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Highlights Report Year 3

EDGE

Source: Visualisation of the planned PV plant at the airport in Samedan, Engadin ©TNC Consulting 2024

sweet swiss energy research for the energy transition

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Highlights

The EDGE consortium was able to integrate individual activities towards first overarching results, which should help to increase the pace towards a more renewable and less import-dependent Swiss energy system. Starting with results from the national survey on preferences for diverse energy solutions and sparked by our demonstration projects, refined assessments of theoretical and more renewable potential for solar PV, wind energy and biomass have been made and will continue to be updated according to changing boundary conditions on implementation pathways. These potential assessments are being combined with new results for future demand due to electrification and grid constraints. On a local scale, the recommender tool uses this input for supporting local communities in their future energy planning. On a national scale, full energy system models are used to develop technically viable scenarios for a future fully-renewable Switzerland. This is documented in the first Renewable Energy Outlook, which was released in early 2024, and shows the technical feasibility of replacing nuclear power by mostly solar PV, wind and also biomass. This will only be possible by maintaining the possibility to import energy from Europe, especially during the winter. To aid the actual implementation of renewable installations, the financing needs have been analysed for the diverse installation options and show a promising situation for rooftop, alpine and agri-PV. To inform political and governance decisions, factors that boost or impede new installations of renewable energies, have been analysed, for example for wind and PV. Distributional effects of regulations and subsidies have been pointed out. Overall, the picture emerges that winter production needs to stay in the focus of support for new-renewable installations, which is best achieved with a combination of Alpine PV and wind. The latter must play a more important role - current acceptance studies show that this can certainly be successful. Despite the recent setbacks, Alpine PV and its contribution to winter production has to remain at the centre of support measures. Acceptance problems for large free-standing plants could draw attention to smaller and medium-sized installations, preferably in conjunction with existing infrastructure in the mountains.

Faits marquants

Le consortium EDGE a été en mesure d'intégrer des activités individuelles en vue d'obtenir des résultats globaux, ce qui devrait contribuer à accélérer le rythme vers un système énergétique suisse plus renouvelable et moins dépendant des importations. Basé sur les résultats de l'enquête nationale sur les préférences pour diverses solutions énergétiques et déclenché par nos projets de démonstration, des évaluations affinées du potentiel théorique et plus renouvelable de l'énergie solaire photovoltaïque, de l'énergie éolienne et de la biomasse ont été réalisées et continueront d'être mises à jour en fonction de l'évolution des conditions limites sur les voies de mise en œuvre. Ces évaluations du potentiel sont combinées à de nouveaux résultats concernant la demande future due à l'électrification et aux contraintes du réseau. À l'échelle locale, le recommender tool utilise ces données pour soutenir les communautés locales dans leur planification énergétique future. À l'échelle nationale, des modèles de systèmes énergétiques complets sont utilisés pour développer des scénarios techniquement viables pour une Suisse entièrement renouvelable dans le futur. Ces scénarios sont documentés dans le Renewable Energy Outlook, publié au début de l'année 2024, qui montre la faisabilité technique du remplacement de l'énergie nucléaire par l'énergie solaire photovoltaïque, l'énergie éolienne et aussi la biomasse. Cela ne sera possible qu'en maintenant la possibilité d'importer de l'énergie européenne, en particulier pendant l'hiver. Pour faciliter la mise en œuvre effective des installations renouvelables, les besoins de financement ont été analysés pour les différentes options d'installation et montrent une situation prometteuse pour les toits, les alpages et l'agri-PV. Pour éclairer les décisions politiques et de gouvernance, les facteurs qui stimulent ou entravent les nouvelles installations d'énergies renouvelables ont été analysés, par exemple pour l'éolien et le photovoltaïque. Les effets distributifs des

réglementations et des subventions ont été soulignés. Dans l'ensemble, il apparaît que la production hivernale doit rester au centre du soutien aux nouvelles installations d'énergies renouvelables, ce qui est plus facile à réaliser en combinant le photovoltaïque et l'éolien dans les Alpes. Ce dernier doit jouer un rôle plus important - les études d'acceptation actuelles montrent que cela a un potentiel de réussite. Malgré les récents revers, le photovoltaïque alpin et sa contribution à la production hivernale doivent rester au centre des mesures de soutien. Les problèmes d'acceptation des grandes installations autonomes déplacer l'attention vers les installations de petite et moyenne taille, de préférence en lien avec les infrastructures existantes dans les montagnes.

Highlights

Das EDGE-Konsortium konnte im dritten Jahr die einzelnen Aktivitäten in erste übergreifende Ergebnisse integrieren, die dazu beitragen, die Transformation zu einem erneuerbaren und weniger importabhängigen Schweizer Energiesystem zu beschleunigen. Ausgehend von den Ergebnissen der nationalen Umfrage zu den Präferenzen für verschiedene Energielösungen und angeregt durch die EDGE-Demonstrationsprojekte wurden verfeinerte Abschätzungen des theoretischen Potenzials für die Photovoltaik, die Windenergie und die Biomasse vorgenommen. Diese werden weiterhin aktualisiert, um den sich ändernden Randbedingungen der Wege zur Umsetzung Rechnung zu tragen. Diese Potenzialabschätzungen werden mit neuen Ergebnissen für die zukünftige Nachfrage aufgrund von Elektrifizierung und Netzbeschränkungen kombiniert. Auf lokaler Ebene nutzt das Recommender Tool diesen Input zur Unterstützung von Gemeinden für ihre zukünftige Energieplanung. Auf nationaler Ebene werden vollständige Energiesystemmodelle verwendet, um technisch realisierbare Szenarien für eine in Zukunft vollständig erneuerbare Schweiz zu entwickeln. Dies wird im ersten Renewable Energy Outlook REO dokumentiert, der Anfang 2024 veröffentlicht wurde, und der die technische Machbarkeit des Ersatzes der Kernenergie durch Photovoltaik, Windkraft und auch Biomasse aufzeigt. Dies wird nur möglich sein, wenn die Möglichkeit weiter besteht, Energie aus Europa zu importieren, besonders im Winter. Um die eigentliche Umsetzung von Anlagen zur Produktion erneuerbarer Energie zu unterstützen, wurde der Finanzierungsbedarf für die verschiedenen Installationsoptionen analysiert. Dabei zeigt sich, dass die Situation für Dach-, Alpin- und Agrar-PV vielversprechend ist. Als Grundlage für politische und verwaltungstechnische Entscheidungen wurden die Faktoren analysiert, die neue Produktionsanlagen für erneuerbare Energien, wie Wind und Photovoltaik fördern oder behindern können. Hierbei wurde auch demonstriert, wie regional unterschiedliche Vorschriften und Subventionen diese Faktoren beeinflussen können. Insgesamt ergibt sich das Bild, dass die Winterproduktion im Fokus der Förderung neuer Anlagen bleiben muss, was am besten mit einer Kombination aus alpiner PV und Wind erreicht werden kann. Letzterer muss eine wichtigere Rolle spielen – aktuelle Akzeptanzstudien zeigen, dass dies durchaus erfolgreich sein kann. Trotz der jüngsten Rückschläge muss die alpine PV und ihr Beitrag zur Winterproduktion im Zentrum der Fördermassnahmen bleiben. Akzeptanzprobleme für grosse Freiflächenanlagen könnten die Aufmerksamkeit auf kleinere und mittelgrosse Anlagen lenken, vorzugsweise in Verbindung mit bestehender Infrastruktur in den Bergen.

Punti salienti

Il consorzio EDGE è stato in grado di integrare le singole attività verso primi risultati comuni, che dovrebbero contribuire ad aumentare il ritmo verso un sistema energetico svizzero più rinnovabile e meno dipendente dalle importazioni. Partendo dai risultati del sondaggio nazionale sulle preferenze per le diverse soluzioni energetiche e grazie ai nostri progetti dimostrativi, sono state effettuate valutazioni raffinate del potenziale teorico e rinnovabile per il solare fotovoltaico, l'energia eolica e la biomassa, che

continueranno a essere aggiornate in base ai mutevoli percorsi di attuazione. Queste valutazioni del potenziale vengono combinate con nuovi risultati relativi alla domanda futura dovuta all'elettrificazione e ai vincoli della rete. Su scala locale, lo Recommender Tool utilizza questi input per supportare le comunità locali nella loro futura pianificazione energetica. Su scala nazionale, i modelli di sistemi energetici completi vengono utilizzati per sviluppare scenari tecnicamente validi per una futura Svizzera completamente rinnovabile. Questo è documentato nel primo Renewable Energy Outlook, pubblicato all'inizio del 2024, che mostra la fattibilità tecnica della sostituzione dell'energia nucleare principalmente da solare fotovoltaico, eolico e biomassa. Ciò sarà possibile solo mantenendo la capacità di importare energia dall'Europa, soprattutto durante l'inverno. Per favorire l'effettiva realizzazione di impianti rinnovabili, sono state analizzate le esigenze di finanziamento per le diverse opzioni di installazione e si evidenzia una situazione promettente per il fotovoltaico su tetto, alpino e agricolo. Per informare le decisioni politiche e di governance, sono stati analizzati i fattori che favoriscono o ostacolano le nuove installazioni di energie rinnovabili, ad esempio per l'eolico e il fotovoltaico. Sono stati evidenziati gli effetti distributivi di regolamenti e sussidi. Nel complesso, emerge che la produzione elettrica invernale deve rimanere al centro del sostegno alle nuove installazioni di energie rinnovabili, il che si ottiene meglio con una combinazione di fotovoltaico ed eolico alpino. Quest'ultimo deve svolgere un ruolo più importante - gli attuali studi di accettazione dimostrano che esiste un potenziale di successo. Nonostante le recenti svantaggi, il fotovoltaico alpino e il suo contributo alla produzione invernale devono rimanere al centro delle misure di sostegno. I problemi di accettazione dei grandi impianti indipendenti potrebbero spostare l'attenzione verso impianti di piccole e medie dimensioni, preferibilmente in connessione con le infrastrutture già esistenti in montagna.

1 Highlights of the reporting period

1.1 Renewable Energy Outlook REO

The Renewable Energy Outlook presents three strategies to advance Switzerland's green electricity production, aligning with national goals of carbon neutrality and nuclear phase-out. These strategies aim to achieve substantial increases in renewable energy output by 2035, with targets of renewable production of 17, 25 and 35 TWh/year.

The first strategy emphasizes diversity in energy sources, combining technologies such as solar, wind, biomass, and biogas to ensure supply security. The second strategy focuses on solar photovoltaic installations with storage batteries, predominantly on private roofs, while the third strategy prioritizes productivity, optimizing the production for wind and photovoltaic infrastructures, including photovoltaics on rooftops and in open fields.

Each strategy presents varying implications for technical, regional, economic, and social factors. While substantial investments ranging from CHF 0.5 billion to CHF 2.1 billion annually are required until 2035, these strategies are projected to create between 18'000 and 57'000 full-time jobs per year. Photovoltaic installations emerge as the dominant energy source across all models and therefore absorb the largest portion of investment while generating the most employment opportunities.

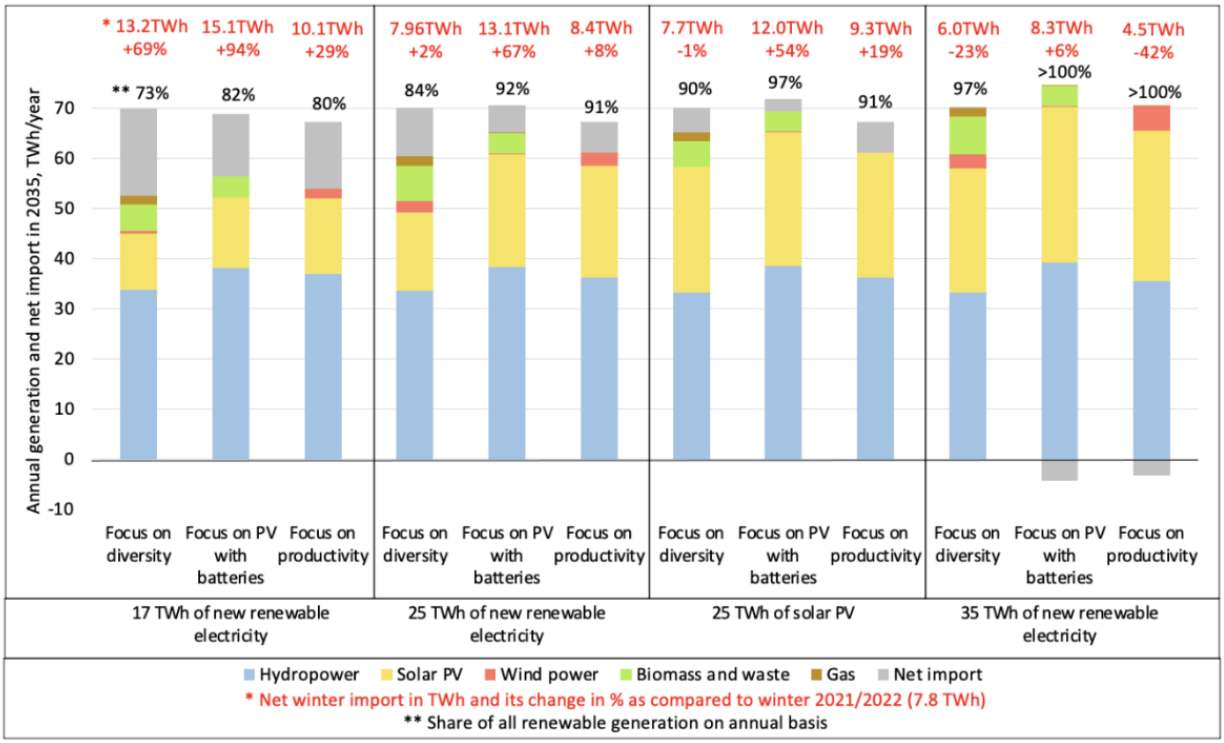

Figure 1: Electricity supply mix, share of new renewable electricity, and net winter electricity import in 2035 in the case of 61.2 TWh/year final electricity demand. Note that the aggregation is over the whole half-year for winter and that for the main winter months. The more renewable energy is produced in Switzerland, the higher the degree of self-sufficiency is, without fully covering the core winter months.

The models demonstrate that achieving the proposed electricity production targets is technically feasible without nuclear power, as also shown in figure 1. Moreover, higher targets lead to larger over-production

with respect to demand in the summer, with the 35 TWh/year target leading to a nearly balanced domestic renewable production over the year. However, electricity exchange with Europe will increase and imports will remain crucial for balancing supply and demand, particularly during winter. Overall, these findings endorse the technical viability of ambitious green electricity targets, including the recently approved 35 TWh/year goal.

1.2 Recommender tool: Supporting communities in energy planning

Energy planning supports communities to take future-oriented decisions for the development of the energy system and help to integrate renewable energy. However, small to medium sized communities can often not afford professional energy system planning activities.

The recommender tool helps communities to identify (local to regional) renewable energy potentials and to assess the impact (cost, energy and emission savings) of different energy system options to increase the share of locally produced renewable energy. To streamline its usability, the tool is equipped with validated public data about the community, its infrastructure, and its energy system. It automatically selects suitable energy system options and assesses their impact through a dynamic energy system model. Target groups are community representatives as well as experts from utilities and planners, supporting the community in their energy planning efforts.

In EDGE, a first prototype of the tool has been developed during years 1 – 3 and three key steps were achieved: First, public data about the energy system were identified and aggregated. Second, novel classical and machine learning tools were developed to remove inconsistencies, correct false, and impute missing data. Third, an energy system model was developed to assess the impact of different energy system options. In year 3, the simulation model has significantly improved and is currently under validation with real-world measurement data from single buildings as well as data from communal energy systems. As next steps, the aggregated data will be exploited to develop methods to suggest community specific options for the energy system development.

Currently, three families of field tests are running to assess the tool's accuracy and applicability: First, supporting initiatives to integrate more locally generated renewable energy such as «Regionale Identität Baden-Brugg» in their activities to push the integration of PV and prosumers in a district. The provided potential maps helped to motivate building owners to agree to a more in-depth analysis of solutions. Second, a field test with the community Sirnach and its utility EW Sirnach, where the recommender tool is tested as an aid for a digital energy planning process. The tests indicate that the data quality for Sirnach is higher than expected and estimations of the energy demand match actual values within expectable deviations. Third, the utility Eniwa where the tool is tested for supporting the planning process of district heating networks. The tests indicate that the developed methodology provides reliable planning data and suggestions for thermal grids. However, the actual planning process necessitates also the consideration of non-technical factors (building code, protected areas, etc.).

Summarized, the recommender tool supports communities, utilities, and planners in ensuring a higher integration of renewable energy in the communal energy system, thus implementing the key objective of EDGE. It therefore serves as an integrating activity across many teams in EDGE and leverages results e.g., from potential and demand quantification or grid constraints.

1.3 Progress in renewable potential estimates

2023 has seen several updates on renewable potential estimates in Swiss landscapes. Applying refined criteria for PV placement over agricultural land, it could be shown that the theoretical potential for Agri-

PV is substantial and that it could contribute significantly to the Swiss energy turn-around. Given the lack of practical experience in Switzerland regarding the benefits of using PV for agricultural production, it was not considered that PV over many types of crops is incompatible with current agriculture practices. The calculated potential therefore represents a maximum theoretical potential, while the practical potential may be much lower. The positive effects on agriculture must be proven before a roll-out of this type of system can be recommended, as current legislation states that agrivoltaics should not weaken or even make agricultural production impossible.

The PV-potential estimates for roofs have been updated as well, and maps of PV potential, based on the available incoming radiation, have been published. The latter are important as they allow estimates at high spatial resolution for snow-covered mountain locations. Especially as so far, the effect of a reflecting snow cover is not properly accounted for in standard software packages such as PolySun or PVSyst.

A lot of development work has gone into improved estimates of wind in complex terrain. The machine learning tool WindTopo has been refined and is now being applied to specific target areas for a more complete assessment of wind potential in mountainous terrain. It has been shown that this assessment has higher accuracy than previous methods. The wind work includes measurement campaigns, for example at Gotthard, and a characterisation of the influence of mountain waves and Föhn events on wind energy production. A new branch of wind work was initiated on specific requests from our cooperation partners: For high Alpine PV installations, wind load estimates are crucial for design and dimensioning decisions. Therefore, we have combined computational fluid dynamics and extreme value statistics to make accurate estimates of maximum wind loads in PV panel fields. This wind work will also be used in future to study snow accumulation and develop tools for accumulation mitigation in Alpine PV installations, an example is shown in figure 2.

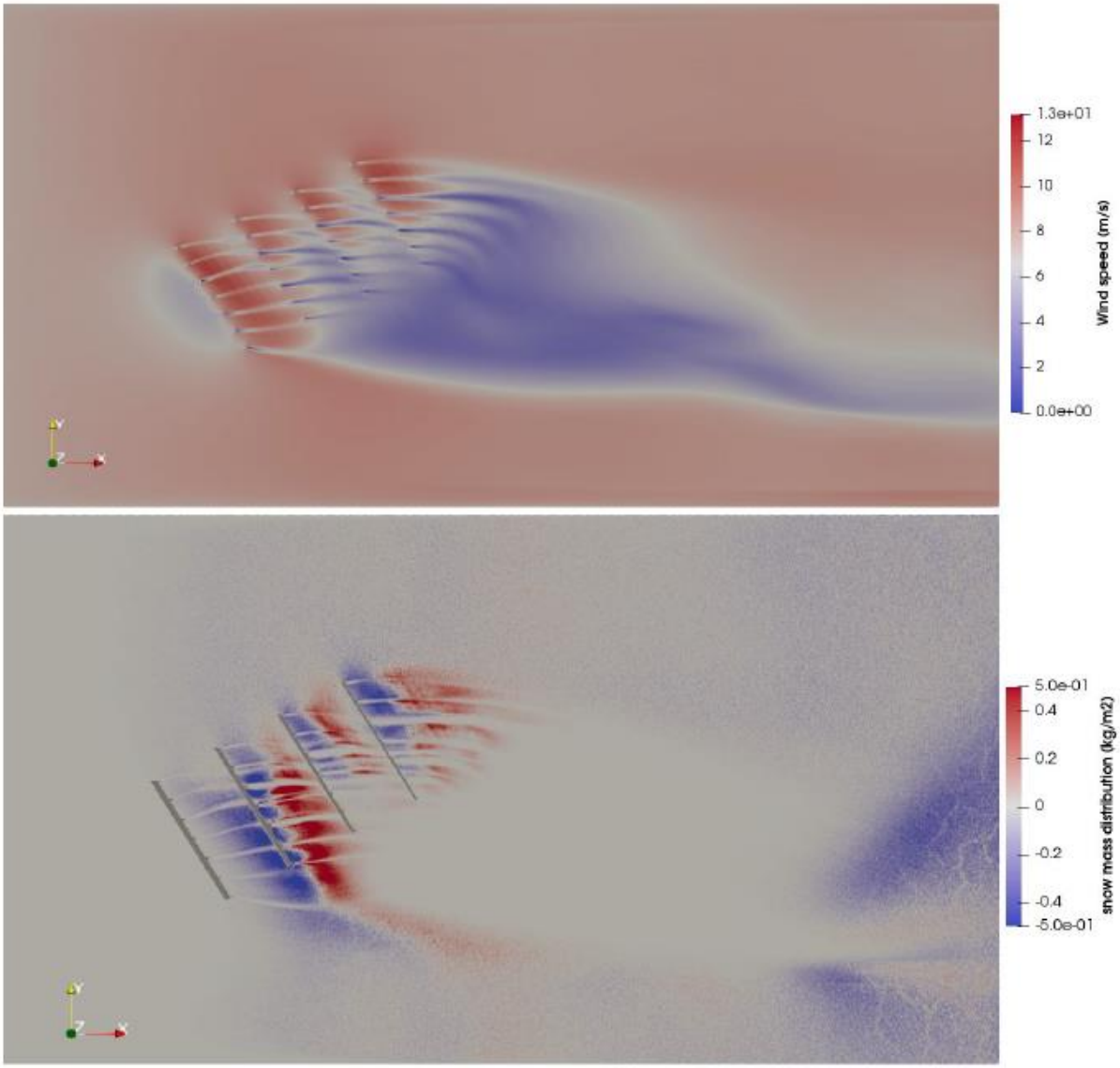

Figure 2: a) Wind loads on PV panels for the design planned for the Samedan Alpine PV plant. b) A first assessment of potential snow accumulation between the rows of the Samedan plant.

2 Outputs of the reporting period

Peer-reviewed publications

Author(s), title, journal name, year	**doi**
V. Heinisch, J. Dujardin, P. Gabrielli, P. Jaine, M. Lehning, G. Sansavini, J.-P. Sasse, C. Schaffner, M. Schwarz, E. Trutnevyte. Inter-comparison of spatial models for high shares of renewable electricity in Switzerland, 2023, Applied Energy, 350, 121700	**https://doi.org/10.1016/j.apenergy.2023.121700**
F. Kristianti, J. Dujardin, F. Gerber, H. Huwald, S. W. Hoch, M. Lehning. Combining Weather Station Data and Short-Term LiDAR Deployment to Estimate Wind Energy Potential with Machine Learning: A Case Study from the Swiss Alps", in Boundary-Layer Meteorology, May 2023	**https://doi.org/10.1007/s10546-023-00808-y**
M. Meyer, E. Linder, U. Schilt, S. Schneeberger, A. Melillo, E. Köker, P. Gökgöl, P. Schuetz. Tool for evaluation of energy system options for municipalities, 2023, Journal of Physics: Conference Series, Volume 2600, Energy & thermal management systems, Conf. Ser. 2600 022010	**DOI:10.1088/1742-6596/2600/2/022010**
N. Ratnaweera, A. Kahl, V. Sharma. Geospatial segmentation of high-resolution photovoltaic production maps for Switzerland, 2023, Frontiers in Energy Research,	**https://doi.org/10.3389/fenrg.2023.1254932**
S. Ruprecht. Bridging the gap: the influence of information and education on acceptance of environmental taxes in Switzerland, 2023, Environ. Res. Commun. **5** 075010	**DOI 10.1088/2515-7620/ace29f**
J.-P. Sasse, E. Trutnevyte. Cost-effective options and regional interdependencies of reaching a low-carbon European electricity system in 2035, 2023, Energy 2023, 282, 128774.	**https://doi.org/10.1016/j.energy.2023.128774**
J.-P. Sasse, E. Trutnevyte. Low-carbon electricity sector in Europe risks sustaining regional inequalities in benefits and vulnerabilities, 2023, Nature Communications 2023, 14, 2205.	**https://www.nature.com/articles/s41467-023-37946-3**
U. Schilt, E. Linder, M. Meyer, S. Schneeberger, A. Melillo, P. Roos, P. Schuetz. Modelling of multi-energy systems of residential buildings with Calliope and validation of results, 2023, Journal of Physics: Conference Series, Volume 2600, Energy performance modelling, Conf. Ser. 2600 032005	**DOI:10.1088/1742-6596/2600/3/032005**
S. Schneeberger, E. Lucas, C. Meister, P. Schuetz. Wärmebedarfsschätzungen für	**PDF**

Wohngebäude, 2024, 18. Symposium Energieinnovation, 14.-16.02.2024, Graz/Austria	
T. Schmidt, I. Stadelmann-Steffen, M. Dukan, D. Giger, N. Schmid, V. Schneuwly. Quantifying the degree of fragmentation of policies targeting household solar PV in Switzerland, 2023, First EDGE White Paper	**https://doi.org/10.3929/ethz-b-000596612**
A. Torné, E. Trutnevyte. Banning fossil fuel cars and boilers in Switzerland: Mitigation potential, justice, and the social structure of the vulnerable, 2024, Energy Research & Social Science, Volume 108, February 2024, 103377	**https://doi.org/10.1016/j.erss.2023.103377**
M. Wild, M. Siegwart, N. Stocker, J. Rohrer. Nachhaltiges Energiekonzept für Biogasanlagen: Fallstudie Wittenbach, 2024, ZHAW Zürcher Hochschule für Angewandte Wissenschaften.	**https://doi.org/10.21256/zhaw-2648**

Policy briefs, white papers, discussion papers

Author(s), title, channel or type of publication, year
C. Bucher, D. Joss, BFH, Netzanschluss von 50-Gigawatt Photovoltaik in der Schweiz - Diskussionspapier zu Lösungsansätzen für die Netzintegration, **https://arbor.bfh.ch/19728/**
D. Anderegg, M. Jäger, S. Strebel, J. Rohrer. Assessing the potential for agri-PV in Swiss agriculture, January 2024. Available in **English** and **German**. **https://doi.org/10.21256/zhaw-2649**
J. Schmid and I. Stadelmann-Steffen. 2023. Biomass-plants in Switzerland: Do cantonal policies make a difference for deployment? EDGE-Report.
J. Schmid and I. Stadelmann-Steffen. 2023. Wind energy-policy and authorization procedures in Switzerland: competences, duration, and effectiveness. EDGE-Report.
E. Trutnevyte, J.-P. Sasse, V. Heinisch, M. Dukan, P. Gabrielli, J. Garrison, P. Jain, S. Renggli, G. Sansavini, C. Schaffner, M. Schwarz, B. Steffen, J. Dujardin, M. Lehning, P. Ripoll, P. Thalmann, M. Vielle, I. Stadelmann-Steffen. Renewable Energy Outlook for Switzerland, 2024, University of Geneva: Geneva, Switzerland, **https://doi.org/10.13097/archive-ouverte/unige:172640**

Other non-peer-reviewed publications (working papers, press articles, etc.)

Author(s), title, channel or type of publication, year
SWEET EDGE, YouTube, "**What could the Swiss electricity supply look like in 2035?**", February 2024
SWEET EDGE, YouTube, "**Alpine photovoltaic in Switzerland: do we really need it?**", November 2023
SWEET EDGE, Infographic, "**What could the Swiss electricity supply look like in 2035?**", February 2024
SWEET EDGE, Infographic, "**Switzerland's energy strategy 2050 will trigger an increase of solar energy**", November 2023
SWEET EDGE, Newsletter 7, February 2024, **English**, **German**, **French**
SWEET EDGE, Newsletter 6, November 2023, **English**, **German**, **French**
SWEET EDGE, Newsletter 5, June 2023, **English**, **German**, **French**

Swissmechanic| **Lösungsansätze für die Netzintegration von Solarstrom** | 31.10.2023
Handelszeitung | **Special Solar- und Windenergie** | 16.03.2023
Tagesanzeiger |**Eine Solaranlage zu installieren, soll sich wirklich lohnen** | 11.03.2023
Der Bund | **Steuerchaos bei Solaranlagen ist beendet** | 10.03.2023
RTS Le journal 19h30 | **La Confédération ambitionne de disposer d'un approvisionnement en électricité entièrement renouvelable d'ici 2035 (04:21)** | 18.01.2024
SRF | **10 vor 10, Stand der Solarprojekte im Alpenraum (15:13)** | 16.05.2023
Plattform J | **«Null Eingriffe in die Landschaft und Ausbau der Erneuerbaren. Das geht nicht!»** | 23.01.2024 (video interview)
Schweizerischer Wasserwirtschaftsverband | **Beschwerde gegen Trift-Projekt eingereicht** | 17.01.2024
Maschinenmarkt.ch | **Drei Säulen für genügend Ökostrom in der Schweiz** | 15.01.2024
Vogel-media | Drei Säulen für genügend Ökostrom in der Schweiz | 15.01.2024
Sonnenseite.com | **Drei Strategien zur Förderung von Ökostrom in der Schweiz** | 13.01.2024
Sciencesprings | **Three strategies to boost green electricity in Switzerland** | 13.01.2024
Organisator | **Three strategies for promoting green electricity in Switzerland** | 12.01.2024
Newsbreak | **Three strategies to boost green electricity in Switzerland** | 11.01.2024
La Quotidiana | **Finam ras realisticas per energ as regenerablas** |11.01.2024
UNIGE | **Énergies renouvelables : trois stratégies pour booster l'électricité verte en Suisse** | 11.01.2024
Awp Informations financières | **Stratégies et coûts pour plus d'électricité "verte" en Suisse** |10.01.2024
Keystone ATS / Agence Télégraphique Suisse | **Stratégies et coûts pour plus d'électricité "verte" en Suisse** | 10.01.2024
Keystone SDA / Schweizerische Depeschenagentur | **Ziele für Ausbau erneuerbarer Energie sind laut Studie realistisch** | 10.01.2024
Techxplore | **Three strategies to boost green electricity in Switzerland** | 10.01.2024
Lifetechnology | **Three strategies to boost green electricity in Switzerland** | 10.01.2024
ETH Zürich | **Three strategies to boost green electricity in Switzerland** | 10.01.2024
ETH Zürich | **Drei Strategien zur Förderung von Ökostrom in der Schweiz** | 10.01.2024
Be-connected | **Schweizer Forschende entwickeln drei Strategien zum Ökostrom** | 10.01.2024
EPFL | **Trois stratégies pour booster l'électricité verte en Suisse** | 10.01.2024
EPFL | **Three strategies to boost green electricity in Switzerland** | 10.01.2024
Universität Bern – Medienmitteilung | **Drei Strategien zur Förderung von Ökostrom in der Schweiz** | 10.01.2024
Mirage News | **Three Tactics to Amplify Switzerland's Green Electricity** | 10.01.2024
Organisator | **Drei Strategien zur Förderung von Ökostrom in der Schweiz** | 10.01.2024
Science-online.org | **Drei Strategien zur Förderung von Ökostrom in der Schweiz** | 10.01.2024
Watson.ch| **Schweizer Ziele für den Ausbau erneuerbarer Energie sind laut Studie realistisch** | 10.01.2024
Nau | **Ziele für Ausbau erneuerbarer Energie sind laut Studie realistisch** | 10.01.2024
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Plattform J | **Studie zeigt: Ziele für Ausbau realistisch** | 10.01.2024
Der Brienzer | **Studie zeigt: Ziele für Ausbau realistisch** | 10.01.2024
Der Oberhasler | **Studie zeigt: Ziele für Ausbau realistisch** | 10.01.2024
Echo von Grindelwald | **Studie zeigt: Ziele für Ausbau realistisch** | 10.01.2024

Punkt4 | **Sweet Edge entwickelt drei Strategien zum Ökostrom** | 10.01.2024
Punkt4 | **Schweizer Forschende entwickeln drei Strategien zum Ökostrom** | 10.01.2024
Schweizerbauer.ch | **Ökostromziele: So sollen sie erreicht werden** | 10.01.2024
Pv magazine Deutschland | **Forscher präsentieren Konzepte für massiven Erneuerbaren-Ausbau in der Schweiz** | 10.01.2024
Bauernzeitung.ch | **Forscher sehen Bedarf für Stromproduktion auf Alpen** | 10.01.2024
Bulletin.ch | **Comment intégrer 50 GW au réseau?** | 14.12.2023
Bulletin.ch **| Wie bringt man 50 GW ins Netz?** | 14.12.2023
Bulletin.ch | **Strom aus den Alpen** | 28.09.2023
Insidenews | **BFH-Forschende: Solarstrom muss besser integriert werden** | 07.09.2023
BFH | **Spannungsabhängige Wirkleistungsregelung. Wie PV-Wechselrichter sinnvoll das Netz stützen** | July 2023
Bulletin.ch | **PV-Wechselrichter stabilisieren das Netz** | 20.06.2023
Gebaeudetechnik-news.ch | **Trotz mehr Solarstrom kein Netzausbau notwendig?** | 2023
Financial Times | **Switzerland passes law to cut carbon emissions after fractious referendum** | 18.06.2023
EPFL | **Des prévisions météorologiques et climatiques plus précises** | 01.03.2023
Ali Darudi, Hannes Weigt, "**Electricity adequacy in Switzerland and Europe for the winter 2022-2023**," in **EconStor Preprints** 268379, ZBW - Leibniz Information Centre for Economics, 2023

Invited talks (scientific or broad audience)

Presenter(s), title, name of the event and location, year
Gracia Brückmann, Climact Swiss' seminar, **The Energy Transition is a SWEET dea**l, 16.10.2023
Gracia Brückmann, Energy Policy Support Increases through Policy Goal Communication, London School of Economics and Political Science, Social Policy Research Seminar
Alexandre Torné, Evelina Trutnevyte, Banning fossil fuel cars and boilers in Switzerland: mitigation potential, justice, and the social structure of the vulnerable, SDEWES conference 2023, Dubrovnik, Croatia, 26.09.2023
Evelina Trutnevyte, SWEET Conference, **Presentation about SWEET EDGE**, Bern, 06.09.2023
Gracia Brückmann, Acceptance of energy policies in the presence of policy goals, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Mak Dukan, Cost of capital for renewables and enabling technologies: Measuring the multidimensional heterogeneity in Switzerland, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Mert Duygan, Determinants of solar PV adoption in Swiss households, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Manuel Meyer, Reality: tales from communities, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Sabrina Mili, Investigating companies' preferences for corporate power purchase agreements, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
María Parajeles Herrera, Integration of transport electrification in an evolving power system, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Cristian Pons-Seres de Brauwer, Market acceptance of corporate energy prosumers on smart solar EV charging at work, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Giovanni Sansavini, Power grid security in the energy transition, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Philipp Schütz, Supporting energy decisions in communities with the recommender tool, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023

Isabelle Stadelmann-Steffen, Insights aus der Akzeptanzforschung, presentation at WWF Switzerland, Zurich, Switzerland, 2.11.2023
Isabelle Stadelmann-Steffen, EDGE survey results on policy acceptance, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Nicolas Stocker, Decentralized renewables in the Midlands: some hits and misses of a P&D project, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Alexandre Torné, Evelina Trutnevyte, Justice implications of banning fossil fuel boilers and private cars in Switzerland, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Annelen Kahl, Towards significant winter energy production from the Alps, SWEET EDGE biennial conference, Bern, Switzerland. 22.08.2023
Alexandre Torné, Evelina Trutnevyte, Banning the use of fossil fuel boilers and private cars in Switzerland: mitigation potential, fairness, and the social structure of the vulnerable, 8th NEST Conference 2023, Dresden, Germany, 30.06.2023
Energy Drinks, Does Switzerland really need alpine PV? Presentations (in German) from M. Lehning, J. Rohrer, I. Stadelmann, M. Dukan, 21 August 2024, Bern
Energy Drinks, Can Switzerland become fully renewable by 2050? Presentations (in German) from M. Schwarz, C. Bucher, G. Brückmann, S. Biollaz, Bern
Bucher, Christof, Joss, David, Fachtagung Netzanschluss: NA-Schutz, Burgdorf, 06.06.2023, Prüfung des internen NA-Schutzes, Demonstration interner NA-Schutz
Bucher, Christof, **Photovoltaik und Stromspeicherung**, Graz, 08.11.2023, Flexibilitätsoptionen im Niederspannungsnetz
Bucher, Christof, Energieforschungsgespräche Disentis 2024, Disentis, 26.01.2024, Netzanschluss von Photovoltaikanlagen

Completed master theses

Author, title, year
M. Bussmann, Auswirkungen verschiedener Eigenverbrauchsszenarien auf den Ausbaubedarf eines Schweizer Verteilnetzes, ZHAW, 2023
N. Da Silva Montenegro, Life cycle assessment of residential heating systems in Geneva: Current and projected environmental impacts, 2023
M. Frei, Smart Meter Customer Segmentation through Socio-Demographic Analytics on Municipality Level: A Case Study for the Canton of Lucerne, Lucerne University of Applied Sciences, 2024
D. G. Giger, Investment Variables Driving the Spatial Distribution and Economics of Rooftop Solar PV in Switzerland and the Role of Policy Design, ETH Zurich 2022
T. Giger, Estimating Heating Consumption Based on Combined Infrared and Optical Building Façades Images Using Deep Learning, Lucerne University of Applied Sciences, 2024
J. Gonzalez Contreras, Designing socially acceptable Swiss electricity supply scenarios for 2035 by linking population survey data and electricity supply modelling, University of Geneva (UNIGE), 2023
D. Gut, Economics and Financing of Alpine Solar Photovoltaics in the Swiss Alps, ETH Zurich, 2023
G. Rubino, Power-to-hydrogen in 2035 Swiss electricity mix: modelling and technology assessment, University of Geneva (UNIGE), 2023
A. Soubelet, Distributional implications of current solar PV incentives across Swiss households and evaluation of alternative schemes, University of Geneva (UNIGE) and Ecole Polytechnique Fédérale de Lausanne (EPFL), 2023

Other outputs

Brief description: Feasibility studies
David Joss, Peter Cuony, Patrick Joye, Cyril Käser, Christof Bucher, **Grid Optimization with Decentralized Actors Netzoptimierung mit dezentralen Aktoren**, BFH and Groupe e, Aramis, July 2023. Further information on the **poster** and on **BFH website** (partly funded by EDGE).
Jürg Rohrer, Christian Zeyer, **Versicherung für die Schweizer Stromversorgung : Vorschlag für eine rasche und kosteneffiziente Absicherung gegen Strommangellagen und Versorgungsprobleme im Strombereich**, Zurich University of Applied Sciences (ZHAW), April 2023, doi: 10.21256/zhaw-2457
Jürg Rohrer, Michael Wild, Nicolas Stocker, Muriel Siegwart, **Gibt es bessere Alternativen zu fossilen Kraftwerken für die Versorgungssicherheit der Schweiz mit Strom? : eine Analyse und Interpretation von diversen Studien zur Stromversorgungssicherheit**, Zurich University of Applied Sciences (ZHAW), March 2023, doi: 10.21256/zhaw-2529

Appendix

Deliverable reports

The following deliverable reports were completed in year 3 of SWEET EDGE and are available on Aramis.

Deliverable D1.2	**Need for energy balancing by region for renewable energy system scenarios of Switzerland**
Deliverable D2.2	**Publication on policy acceptance in the Swiss midlands: Policy acceptance in the Swiss midlands – Findings from the EDGE survey**
Deliverable D5.11	**Report on the Energy Concept of Biogas Plants**
Deliverable D5.12	**Report on Agri-PV Potential in Swiss Agriculture**
Deliverable D5.13	**Utilisation of permanent storage of CO2 from biogas plants – Evaluation using the example of a planned biogas plant in Wittenbach with a biomethane supply of 100 Nm3/h**
Deliverable D5.14	**Report on the suitability of microgrids for Switzerland**
Deliverable D7.1	**First renewable energy outlook for Switzerland**