Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of the Environment, Transport, Energy and Communications DETEC

Swiss Federal Office of Energy SFOE
Energy Research and Cleantech

SWEET Call 1-2020: EDGE

Deliverable report

Deliverable n°	D1.7
Deliverable name	Publication on policy acceptance in the Swiss urban areas: **Policy acceptance in the Swiss urban areas – Findings from the EDGE survey**
Authors The authors bear the entire responsibility for the content of this report and for the conclusions drawn therefrom.	Isabelle Stadelmann-Steffen, University of Bern Gracia Brückmann, University of Bern Sophie Ruprecht, University of Bern
Delivery date	9.2024

sweet swiss energy research for the energy transition

Table of contents

Summary

This report presents results on regional patterns of policy acceptance with a special focus on urban regions. The urban region forms one of the three "EDGE regions", which comprises the urban areas in the three geographical zones of the Alps, Midlands and Jura. The urban region differs from the three EDGE regions at a techno-economic level primarily in that it is a net importer of energy from the other two regions, both now and in the foreseeable future. At the socio-political level, the cities have a larger proportion of the population with left-green attitudes, which are expressed, for example, in greater concern about climate change, but also in a more pronounced openness towards Europe.

The regional analyses within the framework of Sweet EDGE are based on two key assumptions, which were already set out in Deliverable Report 2.2 with a focus on the Midlands, but are also relevant for the present report. The first assumption is that political measures are necessary to achieve the energy policy targets, in particular the net-zero target. These can be, for example, subsidies to accelerate the expansion of renewable energies, but also regulatory measures such as rules and bans. Secondly, however, such measures can only be implemented if they find at least a certain level of acceptance among the population. In many cases in Switzerland, this means that the majority of the population must approve these measures at the ballot. The recent past has shown that the outcome of such referendums is open and it is therefore important to better understand the preferences of the population with regard to such measures.

In a first part, this report examines the same *general policy principles* and their acceptance as Deliverable Report 2.2, this time focusing on urban regions. Specifically, the importance of energy independence, the acceptance of cooperation with the EU, the compensation of CO2 emissions abroad, but also the preferences of the population with regard to the future energy mix are examined. In a second part, two *specific measures* are examined more thoroughly. Firstly, the acceptance of CO2 offsetting abroad, which receives little attention in the current scientific and public debate, is analysed in detail. Secondly, citizens-financed PV projects are conceptualized as an instrument to actively involve the urban population in particular in renewable electricity production. The EDGE Survey, a representative, regionally stratified population survey designed and conducted as part of Sweet EDGE, again serves as the data basis.

The main result of the analyses is that the urban population shows a specific pattern in some aspects of acceptance of renewable energy policies. For example, respondents in Swiss cities are slightly less concerned about energy independence, while they are significantly more in favour of European cooperation to secure electricity demand, solar installations in the Alps or wind turbines. However, it must be emphasized that these differences are by no means large, but that one can rather speak of an urban tendency. In addition, two further differentiations are important. Firstly, the analyses on CO2 compensation abroad indicate that "the urban pattern" is probably primarily the result of the ideological composition, i.e. more people with left-green attitudes live in the cities, and is less attributable to the region as such. Secondly, the analyses on citizens-financed PV projects also confirm the particularly high level of general support for renewable energy (i.e., high socio-political acceptance) in urban areas. However, this does not go hand in hand with an equally high intention to invest in such projects.

Based on the empirical results, the report identifies a need for action and policy recommendations in three areas: the exploitation of urban potential, a public debate of CO2 compensation abroad and the de-politicization of the urban-rural divide.

Zusammenfassung

Der vorliegende Bericht präsentiert Ergebnisse zu regionalen Mustern der Policy-Akzeptanz mit besonderem Fokus auf urbane Regionen. Die urbane Region bildet eine der drei "EDGE-Regionen", die als dritte geographische Einheit neben dem Alpenraum und dem Mittelland die urbanen Gebiete in den drei geographischen Räumen Alpen, Mittelland und Jura umfasst. Die urbane Region unterscheidet sich von den drei EDGE-Regionen auf techno-ökonomischer Ebene vor allem dadurch, dass sie heute und in Zukunft Nettoimporteurin von Energie aus den beiden anderen Regionen ist. Auf sozio-politischer Ebene findet sich in den Städten gleichzeitig ein grösserer Bevölkerungsanteil mit links-grünen Einstellungen, die sich etwa in einer grösseren Besorgnis über den Klimawandel, andererseits aber auch in einer ausgeprägteren Offenheit gegenüber Europa äussern.

Die regionalen Analysen im Rahmen von Sweet EDGE basieren auf zwei wesentlichen Annahmen, die bereits im Bericht 2.2 mit Fokus auf das Mittelland dargelegt wurden, aber auch für die vorliegenden Ausführungen relevant sind. Die erste Annahme geht davon aus, dass zur Erreichung der energiepolitischen Ziele, insbesondere des Netto-Null-Ziels, politische Massnahmen notwendig sind. Dies können z.B. Subventionen zur Beschleunigung des Ausbaus erneuerbarer Energien sein, aber auch regulative Massnahmen wie Verbote und Gebote. Zweitens sind solche Massnahmen aber nur durchsetzbar, wenn sie zumindest eine gewisse Akzeptanz in der Bevölkerung finden. Konkret bedeutet dies in der Schweiz in vielen Fällen, dass die Mehrheit der Bevölkerung diesen Massnahmen im Rahmen von Volksabstimmungen zustimmen muss. Die jüngste Vergangenheit hat gezeigt, dass der Ausgang solcher Abstimmungen offen ist und es deshalb wichtig ist, die Präferenzen der Bevölkerung bezüglich solcher Massnahmen besser zu verstehen.

In einem ersten Teil beleuchtet dieser Bericht die gleichen *allgemeinen Policy-Leitlinien* und deren Akzeptanz wie der Bericht 2.2, wobei diesmal die städtischen Regionen im Mittelpunkt stehen. Konkret werden die Bedeutung der Energieunabhängigkeit, die Akzeptanz der Zusammenarbeit mit der EU, die Kompensation der CO2-Emissionen im Ausland, aber auch die Präferenzen der Bevölkerung bezüglich des zukünftigen Energiemixes beleuchtet. In einem zweiten Teil werden zwei *konkrete Massnahmen* näher untersucht. Zum einen wird die Akzeptanz von CO2-Kompensationen im Ausland detailliert analysiert, die in der aktuellen wissenschaftlichen und öffentlichen Debatte wenig Beachtung finden. Zum anderen werden bevölkerungsfinanzierte PV-Projekte als Instrument konzipiert, um insbesondere die städtische Bevölkerung aktiv in die erneuerbare Stromproduktion einzubinden. Als Datengrundlage dient wiederum der EDGE Survey, eine repräsentative, regional geschichtete Bevölkerungsbefragung, die im Rahmen von Sweet EDGE konzipiert und durchgeführt wurde.

Das Hauptergebnis der Analyse ist, dass die städtische Bevölkerung bei einigen Aspekten der Akzeptanz von Politiken im Bereich der erneuerbaren Energien ein spezifisches Muster aufweist. So zeigen sich die Befragten in den Schweizer Städten etwas weniger besorgt über die Energieunabhängigkeit, während sie sich signifikant häufiger für eine europäische Zusammenarbeit zur Sicherung des Strombedarfs, für Solaranlagen in den Alpen oder für Windkraftanlagen aussprechen. Es muss jedoch sofort betont werden, dass diese Unterschiede keineswegs substanziell sind, sondern dass man eher von einer urbanen Tendenz sprechen kann. Darüber hinaus sind zwei weitere Differenzierungen wichtig. Erstens deuten die Analysen zur CO2-Kompensation im Ausland darauf hin, dass "das urbane Muster" wohl in erster Linie das Ergebnis der ideologischen Zusammensetzung ist, d.h. in den Städten leben mehr Menschen mit links-grüner Einstellung, und weniger auf die Region als solche zurückzuführen ist. Zweitens bestätigen auch die Untersuchungen zu den von der Bevölkerung co-finanzierten PV-Projekten die hohe allgemeine Unterstützung für erneuerbare Energie (d.h. eine hohe sozio-politische Akzeptanz). Dies geht jedoch nicht mit einer ebenso hohen Investitionsabsicht in solche Projekte einher.

Auf Basis der empirischen Ergebnisse identifiziert der Bericht Handlungsbedarf bzw. Handlungsempfehlungen in drei Bereichen: die Ausschöpfung der urbanen Potenziale, eine öffentliche Diskussion der CO2-Kompensation im Ausland und die Entpolitisierung des Stadt-Land-Grabens.

Résumé

Le rapport présente des résultats sur la fragmentation régionale d'acceptation des politiques, avec un accent particulier sur les régions urbaines. La région urbaine constitue l'une des trois "régions EDGE" qui, en tant que troisième unité géographique à côté de l'espace alpin et du Plateau, comprend les zones urbaines dans les trois espaces géographiques des Alpes, du Plateau et du Jura. Au niveau technico-économique, la région urbaine se distingue principalement des trois régions EDGE par le fait qu'elle est aujourd'hui et sera à l'avenir importatrice nette d'énergie en provenance des deux autres régions. Sur le plan socio-politique, on trouve dans les villes une plus grande part de la population avec des attitudes gauche-verte, qui s'expriment par exemple par une plus grande préoccupation pour le changement climatique, mais aussi par une ouverture plus marquée envers l'Europe.

Les analyses régionales effectuées dans le cadre de Sweet EDGE se basent sur deux hypothèses principales, qui ont déjà été présentées dans le rapport 2.2 en se concentrant sur le Plateau suisse, mais qui sont également pertinentes pour les présentes discussions. La première hypothèse part du principe que des mesures politiques sont nécessaires pour atteindre les objectifs de la politique énergétique, notamment l'objectif net zéro. Il peut s'agir par exemple de subventions pour accélérer le développement des énergies renouvelables, mais aussi de mesures de régulation telles que des interdictions et des obligations. Deuxièmement, de telles mesures ne sont toutefois réalisables que si elles sont acceptées par une certaine partie de la population. Concrètement, en Suisse, cela signifie dans de nombreux cas que la majorité de la population doit approuver ces mesures dans le cadre de votations populaires. Le passé récent a montré que l'issue de ces votations est ouverte et qu'il est donc important de mieux comprendre les préférences de la population concernant ces mesures.

Dans une première partie, ce rapport met en lumière les mêmes *principes politiques généraux* et leur acceptation que le rapport 2.2, en se concentrant cette fois sur les régions urbaines. Concrètement, il met en lumière l'importance de l'indépendance énergétique, l'acceptation de la coopération avec l'UE, la compensation des émissions de CO2 à l'étranger, mais aussi les préférences de la population quant au futur mix énergétique. Dans une deuxième partie, deux *mesures concrètes* sont examinées de plus près. D'une part, l'acceptation des compensations de CO2 à l'étranger, qui ne reçoivent que peu d'attention dans le débat scientifique et public actuel, est analysée en détail. D'autre part, des projets PV financés par la population sont conçus comme un instrument permettant d'impliquer activement la population urbaine dans la production d'électricité renouvelable. La base de données utilisée est à nouveau l'EDGE Survey, une enquête représentative auprès de la population, stratifiée par région, qui a été conçue et réalisée dans le cadre de Sweet EDGE.

Le principal résultat de l'analyse est que la population urbaine présente un schéma spécifique pour certains aspects de l'acceptation des politiques en matière d'énergies renouvelables. Ainsi, les personnes interrogées dans les villes suisses se montrent un peu moins préoccupées par l'indépendance énergétique, alors qu'elles sont significativement plus nombreuses à se prononcer en faveur d'une coopération européenne pour garantir les besoins en électricité, d'installations solaires dans les Alpes ou d'éoliennes. Mais il faut tout de suite souligner que ces différences sont loin d'être substantielles et que l'on peut plutôt parler d'une tendance urbaine. En outre, deux autres différenciations sont importantes. Premièrement, les analyses sur la compensation du CO2 à l'étranger indiquent que le "modèle urbain" est en premier lieu le résultat de la composition idéologique, c'est-à-dire que plus de personnes avec une attitude gauche-verte vivent dans les villes, et qu'il est moins imputable à la région en tant que telle. Deuxièmement, les études sur les projets PV cofinancés par la population confirment également le soutien général élevé en faveur des énergies renouvelables (c'est-à-dire une acceptation socio-politique élevée). Toutefois, cela ne va pas de pair avec une intention d'investissement aussi élevée dans de tels projets.

Sur la base des résultats empiriques, le rapport identifie un besoin d'action ou des recommandations d'action dans trois domaines : l'exploitation des potentiels urbains, un débat public sur la compensation du CO2 à l'étranger et la dépolitisation du clivage ville-campagne.

Acknowledgment

The research published in this report was carried out with the support of the Swiss Federal Office of Energy SFOE as part of the SWEET consortium EDGE. The authors bear sole responsibility for the conclusions and the results presented in this report.

We thank Noel Strahm for great research assistance in the preparation of descriptive figures and Jonas Schmid as well as Céline Imobersteg for helpful comments on earlier versions of this report.

1 Introduction

This Deliverable Report focuses on policy acceptance in urban areas and is a follow-up and, thus, closely linked to Deliverable Report 2.2, which focused on the Swiss Midlands. In this vein, also the present support understands "policy acceptance" as a multidimensional concept, which needs to be considered to understand better why and under which conditions citizens accept or oppose certain measures. In this context, this report provides two main contributions.

First, we expand our previous analyses on the regional dimension of policy acceptance, this time focusing on the preferences of the urban population. In Deliverable Report 2.2, we found evidence for the thesis that policy acceptance in Switzerland has a strong national flavour, in accordance with political and direct-democratic debates of the last decade, which has led to a nationalization of the discourse. However, as the focus was on the Swiss Midlands, it still remains an open question as to whether the urban centres exhibit specific and different preferences with respect to policy acceptance. In the first part of the present report, we therefore analyse the *policy principles* that underpin Swiss energy policy and serve as a guide for more concrete policy decisions from an urban perspective.

Second, we then proceed with two specific policy instruments that, theoretically, can be expected to be of particular relevance for the urban population or where the urban population might have a different view. On the one hand, the urban population is usually characterised by higher climate concern, a strong predictor for climate policy support, and this urban support for climate policy was exemplified by the 2021 referendum on the CO2 act (Montfort, 2023). Relatedly, urban dwellers might also be more interested in compensating emissions abroad, to meet Switzerland's Nationally Determined Contributions (NDCs), compared to their midlands and alpine dwelling counterparts. On the other hand, we investigate citizen-financed (CiFi) PV projects (Sierro & Blumer, 2024) as an instrument that might particularly speak to urban residents due to their lower likelihood to own their own roof-top on which they could install PV.

The data presented in the following has been collected within a large-scale survey conducted in Switzerland from August 26 to October 31, 2022. An invitation to the survey was sent out to a random sample of the Swiss resident population, stratified by nine geographical areas, as depicted in Figure 1. Overall, 4'948 respondents completed the survey, which corresponds to a response rate of 36.6%. 2'279 respondents live in urban areas as defined for the present analyses. The sample fits population metrics with respect to gender, age and education quite well, while higher-income individuals (as it is often the case in surveys) are somewhat overrepresented. Regional differences are presented graphically, whereas OLS and logistic regressions have been used (and are presented in the Appendix) to test whether observed differences are statistically significant. In these regression models, we controlled for household income, educational level, age, gender, whether an individual owns a house or flat as well as self-placement on the political left-right scale to account for potential regional composition effects. To analyse the experimental data on CiFi PV we rely on Average Marginal Component Effects (AMCE) and marginal means following standard practise (Hainmueller et al., 2014; Leeper et al., 2020).

This report is structured as follows. First, we present a characterization of the urban areas, namely how this region is defined in the EDGE project and how the composition of the urban population in the EDGE survey looks like. Second, we proceed with the analyses of general policy principles before delving deeper into the acceptance of two more specific instruments. The reports concludes with a summary of the main findings and policy recommendations.

2 Who are the urban areas?

2.1 Definition of EDGE regions

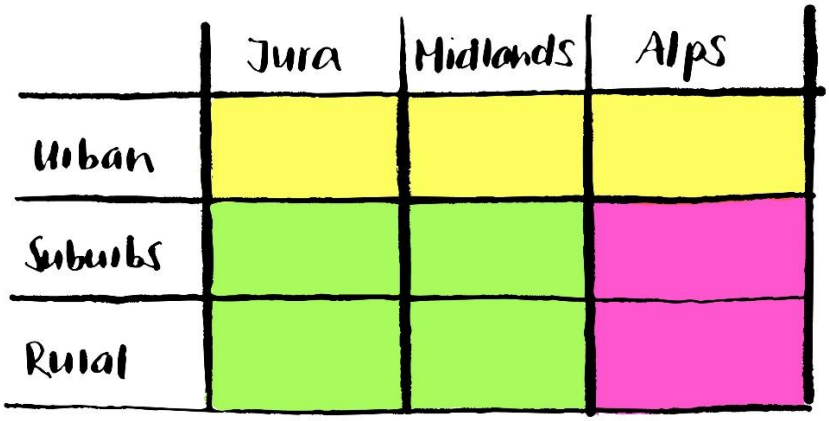
Within the EDGE consortium, three geographical regions have been defined based on two main geographical dimensions, namely the geographical zones[1] (Alps, Midlands, Jura) and the spatial typology

[1] https://www.eda.admin.ch/aboutswitzerland/de/home/umwelt/geografie/geografie---fakten-und-zahlen.html

of urban, peri-urban and rural areas.[2] As Figure 1 illustrates, the urban, as conceptualized in the Sweet EDGE consortium and for the present analyses, contain the urban areas across all geographic zones, i.e., situated in the Midlands, the Jura or the Alps. In the following, whenever we mention the urban areas, we always refer to this definition.

While an earlier report has concentrated on the (rural and peri-urban) Midlands, and a later one will look at the alpine areas, the present report focuses on the urban areas. It aims at identifying this region's peculiarities by distinguishing data from urban contexts from the rest of Switzerland. The subsequent subsections provide an overview of the existing knowledge and EDGE survey results regarding the techno-economic and socio-political characteristics of the urban region. While the former capture factors such as the technological potential and availability but also economic aspects of technologies, the latter includes the socio-economic and political composition of the population. The insights on the techno-economic and socio-political characteristics subsequently guide our expectations regarding policy acceptance and empirical analyses.

Figure 1: The EDGE regional typology



Note: Yellow = Urban; Pink = Alps, Green = Midlands

2.2 Socio-technical characteristics of the urban areas

From a techno-economic point of view, urban areas differ from the other two EDGE regions in several respects. Most notably, their (future) energy consumption is significantly higher (not least due to high industry demands) than their renewable energy production potential (Sasse & Trutnevyte, 2019), which distinguishes them from the Alpine region and the Midlands. This implies that urban areas depend on (renewable) energy production in other Swiss regions.

Moreover, urban areas are naturally characterized by their high density of people, buildings and infrastructure, which brings specific opportunities but also challenges. For example, the dense public transport infrastructure is reflected in a significantly higher proportion of respondents in the EDGE survey who do not own a car than in the rest of Switzerland (Table 1). On the other hand, in urban areas, replacing fossil fuel heating systems may be more challenging due to infrastructure constraints and greater reliance on gas-based district heating (for a similar argument see Glennerster & Jayachandran, 2023), particularly in older city centres (Chambers et al., 2019, p. 690). According to the EDGE survey, a significantly higher proportion of urban respondents indeed reported that the place where they live relies on gas or oil heating.

One of the most striking features of urban areas is the high proportion of tenants. While home ownership in Switzerland is generally low by international standards, this is particularly true in cities, where only a minority own the apartment or house in which they live (see Table 1). These structural conditions are

[2] https://www.bfs.admin.ch/bfs/de/home/statistiken/querschnittsthemen/raeumliche-analysen/raeumliche-gliederungen/raeumliche-typologien.html

likely to hinder the private adoption of solar PV and thermal collectors in these areas (Müller & Trutnevyte, 2020; Thormeyer et al., 2020).

2.3 Socio-political characteristics of the urban areas

Table 1 presents several socio-political factors relevant to the energy transition and to the EDGE consortium analyses and compares their distribution in the urban sample with that of the other respondents (i.e., from the Midlands and the Alps).

The significant test statistics show that the urban sample is significantly different from the other regions in all observed characteristics. In terms of socioeconomic factors, urban respondents are more likely to have tertiary education and higher income levels.

In addition, the share of individuals who place themselves on the left side of the political spectrum[3] is significantly larger, while fewer hold right-wing political views. Interestingly, in urban areas we also observe a larger proportion of individuals who do not place themselves on the left-right scale. These patterns are reflected in individual party affiliations, with urbanites slightly preferring left-wing and green parties, while showing lower preferences for the Swiss People's Party and the Liberal Party. In addition, respondents in urban areas are more likely to trust science than their counterparts in the Midlands and the Alps.

2.4 Expectations about policy acceptance in the urban areas

The analyses conducted in this report are guided by two competing expectations. On one hand, the analyses in Deliverable Report 2.2 have provided evidence that the energy transition debate in Switzerland has a strong national dimension, despite the many regional differences that exist. Especially the repeated direct-democratic campaigns and decisions, most recently the clear acceptance of the Electricity Act in June 2024, have largely nationalized the energy transition debate. Moreover, the country's small size may prevent preferences to have a strong regional dimension, like, e.g., for energy infrastructure "away" from one's own region, because distances are small anyways.

On the other hand, however, the urban population may still be different because it differs from the other two Swiss regions more fundamentally. First, it can be assumed that the techno-economic and socio-political peculiarities of urban areas are associated with distinct policy preferences. In particular, urban areas depend on renewable energy production in other Swiss regions (Sasse & Trutnevyte, 2019). At the same time, large renewable infrastructure projects are typically not planned in urban areas, i.e., the "Not in my backyard" argument should play a (even) less important role. Moreover, the prevalent left-wing and green political norms (Kübler et al., 2013) are conducive to supporting renewable energy policy and projects. In combination, it can be expected that urban residents are particularly supportive of renewable energy policies and infrastructure projects. Against this background, we test in how far these urban peculiarities correlate with patterns of policy acceptance.

In accordance with Deliverable Report 2.2, we conceptualize policy acceptance in a broad way and account for the fact that social acceptance is a multifaceted phenomenon, strongly depending on the specific object of acceptance, the actors and their roles in the policymaking process (Dermont et al., 2017a). Therefore, we consider two main elements of socio-political acceptance (Wüstenhagen et al., 2007a)[4] that are relevant in different phases of the policymaking process (Dermont et al., 2017a):

The initial focus is on the overarching **policy principles** that inform the Swiss energy policy framework, which in turn provide guidance for more specific policy decisions. These pertain to the objectives of energy policy in general, such as the transition from fossil fuels to renewable energy sources. In addition, the policy principles encompass conditions that must be met in order to achieve the aforementioned goals, namely, the manner in which the goals should be attained. In Section 3, we examine various policy principles, including the significance of energy independence, the collaboration with the EU, the mitigation of CO2 emissions abroad, and the public's preferences regarding the future energy mix and

[3] The left-right scale ranges from 0 to 10 with low values indicating a left-wing orientation and high values describing a rightist political view.

[4] While some analyses include questions of project siting that could be interpreted to be closer to community acceptance, we do not study concrete projects and therefore consider these analyses to still capture socio-political acceptance – with a community acceptance nuance.

the role of the energy provider. These elements serve as crucial policy guidelines. The extent to which the public endorses these principles subsequently influences the acceptance of specific instruments.

Table 1: Socio-economic and political characteristics of the urban areas compared

	Urban areas		Other		Test
	N	Percent	N	Percent	
Education	1700		3028		X2=64.004***
... Secondary I	104	6%	155	5%	
... Secondary II	641	38%	1507	50%	
... Tertiary	955	56%	1366	45%	
Income	1720		3065		X2=21.218***
... under CHF 5'000	333	19%	582	19%	
... CHF 5'000 to CHF 7'000	361	21%	724	24%	
... CHF 7'000 to CHF 9'000	334	19%	635	21%	
... CHF 9'000 to CHF 13'000	379	22%	711	23%	
... over CHF 13'000	313	18%	413	13%	
Left-right placement	2279		3923		X2=34.277***
... Left	696	31%	1029	26%	
... Center	487	21%	896	23%	
... Right	553	24%	1180	30%	
... None	543	24%	818	21%	
Preferred political party	2279		3923		
... Green Liberal Party	205	9%	320	8%	X2=75.212***
... Green Party	192	8%	211	5%	
... Liberal Party	182	8%	406	10%	
... Social Democrats	196	9%	285	7%	
... Swiss People's Party	153	7%	425	11%	
... The Center	137	6%	291	7%	
... Other	436	19%	687	18%	
... None	286	13%	562	14%	
... NA	492	22%	736	19%	
Trust in Science	1770		3145		
Mean	7.5		7.1		
SD	2.2		2.2		F=31.361***
Housing conditions	1773		3165		
... Cooperative	48	3%	7	0%	
... Other	59	3%	155	5%	X2=315.907***
... Own flat	254	14%	366	12%	
... Own house	473	27%	1558	49%	
... Tenant	939	53%	1079	34%	
Heating of the house/apartment	2279		3923		
... (Some) Renewables	1225	54%	2522	64%	
... Oil or gas	1054	46%	1401	36%	X2=66.472***
Household has…	2093		3622		
... a car	1750	84%	3456	95%	
... no car	343	16%	166	5%	X2=226.389***

Second, in Sections 5 and 6 we delve deeper into the factors that explain social acceptance for **specific instruments** to accelerate the energy transition. The first are reducing Swiss GHG emissions abroad, by using internationally transferred mitigation outcomes (ITMOs) to meet Swiss NDCs, in accordance with Article 3 of the CO2 Act, and, therefore, speeding up global energy transition. Finally, in Section 6, we investigate the potential to make investments in solar PV attractive for tenants, namely through offering so called CiFi PV projects.

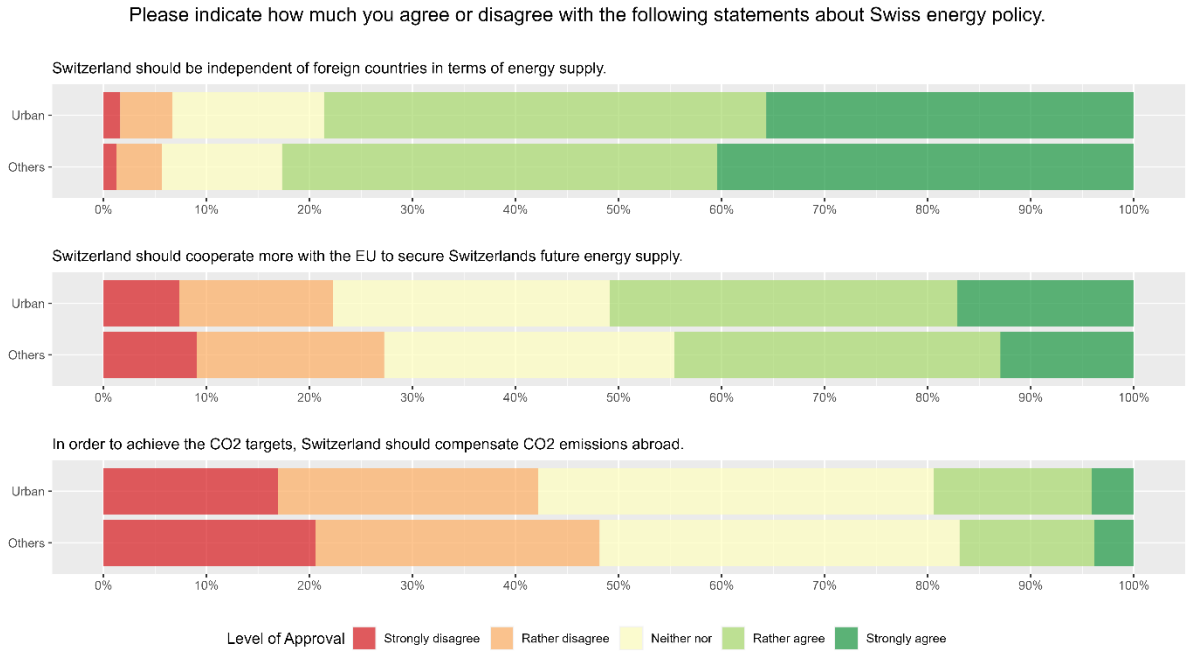
3 Energy policy preferences in the urban areas

3.1 General principles of Swiss energy policy

The most important political principle for the urban population is energy independence, with almost 80% of urban residents agreeing with the statement that Switzerland should be independent from other countries in terms of energy supply (see Figure 2). This level of agreement is slightly but significantly lower than in the Swiss Alps and the Midlands. One reason for this may be that urban respondents are also significantly more likely than the rest of the Swiss population to support greater cooperation with the EU to secure energy supplies. Overall, these patterns are consistent with the expectation that the stronger left-green preferences among urban citizens go hand in hand with a lower emphasis on Swiss independence and a greater openness to cooperation with the EU.

Finally, we also find significantly stronger agreement (or less disagreement) that Switzerland should compensate CO2 emissions abroad to meet its CO2 target. Across all regions, however, support for CO2 emission compensation abroad is (surprisingly[5]) low, with a large proportion of respondents being undecided on this question, which is why we examine this policy option in more detail in Section 4.

Figure 2: Preferences for Swiss energy policy



Note: The respective differences between the urban areas and the other Swiss regions are statistically significant (see Table 2 in the Appendix).

[5] The finding is surprising because according to the Swiss CO2 Act, Switzerland is allowed to compensate 25% of its CO2 emissions abroad. However, the finding is not surprising, with respect to the existing literature on preferences for local mitigation policies due to local co-benefits (Abildtrup et al., 2024; Buntaine & Prather, 2018; Gaikwad et al., 2024).

.

As shown in the Sweet EDGE Renewable Energy Outlook (Trutnevyte et al., 2024), hydropower and an increase in solar PV at the building level are the cornerstones of Switzerland's future electricity supply. However, other technologies - e.g. wind power, alpine PV, biomass - will be needed to reach the energy targets. In addition, nuclear power has returned to the political agenda, culminating in the Federal Council's decision to lift the ban on the construction of new nuclear power plants in August 2024. In this context, public preferences for different energy sources can be seen as an important element of policy principles, influencing the subsequent acceptance of specific policy instruments and mixes.

Figure 3: Preferences about the future Swiss energy mix

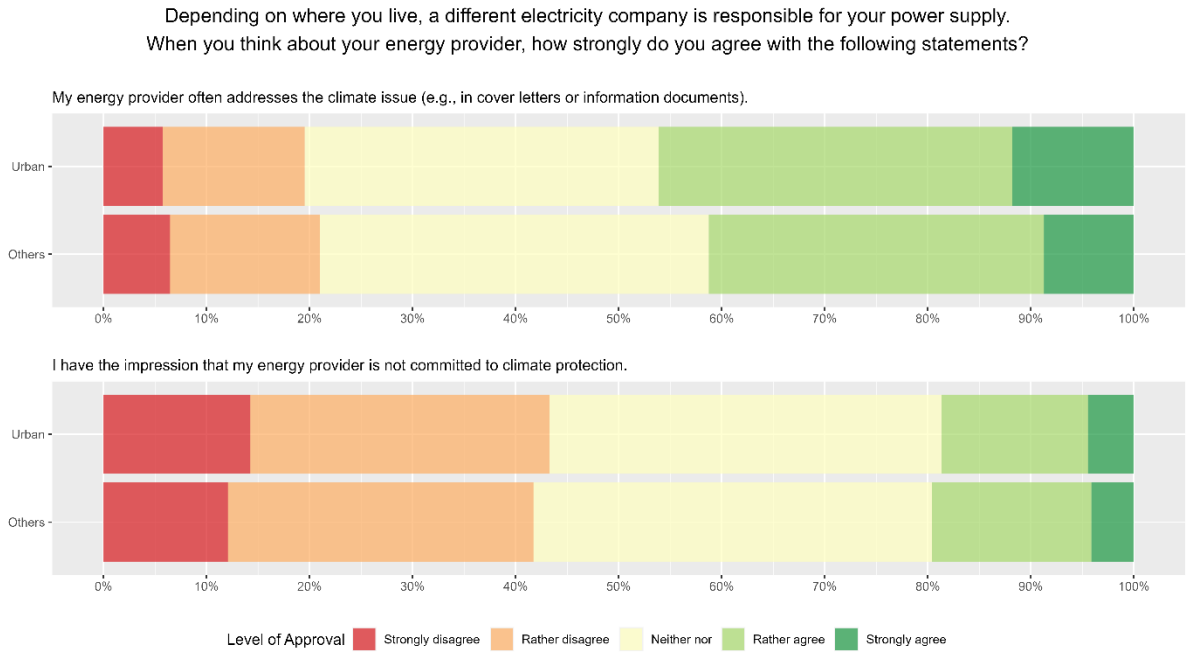
Note: The following differences between urban areas and the other Swiss areas are statistically significant: Wind turbines and open-space PV (the difference for gas turbines is significant with a p-value < 0.10) (see Table 3 in the Appendix).

Figure 3 shows that, not surprisingly, large hydro power and rooftop PV are clearly the most popular energy sources. On the other hand, electricity is disfavoured by almost 80% of respondents, followed by gas-fired power plants. The preference patterns for these most and least preferred energy sources do not differ significantly between urban dwellers and those in the other regions of Switzerland. Five other energy sources are somewhat in between, with a (relative) majority in favour of their inclusion in the future energy mix, but still a significant minority against these technologies, namely small hydro, open space PV, wind power, nuclear power and geothermal energy. There are two statistically significant differences between respondents from urban areas and others: Wind power and open-space PV are slightly more popular and, most importantly, less opposed in urban areas than in the Swiss Midlands and Alps.

As already documented in Deliverable Report 2.2, energy mix preferences are ideologically polarized. When focusing on urban areas (see Table 3 in the Appendix), the same ideological patterns can be observed as in the rest of Switzerland. Interestingly, however, they are even reinforced with regard to open-space PV and wind: Among urban residents, left-wing individuals are even more supportive of open-space PV, while right-wing individuals in urban areas are even more opposed to wind power than their counterparts in the Midlands and the Alps.

Energy providers play a crucial role in Swiss energy governance. While these providers tend to be privately organized companies, many of them are majority- or completely publicly owned. Additionally, they hold regional monopolies for supplying private households and can act as important multiplier to push the energy transition forward, e.g., through attractive feed-in tariffs or an active role in promoting renewable energy projects. Overall, as shown in Figure 4, the Swiss population is rather divided on how they perceive their energy provider with respect to their role and commitment for the energy transition. However, urban residents indicate more often than their counterparts in the other Swiss regions, that their energy provider addresses the climate issue. Interestingly, they do not perceive them to be more committed to engage in climate protection.

Figure 4: Perceptions about the local energy provider



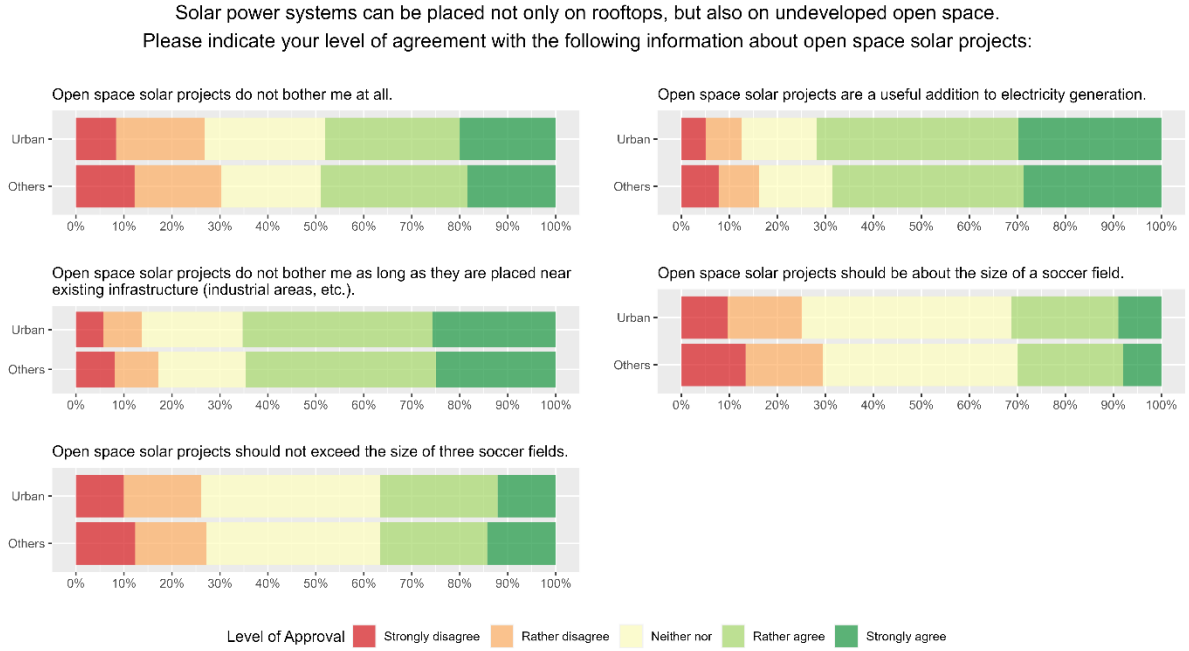
Note: The difference in the first item (My energy provider often addresses the climate issue) between the urban areas and the rest of Switzerland is statistically significant (see Table 4 in the Appendix).

3.2 A focus on open-space PV

According to the EDGE energy models (Heinisch et al., 2023), open-space PV can play an important role in Switzerland's energy transition. At the same time, recent debates around the "Solar Express", but also data from the EDGE survey (Trutnevyte et al., 2024), show that open space PV is much less popular with the Swiss population than building level PV (see also Figure 3).

Figure 5 provides more detailed information on the conditions under which the population is more or less critical of open-space PV. The main finding is that clear majorities of respondents consider this type of PV useful and do not feel disturbed as long as the installations are located near existing infrastructure. Urban dwellers show very similar preferences for open-space PV to the rest of Switzerland, with the exception that they consider this energy source to be significantly more useful than respondents from other areas while disagreeing less frequently on this energy source’s usefulness.

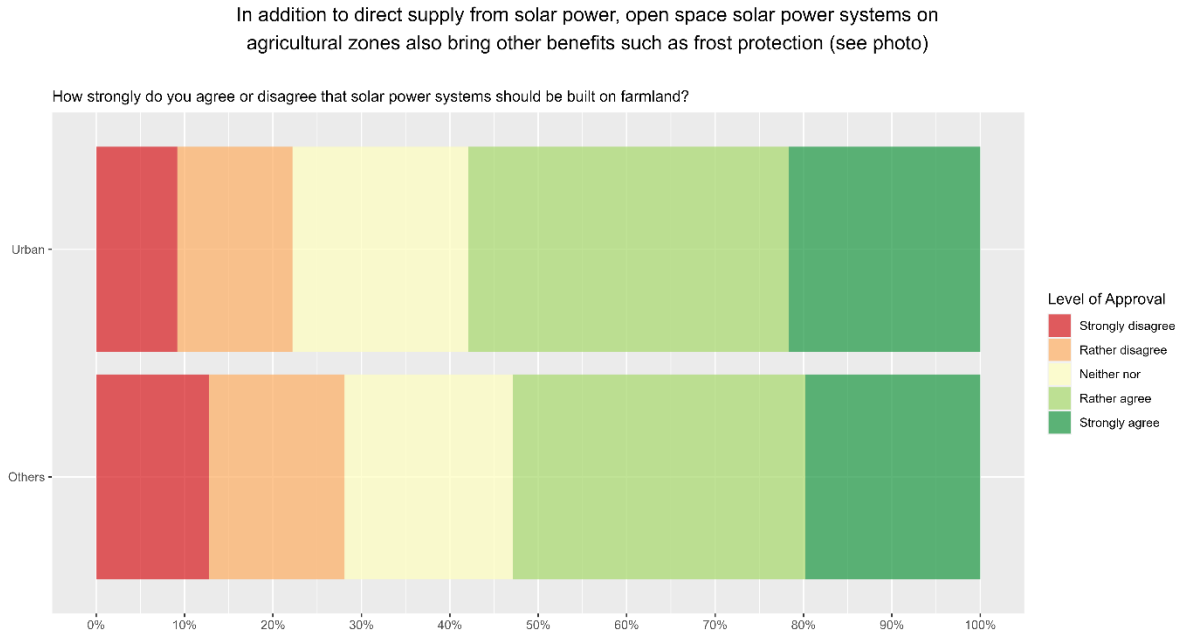
Figure 5: Acceptance of open-space PV promotion in the urban areas



Note: The following difference between urban areas and the other Swiss areas are statistically significant: “Open space solar projects are a useful addition to electricity generation” (see Table 5 in the Appendix).

A typical application of open-space PV is its placement on farmland or farms. Figure 6 shows that, overall, about half of the population agrees that open-space PV should be placed on cultural land. This proportion is significantly higher among respondents from urban areas, while fewer people in urban areas (tend to) disagree with agricultural PV. It should be noted that the wording of this question tends to emphasize the positive side effects of Agri-PV rather than the potential risks and challenges. Against this background, the proportion of respondents in favour of Agri-PV can be considered rather low.

Figure 6: Acceptance of Agri-PV promotion in the urban areas



Note: The difference between the urban area and the rest of Switzerland is statistically significant. The photo integrated into the survey question to show what Agri-PV looks like, can be found in Figure 13 in the Appendix.

4 ITMOs

4.1 General motivation for studying public opinion on the use of ITMOs

Given the urgency to combat the climate crisis, all countries need to reduce their emissions, which usually is one important motivating factor for the energy transition. Following international agreements - most notably - the Paris Agreement, parties set their emission reduction goals (Nationally Determined Contribution, NDC). While the Paris Agreement encourage to reach the NDCs through domestic emission reductions, it also allows for *voluntary cooperative approaches*, that centre sustainable development, environmental integrity, transparency in governance, and no *double counting*. This means, under Article 6.2 of the Paris Agreement, bilateral or plurilateral agreements to purchase ITMOs from other countries to reach one's own NDC is allowed (Federal Office for the Environment (FOEN), 2024; Schneider & La Hoz Theuer, 2019). As many low- and middle income countries are lacking climate finance (Chancel et al., 2023), ITMOs might provide them with funding for climate change mitigation and potentially simultaneously provide a less contested policy option for high-income countries, who have lately suffered from low public support for climate policies (e.g., Dechezleprêtre et al., 2022; Drews & van den Bergh, 2016; Fairbrother, 2022; Stadelmann-Steffen & Dermont, 2018). Lacking public support for domestic climate action was exemplary demonstrated by the vote against the revised CO2 Act in 2021 (Stadelmann-Steffen & Rihm, 2022).

Currently, Switzerland is one of the first countries to have signed bilateral agreements with other countries to reach its NDCs by using ITMOs (KliK Foundation, 2024; Stegmüller & Weiss, 2024). The main rational for using ITMOs is that reducing GHG emissions in developing countries is cheaper, due to the fact that high-income countries have already implemented the cheapest mitigation actions, smaller land and labour costs in low- and middle- income countries, lower costs to plan mitigation with new infrastructure than retrofitting mitigation in high- income countries and general equilibrium consideration arising from the fact that a stable climate is a true global public good, and where emissions are reduced first does not matter as argued by Glennerster & Jayachandran (2023). The notion of cost-effectiveness is also reflected in the Swiss dispatch on the revision of the CO2 Act for the time after 2024 (see 3.2.3, Federal Gazette 2022 2651).

To date, there is no literature that specifically addresses public support for the use of ITMOs, i.e., domestic public support for reducing emissions abroad to meet NDCs under the Paris Agreement. Even more so, no studies have examined the determinants of public opinion with respect to the degree of urbanity of the respondents' place of residence. While we do find significant differences in the support for ITMOs by level of urbanity (see Figure 2 and Table 2), these might be driven by residential self-selection and might proxy other variables, such as individual attitudes towards the importance of reducing GHGs and interest in globalisation/global collaboration. Therefore, this study is exploratory and draws on general climate policy literature and studies analysing voluntary carbon offsets abroad, either by individuals or their government, with a special focus on urban areas.

This section presents the main theoretical arguments with respect to the use of ITMOs and who should support these instruments as well as the main findings. The full study can be found in the following working paper attached to this Deliverable Report:

Gracia Brückmann (2024): Public opinion on climate policies: the peculiar case of reducing emissions abroad to reach national targets. Working Paper, University of Bern.

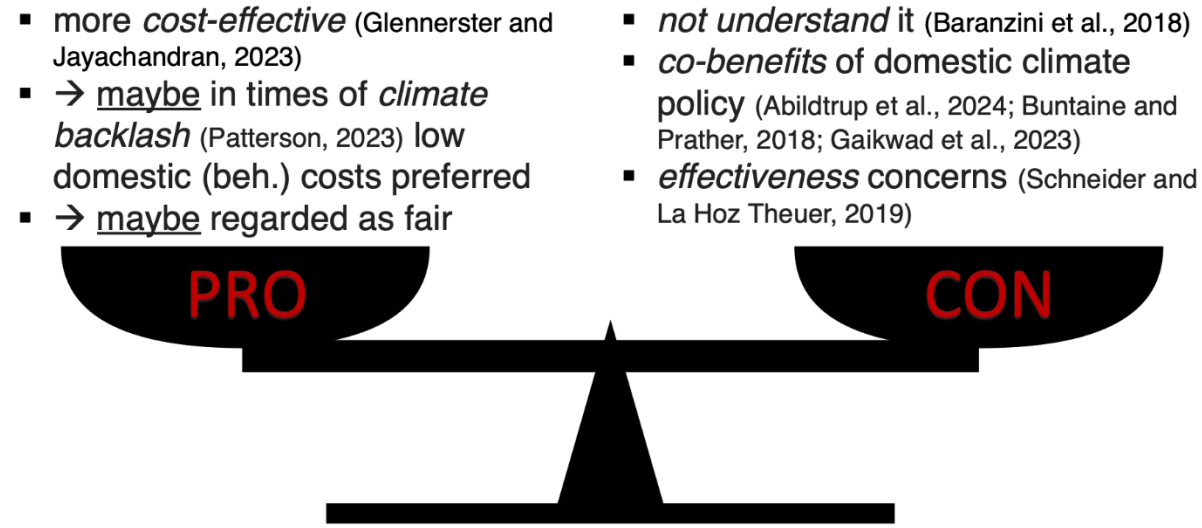
4.2 Theoretical arguments for and against using ITMOs

As mitigating CO2 abroad, especially in developing countries, is a cost-effective way to reduce emissions (Glennerster & Jayachandran, 2023), it might be appealing to those concerned with reaching NDCs and the costs of climate policy, simultaneously. However, the literature provides evidence that

people do not necessarily understand the cost-effective argumentation (Baranzini et al., 2018). Moreover, many people seem to prefer implementing climate policy within their home country due to domestic co-benefits, such as cleaner air through more stringent GHG emission reductions (Abildtrup et al., 2024; Buntaine & Prather, 2018; Gaikwad et al., 2024). This is indeed somewhat counterintuitive when considering the recent concerns about climate policies' (behavioural) costs, that even lead to protest, like the French yellow vest movement (Banerjee & Duflo, 2019; Fairbrother, 2022).

Given concerns about *additionality* (i.e., the projects abroad should not have happened without the financial contribution from the other country but should be "additional" to what would have been done without this additional contribution), double-counting, and the quality of the implementing government, as well as environmental integrity and concerns about ITMOs disincentivising local climate ambition (Schneider & La Hoz Theuer, 2019), even highly climate concerned individuals might oppose the use of ITMOs to meet NDCs. Similarly, even highly climate-concerned individuals might want to avoid encroaching the land and rights of local communities abroad (Park et al., 2024), while still wanting to providing funding to countries likely to be hit hardest by climate change. Both considerations might be attributed to a preference for fairness, and, as fairness is one of the most important predictors for climate policy support (Bergquist et al., 2022), this might be important when studying public opinion towards ITMOs. **Error! Reference source not found.** provides an overview of the a-priori theoretical arguments for and against support for using ITMOs to reach NDCs.

Figure 7: Theoretical arguments pro and con using ITMOs to reach domestic NDCs



Taken together, those respondents demanding more climate policy and those who are more concerned with the domestic economy (due to ITMO's cost-efficiency arguments) as well as those who want global fairness, should be most in favour for using ITMOs. While the first group, those more in favour of climate policy, is characterised in previous research (see e.g., Bergquist et al., 2022), and more likely to be found in urban areas (see e.g., the 2021 referendum on the CO2 act, Montfort, 2023), this is not clear for the other two groups.

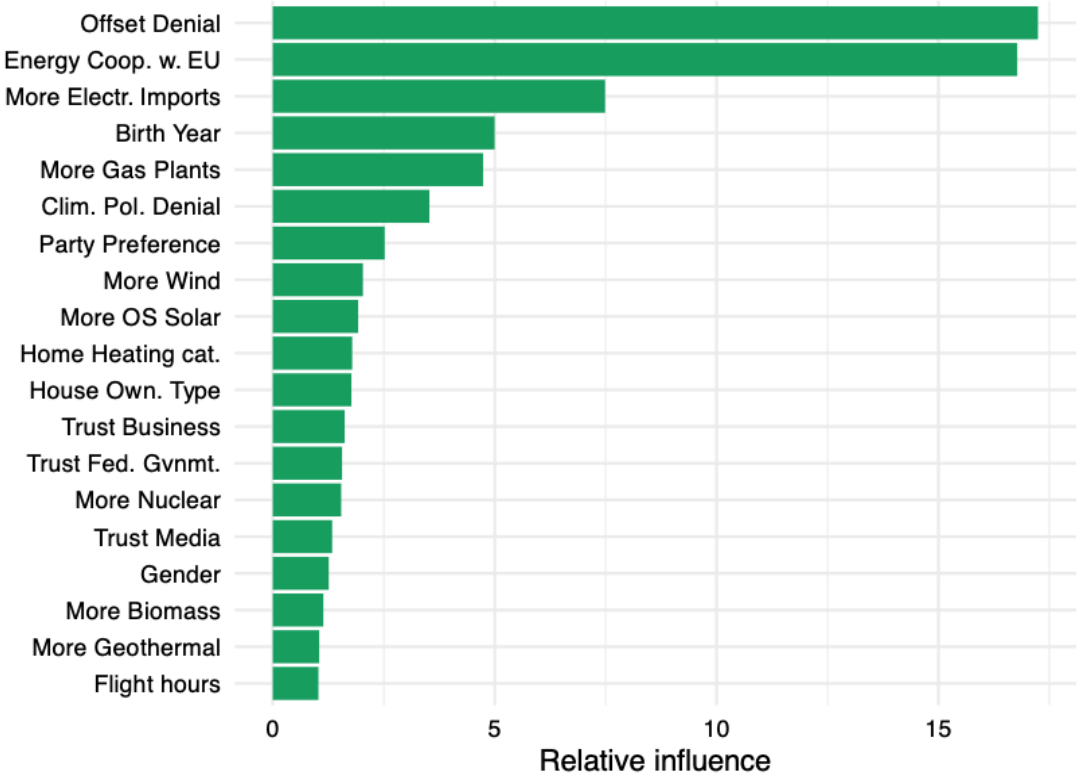
4.3 Main results

Starting with the descriptive results, which are also displayed in Figure 2, these can be summarized as follows: First, most people (independent of their residential location) are selecting themselves in the middle category, i.e., they *neither* agree *nor* disagree with the statement "In order to achieve the CO2 targets, Switzerland should compensate CO2 emissions abroad". In sum, more respondents are strongly and rather disagreeing with foreign emission reductions than those who (rather or strongly) agree with them. Second, the urban areas are slightly less against using ITMOs, compared to the other two EDGE areas.

Next, a prediction model using *Gradient Boosting* (Friedman, 2001; see also Ridgeway & GBM Developers, 2024) is employed to determine which individual characteristics (including residential location in EDGE region) and attitudes in the EDGE survey from 2022 determine support for using ITMOs. The main idea of gradient boosting is that it fits sequential models based on machine learning based on where previous models (trees) where predicting less accurately (Papadopoulos, Azar, et al., 2018).

Gradient boosting machines (GBM) provide us with the variables with the highest predictive power, as displayed in Figure 8, which shows the results from gradient boosting with maximal 1 interaction using the model that minimizes the least squares error in the test data set (which is a random sample of 25% of the data, that is not used in the training data set). Here, we cannot see the EDGE region, as its relative influence is only 0.21. However, we can observe that good predictors are the support for the statement "Carbon offsets (such as forestation, compensating flights, carbon credits) can solve the climate problem without individuals having to make big changes in their lives" (Offset denial), support for "Switzerland should cooperate more with the EU to secure Switzerland's future energy supply" (Energy Coop. w. EU), and support for "In order to guarantee Switzerland's electricity supply in the future, more electricity is to be imported from abroad" (More Electr. Imports). Their predictions (alone) change the category for the dependent variable, ITMO support, which is included in the Appendix (Figure 14 to Figure 118). These are followed by other variables such as age (Birth Year), as displayed in **Error! Reference source not found.**.

Figure 8: Relative influence of different variables (with highest relative influence) in EDGE 2022 survey to predict support for ITMOs using GBM



These prediction results lead to the tentative conclusion that the support for ITMOs is highest among those who do not want any changes in their "way of life" (as can be inferred from the offset denial variable and those who accept gas and nuclear power in the future Swiss energy mix), those with more openness towards cooperation with other countries (following the energy cooperation with EU and electricity imports variables), and younger individuals. Interestingly, strong climate problem perception is not a good predictor for supporting the use of ITMOs, and neither is the EDGE region.

5 Integrating tenants into PV expansion – the case of Citizen-Financed PV projects

One of the key challenges for the energy transition is to get the population on board (Brückmann et al., 2023) - at the very least, they should passively accept the energy transition and related measures, i.e. not actively resist them (Dermont et al., 2017b). However, it is even better if citizens are willing to act, pay or invest to accelerate the transition. Many existing policy instruments to encourage individual action are financial incentives, e.g. to promote installations on private rooftops. However, these are obviously targeted and mostly relevant to those who own their house or apartment and are able to invest significant amounts of money in a PV installation. In this context, citizen-financed photovoltaic projects (CiFi PV) represent a less familiar but promising avenue for inclusive participation and investment (Sierro & Blumer, 2024). CiFi PV are co-financed or crowdfunded by citizens, often consist of a larger array of solar panels installed by a provider, are typically located in public or commercially used areas, and can also include open space installations, such as in agricultural or alpine areas (Sierro & Blumer, 2024). Due to their size, they are advantageous from a techno-economic point of view (Nuñez-Jimenez et al., 2023). As these projects are collectively financed by several private stakeholders, they are accessible to a wide range of individuals, as the entry prices are low.[6]

With this in mind, the EDGE survey looked at the project characteristics that make these projects attractive to the community. In Deliverable 8.3, we presented these findings with a focus on tenants, i.e., respondents who do not own their homes and for whom these co-financed projects offer an opportunity to still financially participate in the energy transition. For the present deliverable, we have refined these analyses with a specific focus on urban areas. In this section, we provide a summary of the main expectations and findings, while the full study (which includes an even more detailed urban-rural scale) has been published as:

Ruprecht, S. (2024). The effect of place of living on social acceptance of shared PV projects in Switzerland. Environmental Research: Energy, 1(3), 035002. https://doi.org/10.1088/2753-3751/ad5a13

5.1 Which CiFi projects for urban areas? Theoretical expectations

While non-urban residents are more likely to have their own roof and install solar panels thereon, urban residents live in more condensed spaces and are henceforth more likely to be tenants, i.e. not having the opportunity to put solar panels on the roof of their dwelling. Therefore, CiFi PV projects are a promising alternative especially for urban residents, as they allow them to participate in the energy transition and contribute to climate change mitigation as well. So far, it remains unclear which project configurations might be attractive for urban residents to foster their participation and investment in such community PV projects. Some of the following project characteristics could lead to different levels of social acceptance (Wüstenhagen et al., 2007b), depending on whether a potential investor lives in more rural or urban areas:

Price of an investment: Since investments in community PV projects typically start at low prices and therefore basically allow anyone to invest in, the price per module might be less relevant for the choice itself but more so for the scale of an investment. In accordance with economic theory, higher prices lead to lower willingness to buy or invest (Süsser & Kannen, 2017). As urbans are, on average, financially better off and less likely than non-urbans to already have solar panels on the roof of their dwelling, it can be expected that higher prices are more accepted by urban investors.

Form of reimbursement to investor: Despite solar experts arguing that such projects do not pay off financially (at least in the short run), people might still value various returns on investment differently. In

[6] There are available offers in Switzerland starting at CHF 10 (approx. USD 11.33 as of March 15, 2024), see solarvignette.ch

general, the more tangible a benefit, the higher social acceptance should be (Beiser-McGrath & Bernauer, 2019), which would lead to higher social acceptance of community PV projects for financial returns on investment. Compared to non-urbans, for urban residents, it can be expected that non-financial forms of reimbursement are more accepted: Due to the higher probability of being on the left-green side of the political spectrum when living in a city, it is possible that urbans are more willing to forego monetary benefits because they recognize the need to transform the energy system. Further, non-urbans might already have solar panels on their own rooftop, so any additional investments in community PV projects might purely be seen as a financial investment, i.e. expecting direct monetary payments and disapproving of more symbolic benefits (like a certificate) or indirect monetary benefits (such as federal payments that benefit others as well, e.g. OASI compensation fund).

Project location: Energy infrastructure has long been shown to be influential for social acceptance (van der Horst, 2007), with it being unpopular close to a person's place of living (Swofford & Slattery, 2010) or when placed in residential zones in general (Stadelmann-Steffen & Dermont, 2021). Following this line of argumentation, urbans might be more open to placing community PV projects in areas further away from them, such as on farmland or in skiing areas. However, placing infrastructure in landscapes of value also generates opposition (Langer et al., 2016). Especially due to having a more left-green mindset, urbans might, on the other hand, be more opposed than non-urbans to place energy infrastructure in nature.

Project provider: Who provides a CiFi PV project might also play a crucial role for social acceptance. Research shows that public suppliers are preferred over private (Stadelmann-Steffen & Dermont, 2021), and local providers are more accepted than foreign ones (Sagebiel et al., 2014). While urban investors, due to their leftist political values, might especially prefer public suppliers, non-urban investors might place more value on local providers (due to their rightist attitudes).

Purchasing modality: Lastly, how someone learns about the way community PV projects function and how to invest in them might also influence social acceptance. In general, the distribution of information has shown to be relevant for project satisfaction and acceptance (Van Der Schoor & Scholtens, 2015; Vuichard et al., 2021). Being informed about a project by its leader was preferred over learning about from a politician (Kluge et al., 2021). Based on literature on consumer behaviour, it can moreover be expected that different purchasing modalities may attract urban residents and their Midlands or Alpine counterparts differently, e.g., concerning web-based and physical purchasing options. While, on the one hand, urban citizens might be more inclined for online purchase modalities due to their higher affinity to the internet and new technologies, on the other hand, online modalities may be particularly important for situations, for example in remote areas, where physical purchasing opportunities are lacking (Anderson et al., 2003).

5.2 Research Design

To find out about potential investors' preferences regarding CiFi PV project configurations, a conjoint experiment was conducted. This enables causal testing of the influence of project configurations (i.e. multiple project attributes shown at the same time) on different dimensions of social acceptance (Leeper et al., 2020). In conjoint analyses, attribute levels are randomly drawn and displayed, both between each of the five scenarios (project comparisons) as well as between respondents (Hainmueller et al., 2014). To measure the effect of project attributes on social acceptance, marginal means (MM) are calculated. They "represent the mean outcome across all appearances of a particular conjoint feature level, averaging across all other features. In forced choice conjoint designs with two profiles per choice task, MM by definition average 0.5 with values above 0.5 indicating features that increase profile favourability and values below 0.5 indicating features that decrease favourability. For continuous outcomes, MM can take any value in the full range of the outcome" (Leeper et al., 2020).

The conjoint experiment at hand has already been presented in Deliverable 8.3. Table 7 in the Appendix documents the five project attributes (i.e. five independent variables) with four to six attribute levels each. For five paired scenarios, respondents had to answer three questions, which made up the three

dependent variables. Market acceptance was operationalised by the variables of project choice and the number of chosen modules, while project rating measured socio-political acceptance (Wüstenhagen et al., 2007b). Their wording was as follows:

1. **Project choice**: *Which project do you choose?* – Choice between project A or B.

2. **Number of chosen modules**: *In how many solar modules with an area of 1m² each of your chosen project do you want to invest? (please enter as numbers)* – Open question, afterwards recoded to range from 0-300.

3. **Project rating**: *Regardless of whether you invest in these projects or not, would you support their implementation?* – For both projects separately: Choice along 5-point-Likert scale ranging from “certainly approve” to “certainly disapprove”.

5.3 Results and discussion

Starting with the dependent variable of **project choice**, a first form of market acceptance, the marginal means of the urban subgroup (in Figure 10) mostly do not significantly deviate from those of the Alps and the Midlands. For example, all three subgroups are more likely to choose a project when it is reimbursed by a credit voucher, when it is located on traffic infrastructure or large consumer roofs (urbans however only significantly differ from Alpine residents, see right column with differences in MM), when the project supplier is the electricity provider or the community where a solar plant is built in (left column). And while the Alpine and Midland regions approve of tax deductions, urban regions are indifferent towards them. However, these subgroup-differences are not significant (right column). Still, the urban subgroup seems to deviate from the other two regions in the following ways (right column): One, urbans are more likely to choose a project when the form of reimbursement is a federal investment in a developing country than the other two groups, however, project choice remains negative even for them (as shown by the MM on the left). And two, community PV projects located on farms foster more reluctance in urban regions.

Looking at overall project approval, i.e. **project rating** (Figure 11), a form of socio-political acceptance, it first of all becomes apparent that the Alpine and Midland regions display very similar project ratings on average, with the urban regions exhibiting higher means. As shown in the left column, all three regions are more likely to positively evaluate a project when the form of reimbursement is a credit voucher (insignificant group differences, see right column) or when the project’s location is traffic infrastructure (difference only significant between urbans and Midlands, see right column). A skiing area as a location however decreases socio-political acceptance for all three subgroups, the same is true when investors are reimbursed via solar vignettes (for both, difference only significant between urbans and Midlands, see right column). Urban deviations from the other two regions are primarily observed for the federal investments in developing countries, which are negative for the Alps and Midlands (left column), and furthermore significantly different from urban investors’ ratings (right column). Regarding the project’s provider, urban investors are approving of the solar plant’s community and, at least, do not disapprove of large companies like the other two regions (left column). For both provider attribute levels, these differences are statistically significant between regions (right column).

Figure 9: Choice

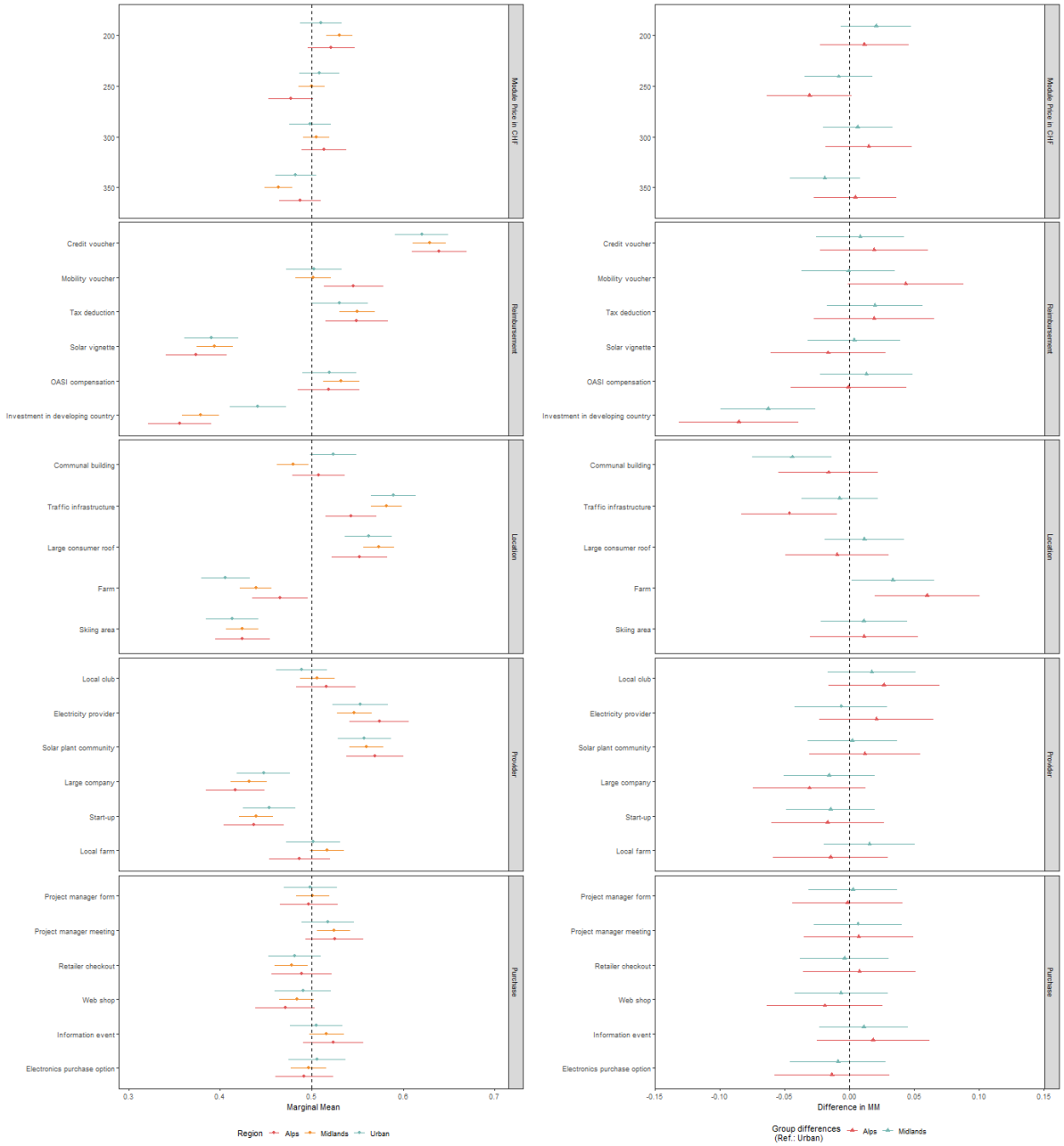
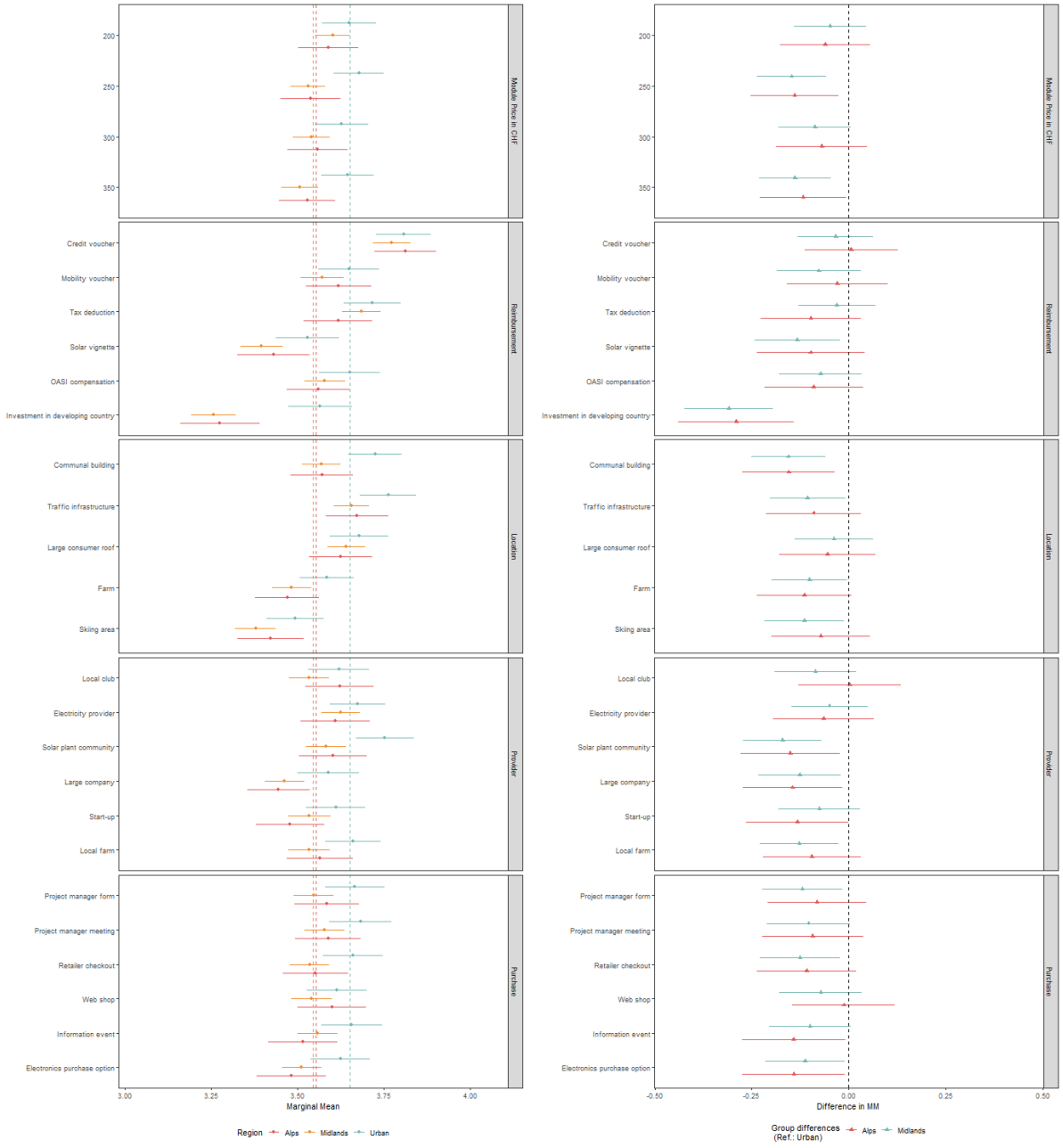
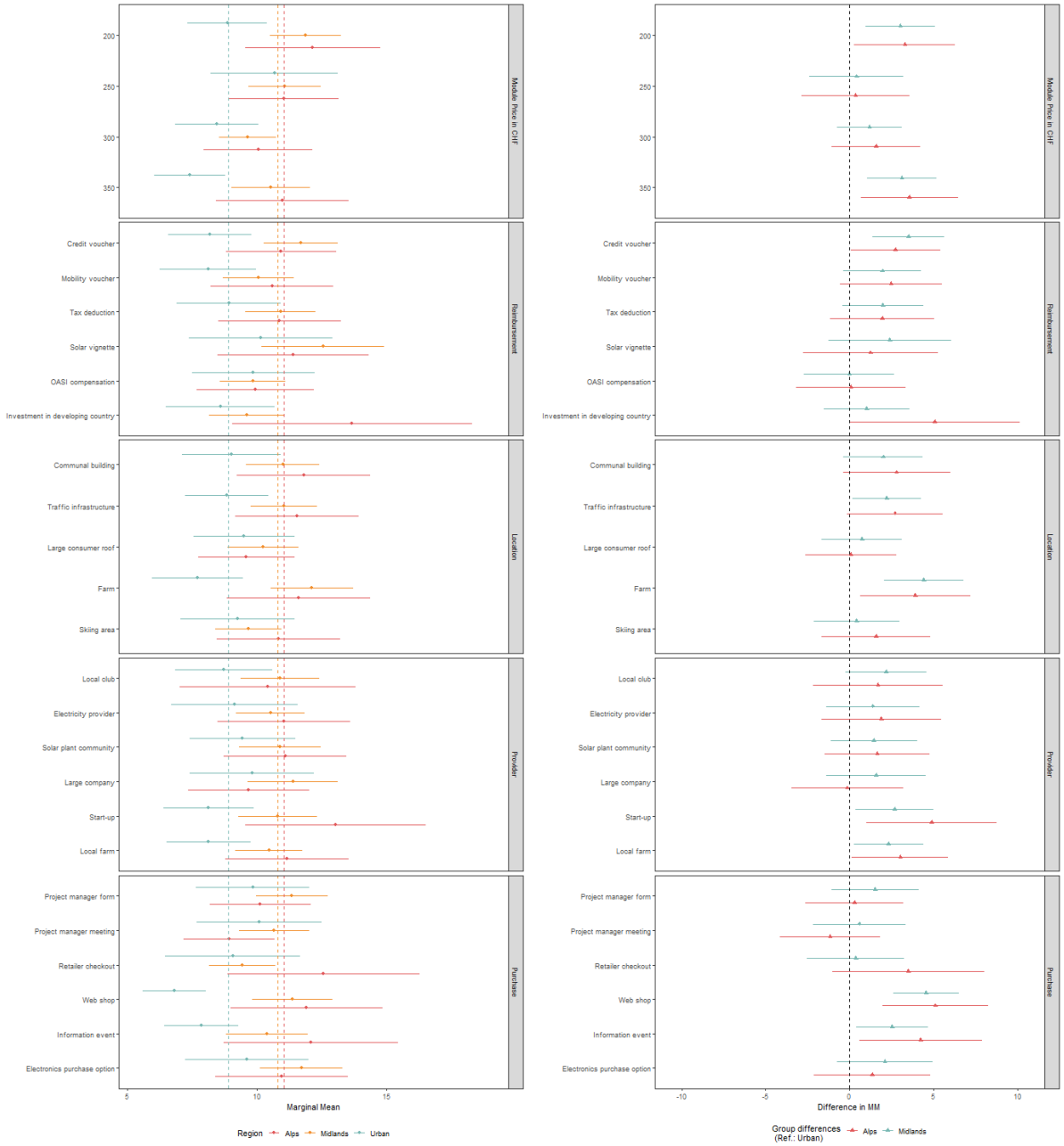


Figure 101: Rating



Lastly, for the **number of chosen modules** (another form of market acceptance, see Figure 12), it is interesting to observe that urban investors would, on average, buy a much lower number of PV modules than those from the Alps or Midlands. Here, no general patterns for all three subgroups are observed (left column). But it becomes apparent that those from urban regions buy significantly less modules when the module price is 350 CHF (left column), this difference is also statistically significant between groups (right column). The same holds true if the purchasing modality is a web shop.

Figure 12: Number of chosen modules



In summary, two main conclusions can be drawn. First, urban residents indicate clearly higher socio-political acceptance (i.e. project ratings) than respondents from the Alps or the Midlands. Most of the significant differences in preferences as a result of project design are indeed found in this acceptance dimension. However, and second, this higher socio-political acceptance levels is not related to stronger investments in CiFi PV projects and preferences for market acceptance are either very similar between the three regions (project choice) or pretty much inexistent (number of chosen modules). In other words, when it comes to actual investments beyond stated preferences, project design does not have to be adjusted according to regional preferences, which is obviously very convenient for policymaking. This investigation hence also demonstrates the importance of going deeper than only capturing attitudes, i.e. also measuring (stated) willingness to invest.

6 Conclusions and policy implications

The aim of this report was to examine regional policy acceptance with a special focus on urban areas. The starting point was that there are relevant techno-economic and socio-political differences between urban areas and other Swiss regions. For example, from a techno-economic perspective, urban areas are and will remain energy importers and thus dependent on renewable energy produced in the Midlands or the Alps. On the one hand, industrial energy demand is particularly high in densely populated areas (Sasse and Trutnevyte 2019), while energy production infrastructure is often located outside of urban centers. On an individual level, given that the proportion of homeowners is particularly small in cities, and available rooftops per capita are relatively limited, urban dwellers are on average more challenged to actively engage in the energy transition. At the same time, from a political perspective, urban dwellers are often found to have the most left-green values and preferences in the country, implying that support policies to facilitate and accelerate the energy transition should be most pronounced. This report therefore sought to shed light on the extent to which the urban population differs in terms of its policy preferences, and under what conditions CiFi PV could be an attractive way for urban residents to participate in renewable energy production.

The main finding of our analysis reveals that urban residents significantly differ from the populations of the Midlands and Alpine areas in several respects. Certainly, the deviations are not huge and, overall, the analyses presented in this report clearly confirm findings from Deliverable Report 2.2. that regional variation in policy acceptance is limited. Nevertheless, we can identify a distinct urban preference pattern, which is well in accordance with the previously mentioned ideological, i.e., left-green, predispositions: Urban residents are significantly more open towards European cooperation to secure energy supply, do weigh energy independence a bit less strongly, and are slightly more likely to accept wind and open-space PV (including Agri-PV) in the future Swiss energy mix.

However, the analyses presented in the report also document that the uniquely urban general policy preference and technology acceptance does not translate into a distinct specific policy acceptance and behavioral intention. First, while we find descriptive evidence that carbon offsets abroad are slightly more popular in urban areas than in the Alps and the Midlands, more detailed analyses show that support for ITMOs is strongly driven by those who agree that carbon offsets offer a way for everyone's life to continue as before, and those who are more open to cooperation with foreign countries (especially energy cooperation with the EU and support for electricity imports). Therefore, it is attitudinal variables rather than residence in a particular EDGE region that shape support for ITMOs. Second, CiFi PV, as an instrument specifically targeted at urban dwellers who do not have the possibility to install PV on their own roofs, seems indeed to be particularly well suited to urban dwellers in terms of ideology, which is reflected in high socio-political acceptance patterns. However, these ideological patterns do not translate into higher investment behavior.

Based on the results and implications discussed in this report, the following policy recommendations are formulated:

1) **Better exploiting the urban potential**

This report has shown that urban residents, in terms of their ideological and socio-political acceptance patterns, should be a fertile ground for effective energy transition policies and activities. However, at the same time, as the analyses on CiFi PV has demonstrated, the gap between these preferences and actual investment behavior is more pronounced in urban areas than in other Swiss regions. To better exploit the urban potential two strategies seem to be important. First, more research is needed to better understand the attitude-behavior gap. Based on our analyses and data, we do not know whether the relatively low investment intention has economic reasons, is due to disadvantageous perceptions about these projects in urban settings, or has other reasons. Second, more effort is needed in urban areas to specifically target the urban population for CiFi PV projects (or other possibilities for urban tenants to co-invest) . As our results suggest, this does not mean that specific urban projects need to be designed, as the project design preferences do not substantively vary between urban and other areas, especially when it comes to investment intention. Much rather, additional effort is necessary to inform and sensitize urban residents for getting actively engaged. One framing that may be promising is to emphasize that

urban areas are and will be importers of energy from other Swiss regions – a fact that is likely not very present in peoples' minds but might be relevant given the high popularity of "energy independence" also in urban areas. In this context, it may also be fruitful to consider projects and opportunities beyond the case of co-financed PV that allow for the active involvement of the urban population (e.g., using different technologies or different "business models").

2) **Integrate ITMOs into the discussion**

CO2 compensation abroad likely is an inherent element of the Swiss energy transition to net zero. According to the current CO2 Act, a maximum of 25% of the CO2 reduction can be compensated abroad. Whether this proportion should be increased or decreased has been debated in the recent process to revise the CO2 Act. Moreover, current energy models[7] suggest to rely on ITMOs quite heavily when allowed to. However, the public debate has largely neglected this aspect or only discussed specific examples taken up by the media. Against this background, ITMOs need to be specifically integrated into the public debate, including a discussion about their purpose, pros and cons but also trade-offs. This is relevant in order to create an informed citizenry and thus factual debate for the next referendum campaign, which is likely to occur over the next years.

3) **Again: avoiding political polarization between urban and rural areas**

The analyses presented in this report corroborate our recommendation from Deliverable Report 2.2 that the public discourse about the energy transition should aim at de-politization of the issue given that political polarization has been shown to act as important barrier to policy acceptance. This recommendation can be further nurtured by the findings of the present report First, we can identify a specific preference pattern in urban areas but also observe that most of the differences between urban respondents and their counterparts in the Midlands and Alps are mostly driven by ideological clustering rather than the urban region as such. Indeed, the in-depth analysis of CiFi PV acceptance even demonstrates that an urban label as such is too broad. Indeed, there is a huge difference between someone living in a city of 10'000 inhabitants or in a highly populated large city. Our analyses reveal that these within-urban differences are sometime more important than those between urban and periurban or even rural regions. Overall, these findings suggest that emphasizing the similarities rather than the differences is important to not further fuel the ideological urban-rural divide.

[7] https://sweet-cross.ch/wp-content/uploads/2023/07/CROSS_scenarios_V2022-09_2023_07_19.pdf

References

Abildtrup, J., Jacobsen, J. B., Vedel, S. E., Mantau, U., Mavsar, R., Pettenella, D., Prokofieva, I., Schubert, F., Stenger, A., Varela, E., Vidale, E., & Thorsen, B. J. (2024). Preferences for climate change policies: the role of co-benefits. *Journal of Environmental Economics and Policy*, *13*(1), 110–128. https://doi.org/10.1080/21606544.2023.2223182

Anderson, W. P., Chatterjee, L., & Lakshmanan, T. R. (2003). E-commerce, transportation, and economic geography. *Growth and Change*, *34*(4), 415–432. https://doi.org/10.1046/j.0017-4815.2003.00228.x

Banerjee, A. V, & Duflo, E. (2019). *Good economics for hard times*. PublicAffairs.

Baranzini, A., Borzykowski, N., & Carattini, S. (2018). Carbon offsets out of the woods? Acceptability of domestic vs. international reforestation programmes in the lab. *Journal of Forest Economics*, *32*, 1–12. https://doi.org/10.1016/j.jfe.2018.02.004

Beiser-McGrath, L. F., & Bernauer, T. (2019). Could revenue recycling make effective carbon taxation politically feasible? *Science Advances*, *5*(9), 3323–3341. https://doi.org/10.1126/sciadv.aax3323

Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, *12*(3), 235–240.

Buntaine, M. T., & Prather, L. (2018). Preferences for Domestic Action Over International Transfers in Global Climate Policy. *Journal of Experimental Political Science*, *5*, 73–87. https://doi.org/10.1017/XPS.2017.34

Chambers, J., Narula, K., Sulzer, M., & Patel, M. K. (2019). Mapping district heating potential under evolving thermal demand scenarios and technologies: A case study for Switzerland. *Energy*, *176*, 682–692. https://doi.org/10.1016/j.energy.2019.04.044

Chancel, L., Bothe, P., & Voituriez, T. (2023). *Climate Inequality Report 2023*. https://prod.wid.world/www-site/uploads/2023/0 1/CBV2023-ClimateInequalityReport-3.pdf

Dechezleprêtre, A., Fabre, A., Kruse, T., Planterose, B., Chico, A. S., & Stantcheva, S. (2022). *Fighting climate change: International attitudes toward climate policies* (30265). http://www.nber.org/data-appendix/w30265

Dermont, C., Ingold, K., Kammermann, L., & Stadelmann-Steffen, I. (2017a). Bringing the policy making perspective in: A political science approach to social acceptance. *Energy Policy*, *108*(July 2016), 359–368. https://doi.org/10.1016/j.enpol.2017.05.062

Dermont, C., Ingold, K., Kammermann, L., & Stadelmann-Steffen, I. (2017b). Bringing the policy making perspective in: A political science approach to social acceptance. *Energy Policy*, *108*(July 2016), 359–368. https://doi.org/10.1016/j.enpol.2017.05.062

Drews, S., & van den Bergh, J. C. J. M. (2016). What explains public support for climate policies? A review of empirical and experimental studies. *Climate Policy*, *16*(7), 855–876. https://doi.org/10.1080/14693062.2015.1058240

Fairbrother, M. (2022). Public opinion about climate policies: A review and call for more studies of what people want. *PLOS Climate*, *1*(5), e0000030. https://doi.org/10.1371/journal.pclm.0000030

Federal Office for the Environment (FOEN). (2024). *Compensation projects abroad*.

Friedman, J. H. (2001). Greedy function approximation: A gradient boosting machine. *Annals of Statistics*, *29*, 1189–1232. https://api.semanticscholar.org/CorpusID:39450643

Gaikwad, N., Genovese, F., Tingley, D., Gilkerson, D., Ding, D., Rutherford, K., Gonzalez, A., Xiao, J., Housekeeper, S., Riaz, B., Singh, S., Bayer, P., Beiser-Mcgrath, L., Bernauer, T., Gambetta, D., Kennard, A., Koubi, V., Kurti, E., Nahar, J., … Zhang, A. (2024). Climate Action from Abroad: Assessing Mass Support for Cross-Border Climate Transfers. *Available at SSRN*, *4470596*. https://ssrn.com/abstract=4470596

Glennerster, R., & Jayachandran, S. (2023). Think Globally, Act Globally: Opportunities to Mitigate Greenhouse Gas Emissions in Low- and Middle-Income Countries. *Journal of Economic Perspectives*, *37*(3), 111–136. https://doi.org/10.1257/jep.37.3.111

Hainmueller, J., Hopkins, D. J., & Yamamoto, T. (2014). Causal Inference in Conjoint Analysis: Understanding Multidimensional Choices via Stated Preference Experiments. *Political Analysis*, *22*(01), 1–30. https://doi.org/10.1093/pan/mpt024

Hassan, M. A., Khalil, A., Kaseb, S., & Kassem, M. A. (2017). Exploring the potential of tree-based ensemble methods in solar radiation modeling. *Applied Energy*, *203*, 897–916. https://doi.org/https://doi.org/10.1016/j.apenergy.2017.06.104

Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning. Data Mining, Inference, and Prediction, Second Edition*. Springer New York. https://doi.org/10.1007/978-0-387-84858-7

Heinisch, V., Dujardin, J., Gabrielli, P., Jain, P., Lehning, M., Sansavini, G., Sasse, J.-P., Schaffner, C., Schwarz, M., & Trutnevyte, E. (2023). Spatial scenarios with high shares of renewable electricity generation: A model inter-comparison for Switzerland, in preparation. *Submitted*.

KliK Foundation. (2024). *First ever ITMOs for NDC use*. Foundation for Climate Protection and Carbon Offset KliK (KliK Foundation). https://www.klik.ch/news/news-article/first-ever-itmos-for-ndc-use

Kluge, J., Offermann-van Heek, J., & Ziefle, M. (2021). How will I know about local energy projects? A conjoint-analysis of communication preferences in Germany. *Energy Research and Social Science*, *75*. https://doi.org/10.1016/j.erss.2021.102016

Kübler, D., Scheuss, U., & Rochat, P. (2013). The metropolitan bases of political cleavage in Switzerland. In J. M. Sellers, D. Kübler, M. Walter-Rogg, & R. A. Walks (Eds.), *The Political Ecology of the Metropolis* (pp. 199–226). ECPR press.

Langer, K., Decker, T., Roosen, J., & Menrad, K. (2016). A qualitative analysis to understand the acceptance of wind energy in Bavaria. In *Renewable and Sustainable Energy Reviews* (Vol. 64, pp. 248–259). Elsevier Ltd. https://doi.org/10.1016/j.rser.2016.05.084

Leeper, T. J., Hobolt, S. B., & Tilley, J. (2020). Measuring Subgroup Preferences in Conjoint Experiments. *Political Analysis*, *28*(2), 207–221. https://doi.org/10.1017/pan.2019.30

Montfort, S. (2023). Key predictors for climate policy support and political mobilization: The role of beliefs and preferences. *PLOS Climate*, *2*(8), e0000145. https://doi.org/10.1371/journal.pclm.0000145

Müller, J., & Trutnevyte, E. (2020). Spatial projections of solar PV installations at subnational level: Accuracy testing of regression models. *Applied Energy*, *265*(February), 114747. https://doi.org/10.1016/j.apenergy.2020.114747

Nuñez-Jimenez, A., Mehta, P., & Griego, D. (2023). Let it grow: How community solar policy can increase PV adoption in cities. *Energy Policy*, *175*. https://doi.org/10.1016/j.enpol.2023.113477

Park, D. S., Lee, D., & Rhee, I. (2024). *Balancing Global Climate Action and Local Rights: Survey Experimental Evidence on Public Support for Carbon Offsetting in Liberia* (AEA RCT Registry). https://doi.org/10.1257/rct.12752-1.0

Ridgeway, G., & GBM Developers. (2024). *gbm: Generalized Boosted Regression Models*. https://CRAN.R-project.org/package=gbm

Sagebiel, J., Müller, J. R., & Rommel, J. (2014). Are consumers willing to pay more for electricity from cooperatives? Results from an online Choice Experiment in Germany. *Energy Research and Social Science*, *2*, 90–101. https://doi.org/10.1016/j.erss.2014.04.003

Sasse, J. P., & Trutnevyte, E. (2019). Distributional trade-offs between regionally equitable and cost-efficient allocation of renewable electricity generation. *Applied Energy*, *254*(August), 113724. https://doi.org/10.1016/j.apenergy.2019.113724

Schneider, L., & La Hoz Theuer, S. (2019). Environmental integrity of international carbon market mechanisms under the Paris Agreement. *Climate Policy*, *19*(3), 386–400. https://doi.org/10.1080/14693062.2018.1521332

Sierro, F., & Blumer, Y. (2024). Material energy citizenship through participation in citizen-financed photovoltaic projects. *Energy, Sustainability and Society*, *14*(1). https://doi.org/10.1186/s13705-024-00465-0

Papadopoulos, S., Azar, E., Woon, W.-L., & Kontokosta, C. E. (2018). Evaluation of tree-based ensemble learning algorithms for building energy performance estimation. *Journal of Building Performance Simulation*, *11*(3), 322–332. https://doi.org/10.1080/19401493.2017.1354919

Stadelmann-Steffen, I., & Dermont, C. (2018). The unpopularity of incentive-based instruments: what improves the cost–benefit ratio? *Public Choice*, *175*(1–2), 37–62. https://doi.org/10.1007/s11127-018-0513-9

Stadelmann-Steffen, I., & Dermont, C. (2021). Acceptance through inclusion? Political and economic participation and the acceptance of local renewable energy projects in Switzerland. *Energy Research and Social Science*, *71*, 101818. https://doi.org/10.1016/j.erss.2020.101818

Stadelmann-Steffen, I., & Rihm, M. (2022). Switzerland: Political Developments and Data in 2021. *European Journal of Political Research Political Data Yearbook*, *forthcoming*. https://doi.org/10.1111/2047-8852.12353

Stegmüller, C., & Weiss, S. (2024). *Switzerland's pioneering carbon offsets strategy raises questions*. Swissinfo. https://www.swissinfo.ch/eng/business/switzerland-leads-the-way-in-carbon-offsets-raising-questions/49130514

Süsser, D., & Kannen, A. (2017). 'Renewables? Yes, please!': perceptions and assessment of community transition induced by renewable-energy projects in North Frisia. *Sustainability Science*, *12*(4), 563–578. https://doi.org/10.1007/s11625-017-0433-5

Swofford, J., & Slattery, M. (2010). Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. *Energy Policy*, *38*(5), 2508–2519. https://doi.org/10.1016/j.enpol.2009.12.046

Thormeyer, C., Sasse, J. P., & Trutnevyte, E. (2020). Spatially-explicit models should consider real-world diffusion of renewable electricity: Solar PV example in Switzerland. *Renewable Energy*, *145*, 363–374. https://doi.org/10.1016/j.renene.2019.06.017

Trutnevyte, E., Sasse, J.-P., Heinisch, V., Đukan, M., Gabrielli, P., Garrison, J., Jain, P., Renggli, S., Sansavini, G., Schaffner, C., Schwarz, M., Steffen, B., Dujardin, J., Lehning, M., Ripoll, P., Thalmann, P., Vielle, M., Stadelmann-Steffen, I., Trutnevyte, E., … Stadelmann-Steffen, I. (2024). *Renewable Energy Outlook for Switzerland*. https://doi.org/10.13097/ARCHIVE-OUVERTE/UNIGE:172640

van der Horst, D. (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy*, *35*(5), 2705–2714. https://doi.org/10.1016/j.enpol.2006.12.012

Van Der Schoor, T., & Scholtens, B. (2015). Power to the people: Local community initiatives and the transition to sustainable energy. *Renewable and Sustainable Energy Reviews*, *43*, 666–675. https://doi.org/10.1016/j.rser.2014.10.089

Vuichard, P., Stauch, A., & Wüstenhagen, R. (2021). Keep it local and low-key: Social acceptance of alpine solar power projects. *Renewable and Sustainable Energy Reviews*, *138*(March 2020), 110516. https://doi.org/10.1016/j.rser.2020.110516

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007a). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007b). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

Appendix

Table 2: Regional policy preference – Regression results

	Independence	Cooperation	Compensation abroad	Independ-ence	Coopera-tion	Compensation abroad
	M1a	M2a	M3a	M1b	M2b	M3b
Swiss region (Ref. Other)						
Urban	0.066**	-0.133***	-0.098***	0.013	-0.086	-0.048
	(0.028)	(0.035)	(0.034)	(0.053)	(0.067)	(0.064)
Lower income (Ref.: High income)	0.038	0.036	-0.037	0.037	0.037	-0.037
	(0.031)	(0.039)	(0.038)	(0.031)	(0.039)	(0.038)
Education (Ref.: Sec. I)						
Secondary II	-0.123**	0.070	0.228***	-0.124**	0.072	0.229***
	(0.061)	(0.077)	(0.074)	(0.061)	(0.077)	(0.074)
Tertiary	-0.094	-0.169**	0.299***	-0.096	-0.167**	0.299***
	(0.061)	(0.077)	(0.073)	(0.061)	(0.077)	(0.074)
Age	-0.0004	-0.012***	0.004***	-0.0004	-0.012***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gender (Ref.: Female)						
Male	-0.065**	-0.060*	0.171***	-0.064**	-0.061*	0.171***
	(0.027)	(0.033)	(0.032)	(0.027)	(0.033)	(0.032)
Non-binary (as umbrella term)	-0.070	0.753**	0.828***	-0.068	0.751**	0.827***
	(0.235)	(0.307)	(0.284)	(0.235)	(0.307)	(0.284)
Owns house/flat	-0.073**	-0.065*	0.148***	-0.073**	-0.064*	0.147***
	(0.029)	(0.037)	(0.035)	(0.029)	(0.037)	(0.035)
*Region*Political ideology*						
Urban*Left				0.081	-0.018	-0.118
				(0.069)	(0.087)	(0.083)
Urban*None				-0.024	0.041	-0.155
				(0.224)	(0.284)	(0.274)
Urban*Right				0.066	-0.119	-0.012
				(0.070)	(0.089)	(0.085)
Political ideology (Ref.: Centre)						
Left	0.122***	-0.300***	0.017	0.092**	-0.295***	0.062
	(0.034)	(0.042)	(0.041)	(0.042)	(0.053)	(0.051)
	-0.121***	0.328***	0.213***	-0.143***	0.367***	0.219***
	(0.034)	(0.042)	(0.041)	(0.041)	(0.052)	(0.050)
None	0.089	0.198	0.198	0.100	0.180	0.257
	(0.109)	(0.139)	(0.134)	(0.141)	(0.177)	(0.172)
Constant	1.992***	3.426***	2.809***	2.013***	3.405***	2.791***
	(0.078)	(0.098)	(0.094)	(0.080)	(0.101)	(0.097)
Observations	4,517	4,511	4,502	4,517	4,511	4,502
R^2	0.024	0.096	0.039	0.024	0.096	0.039
Adjusted R^2	0.022	0.094	0.036	0.021	0.094	0.036

Note: High values describe stronger disagreement. *p**p***p<0.01

Table 3: Regional policy mix preferences

	Large Hydro	Nuclear	Small Hydro	OS-PV	Small PV	Geothermal	Wind	Biomass	Gas	Imports
Urban region (Ref.: Other)	0.076	-0.022	0.068	-0.212***	-0.015	-0.038	-0.142**	0.022	-0.113*	-0.056
	(0.052)	(0.076)	(0.068)	(0.075)	(0.046)	(0.061)	(0.071)	(0.055)	(0.067)	(0.053)
Political ideology (Ref.: Centre)										
Left	0.085**	0.708***	0.219***	-0.250***	-0.173***	-0.110**	-0.225***	-0.135***	0.201***	0.122***
	(0.042)	(0.061)	(0.055)	(0.060)	(0.037)	(0.049)	(0.057)	(0.044)	(0.054)	(0.043)
Right	-0.140***	-0.584***	-0.066	0.194***	0.026	-0.019	0.132**	-0.027	0.007	0.105**
	(0.040)	(0.059)	(0.053)	(0.058)	(0.035)	(0.048)	(0.055)	(0.043)	(0.052)	(0.041)
None	0.264**	0.390**	0.109	0.431**	0.066	0.045	0.106	0.237	0.134	-0.134
	(0.134)	(0.197)	(0.176)	(0.195)	(0.119)	(0.164)	(0.186)	(0.146)	(0.177)	(0.141)
Lower income (Ref.: High income)	0.016	-0.024	-0.003	0.087**	0.133***	0.149***	0.037	0.116***	0.016	-0.040
	(0.030)	(0.045)	(0.040)	(0.044)	(0.027)	(0.036)	(0.042)	(0.032)	(0.039)	(0.031)
Education (Ref.: Sec. I)										
Secondary II	-0.043	0.027	0.022	-0.001	-0.074	0.112	-0.015	-0.070	0.168**	0.251***
	(0.059)	(0.087)	(0.078)	(0.086)	(0.053)	(0.071)	(0.081)	(0.064)	(0.077)	(0.061)
Tertiary	-0.079	0.093	0.00003	-0.169**	-0.239***	-0.181**	-0.014	-0.206***	0.215***	0.345***
	(0.059)	(0.087)	(0.078)	(0.086)	(0.052)	(0.071)	(0.081)	(0.063)	(0.077)	(0.061)
Age	-0.005***	0.003**	0.001	-0.004***	-0.003***	0.002	0.003**	-0.006***	0.001	-0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gender (Ref.: Female)										
Male	-0.189***	-0.241***	-0.130***	-0.091**	-0.086***	-0.270***	-0.016	-0.080***	0.214***	0.046*
	(0.026)	(0.038)	(0.034)	(0.038)	(0.023)	(0.031)	(0.035)	(0.028)	(0.033)	(0.027)
Non-binary (as umbrella term)	-0.347	-0.369	0.036	0.620*	0.330	0.629**	0.562*	-0.070	0.377	0.102
	(0.239)	(0.338)	(0.302)	(0.334)	(0.203)	(0.272)	(0.315)	(0.244)	(0.297)	(0.237)
Owns house	-0.118***	0.027	-0.092**	0.105**	-0.102***	-0.027	-0.065*	-0.116***	0.163***	0.057*
	(0.028)	(0.042)	(0.037)	(0.041)	(0.025)	(0.034)	(0.039)	(0.030)	(0.037)	(0.029)
Interaction region*Political ideology										
Urban*Left	-0.018	-0.027	-0.046	0.181*	-0.029	-0.004	0.058	-0.049	0.017	-0.011
	(0.067)	(0.099)	(0.088)	(0.098)	(0.059)	(0.080)	(0.092)	(0.072)	(0.087)	(0.069)
Urban*Right	0.039	0.018	0.066	-0.015	-0.014	-0.064	0.227**	0.059	0.022	-0.017
	(0.069)	(0.101)	(0.090)	(0.100)	(0.061)	(0.082)	(0.094)	(0.073)	(0.089)	(0.071)
Urban*None	-0.116	0.090	0.092	0.446	0.139	0.277	0.312	-0.263	-0.216	0.314
	(0.214)	(0.318)	(0.281)	(0.311)	(0.187)	(0.257)	(0.292)	(0.232)	(0.279)	(0.223)
Constant	2.236***	2.802***	2.483***	2.792***	1.891***	2.410***	2.373***	2.675***	2.755***	3.741***
	(0.078)	(0.115)	(0.103)	(0.114)	(0.069)	(0.093)	(0.107)	(0.084)	(0.101)	(0.081)
Observations	4,518	4,519	4,521	4,516	4,521	4,506	4,522	4,509	4,509	4,514
R^2	0.049	0.172	0.018	0.037	0.050	0.051	0.026	0.038	0.027	0.017
Adjusted R^2	0.046	0.169	0.015	0.034	0.047	0.048	0.023	0.035	0.024	0.014

Note: OLS regression, Likert scale treated as metric. High values describe higher disagreement.

*p**p***p<0.01

Table 4: Regional perception of the energy provider

	Active Provider	Committed Provider
Urban region (Ref.: Other)	-0.124***	0.050
	(0.032)	(0.032)
Lower income (Ref.: High income)	0.004	-0.077**
	(0.036)	(0.036)
Education (Ref.: Sec. I)		
Secondary II	-0.051	0.112
	(0.070)	(0.070)
Tertiary	-0.060	0.140**
	(0.070)	(0.070)
Age	-0.013***	0.008***
	(0.001)	(0.001)
Gender (Ref.: Female)		
Male	-0.068**	0.067**
	(0.030)	(0.031)
Non-binary (as umbrella term)	0.185	-0.208
	(0.270)	(0.270)
Owns house	-0.009	0.028
	(0.033)	(0.033)
Political ideology (Ref.: Centre)		
Left	0.021	0.069*
	(0.039)	(0.039)
Right	-0.057	0.167***
	(0.039)	(0.039)
None	0.040	-0.050
	(0.122)	(0.123)
Constant	3.485***	2.709***
	(0.090)	(0.090)
Observations	4,521	4,502
R^2	0.042	0.026
Adjusted R^2	0.039	0.024

Note: OLS regression, Likert scale treated as metric. High values describe higher disagreement

*p**p***p<0.01

Table 5: Regional preferences for open-space PV

	Useful	Do not bother	Close to infra-structure	Size soccer field	Max 3 Soccer fields
Urban region (Ref.: Other)	-0.083**	-0.048	-0.031	-0.088**	-0.004
	(0.036)	(0.040)	(0.037)	(0.035)	(0.037)
Lower income (Ref.: High income)	0.009	-0.060	0.098**	0.043	0.073*
	(0.040)	(0.045)	(0.041)	(0.039)	(0.041)
Education (Ref.: Sec. I)					
Secondary II	-0.040	0.188**	0.189**	0.050	0.071
	(0.078)	(0.087)	(0.079)	(0.076)	(0.080)
Tertiary	-0.194**	0.160*	0.061	0.073	0.152*
	(0.078)	(0.087)	(0.079)	(0.075)	(0.080)
Age	-0.007***	-0.006***	-0.005***	-0.004***	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gender (Ref.: Female)					
Male	-0.061*	-0.106***	0.089**	0.051	0.358***
	(0.034)	(0.038)	(0.035)	(0.033)	(0.035)
Non-binary (as umbrella term)	0.899***	0.461	0.816***	0.521*	0.124
	(0.303)	(0.338)	(0.307)	(0.292)	(0.311)
Owns house	0.089**	0.146***	0.091**	0.146***	0.131***
	(0.037)	(0.042)	(0.038)	(0.036)	(0.038)
Political ideology (Ref.: Centre)					
Left	-0.143***	-0.034	-0.096**	-0.028	0.059
	(0.044)	(0.049)	(0.044)	(0.042)	(0.045)
Right	0.114***	0.150***	0.074*	0.047	0.083*
	(0.043)	(0.048)	(0.044)	(0.042)	(0.045)
None	0.479***	0.346**	0.375***	0.323**	0.102
	(0.137)	(0.153)	(0.140)	(0.132)	(0.142)
Constant	2.679***	2.805***	2.249***	3.025***	2.409***
	(0.101)	(0.112)	(0.102)	(0.097)	(0.103)
Observations	4,520	4,516	4,515	4,510	4,510
R^2	0.030	0.015	0.018	0.011	0.031
Adjusted R^2	0.028	0.013	0.016	0.009	0.028

Note: OLS regression, Likert scale treated as metric. High values describe higher disagreement

*p**p***p<0.01

Figure 13: Picture of Agri-PV integrated in the EDGE survey next to the question on Agri-PV

Figure 14: Prediction for ITMO opinions given offset denial, i.e., agreement with "Carbon offsets (such as forestation, compensating flights, carbon credits) can solve the climate problem without individuals having to make big changes in their lives."

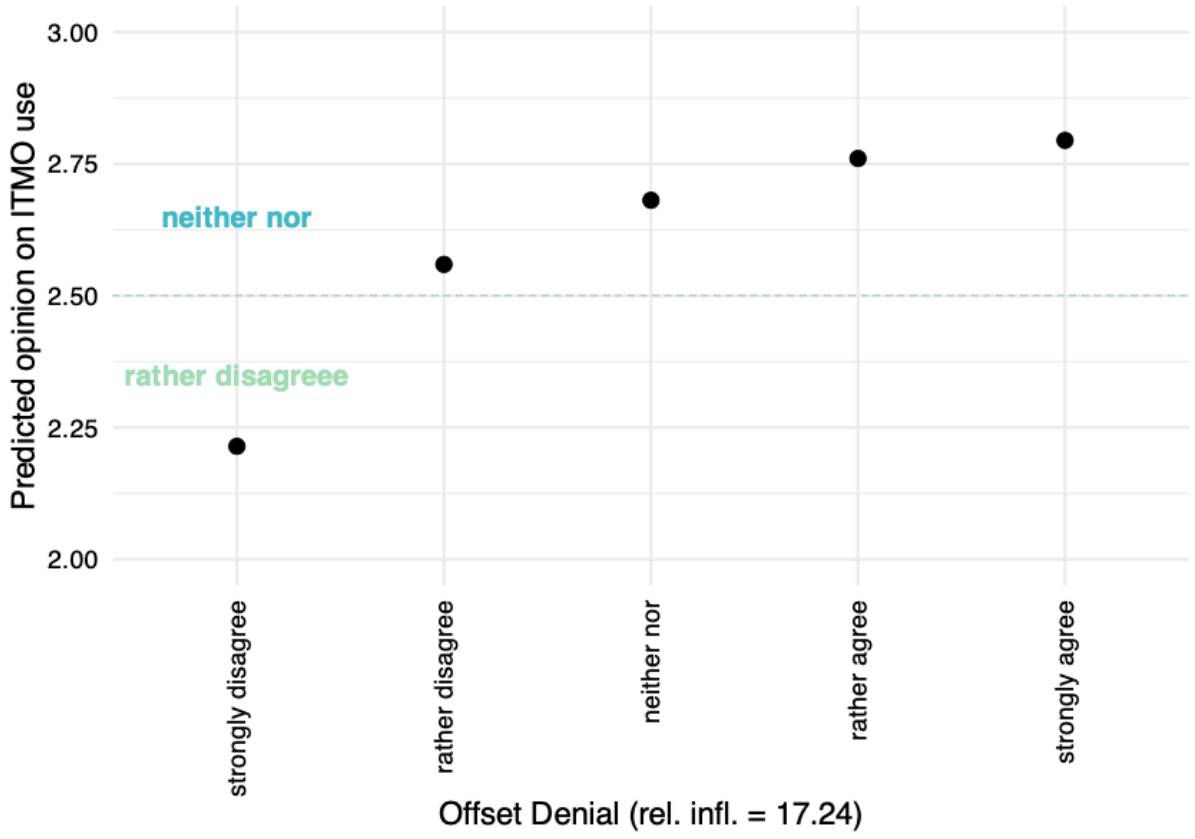


Figure 15: Prediction for ITMO opinions given energy cooperation preferences, i.e., agreement with "Switzerland should cooperate more with the EU to secure Switzerland's future energy supply."

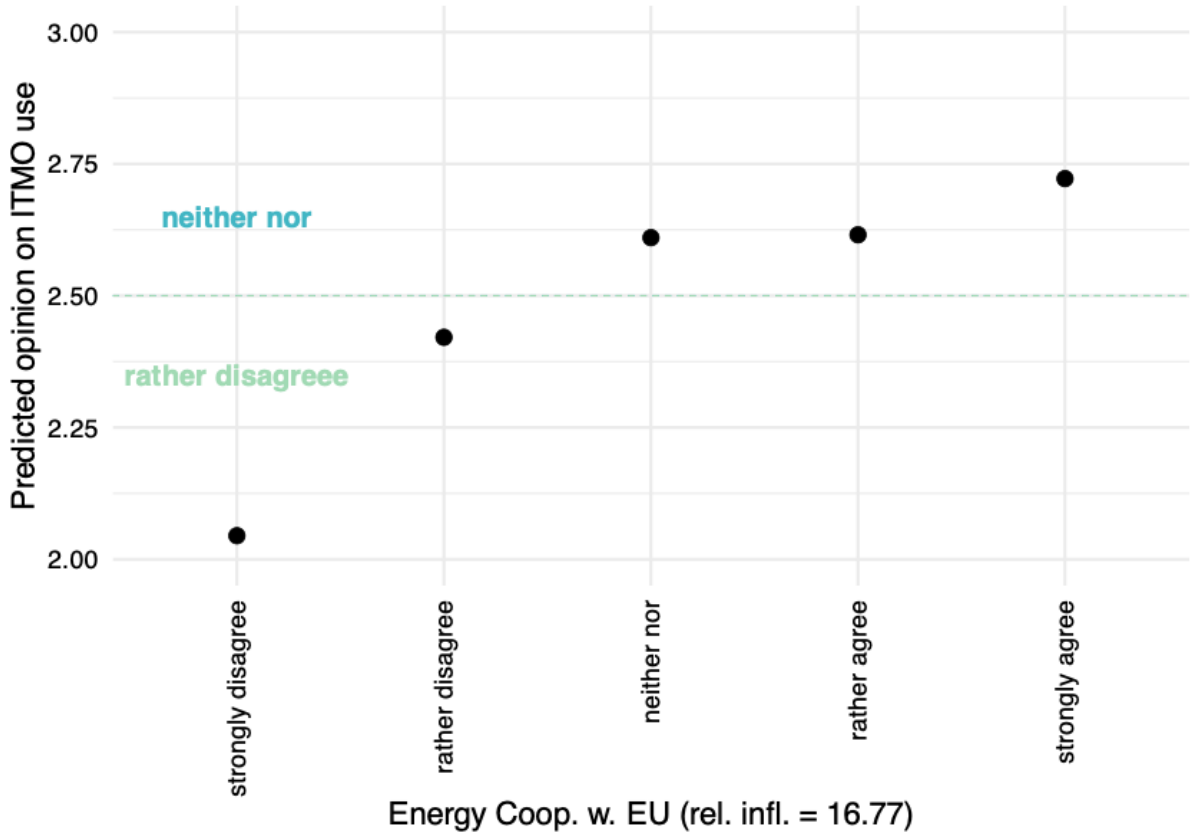


Figure 16: Prediction for ITMO opinions given electricity import preferences, i.e., agreement with "In order to guarantee Switzerland's electricity supply in the future, more electricity is to be imported from abroad."

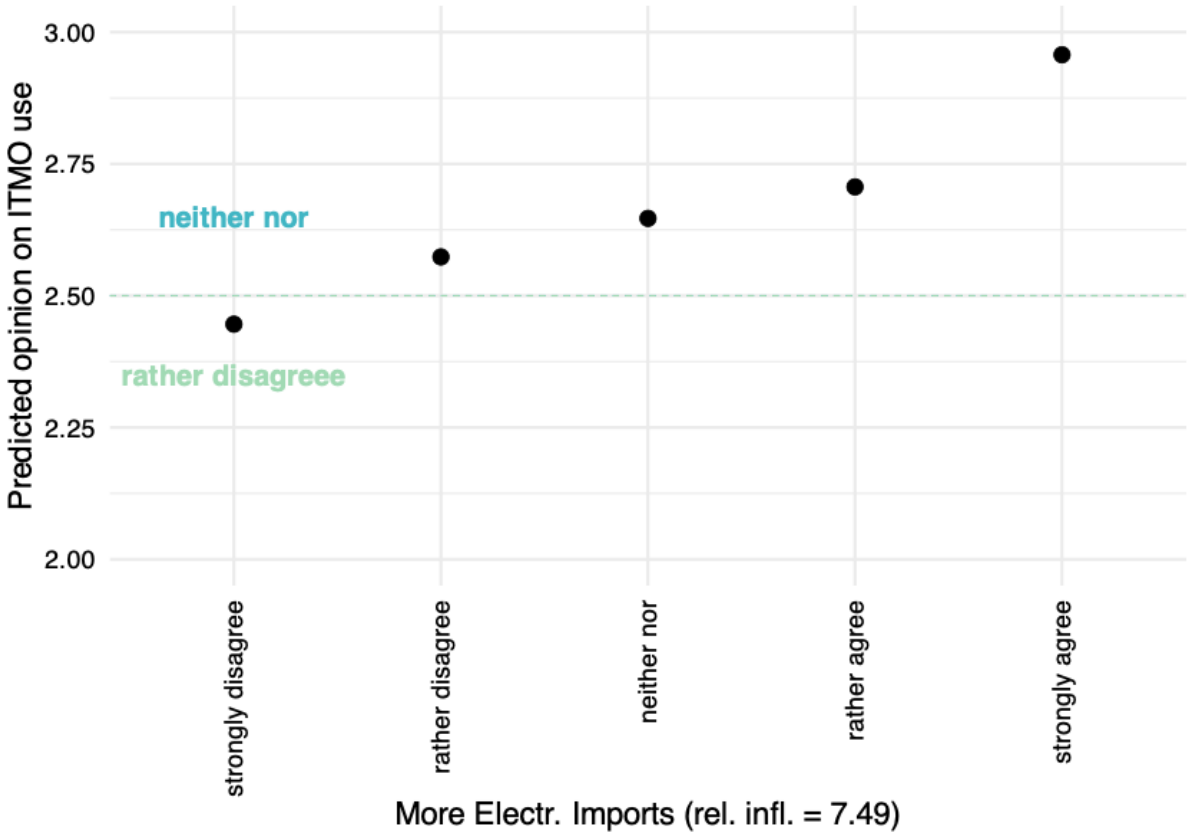


Figure 17: Prediction for ITMO opinions based on Birth Year

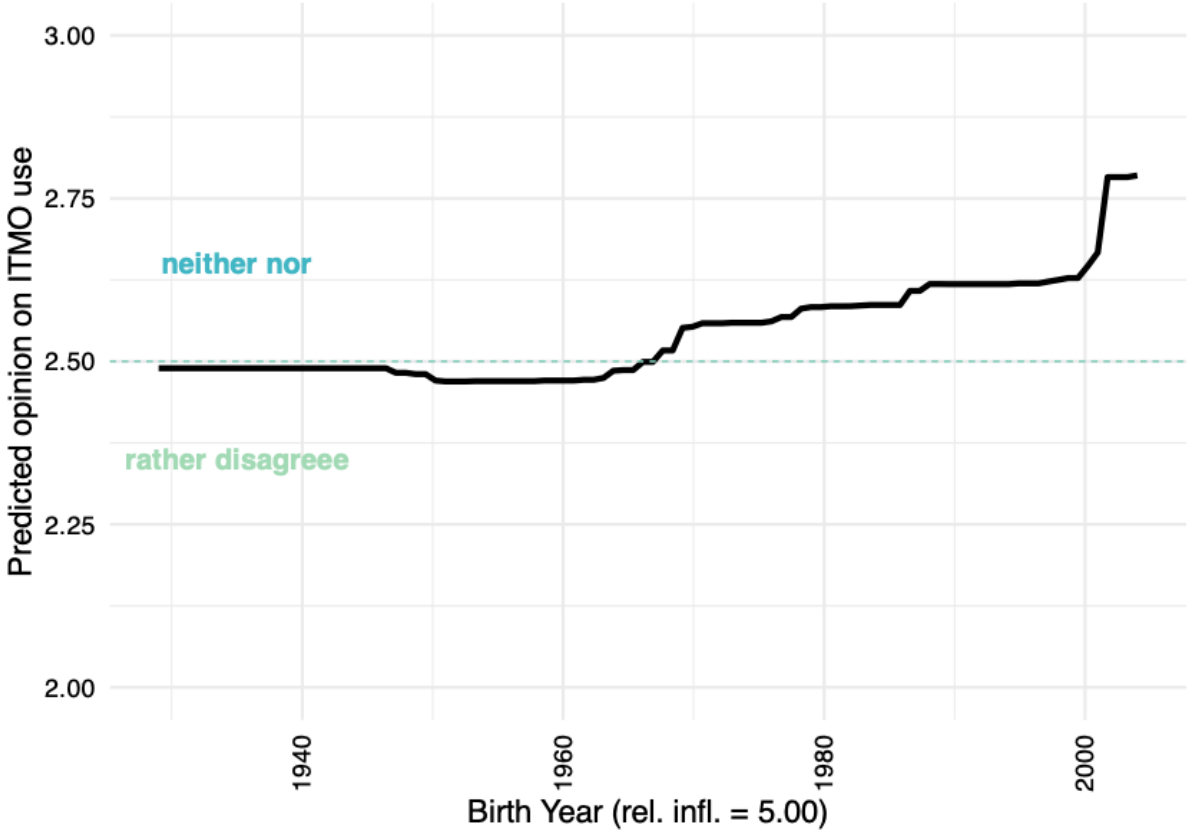


Figure 1118: Prediction for ITMO opinions given EDGE region of respondents home location

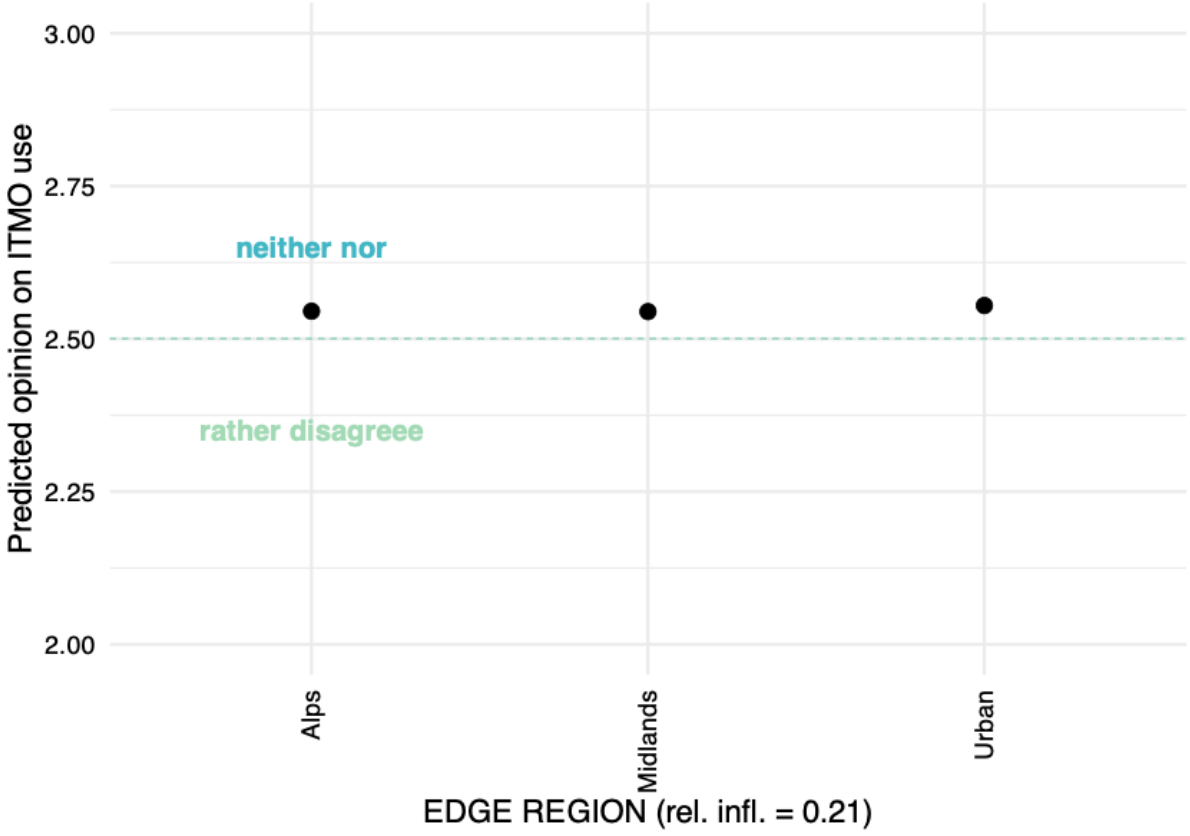


Table 7: Conjoint design

Attribute	*Levels*
Price per module	1. 200 CHF 2. 250 CHF 3. 300 CHF 4. 350 CHF
Type of reimbursement to respondent	5. Credit voucher on the electricity bill (10 years guaranteed) 6. Mobility voucher, e.g. voucher for charging electric cars or using public transportation (10 years guaranteed) 7. One time tax deduction 8. Solar vignette (a proof of investment as a plaque, sticker or the like. 10 years guaranteed.) 9. The federal government pays the same amount into the old-age and survivors' insurance compensation fund. 10. The federal government pays the same amount to an energy project in a developing country.
Location of the solar power plant	11. On a building in the residential community 12. On a farm 13. On traffic infrastructure in the residential community (e.g. noise barriers of highways and train lines, roofs of bus stops or train stations) 14. In a skiing area (e.g. avalanche barriers, ski lifts) 15. On a roof of a large consumer in the residential community (e.g. industry, school, indoor swimming pool)
Provider	16. A local club or association 17. The electricity provider at your place of residence 18. The community of the solar power plant 19. A start-up 20. A large company 21. A local farm
Purchasing modality	22. Via a form sent by the project managers 23. During a meeting with project managers 24. Registration forms are available at retailer check-outs 25. Via web shop 26. Within the scope of an information event 27. Additional option when buying an electric appliance or electric car