voluntarily.	For this study, the following technologies were required: Smart meters (Landis+Gyr E750 SyM2-electricity meter), smart plugs, Android tablets and an Android app.	Energie Thun AG and the ETH mainly wanted to find out, if it is possible to provide consumers personalised recommendations for energy savings with smart meter data. The participant's behavioural change was not precisely investigated within this study. However, the personalised recommendations are able to change the consumer's behaviour. With the standby energy consumption displayed on the tablet, the consumer is able to identify which electrical devices should be unplugged when unused. It is possible to create new habits dealing with electrical devices, e.g. unplugging the television once it is turned off. With the calculation of the cooling device consumption, it is possible to recommend a replacement of this device to save energy.	The main focus was to find out if it is possible to give personalized recommendations regarding the consumers' energy consumption with smart meter data. The data was collected with two different methods. Firstly, data for the energy consumption was measured every 15 minutes. Secondly, the current energy data was measured every second. With these measurements, it was possible to calculate the consumptions of standby- and cooling devices with an algorithm. Based on these calculations personalized energy saving recommendations can be given.	The participant's behavioural change was not investigated during this study, but the personalised recommendations on the app fit into a behavioural changing model. Looking at the "Want-Can-Do"-model, the personalised notes give a clear advice for the "Can"-section. The recommendations give different personalised possibilities to reduce the energy consumptions, e.g. "buy a new fridge". Smart meters also help to overcome knowledge-based barriers for energy savings.

Example of use (DSI/DSM)		Short description/Summary	Systems and technologies applied	Behavioural change investigated	Main focus/hypothesis/motivation	Model of Behaviour Change used
26	Nest - Controlling of room temperature.	Nest is a company which is trying to help homeowners to save energy. The goal is to save energy without losing any comfort. They try to reach this goal by collecting and analysing data, to improve their technology.	Nest is a manufacturer of "intelligent" smoke detectors and thermostats which both use innovative technologies. For example, the smoke detector is also fitted with a motion detector. In case of a false alarm the detector can easily be deactivated by the user by waving his hands in front of the detector. The thermostat is also fitted with a feature which allows the user to control the temperature from all around the world by using a mobile phone app.	Due to the fact that Nest is building technologies which allow the user to not lose any comfort but still saving energy, the behavioural changes are probably in the first-time period not very high. But if the customers realise their savings in energy and money they might soon try to adapt their attitude of living more efficient in to other life situations.	Nest is collecting data from installed smoke detectors, thermostats and so on. They are using this data for research to try to improve their products to save even more money and energy.	The model used, is the theory of the planned behaviour. Applied on this project it would mean the following: First it would need the awareness of the customer to do something for the environment. Then he or she should apply this attitude to their behaviour. For example, if someone wants to build a new home, he or she would consider building their house more environmentally friendly and then decide to install a product like the thermostat that Nest provides. The last step for this person would be to really buy this product, to become a person with an ecological behaviour.
27	amphiro water consumption meter. Case study from ETH Zurich.	The amphiro is a device for measuring warm water consumption during the shower procedure. It can be attached between the water hose and shower head. It is powered through a small water turbine which also acts as a water flow measuring tool. In addition, a temperature sensor measures the actual water temperature. While showering it displays the actual water consumption, temperature, energy efficiency class as well as an animation with a polar bear on an ice floe. As the warm water/energy consumption rises, the ice floe shrinks and eventually the polar bear sinks into the ocean. After showering it shows the cumulated energy and water consumption. The goal of this device is to motivate people to save warm water through direct feedback. Financial savings are the largest incentive for using this device. The case studies from Verena Tiefenbeck at ETH Zurich investigated the effects on showering behaviour of nearly 700 households by installing the amphiro measuring device. The main focus was to investigate the change of water consumption, temperature, showering time and energy consumption. Also, different external factor (e.g. long hair) influences on behaviour change were evaluated.	The amphiro a1 which is a water consumption device with a digital display, was used in the ewz-amphiro-study. It was installed in around 700 households to give direct feedback to consumers. There is also another version, the amphiro b1, available, which is able to connect with the according mobile-app. The mobile app shows a more detailed summary of the warm water and energy consumption over long time. It also displays a comparison to previous showering sequences and how your showering habits change over time.	In the ETH study the water consumption while showering was investigated by measuring and evaluating the data of the amphiro a1. The amphiro device gives feedback on ones showering habits and therefore implicates a motivation to decrease the water and energy consumption. Through this method the warm water consumption in general and along with this the energy consumption should be reduced. The showering time, flow rate, water temperature, energy consumption and breaks were investigated. With lowering the average water temperature massive energy savings are targeted.	How is the effect of energy-saving technologies, especially water-consumption-saving-technologies, and how can they be optimized depending on consumer group and context? Which insights were achieved and which measures were taken?	Behaviour-Specific Real-Time Feedback: One group received a real-time feedback, a second one received real-time and past-feedback and the control group received no feedback.

General Information II

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned	
1	The MUNX (Web platform from Repower an international energy company based in Switzerland. It operates along the entire value chain, from generation, trading, transmission and distribution to sales.)	reading of the electric meter, comparison of own power consumption with the consumption of others/neighbours, learning more about energy / energy saving / efficient energy use, bonus system	http://www.munx.ch (in German)	Switzerland	Canton of Graubünden (Grisons) (You can use it in the whole German speaking part of the world, but only in the canton of Graubünden there are enough users to compare the usage with your neighbours in the same street)	The weekly power consumption of the participants (not very good data, because the user has to enter them manually). The answers the user gave to the quiz other information the user gave about their flats.	electricity, warm water (amphiro shower meter)	since 2013	n.a.	There was negative feedback from customers concerning the comparison with the neighbours. They didn't want to be compared with other people and did not want to disclose their consumption to others.
2	Smart Metering case study Uttwil (EKT)	Smart metering with feedback, Information on energy consumption	http://www.smartmetering.ch (in German) http://www.clever-strom-sparen.ch/ (in German) project report: „Feedback Smart Metering“ der EKT AG – Schlussbericht (in German)	Switzerland	Uttwil and Kreuzlingen, both municipalities within the Canton of Thurgau in the east of Switzerland	Electricity consumption over a year was analysed combined with several questionnaires about attitude, opinion and acceptance of smart meters and energy saving behaviour.	electricity	2011-2012	1468	Smart meters will not change our energy behaviour significantly and there are also certain concerns against them. An average reduction of 1.7% of electricity consumption for a confidence level of 95% (2.49% for a confidence level of 99%) could be reached by the participants who used the smart meter (electricity use displayed on in-home-display). The frequency of checking the smart meter display and thus control electricity consumption declined rapidly after the first month. Perceived benefits of smart meters were lower after a year of pilot-use and concerns against it rose a little bit. Concerns about data security and economic advantages for utilities were the most important ones for the participants. Control over electricity consumption and simpler billing of electricity were the biggest perceived benefits of smart meters.
3	bonus model for energy efficient households (EWZ), research project FP-1.9 platform "www.smart-steps.ch" (mailing, web-portal, newsletter and mobile app)	bonus system, incentives, IT based information system, learning platform, efficiency measurements	study report: "Bericht Bonusmodelle FP-1.9" (in German)	Switzerland	city of Zurich and parts of the canton Graubünden in the northeast of Switzerland	registration quote (compared to mailing); electricity consumption, questionnaires on important measurement points; impact of bonus system in different groups of experiment (amount of realised measurements, amount of bonus points); Impact measurement: Possible reachable energy savings due to realised	electricity, warm water (amphiro shower meter), heating energy	2014-2015	3820	Bonus models can increase the user activity on the platform. Monetary incentives are motivating the most people to use the platform in short term. But especially in long term the effect depends on the amount. Ideational awards have a significant effect and can eliminate the negative effects of monetary incentives in long term, furthermore material incentives can be demotivating. Gain in efficiency depend on the activity on the platform. No overall savings have

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned	
					measurements ("saving score"); Probability of chosen positive measurements due to recommender system compared to complementary system				been evaluated for the group of users. Recommender systems for personalising of energy efficiency programs provide an additional benefit. Possibilities and motivations for measurements differ strongly between households. The system increases the selection of an appropriate measurement for the reduction of the energy consumption. The abstinence of monetary motives can increase the success of an efficiency campaign, comparisons with neighbours increases the success. Many measurements do not result in a lower electricity consumption but in less warm consumption water or heating energy. For increasing the effectiveness of the web-portal, further enhancements are recommended. Focussing on a scalable transfer of comprehensible consumption feedback could be an approach.	
4	Smart Metering case study Zurich (EWZ)	smart metering with feedback, expert advice, information on electricity consumption, social comparison and social competition	study report: "Smart Metering, Beratung oder Sozialer Vergleich - Was beeinflusst den Elektrizitätsverbrauch?" (in German)	Switzerland	City of Zurich	8 periodical electricity readings to construct electricity consumption per day for the evaluation of electricity consumption; 6 web-surveys with indicators for attitudes and values, knowledge and awareness of energy savings potentials, and different indicators for satisfaction.	electricity	2011-2012	3820	Information can lead to significant electricity savings. Smart meters reduce the electricity consumption about 3% in the medium term and can shift the loads to low tariff times. An invitation for an efficiency consulting does not influence the consumption but delivers information about potential savings and increases the self-estimated implementation potential of energy saving measurements. Social information can marginal reduce the consumption, particularly if the feedback about the consumption of the partner household is frequent. The usage of the smart meter displays decreases in a long term.
5	Smart Metering case study (EKZ)	smart metering with feedback, expert advice, information on electricity consumption	Media report: "Einfach sichtbar – so wird Strom gespart" (in German)	Switzerland	Dietikon	15 minutes feedback of an Eco Meter; Daily feedback over web portal; Monthly paying-in slip; 2 customer surveys	electricity	2009-2010	5463	Smart electricity meters are able to support slightly the customer in saving electricity, if the electricity consumption is visualised. There was up to 3% less electricity consumption on average by using the Ecometer or the Smart Meter portal compared with the control group in Regensdorf. Customer who didn't use any visualisation technology weren't able to save electricity compared to the control group in Regensdorf.
6	portal repower - online customer portal (swibi)	web-portal, Information on energy consumption, customer relationship	user manual: "Anleitung Kundenportal Repower" (in German)	Switzerland	Canton of Graubünden	2 electricity meter readings per year	electricity		n.a.	

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned
		management, comparison of consumption							
7	my sgsw - online customer portal (i-web)	web-portal, information on energy consumption, customer relationship management, comparison of consumption	Switzerland	City of Sankt Gallen	1 meter reading per year	electricity, gas, heating energy	Feb 17	501	It is too early for lessons learned.
8	energybox EKS (EW Kt. Schaffhausen)	web-portal, energy efficiency check, decision guidance, comparison of efficiency, efficiency measurements	Switzerland	Can be used from all over Switzerland, but is labelled for customers of EKS (Canton of Schaffhausen without the city of Schaffhausen)	Electricity consumption per year	electricity	2015	576	The usage of the portal was 1000 people in 2015 and 600 in 2016
9	E-Rechnung - EKS	e-invoicing, e-banking, billing process	Switzerland	Canton of Schaffhausen without the city of Schaffhausen	Electricity consumption per year	electricity	2015	576	There is only good feedback from customers until now.
10	WaZApp - Werke am Zürichsee	mobile-app, online services	Switzerland	Zollikon, Küsnacht, Erlenbach	energy consumption per year, energy costs per year	electricity, gas	since 2016	147	positive feedback from customers
11	tiko power	mobile-app, web-portal, heating system control, intelligent energy network	Switzerland	all households with electrical heating systems	electricity consumption	electricity for boiler and heat pump	since 2013	-	n.a.
12	Thermography - EKS	thermography, heating losses, thermal bridges	Switzerland	Canton of Schaffhausen without the city of Schaffhausen	thermography	heating energy	since 2014	576	There were many requests in the first year. But then the number of requests declined with time. There will be a new evaluation for the project next year.
13	wattson energy meter - EW Höfe	energy meter, information on energy consumption, energy monitoring, electricity costs, CO2 emissions	Switzerland	Feusisberg, Freienbach, Wollerau	actual electrical power	electricity	n.a.	169	n.a.
14	EMU check USB energy meter - EW Höfe	energy meter, information on energy consumption, energy monitoring, electricity costs, CO2 emissions	Switzerland	Feusisberg, Freienbach, Wollerau	actual electrical power and electricity consumption	electricity	n.a.	169	n.a.
15	Stromdetektiv - EKZ (energy consulting)	energy consulting, standby consumption, electricity efficiency	Switzerland	Canton of Zurich	standby electricity consumption, electricity consumption	electricity	n.a.	5463	n.a.

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned	
16	invoice by post - SGSW	invoice, payment, energy costs, information on energy consumption	exemplary invoice: "St. Galler Stadwerke Musterrechnung" (in German)	Switzerland	City of Sankt Gallen	energy consumption per year, energy costs per year	electricity, gas, heating energy	-	501	There are customer feedbacks about the insufficient transparency of the invoice. But the most feedbacks are about the value of the invoice. 1700 customers of 45000 in total receive the invoice by mail and 8200 by e-invoicing.
17	invoice by post - EKS	invoice, payment, electricity costs, information on electricity consumption	invoice explanations: "EKS Rechnungserklärung 2015" (in German)	Switzerland	Canton of Schaffhausen without the city of Schaffhausen	electricity consumption per year, electricity costs per year	electricity	-	576	There were problems and confusions when the billing period has been changed from hydrological to the calendar year because the amount of the payments on account changed. But otherwise the customers are used to the paper invoice.
18	invoice by post - Repower	invoice, payment, electricity costs, information on electricity consumption	online: http://www.repower.com/ch/privatkunden/stromprodukte/stromrechnung/#13251 (in German)	Switzerland	Canton of Graubünden	semi-annual electricity consumption, semi-annual electricity costs	electricity	-	n.a.	
19	energy2click (Swibi and asgal)	web-portal, energy consulting, real-time data Information on energy consumption, customer relationship management	product flyer: "energy2click flyer" (in German); media report: "Unablässig am Puls der Zeit", VSE-Bulletin 9/2016 (in German)	Switzerland	potential for all EVU in Switzerland	energy consumption real-time, energy costs	-	n.a.	-	n.a.
20	snoope messenger - EWZ	mobile-app, customer service, instant messaging,	online: https://www.ewz.ch/de/ueber-ewz/medien/medienmitteilungen/2016/snoope-pilotprojekt.html ; media report: "Medienmitteilung EWZ Snoope Pilotprojekt 18.01.2016" call with Denis Beier, EWZ 08.05.17	Switzerland	City of Zurich	n.a.	electricity, heating energy	Pilot: 01/2016-04/2016, since then used as a normal service	3820	There was a high quality of interaction with customers; Traceable process; good customer support; Customers which used the channel once for testing returned on this channel for other requests. The most of the requests are related to products/tariffs or administrative processes like movement or questions about bills. There were not many requests about consumption; All customer feedbacks were positive; service could be used for automatically send the consumption to the customers.
21	Social Power	mobile app, gamification, social interaction, energy feedback	https://www.zhaw.ch/de/engineering/institute-zentren/ine/nachhaltige-energiesysteme/social-power-projekt/	Switzerland	Winterthur (ZH) and Massgno (TI)	Energy consumption	n.a.	Historical reference: Oct-Dec 2015; Playing the game: Feb-May 2016; Post-evaluation planned: May 2017	n.a.	Overall interventions both saved electricity compared to their historical value, and particularly compared to the control groups. However, there was no significant difference between the competitive and collaborative approach.
22	optimised self-consumption of solar energy (EKS)	self-consumption, intelligent devices, solar energy	Ramon Felder, EKS; EKS Sunpower (https://www.ekson.ch/menschen-mit-energie-detail/waschen-wenn-die-sonne-scheint.html), EKS Suncontrol (http://www.eks.ch/privatkunden/dienstleistungen/photovoltaik/sun-control-ch)	Switzerland	Region Schaffhausen in the north of Switzerland	Power-meters measure the produced and consumed energy in real-time and send the information to the control devices (smartphone, tablet).	electricity	2015-unspecified	576	An optimised self-consumption doesn't have to minimise the total amount of energy consumption. But it shows energy-losses. This might contribute to a sufficient behaviour.

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned	
23	EKT (Energie Kanton Thurgau) energy efficiency support program	Energy saving strategy Efficiency Sufficiency Reach strategy goals 2020 Reduce energy consumption by 15%	http://www.ekt.ch/aktuell/projekte-und-kampagnen/ekt-energieeffizienz-foerderprogramm/ http://www.keest.ch/kmu-foerderung/ekt-energie-thurgau.html Reglement_EEF_2014-2016	Switzerland	Canton of Thurgau in the east of Switzerland and near surroundings	Every year, measured energy consumption will be analysed. If the company isn't able to reduce its energy consumption by the required 15%, the EKT helps to reach the saving goals with suggestions and specific strategies.	electricity	2014-2020	1467.9	The effect of this program can be great due to the fact that with the EKT an energy selling company gives companies some advices to reduce the energy consumption and to use the energy more effective. That's unusual for the energy sector. Companies want to work with the EKT to save energy. Nevertheless, the biggest effort will be reached, because of the aspect that the companies can save a lot of money during the programme. They achieve lower energy costs and earn money for every saved kWh of energy. It is possible to make big change even with a small effort.
24	"Meter to Cash" case study elog Energielogistik AG (elog)	smart metering, M2C (Meter-to-Cash), information on energy consumption and integrated-standard solutions.	http://www.elog.ch/ueber-uns/leitbild/0712245932 [18.04.17]	Switzerland	leader in east Switzerland for energy logistic. Specially in St. Gallen	Monitoring starts with smart meters, which sends the daily data consumption of the clients to eelog engineering. The company then analyses and assembles the collected information and finds standard solutions. Therefore, the customers receive a monthly feedback on their consumption and solutions to decrease their energy usage and to increase electrical efficiency. These solutions allow saving money.	electricity	2008-indeterminate	-	Project not finished yet
25	Innovative services with smart meters (Energie Thun)	Smart meter, electricity meter, smart plugs, energy consumption, Energie Thun AG, energy saving, standby, cooling devices	Wilhelm Kleiminger, Christian Beckel, Silvia Santini, Christoph Woodtli, Martin Bühler, Thorsten Staake, "Innovative Dienste mit intelligenten Stromzählern," pp. 1-4, 2014.	Switzerland	It is assumed that the geographical scope of this study was around Thun because all the participants are employees of Energie Thun AG.	This project analysed three different services which help the consumers to reduce their energy consumption within eight months. The services include a visual consumer-feedback on a tablet- an automatic calculation of the standby consumption- an automatic calculation of the cooling device consumptions. The	electricity	July 2013 – January 2014	188	The project team examined three different services to provide consumption statistics for the consumer. To get exact measurements, data is required every second, but the problem with these precise measurements is the large amount of resulting data. Unfortunately, it is not yet possible to store such huge amount of data in an economical and cost-efficient way. To reduce the data quantity, measurements every 15

Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned	
					participants got an overview about the consumptions statistics on their tablet. Due to the frequent update every second, the current rise of energy use appeared immediately on the display after turning on an electrical device. The standby consumption was calculated by an algorithm during 1 to 5 a.m. because usually no other devices were used at this time except cooling devices. Because of the fluctuating consumption behaviour of cooling devices, it was possible to measure the standby consumption when currently no cooling device was operating. During a consumption peak caused by a cooling device it was possible to subtract the standby consumption and get the effective value of the cooling device's energy consumption.				minutes can be applied, which do not cause such a big amount of data but the outcome is less accurate. When it comes to an acquisition of a smart meter, it is important to consider the existence of a "turbo-mode" which can be switched on to get, when necessary, a precise data every second. The effect of a personalised recommendation regarding the energy consumption can be very high. Energy savings can definitely be achieved with personalised recommendations.	
26	Nest - Controlling of room temperature.	Data collecting, improved products, life becomes easier	Nest Labs, "Energy Savings from the Nest Learning Thermostat: Energy Bill Analysis Results," no. February, pp. 1-14, 2015. Allison Bailes, "Does the Nest Learning Thermostat Save Energy?" 2015. [Online]. Available: http://www.energyvanguard.com/blog/78078/Does-the-Nest-Learning-Thermostat-Save-Energy . [Accessed: 22-Apr-2017]. NZZ, "Übernahme von Nest für 3,2 Milliarden Dollar: Google kauft Thermostate-Hersteller - NZZ Wirtschaft: Unternehmen," 2014. [Online]. Available: https://www.nzz.ch/wirtschaft/unternehmen/google-kauft-hersteller-ernetzter-thermostate-1.18220512 . [Accessed: 22-Apr-2017].	Developed in the USA, but used worldwide.	Manufactured in Mountainview, California but distributed to the whole world.	This is an ongoing project. Nest is daily receiving and collecting data which they analyse immediately to improve their products.		The company was established in 2010 and is still in operation.	-	The first results are visible in conducted studies. The thermostats savings equal to about 10-20 % of heating usage and the electric savings equal to about 15% of cooling usage in homes with central air conditioning. But there are not just savings in energy. More than 60% of the participants felt that their homes are "somewhat more comfortable" or "much more comfortable" while using the Nest thermostats.
27	amphiro water consumption meter. Case study from ETH Zurich.	amphiro, (warm)-water consumption, energy saving, behavioural change	Tiefenbeck, Verena; Tasic, Vojkan; Schöb, Samuel; Degen, Kathrin; Goette, Lorenz; Fleisch, Elgar; Staake, Thorsten: Steigerung der Energieeffizienz durch Verbrauchsfeedback bei der Warmwassernutzung. Abschlussbericht der ewz-amphiro-Studie, ETH Zürich, Schweiz, 27.11.2013 www.amphiro.com Verena Tiefenbeck, Lorenz Goette, Kathrin Degen, Vojkan Tasic, Elgar Fleisch, Rafael Lalive, Thorsten Staake (2016) Overcoming Salience Bias: How Real-Time Feedback Fosters Resource Conservation. Management Science	Switzerland, Europe	The study was conducted in Zürich, Switzerland. The different amphiro models can also be ordered online to various	After every shower is the used water and energy consumption, efficiency-class, water temperature, and a climate-animation (polar bear) shown on the display of the amphiro.	warm water	two months, from the beginning of December 2012 until the beginning of February 2013. (duration of ETH study)	-	The influence of the amphiro is explicit obvious, then the possible water-savings represent up to 25% or on an average of 360 kWh per shower, depending on the number of the household. This effect was obvious after the eleventh shower and mainly achieved through the reduction of the shower duration by 20% to 24%. Temperature changes were despite the amphiro not noticeable,

	Example of use (DSI/DSM)	Key words, tags	Source/material/literature	Country	Geographical scope	Monitoring and evaluation metrics used	Energy carrier	Project period	Size of utility (GWh)	Key lessons learned
					countries in Europe. [1][2]					however shower breaks extended by 12% on average. That would be an annually saving of 443 kWh energy and 8'500 litres of drinking water, whereby 96 CHF could be saved (costs for drinking water and energy. If 10% of the Swiss population would save this amount of energy, then we could save 155 GWh energy a year, which is the twofold of the annually produced wind energy in Switzerland.

Classification Parameters

Example of use (DSI/DSM)	Feedback frequency	Feedback duration	Feedback content (e.g. consumption, cost, environmental impact)	Level of breakdown (e.g. specific rooms/appliances)	Medium of presentation (e.g. written, electronic)	Mode of presentation (e.g. text, numbers, graphs)	Comparisons to previous consumption	Comparison to the consumption of the reference group	Gamification elements (e.g. tasks, competition)	Combined with other DSM instruments (e.g. financial incentives)
1 The MUNX (Web platform from Repower an international energy company based in Switzerland. It operates along the entire value chain, from generation, trading, transmission and distribution to sales.)	weekly	continuous	Electricity consumption	electricity meter (flat or house)	electronic	web-portal	yes	yes, comparison to neighbours	Yes: Quiz, collection of points, team work	Points can be cashed in the Munx shop
2 Smart Metering case study Uttwil (EKT)	real-time (15min)	continuous	Electricity consumption, estimated CO2-emissions, savings achieved, information on new technical extensions towards smart home	electricity meter (flat or house)	electronic	mobile app, newsletter, blog	yes	no	no	no
3 bonus model for energy efficient households (EWZ), research project FP-1.9 platform "www.smart-steps.ch" (mailing, web-portal, newsletter and mobile app)	weekly	continuous	Electricity consumption, estimated electricity consumption per device (device oracle), shower consumption (water and energy), knowledge improvement	electricity meter (flat or house); showering separate	electronic	visualisations, numbers, newsletter	yes	yes, comparison to neighbours	challenges, bonus	financial incentives can be cashed over electricity bill
4 Smart Metering case study Zurich (EWZ)	continuous for smart meter users (15min); monthly and quarterly	continuous	electricity consumption	electricity meter (flat or house)	electronic, written, verbal	numbers, text	yes	yes	no	no
5 Smart Metering case study (EKZ)	15 minutes for Eco Meter users, daily for web portal users and monthly with electricity bill	continuous	electricity consumption, costs	electricity meter (flat or house)	electronic, written	numbers, signal light	yes	yes	no	no
6 eportal repower - online customer portal (swibi)	twice a year	continuous	electricity consumption, costs	electricity meter (flat or house); high-rate tariff and low-rate tariff times	electronic	web-portal, numbers, graphs	yes	yes, to other swiss households	no	no
7 my sgsw - online customer portal (i-web)	annually	continuous	energy consumption, costs	aggregate (high-rate tariff and low-rate tariff times)	electronic	web-portal, numbers, graphs	yes	no	no	no
8 energybox EKS (EW Kt. Schaffhausen)	immediately while (for total energy consumption) and after answering questions	one-time	electricity consumption per year, evaluation and measurements (text), potential cost savings in standby-check	appliances	electronic, PDF-reports	website, text, numbers, graphs	no	yes, swiss average and best value	no	no
9 E-Rechnung - EKS	annually	continuous	electricity consumption and costs per year	electricity meter (flat or house); high-rate tariff and low-rate tariff times	electronic, PDF	electronic bill, text, numbers	yes	no	no	no
10 WaZApp - Werke am Zürichsee	annually	continuous	electricity consumption and costs per year	electricity meter (flat or house); high-rate tariff and low-rate tariff times	electronic, PDF	mobile-app, text, numbers, graphs	yes (last 5 years)	no	no	No
11 tiko power	n.a.	continuous	electricity consumption	heating system	electronic	mobile app, numbers, graphs	yes	yes	no	control of the heating system, contribution to the intelligent energy network

Example of use (DSI/DSM)		Feedback frequency	Feedback duration	Feedback content (e.g. consumption, cost, environmental impact)	Level of breakdown (e.g. specific rooms/appliances)	Medium of presentation (e.g. written, electronic)	Mode of presentation (e.g. text, numbers, graphs)	Comparisons to previous consumption	Comparison to the consumption of the reference group	Gamification elements (e.g. tasks, competition)	Combined with other DSM instruments (e.g. financial incentives)
12	Thermography - EKS	after recording	one-time	thermography pictures of the building	building	written (postal)	text, pictures	no	no	no	no
13	wattson energy meter - EW Höfe	real-time (3 sec interval)	continuous	electrical power (W) and costs per year (calculated by the actual consumption, electricity price can be defined); CO2 emissions (calculated with electricity from the grid of UK, 0.48152 g/kWh)	electricity meter (flat or house)	electronic	numbers and colours on the device; graphs in the software	yes (only with additional software)	no	no	no
14	EMU check USB energy meter - EW Höfe	real-time	continuous for one week	electrical power (W) and costs (calculated for the actual measurement and per year, electricity price can be defined); CO2 emissions (calculated for the actual measurement)	appliance	electronic	numbers on the device, graphs in the software	no	no	no	no
15	Stromdetektiv - EKZ (energy consulting)	-	one-time	standby electricity consumption, electricity consumption and costs	appliances (for standby), electricity meter (flat or house); high-rate tariff and low-rate tariff times	verbal	verbal, numbers	no	no	no	The customer receives a switched cable "Stromsparmaus" as a present.
16	invoice by post - SGSW	annually; (bi-monthly on account)	continuous	consumption and costs	electricity meter (flat or house); high-rate tariff and low-rate tariff times	written	text, numbers, graphs	yes	no	no	no
17	invoice by post - EKS	annually; monthly on account	continuous	consumption and costs	electricity meter (flat or house); high-rate tariff and low-rate tariff times	written	text, numbers	yes	no	no	no
18	invoice by post - Repower	semi-annually; (four times per year on account)	continuous	consumption and costs	electricity meter (flat or house); high-rate tariff and low-rate tariff times	written	text, numbers, graphs	yes	no	no	no
19	energy2click (Swibi and asgal)	real-time (1-minute interval)	continuous	consumption and costs	aggregate	electronic	text, numbers, graphs	n.a.	n.a.	no	load-control, virtual power plants
20	smoope messenger - EWZ	<15min	on request	consumption and costs possible	electricity meter (flat or house); high-rate tariff and low-rate tariff times	electronic	mobile-app, text	possible	n.a.	no	no
21	Social Power	Weekly assignment of challenges to be completed in different fields of energy consumption	Feb-May 2016	Own historical consumption, challenge completion status of other participants, challenges, energy tips	Own aggregate electricity consumption	Electronic (smartphone, tablet)	well designed, user-friendly point of contact (graphs, numbers, text)	yes	yes	yes	no
22	optimised self-consumption of solar energy (EKS)	real-time	continuous	Electricity consumption, savings achieved (energy and money), proportion of self-consumption	There are 3 smart meters, one at the inverter output for measuring the incoming solar input. One is at the input of the boiler producing warm water (in case of the huge amount of energy needed) and there is one for the rest of the electric devices.	electronic	mobile app, graphs	yes	no	no	no
23	EKT (Energie Kanton Thurgau) energy efficiency support program	once a year	3 years	Energy consumption and reduction, Efficiency, reaching of universal saving goals	the whole company	electronic	website, regulation sheet	yes	no	competition between the companies to save more energy than the others	yes
24	"Meter to Cash" case study elog Energielogistik AG (elog)	Monthly	continuous	electricity consumption and costs, analysed data, concrete and standard solutions.	aggregate	Written and electronic	The customers receive a feedback, which consists of a	Currently the company does not give any	Currently the company does not give comparisons to the customers, only	no	no

Example of use (DSI/DSM)		Feedback frequency	Feedback duration	Feedback content (e.g. consumption, cost, environmental impact)	Level of breakdown (e.g. specific rooms/appliances)	Medium of presentation (e.g. written, electronic)	Mode of presentation (e.g. text, numbers, graphs)	Comparisons to previous consumption	Comparison to the consumption of the reference group	Gamification elements (e.g. tasks, competition)	Combined with other DSM instruments (e.g. financial incentives)
							text with tabs and numbers.	comparisons to the customers, only an individual feedback.	an individual feedback.		
25	Innovative services with smart meters (Energie Thun)	Real-time (every second or every 15 minutes)	continuous	electricity consumption (actual, daily, weekly, total)	A smart meter provides data on building levels. With the help of smart plugs, it is possible to examine the exact energy consumption of a single device. Due to this fact, the level of breakdown with smart plugs is high and focuses on single devices e.g. refrigerators.	electronic via Android app	Graphs, text, numbers	yes	Unfortunately, there were no possibilities for the participants to compare their energy consumptions with each other by the smart metering app.	The participants got messages on their tablets of the following type: "Did you know that your cooling devices use 30 % of your whole energy consumption? Maybe you should think about the acquisition of a new refrigerator."	Saving energy means also saving energy costs and therefore it has a financial incentive to reduce energy consumption. Unfortunately, the app does not show cost savings.
26	Nest - Controlling of room temperature.	There is no given time period.	Continuous	The studies give a look on various aspects. Such as energy consumption, the feeling of the Nest customers and so on.	In Every room, the thermostat is used.	Electronic	Mobile app	Yes, it is compared to the consumption without the new technology.	Yes, there is a comparison for each customer to their old consumptions.	no	The incentive is for the user to save energy and therefore costs.
27	amphiro water consumption meter. Case study from ETH Zurich.	while and after every shower	continuous during the duration of the shower and some minutes after the shower (not mentioned how many minutes)	While showering: water consumption since start of shower, water temperature and energy efficiency class, polar bear on ice floe that progressively shrinks as the amount of energy used increases. After showering: energy and water consumption	direct feedback while showering and afterwards	electronic on digital display	amphiro a1: numbers, letters and animation of polar bear on shrinking ice floe displayed on device. amphiro b1: same as amphiro a1 with additional mobile app	no	ye	none	indirect financial incentives: Through saving warm water and thus energy, lots of electrical energy can be saved. When reducing this energy amount your electricity/oil bill gets lower.

Qualitative and Quantitative Evaluation

Example of use (DSI/DSM)		Objective/quantitative/"hard" evaluation criteria			Subjective/qualitative/"soft" evaluation criteria		Comments
		Achieved energy saving (incl. kWh saved / CHF)	Affected population share	Persistent effect	Strengths of the approach	Weaknesses of the approach	
1	The MUNX (Web platform from Repower an international energy company based in Switzerland. It operates along the entire value chain, from generation, trading, transmission and distribution to sales.)	n.a.	whole German speaking Switzerland possible	n.a.	It's a very simple method of tracking electricity consumption because you don't need any installation.	You have to enter the data on your own. So, there is a possibility for mistakes. You collect only weekly data and it is difficult to know why consumption varies from one week to the next. The possibility to compare consumption can have a bad effect. When you see that others in the same street use more electricity than you, this could stop you to save energy because you think it's not necessary to do it neither.	It's a really funny platform with a playful exposure to the consumption of your electrical power. For example, the three marmots are funny and have nothing to do with electrical power. Customer have to be active by themselves and interested in the energy thematic. Needs time every week, fatigue may occur.
2	Smart Metering case study Uttwil (EKT)	electricity savings of 1.7%	Customers of EKT with a Smart Meter	n.a.	Real-time feedback; easy to access information with in-home display; additional information about estimated CO2-emissions; mobile use; additional information about applied technologies and possibilities; Acceptance of smart meters before and after pilot-use of smart meter display have been analysed;	installation is needed; internet connection is needed for the inhouse display	Will there be any benefit left today?
3	bonus model for energy efficient households (EWZ), research project FP-1.9 platform "www.smart-steps.ch" (mailing, web-portal, newsletter and mobile app)	no savings compared to control group; user which monitor consumption by manually recording meter readings saved 1.71% of the electricity	scalable for all EVU, does not depend on metering system --> all private household customers of EVU	The effect of financial incentives decreases after a few weeks, the effect of virtual bonus increases over time. The share of active users decreases after time.	combination of learning-, information-, and challenge-tool; scalable; personalised (individual recommendation); platform can be used for further research project	meter readings have to be inserted manually; only weekly and aggregated data; "opt in" principle, so a proactive interaction is needed, this leads to behaviour barriers;	
4	Smart Metering case study Zurich (EWZ)	3.2% of the electricity for smart meter users; no significant savings for consulting and social information groups	Customers of EWZ with a Smart Meter	Reduction on a medium-term apparent (1 year)	detailed information and continuous feedback with smart meter; personal consumption targets on smart meter displays are possible	installation is needed; data security The effect of information could go in both directions: For example, households with initially low electricity consumptions could start to use more if they realise that comparable households consume more.	
5	Smart Metering case study (EKZ)	up to 3% with real-time visualisation; 2.6% with daily information on web portal; 1.5% overall compared to 1.1% in control group	Customers of EKT with a Smart Meter	n.a.	detailed information and continuous feedback with smart meter; different types of comparisons on web portal possible; visualisation with signal light	installation is needed; The effect of signal light can go in both directions, if signal is green the customer maybe has no motivation to further reduce the consumption	
6	eportal repower - online customer portal (swibi)		customer of repower		one web-portal for the communication with the customers, bidirectional communication (e.g. purchasing process implemented); uses available consumption information; easy to register with information from the bill; mobile use	Only static consumption information and only twice a year. The effect of comparison could go in both directions: For example, households with initially low electricity consumptions could start to use more if they realise that they are consuming less than the swiss average	
7	my sgsw - online customer portal (i-web)	n.a.	n.a.	n.a.	one web-portal for the communication with the customers, bidirectional communication; uses available consumption information; easy to register with information from the bill	Only static consumption information and only once a year.	

Example of use (DSI/DSM)		Objective/quantitative/"hard" evaluation criteria			Subjective/qualitative/"soft" evaluation criteria		
		Achieved energy saving (incl. kWh saved / CHF)	Affected population share	Persistent effect	Strengths of the approach	Weaknesses of the approach	Comments
8	energybox EKS (EW Kt. Schaffhausen)	n.a. because the inputs are anonymous.	1000 people in 2015 and 600 in 2016; scalable for all EVU --> all private household customers of EVU	n.a.	information of electricity consumption on the level of appliances; guidance for repairing or replacing an appliance; no installation is needed. The calculation model is accurate, there is an error of 2% for the difference between calculated and measured consumption values (Quelle: Auswertung Energybox 2005)	all data have to be inserted manually. Some questions are hard to answer for many users. The information is unique and calculated (no real data). The effect of comparison could go in both directions: For example, households with initially low electricity consumptions could start to use more if they realise that they are consuming less than the swiss average	
9	E-Rechnung - EKS	n.a.	scalable for all EVU --> all private household customers of EVU	n.a.	Receiving the information in the e-banking portal which is used by the customer for all payment transactions (no additional portal).	It is possible to pay the bill without looking at the invoice (the invoice has to be opened actively and manually), so that the consumption is maybe not noticed by the customer.	
10	WaZApp - Werke am Zürichsee	n.a.	100-500 android installations, scalable for all customers of Werke am Zürichsee	n.a.	The information is available at any time on the mobile device; Possibility to contact or inform the customer directly; simple way to access information	Need of installation (app) on the mobile device	
11	tiko power	up to 60% (source: https://tiko.ch/page/product_power/#theoffer) energy savings in total 1553 MWh until now (source: https://tiko.ch/)	over 10000 users (Quelle: Energiate Messenger 09.02.2017) scalable for all households with electrical heating systems	n.a.	Information about a specific appliance (heating system); easy to use (mobile-app)	Only information about the electrical consumption of the heating system is covered. The effect of comparison could go in both directions: For example, households with initially low electricity consumptions could start to use more if they realise that they are consuming less than the other users.	
12	Thermography - EKS	n.a.	customers of EKS which own a building. scalable for all EVU --> all house owner	n.a.	The energy is made visible by thermography, so the customers can see the losses. Investments in buildings can bring long term energy savings.	Only graphically information about the thermal losses of the building, no numeric information (about potential savings in terms of energy or costs).	
13	wattson energy meter - EW Höfe	on average 20% (source: product flyer "Wattson Classic")	can be used in every household and does not depend on the utility	n.a.	Real-time information about electricity; colours for actual consumption are easy to understand; easy to install and use	information is based on the aggregated actual used electrical power. It is hard for the user to interpret this number on the display and the costs (and CO2 emissions) are calculated on the actual used power. An additional device and installation is needed.	
14	EMU check USB energy meter - EW Höfe	n.a.	can be used in every household and does not depend on the utility	n.a.	Real-time information about electricity consumption of a specific appliance; easy to use (put between the plug socket and the device); analyses is delivered by the utility	additional device is needed; only one appliance can be measured	
15	Stromdetektiv - EKZ (energy consulting)	10-20% is possible without losing comfort; 50% of electricity for lightning is possible (source: "Stromsparen: bequem und einfach - EKZ Stromdetektiv")	can be used by all customers of EKZ	n.a.	personal interaction between customer and energy experts; understanding of the electricity bill could have a good effect on energy consumption	time-consuming and costly process for the utility; high entrance barrier (an appointment has to be made, costs for the customer); no durable delivery (only verbal); only standby of specific appliances is measured	
16	invoice by post - SGSW	n.a.	all customers of SGSW which do not use e-invoicing	n.a.	visual consumption comparison over many years; split costs in different services as grid usage, taxes, legal fees or energy gives transparency	Only static consumption information and only once a year; hard to understand	
17	invoice by post - EKS		all customers of EKT which do not use e-invoicing	n.a.	consumption comparison to previous year; split costs in different services as grid usage, taxes, legal fees or energy gives transparency	Only static consumption information and only once a year; hard to understand	
18	invoice by post - Repower		all customers of repower which do not use e-invoicing	n.a.	visual consumption comparison over many years; split costs in different services as grid usage, taxes, legal fees or energy gives	Only static consumption information and only twice a year.	

		Objective/quantitative/"hard" evaluation criteria			Subjective/qualitative/"soft" evaluation criteria		
Example of use (DSI/DSM)		Achieved energy saving (incl. kWh saved / CHF)	Affected population share	Persistent effect	Strengths of the approach	Weaknesses of the approach	Comments
					transparency; visual overview of relative shares of the services		
19	energy2click (Swibi and asgal)	n.a.	n.a.	n.a.	Combination of DSI, DSM and business process automatization; one online-platform for consumers, prosumers and the utility; real-time data available	high investments for implementation (smart meter necessary)	
20	smoopo messenger - EWZ	n.a.	500-800 users, can be used by all customers of EWZ with a smartphone	n.a.	The younger customers are used to communicate with instant messenger; easy to use (registration with mobile number); direct contact; possibility to adapt level of communication (e.g. informal); can be used for different companies (e.g. SBB, AXA Winterthur); many services could be implemented (e.g. request for energy consumption report); push notification possible	Need of installation (app) on the mobile device; customer has to be verified for delivering sensitive data like the energy consumption	
21	Social Power	Winterthur: on average 5.6% compared to previous consumption, on average 11.8% compared to the control group Massgno: on average 11.8% compared to previous consumption, on average 8.1% compared to the control group	120 households from Winterthur and Massagno	To be measured in summer 2017	Savings achieved More social embedding helps reduce frustration and invokes personalization	Some goals have unanticipated results – real-time electricity feedback (2 seconds) is a lot of data to manage need participants to stay in the game	
22	optimised self-consumption of solar energy (EKS)	energy savings not yet evaluated	Customers of EKS	n.a.	financial savings are appreciably ---> self-consumption: Because the customer is able to control his or her energy consumption 24/7 they reduce their usage. Like that financial savings are appreciably for the consumer. A long-lasting effect of energy saving is reached.	investment costs: A consumer has to invest money for reducing costs. This is only profitable in a period of more than 10 years. Which means a consumer has to invest in a sustainable way.	
23	EKT (Energie Kanton Thurgau) energy efficiency support program	Project not finished yet	business customers of EKT with consumption >100'000kWh/a of electricity or >1'000'000 kWh/a of thermic energy, companies which take part in the competition, probably the employees	yes	Close cooperation of consumer and prosumer. Benefit for every participant and for EKT. Additionally, it sharpens the environmental awareness of the companies.	Not fair for smaller companies, because of not getting the same support. Too little encouragement for huge companies towards their needed investments. Would be better to expand the programme over the whole country. --> a lot more savings.	
24	"Meter to Cash" case study eelog Energielogistik AG (eelog)	n.a.	Customers of eelog	n.a.	This System encourages saving energy with the help of economy. Experts manage the energy sources for their clients making it less complicated for the customers.	Customers don't receive immediate feedback on the energy usage. Elog focuses more on energy management than on energy saving.	
25	Innovative services with smart meters (Energie Thun)	No evaluation studies have been done. Recording to the commission of energy regulation in Ireland, different pilot projects have shown that it is possible to save 3-4 % of energy, if the energy consumption is revealed.	Every consumer with a smart meter (if possible with data every second or a "turbo mode") and a tablet or a smart phone with the smart metering app.	n.a.	With the automatic calculation of the standby and cooling device consumption, it was possible to make a personalised visual feedback and recommendation for the consumer. The idea of these interventions is to provide incentives to reduce energy consumptions. E.g. the participants were motivated to undercut the energy consumption of the previous day. The information provided by the smart metering app achieves emotional confrontation with the energy saving topic and creates encouragement to reduce energy.	The algorithm of the approach had difficulties measuring the consumption of one household's old cooling device. The cooling device had a constant standby consumption and therefore it was impossible to deploy the algorithm. Another weakness of the approach is the inaccurate results of the measurements repeated every 15 minutes, comparing to the measurements repeated every second. These however require a large amount of data, which is difficult to store. There are no cost-efficient and economical solutions yet regarding this problem. With the smart metering app, it is not possible for the participants to compare their	It is possible to provide individual and personal recommendations with smart meter regarding energy savings. Unfortunately, no evaluation studies were done, which could have shown the effect of this study. In general, it is possible to provide an overview of the own energy consumption. However, several measurements are still inaccurate due to missing data storage options.

Example of use (DSI/DSM)		Objective/quantitative/"hard" evaluation criteria			Subjective/qualitative/"soft" evaluation criteria		Comments
		Achieved energy saving (incl. kWh saved / CHF)	Affected population share	Persistent effect	Strengths of the approach	Weaknesses of the approach	
						energy consumptions with each other. The comparison could have had a positive influence regarding energy savings. Due to the prevention of loneliness, the social aspect is important when it comes to consumption reductions. The eco-friendly motivation is not as effective as the cost saving aspect for the consumer. Therefore, an additional cost saving tool would be a possible development for the smart metering app.	
26	Nest - Controlling of room temperature.	Overall savings of about 12% energy costs.	Every customer	Energy savings	The approach is to build or establish a safer surrounding for people and to make their lives easier.	Some people might not be happy by the fact, that private data is collected from them.	Overall it is a very good system, which is visible in the energy savings analysed by studies. It is not only good for the customer, who saves money, but also for the environment because of the less energy needed.
27	amphiro water consumption meter. Case study from ETH Zurich.	One-person households had water and energy savings of 21%, two-person households had 25%. On average, compared to the reference group, there was an energy saving of 23%. Under consideration of the average degree of efficiency for warm water preparation, the energy savings were 443 kWh per average household and year.	Participants of the study. Considering the amphiro device itself, the European population is affected as it is only delivered within Europe.	The energy and water savings stagnated at the lower consumption levels until the end of the study. The goal of the amphiro is to achieve a persistent water and energy saving.	Water heating is very energy consuming and therefore it is the right place to apply methods of behavioural change. A great saving potential exists in this topic. The simplicity of the amphiro is a big strength. You do not need any expertise to install and operate the device and the feedback content is easily understandable.	The relatively high costs of the amphiro can be a hurdle for people to buy the device. For extensive energy savings, the amphiro should be more known in society. Possible problems are the costs. Compared to the price of the amphiro the annual savings are low. As today the cost factor is more important to people than energy savings, this could be a reason for its unpopularity.	

Appendix 11. Utilities' interview Questionnaires (in German only)

Interview Leitfaden für die Befragung der Partner-EVU im Projekt IMPROVE –

Ziele:

- *Die bestehenden Kundeninformations-Modelle (DSI) für Haushaltskunden sind bekannt*
- *Die Ziele, welche mit den vorhandenen DSI verfolgt werden, sind bekannt*
- *Die vorhandenen Informationen über die Verbrauchsdaten im EVU sind bekannt (z.B. Smart Meter Daten)*
- *Die Motivation der EVU und der Kunden zur Steigerung der Energieeffizienz von den Kunden ist bekannt*
- *Die Informationsbedürfnisse der Kunden sind bekannt*
- *Ideen, Bestrebungen und Projekte für zukünftige DSI sind bekannt*
- *Die Ziele, welche mit zukünftigen DSI verfolgt werden, sind bekannt*
- *Die zukünftig benötigten Informationen über die Verbrauchsdaten im EVU sind bekannt*

Interviewer:

Teilnehmer:

Zeit und Ort des Interviews:

Material: Audio-Recorder, Papier, Stift

Einführung

Erstmal danke vielmals für Ihre Bereitschaft an diesem Interview teilzunehmen. Bevor wir starten, werde ich Ihnen ein paar Informationen zum Interview geben.

Vorstellung Interviewende

David Suter, Masterstudent am INE, Hintergrund in IT, Wirtschaftsingenieur, Projektleiter und Prozessautomatisierung Energiebranche

Vorstellung Projekt

- *Energiestrategie 2050 kann nicht ausschliesslich durch erneuerbare und verbesserter Effizienz erreicht werden, es braucht Verringerung der Nachfrage*
- *Kundeninformation ist ein Schlüsselement dazu*
- *Projekt IMPROVE -> Informationslücke zwischen vorhandenen Infos bei Kunden und Versorgern schliessen*
- *Vorhandene Informationsmodelle für Haushaltskunden werden untersucht (In- und angrenzendes Ausland), mit Hilfe von EVU in der Schweiz*
- *Daraus werden Empfehlungen für EVU abgeleitet*
- *Zusammenarbeit FHNW, HES-SO, SUPSI und ZHAW, Auftrag von BFE*

Ziel des Interviews

- *Expertenwissen abfragen, ist wichtig für das Projekt*
- *Vorhandene Informationsmodelle kennen lernen*

- Erfahrungen einholen

Die Projektergebnisse werden auf der Plattform ARAMIS (www.aramis.admin.ch) und auf www.energieforschung.ch veröffentlicht. Ausgenommen sind vertrauliche Daten, diese werden in einem unveröffentlichten Anhang dokumentiert.

Dürfen wir den Namen Ihres EVU im Bericht erwähnen, oder sollen die Informationen vertraulich behandelt werden? (ev. Review vor Veröffentlichung)

Ablauf des Gespräches: Dauer 1-1.5h

Ich werde Ihnen offene Fragen stellen, das heisst, Sie sind in Ihrer Antwort ganz frei. Erzählen Sie mir einfach, was Ihnen in den Sinn kommt und was für Sie wichtig ist. Es gibt keine falschen Antworten.

Ich werde mir während des Interviews Notizen machen. Trotzdem wäre es für uns sehr hilfreich, wenn ich das Interview auf Tonband aufnehmen könnte, damit wir sicher alle ihre Aussagen protokolliert haben. Haben Sie dagegen irgendwelche Einwände?

Bevor wir mit der ersten Frage starten: Haben Sie noch irgendwelche Fragen bezüglich des Interviews?

Legende:

kursiv geschrieben: Titel oder Meta-Informationen zum Interview, werden vom Interviewer nicht erzählt

Nach dieser kurzen Einleitung können wir nun mit den ersten Fragen starten.

1. Warm up (5min)

<i>No</i>	<i>Question</i>	<i>Notes of the interviewer</i>	<i>Target</i>
1.1	Können Sie uns erzählen, welches ihr Tätigkeitsgebiet im Unternehmen ist?		Warm up
1.2	Welche Produkte bieten Sie Ihren Kunden an?		Warm up
1.3	Was sind die langfristigen Ziele Ihres Unternehmens?		Warm up
1.4	Welche Ergebnisse aus dem Projekt Improve wären für Sie wünschenswert?		Warm up

Nun werden wir einige Fragen zu den von Ihnen eingesetzten Kundeninformations-Systemen stellen.

2. vorhandene Kundeninformations-Modelle

No	Question	Notes of the interviewer	Target
2.1	Welche Informationen über den Energieverbrauch bieten Sie Ihren Kunden? (E-Rechnung, Energieaudits, Coaching, Online etc.) Wie sind diese ausgestaltet?		Die bestehenden DSI-Modelle sind bekannt
2.2	Über welche Informationen zum Verbrauch Ihrer Kunden verfügen Sie aktuell? (Ablesezeiten, Ablesefrequenz etc.)		Die vorhandenen Informationen zu den Verbrauchsdaten im EVU sind bekannt
2.3	Haben Sie Erfahrungen mit Smart Meter in Ihrem Unternehmen? (Rollout geplant? Rollout Strategie? Verwendung? Wann?)		Die vorhandenen Informationen zu den Verbrauchsdaten im EVU sind bekannt
2.4	Welche Informationen erhalten Ihre Kunden über die Rechnung? (Periodizität, Vergleich, Kosten/Verbrauch, Stromkennzeichnung etc.)		Die bestehenden DSI-Modelle sind bekannt
2.5	Verfügen Sie über zeitabhängige Tarife?		Die bestehenden DSI-Modelle sind bekannt
2.6	In welchen Formen (postal, E-Rechnung, Mail) und zu welchem Zeitpunkt wird die Rechnung versendet?		Die bestehenden DSI-Modelle sind bekannt
2.7	Welche Ziele verfolgen Sie bei der vorhandenen Kundeninformation?		Die Ziele, welche mit den vorhandenen DSI verfolgt werden, sind bekannt
2.8	Gibt es weitere Möglichkeiten, mit denen sich Kunden über Ihren Energieverbrauch informieren können?		Die bestehenden DSI-Modelle sind bekannt

Bei den nächsten Fragen geht es um die Steigerung der Energieeffizienz bei den Endkunden.

3. Steigerung der Energieeffizienz

No	Question	Notes of the interviewer	Target
3.1	Aus welchen Gründen unterstützen Sie die Endkunden dabei, dass diese energieeffizienter werden? (z.B. Finanziell, Load-Shifting, Image etc.)		Die Motivation der EVU und der Verbraucher zur Steigerung der Energieeffizienz ist bekannt
3.2	Was treibt Ihrer Ansicht nach die Endkunden an, energieeffizienter zu werden?		Die Motivation der EVU und der Verbraucher zur Steigerung der Energieeffizienz ist bekannt
3.3	Wo setzt aus Ihrer Sicht ein optimales Kundeninformationssystem an?		Die Ziele, welche mit zukünftigen DSI verfolgt werden, sind bekannt

Die folgenden Fragen drehen sich um ihre Bestrebungen hin zu neuen oder verbesserten Kundeninformations-Modellen.

4. zukünftige DSI

No	Question	Notes of the interviewer	Target
4.1	Wie sehen die Informationsbedürfnisse Ihrer Kunden heute und in Zukunft aus?		Die Informationsbedürfnisse der Kunden sind bekannt
4.2	Welche Ideen oder Projekte für eine neue oder verbesserte Kundeninformation sind in Ihrem Unternehmen vorhanden oder wurden bereits umgesetzt?		Ideen, Bestrebungen und Projekte für zukünftige DSI sind bekannt
4.3	Welche Erfahrungen haben Sie in solchen Projekten bereits gemacht?		Ideen, Bestrebungen und Projekte für zukünftige DSI sind bekannt
4.4	Was waren die Rückmeldungen der Kunden (positive und negative)?		Die Informationsbedürfnisse der Kunden sind bekannt
4.5	Was sind die Gründe für solche Projekte, oder aus welchen Gründen sind keine Projekte angedacht?		Die Ziele, welche mit zukünftigen DSI verfolgt werden, sind bekannt

<i>No</i>	<i>Question</i>	<i>Notes of the interviewer</i>	<i>Target</i>
4.6	Welche Ziele verfolgen Sie, wenn Sie Änderungen an der Kundeninformation vornehmen?		Die Ziele, welche mit zukünftigen DSI verfolgt werden, sind bekannt
4.6	Welche Informationen benötigen Sie, um Ihre Kunden in Zukunft optimal zu informieren? (z.B. Lastgangdaten)		Die zukünftig benötigten Informationen zu den Verbrauchsdaten im EVU sind bekannt

Wir sind nun fast am Ende des Interviews und ich habe nur noch wenige Fragen.

Closing questions

<i>No</i>	<i>Question</i>	<i>Notes of the interviewer</i>	<i>Target</i>
6.1	Haben Sie den Eindruck, dass der Energieverbrauch mit geeigneter Kundeninformation gesenkt werden kann?		Closing interview
6.2	Haben Sie Fragen oder Bemerkungen zum Projekt IMPROVE?		Closing interview

Danke vielmals für die Teilnahme an diesem Interview und Ihre interessanten Antworten. Wir werden nun die Antworten unserer Partner-EVU zusammenfassen. Dies fließt dann in die Analyse des Improve Projektes mit ein. Wir werden im Juni einen Workshop mit allen Partner-EVU durchführen, in dem die Analyse präsentiert wird. Danach wird eine Online-Befragung bei den EVU und den Verbrauchern durchgeführt. Aus den Ideen werden drei optimierte Kundeninformations-Modelle entwickelt. Die Endergebnisse und der Projektbericht werden voraussichtlich im Juni 2018 vorhanden sein. Haben Sie Interesse an dem Abschlussbericht? Einen schönen Abend/Tag!

Appendix 12. Online survey for consumers' satisfaction assesement

IMPROVE WP5_FR

Contexte

Enquête de satisfaction auprès des consommateurs d'énergie

La récolte d'informations et l'analyse des résultats de cette étude se font de manière strictement confidentielle.

Quatre hautes écoles de Suisse actives dans le domaine de l'énergie, ont été mandatées par le programme de recherche Energie dans les Bâtiments de l'Office Fédéral de l'Energie (OFEN) pour effectuer une étude qui vise à analyser les informations sur les factures d'énergie (électricité et chauffage) qui sont transmises par les fournisseurs d'énergie à leurs clients privés. En particulier, l'étude cherche à déterminer si l'information fournie sur votre facture est suffisante pour vous aider à vous positionner par rapport à votre consommation personnelle d'énergie.

Votre avis est essentiel d'une part, pour réaliser un état des lieux de la situation actuelle en Suisse et d'autre part, mettre en évidence votre perception et identifier vos éventuelles attentes concernant une meilleure information sur votre consommation d'énergie.

Le questionnaire s'adresse aux ménages privés concernant leur logement principal.

Il vous faudra environ 10 minutes pour remplir ce questionnaire.

Un prix d'une valeur de 150.- ou ce montant en cash sera offert à un des participants de cette enquête, qui sera tiré au sort.

Délai de participation : 31 décembre 2017

En cas de question ou de problème technique, veuillez contacter sara.eicher@heig-vd.ch.

Nous vous remercions de votre participation!

IMPROVE WP5_FR

A propos de votre facture d'ELECTRICITE

1

* 1. Sous quelle forme recevez-vous votre facture d'électricité?

- Courrier postal
- Email (courriel)
- Portail web (internet)
- Applications mobiles (téléphone mobile, tablette)
- Ecran d'affichage à domicile (In-Home display)
- Justificatif de paiement (compteur à prépaiement)
- Autre (veuillez préciser)

* 2. A quelle fréquence recevez-vous votre facture d'électricité?

- 1 fois par année
- 2 fois par année
- 3 fois par année
- 4 fois par année
- 6 fois par année
- 12 fois par année
- Je ne sais pas
- Autre (veuillez préciser)

* 3. Combien de temps, au total, passez-vous à lire votre facture d'électricité?

- moins de 5 min
- entre 5 et 10 min
- entre 10 et 15 min
- entre 15 et 20 min
- Plus

2

* 4. Comment évaluez-vous votre niveau de compréhension de votre facture d'électricité?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je réussis à m'y retrouver même si je ne comprends pas tout
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je n'arrive pas à comprendre les informations hormis le montant à payer
- Je ne lis pas les informations, je me contente de consulter le montant à payer
- Sans opinion
- Autre (veuillez préciser)

5. Quel est votre fournisseur d'électricité?

MPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

* 6. Recevez-vous, de la part de votre fournisseur d'électricité, des informations qualitatives et/ou quantitatives vous permettant de positionner votre niveau de consommation électrique (bas, moyen, élevé)?

- Non
- Oui
- Je ne sais pas

MPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

* 7. Seriez-vous intéressé par de telles informations?

- Non
- Oui

MPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

3

* 8. Par quel type d'information seriez-vous intéressé?

	Très intéressé	Assez intéressé	Neutre	Peu intéressé	Pas intéressé
Comparaison avec un ménage moyen équivalent en nombre de personnes	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en nombre de pièces (total de chambres+cuisine+salon)	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en surface habitable	<input type="radio"/>				

Si vous avez d'autres suggestions, merci de les indiquer ici:

* 9. De quelle manière souhaiteriez-vous recevoir cette information? (Classer les réponses par ordre de préférence: 1 = plus intéressante; 3 = moins intéressante; ATTENTION, toutes les propositions doivent être classées, merci de ne pas laisser de champs vides)

⋮	<input type="text"/>	Avec une comparaison de la moyenne du quartier
⋮	<input type="text"/>	Avec une comparaison de la moyenne du canton
⋮	<input type="text"/>	Avec une comparaison de la moyenne nationale

* 10. Si ces informations font apparaître que vous consommez plus d'énergie que la moyenne, cela vous inciterait-il à mettre en place des actions d'économie d'énergie?

- Non
- Oui
- Je ne sais pas

MPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

4

* 11. Pourquoi? (plusieurs réponses possibles)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

* 12. Quel type d'information recevez-vous? (plusieurs réponses possibles)

- Comparaison avec la consommation d'un ménage moyen équivalent
- Comparaison avec un objectif de consommation recommandé
- Comparaison avec la consommation moyenne du quartier
- Comparaison avec la consommation moyenne au niveau national
- Je ne peux pas répondre car je ne comprends pas les informations reçues
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

* 13. Est-ce que les informations communiquées sur votre niveau de consommation électrique vous ont incité à réduire votre consommation par la mise en place des actions d'économie d'énergie?

- Non
- Oui

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

5

* 14. Qualifiez l'influence qu'a eu l'information reçue sur votre motivation à réduire votre consommation d'énergie:

- Très forte influence
- Forte influence
- Influence modérée
- Peu d'influence
- Aucune influence
- Sans opinion

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'**ELECTRICITE**

* 15. Pourquoi? (plusieurs réponses possibles)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Ma consommation est déjà au-dessous de la moyenne
- Autre (veuillez préciser)

IMPROVE WP5_FR

Statut d'occupation du logement

Pour la suite du questionnaire, nous nous intéressons à l'énergie de **CHAUFFAGE**

6

* 16. Pour votre logement principal, êtes-vous:

- Propriétaire
 Locataire
 Autre (veuillez préciser)

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 17. Comment payez-vous vos frais de chauffage?

- Compris dans les charges du loyer
 Directement au fournisseur d'énergie
 Autre (veuillez préciser)

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 18. Recevez-vous, de votre propriétaire (privé ou régie), des informations concernant votre consommation de chauffage?

- Non
 Oui
 Je ne sais pas

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 19. Seriez-vous intéressé par de telles informations?

- Non
 Oui

7

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 20. Quel type d'information souhaiteriez-vous recevoir? (*plusieurs réponses possibles*)

- Comparaison avec la consommation d'un ménage moyen équivalent
 Comparaison avec un objectif de consommation recommandé
 Comparaison avec la consommation moyenne du quartier
 Comparaison avec la consommation moyenne au niveau national
 Consommation de chauffage
 Coût de la consommation de chauffage
 Historique des consommations de chauffage
 Autre (veuillez préciser)

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 21. Si ces informations font apparaître que vous consommez plus d'énergie que la moyenne, cela vous inciterait-il à mettre en place des actions d'économie d'énergie?

- Non
 Oui
 Je ne sais pas

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

8

* 22. Pourquoi? (plusieurs réponses possibles)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Autre (veuillez préciser)

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 23. Est-ce que les informations communiquées vous permettent de positionner votre niveau de consommation de chauffage (bas, moyen, élevé)?

- Non
- Oui
- Je ne sais pas

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 24. Seriez-vous intéressé par de telles informations?

- Non
- Oui

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

9

* 25. Par quel type d'information seriez-vous intéressé?

	Très intéressé	Assez intéressé	Neutre	Peu intéressé	Pas intéressé
Comparaison avec un ménage moyen équivalent en nombre de personnes	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en nombre de pièces (total de chambres+cuisine+salon)	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en surface habitable	<input type="radio"/>				

Si vous avez d'autres suggestions, merci de les indiquer ici:

* 26. De quelle manière souhaiteriez-vous recevoir cette information? (Classer les réponses par ordre de préférence: 1 = plus intéressante; 3 = moins intéressante; ATTENTION, toutes les propositions doivent être classées, merci de ne pas laisser de champs vides)

⋮	<input type="text"/>	Avec une comparaison de la moyenne du quartier
⋮	<input type="text"/>	Avec une comparaison de la moyenne du canton
⋮	<input type="text"/>	Avec une comparaison de la moyenne nationale

* 27. Si ces informations font apparaître que vous consommez plus d'énergie que la moyenne, cela vous inciterait-il à mettre en place des actions d'économie d'énergie?

- Non
- Oui
- Je ne sais pas

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

10

* 28. Pourquoi? (*plusieurs réponses possibles*)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Autre (veuillez préciser)

MPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 29. Quel type d'information recevez-vous? (*plusieurs réponses possibles*)

- Comparaison avec la consommations d'un ménage moyen équivalent
- Comparaison avec un objectif de consommation recommandé
- Comparaison avec la consommation moyenne du quartier
- Comparaison avec la consommation moyenne au niveau national
- Je ne peux pas répondre car je ne comprends pas les informations reçues
- Autre (veuillez préciser)

MPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 30. Est-ce que les informations communiquées vous ont incité à réduire votre consommation de chauffage par la mise en place des actions d'économie d'énergie?

- Non
- Oui

MPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 31. Qualifiez l'influence qu'a eu l'information reçue sur votre motivation à réduire votre consommation d'énergie:

- Très forte influence
- Forte influence
- Influence modérée
- Peu d'influence
- Aucune influence
- Sans opinion

IMPROVE WP5_FR

Information sur la consommation de **CHAUFFAGE** à disposition du locataire

* 32. Pourquoi? (*plusieurs réponses possibles*)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Ma consommation est déjà au-dessous de la moyenne
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos du système principal d'énergie pour le **CHAUFFAGE**

* 33. Quel est le système de chauffage principal de votre logement?

- Chaudière à gaz
- Chaudière à mazout
- Electricité
- Pompe à chaleur
- Chaudière à bois
- Je ne sais pas
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos de votre facture de CHAUFFAGE

* 34. Sous quelle forme recevez-vous votre facture de chauffage?

- Courrier postal
- Email (courriel)
- Portail web (internet)
- Applications mobiles (téléphone mobile, tablette)
- Ecran d'affichage à domicile
- Justificatif de paiement (compteur à prépaiement)
- Avec la livraison (mazout, bois)
- Autre (veuillez préciser)

13

* 35. A quelle fréquence recevez-vous votre facture de chauffage?

- 1 fois par année
- 2 fois par année
- 3 fois par année
- 4 fois par année
- 6 fois par année
- 12 fois par année
- Je ne sais pas
- Autre (veuillez préciser)

* 36. Combien de temps, au total, passez-vous à lire votre facture de chauffage?

- moins de 5 min
- entre 5 et 10 min
- entre 10 et 15 min
- entre 15 et 20 min
- Autre (veuillez préciser)

* 37. Comment évaluez-vous votre niveau de compréhension de votre facture de chauffage?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je réussis à m'y retrouver même si je ne comprends pas tout
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je n'arrive pas à comprendre les informations hormis le montant à payer
- Je ne lis pas les informations, je me contente de consulter le montant à payer
- Sans opinion
- Autre (veuillez préciser)

38. Quel est votre fournisseur d'énergie pour le chauffage?

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le

14

CHAUFFAGE

* 39. Recevez-vous, de la part de votre fournisseur d'énergie, des informations qualitatives et/ou quantitatives vous permettant de positionner votre niveau de consommation de chauffage (bas, moyen, élevé)?

- Non
 Oui
 Je ne sais pas

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 40. Seriez-vous intéressé par de telles informations?

- Non
 Oui

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 41. Par quel type d'information seriez-vous intéressé?

	Très intéressé	Assez intéressé	Neutre	Peu intéressé	Pas intéressé
Comparaison avec un ménage moyen équivalent en nombre de personnes	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en nombre de pièces (total de chambres+cuisine+salon)	<input type="radio"/>				
Comparaison avec un ménage moyen équivalent en surface habitable	<input type="radio"/>				

Si vous avez d'autres suggestions, merci de les indiquer ici:

* 42. De quelle manière souhaiteriez-vous recevoir cette information? (Classer les réponses par ordre de préférence: 1 = plus intéressante; 3 = moins intéressante; ATTENTION, toutes les propositions doivent être classées, merci de ne pas laisser de champs vides)

⋮	<input type="text"/>	Avec une comparaison de la moyenne du quartier
⋮	<input type="text"/>	Avec une comparaison de la moyenne du canton
⋮	<input type="text"/>	Avec une comparaison de la moyenne nationale

* 43. Si ces informations font apparaître que vous consommez plus d'énergie que la moyenne, cela vous inciterait-il à mettre en place des actions d'économie d'énergie?

- Non
 Oui
 Je ne sais pas

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 44. Pourquoi? (*plusieurs réponses possibles*)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 45. Quel type d'information recevez-vous? (*plusieurs réponses possibles*)

- Comparaison avec la consommations d'un ménage moyen équivalent
- Comparaison avec un objectif de consommation recommandé
- Comparaison avec la consommation moyenne du quartier
- Comparaison avec la consommation moyenne au niveau national
- Je ne peux pas répondre car je ne comprends pas les informations reçues
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 46. Est-ce que les informations communiquées sur votre niveau de consommation de chauffage vous ont incité à réduire votre consommation par la mise en place des actions d'économie d'énergie?

- Non
- Oui

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le

17

CHAUFFAGE

* 47. Qualifiez l'influence qu'a eu l'information reçue sur votre motivation à réduire votre consommation d'énergie:

- Très forte influence
- Forte influence
- Influence modérée
- Peu d'influence
- Aucune influence
- Sans opinion

IMPROVE WP5_FR

A propos du type d'information reçue de la part de votre fournisseur d'énergie pour le **CHAUFFAGE**

* 48. Pourquoi? (*plusieurs réponses possibles*)

- Pas d'intérêt
- Je n'ai pas l'information pour mieux faire
- Mise en pratique trop complexe
- Mise en pratique trop chère
- Ma consommation est déjà au-dessous de la moyenne
- Autre (veuillez préciser)

IMPROVE WP5_FR

A propos de l'amélioration de l'information énergétique fournie aux consommateurs

18

Pour la suite de ce questionnaire nous allons vous présenter six propositions d'affichage de votre consommation d'énergie.

Pour chaque proposition, merci de bien vouloir évaluer vos degrés de compréhension et d'intérêt pour situer votre niveau de consommation d'énergie (bas, moyen ou élevé).

IMPROVE WP5_FR

Proposition 1

Proposition 1

Energie consommée	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
<i>Période de facturation</i>				
Énergie	2900	0,10256	287,17	8,0
Consommation énergétique d'un ménage moyen équivalent	2530			
Sous-total énergie (hors TVA)			287,17	
Distribution	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
<i>Période de facturation</i>				
Énergie	2800	0,06523	182,64	8,0
Abonnement		5,50000	66,00	8,0
Sous-total distribution (hors TVA)			248,64	
Réseau	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
<i>Période de facturation</i>				
Énergie	2900	0,01400	39,20	8,0
Sous-total Réseau (hors TVA)			39,20	
Taxes publiques & émoluments	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
<i>Période de facturation</i>				
Taxes	2900	0,00600	16,80	8,0
Émoluments	2800	0,00700	19,60	8,0
Sous-total Taxes (hors TVA)			36,40	
Total (hors TVA)			611,41	

* 49. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

19

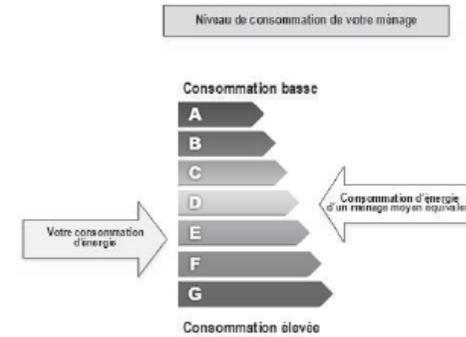
* 50. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR

Proposition 2

Proposition 2



* 51. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

20

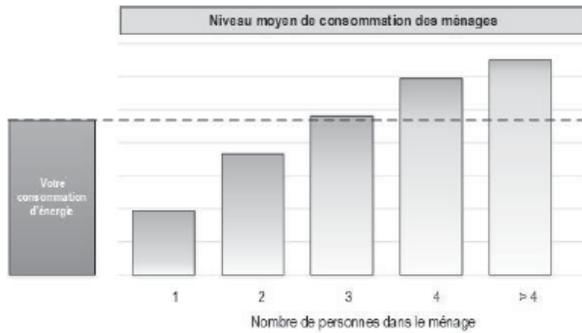
* 52. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR

Proposition 3

Proposition 3



* 53. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

21

* 54. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR

Proposition 4

Proposition 4



* 55. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

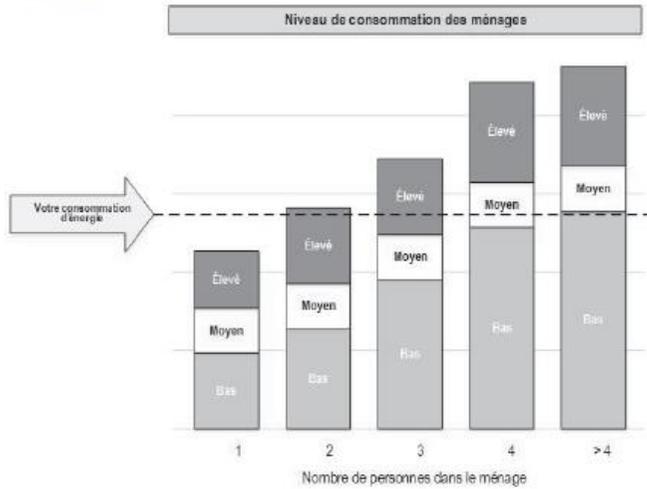
22

* 56. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR
Proposition 5

Proposition 5



* 57. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

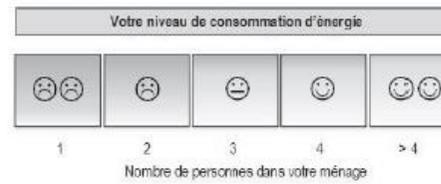
- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

* 58. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR
Proposition 6

Proposition 6



* 59. Comment évaluez-vous votre niveau de compréhension de cette proposition ?

- Excellent: j'arrive à tout comprendre
- Satisfaisant: je comprends globalement
- Passable: je parviens péniblement à comprendre certains éléments
- Mauvais: je ne comprends pas les informations
- Sans opinion

* 60. Quel est votre intérêt à recevoir ce visuel afin de positionner votre consommation d'énergie:

- Très fort intérêt
- Fort intérêt
- Assez d'intérêt
- Peu d'intérêt
- Aucun intérêt
- Sans opinion

IMPROVE WP5_FR

A propos de l'amélioration de l'information énergétique fournie aux consommateurs

* 61. Comment souhaiteriez-vous recevoir cette information? (un seul choix possible)

- Avec la facture énergétique (format actuel)
- Par email
- Via un portail web
- Via une application mobile
- Via un écran d'affichage à domicile (In-Home display)
- Via le magazine de votre fournisseur d'énergie
- Avec la facture du loyer (si locataire)
- Autre (veuillez préciser)

62. Si vous avez d'autres solutions de visuel à proposer, merci de les indiquer ici:

IMPROVE WP5_FR

Profil sociodémographique du répondant

* 63. Sexe

- Féminin
- Masculin
- Je ne veux pas répondre

* 64. Âge

- de 18 à 25 ans
- de 26 à 35 ans
- de 36 à 45 ans
- de 46 à 55 ans
- de 56 à 65 ans
- 66 ans et plus

* 65. Occupation

- En emploi
- Étudiant
- Retraité
- Sans emploi / à la maison
- Autre (veuillez préciser)

* 66. Niveau d'études

- Primaire
- Secondaire
- Formation professionnelle (apprentissage, technicien)
- Supérieur
- Autre (veuillez préciser)

* 67. Type de logement

- Maison individuelle
- Bâtiment collectif
- Autre (veuillez préciser)

* 68. Taille du ménage (adultes et enfants)

- 1 personne
- 2 personnes
- 3 personnes
- 4 personnes
- 5 personnes
- Autre (veuillez préciser)

* 69. Revenu annuel brut du ménage

- moins de 60'000 CHF
- entre 60'000 et 79'999 CHF
- entre 80'000 et 99'999 CHF
- entre 100'000 et 119'999 CHF
- entre 120'000 et 149'999 CHF
- plus de 150'000 CHF
- Je ne veux pas répondre

* 70. Canton

* 71. Code Postal

IMPROVE WP5_FR

Participation au tirage au sort (facultatif)

72. Pour participer au tirage au sort, merci d'indiquer vos coordonnées:

Nom:	<input type="text"/>
Prénom:	<input type="text"/>
Rue:	<input type="text"/>
Code postal:	<input type="text"/>
Ville:	<input type="text"/>
Canton:	<input type="text"/>
E-mail:	<input type="text"/>
Téléphone:	<input type="text"/>
Année de naissance:	<input type="text"/>

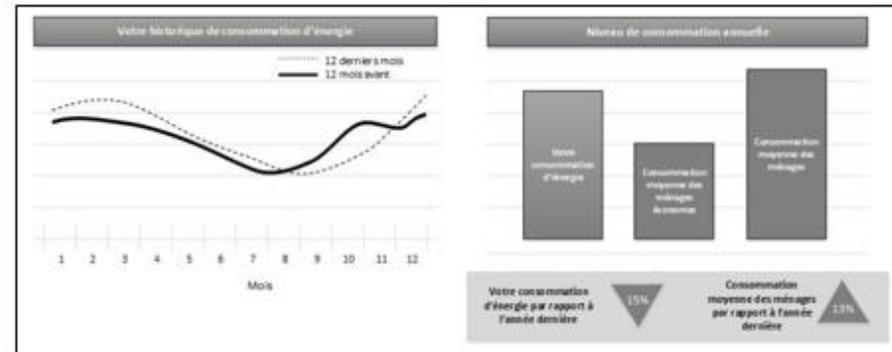
**Fin du sondage.
Merci de votre participation!**

Appendix 13. IMPROVE proposals

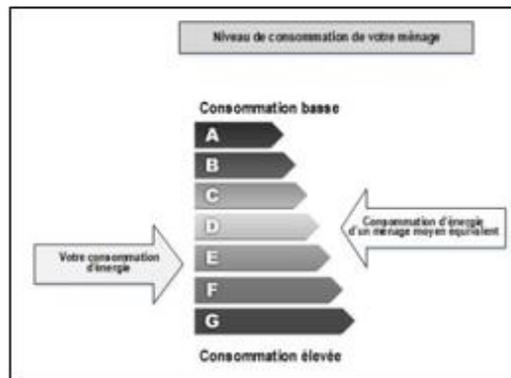
1

Energie consommée	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
Prises de factures				
Energie	2600	0.10296	267.71	0.0
Consommation énergétique d'un ménage moyen équivalent	2534			
Sous-total Energie (hors TVA)			267.71	
Distribution				
Prises de factures				
Energie	2600	0.08122	181.54	0.0
Recommandation		1.00000	60.91	0.0
Sous-total distribution (hors TVA)			242.45	
Réseau				
Prises de factures				
Energie	2600	0.07495	192.87	0.0
Sous-total Réseau (hors TVA)			192.87	
Taxes publiques & émoluments				
Prises de factures				
Taxes	2600	0.00660	17.16	0.0
Émoluments	2600	0.00750	19.50	0.0
Sous-total Taxes (hors TVA)			36.66	
Total (hors TVA)			611.41	

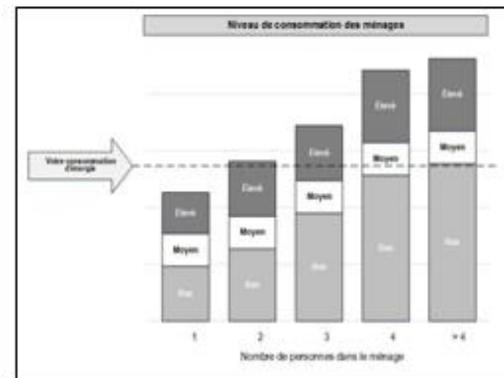
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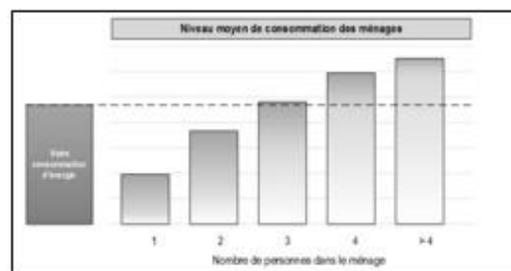
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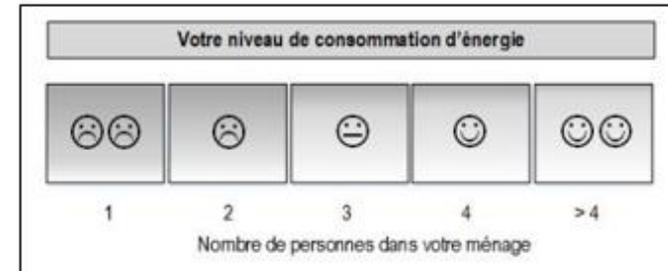
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3



6



Appendix 14. Statistical analysis report

Improve project STATISTICAL report

27/2/2018

Electricity consumers' profile (questions 1 - 15)

Bill (questions 1 - 5)

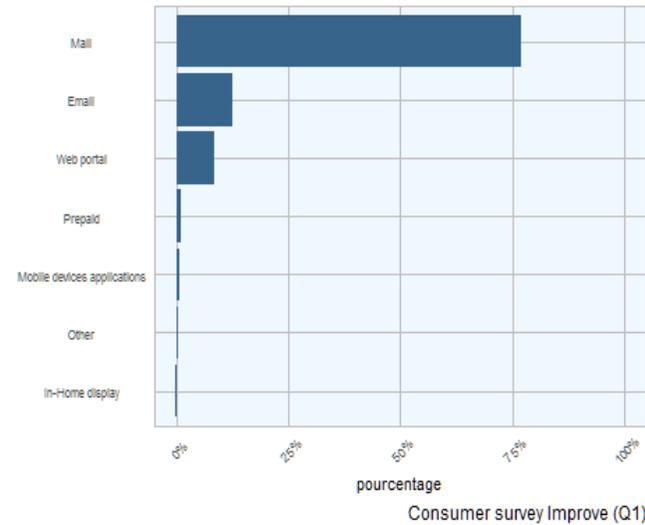
Question 1

Under what format do you receive your electricity bill?	pourcentage
Email	12.4
In-Home display	0.2
Mail	77.2
Mobile devices applications	0.6
Other	0.4
Prepaid	1.0
Web portal	8.4

Question 2

At what frequency do you receive your electricity bill?	pourcentage
Annually	6.5
Bi-annually	7.2
Bi-monthly	11.2
Do not know	5.9
Monthly	3.9
Other	1.7
Quarterly	52.2
Triannually	11.3

Under what format do you receive your electricity bill? (n = 3047)



Appendix 15. List of utilities contacted by regions

A) German-speaking part of Switzerland:

No.	Name	Location
1	Wasser- & Elektrizitätswerk Walenstadt	8880 Walenstadt
2	Werkbetriebe Frauenfeld	8503 Frauenfeld
3	Elektrizitätsgenossenschaft Bubikon	8608 Bubikon
4	Industrielle Betriebe Kloten AG	8302 Kloten
5	TBS Strom AG	5034 Suhr
6	Technische Betriebe Würenlos	5436 Würenlos
7	Technische Betriebe Kreuzlingen	8280 Kreuzlingen
8	TB Gränichen Energie AG	5722 Gränichen
9	Technische Betriebe Grabs Strom / CATV	9472 Grabs
10	Technische Betriebe Goldach	9403 Goldach
11	Elektrizitätswerk der Gemeinde Bergün	7482 Bergün/Bravuogn
12	eug Elektra Untergäu Genossenschaft	4616 Kappel SO
13	Stadtwerk Winterthur	8403 Winterthur
14	Gemeindewerke Rüti Elektrizitätsversorgung	8630 Rüti ZH
15	Regio Energie Amriswil (REA)	8580 Amriswil
16	Elektrizitätswerk Vaz/Obervaz	7078 Lenzerheide/Lai
17	Kraftwerk Schaffhausen AG	8201 Schaffhausen
18	Arbon Energie AG	9320 Arbon
19	Elektrizitätswerk Obwalden	6064 Kerns
20	Elektrizitätsversorgung Würenlingen	5303 Würenlingen
21	Elektrizitätsversorgung Murgenthal	4853 Murgenthal
22	Kantonales Elektrizitätswerk Nidwalden	6371 Stans
23	Elektrizitätswerk Obwalden	6064 Kerns
24	Liechtensteinische Kraftwerke	9494 Schaan
25	Stadtwerke Wetzikon	8621 Wetzikon ZH
26	Elektrizitätswerke des Kantons Zürich	8022 Zürich
27	die werke versorgung wallisellen ag	8304 Wallisellen
28	Energie Wasser Bern	3001 Bern
29	EBM (Genossenschaft Elektra Birseck)	4142 Münchenstein
30	Genossenschaft Licht- und Kraftwerke Glattfelden	8192 Glattfelden
31	Elektrizitätswerk Urnäsch AG	9107 Urnäsch
32	EW Aadorf	8355 Aadorf
33	ELEKTRA Bözen	5076 Bözen
34	Elektrizitäts- und Wasserwerk der Stadt Buchs	9471 Buchs SG 1

35	Technische Betriebe Elektrizitätsversorgung	9400 Rorschach
36	WWZ Energie AG	6301 Zug
37	Werke am Zürichsee AG (Kuesnacht)	8700 Küsnacht ZH
38	Werke Wangen-Brüttisellen	8306 Brüttisellen
39	Thurwerke AG	9630 Wattwil
40	Technische Betriebe Wil	9500 Wil SG
41	Technische Betriebe Glarus Nord	8752 Näfels
42	tba energie ag	4663 Aarburg
43	St. Moritz Energie	7500 St. Moritz
44	SN Energie AG	9000 St. Gallen
45	SH POWER	8201 Schaffhausen
46	SATOM SA	1870 Monthey
47	St. Gallisch-Appenzellische Kraftwerke AG	9001 St. Gallen
48	rwt Regionalwerk Toggenburg AG	9533 Kirchberg SG
49	WERKE Rheineck Elektrizitäts- u. Wasserversorgung	9424 Rheineck
50	ReLL Regionale energie Lieferung Leuk AG	3952 Susten
51	Regionalwerke AG Baden	5401 Baden
52	Regio Energie Solothurn	4502 Solothurn
53	Rabiosa Energie	7075 Churwalden
54	Gemeindebetriebe Elektrizitätswerk	4914 Roggwil BE
55	Martin Zeller AG Flums Elektrizitätswerk	8890 Flums
56	Licht- und Wasserwerk Adelboden AG	3715 Adelboden
57	Industrielle Betriebe Interlaken	3800 Interlaken
58	Industrielle Betriebe Huttwil AG	4950 Huttwil
59	Gemeindewerke Pfäffikon	8330 Pfäffikon ZH
60	Gemeindewerke Arth	6415 Arth
61	Glattwerk AG	8600 Dübendorf
62	Elektra Gaiserwald	9030 Abtwil SG
63	EWZ Elektrizitätswerk Zermatt AG	3920 Zermatt
64	EGW Weiach Elektrizitätsgenossenschaft c/o Genossenschaft Licht- und Kraftwerke Glattfelden	8192 Glattfelden
65	EW Wald AG	8636 Wald ZH
66	Elektrizitäts- und Wasserwerk Wettingen	5430 Wettingen
67	Elektrizitätswerk Ursern	6490 Andermatt
68	Elektrizitätswerk Uznach AG	8730 Uznach
69	Elektrizitätswerk Sennwald	9466 Sennwald
70	EWS Energie AG	5734 Reinach AG

71	Elektrizitätswerk Schmerikon AG	8716 Schmerikon
72	Elektrizitätswerk Samnaun Gemeindehaus	7562 Samnaun-Compatsch
73	Elektrizitätswerk Schwyz AG	6438 Ibach
74	Elektrizitätswerk Rümlang	8153 Rümlang
75	EW Rothrist AG	4852 Rothrist
76	Genossenschaft EW Romanshorn	8590 Romanshorn
77	Elektrizitätswerk Obergoms AG	3985 Münster VS
78	Genossenschaft EW Münchwilen (EWM)	9542 Münchwilen TG
79	Energie und Wasser Meilen AG	8706 Meilen
80	ewl energie wasser luzern	6002 Luzern
81	EWJR Elektrizitätswerk Jona-Rapperswil AG	8645 Jona
82	e & w Dussnang	8374 Dussnang
83	EWD Elektrizitätswerk Davos AG	7270 Davos Platz
84	EWA Energie Wasser Aarberg AG	3270 Aarberg
85	Energie- und Wasserversorgung Appenzell (Feuerschaugemeinde)	9050 Appenzell
86	EV Gebenstorf AG	5412 Gebenstorf
87	Energieversorgung Büren AG	3294 Büren an der Aare
88	EV Energieversorgung Biberist	4562 Biberist
89	Energie Uster AG	8610 Uster
90	Energie Thun AG	3607 Thun
91	Energie Pool Schweiz AG	8050 Zürich
92	Energie Opfikon AG	8152 Opfikon
93	Energie Gossau AG	8625 Gossau ZH
94	Energie 360° AG	8010 Zürich
95	Elektra Gams	9473 Gams
96	Genossenschaft Elektra, Jegenstorf	3303 Jegenstorf
97	Elektra-Korporation Wolfhalden EKW	9427 Wolfhalden
98	Elektrizitätswerk des Kantons Schaffhausen AG	8201 Schaffhausen
99	Elektrizitätsgenossenschaft Marthalen	8460 Marthalen
100	EGH Elektro - Genossenschaft Hünenberg	6331 Hünenberg
101	EFA Energie Freiamt AG	5630 Muri AG
102	EE-ENERGIA ENGIADINA	7550 Scuol
103	ebs Energie AG	6431 Schwyz
104	Axpo Power AG	5401 Baden
105	Arosa Energie	7050 Arosa
106	AEW Energie AG	5001 Aarau 1 Fächer
107	a.en Aare Energie AG	4601 Olten

108	Licht- und Wasserwerk Adelboden AG	3715 Adelboden
109	Technische Betriebe Glarus	8750 Glarus
110	Gemeindewerke Stäfa energie und wasser	8712 Stäfa
111	Infrastruktur Männedorf Elektrizitätswerk	8708 Männedorf
112	AG Elektrizitätswerk Maienfeld Stadtverwaltung	7304 Maienfeld
113	Gemeindewerke Horgen	8810 Horgen
114	Gemeindewerke Dietlikon	8305 Dietlikon
115	Technische Betriebe Kemptal (Gemeindezentrum)	8573 Siegershausen
116	Technische Betriebe Flawil Elektrizität	9230 Flawil
117	Elektra Leibstadt	5325 Leibstadt
118	Elektrizitätsversorgung der Gemeinde Saas-Fee	3906 Saas-Fee
119	Elektrizitätswerk der Gemeinde Samedan	7503 Samedan
120	Elektrizitätswerk der Gemeinde Lindau	8312 Winterberg ZH
121	Elektrizitäts- und Wasserwerk Windisch	5210 Windisch
122	Elektrizitätswerk Vals	7132 Vals
123	EVS Energieversorgung Schänis AG	8718 Schänis
124	Elektrizitätsversorgung Kaltbrunn AG	8722 Kaltbrunn
125	Elektrizitätsversorgung Altendorf AG	8852 Altendorf
126	Elektrizitätswerk Herrliberg	8704 Herrliberg
127	Energie Seeland AG	3250 Lyss
128	Energie AG Sumiswald	3454 Sumiswald
129	tbgs - Technische Betriebe Glarus Süd	8762 Schwanden GL
130	Elektrizitätsgenossenschaft Lufingen	8426 Lufingen
131	Dorfkorporation Weite	9476 Weite
132	Wasser- & Elektrizitätswerk Steinhausen	6312 Steinhausen
133	Kraftwerk Schaffhausen AG	8201 Schaffhausen
134	Industrielle Betriebe Kloten AG	8302 Kloten
135	Technische Gemeindebetriebe Hauptwil-Gottshaus	9213 Hauptwil
136	Einwohnergemeinde Lengnau Bau- und Werkabteilung	2543 Lengnau BE
137	BKW AG*	3013 Bern
138	SGSW St.Galler Stadtwerke *	9001 St. Gallen
139	EKS Elektrizitätswerk des Kantons Schaffhausen*	8201 Schaffhausen
140	EKS Elektrizitätswerk des Kantons Schaffhausen*	8201 Schaffhausen
141	EKS Elektrizitätswerk des Kantons Schaffhausen*	8201 Schaffhausen

* Official partner utilities collaborating in the IMPROVE research project

B) French-speaking part of Switzerland:

No.	Name	Location
1	Services Techniques Tramelan	2720 Tramelan
2	Services Industriels Lausanne de l'Electricité*	1002 Lausanne
3	Services industriels de Delémont	2800 Delémont
4	Services Industriels Lutry	1095 Lutry
5	Services Industriels de Nyon	1260 Nyon 2
6	Services Industriels de la Commune de Fully	1926 Fully
7	Services Electricité, Energies & Développement Durable (SED2)	1870 Monthey
8	Yverdon-les-bains Energies*	1401 Yverdon-les-Bains
9	GESA Gruyère Energie SA	1630 Bulle
10	L'Energie de Sion-Région SA (esr)	1951 Sion
11	Energie Service Biel / Bienne	2500 Biel/Bienne 1
12	SwissElectricity.com SA	1208 Genève
13	SWG	2540 Grenchen
14	Sinergy Infrastructure SA	1920 Martigny
15	Sierre-Energie SA	3960 Sierre
16	Services Industriels de Bagnes	1934 Le Châble VS
17	Services Industriels Moutier	2740 Moutier
18	Société Électrique du Val-de-Travers S.A.	2108 Couvet
19	Société Electrique de la Vallée de Joux SA	1341 Orient
20	Service Electrique Intercommunal SA (SEIC)	1904 Vernayaz
21	Société Electrique Intercommunale de la Côte SA	1196 Gland
22	Société Electrique des Forces de l'Aubonne (SEFA)	1170 Aubonne
23	Services Techniques de la Municipalité de St-Imier	2610 St-Imier
24	Romande Energie SA	1110 Morges
25	Ville de Pully	1009 Pully
26	EnAlpin AG	3930 Visp
27	Eli10 S.A.	2022 Bevaix
28	Service de l'Electricité SEB	1030 Bussigny
29	FMV SA	1951 Sion
30	Rhonerwerke AG c/o FMV SA	1951 Sion
31	Services Industriels de La Neuveville	2520 La Neuveville
32	Electricité de la Lienne S.A.	1951 Sion
33	Bielensee Kraftwerke AG (BIK)	2504 Biel/Bienne
34	Société des Forces Electriques de La Goule	2610 St-Imier

* Official partner utilities collaborating in the IMPROVE research project

C) Italian-speaking part of Switzerland:

No.	Name	Location
1	AGE SA	6830 Chiasso
2	AEC - Azienda Elettrica Comunale Airolo	6780 Airolo
3	CEF - Cooperativa Elettrica Faido	6760 Faido
4	AMS - Aziende Municipalizzate Stabio	6855 Stabio
5	AEC – Azienda Elettrica Comunale	6612 Ascona
6	SES* - Società Elettrica Sopracenerina SA	6600 Locarno
7	AEM* - Azienda Elettrica Massagno	6900 Lugano Massagno
8	AIL* - Aziende Industriali di Lugano	6900 Lugano
9	AMB* - Azienda Multiservizi Bellinzona	6500 Bellinzona
10	AIM* - Aziende Industriali di Mendrisio	6850 Mendrisio

* Official partner utilities collaborating in the IMPROVE research project

Appendix 16. The questionnaire for utilities on DSI models

The present survey offers an overview of **6 possible solutions** that have been elaborated by the IMPROVE researchers in the context of currently evolving concepts of demand-side information (DSI). The main aim of these solutions is to **enhance energy billing information** in Switzerland as **to allow consumers to have a better understanding of their energy use and to increase their active engagement in energy efficiency**. However, to be effective and feasible, it is fundamental that any proposition takes into account needs and requests of both utilities and consumers. Hence, ultimate aim of this survey is to **collect feedback from a utility's point of view about motivations, costs and benefits linked to the 6 IMPROVE solutions** so far developed.

The input provided by your energy utility in this survey is very precious, as it will allow to elaborate and better target recommendations for future DSI for Swiss utilities that will be forwarded to the Swiss Federal Office of Energy (SFOE).

About this questionnaire:

- To answer the questionnaire will take you about 15 minutes.
- The IMPROVE project considers only the residential sector.
- All answers will be treated confidential and anonymous and will not be available to third parties.

Thank you for your collaboration!

1. GENERAL INFORMATION

1.1 Utility name:	
1.2 Address/Location:	
1.3 Contact person:	
1.4 E-mail address:	

1.5. What form of energy supplies your company to households (check all that apply)?

Form of energy	Supplied	Total number of residential customers served by your utility:
Electricity	<input type="checkbox"/>	
Gas	<input type="checkbox"/>	
District heating	<input type="checkbox"/>	

2. MOTIVATIONS FOR IMPROVING INFORMATION FOR RESIDENTIAL HOUSEHOLDS

2.1. To what extent do you agree that the following factors can trigger an improvement in the consumption information provided in energy bills for households by your utility?

Factor	Disagree	Somewhat disagree	Nor disagree nor agree	Somewhat agree	Agree
1. Need for transparency					
2. Compliance with federal legal requirements					
3. Compliance with Municipal service mandate					
4. Observance of Energy Strategy 2050					
5. Reduction of Energy Consumption					
6. Customer satisfaction					
7. Promotion of load shifting					
8. Promotion of utility's energy consulting services					
9. Profiling of customers' consumption patterns					
10. Marketing strategy and customer fidelity programmes					

3. DATA AVAILABILITY

3.1. Please, evaluate your availability of the following **RAW DATA** for residential households in your supply area (1 = low; 5 = high)

Raw data	1	2	3	4	5
Annual consumption data					
Monthly consumption data					
Real-time consumption data (smart meter)					
Meteorological data					
Number of household members					
Type of building (single house, apartment, etc.)					
Number of rooms					
Energy reference surface SRE (m ²)					
Type of heating system for hot water					
Share of consumption data for hot water					
Type of heating system for space heating					
Share of consumption data for heating					
Type of electrical appliances equipment provided (e. single or combined freezer; private or shared washing machine etc.)					

3.2. Please, evaluate feasibility of estimating the following **PROCESSED DATA** for residential households in your supply area (1 = low; 5 = high)

Organised/ processed data	1	2	3	4	5	I do not know
Disaggregation of consumption data for electric appliances						
Energy usage compared to previous months / previous year (same period)						
Change in energy consumption (%) over a given billing period						
Profiling similar households (no. of occupants, type of building, surface)						
Profiling of households based on level of consumption of similar households (e.g. A- G energy label classes, average/efficient/intensive household etc.)						
Correlation between energy consumption and temperature/weather conditions over billing period						

4. GENERAL ASSESSMENT OF IMPROVE SOLUTIONS

In this section we present an overview of the six possible solutions that have been elaborated within the IMPROVE project that could be included into current energy bills in order to improve customers' understanding of their energy consumption.

Solution 1				
Energie consommée				
Période de facturation				
Energie	2800	0.10256	287.17	8.0
Consommation énergétique d'un ménage moyen équivalent				
	2530			
Sous-total énergie (hors TVA)			287.17	
Distribution				
Période de facturation				
Energie	2800	0.06523	182.64	8.0
Abonnement				
		5.50000	66.00	8.0
Sous-total distribution (hors TVA)			248.64	
Réseau				
Période de facturation				
Energie	2800	0.01400	39.20	8.0
Sous-total Réseau (hors TVA)			39.20	
Taxes publiques & émoluments				
Période de facturation				
Taxes	2800	0.00500	16.80	8.0
Émoluments				
	2800	0.00700	19.60	8.0
Sous-total Taxes (hors TVA)			36.40	
Total (hors TVA)			611.41	
Language:		technical		
Comparative statistics:		peer comparison		
Comparison indicator				
Evaluation of the consumption level:		not possible		
Basic data requirements:		Billing consumption data (monthly, annual, real-time)		

4.1 Please, indicate whether your utility is already implementing, as shown above, this kind of solution:

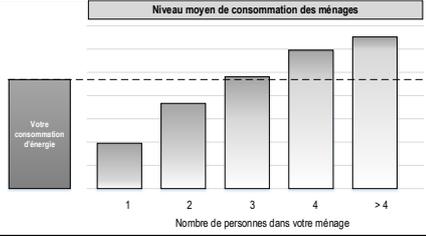
Yes No

Solution 2	
<p>The diagram illustrates energy consumption levels from A (low) to G (high). A horizontal bar chart shows levels A through G. A label 'Consommation d'énergie d'un ménage moyen équivalent' points to level D. A label 'Niveau de consommation de votre ménage' is at the top. A label 'Votre consommation d'énergie' points to the bar chart.</p>	
Language: non technical – image (eco label)	
Comparative statistics: peer comparison	
Comparison indicator : peer household average energy consumption	
Evaluation of consumption level: score of a letter (A, B, C, etc.) grey-black colour coding display of own consumption profile	
Basic data requirements: Billing consumption data (monthly, annual, real-time) Building type (SFH vs MFH) Number of household members Share of consumption data for heating Share of consumption data for hot water Profiling of HH consumption based on a Utility's or National benchmark of energy classes (A - G)	

4.2 Please, indicate whether your utility is already implementing, as shown above, this kind of solution:

Yes No

Solution 3

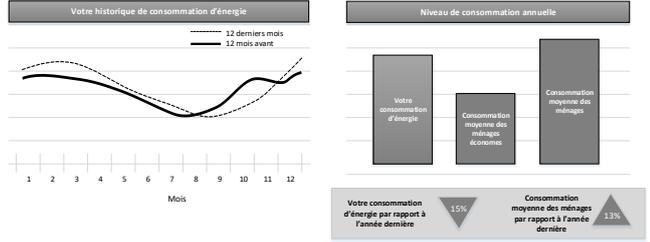


Language:	technical
Comparative statistics:	peer comparison
Comparison indicator e:	peer household size (no. of members)
Evaluation of consumption level:	bar chart display of own consumption profile
Basic data requirements:	Billing consumption data (monthly, annual, real-time) Building type (SFH vs MFH) Number of household members Share of consumption data for heating Share of consumption data for hot water Profiling of HH consumption based on a Utility's or National benchmark (household consumption average /no. of occupants)

4.3 Please, indicate whether your utility is already implementing, as shown above, this kind of solution:

Yes No

Solution 4

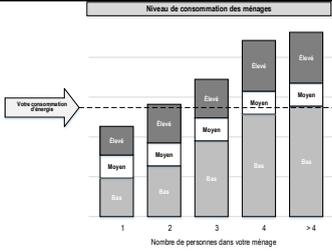


Language	Technical
Comparative statistics:	peer comparison historical self-comparison over time
Comparison indicator:	energy usage over time (12 months) peer household annual average consumption peer en-efficient household consumption
Evaluation of consumption level:	bar chart progressive curve % of energy-savings
Basic data requirements:	Billing consumption data (monthly, annual, real-time) Historical consumption data (monthly, annual, real-time) Building type (SFH vs MFH) Number of household members Share of consumption data for heating Share of consumption data for hot water Profiling of HH consumption based on a Utility's or National benchmark of energy classes (average/ efficient / intensive) Change in energy consumption (%)

4.4 Please, indicate whether your utility is already implementing, as shown above, this kind of solution:

Yes No

Solution 5

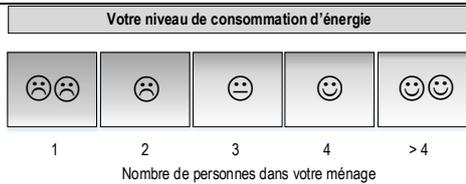


Language:	technical
Comparative statistics:	peer comparison
Comparison indicator	peer household average consumption/no. of HH members en-efficient household consumption/no. of HH members en-intensive household consumption/no. of HH members
Evaluation of consumption level:	bar chart grey-black colour coding display of own consumption profile
Basic data requirements:	Billing consumption data (monthly, annual, real-time) Historical consumption data (monthly, annual, real-time) Building type (SFH vs MFH) Number of household members Share of consumption data for heating Share of consumption data for hot water Profiling of HH consumption based on a Utility's or National benchmark of energy classes (average/ efficient / intensive)

4.5 Please, indicate whether your utility is already implementing, as shown above, this kind of solution:

Yes No

Solution 6



Language:	non technical – image (emoticon)
Comparative statistics:	Peer comparison
Comparison indicator :	peer household size (no. of members)
Evaluation of consumption level :	score of emoticons grey-black colour coding
Basic data requirements:	Billing consumption data (monthly, annual, real-time) Building type (SFH vs MFH) Number of household members Share of consumption data for heating Share of consumption data for hot water Profiling of HH consumption based on a Utility's or National benchmark (household consumption average /no. of occupants)

4.6 Please, indicate whether your utility is already implementing, as shown above, this kind of solution: Yes

No

5. COST EVALUATION OF THE IMPROVE SOLUTIONS

5.1 Please, evaluate how possible additional planning costs (e.g. decision-making, organisational tasks, consultancy, etc.) arising for the implementation of the IMPROVE solutions would be judged by your energy utility (1 = low; 5 = high):

PLANNING COSTS	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

5.2 Please, evaluate how possible additional management costs (e.g. administration of new service, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

MANAGEMENT COSTS	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

5.3 Please, evaluate whether possible additional hardware costs (e.g. smart meter equipment, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

HARDWARE COSTS	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

5.4 Please, evaluate the possible additional software costs (e.g. programme, data maintenance, upgrading) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

SOFTWARE COSTS	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

5.5 Please, evaluate the possible additional costs associated to human resources (e.g. training of the existing staff, hiring additional staff, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility(1 = low; 5 = high):

HUMAN RESOURCES	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

6. BENEFIT EVALUATION OF THE IMPROVE SOLUTIONS

6.1. Please, evaluate the possible benefits in terms of improved customer satisfaction, thanks to the implementation of each solution (1 = low; 5 = high):

CUSTOMER SATISFACTION	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

6.2. Please, evaluate the possible benefits in terms of improved customer fidelity arising thanks to the implementation of each solution (1 = low; 5 = high):

IMPROVED CUSTOMER FIDELITY	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

6.3. Please, evaluate the possible benefits in terms of utility’s reputation arising thanks to the implementation of each solution (1 = low; 5 = high):

UTILITY’S REPUTATION	1	2	3	4	5
Tabular form – IMPROVE Solution 1					
Graphical form – IMPROVE Solution 2 – 6					

6.4. Would you like to add any comments related to the possible costs and benefits associated to any of the Improve solutions? Or about needs or constraints precluding their implementation?

6.4.1. Improve solutions in general

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6.4.2. Improve solution 1

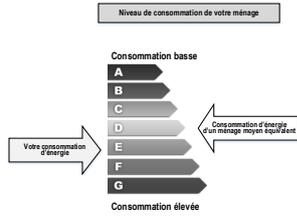
Elemento económico	Descripción	Unidad	Pre. unitario	Cantidad	Importe total	% IVA
Costos de producción	Costos de producción	€	0,00	10000	0,00	0%
Costos de distribución	Costos de distribución	€	0,00	10000	0,00	0%
Costos de gestión	Costos de gestión	€	0,00	10000	0,00	0%
Costos de mantenimiento	Costos de mantenimiento	€	0,00	10000	0,00	0%
Costos de transporte	Costos de transporte	€	0,00	10000	0,00	0%
Costos de otros	Costos de otros	€	0,00	10000	0,00	0%
Total	Total	€	0,00	10000	0,00	0%

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6.4.3. Improve solution 2

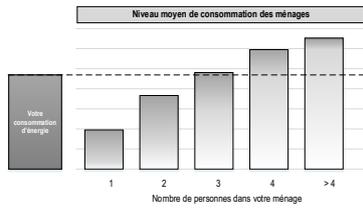


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6.4.4. Improve solution 3

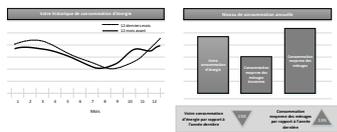


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6.4.5. Improve solution 4

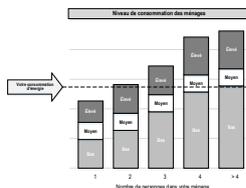


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6.4.6. Improve solution 5

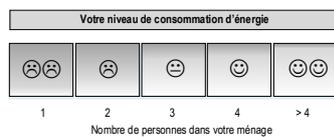


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6.4.7. Improve solution 6



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7. FINAL EVALUATION

7.1. On the basis of your above evaluation, how would you assess the **LIKELIHOOD** that **YOUR UTILITY COMPANY WILL IMPLEMENT** the Improve solutions in the paper energy bill format (1 = unlikely; 5 = very likely)?

	1	2	3	4	5																																																																																					
<p>Solution 1</p> <table border="1"> <thead> <tr> <th>Énergie consommée</th> <th>Quantité</th> <th>Prix unitaire (¢/kWh)</th> <th>Montant (¢)</th> <th>Montant (€)</th> </tr> </thead> <tbody> <tr> <td>Énergie</td> <td>2000</td> <td>0.12500</td> <td>250.00</td> <td>25.00</td> </tr> <tr> <td>Montant payé par le ménage (hors taxes)</td> <td>2000</td> <td></td> <td>250.00</td> <td>25.00</td> </tr> <tr> <td>Sous-total Énergie (hors TVA)</td> <td></td> <td></td> <td>250.00</td> <td>25.00</td> </tr> <tr> <th>Distribution</th> <th>Quantité</th> <th>Prix unitaire (¢/kWh)</th> <th>Montant (¢)</th> <th>Montant (€)</th> </tr> <tr> <td>Énergie</td> <td>2000</td> <td>0.00000</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Montant payé par le ménage (hors taxes)</td> <td>2000</td> <td></td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Sous-total Distribution (hors TVA)</td> <td></td> <td></td> <td>0.00</td> <td>0.00</td> </tr> <tr> <th>Réseaux</th> <th>Quantité</th> <th>Prix unitaire (¢/kWh)</th> <th>Montant (¢)</th> <th>Montant (€)</th> </tr> <tr> <td>Énergie</td> <td>2000</td> <td>0.00000</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Montant payé par le ménage (hors taxes)</td> <td>2000</td> <td></td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Sous-total Réseaux (hors TVA)</td> <td></td> <td></td> <td>0.00</td> <td>0.00</td> </tr> <tr> <th>Taxes publiques & émoluments</th> <th>Quantité</th> <th>Prix unitaire (¢/kWh)</th> <th>Montant (¢)</th> <th>Montant (€)</th> </tr> <tr> <td>Taxes</td> <td>2000</td> <td>0.00000</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Émoluments</td> <td>2000</td> <td>0.00000</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Montant payé par le ménage (hors taxes)</td> <td>2000</td> <td></td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Total (hors TVA)</td> <td></td> <td></td> <td>250.00</td> <td>25.00</td> </tr> </tbody> </table>	Énergie consommée	Quantité	Prix unitaire (¢/kWh)	Montant (¢)	Montant (€)	Énergie	2000	0.12500	250.00	25.00	Montant payé par le ménage (hors taxes)	2000		250.00	25.00	Sous-total Énergie (hors TVA)			250.00	25.00	Distribution	Quantité	Prix unitaire (¢/kWh)	Montant (¢)	Montant (€)	Énergie	2000	0.00000	0.00	0.00	Montant payé par le ménage (hors taxes)	2000		0.00	0.00	Sous-total Distribution (hors TVA)			0.00	0.00	Réseaux	Quantité	Prix unitaire (¢/kWh)	Montant (¢)	Montant (€)	Énergie	2000	0.00000	0.00	0.00	Montant payé par le ménage (hors taxes)	2000		0.00	0.00	Sous-total Réseaux (hors TVA)			0.00	0.00	Taxes publiques & émoluments	Quantité	Prix unitaire (¢/kWh)	Montant (¢)	Montant (€)	Taxes	2000	0.00000	0.00	0.00	Émoluments	2000	0.00000	0.00	0.00	Montant payé par le ménage (hors taxes)	2000		0.00	0.00	Total (hors TVA)			250.00	25.00					
Énergie consommée	Quantité	Prix unitaire (¢/kWh)	Montant (¢)	Montant (€)																																																																																						
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Total (hors TVA)			250.00	25.00																																																																																						
<p>Solution 2</p> <p>Niveau de consommation de votre ménage</p>																																																																																										
<p>Solution 3</p> <p>Niveau moyen de consommation des ménages</p>																																																																																										
<p>Solution 4</p> <p>Votre niveau de consommation d'énergie</p> <p>Niveau de consommation annuelle</p> <p>Votre consommation d'énergie par rapport à l'année dernière: -10%</p> <p>Consommation moyenne des ménages par rapport à l'année dernière: -15%</p>																																																																																										
<p>Solution 5</p> <p>Niveau de consommation des ménages</p>																																																																																										
<p>Solution 6</p> <p>Votre niveau de consommation d'énergie</p> <p>1 2 3 4 >4</p> <p>Nombre de personnes dans votre ménage</p>																																																																																										

7.2. Depending on the customers' socio-demographic and educational background, needs and expectations in regards to energy billing information may differ. What is the current LIKELIHOOD of your utility to provide different graphical billing solutions depending on the customer segment that is being addressed (1 = low; 5 = high)?

Factor	1	2	3	4	5
Providing different graphical billing solutions based on the customer profile					

7.3. Is there any element you already include/plan to include in energy bills for household customers, that you would like to notify us?

7.4.

Yes:, namely: _____

.....

No (-> end of the survey)

7.5. If you have any material that can be useful regarding DSI (Demand-Side-information) billing improvement in your utility company, and would like to share it with us, please, upload it here.

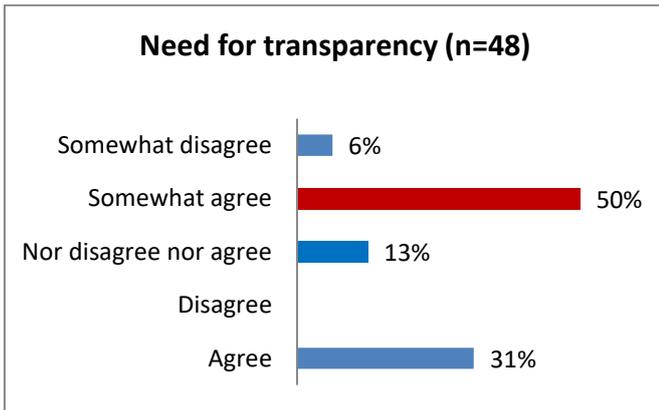
Thank you for answering!

Appendix 17. Responses to the questionnaires

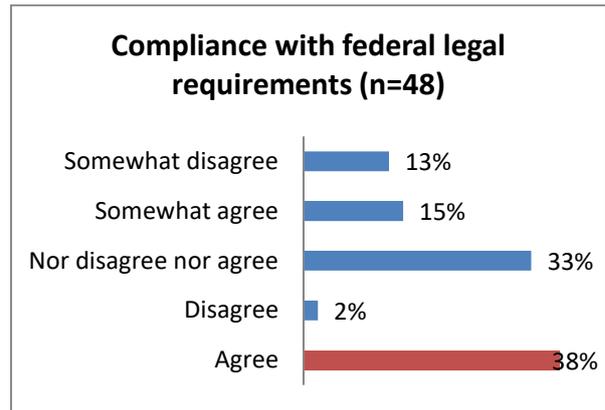
A) MOTIVATIONS FOR IMPROVING INFORMATION FOR RESIDENTIAL HOUSEHOLDS

Q2.1 To what extent do you agree that the following factors can trigger an improvement in the consumption information provided in energy bills for households by your utility?

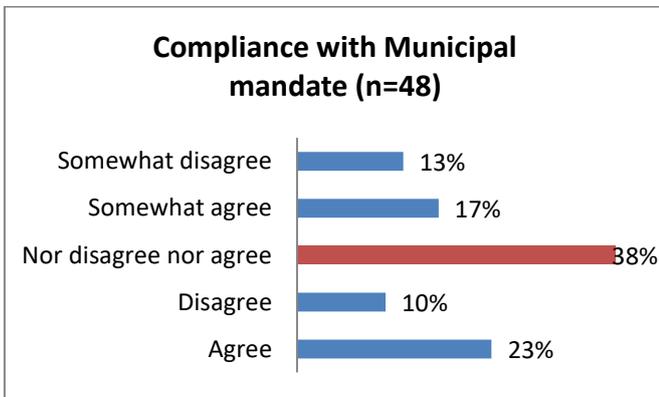
5 = Agree; 4 = Somewhat agree; 3 = Nor disagree nor agree; 2 = Somewhat disagree; 1 = Disagree



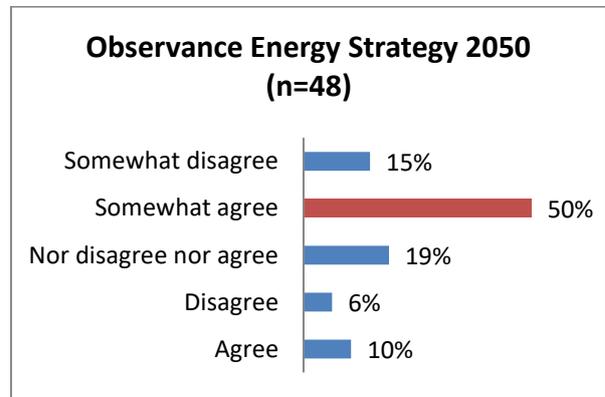
MEAN = 4.04; St. Dev = 0.90



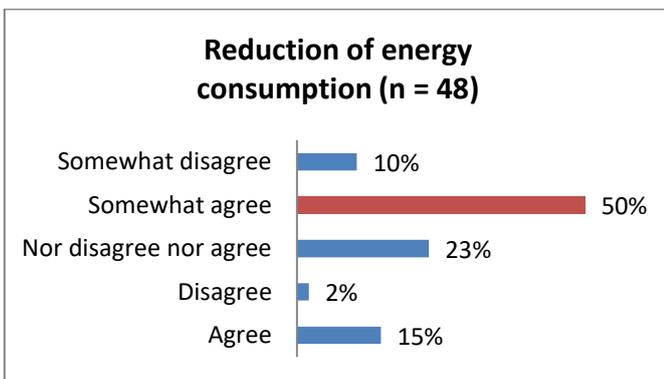
MEAN = 3.69; St. Dev = 1.24



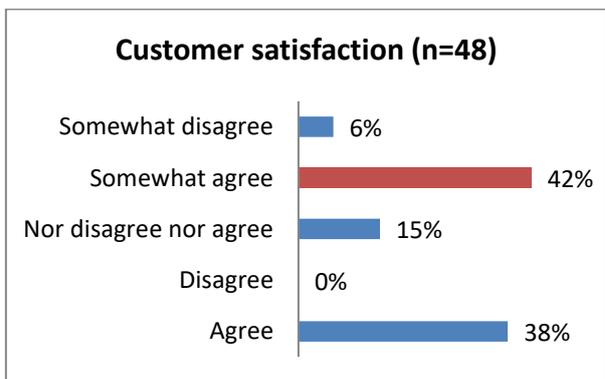
MEAN = 3.27; St. Dev = 1.27



MEAN = 3.44; St. Dev = 1.07



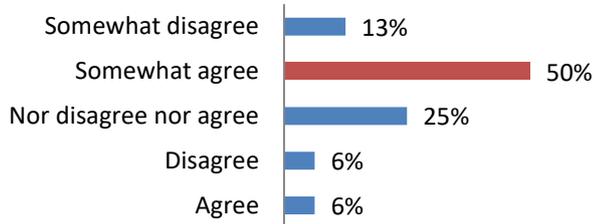
MEAN = 3.65; St. Dev = 0.93



MEAN = 4.08; St. Dev = 0.92

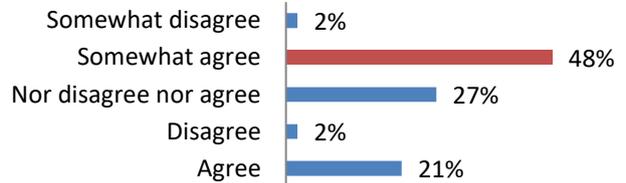
5 = Agree; 4 = Somewhat agree; 3 = Nor disagree nor agree; 2 = Somewhat disagree;
 1 = Disagree

Promotion of load shifting (n=48)



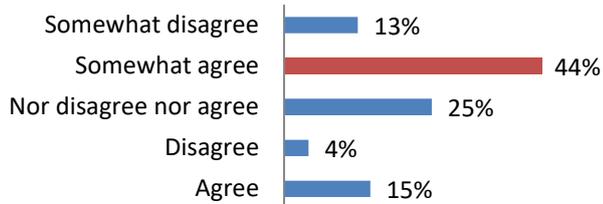
MEAN = 3.38; St. Dev = 1.00

Promotion of utility's energy consulting services (n=48)



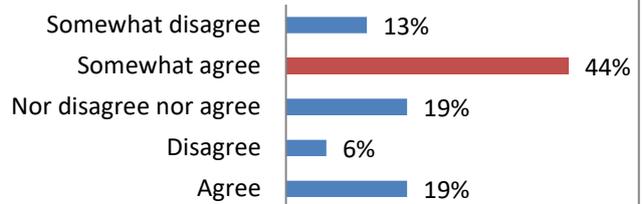
MEAN = 3.83; St. Dev = 0.86

Profiling of customers' consumption patterns (n=48)



MEAN = 3.52; St. Dev = 1.03

Marketing strategy and customer fidelity programmes(n=48)



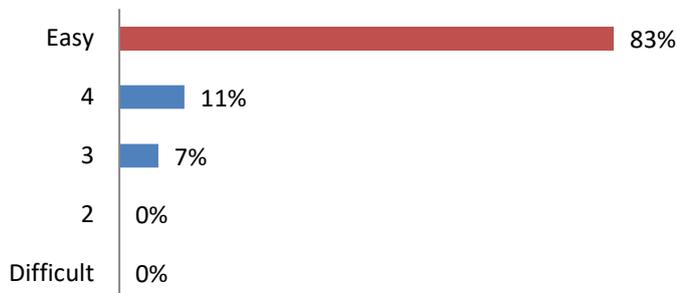
MEAN = 3.54; St. Dev = 1.15

B) DATA AVAILABILITY

Q3.1 Please, evaluate your availability of the following **RAW DATA** for residential households in your supply area (1 = low; 5 = high)

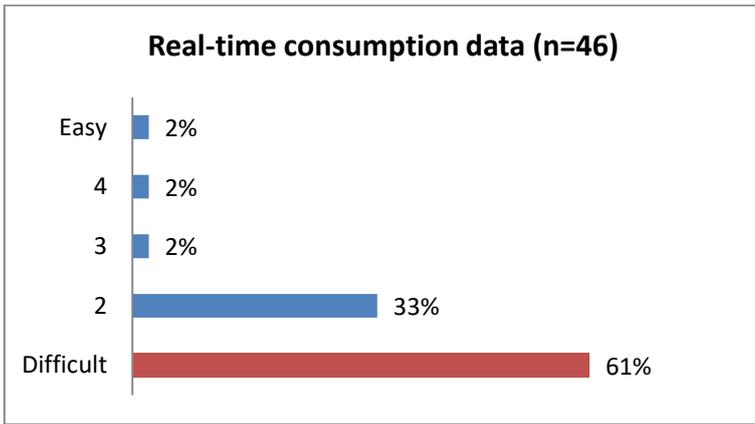
RAW DATA

Annual consumption data (n=46)

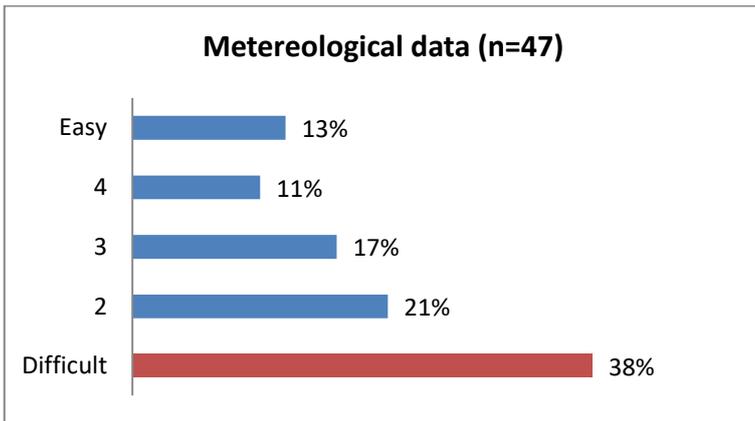


MEAN = 4.76
 ST.DEV = 0.57

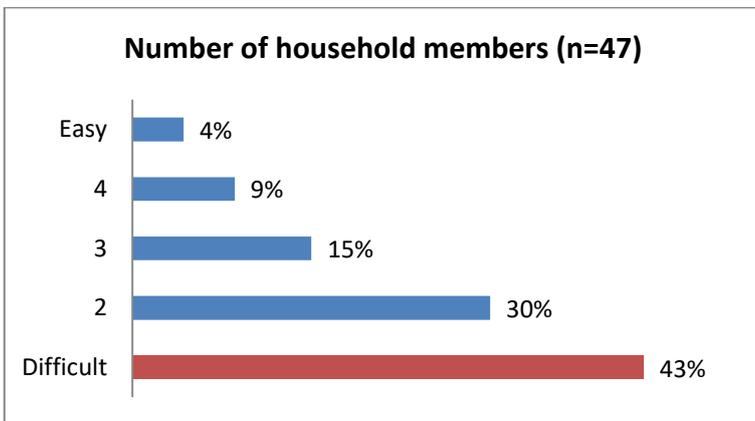
MEAN = 2.00
 ST.DEV= 1.17



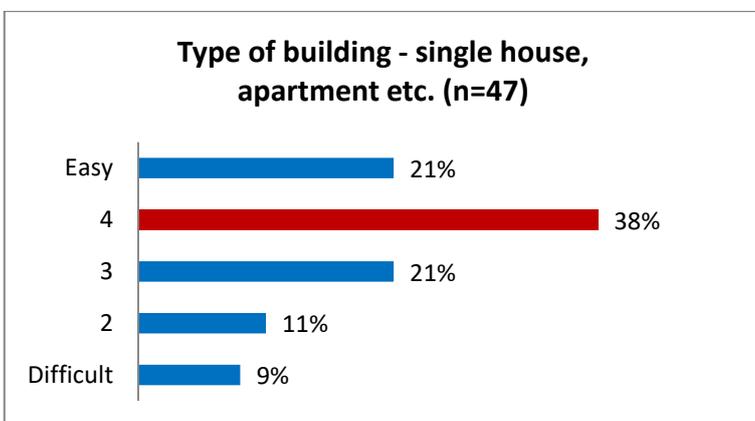
MEAN = 1.52
ST.DEV = 0.84



MEAN = 2.38
ST.DEV = 1.42

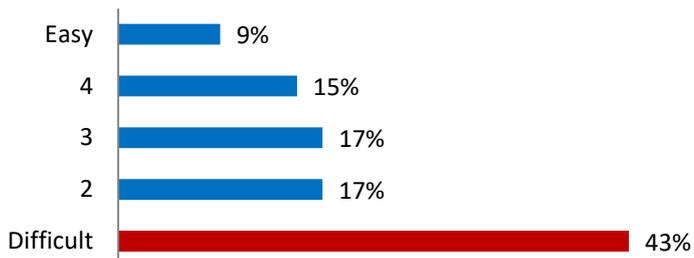


MEAN = 2.02
ST.DEV = 1.15



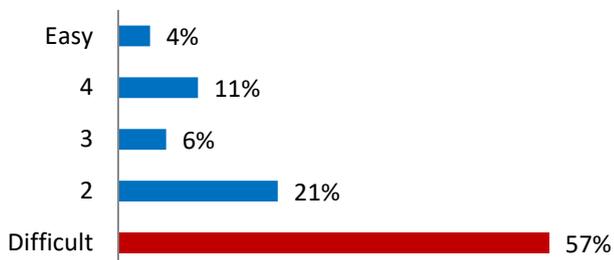
MEAN = 3.53
ST. DEV = 1.20

Number of rooms (n=47)



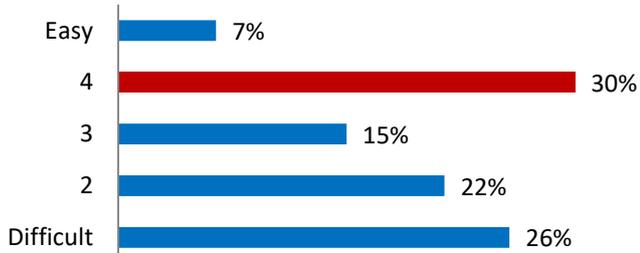
MEAN = 2.30
ST.DEV = 1.38

Energy reference surface SRE - m² (n=47)



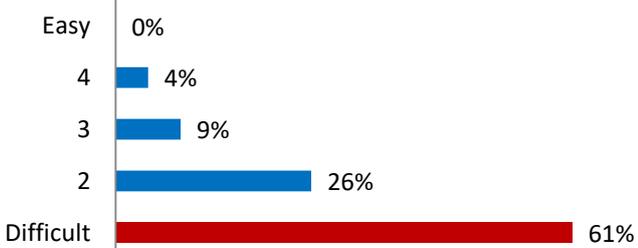
MEAN = 1.83
ST.DEV = 1.20

Type of heating system for hot water (n=46)



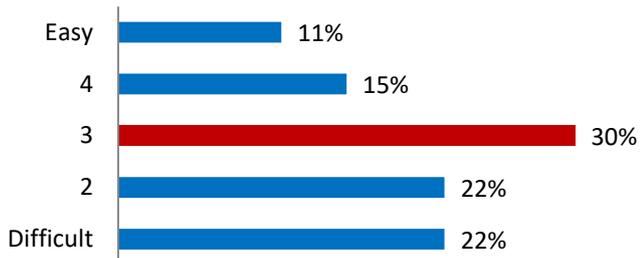
MEAN = 2.70
ST.DEV = 1.33

Share of consumption data for hot water (n=46)



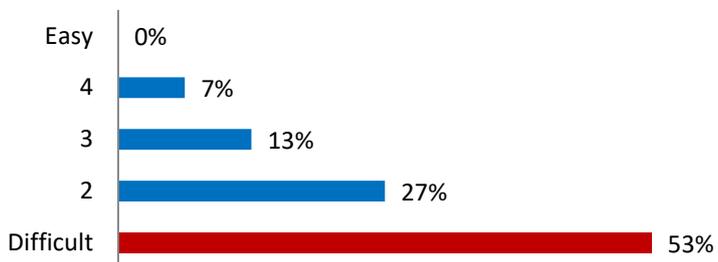
MEAN = 1.57
ST.DEV = 0.83

Type of heating system for space heating (n=46)



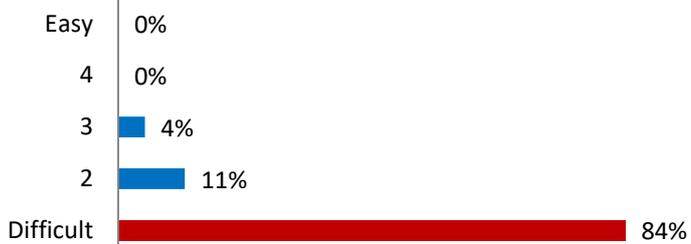
MEAN = 2.72
ST. DEV = 1.28

Share of consumption data for space (n=45)



EAN = 1.73
ST.DEV = 0.94

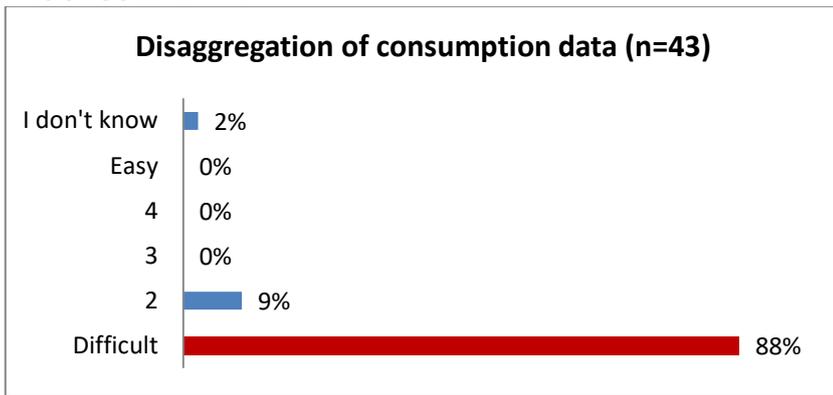
Type of electrical appliances equipment provided (n=45)



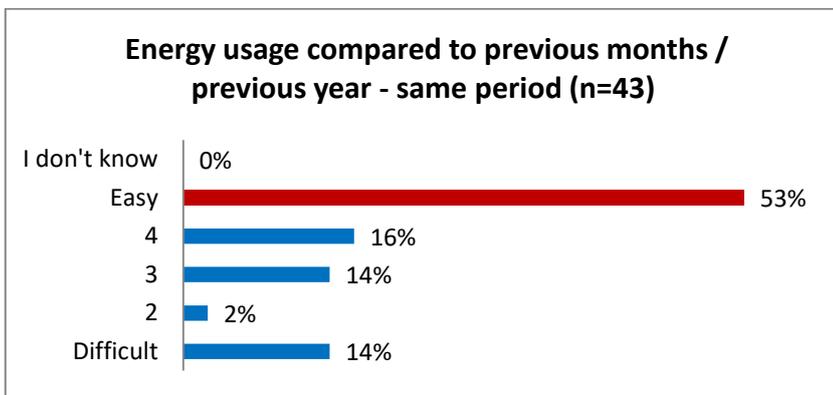
MEAN = 1.20
ST.DEV = 0.50

Q3.2 Please, evaluate feasibility of estimating the following **PROCESSED DATA** for residential households in your supply area (1 = low; 5 = high)

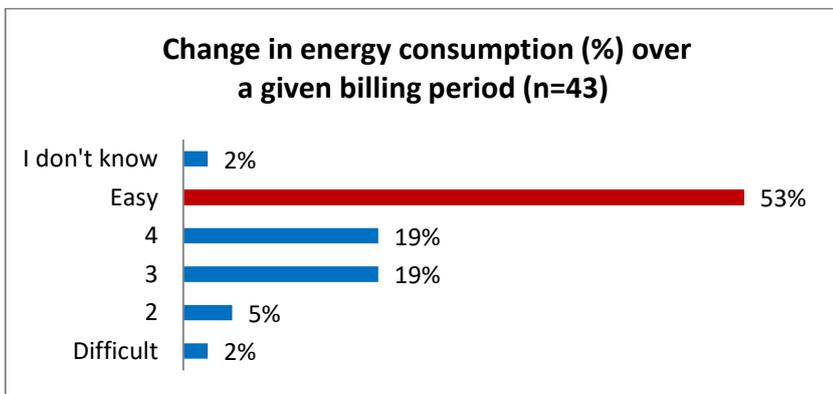
PROCESSED DATA



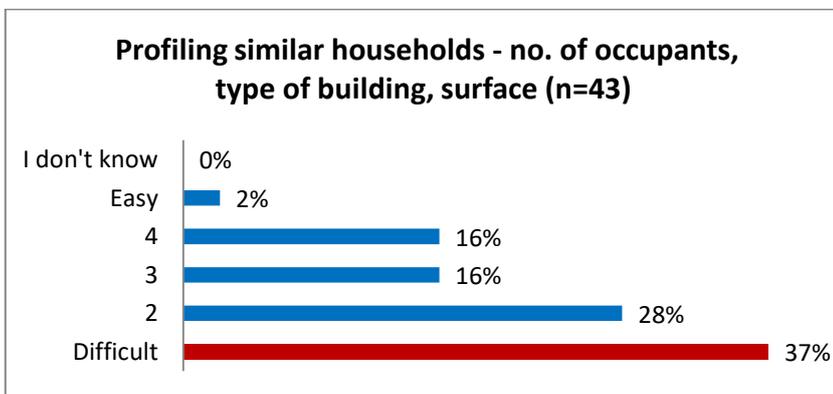
MEAN = 1.10
ST.DEV = 0.30



MEAN = 3.93
ST.DEV = 1.44



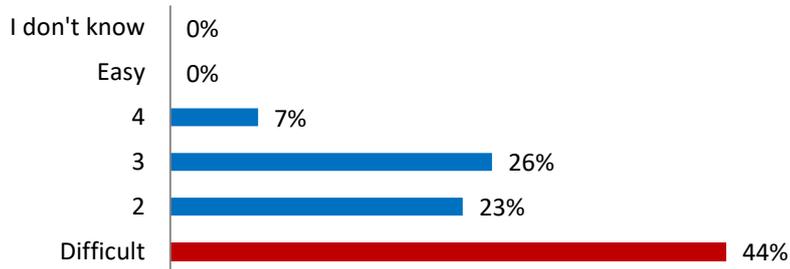
MEAN = 4.19
ST.DEV = 1.06



MEAN = 2.19
ST.DEV = 1.18

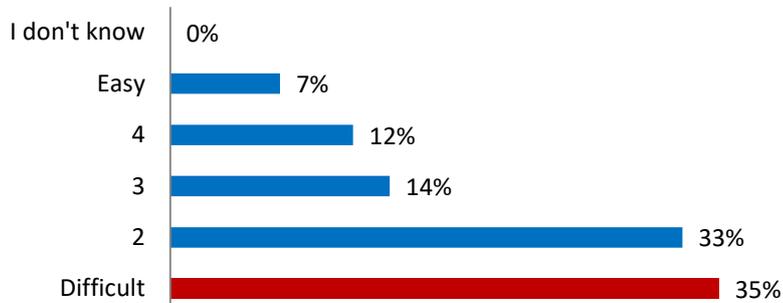
Profiling of households based on level of consumption of similar households - A -G energy label classes, average/efficient/intensive household etc. (n=43)

MEAN = 1.95
ST.DEV = 1.00



Correlation between energy consumption and temperature/weather conditions over billing period (n=43)

MEAN = 2.23
ST.DEV = 1.25

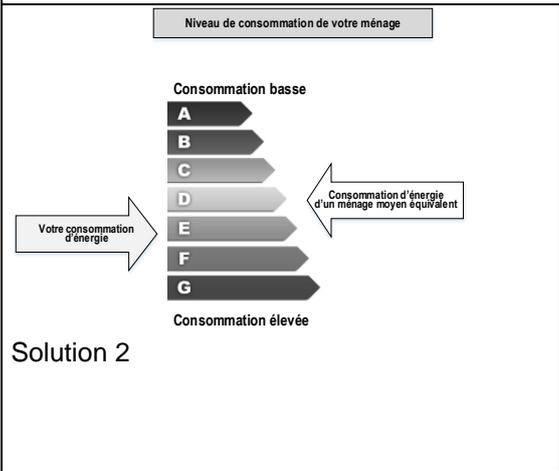
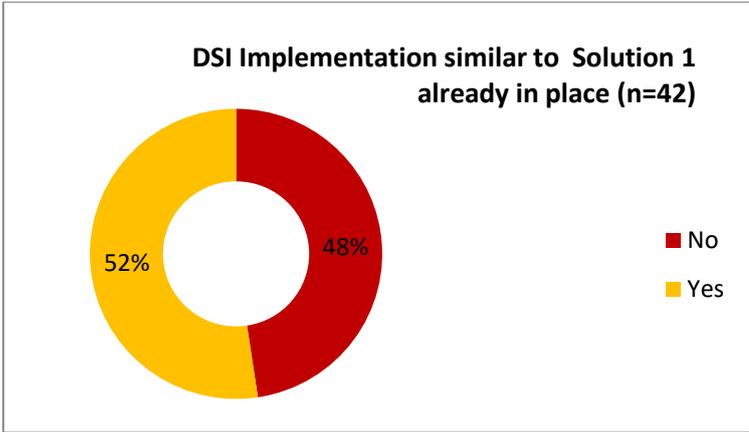


C) GENERAL ASSESSMENT OF IMPROVE SOLUTIONS

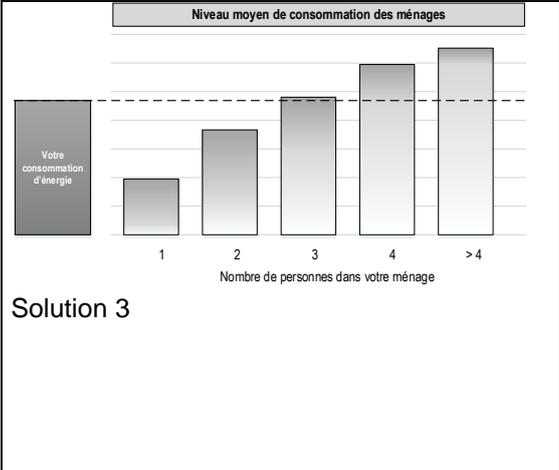
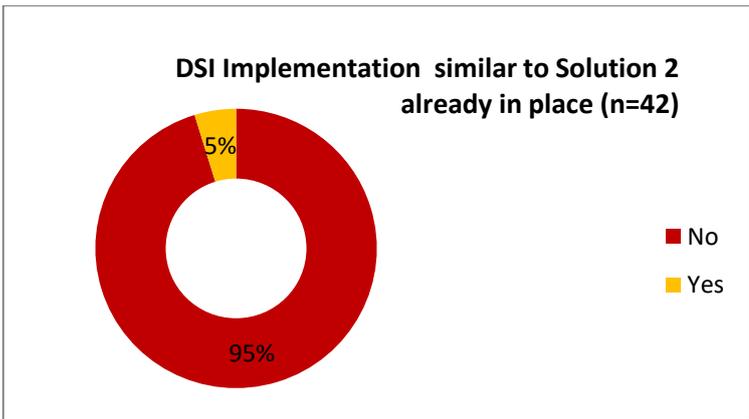
Q4.1 – Q4.6 Please, indicate whether your utility is already implementing this kind of solution (Solution 1 – 6): Yes No

Energie consommée	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
Periode de facturation				
Energie	2800	0.10250	287.17	8.0
Consommation énergétique d'un ménage moyen équivalent				
	2533			
Sous-total énergie (hors TVA)				
			287.17	
Distribution				
Periode de facturation				
Energie	2800	0.06523	182.64	8.0
Abonnement		5.92000	65.99	8.0
Sous-total distribution (hors TVA)				
			248.64	
Réseau				
Periode de facturation				
Energie	2800	0.01400	39.20	8.0
Sous-total Réseau (hors TVA)				
			39.20	
Taxes publiques & émoluments				
Periode de facturation				
Taxes	2800	0.00800	16.80	8.0
Émoluments	2800	0.00700	19.60	8.0
Sous-total Taxes (hors TVA)				
			36.40	
Total (hors TVA)				
			611.41	

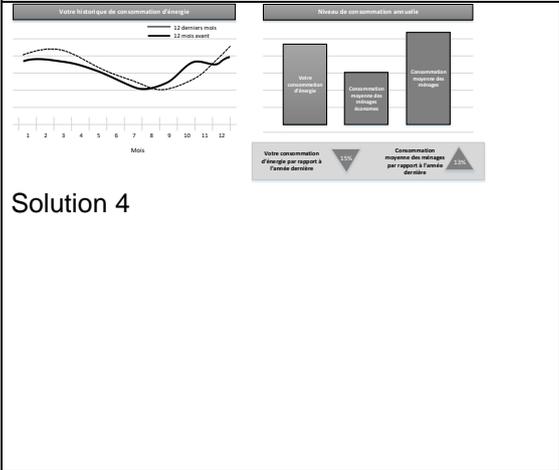
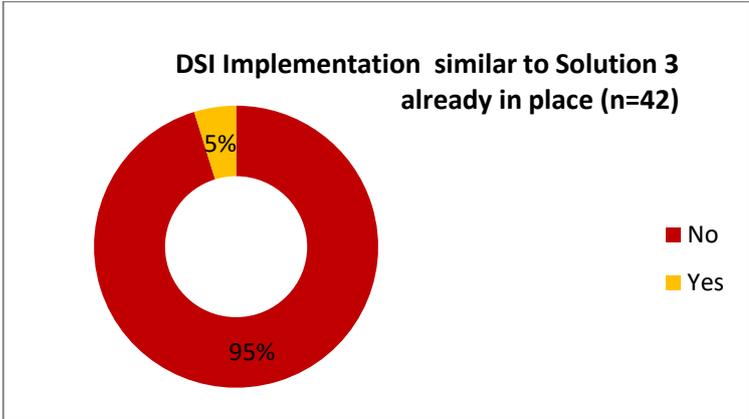
Solution 1



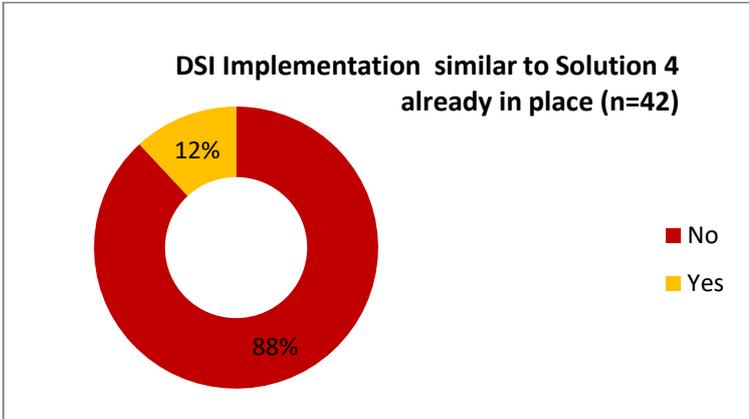
Solution 2

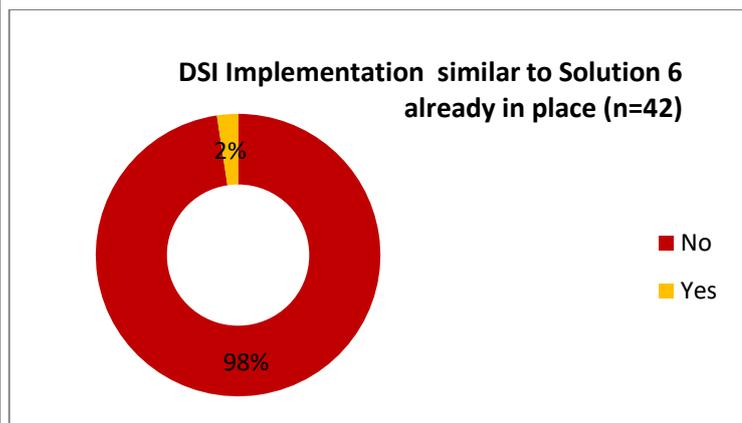
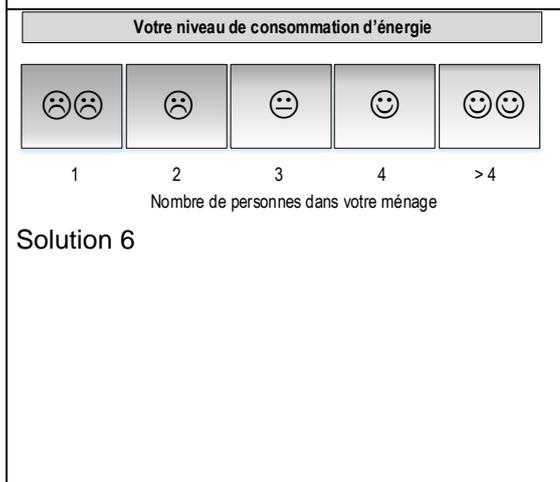
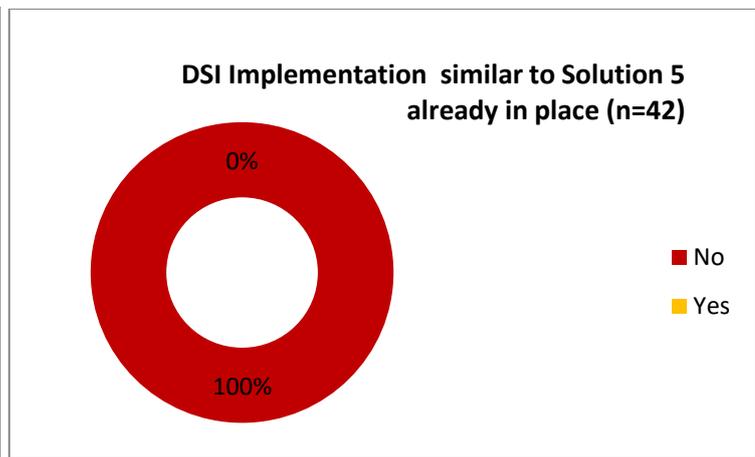
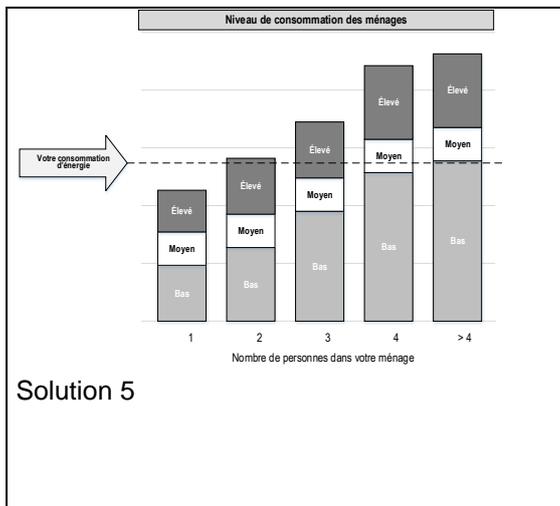


Solution 3



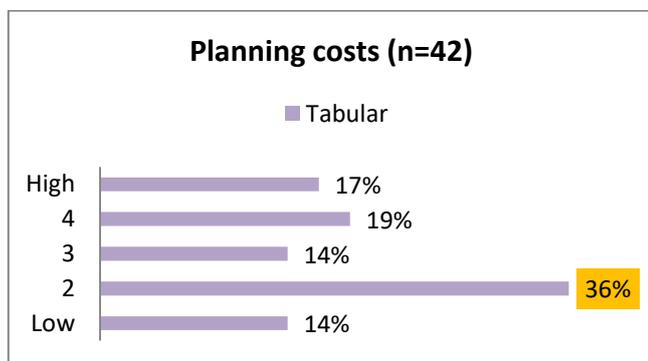
Solution 4



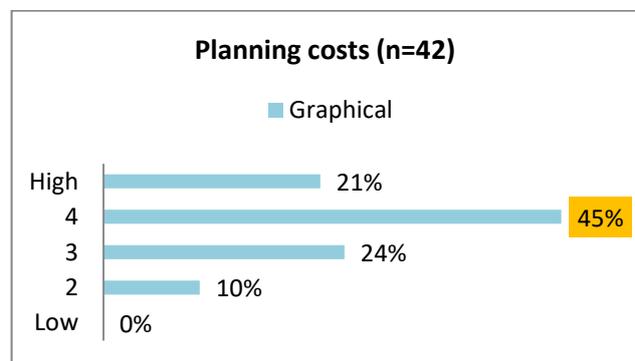


D) COST EVALUATION OF THE IMPROVE SOLUTIONS

Q5.1 Please, evaluate how possible additional planning costs (e.g. decision-making, organisational tasks, consultancy, etc.) arising for the implementation of the IMPROVE solutions would be judged by your energy utility (1 = low; 5 = high):

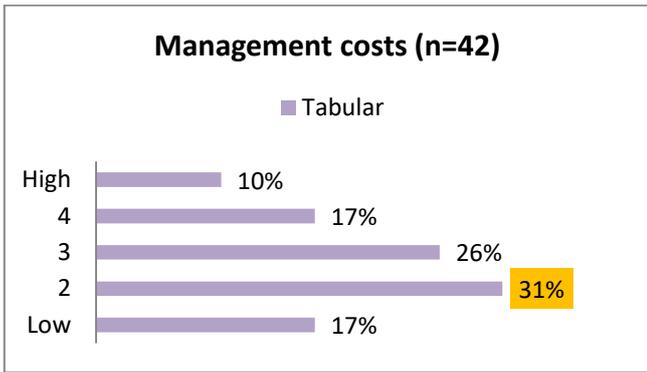


MEAN = 2.88
ST.DEV = 1.35

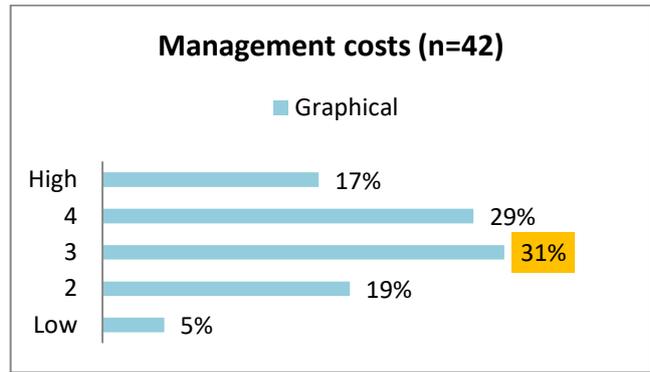


MEAN = 3.79
ST. DEV = 0.90

Q5.2 Please, evaluate how possible additional management costs (e.g. administration of new service, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

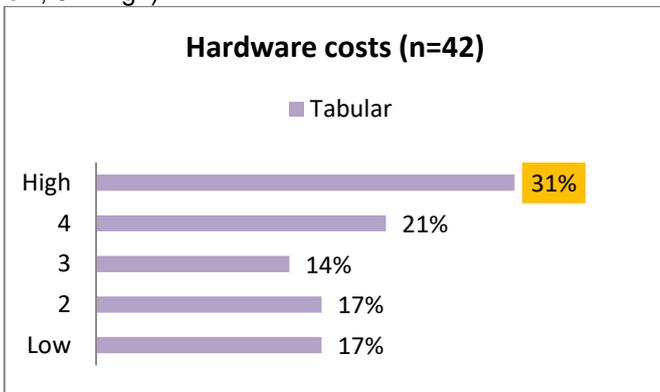


MEAN = 2.71
ST.DEV = 1.22

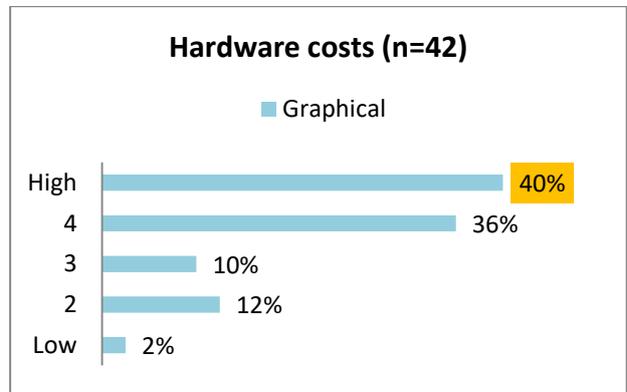


MEAN = 3.33
ST.DEV = 1.12

Q5.3 Please, evaluate whether possible additional hardware costs (e.g. smart meter equipment, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

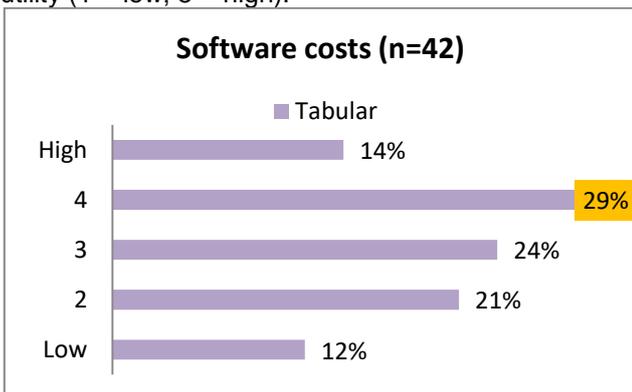


MEAN = 3.33
ST.DEV = 1.49

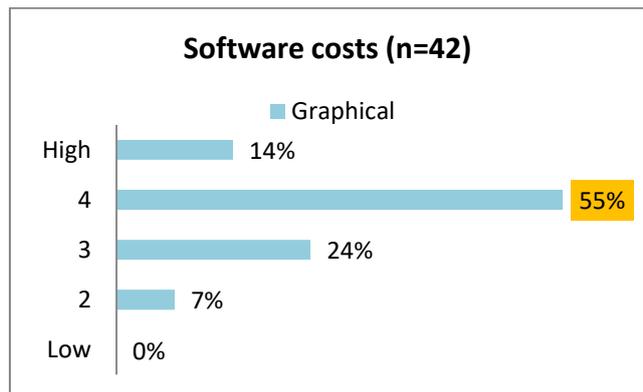


MEAN = 4.00
ST.DEV = 1.10

Q5.4 Please, evaluate the possible additional software costs (e.g. programme, data maintenance, upgrading) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility (1 = low; 5 = high):

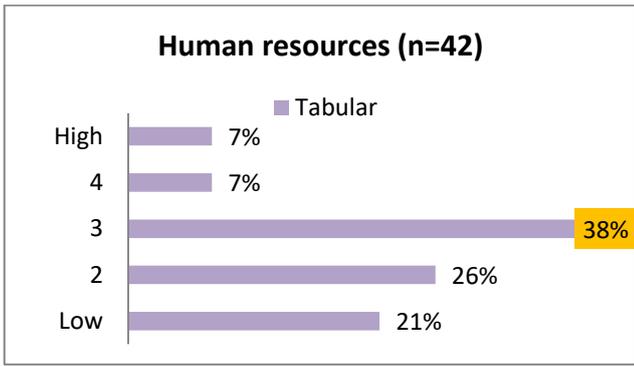


MEAN = 3.12
ST.DEV = 1.25

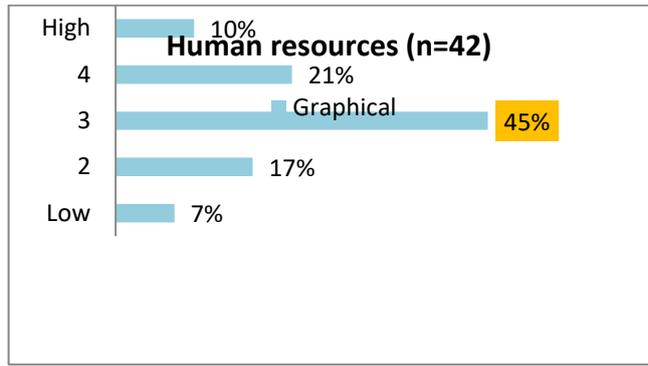


MEAN = 3.76
ST.DEV = 0.79

Q5.5 Please, evaluate the possible additional costs associated to human resources (e.g. training of the existing staff, hiring additional staff, etc.) arising for the implementation of the different solutions would be judged as low, medium or high by your energy utility(1 = low; 5 = high):



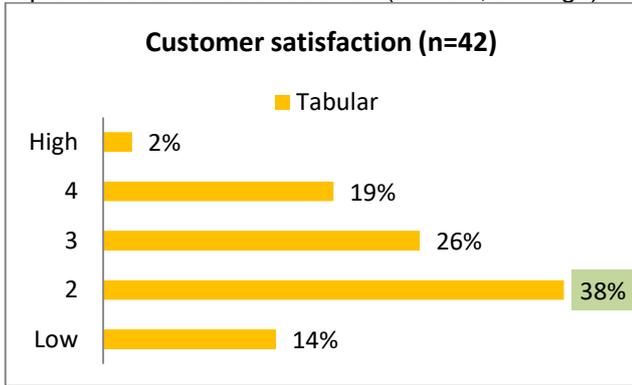
MEAN = 2.52
ST.DEV = 1.13



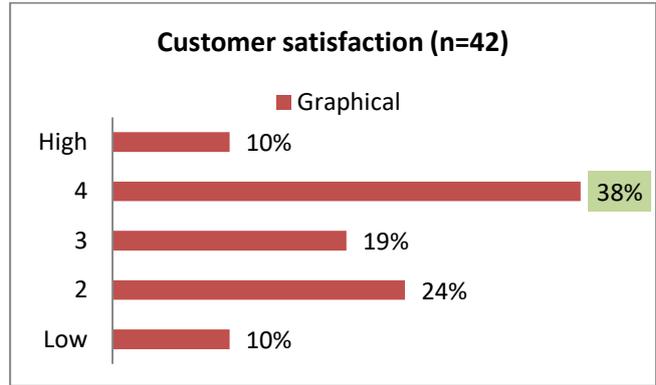
MEAN = 3.10
ST.DEV = 1.03

E) BENEFIT EVALUATION OF THE IMPROVE SOLUTIONS

Q6.1 Please, evaluate the possible benefits in terms of improved customer satisfaction, thanks to the implementation of each solution (1 = low; 5 = high):

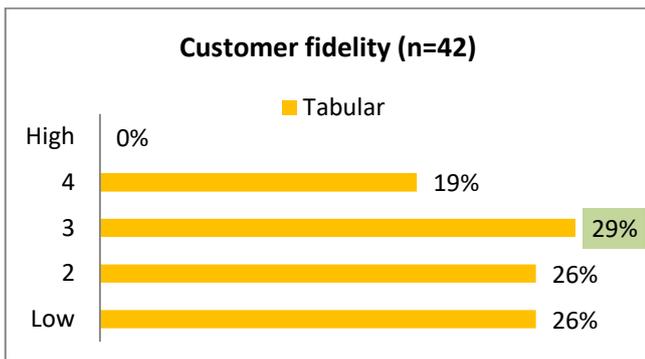


MEAN = 2.57
ST.DEV = 1.04

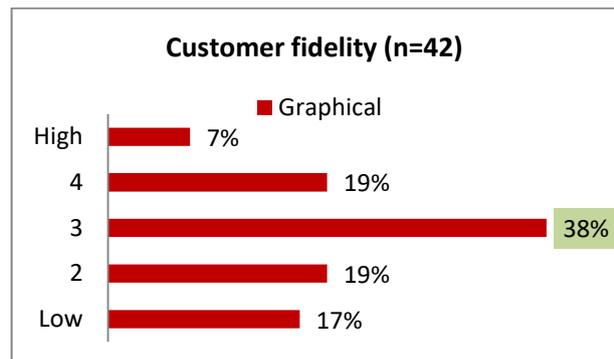


MEAN = 3.14
ST.DEV = 1.18

Q6.2 Please, evaluate the possible benefits in terms of improved customer fidelity arising thanks to the implementation of each solution (1 = low; 5 = high):

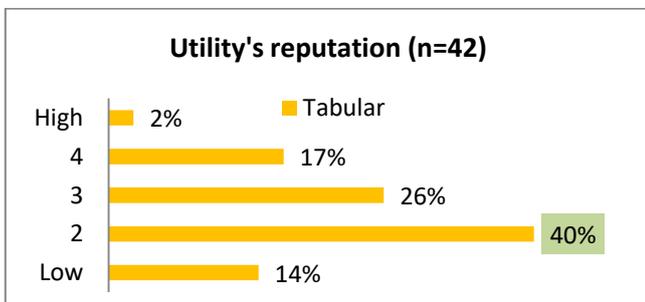


MEAN = 2.40
ST.DEV = 1.08

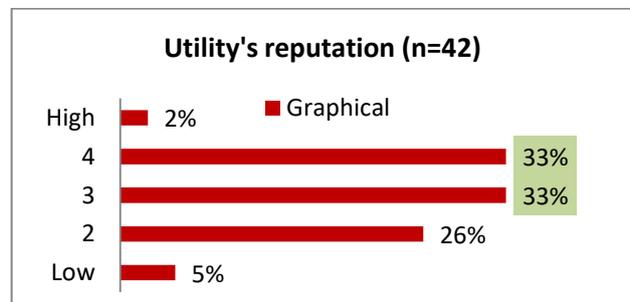


MEAN = 2.81
ST.DEV = 1.15

Q6.3 Please, evaluate the possible benefits in terms of utility's reputation arising thanks to the implementation of each solution (1 = low; 5 = high):



MEAN = 2.52
ST.DEV = 1.02



MEAN = 3.02
ST.DEV = 0.95

Q6.4 Would you like to add any comments related to the possible costs and benefits associated to any of the Improve solutions? Or about needs or constraints precluding their implementation?

Solution 1 – Comments

It is the standard solution used by all companies, with some difference or additional information (for us, for example, a graphical comparison of annual, quarterly or monthly consumption depending on the type of customer).

It could be fine, but it only reaches the customers who really care about it and understand the bill.

The parameters necessary for the reference classes must be defined

Possibility of integrating the customer's energy consumption with consumption levels of the previous year, for the same billing period. This is what we have in place at our company

Relatively simple to implement and to automate at acceptable costs.

This solution corresponds to our current status and informs the customer.

Today's stand. The peer comparison of consumption behavior is neutral and does not include a rating of the customer. Difficulty: What is a comparable customer (e.g. space heating with heat pump, electricity, district heating)

How do you obtain the comparative figures and how do you manage data updating?

Easy to implement, but rather customer-unfriendly. Interpretation is not easy.

Legal requirement

Too complex

What does the section "Distribution" mean?

The main problem is to find a suitable reference household. Difficult to read.

Solution 2 – Comments

Very used and known but I am rather skeptical about its communicative effectiveness.

"Fashion" solution but not reasonable for the energy consumption of an individual. No relationship with the categories of electrical appliances (given that it depends mainly on the frequency of use of the same) which inevitably leads to confusion. To avoid.

The parameters necessary for the reference classes must be defined

System too similar and therefore potentially inconsistent with the energy label / CEBS system. The information available in regards to households (potentially changing with each relocation/transfer) is too limited to establish such information with relevance.

This approach is too simple; insufficient information

Comments in regards to Solutions 2-6:

1. These solutions require a great deal of basic data, which must be constantly updated.
2. I am convinced that only a small proportion of energy customers will investigate the actual relationship (smart meter with interface).
3. The graphical representations will confuse or unsettle some customers.
4. There is no incentive to save energy.
5. The saving leverage should perhaps be applied to the sale or production of more and more electrical and electronic equipment. But since this represents a profitable industry, this is never taken into consideration.
6. Energy-savings and sustainable, decentralized energy production are being discussed. In this context, the consequences for existing or new energy networks in terms of size, voltage, frequency fluctuations, harmonic waves etc. must be urgently included.

Clear solution for customers. Labels are accepted. Difficulty of definition from A to G.

How do you obtain the comparative figures and how do you manage data updating?

"Energy label" is known, rather understandable, information at a glance, without having to read a text.
Problem: allocation is unknown.

Hackneyed

For all comparisons -> Basics for benchmark are missing!

Not meaningful

The main problem is to find a suitable household for reference. Representation is clear.

Solution 3 – Comments

Not very interesting, the customer may want to compare consumption with peers, however, the other codifications are of little interest.
Good solution neutral and not offensive to the customer. Technically relatively easy to achieve.
Need to know if the consumption presented / compared does or does not include the consumption of heating and that of domestic hot water.
Good approach that allows a reading of one's own consumption without judgment.
Simple solution. Data base, number of persons in the household, which is not always known, and data updating has to be questioned, since there is no obligation to register.
How do you obtain the comparative figures and how do you manage the data updating?
Simple illustration. Allocation simply solved.
What is an average household? Customer cannot make out anything with this representation. The profiles are very different.
We cannot estimate the number of people and there are no statistics which we can officially access -> Privacy!
Cross-comparisons of households are questionable, not meaningful and always in need of interpretation. Customer behavior and the relevant equipment used are too different.
The main problem is to find a suitable reference household. The problem is somewhat diminished through the given representation.

Solution 4 – Comments

Interesting, graphs are the best to stimulate attention.
This Solution is too complicated to achieve at the moment. Only with smart meter roll-out will it be possible to provide meaningful monthly consumption to the customer.
Need to know if the consumption presented / compared does or does not include the consumption of heating and that of domestic hot water. Possibility of obtaining this information by analysis of the load curve, but heavy infrastructure to set up for this.
Very technical and rich in information. Possibly too complex for private customers. Also complicated for the energy suppliers to set the data according to the average profiles.
Only accessible via smart meter solution (since monthly reading is required)
How do you obtain the comparative figures and how do you manage data updating?

Very big effort, requires smart meters, implementation possible only after smart meter roll-out
Rather feasible solution
If the smart meters are rolled-out nationwide, then such evaluations can be made, otherwise the reporting is annual.
Comparison of one's own consumption in the previous year is the most reasonable solution. Efforts to reduce energy consumption are easily observed.

Solution 5 – Comments
Not meaningful nor explanatory
This Solution is easily understood by the customer, more accurate than Solution 3 and less irritating than Solution 6.
Good solution easy to understand, graphical and accessible. Draws more attention to one's one consumption, without real judgment.
The definition of the different ratings is difficult because electricity consumption differs according to different applications per household (electric heating, heat pump, district heating)
How do you obtain the comparative figures and how do you manage the data updating?
Although we do not provide it on our energy bill, we offer it in our customer portal on an annual basis
Same as Solution 3, but more detailed.
Differentiated, but like Solution 3
Same comment as for Solution 3: Cross-comparisons of households are questionable, not meaningful and always in need of interpretation. Customer behavior and the relevant equipment used are too different.
The main problem is to find a suitable reference household. The additional subdivision of the bars brings low added value.



Solution 6 – Comments

Simple solution, always appreciated.

To avoid. The icons implicitly contain a judgment on customer consumption (good / bad) that would be negatively interpreted by most people.

Necessary analysis

Not meaningful.

Contains a judgement from sides of the energy utility. We should not rate the customers. So solutions 1 - 5 are better.

How do you obtain the comparative figures and how do you manage data updating?

too little "exact" / not meaningful

Not possible.

Not effective

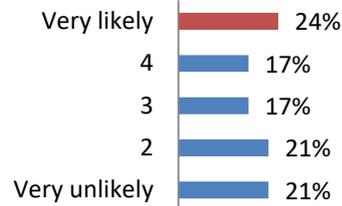
Different rating levels are merged. Is it the number of people or the energy consumption that is being assessed?

F) FINAL EVALUATION

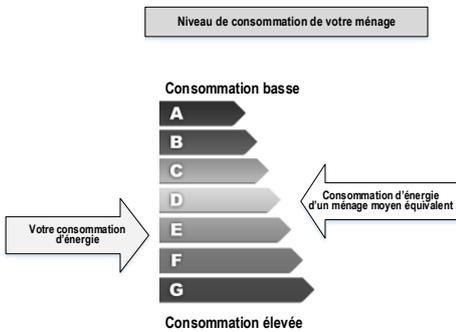
Q7.1 On the basis of your above evaluation, how would you assess the **LIKELIHOOD** that **YOUR UTILITY COMPANY WILL IMPLEMENT** the Improve solutions in the paper energy bill format (1 = unlikely; 5 = very likely)?

Energie consommée	Quantité	Prix unitaire CHF	Montant CHF (hors TVA)	% TVA
Periode de facturation				
Energie	2800	0.10256	287.17	8.0
Consommation énergétique d'un ménage moyen équivalent	2530			
Sous-total énergie (hors TVA)			287.17	
Distribution				
Periode de facturation				
Energie	2800	0.06523	182.64	8.0
Abonnement		5.50000	66.00	8.0
Sous-total distribution (hors TVA)			248.64	
Réseau				
Periode de facturation				
Energie	2800	0.01400	39.20	8.0
Sous-total Réseau (hors TVA)			39.20	
Taxes publiques & émoluments				
Periode de facturation				
Taxes	2800	0.00600	16.80	8.0
Émoluments	2800	0.00700	19.60	8.0
Sous-total Taxes (hors TVA)			36.40	
Total (hors TVA)			611.41	

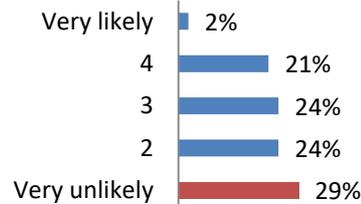
Solution 1



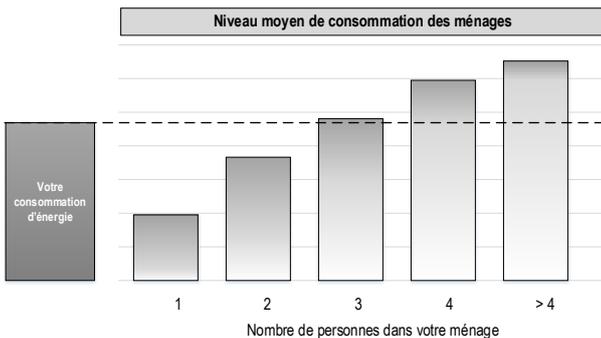
MEAN = 3.00
ST.DEV = 1.50



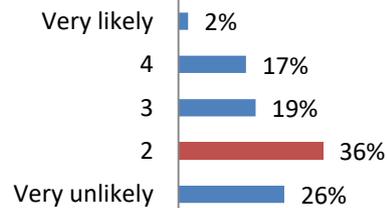
Solution 2



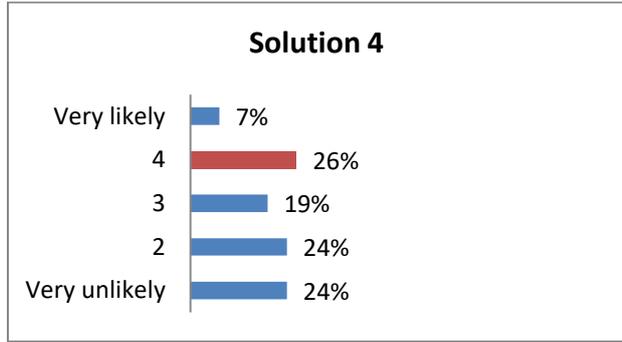
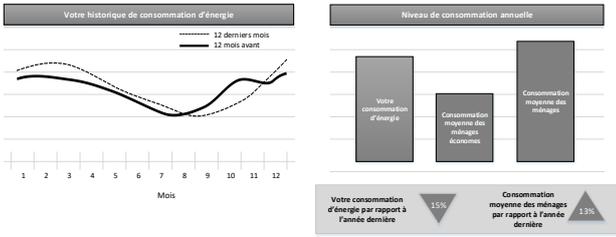
MEAN = 2.45
ST.DEV = 1.19



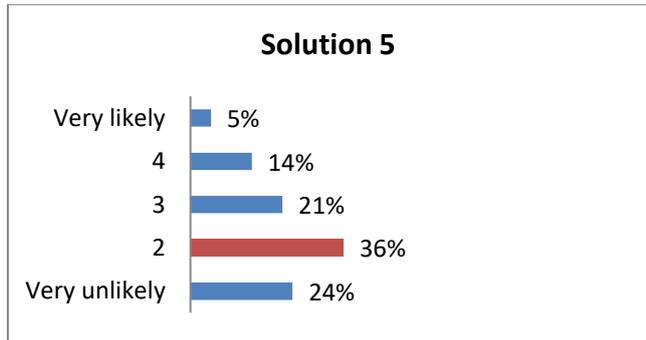
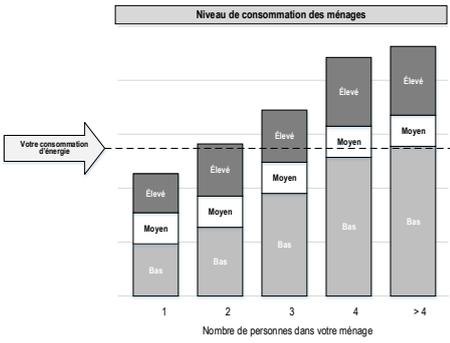
Solution 3



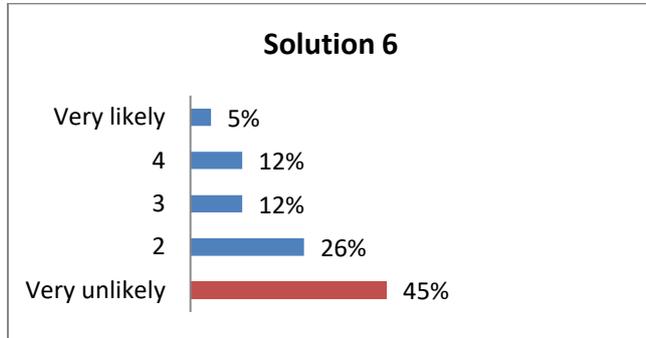
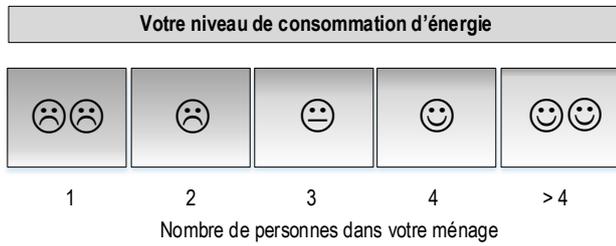
MEAN = 2.33
ST.DEV = 1.12



MEAN = 2.69
ST.DEV = 1.30

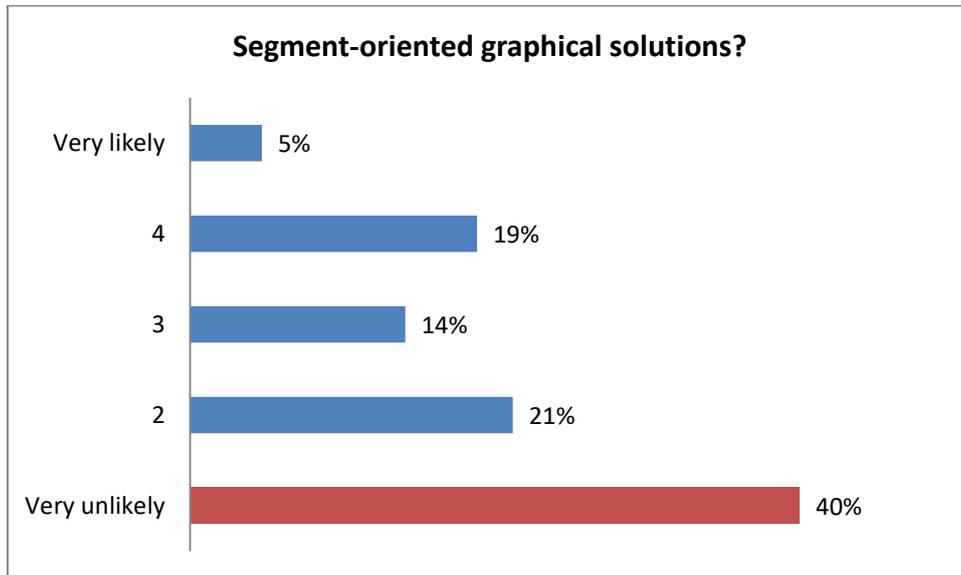


MEAN = 2.40
ST.DEV = 1.15



MEAN = 2.05
ST.DEV = 1.23

Q7.2 Depending on the customers' socio-demographic and educational background, needs and expectations in regards to energy billing information may differ. What is the current LIKELIHOOD of your utility to provide different graphical billing solutions depending on the customer segment that is being addressed (1 = low; 5 = high)?



MEAN = 2.26
ST.DEV = 1.31

Q.7.3 - Q.7.4 Description of other informative elements:

Description of other informative elements	Uploaded material
With a profile analysis every 15 minutes you can offer advice on the effectiveness of your equipment (heat pump sizing, boiler time ...)	
The integration of the comparison (in %) of the energy consumed by the customer in relation to the preceding year, for the same period, in the form of a summarizing table at the end of the bill.	
Evolution of consumption over similar periods: last 3 years; or same period of last 3 years (for bi-monthly surveys)	
In the context of a feed-in remuneration, the display of the detail of the differentiated consumption: roof / grid	
Starting 1.1.2019, the current billing system will be replaced by a new one based on IS-E/Abacus. In addition, data from the building and housing archive (GWR) will also be imported.	