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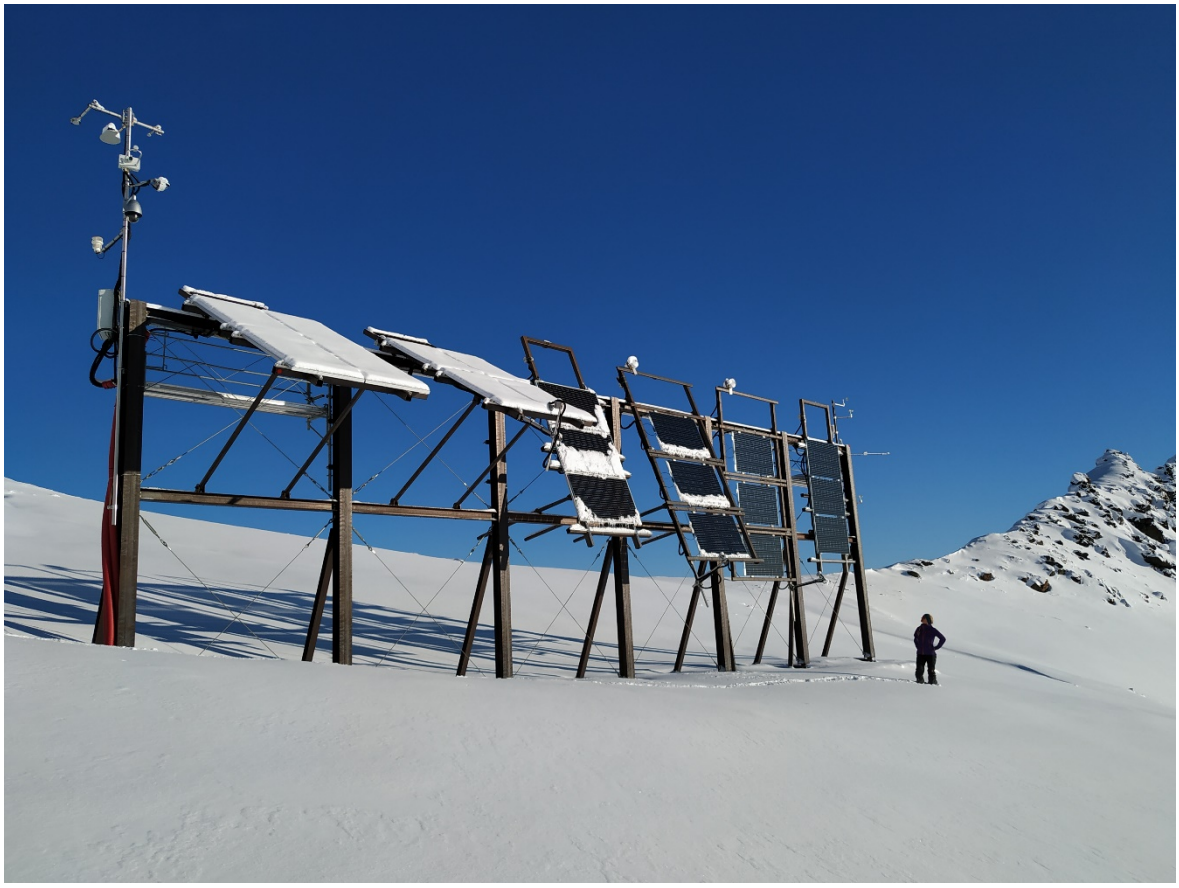
SWEET Call 1-2020 – SWEET EDGE



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sweet swiss energy research for the energy transition

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The authors bear the entire responsibility for the content of this report and for the conclusions drawn therefrom.

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Abbreviations

(in alphabetical order)

Abbreviation	Meaning
CHP	Combined Heat Power Units
EV	Electrical Vehicle
EXPANSE	Exploration Of Patterns In Near-Optimal Energy Scenarios (Model)
KPI	Key Performance Indicators
OREES	Optimized Renewable Energy By Evolution Strategy (Model)
P(f)	Active Power as a Function of the Grid Frequency (f=Frequency)
PPA	Corporate Power Purchase Agreements
P(U)	Active Power as a Function of the Grid Voltage
PV	Photovoltaic
Q(U)	Reactive Power as a Function of the Grid Voltage (U=Voltage)
RE	Renewable Energy
TWh	Terawatt Hours
WRF	Weather Forecasting And Research (Model)

Summary

The EDGE project aims at increasing the share of locally sourced renewable energy in the focus areas of cities, midlands and Alps. During the first reporting period of SWEET EDGE, the negotiation of the grant and consortium agreement, the addition of two new partners for the placeholder partner #9 and the set-up of management procedures, including the first meeting with the advisory board, could be completed. In particular, the negotiation of the consortium agreement took a long time because of learning processes on both sides, SFOE and project partners. As a result, some core activities started later than originally planned and the planning has been adjusted accordingly with the consent of SFOE.

The work in the individual work packages proceeds successfully. WP1 to WP3 have been reorganized into a matrix structure, in which the overarching topics “modelling and recommender tool”, ”techno-economic analysis”, ”grid capacities”, “operator recommendations”, “financing aspects”, “business models” and “governance” are treated across the geographic units of cities (WP1), midlands (WP2) and Alps (WP3). This has led to good progress in the specification of the recommender tool and the improvement of energy system models. The collection of new data on energy demand and on typical set-ups of local to regional energy hubs and their distribution grids has been achieved in combination with first results on grid management requirements, caused by increased local photovoltaic (PV) production and electric vehicle charging. An inter-comparison of three spatially explicit models of the Swiss electricity sector was conducted with publishable results to understand model divergences, and to prepare for the collaborative EDGE renewable energy outlook next year (WP7). The definition of the three EDGE areas was refined into nine areas, combining geographic types (midlands, Alps, and Jura) and settlement types (urban, peri-urban, rural). The determination of financing needs and the development of potential business models have started, with a particular focus on electric vehicle operation including for agricultural use. On governance, a comprehensive population survey focusing on the conditions for increased penetration of renewable generation and the acceptance of ambitious energy policies was designed and will be conducted soon (WP8).

Significant effort has been devoted towards the generation of P&D projects. In general, the generation of SFOE-conform P&D projects is a challenge, as the socio-economic boundary conditions are often not fulfilled for a self-sustained realization. Nonetheless, we are on a good track to launch P&D projects in all three areas of Alps, midlands and cities. In fact, one P&D project is already running (Muttsee) with financial support from Innosuisse. In the Alps, projects in Davos, at Lukmanier and the Valais have been identified as potential further candidates. In the midlands, Wittenbach is being considered and a small agro-PV site has been set-up. For the cities, multiple projects are in preparation.

Governance and management procedures have been fully established and appear suitable to ensure proper project execution for the full length of the project duration. Finally, the KTT activities are operating at full capacity. Our website and newsletters in three languages, social media, Youtube channel, interviews with implementation and support partners, and consortium meetings are ingredients for a successful dissemination of results.

In essence, EDGE started operating successfully, intended demonstration projects are in acquisition or starting and the scientific work provides the foundation of a successful implementation. The upcoming years will show, how the fundamental research results can be turned into actual implementations by EDGE.

Résumé

Le projet EDGE vise à augmenter la part des énergies renouvelables d'origine locale dans les villes, le plateau suisse et les Alpes. Au cours de la première période de rapport de SWEET EDGE, la négociation de la subvention et de l'accord de consortium, l'ajout de deux nouveaux partenaires (en lieu et place du partenaire #9) et l'instauration des procédures de gestion, y compris la première réunion avec le conseil consultatif, ont pu être achevés. En particulier, la négociation de l'accord de consortium a pris beaucoup de temps en raison des processus d'apprentissage des deux parties, l'OFEN et les partenaires du projet. En conséquence, certaines activités principales ont commencé plus tard que prévu et le planning a donc été ajusté avec l'accord de l'OFEN.

Le travail dans les différents WP se poursuit avec succès. Les WP1 à WP3 ont été réorganisés en une structure matricielle, dans laquelle les thèmes principaux "outil de modélisation et de recommandation", "analyse technico-économique", "capacités du réseau", "recommandations pour les opérateurs", "aspects financiers", "modèles économiques" et "gouvernance" sont traités à travers les trois types de zone : les villes (WP1), le plateau suisse (WP2), et les Alpes (WP3). Cela a permis une progression rapide dans la spécification de l'outil de recommandation et l'amélioration des modèles du système énergétique. La collecte de nouvelles données sur la demande d'énergie et sur les configurations typiques des centres énergétiques locaux et régionaux et de leurs réseaux de distribution a été réalisée en combinaison avec les premiers résultats sur les exigences de gestion du réseau causées par l'augmentation de la production photovoltaïque locale (PV) et la charge des véhicules électriques. Une inter-comparaison de trois modèles spatialement explicites du secteur électrique suisse a été réalisée et sera publiée prochainement. Cette étude permet de comprendre les divergences entre les modèles et de préparer la collaboration EDGE sur le rapport concernant les perspectives des énergies renouvelables l'année prochaine (WP7). La définition des trois zones géographiques de EDGE a été affinée en neuf zones, combinant des types de paysages (plateau, Alpes et Jura) et des types d'habitat (urbain, périurbain, rural). La détermination des besoins de financement et l'élaboration de modèles commerciaux potentiels ont commencé, avec un accent particulier sur l'utilisation de véhicules électriques, y compris à des fins agricoles. En ce qui concerne la gouvernance, une enquête exhaustive auprès de la population portant sur les conditions d'une pénétration accrue de la production d'énergie renouvelable et sur l'acceptation de politiques énergétiques ambitieuses a été conçue et sera menée prochainement (WP8).

Des efforts significatifs ont été consacrés à la création de projets de P&D. En général, la génération de projets de P&D conformes à l'OFEN est un défi car les conditions socio-économiques ne sont souvent pas remplies pour une réalisation autonome. Néanmoins, nous sommes sur la bonne voie pour lancer des projets de P&D dans les trois régions. En fait, un projet de P&D est déjà en cours (Muttsee) avec le soutien financier d'Innosuisse. Dans les Alpes, les projets de Davos, du Lukmanier et du Valais sont d'autres candidats potentiels. Sur le plateau suisse, Wittenbach est envisagé et un petit site agro-PV a été mis en place. Pour les villes, de multiples projets sont en préparation.

Les procédures de gouvernance et de gestion ont été entièrement établies et semblent convenir pour assurer la bonne exécution du projet pendant toute sa durée. Enfin, les activités du KTT fonctionnent à plein régime. Notre site web et nos bulletins d'information en trois langues, les réseaux sociaux, la chaine Youtube, les entretiens avec les partenaires de mise en œuvre et de soutien, et les réunions du consortium sont les ingrédients d'une diffusion réussie des résultats.

Pour résumer, EDGE a commencé à fonctionner avec succès, les projets de démonstration prévus sont en cours d'acquisition ou de démarrage et le travail scientifique constitue la base d'une mise en œuvre réussie. Les années à venir montreront comment les résultats de la recherche fondamentale peuvent être transformés en applications réelles par EDGE.

Zusammenfassung

Das Projekt EDGE hat das Ziel, den Anteil der lokal erzeugten erneuerbaren Energie in den Schwerpunktgebieten Stadt, Mittelland und Alpen zu erhöhen. Während des ersten Berichtszeitraums von SWEET EDGE konnten die Verhandlungen über die Finanzmittel und den Konsortialvertrag abgeschlossen werden. Zwei neue Partner für den bisher unbenannten Partner #9 konnten integriert werden, die Management-Strukturen wurden aufgebaut und die erste Sitzung mit dem Beirat fand statt. Insbesondere die Aushandlung des Konsortiumsvertrages nahm – aufgrund von Lernprozessen auf beiden Seiten, BFE und Projektpartner – viel Zeit in Anspruch. Dies hatte zur Folge, dass einige Kernaktivitäten später als ursprünglich geplant beginnen konnten, und die Gesamtplanung in Absprache mit dem BFE entsprechend angepasst wurde.

Die Arbeit in den einzelnen Arbeitspaketen kommt erfolgreich voran. WP1 bis WP3 wurden in eine Matrixstruktur umorganisiert, in der die übergreifenden Themen "Modellierung und Empfehlungswerkzeug", "Techno-ökonomische Analyse", "Netzkapazitäten", "Betreiberempfehlungen", "Finanzierungsaspekte", "Geschäftsmodelle" und "Governance" über die Schwerpunktgebiete Städte (WP1), Mittelland (WP2) und Alpen (WP3) hinweg behandelt werden. Dies hat zu guten Fortschritten bei der Spezifikation des Empfehlungswerkzeugs und der Verbesserung der Energiesystemmodelle geführt. Die Erfassung neuer Daten zum Energiebedarf und zu typischen Strukturen lokaler bis regionaler Energieknotenpunkte und ihrer Verteilnetze wurde erzielt in Kombination mit ersten Ergebnissen zu den Anforderungen an das Netzmanagement durch zunehmende lokale Photovoltaik-Produktion und erhöhten Strombedarf für Elektrofahrzeuge. Ein Vergleich von drei räumlich expliziten Modellen des Schweizer Elektrizitätssektors wurde durchgeführt, und die Ergebnisse wurden veröffentlicht, um die Abweichungen zwischen den Modellen zu verstehen und um die geplante EDGE-Prognose für erneuerbare Energien im nächsten Jahr vorzubereiten (WP7). Die ursprüngliche Definition der drei EDGE-Schwerpunktgebiete wurde in neun Gebiete verfeinert, die die Landschaftstypen (Mittelland, Alpen und Jura) und die Siedlungstypen (städtisch, stadtnah, ländlich) kombinieren. Die Ermittlung des Finanzierungsbedarfs und die Entwicklung potenzieller Geschäftsmodelle haben begonnen, mit einem Schwerpunkt auf dem Betrieb von Elektrofahrzeugen, auch für die Landwirtschaft. Zum Thema Governance wird momentan eine umfassende Bevölkerungsbefragung konzipiert, die sich auf die Randbedingungen für eine stärkere Durchdringung mit erneuerbaren Energien und auf die Akzeptanz ehrgeiziger energiepolitischer Massnahmen konzentriert. Sie wird in Kürze durchgeführt (WP8).

Erhebliche Anstrengungen wurden auch unternommen, um P&D-Projekte zu entwickeln. Generell ist es eine Herausforderung, BFE-konforme P&D-Projekte zu entwickeln, da die sozioökonomischen Randbedingungen für eine selbsttragende Umsetzung oft nicht erfüllt sind. Dennoch sind wir auf einem guten Weg, in allen drei Gebieten Alpen, Mittelland und Städte P&D-Projekte zu lancieren. Eines läuft sogar bereits (Muttsee), dies mit finanzieller Unterstützung von Innosuisse. In den Alpen sind Projekte in Davos, am Lukmanier und im Wallis mögliche weitere Kandidaten. Im Mittelland wird Wittenbach in Erwägung gezogen, wo eine kleine Agro-PV-Anlage errichtet wurde. In den Städten sind mehrere Projekte in Vorbereitung.

Governance- und Managementprozesse für EDGE wurden vollständig eingeführt und umgesetzt, und werden den ordnungsgemässen Projektablauf für die gesamte Laufzeit gewährleisten. Die Aktivitäten im Bereich Wissens- und Technologietransfer laufen sehr zufriedenstellend. Unsere Website und der Newsletter in drei Sprachen, die sozialen Medien, der Youtube-Kanal, Interviews mit Durchführungs- und Unterstützungspartnern und Sitzungen des Gesamtkonsortiums bieten Wege für eine erfolgreiche Verbreitung der Ergebnisse.

Im Wesentlichen hat EDGE seine Arbeit erfolgreich aufgenommen, die geplanten Demonstrationsprojekte befinden sich in der Akquisition oder in der Anfangsphase, und die wissenschaftliche Arbeit bildet die Grundlage für eine erfolgreiche Umsetzung. Die kommenden Jahre

werden zeigen, wie die Ergebnisse der Grundlagenforschung durch EDGE in die Praxis umgesetzt werden können.

Riassunto

Il progetto EDGE mira ad aumentare la quota di energia rinnovabile di origine locale nelle aree di interesse delle città, delle regioni centrali, e delle Alpi. Durante il primo periodo di riferimento di SWEET EDGE, è stato possibile completare la negoziazione della sovvenzione e dell'accordo consortile, l'aggiunta di due nuovi partner effettivi al posto del partner provvisorio #9 e l'impostazione delle procedure di gestione, compreso il primo incontro con l'advisory board. In particolare, la negoziazione dell'accordo consortile ha richiesto molto tempo a causa dei necessari processi di apprendimento da entrambe le parti, cioè l'UFE e i partner del progetto. Di conseguenza, alcune attività principali sono iniziate in ritardo rispetto a quanto originariamente previsto e la pianificazione è stata adattata di conseguenza con il consenso dell'UFE.

Il lavoro nei singoli WP procede con successo. I WP da 1 a 3 sono stati riorganizzati in una struttura a matrice, in cui i temi generali "modelling and recommender tool", "techno-economic analysis", "grid capacities", "operator recommendations", "financing aspects", "business models", e "governance" sono analizzati attraverso le diverse prospettive regionali, rispettivamente, delle città (WP1), delle regioni centrali (WP2) e delle Alpi (WP3). Questo ha portato a buoni progressi nelle specifiche dello strumento di raccomandazione ("recommender tool") e nel miglioramento dei modelli di sistema energetico ("modelling tool"). La raccolta di nuovi dati sulla domanda di energia e sulle architetture tipiche dei centri energetici locali e regionali e delle relative reti di distribuzione è stata realizzata insieme ai primi risultati sui nuovi requisiti di gestione della rete per far fronte all'aumento della produzione fotovoltaica locale e alla ricarica dei veicoli elettrici. Inoltre, è stato condotto un confronto tra tre modelli del settore elettrico svizzero aventi dettagliata risoluzione spaziale per comprendere le divergenze tra i modelli. Questo confronto ha portato a risultati pubblicabili e serve a preparare la compilazione del documento collaborativo di EDGE detto "Outlook sulle energie rinnovabili" prevista per prossimo anno (WP7). La definizione delle tre aree EDGE è stata perfezionata in nove aree, combinando tipi di paesaggio (pianura, Alpi e Giura) e tipi di insediamento (urbano, periurbano, rurale). È stata avviata la determinazione delle esigenze di finanziamento ("financing aspects") e lo sviluppo di potenziali modelli di business ("business models"), con particolare attenzione al funzionamento dei veicoli elettrici, anche per uso agricolo. Per quanto riguarda la governance, è stata progettata un'indagine demografica completa che si concentra sulle condizioni per una maggiore penetrazione della generazione rinnovabile e sull'accettazione di politiche energetiche ambiziose, la quale sarà condotta a breve (WP8).

Uno sforzo significativo è stato dedicato alla generazione di progetti dimostrativi P&D. In generale, la generazione di progetti P&D conformi alle specifiche di UFE rappresenta una sfida, poiché le condizioni socio-economiche di riferimento spesso non sono soddisfatte per una realizzazione autonoma. Ciononostante, siamo sulla buona strada per lanciare progetti di P&D in tutte e tre le aree: Alpi, regioni centrali, e città. In effetti, un progetto P&D è già in corso (Muttsee) con il sostegno finanziario di Innosuisse. Nelle Alpi, i progetti a Davos, al Lucomagno e nel Vallese sono potenziali candidati. Nelle regioni centrali, si sta valutando Wittenbach, dove è stato allestito un piccolo sito agro-elettrico. Per le città, sono in preparazione diversi progetti.

Le procedure di governance e di gestione sono state completamente stabilite e sembrano adatte a garantire una corretta esecuzione del progetto per tutta la sua durata. Infine, le attività di trasferimento scientifico e tecnologico stanno operando a pieno regime. Il nostro sito web e le newsletter in tre lingue, i social media, il canale Youtube, le interviste con i partner di attuazione e di supporto e le riunioni del consorzio sono gli ingredienti per una diffusione di successo dei risultati.

In sostanza, EDGE ha iniziato a operare con successo, i progetti dimostrativi previsti sono in fase di acquisizione o di avvio, e il lavoro scientifico fornisce le basi per un'implementazione di successo. I prossimi anni mostreranno come il consorzio EDGE riuscirà a tradurre i risultati della ricerca fondamentale in reali implementazioni

.

1 Consortium's objectives

The overall EDGE objective is to fast-track the growth of locally sourced decentralized renewable energy in Switzerland, and to ensure that by 2035 and 2050, when ambitious shares of renewable energy are reached, the Swiss energy system is designed and operated in a technically and economically optimal as well as secure way, and that it is well positioned in the European markets. Specifically, the EDGE consortium aims to move beyond generic designs of decentralized renewable systems and markets to a regional analysis that is tailored to the Swiss cities, midlands, and the Alps. The pathways towards largely electrified and multi-carrier energy systems will be examined by analysing electricity, mobility, and heating sectors. The consortium aims to combine research with innovation from three clusters of Pilot and Demonstration project (P&Ds) in the field in urban settings (cities in the cantons of Bern, Luzern, and Aargau), midlands (community in St. Gallen), and the Alps (Graubünden and Wallis). The mutual learning from setting up the P&D projects will ensure feedback loops between theory and practice and enable the use of the outcomes for delineating realistic, national-level pathways for the successful implementation of a nearly or fully renewable Switzerland by 2050. As the energy system is a socio-technical system, the EDGE consortium seeks to deliver the essential interdisciplinary and transdisciplinary expertise, ranging from technology development to systems modelling, political science, management, economics, sustainability science, and energy practice, to identify the most efficient measures to unlock the full potential of decentralized renewable energy. In sum, the EDGE consortium aims to become the point of reference in Switzerland for integrating very high shares of renewable generation, based on solid scientific work and science-practice collaboration, taking the specific settings in cities, midlands, and the Alps into consideration.

Specifically, the objectives of EDGE are:

- Quantify new national-level scenarios and implementation pathways with high shares of decentralized renewable energy.
- Design and analyse multi-energy systems with a high share of renewable energy to coordinate region-specific supply, demand, and distribution grids in the three Swiss regions: cities, midlands, and Alps.
- Design and demonstrate typical local renewable energy systems for each region in P&D projects.
- Investigate, how high shares of decentralized renewable energy can be scaled up and be integrated into the existing infrastructures of distribution, transmission, centralized generation, and storage.
- Evaluate various options for policy, market design and instruments, and other measures to mobilize finance, coordinate key actors, and enable socio-political acceptance.

2 Status of the work packages

WP n°	WP title	Status					
		Previously completed: Final report published on ARAMIS	Completed during the reporting period (RP): Final report submitted to be reviewed	Ongoing: Progress & next steps to be reviewed	Starting during the next RP: First steps to be reviewed	New: Proposal and budget to be reviewed and approved; notes to be reviewed	Starting after the next RP: not yet reviewed
1	Research focus on cities			x			
2	Research focus on midlands			x			
3	Research focus on the Alps			x			
4	P&D in a city			x			
5	P&D in the midlands			x			
6	P&D in the Alps			x			
7	Deployment and integration of decentralized systems			x			
8	Policy, markets, and finance			x			
9	Consortium management			x			
10	Knowledge and technology transfer			x			
11	Coordination of scenarios and modelling among consortia from SWEET Call 1-2020			x			

3 Work performed and results of ongoing work packages

3.1 WP 1-3

Due to the matrix structure, work packages 1-3 share many common objectives and tasks that had initially been split in three work packages, focusing on cities, midlands, and the Alps, respectively. The implementation of the foreseen work in all three work packages and the reporting is now organized into seven cross-cutting topics (leading partner in bold):

- Modelling and recommender tool (BFH, EPFL-C, ETHZ-P, ETHZ-R, **HSLU**, PSI, SUNWELL, UNIGE, WSL, ZHAW)
- Techno-economic analysis (EPFL-H, HSLU, UNISTG, **ZHAW**)
- Grid capacities (**ETHZ-P**, ETHZ-R, UNIGE)
- Operator recommendations (**BFH**, ETHZ-R, SUNWELL)
- Financing aspects (**ETHZ-E**)
- Business models (**UNISTG**, WSL)
- Governance (EPFL-H, **UNIBE**)

In the upcoming section, the objectives of the individual work packages 1-3 are restated, and results that do not fit into the topic structure, defined above, are reported. The majority of results will be reported structured by topic.

WP 1

Title	Research focus on cities			
Actual start	05/2021		**End**	05/2025
TRL range	**Starting at**	n.a.	**Ending a**t	n.a.
WP leader	Philipp Schütz, HSLU, philipp.schuetz@hslu.ch			
Members and coop. partners	Evelina Trutnevyte, UNIGE Claudia Binder, EPFL-H Gabriela Hug, ETHZ-P Giovanni Sansavini, ETHZ-R Bjarne Steffen, ETHZ-E Isabelle Stadelmann UNIBE, Rolf Wüstenhagen, UNISG Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Oliver Kröcher, PSI Alain Schilli, SWISSPOW Martin Jutzeler, EWB Christian Röthemund, SWISSPOR			

Objectives

WP1 will work on the design, operation, and ways to foster the uptake of urban multi-energy systems that would allow to reach as high shares as possible of locally sourced renewable energy in the Swiss cities. Applying comparable methods as WP2 and WP3, WP1 will in particular focus on the specifics of cities.

The Swiss cities have a much higher energy demand than their local renewable energy potential, meaning that urban multi-energy systems need to be designed in such a way as to integrate renewable sources as extensively and effectively as possible in addition to a net import. The key resources are building-integrated solar PV and thermal units, anthropogenic biomass and waste, ambient heat for heat pumps, and district heating. The harvesting of these resources needs to be optimized together with electricity, heat, and transportation demands that are in relative proximity.

Specifically, WP1 will:

1. Conduct physics-based modeling of highly renewable multi-energy systems in representative urban quarters in Switzerland and create an open-access recommender tool that allows any other urban neighborhood to evaluate its design and operation options for such systems.
   → Topic Modeling and recommender tool
1. Fill existing knowledge gaps on the role and techno-economic performance of battery and thermal storage, power-to-x, private and public electric transport, and new biomass technologies in renewable energy systems for Swiss cities.
   → Topic Techno-economic analysis
2. Assess the capability and upgrading needs of urban distribution grids to incorporate high shares of renewable electricity, define recommendations for distribution system operators on grid connection requirements and lab testing, and identify urban segments that are particularly fit for microgrids or for coupling with district heating grids.
   → Topics Grid capacities and Operator recommendations
3. Quantify financing needs for local renewable energy systems in the Swiss cities and define how these needs depend on policy and local markets.
   → Topic Finances
4. Investigate how actors in various parts of the urban energy value chains (utilities, installation companies, energy advisers etc.) and in various policy departments can be coordinated to

unlock the renewable energy potential.
→ Topic Governance

5. Work on business models for innovative urban energy systems with a focus on electric vehicles as rolling storage.
   → Topic Business models
6. Learn from public acceptance of renewable energy policies in Swiss cities to aid policy design and policy choice.
   → Topic Governance

Work performed and results

All work performed for WP1 will be reported below in the section of the individual topics.

As a connecting activity between multiple topics, also workshops aiming for the clarification of the interfaces in the modelling of biomass have been conducted. As the results are mostly relevant for the modelling and recommender topic, the techno-economic analysis and socio-economic analysis, the work is reported under the first topic.

WP 2

Title	Research focus on midlands			
Actual start	05/2021		**End**	05/2025
TRL range	**Starting at**	n.a.	**Ending at**	n.a.
WP leader	Tobias Schmidt, ETHZ-E, tobiasschmidt@ethz.ch			
Members and coop. partners	Evelina Trutnevyte, UNIGE Claudia Binder, EPFL-H Gabriela Hug, ETHZ-P Giovanni Sansavini, ETHZ-R Bjarne Steffen, ETHZ-E Isabelle Stadelmann UNIBE, Rolf Wüstenhagen, UNISG Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Vanessa Burg, WSL Christian Röthemund, SWISSPOR Ingo Herbst, SIEMENS			

Objectives

WP2 will work on the design, operation, and ways to foster the uptake of multi-energy systems that would allow to reach as high shares as possible of locally sourced renewable energy in the Swiss midlands, including the Jura mountains. Applying comparable methods as WP1 and WP3, WP2 will in particular focus on the specifics of the midlands, including their agricultural and forestry areas. The key resources in the Swiss midlands are agricultural and woody biomass, solar PV, or thermal units, as well as wind. In a nearly or fully renewable Switzerland, less densely populated midland settlements with dispersed villages and agricultural or industrial sites require optimized local renewable energy resources for own use in electricity, heat, and transportation sectors, as well as for the net export of energy to the cities.

Specifically, WP2 will:

1. Conduct physics-based modelling of highly renewable multi-energy systems in representative midland settlements and farms in Switzerland and create an open-access recommender tool that allows any other settlement or farm to evaluate its design and operation options for such systems.
   → Topic Modelling and recommender tool
2. Fill existing knowledge gaps on the role and techno-economic performance of woody and agricultural biomass (including small-scale biogas CHPs and combined applications of biomass and solar), battery and power-to-x storage, and electric transportation, including agricultural transportation, in renewable energy systems for the Swiss midlands.
   → Topic “Techno-economic analysis”
3. Assess the capability and upgrading needs of distribution grids to incorporate high shares of renewable electricity, define recommendations for distribution system operators on grid connection requirements and lab testing, and identify segments in the midlands that are particularly fit for microgrids.
   → Topics Grid capacities and Operator recommendations
4. Quantify financing needs for local renewable energy systems in the Swiss midlands and define how these needs depend on policy and local markets.
   → Topic “Finances”

5. Investigate how actors in various parts of the energy value chains (utilities, installation companies, energy advisers etc.) and in various policy departments can be coordinated to unlock renewable energy potential.
   → Topic Governance
6. Work on business models for innovative energy systems with a focus on electrifying agricultural vehicles.
   → Topic “Business models”
7. Learn from public acceptance of renewable energy policies in the midlands in order to aid policy design and policy choice.
   → Topic Governance

Work performed and results

Most of the work performed for WP2 is reported below in the section of the individual topics. More specifically, work has progressed on topics including the potential of Agri-PV in Switzerland (WSL, ZHAW in Task 2.1), biomass performance parameters and grid optimization (PSI, WSL, BFH in Task 2.1), distribution grids in midlands (ETHZ-R in Task 2.2), and market analyses of electrifying agricultural transport systems (HSG in Task 2.3). Work performed in these tasks is described in more detail below.

WP 3

Title	Research focus on the Alps			
Actual start	05/2021		**End**	05/2025
TRL range	**Starting at**	n.a.	**Ending at**	n.a.
WP leader	Michael Lehning, EPFL-C, michael.lehning@epfl.ch			
Members and coop. partners	Michael Lehning, EPFL-C Evelina Trutnevyte, UNIGE Claudia Binder, EPFL-H Gabriela Hug, ETHZ-P Giovanni Sansavini, ETHZ-R Bjarne Steffen, ETHZ-E Isabelle Stadelmann UNIBE Rolf Wüstenhagen, UNISG Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Vanessa Burg, WSL Annelen Kahr, SUNW Christian Röthemund, SWISSPOR Ivo Schillig, ALPENFORCE Ingo Herbst, SIEMENS			

Objectives

WP3 will work on improving the estimates of solar, wind, and biomass resources in the Swiss Alps, and the analysis of the design, operation, and ways to foster the uptake of multi-energy systems that would allow to reach as high shares as possible of locally sourced renewable energy in the Swiss Alps. Applying comparable methods as WP1 and WP2, WP3 will focus on the specifics of the Alps. Although a relatively small energy consumer, the Alps have been recently shown to have potential for high-efficiency PV, even during the winter months, and this PV can also be mounted on existing infrastructures (Kahl et al., 2019), whereas the wind or biomass potential has typically been considered to be low, due to logistical reasons (Mohr et al., 2019; Sasse and Trutnevyte, 2019). For wind, recent research suggests an untapped potential at least at specific locations (Kruyt et al., 2017). A large share of remote individual buildings and highly dispersed settlements, in addition to reliance on individual transportation and mountain infrastructure mean that the Alps require solutions that are different than for cities or midlands.

Specifically, WP3 will:

1. Improve existing estimates of solar PV, wind, and biomass potentials, including their spatial and temporal resolution, using new empirical data and advanced modelling techniques.
   → Topic Modelling and recommender tool
2. Conduct physics-based modelling of highly renewable multi-energy systems in representative alpine settlements and island-type alpine systems and create an open-access recommender tool that allows any other settlement or farm to evaluate its design and operation options for such systems.
   → Topic Modelling and recommender tool
3. Fill existing knowledge gaps on the role and techno-economic performance of battery, thermal, and power-to-x storage, and electric transportation, including mountain transportation infrastructure, which is an important aspect in the integration with existing hydropower infrastructure
   → Topic “Techno-economic analysis”

4. Assess the capability and upgrading needs of distribution grids to incorporate high shares of renewable electricity, define recommendations for distribution system operators on grid connection requirements and lab testing, and identify segments in the Alps that are particularly fit for microgrids.
   → Topics Grid capacities and “Operator Recommendations”
5. Quantify financing needs for local renewable energy systems in the Swiss Alps and define how these needs depend on policy and local markets.
   → Topic “Finances”
6. Investigate how actors in various parts of the energy value chains (utilities, installation companies, energy advisers, etc.) and policy departments can be coordinated to unlock renewable energy potential.
   → Topic Governance
7. Work on business models for renewable energy systems with a focus on mountain resorts.
   → Topic “Business models”
8. Learn from public acceptance of renewable energy policies in the midlands to aid the design of policies.
   → Topic Governance

Work performed and results

Most of the work performed for WP3 is reported below in the section of the individual topics. Two points that are mentioned specifically for the Alps are:

- Evaluation of the measurements of the Davos-Totalp test facility and publication on the effects of snow on Alpine PV production.
- In-depth analysis on wind potential specifically for the Lukmanier and les Diablerets sites and development of a methodology to estimate the local terrain effect on wind potential.

In addition, the development of contacts for PV – site development with diverse consortia and for locations such as Davos, Zuoz, Gondo and Lac des Toule will be summarized in more detail in WP6.

Topic: Modelling and recommender tool

Work performed and results

This topic encompasses the modelling work and development for a recommender tool, targeted at communities and utilities to support the assessment of different pathways towards a locally sourced renewable energy system. To ensure a fast adoption of the tool, public information about the buildings, the available energy resources, and energy potentials shall be collected and employed to reduce the amount of information to be supplied manually by each community. The key output of the recommender tool is a comparison of different scenarios (strong increase of PV production, bidirectional charging of electric vehicles etc.) with respect to the chosen Key Performance Indicators (KPI). The recommender tool will be an integral part for consulting the communities and cities in the P&D projects in WP4 - 6. The developed local models will help to challenge the assumptions in the national model developed in WP7.

The above goals require the following key steps:

a. *Specification and interface clarification*: Definition of the modelling steps, inputs and outputs, selection of the KPIs, and clarification of the data sources for the modelling parameter.

b. *Implementation*: The functionalities specified in step a) have to be implemented in a suitable framework, and its basic functionality has to be shown in function tests.

c. *Validation*: The modelling results have to be challenged with real-world consumption and supply data. This data is extracted from public sources as well as from P&D projects running in WP4 – 6.

For tasks 1.1 through 3.1, data collection is necessary to describe important performance parameters of biomass, solar and wind related potential and technologies as input for the modeling activities and thus also for the techno-economic assessment and for the grid optimization (Tasks X.2). Towards the two milestones 2.1 and 1.1, the partners agreed on the biomass related technologies to be considered (incl. woody/agricultural biomass and anthropogenic biomass technologies) based on the technical readiness and applicability in Swiss cities and the midlands. The partners agreed further on the performance parameters to be considered to offer a sufficient level of technical detail for the modeling tools to be developed within Tasks 1.1 and 2.1. Areas suitable for decentralized agricultural CHPs have been identified.

Likewise, for PV and wind potential, we refined estimates of PV potential and feasibility across Switzerland but in particular for the Alps. Especially, since current estimates for wind potential are insufficient, the following steps have been taken:

- Development of a machine learning method to generate long time-series of wind power generation based on limited data. Test for two high-Alpine sites (Lukmanier pass, Les Diablerets).
- Finalisation of the model Wind-Topo (Dujardin and Lehning, 2022) to generate high-resolution (50 m) maps (time series) of near surface wind fields that better reflect the interactions between wind and topography in complex terrain. This high-resolution dataset will be used to assess wind power potential in a spatially and temporally explicit manner.

The handshake among Tasks 1.1 and 2.1 to define joint review methodology for biomass technologies (joint with M1.1) has taken place.

The potential of systems combining biomass and solar technologies is assessed by investigating the potential synergies between the use of biomass and sun for power and heat production. First, the available technologies for energy generation with biomass and sun and possible synergies were reviewed. Then the spatio-temporal patterns of biomass and solar energy were analyzed. Finally, the

technical feasibility with consideration of further restrictions such as legal, environmental and/or social aspects was investigated.

Specifically for the recommender tool, the following steps have been taken:

- Performed interviews with consortium partners to identify key performance indicators for the recommender tool and available data sets for model parametrisation and validation.
- Developed models for the estimation of the building energy demand (profiles) based on public building information and validated them with actual consumption data from two cities in Switzerland.
- Development of a data and logic workflow for the recommender tool, and drafts for the graphical interface presented to the end-users. The graphical interface was discussed with multiple end-users groups and their feedback was integrated.
- Initiation of exchange meetings with other modelling partners (PSI, WSL, ZHAW, ETHZ-P/R) to clarify modelling interfaces.

The above steps are necessary to meet the requirements of the deliverables D1.6, D2.9, D3.7 where the recommender tool will be released for cities, midlands, and the alpine area, respectively. The developed tools will help communities and utilities with the assessment of their energy plans, help to foster the integration of locally sourced renewable energy into the energy system, and thereby help with the implementation of the energy strategy 2050. The modelling work in this topic will also be essential for the estimation of the heating/cooling and electricity demand. The latter will be required in WP7 for the cross-validation with the national models as well as in WP2 of SWEET PATHFNDR and will help the implementation of digitisation procedures in the framework of WP3 and WP5 of SWEET DecarbCH.

Topic: Techno-economic analysis

Work performed and results

This topic addresses the techno-economic assessment of different solutions towards the multi-energy system in the urban, midlands and alpine area. In particular, the assessment of different storage options, power-to-X concepts and vehicle to grid technologies are in the focus of this topic. The results of this topic help to identify suitable business opportunities and suitable P&D projects to be implemented in the framework of WP 4 - 6. The results of this topic will directly feed into the deliverables D1.2, D2.4, D3.9 where the potential of the above-named concepts is examined. These technologies are vital pillars to reach the aims for the energy strategy 2050 and the new goal of net-zero emissions and will thereby contribute to the fast implementation of these concepts.

In this reporting period, the following tasks have been executed:

- Evaluated and tested simulation software for rough energy simulations (mainly electricity) without a grid. Own software created with Stella Architect, which primarily compares PV electricity generation with the electricity demand. These simulations should be able to provide initial indications of storage requirements in cities, midlands and Alps.
- General research into biogas plants and the production and use of plant charcoal from wood pyrolysis.
- General research into vehicle to Grid (V2G).
- Adaptation of the electricity model OREES to optimize simultaneously photovoltaic and wind power installation across Switzerland for diverse objective functions. This new version was used for the model intercomparison of WP7.

The results of this topic are also relevant for further SWEET projects, in particular for PATHFNDR and DecarbCH, for their impact on the flexibility provision (PATHFNDR WP2/3) as well as for the energy efficient operation of local energy grids (DecarbCH WP3 - 5).

Topic: Grid capacities

Work performed and results

Switzerland's Energy Strategy 2050 promotes the extensive use of renewable energy sources and electrified mobility to reduce the country's dependence on imported fossil fuels (SFOE Energy Strategy 2040) and to limit its GHG emissions. An electrified transport sector poses an extensive burden on the electricity supply system, particularly in the distribution networks (Level 4 - Level 7), where the better part of electric vehicles (EV) will have their charging connection points (J. Quirós-Tortós et al, 2018). The charging demand is expected to be highly space- and time-dependent since it is a result of the adoption and use-behaviour of EVs and existing generation infrastructure. Considering this, the work performed during the first reporting period includes:

- Ongoing development of a methodology for estimating the charging demand of electrified passenger cars: the approach chosen corresponds to a highly spatially and temporally detailed simulation, built upon the results of the agent-based mobility simulation tool MATSim (**https://matsim.org**) based on real distributed data and aggregating towards the national scale.
- Building of a portfolio of real representative distribution networks of both different geographic areas in Switzerland (Alps, midlands, Jura) and different supply tasks and generation portfolios. Several contacts and collaborations have been established with e.g., Primeo Energie, Electra AG, Groupe E and AGE SA, Adaptricity AG. Coordination with SWEET EDGE partner ETHZ-R on representative distribution grids has also been achieved. For this purpose, the surface of the midlands has been segmented according to the inferred position of high to medium voltage and medium to low voltage substations. According to the project's needs, ETHZ-R modified the methodology developed in Gupta et al. (2021). The required data for estimating the spatial distribution of electric demand was obtained from the Swiss geoportal (n.d.) and Eymann et al. (2014). This step is crucial for the definition of typical distribution grids, and it is prerequisite for answering the questions about the optimal operation and planning of these networks (Figure 3.2.1). Moreover, this activity connected to WP2.2 contributes to WP1.2. and WP3.2 since the task of distribution grid representation of midland areas is closely related to the problem for those in urban and alpine areas. Further, the output of this activity is an input to further activities related to grid analysis and will be reported in deliverable D2.3 (Recommendations focusing on midlands).

- Conceptualization of the integration of the electrified road transport charging demand and the challenges and opportunities of it in the operation of distribution networks into Nexus-e. There has been close contact and communication with the Nexus-e developing group to improve the understanding of the model capabilities of highly spatial and temporal resolution simulations.

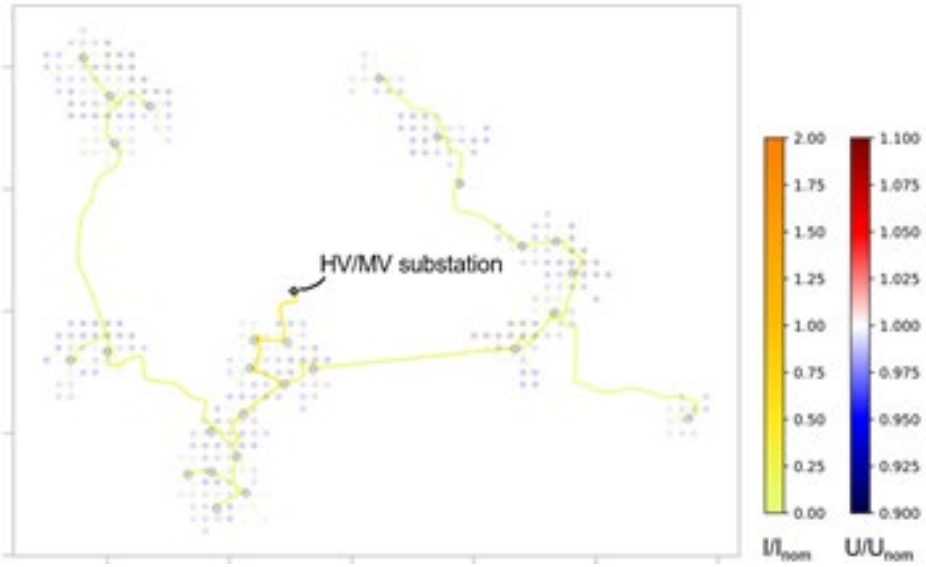

Figure 3.2.1: Distribution grids routing: Medium voltage grid under nominal operation and reports per-unit voltage of buses and current conductors.

The work performed contributes to the deliverables D1.4, D2.10 and D3.4 (electric transportation analysis in cities, midlands, and alps, respectively), by establishing the data basis for the required specific simulations on transport electrification integration in the diverse grids within the geographic areas. Furthermore, the work also contributes to deliverable D7.2 (publication on the optimization methodologies for including electric transport at a distribution grid level in Nexus-e), by establishing the grounds of the bottom-up estimation of the EVs' demand up to the national scale.

Research work on microgrids is foreseen to start at a later stage of the project.

Topic: Operator recommendations

Work performed and results

The prediction and assessment of consequences of more de-centralized generation and electrified mobility must be translated into actionable recommendations for grid operators at different levels. SWEET-EDGE works towards such guidelines and the following work has been accomplished during the reporting period:

- Preparation for the dissemination workshop "Fachtagung Netzanschluss" as a handshake event for DSOs and the PV-industry (milestone M2.6). A demonstrator has been developed to show the participants the important functionality of independent active power regulation as a function of frequency or grid voltage with a PV inverter.
- Co-Initiation of an IEC (International Electrotechnical Commission) Specs Draft 63409 for worldwide harmonized grid connection requirements of PV, in particular for the document sections Part 4 "Protection" and Part 6 "Smart Control Function". In this context, preparation, and set-up of appropriate inverter lab testing infrastructure for grid connection issues (P(U), P(f), Q(U), NA-Schutz; NA=Grid Connection) has been achieved.
- Acquired and started a related P+D project called GODA with Groupe e. A project to demonstrate P(U) in a real distribution grid including the development of algorithms for the calculation of lost

plant operator revenues by the active power curtailment with P(U) has been acquired and started.

- Initiated an executive collaboration workshop among the WP1-3 topic leaders for “grid capabilities” and “operator recommendations” with the possibility to document action and insight.
- Organized real distribution grid data for grid level 5 and 7 to share within the EDGE Consortium. Real distribution grid data for the simulation entities within the EDGE consortium WP1-3 has been identified as a need. Thanks to the close relationship of BFH and distribution grid operators three partners could be convinced to confidentially share several interesting grid models.

Topic: “Financial needs”

Work performed and results

The objective of the financing part in work packages 1, 2 and 3 is to analyse the financing needs of key renewable energy technologies in the three regions (cities/midlands/alps), i.e., what are appropriate sources of finance, financing structures, and financing instruments. In a second step, the goal is to infer the cost of capital for different potential financiers of renewable energy assets. The following work has been accomplished during the reporting period:

- ETHZ-E concluded an analysis of potential cost of capital drivers that were derived, based on a systematic literature review. The analysis has been submitted to the academic journal *Progress in Energy* and following peer review has been invited to re-submission. It will serve as a basis for the next steps, namely the organization of expert interviews concerning financing needs, and the techno-economic and financial modelling foreseen.

Topic: “Business Models”

Work performed and results

As part of task 1.3, we have conducted a comprehensive consumer survey (N>1’300) on the preferences of Swiss residents for renewable energy technologies in Sep/Oct 2021. A section of the survey contained questions for potential and actual owners of electric vehicles, especially their pre-purchase expectations compared to their post-purchase experience in terms of charging at the workplace. We found a demand for charging EVs at the workplace, as so far only a small minority of Swiss employees can charge their electric vehicle at the workplace, but state a need for this, rather than charging at home. We found further insights on consumer preferences for solar charging at home, at work, and on-road (e.g., personal attitudes and beliefs, goals, barriers). An important finding is that driving experience with corporate electric vehicles often leads to buying a private electric vehicle. So far, the survey results clarify the demand side for potential business models to use electric vehicles as rolling storage and to electrify corporate fleets. Next, we will examine the supply side by conducting a case study on companies with (electrified) corporate fleets and service providers for fleet electrification – with focus on smart charging solutions for corporate fleets that couples the charging demand of corporate fleets and the residual corporate energy demand with local PV generation, while providing benefits to the power system, including minimizing the evening peak load, providing congestion management services to the distribution grid, and deferring capacity-increasing hardware investments in the distribution grid. This work package is very well aligned with the other more technical work packages in that, first, its findings clarify the customer demand and business supply to overcome the dissatisfying and dangerous underutilization of existing technologies to electrify corporate fleets, and second, some findings (e.g., customer preference for charging locations) could serve as model inputs for technical analyses.

The electrification of agricultural vehicles presents various benefits. Not only does it enable emission-free transportation in the agricultural sector, but it also eliminates air pollution and contamination of the crops by otherwise traditional fossil-fuelled tractors. Combining electric agricultural transportation with solar PV and distributed storage has a high potential to de-carbonize the vehicles and increase the use of renewable energy sources in Switzerland. The goal of this task is to investigate the market potential of such concepts, by studying social acceptance, effective policy incentives and ways to mobilize and coordinate the key actors. The goal of this activity in Task 2.3 is to use interviews and surveys to explore the potential demand of Swiss farmers in the midlands for electric agricultural vehicles. In particular, UNISG will investigate the customer journey of farmers when it comes to the purchase of agricultural vehicles, to better understand their decision process as well as needs and challenges. The customer journey model will be used as a means to locate touchpoints for policies to incentivize purchases of electrified alternatives.

During the Forum for Management of Renewable Energies (**REMforum 2022)** on 24 June 2022, a workshop on electrifying the agricultural sector will inform about electric agricultural vehicles and Agri-PV. The participants will get expert insights on the technology behind electric tractors and their application by a Swiss manufacturer of electric tractors. In addition, the workshop introduces the technological development and applications of Agri-PV. This research will serve as a basis for policymakers as well as for manufacturers of agricultural vehicles to better understand the demand for agricultural EVs, and how to incentivize farmers to choose and invest in such low-carbon transportation.

In addition to the specific study mentioned above, economic aspects have been covered in the modelling of biomass roles and of wind and solar installations. These efforts are reported in the topics recommender tool and socio-economic analysis.

Topic: Governance

Work performed and results

The objective of the governance part in work packages 1-3, in coordination with WP8, is to analyse the energy policy landscape required for a decentralized and renewable energy system in Switzerland. To do so, project partners assess both the various policy instruments and their design, as well as patterns of public support. Crucially, WP8 is informed heavily by technical and economic assessments in WP1, 2 and 3. The following work has been accomplished during the reporting period:

- A conceptual and methodological framework was developed for running workshops and case studies on governance of energy transitions in urban areas, midlands, and Alpine regions.
- A preliminary list for sampling of case study regions was prepared.
- The relevant coordination meetings for tasks 1.3, 2,3, 3.3 were organised.
- Data collection on cantonal policies for solar PV was started (in line with WP8). The analysis not only serves as a first step to collect data more comprehensively on cantonal policies for different renewable energy sources but will also be used to elucidate how the differences in cantonal policies and regulations are linked to the social acceptance of policies in the different geographical areas.
- Development of the joint population survey (in line with WP8), which will be used to investigate the social acceptance of policies in different geographical regions. The survey will also elicit what the barriers and leverage points for technology adoption are, which will help to investigate the social acceptance of policies in different geographical regions. Further, it will investigate which actors are perceived as influential for the diffusion of solar PV in various geographical regions (see also more on the survey in the reporting on WP8).

3.2 WP 4

Title	P&D in a city			
Actual start	05/2022		**End**	05/2028
TRL range	**Starting at**	5	**Ending at**	7
WP leader	Philipp Schütz, HSLU, philipp.schuetz@hslu.ch			
Members and coop. partners	Michael Lehning, EPFL-C Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Claudia Binder, EPFL-H Peter Toggenweiler, B&H Reto Herger, EWL Matthias Eifert, ZukArg Hans-Kaspar Scherrer, Eniwa Martin Jutzeler, EWB Markus Blätter, SWL, Christian Röthemund, Swisspor Marcel Kränzlin, AEW Ingo Herbst, Siemens			

Objectives

In WP4, the methodologies, models, and technological solutions developed within the EDGE project are show-cased on real-world challenges in the urban context by means of P&D projects. Quantifiers for the success are the increase of the share of locally sourced renewable energy, the impact on efficiency and resilience of the energy system, the economic feasibility, the social acceptance of the EDGE solutions, and the replication potential. These field-tests are required to convince stakeholders such as communities, utilities and large portfolio managers of the maturity of the EDGE procedures and solutions and trigger initiatives for their realization.
To ensure the adaptability of the solutions to all urban areas in Switzerland, the P&D projects are chosen such that all spatial scales (districts, cities, canton) and development phases (concept, design, implementation, operation, optimization) are covered. The principal research questions are:

- How to identify the optimum technological solutions for a specific district or city in Switzerland?
- How to ensure that the identified solutions are transferable to other cities? Which social, economic, and legal performance indicators enable reproducibility?
- Which procedures, guidelines, or legal frameworks support stakeholders to choose the solution with an optimum balance between energy efficiency, locally sourced, renewable energies, economic impact, and social acceptance? Which arguments or incentives convince the stakeholders?
- Which challenges must be faced during the implementation of the (novel) technological solutions? How do challenges differ depending on the involved stakeholders?
- Given a particular configuration of the energy system in an urban context: How can the existing hardware be exploited better to improve the integration of locally sourced, renewable energy?
- Which policy creates an environment fostering the implementation of identified solutions?

Work performed and results

As the work package starts after the reporting period, only preparatory work has been performed:

- First analyses of the available public information on the energy systems of the demo sites have been performed. In addition, the discussion among the modelling partners has been initiated, which data is required from the respective demo site owner.
- A review of the research questions has been performed and the workflow of the modelling work in the topic modelling and recommender tool of WP1-3 has been extended accordingly.
- The contacts to the demo site owners have been re-intensified.

In addition to the demo sites described in the work package, also first contacts to 15 communities in the cantons of Aargau, Solothurn, Lucerne as well as Nid- and Obwalden have been established. In particular for the city of Turgi promising, first discussions took place.

3.3 WP 5

Title	P&D in the midlands			
Actual start	05/2021		**End**	04/2027
TRL range	**Starting at**	6	**Ending a**t	8
WP leader	Jürg Rohrer, ZHAW, rohu@zhaw.ch			
Members and coop. partners	Michael Lehning, EPFL-C Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Peter Toggweiler, B&H Oliver Kröcher, PSI Thomas Keel, Laveba Sepp Knüsel, Rigitrac Samuel Pfaffen, Eniwa Joel Heggli, Heim Pirmin Reichmuth, EcoCoach			

Objectives

In parallel to the comparable implementations in urban and mountain settings of WP4 and WP6, this work package will develop a concrete plan for demonstration projects in the Swiss midlands. It starts with a biogas plant and extends to a fully integrated system with additional producers such as PV and wood pyrolysis, as well as consumers such as traffic, machinery, and industry, complemented by battery storage. Over almost the full length of the project duration, SWEET-EDGE WP5 will coordinate planning activities among stakeholders, and will try to launch real-world implementation, partly supported by additional SFOE funding through the separate P&D calls.

Work performed and results

Since building permits have to be obtained for the construction of a biogas plant and a wood pyrolysis plant, WP5 was started earlier than planned.

A feasibility study was conducted by the project partner Laveba for a biogas plant in Waldkirch. The result was positive. However, since the landowner had lost interest in a biogas plant in the meantime, a new location for the P&D project in the midlands had to be found.

The new location is Wittenbach (SG), where the planned project is now to be realized. The following work was carried out for this:

- Project coordination established with the local energy companies Laveba, EW Wittenbach, Stadtwerke St. Gallen, SAK and the municipality of Wittenbach.
- Analysis of Wittenbach's energy networks and energy production facilities. Photovoltaic plants and hydroelectric plants inserted into a graphical information system.
- Analysis of the production potential with photovoltaics on the existing roofs of Wittenbach carried out and checked with the municipality. With approx. 130 roofs (corresponding to 10% of all roofs), around 50% of the potential could be exploited.
- After consultation with SFOE and Swissolar, a procedure was defined to realise the remaining free potential as efficiently as possible and to a large extent. The owners of the roofs with the greatest potential are known and will be contacted personally by the project team from May 2022 onwards.

- Feasibility study for a biogas plant in Wittenbach carried out by project partner Laveba. The result is positive, but still leaves the heating of the biogas plant open and shows different options, including one with heat from a wood pyrolysis plant.

On the Grüental campus of ZHAW in Wädenswil, a small agri-photovoltaic test facility was set up with modules from the Swiss start-up Insolight. The trials were started with sweet lettuce (Nüsslisalat) (Fig 3.5.1). The first results can be expected in the next reporting period.

Figure 3.5.1: Agri-PV pilot plant in Wädenswil (campus Grüental, ZHAW)

3.4 WP 6

Title	P&D in the Alps			
Actual start	04/2022		**End**	04/2027
TRL range	**Starting at**	n.a.	**Ending a**t	n.a.
WP leader	Michael Lehning, EPFL-C, lehning@slf.ch			
Members and coop. partners	Michael Lehning, EPFL-C Claudia Binder, EPFL-H Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Annelen Kahl, SUNW Peter Schwer, B&H Philipp Wilhelm, Davos Klaus May, Davos Klosters Mountains Reinhard Marcel, SBB			

Objectives

In parallel to the comparable implementations in urban and midland settings of WP4 and WP5, this work package will develop a concrete plan for demonstration projects in the Alps. The focus is on high-alpine PV installations at several locations and – if possible – some wind power installations. Over almost the full length of the project duration, SWEET-EDGE WP6 will coordinate planning activities among stakeholders, and will try to launch real-world implementation, partly supported by additional SFOE funding through the separate P&D calls.

Work performed and results

With Axpo as the main industry (and cooperation) partner, the Muttsee demonstration site has been initiated and equipped with a powerful PV plant. A matching Innosuisse project could successfully be acquired by EPFL-C and WSL and SUNWELL. The project focusses on the interaction of snow with the solar panels at this high-elevation demonstration site.

Due to an upcoming opportunity, EPFL-C and WSL got involved in the development of a demonstration project at Lukmanier pass. A combination of smaller-scale wind turbines with PV (so called windflowers) is foreseen to be installed at the “La Stadera” site to allow for de-centralized renewable energy generation for the Armasuisse infrastructure operations. In addition, measurements (LIDAR; Light Detection And Ranging) and modelling of wind profiles have been carried out at the Diablerets ski area to investigate a potential influence of mountain waves on high local wind speeds.

One aspect of the analysis was the investigation of spatial differences in the wind power potential, which was addressed by conducting very high-resolution simulations with the meteorological model WRF (Figure 3.6.1).

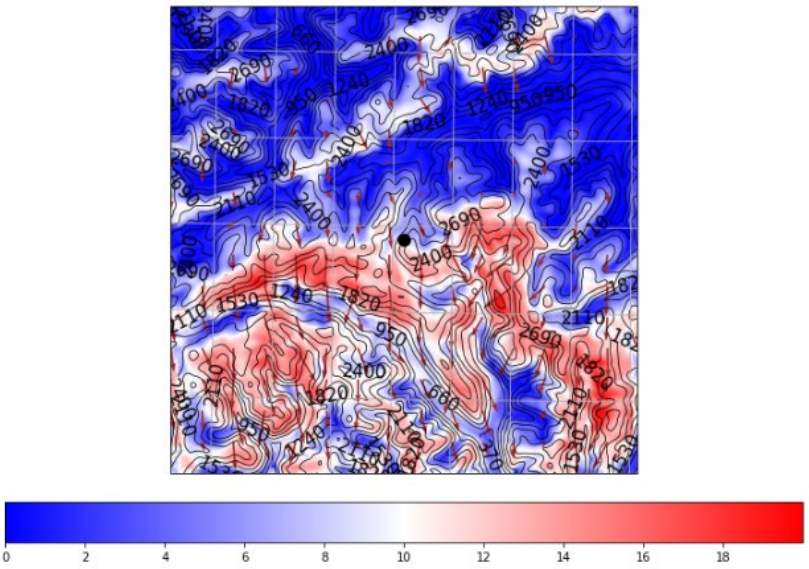

Figure 3.6.1: Daily averaged wind speed from WRF-COSMO1 simulation results at 100 m a.g.l. for the Lukmanier site on 09/12/2020 for north-easterly flow.

In summary, the following work has been carried out:

- Initiation of a matching Innosuisse P&D project with Axpo: Establishment of the Muttsee PV plant with instrumentation (camera etc.) for studying the snow – PV panel interaction.
- Estimation of wind potential and its spatial variation at the La Stadera and Diablerets mountain sites (also reported in WP3).
- Negotiations with stakeholders about the establishment of a PV demonstration-production site in the region Davos.
- Establishment of contact with the promoters and stakeholders of the planned Gondo high-Alpine PV plant.

3.5 WP 7

Title	Deployment and integration of decentralized systems			
Actual start	05/2021		**End**	04/2027
TRL range	**Starting at**	n.a.	**Ending a**t	n.a.
WP leader	Evelina Trutnevyte, UNIGE, evelina.trutnevyte@unige.ch			
Members and coop. partners	Michael Lehning, EPFL-C Gabriela Hug, ETHZ-P Giovanni Sansavini, ETHZ-R Philipp Schütz, HSLU Patrick Horka, South Pole			

Objectives

WP7 develops new scenarios and transition pathways for a nearly or fully renewable Switzerland by 2050, on the basis of bottom-up outputs from WP1-3, and it investigates the impact of these scenarios on the transmission, centralized generation and storage, transport, and European interconnection.

Specifically, WP7 aims to:

1. Integrate the findings from WP1-3 on bottom-up analysis of decentralized renewable energy systems to investigate the national-scale deployment of these systems and their implications.
2. Develop and periodically update new Swiss energy scenarios with the ambition of a nearly or fully renewable Switzerland by 2050.
3. Conduct model inter-comparison projects (Expanse, OREES, Nexus-e) in order to achieve the highest robustness of these scenarios.
4. Publish and widely advertise three biennial renewable energy outlooks for Switzerland.
5. Develop new country-wide spatial forecasting models of renewable energy outputs in order to aid operational management of the whole electricity system.
6. Investigate the implications of a nearly or fully renewable Switzerland on transmission, centralized generation and storage, and the mobility sector.
7. Develop new modelling tools to integrate the electric mobility sector into modelling from the distribution to the transmission level.

Investigate synergies, trade-offs, and interdependencies between the energy system developments elsewhere in Europe and in a nearly or fully renewable Switzerland by 2050.

Work performed and results

Task 7.1. Modelling new Swiss scenarios and implementation pathways with very high shares of decentralized renewable energy

First model-intercomparison and preparations for the Renewable Energy Outlook

First, as foreseen in the proposal, Task 7.1 started with a collaborative activity led by UNIGE to conduct a model inter-comparison with three existing electricity sector models: Expanse (UNIGE), OREES (EPFL-C), and Nexus-e models (ETHZ-P, ETHZ-R). These models use different methodological approaches and have different foci, but essentially the same goal of simulating the Swiss electricity system. By having three models run harmonized scenarios and investigating the commonalities and divergences in the outputs, the inter-comparison enables learning among the three modelling teams and ensures maximum robustness of the modelled scenarios for the upcoming Renewable Energy Outlook.

Milestone 7.1 was met in December 2021, when the protocol of the model inter-comparison was completed. The protocol includes the methodological concept, guiding policy questions, shared scenarios to be modelled, and the common reporting of model inputs and outputs that the modelling teams agreed on. The inter-comparison focuses on these questions:

- What are the technology, cost and regional implications of reaching the federal target of 17 TWh/year electricity generation from renewable sources (solar PV, wind power and biomass) or a more ambitious target of 25 TWh/year by 2035 in Switzerland?
- What are the implications of a rapid solar PV expansion with 25 TWh/year by 2035?
- What are the technological, financial and regional implications for the results of future developments in electricity demand (i.e., different adoption rates of electric vehicles and heat pumps)?

The first round of model runs (with 15 harmonized scenarios) was completed and submitted for analysis in February 2022. The analysed results were then extensively discussed by the modelling teams, who all decided to revise some assumptions or parts of their models, which indicates learning effects in this exercise. In response to the latest geopolitical situation, it was also agreed that the second iteration should include an additional scenario category of no natural gas and oil for electricity generation in Switzerland. The first inter-comparison results were presented at the consortium meeting in April 2022. The three teams then met Milestone 7.2 when they submitted their second round of model results for analysis in May 2022. A journal publication with the results is in preparation.

This model inter-comparison will be the basis for the first Renewable Energy Outlook to be finalized in spring-summer 2023. Early preparations for preparing this outlook already started, with a break-out group session during the consortium meeting to specify the goals and topics to be included in the Renewable Energy Outlook. Questions on the concept of the Renewable Energy Outlook were included in the ongoing interview with implementation and cooperation partners in WP10. Furthermore, Lukas Braunreiter from ZHAW, the recipient of a SWEET SOUR project on improving usability of scenarios, was invited to accompany the development of Renewable Energy Outlook in order to help prepare the outlook in a way that it is useful for the practitioners' community in Switzerland.

Redefinition of the EDGE regions

Although not foreseen in the proposal, the consortium's discussions showed that the initial distinction of the three Swiss regions (cities, midlands, and the Alps) could not fit well all purposes. Thus, an activity was initiated by UNIGE in collaboration with the survey team at UNIBE in WP8 to take a more systematic approach in defining the EDGE regions. After multiple iterations between WP7 and WP8, a new matrix structure was adopted to define nine Swiss regions, using the typologies of the Swiss Federal Office of Statistics: (i) midlands, Jura, and the Alps, and (ii) urban, peri-urban, and rural areas. The spatial datasets on the new classification of municipalities, electricity and heat demands as well as renewable energy potentials were prepared and shared with the consortium (see Figure 3.7.1). A collaborative effort is on the way to describe these new nine regions from an interdisciplinary perspective to prepare a framework publication for SWEET EDGE.

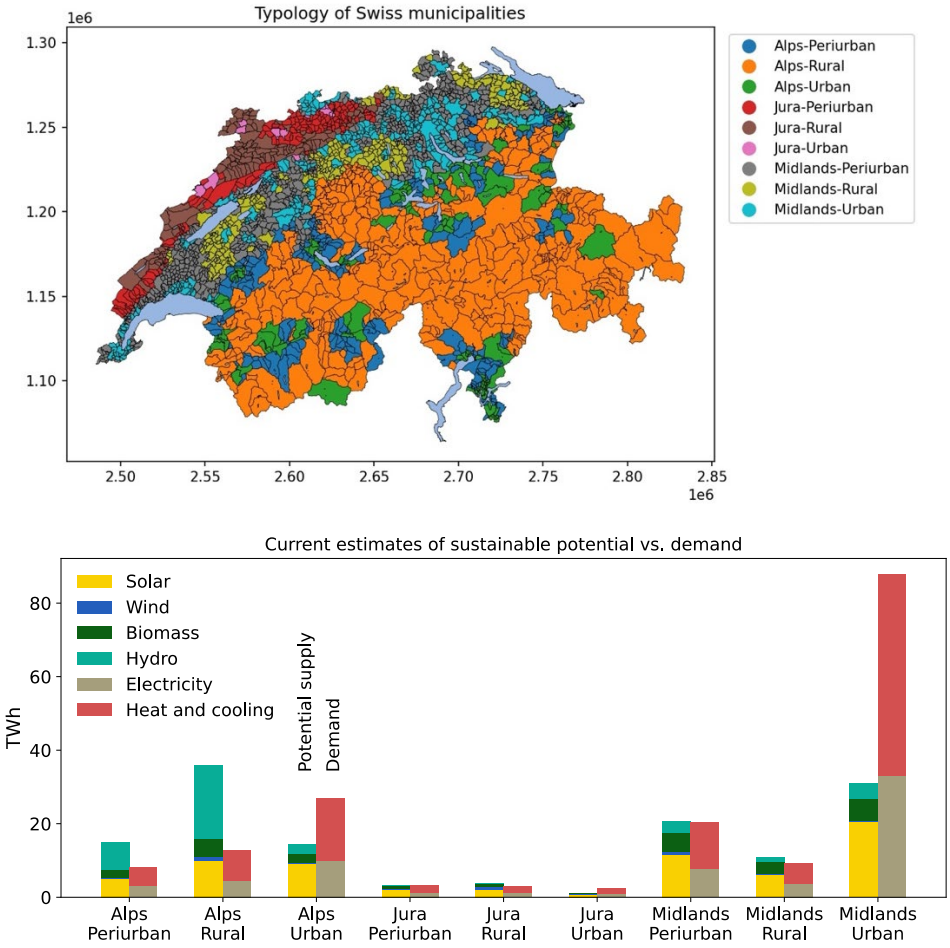

Figure 3.7.1: New definition of nine Swiss regions for EDGE analysis

Modelling long-range transition pathways

Overall, this research activity is foreseen at later stages of the project (UNIGE). Nonetheless, a first stylized version of the retrospective Swiss energy system model (1980-2020) was set up in collaboration with the Swiss National Science Foundation Eccellenza project “Accuracy”. Very preliminary results indicate that in the analysed time frame, the Swiss energy system evolved in a way that would have about 30% higher total system costs than the least-cost pathway. The largest differences between the real-world and least-cost pathways are related to the real-world investments in overcapacity of electricity generation (possibly due to the underestimated future role of energy efficiency as happened in other countries) and electricity import and export patterns (possibly due to the deviations from pure price-based trading). This model will be further developed, refined, and extended to a prospective version later in the EDGE project.

Task 7.2. Transmission grid, centralized generation and storage, and transport

The second model-intercomparison and other modelling improvements are foreseen in later periods of the project. In the area of transport modelling (ETHZ-P), Task 7.2 aims to expand Nexus-e, starting bottom-up from the inclusion of electric transport and its impacts at the distribution grid level (WP1-3)

and then computing the resulting power-flows up to the transmission grid level in interaction with the rest of the system. In concert with WP1-3 which characterize regional transport electrification and its impact on diverse distribution networks, Task 7.2, in the first year, identified current capabilities of Nexus-E to model electric vehicles and needs for improvements in spatial and temporal accuracy. Important aspects of integrating the relevant modelling platforms were also explored.

Task 7.3. Interconnection with Europe

The third model inter-comparison and other research activities in this task are foreseen for later stages of the project. In the first year, using in-kind contributions, UNIGE conducted a modelling study on implementing national and EU-level electricity sector targets of 2035 to investigate national interdependencies between targets, technology deployment, and impacts on system costs and greenhouse gas emissions in Europe. Switzerland was included as a part of the broader alpine region, together with Austria and Italy. The largest interdependencies were found between targets of countries of Central Europe and Eastern Europe. Implementing electricity sector targets in Central European countries can lead to higher fossil fuel capacities and greenhouse gas emissions in Eastern European countries if only the overall EU target is kept. The results suggest that reaching a low-carbon electricity sector in Europe requires the coordinated implementation of electricity sector targets to ensure that individual national targets do not undermine overarching European targets.

3.6 WP 8

Title	Policy, markets, and finance			
Actual start	09/2021		**End**	04/2027
TRL range	**Starting at**	n.a.	**Ending a**t	n.a.
WP leader	Isabelle Stadelmann, UNIBE, isabelle.stadelmann@unibe.ch			
Members and coop. partners	Eveline Trutnevyte, UNIBE Claudia Binder, EPFL-H Tobias Schmidt, ETHZ-E Rolf Wüstenhagen, UNISTG Regina Betz, ZHAW Philippe Thalmann, EPFL			

Objectives

WP8 works on policies, market design options, market instruments, and measures to mobilize finance and social acceptance to foster the country-wide uptake of decentralized renewable energy systems. The WP connects local to national scale by investigating the regional dimensions in policy, markets, etc. as well as evaluating the distributional impacts and ways to minimize inequalities across Swiss regions, households from various income groups, key actors from the energy value chain, and gender. WP8 is primarily based on policy, markets, and social scientific analysis in the Tasks 8.1 and 8.2 and on modelling in Task 8.3.

During the reporting period, the main objective was to develop the necessary conceptual fundamentals and prepare data collection, which will, in later stages of the project, help to reach the more substantial milestones and deliverables.

Work performed and results

The work so far conducted in WP 8 was dominated by the development and preparation of the joint population survey (Task 8.2, M.1). Moreover, substantial work has also been performed in Task 8.1., while activities related to Task 8.3. concentrated on the search of the economic partner.

Task 8.1: Policy and market design

Collecting cantonal policy data

The goal of this subtask is to collect detailed cantonal policy data, focusing on decentralized renewable energy sources, assessed in WP 1-3 (M 8.3). This information will be a major contribution to the identification of best practises and, accordingly, also to the first policy white paper. Further, the “policy status quo” will also be considered as a context within which citizens form their opinion about future policies. Hence, the current policies, for example through policy feedback effects (Stadelmann-Steffen and Eder 2021), may influence what is preferred and possible in the future.

During the first reporting period, the main activity in that respect was to develop an analytical framework for the coding of cantonal policies based on literature review, i.e., identifying different previous accounts to measure and code policies, but also by integrating previous experiences from different teams within EDGE (ETHZ-E and UNIBE). The analytical framework – as it stands now – consists of the coding of different policy instruments (information, market-based, i.e., mostly financial, instruments, and regulations), as is common practise in comparative policy research, but also integrates policy goals as well as organizational aspects (i.e., resources to implement goals and instruments but also information and communication activities that may facilitate implementation). This encompassing approach shall account for the fact that policy instruments do not occur in isolation but are embedded in larger policy

mixes, of which the implementation and effectiveness may strongly depend on the related goals as well as on organizational matters.

To account for differences between energy sources, policies are conceptualized and coded separately for the different decentralized renewable energy sources. To start with, the activities have so far concentrated on solar PV (including solar thermal energy). A first round of data collection and coding has been conducted. This data will now be validated and then be used for initial analysis that shall result in a bachelor thesis investigating the correlation between cantonal policies and the deployment of solar PV in sub-national entities. Regarding the two other central renewable energy sources, namely wind and biomass, Isabelle Stadelmann-Steffen is currently teaching a masters seminar at UNIBE, in the framework of which students conduct cantonal case studies. These serve as pre-studies for the more systematic data collection on biomass and wind policy.

First policy white paper

The first deliverable of WP 8 (D8.1) is a policy white paper on the role of policy and market design for high shares of decentralized renewables in Switzerland. A break-out session was organized on 14 April 2022, by ETHZ-E with concerned project partners (including ZHAW, UNIBE, and others) to discuss the structure of the deliverable and the workflow over the next months. ETHZ-E has started reviewing the literature on localization in energy policy design, and is starting to set up a simplified techno-economic model to analyse various options for decentralized renewable energy technologies in Switzerland. The focus is primarily on solar PV, but may also include other decentralized renewables, as well as heat pumps. Together with these findings, other insights from Task 8.1 on market design and other factors are used to prepare the deliverable 8.1. We expect the findings to contain significant policy conclusions with regards to policy design adapted to diverse geographical settings and use cases in Switzerland.

Corporate PPAs as an alternative to government policies

The goal of this subtask is to investigate the extent to which Corporate Power Purchase Agreements (PPA) can become a viable alternative to government policies, such as feed-in tariffs or auctions, in incentivizing long-term investment in domestic renewables. The perceived trade-offs by large companies between novel solutions around corporate PPA and the more traditional policy instruments (feed-in tariffs or auctions) as well as the existing hurdles and benefits of signing Corporate PPAs have been investigated. Subject of this research are Swiss energy suppliers as well as potential off-takes such as companies to ensure a profound understanding of the PPA market in Switzerland.

As a method, we identified qualitative research with expert interviews to be the most suitable means to get a rich source of information on the preferences and hurdles of investors regarding PPAs. So far, two semi-structured expert interviews with representatives of Swiss energy suppliers at executive level have been conducted.

The preliminary results show that Corporate PPAs are becoming more popular in countries where policy instruments for renewable energy (RE) sources get reduced. The energy suppliers view PPAs as a valuable means to secure income for their RE projects. A significant challenge represents defining the price for the PPA contract, as it is based on forecasting the energy market price, which may be challenging in a highly volatile market. As energy suppliers sign PPAs more for large capacities such as wind parks or utility-scale PV systems, the PPA market in Switzerland remains smaller than in other European countries. An interviewee advocates simplifying and accelerating the permitting processes in Switzerland for utility-scale RE projects, which would drive PPAs and investments in RE in Switzerland. Further interviews will provide more insights into these issues.

This study allows to elicit renewable energy investors' preferences. The results will also inform the scenario development in Task 7.1.

Task 8.2: Mobilizing social acceptance and finance

Joint population survey on socio-political, community and market acceptance (EDGE Survey)

The joint population survey is a core element of EDGE from a social science perspective, since it will generate the empirical basis for the substantial analyses conducted in WP 1-3 as well as in WP 8. The survey is led by UNIBE and involves teams from EPFL-H, UNISTG and ETHZ-E. The survey will be conducted in September 2022. As a result, in the reporting period, the work performed in Task 8.2 was dominated by designing and preparing this survey.

Being a joint product from different social science disciplines and research groups, quite some time was spent on discussing and deciding on the main perspectives and question modules to be integrated in the survey but also on common definitions and wordings. This process was extremely important to guarantee the consistency of the survey. The result of this process was that two main topics are now at the core of the survey (in accordance with the milestones and deliverables in WP 1-3 and 8). One is a focus on solar PV adoption, i.e. the motivating and hindering factors of solar PV installations and participation in solar PV projects. The second focus is on policy acceptance.

Regarding PV adoption, one module focuses on individual adoption, namely the installation of PV on one's own roof top. The survey design and questions are based on (i) the theory of planned behavior (Ajzen, 1991) and the diffusion of innovations theory (Rogers, 2003); (ii) previous studies on technology adoption (f.e. Hecher et al., 2016, Duygan et al., (under review)); as well as (iii) qualitative interviews with Swiss adopters of energy management systems integrating PV and e-mobility (**InnoNet-Energy project**). A second module is a conjoint analysis with the aim to identify the conditions under which individuals are willing to co-invest in (market acceptance) or to accept (community acceptance) local PV projects. The design of the conjoint instrument is based on a fully randomized approach (Hainmüller et al. 2014), while the attributes and levels have been defined based on previous literature as well as on six expert interviews (within the EDGE team but also with external experts).

Regarding policy acceptance, a novel survey instrument, integrating the interdisciplinary potential of EDGE, is being developed. Both scientifically but also in the political discourse, astonishingly, policy goals and policy effectiveness are seldom discussed in conjunction but typically treated as two rather separate "issues". Hence, a main interest within EDGE is to study citizens' reactions when they learn that their preferred policies are not in accordance (i.e., do not reach) the preferred policy goals. To prepare such a survey instrument, a central element is to create (hypothetical and realistic) policy mixes (a policy mix is a combination of different policy instruments) and to determine in how far these policy mixes are in accordance or not with different policy goals. For that reason, an EDGE expert survey is currently being conducted, in which the EDGE survey team asks the technical and modelling experts in EDGE to evaluate different policy mixes with respect to whether they might reach different policy goals or whether they most likely fail to do so. The goals describe different levels of ambition with the "official" renewable energy goal serving as "medium category". Regarding policy mixes, five policy mixes were chosen based on several criteria. One important criterion was that the policy instruments are tangible and "easy to understand" for the lay public. A second criterion was that they – similar to the goals – have different levels of ambition. And a third criterion was to also integrate policy mixes that differ regarding their focus, i.e., whether they for example emphasize subsidies, taxation or regulation. The expert ratings will then be used to prepare the survey logic, i.e., to determine whether respondents, depending on their choices in the survey, are asked to adapt either their goal or their preferred policy mix.

Beside these central survey elements, the survey further contains other modules that inform about respondents' socio-economic characteristics but also include a rich set of attitudinal and behavioral questions. Table 3.8.1 gives an overview about the planned survey structure.

Table 3.8.1: Modules included in the EDGE survey

A General environmental and climate attitudes
B Behavioural patterns
C Joint Conjoint – co-investment in PV projects
D Solar - Adoption
E Acceptance of Open Space PV
F Energy Policy
G Policy acceptance module
H Politics
Z Sociodemographic questions

At the organizational level, the EDGE survey was approved by the Federal Statistical Office FSO to be eligible for using their sampling frame. UNIBE and ETHZ-E are, moreover, preparing the set-up of the survey, i.e., the data collection as such, through a partner organization within ETHZ.

Once collected, the survey data will provide many opportunities for analyzing relevant research questions in the context of EDGE. To provide some examples:

- It will shed light on the personal and socio-economic characteristics of early adopters (residents who have already installed solar PV or took part in a community PV project), potential adopters (ones who think it is likely/very likely for them to adopt solar PV or in the next 5 years) and skeptics/non-adopters (who are not interested in adoption) but also on the willingness to invest in co-funded PV projects. This will also enable us to study the inter-linkages between socio-political, market and community acceptance (D 8.3).
- These insights along with the knowledge on the motivating and hindering factors for adoption/non-adoption and investment/non-investment can help to design more effective interventions and communication strategies that are sensitive to socio-psychological characteristics (i.e., values, norms, attitudes) and personal context (i.e., household characteristics, information sources) of potential users. As a result, the social acceptance of decentralized renewable energy solutions such as rooftop or community solar PV can be increased.
- The survey will also elicit on which actors' respondents perceive as influential in the diffusion of solar energy in their communities. This complements the research focusing on the governance of energy transitions in WP1-3. A conceptual framework was developed to help identify the leverage points and influential actors for transitions to decentralized renewable energy options. The insights from the case studies in Task (1.3, 2.3, 3.3) will serve for designing policies that consider the role of actors (Task 8.1).
- Moreover, the survey data will be used to analyze the social acceptance of policies in the different geographical areas (D 2.2, D 1.7, D 3.12). In particular, whether respondents – if they learn that their preferred policies do not reach the renewable energy goals – tend to be ready to accept more far-reaching policies or whether they rather prefer to downscale the goals. This is an important insight for policymaking in Switzerland, especially regarding the steering of political campaigns, e.g., in the context of direct-democratic decisions.

Business dynamics at intersection of EV, PV, storage

In August-November 2021, UNISTG conducted a comprehensive survey "Consumer Barometer of Renewable Energies" with 1'054 households (=representative sample) and 250 energy prosumers (=boost) across Switzerland. The results are published online (**www.kuba.iwoe.unisg.ch**). The authors identified the rapidly increasing customer segment of "Early Electrifiers", i.e., homeowners who have

already or will soon adopt EV, PV, and battery storage. Their preferences and key attributes were analyzed.

As part of the St. Gallen Forum for Management of Renewable Energies (**REMforum 2022)**, UNISTG has prepared workshops that address business dynamics and social acceptance of renewable energy. Especially, the workshop "Solar Mobility" will bring together business representatives from Swiss and European companies that offer solar PV and EV charging solutions for homeowners. In the workshop, business models for accelerating the convergence of PV, EV, storage and for overcoming distribution grid congestion with flexible demand solutions, incl. smart charging and solar PV forecasting, will be discussed.

Task 8.3: Market modelling and distributional impacts

In the first reporting period, the search for the economic partners was undertaken and two groups were appointed (Prof. Regina Betz from ZHAW and Prof. Philippe Thalmann from EPFL), both of these groups are foreseen to make a major contribution to Task 8.3.

Among individual research activities, a PhD student was appointed at UNIGE to work on quantifying distributional impacts of the transition to high shares of renewable energy on different types of Swiss households. He is in the process of designing his first PhD study, where he will focus on quantifying the benefits and vulnerabilities of the Swiss households in the case of adopting solar PV, batteries, heat pumps, and electric vehicles under various policy scenarios. The households will be classified in groups that combine income levels as well as other socio-demographic and consumption characteristics.

3.7 WP 9

Title	Consortium management			
Actual start	05/2021		**End**	04/2027
TRL range	**Starting at**	n.a.	**Ending a**t	n.a.
WP leader	Michael Lehning, EPFL-C, lehning@slf.ch			
Members and coop. partners	Michael Lehning, EPFL-C Evelina Trutnevyte, UNIGE Claudia Binder, EPFL-H Gabriela Hug, ETHZ-P Giovanni Sansavini, ETHZ-R Tobias Schmidt, ETHZ-E Isabelle Stadelmann. UNIBE Rolf Wüstenhagen, UNISTG Partner 9 (Philippe Thalmann(EPFL LEURE) & Regine Betz (ZHAW) Philipp Schütz, HSLU Jürg Rohrer, ZHAW Christof Bucher, BFH Oliver Kröcher, PSI Vanessa Burg, WSL Annelen Kahl, Sunwell Peter Schwer, B&H			

Objectives

- Monitoring of activities (incl. milestones and deliverables).
- Ensure efficient management and coordination of EDGE activities.
- Preparation of annual and final reports for the SFOE.
- Point of contact for SFOE.
- Coordination of exchange and feedback among and from advisory board, partners, and participatory stakeholder forum.
- Collaboration with other SWEET projects to ensure EDGE is embedded in the SWEET landscape and potential synergies get furthered.
- Overseeing risk management, as well as ethical and gender aspects.

Work performed and results

Task 9.1: Administrative and work-flow coordination and representation towards the Swiss Federal Office of Energy

The project management unit successfully implemented management structures.

Management meetings: While early meetings were arranged only from one to the next meeting, by now, meeting schedules are developed to also cover the coming year, aiming to have dates fixed well in advance.

- The **Project Management Unit (PMU)** meets bi-weekly online.
- The **Coordination Board (CB)** meets online in intervals of 6-8 weeks.
- The first **Advisory Board (AB)** Meeting took place online on 10 February 2022, the next one is planned, combined with the CB for 4 July 2022.

List of Advisory Board (AB) members

Kornelis Blok (TU Delft, Engineering Systems and Services, Energy and Industry)

Marius Haibel (Federal Office for the Environment FOEN, Climate Policy Section)

Julie Lundquist (National Renewable Energy Laboratory and University of Colorado, Department of Atmospheric and Oceanic Sciences)

Gianni Operto (aeesuisse, Organization of the economy of renewable energies and energy efficiency)

Carlos Alvarez Pereira (Club of Rome)

Gabriele Spilker (University of Konstanz, Department of Politics and Public Administration)

Consortium agreement: the consortium agreement was signed by all; signature sheets are available.

New economic partner: The economic partner (#9) has been found; the tasks will be shared by two partners. An agreement with EPFL LEURE has been signed for one part, the second part will be handled by a group from ZHAW.

As of January 2022, a new project manager took up work. A project management system is being developed, so that the project manager can be in direct contact with each responsible for milestones and deliverables from partners and consortium members. Currently, reminders for milestones and deliverables are addressed to WP leaders, which is not an efficient system. Discussions are ongoing as to the level at which a milestone or deliverable should be monitored. Once there is a clear conclusion, the new addressees for reminders will be included in the project management tool, which should ease the workload for work package leaders to some extent.

Task 9.2: Coordination of the exchange with the advisory board, partnership body, participatory stakeholder forum, and other SWEET projects

As mentioned in Task 9.1, work with the advisory board has started. The terms of reference for the advisory board have been completed, and non-disclosure agreements have been signed with each advisory board member. The terms of reference/non-disclosure agreements regulate the work and collaboration for the advisory board members and are an integrated part of the consortium agreement. Several advisory board members took part in the full consortium meeting in April 2022. The meeting minutes of the advisory board meeting in February were circulated to the consortium for information.

The EDGE project manager is in contact with the project managers of SWEET PATHFNDR and SWEET SURE to increase exchange of ideas, for now mainly regarding reporting and project management.

Participation in CROSS has started, and substantial contributions to CROSS activities have been achieved. Regular PI exchange between SWEET projects has been initiated and took place during the start-up phase of the projects.

3.8 WP 10 (Knowledge and technology transfer

WP leader	Evelina Trutnevyte, UNIGE, evelina.trutnevyte@unige.ch Flora Dreyer, UNIGE, flora.dreyer@unige.ch
Members and coop. partners	Michael Lehning, EPFL-C Anja Schilling Hoyle, EPFL-C Isabelle Derivaz-Rabii, EPFL-C

Work performed and results

Task 10.1: Development and implementation of internal communication procedures

Organisation of in-person and online project meetings

- Organisation of in-person project meetings:
  Task 10.1 enables the communication within the EDGE project consortium. To this end, it notably oversees the scheduling and organization of the in-person project meetings once a year. Our first milestone 10.1 was met on 26 October 2021 with a kick-off in-person meeting held at EPFL in Lausanne and organized by EPFL-C with a total of 45 participants (amongst which 5 joined online). All meeting slides are available on the shared switchdrive folder.
  Due to the consequences and travel restrictions arising from the COVID pandemic, Milestone M10.1 (in-person meeting) and Milestone M10.2 (online meeting) were swapped in 2021. Equally, the year 2022 started with mandatory home office work, which lead the Project Management Team to decide to continue holding consortium meetings on this basis; M10.1 became the online meeting and M10.2 became the in-person meeting. Therefore, the next in-person Consortium Meeting will be held on 31 August 2022 and 1 September 2022 in Geneva.

- Organisation of annual online half-day meetings:
  Annual online meetings ensure that the Consortium meets every six months while mitigating the logistical costs to in-person meetings. Our first milestone 10.2 was met on 15 July 2021 with a total of 26 participants. This kick-off half day online meeting enabled to introduce all partners to one another, present WP work and leaders, review the milestones of the first 18 months, plan the reporting and the next in-person meeting, and suggest first outreach events. Note: no agenda, other than the one in the minutes report, has been drafted. This is due to the short amount of time available to unlock funds and plan the meeting after the signature of the Consortium Agreement (29 June 2021).
  Our second milestone M10.2 was met on 14 April 2022 with a total of 53 participants. This second online meeting assessed the current states of all project work packages in relation to stated objectives, planned milestones, deliverables, and screened for and encouraged interdisciplinary collaborations in break-out groups.

Development and maintenance of an internal online platform

To support the exchange of information and data across project partners, a first internal online platform was developed on Microsoft Teams. Deliverable 10.1 was therefore met in November 2021 with a “SWEET EDGE” folder made accessible to all partners. However, the Project Management Team and other partners quickly realized the limited use of the Microsoft Team platform and faced access restrictions to some partners. In February 2022, the Microsoft Team exchange platform was replaced by the Switchdrive exchange platform, with relevant regulations on data protection. This platform was implemented and operated by the Project Management Team with ICT support from UNIGE and EPFL and is now used by 55 Consortium Members. Alternative solutions for members whose organizations did not grant access to Switchdrive have been found, by enabling members to access the shared folder via their polybox or by creating vouchers.

Task 10.2: External communication and dissemination of results

Biennial conferences and dissemination

Task 10.2 aims to ensure that EDGE findings are communicated effectively and widely across various stakeholder groups and potential users of the outreach, by developing external communication activities towards different target audiences.

Since the EDGE program has started a year ago, there are no completed results yet that could be disseminated. However, communication activities for academic ad policy audiences have been actively explored over the year to represent EDGE at events and conferences in Switzerland. Foreseen events include the SWEET Day in June 2022 as well as the Swiss US Energy Innovation Days - SUEID in August 2022. Particular attention has been given to events that bridge academia, policy, and industry to facilitate the development of networks outside academia.

Project website

Deliverable 10.2 was met in December 2021 with the launch of the SWEET EDGE website. The coordination with the webmaster was done by the Project Management Team while waiting for the KTT Manager to be hired. The project website enables to publish project details, news, and results when applicable, and is accessible at this web address: **https://www.sweet-edge.ch/**. The website has been translated in both German and French and a trilingual website is available.

Quarterly Newsletter

Deliverable 10.3 was met on 3 March 2022 with the launch of the first EDGE quarterly newsletter, Quarterly Newsletter), sent to 141 EDGE partners, including 42% openers and 18% clickers. The first EDGE Newsletter was slightly delayed due to the necessary time spent to hire the EDGE Communication Manager. The next Newsletter is planned to be out in May 2022 and will be available in three languages: English, French, and German.

Social Media Engagement

Milestone 10.3 was met when social media platforms have been created on 18th October 2021 with first original contents being shared on both EDGE Twitter and Linkedin pages, including updates from the EDGE kick-off meeting. These two accounts report the project news and updates, introduce partners, and communicate about partners' events. To this day, EDGE has a total of 165 followers on Linkedin and 106 followers on Twitter, with 43 tweets and more than 80 shares of original content. EDGE Twitter account is **@sweetedge_ch** and Linkedin account is **@sweet-edge.**

The Youtube channel has also been created with the first repost content shared on 9 November 2021: two **videos from PATHFNDR** that introduce EXPANSE and Nexus-E models**.** EDGE Youtube channel's first original content has been published on March 30th 2022 with a user-friendly **video of Annelen Kahl**, Co-founder of EDGE partner spin-off SUNWELL, highlighting SUNWELL's overall work and how it relates to EDGE. The video reached 126 views (the view count was, however, reset to zero in May 2022 after changes were made to correct a logo in the video). The Youtube channel is aimed at highlighting partners' work and making it accessible to academia and non-academia community to provide updates from research, fieldwork, P&D activities, and other more general perspectives on renewable energy and policy in Switzerland. EDGE Youtube's account is **@SWEET EDGE.**

Partnership Body Engagement

To understand the interests of EDGE cooperation and support partners, and better plan their engagement, the KTT Team has started to undertake one-to-one partner interviews. Conducting such interviews is more time consuming than a survey that was initially planned, but we chose to do interviews to have more in-depth discussions and individual attention to each partner. The first interview was held with Patrick Horka from South Pole on 19 April 2022. The second interview was held with Ingo Herbst from Siemens on 27 April 2022. Each interview is then summarized in written form and this summary is

made available to the whole consortium. Based on the interview, the cooperation and support partners are also put in touch with the respective research partners in EDGE. In 2022, the aim is to interview most of the 62 partners.

4 Outreach & outputs during the reporting period

Peer-reviewed publications

Members and coop. partners	**Description:** author(s), title, journal or type of publication, year of publication	**doi**
EPFL-C	Dujardin and Lehning, Wind-Topo: Downscaling near-surface wind fields to high-resolution topography in highly complex terrain with deep learning, QJRMS, 2022	10.1002/qj.4265
HSLU	Melillo, Linder, Barahona, Schuetz: Statistical analysis of 200 digital twins for thermal load of Swiss buildings created from smart grid monitoring data; J. Phys.: Conf. Ser. **2042** 012009	10.1088/1742-6596/2042/1/012009
HSLU	Barahona, Buck, Oskara, Schuetz: Detection of thermal anomalies on building façades using infrared thermography and supervised learning; J. Phys.: Conf. Ser. **2042** 012013	10.1088/1742-6596/2042/1/012013
HSLU	Villasmil, Troxler, Hendry, Schuetz, Worlitschek: Control strategies of solar heating systems coupled with seasonal thermal energy storage in self-sufficient buildings; Journal of Energy Storage, 42, 103069	10.1016/j.est.2021.103069
HSLU	Villasmil, Troxler, Hendry, Schuetz, Worlitschek: Parametric Cost Optimization of Solar Systems with Seasonal Thermal Energy Storage for Buildings E3S Web Conf., **Volume** 246, 202	10.1051/e3sconf/202124603003
PSI	Emanuele Moioli, Linking heat and electricity supply for domestic users: an example of power-to-gas integration in a building, RSC Adv., 2022, 12, 10355-10365	DOI: 10.1039/D2RA00951J

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

Members and coop. partners	**Description:** author(s), title, channel or type of publication, year of publication
EPFL-C	Fabrice Delaye, Sans l'Europe, la Suisse se coupe du grand atout des énergies renouvelables, heidi.news, 2022
EPFL-C	Fabrice Delaye, L'invraisemblable retard solaire de la Suisse, heidi.news, 2022
UNISTG	Gahrens, Petrovich, Wüstenhagen, Motz: “Is perceived climate friendliness driving EV adoption? Exploring consumer knowledge at different stages of the vehicle purchasing process”, IAEE Energy Forum. No. Q3 2022. IAEE, 2022.
UNISTG	Motz, Petrovich, Gahrens, Wüstenhagen: "Solar sharing economy” or “my home is my power plant"? Profiling collective and individual solar prosumers in Southern Switzerland." IAEE Energy Forum. No. Q2 2022. IAEE, 2022.

Public oral and visual presentations (scientific or broad audience)

Members and coop. partners	**Description:** author(s), title, name of the event and location, year of presentation
EPFL-C	Dujardin and Lehning, Towards better estimates of wind power potentials in the Alps, Applied Machine Learning Day, Lausanne, 2022
ETHZ-R	Giovanni Sansavini; Balancing costs, emissions, and reliability in Active Distribution Networks; ISTP Colloquia; Institute of Science, Technology and Policy, ETH Zurich, May 2021
ETHZ-R	Giovanni Sansavini; Balancing costs, emissions, and reliability in active distribution networks; ReMaP Workshop; PSI; September 2021
ETHZ-R	Giovanni Sansavini; Planning Fit-for-the-Future Energy Systems - The Argument for Resilience; Annual Meeting of the Society for Risk Analysis; online; December 2021
HSLU	Philipp Schütz; Gebäude im Gesamtsystem und Beitrag zu Netto Null; Zukunftsregion Argovia Forum, April 2022
HSLU	Philipp Schütz; Data-based assessment of retrofitting measures; March 2022
HSLU	Philipp Schütz: Beispiele Energieforschung an der HSLU; general assembly of NELU; March 2022
HSLU	Esther Linder: Statistical analysis of 200 digital twins for thermal load of Swiss buildings created from smart grid monitoring data; CisBAT; September 2021
UNIGE	Evelina Trutnevyte: «Comment les modèles informatiques peuvent-ils accompagner la transition énergétique?» Les Grands Soirs au Collège de Saussure, Genève, 2022.
EPFL, UNIGE	Michael Lehning, Jérôme Dujardin, Annelen Kahl, Evelina Trutnevyte: «SWEET EDGE: Enabling Decentralized renewable GEneration in the Alps». Energieforschungsgespräche Disentis, 2022.
UNIGE, EPFL	Evelina Trutnevyte, Michael Lehning: «SWEET EDGE: Enabling Decentralized renewable GEneration in the Swiss cities, midlands, and the Alps». CLIMACT seminar, online, 2021.
UNIGE, EPFL	Evelina Trutnevyte, Michael Lehning: «SWEET EDGE: Enabling Decentralized renewable GEneration in the Swiss cities, midlands, and the Alps ». Energieforschungsgespräche Disentis, 2021.

Completed theses

Members and coop. partners	**Description:** author(s), title, type (master, PhD), year
EPFL-C	Jerome Dujardin, The complex winds of the Alps: an unseen asset for the energy transition, PhD thesis, 2021
ETHZ-R	Filippo Tettamanti, Design and optimization of reliable active distribution networks, master thesis, 26 July 2021
WSL	Armin Siegrist, Analysis of suitable agricultural biogas plant locations, biomass utilization potentials and substrate allocation in Switzerland using GIS, Master Thesis, ETH, 2022
ETHZ-E	David Giger, A review and techno-economic model on the role of localization in renewable energy policy, Master Thesis, ETH, 2022
HSLU	Andy Gubser, Modelling the energy demand of individual buildings in Switzerland, Master thesis, HSLU, 2022.

5 Updated list of consortium members and cooperation partners

Table 5-1: List of consortium members (Any modification is subject to prior approval by the SWEET Office)

Additional members							
Previous members (no longer part of the consortium)							
N°	**Members** • Legal organisation's name • Group/laboratory • Name of the representative	**Short name**	**Type of organisation**	**Canton or country**	**Language region of CH**	**Expertise and contribution** E: Expertise C: Contributions List of work packages	**Member in other SWEET consortia**
1	École Polytechnique Fédérale de Lausanne Laboratory of Cryospheric Sciences Michael Lehning	EPFL-C	University	Vaud	French	E: Wind and solar potential, interaction with snow, energy system modelling at high resolution C: Advanced estimates of wind and solar power (Alpin), modelling de-centralized renewable energy input for Switzerland WP3, WP4, WP5, WP6, WP7, WP9, WP10	---
2	Université de Genève Renewable Energy Systems Evelina Trutnevyte	UNIGE	University	Genève	French	E: renewable energy, energy systems modelling, socio-technical transitions, spatial modelling, distributional impacts and equity, long-range scenarios C: Spatial electricity sector modelling for Switzerland and Europe, analysis of distributional impacts, modelling of microgrids, model inter-comparisons, co-leadership, knowledge, and technology transfer WP1, WP2, WP3, WP7, WP8, WP9, WP10	EDGE, SURE, PATHFNDR

3	École Polytechnique Fédérale de Lausanne Human-Environment Relations in Urban Systems Claudia Binder	EPFL-H	University	Vaud	French	E: transition studies, systems science, diffusion of innovation, acceptance C: governance of energy transitions, actor analysis, transition pathways WP1, WP2, WP3, WP4, WP6, WP8, WP9, WP10	SWEET SURE
4	Eidgenössische Technische Hochschule Zürich Power System Laboratory Gabriela Hug	ETHZ-P	University	Zurich	German	E: power systems, power grid capabilities, electrification C: impact of electrification of mobility sector on power grid WP1, WP2, WP3, WP7	PATHFNDR
5	Eidgenössische Technische Hochschule Zürich Risk and Reliability Engineering Giovanni Sansavini	ETHZ-R	University	Zurich	German	E: Reliability, Resilience, Typical distribution networks C: Reliability analysis of distribution networks; challenges to distribution networks with high-penetration of renewables; scenario analysis using nexus-e model WP1, WP2, WP3, WP7	PATHFNDR
6	Eidgenössische Technische Hochschule Zürich Energy Politics IFW Tobias Schmidt, Bjarne Steffen	ETHZ-E	University	Zurich	German	E: Energy policy, energy politics, public opinion, policy design C: Contributing primarily to WP8 Task 1 (population survey, cantonal energy policy) and its deliverables, as well as project management in WP2 WP2, WP8	---
7	University of Bern Institute of Political Science, Chair of Comparative Politics Isabelle Stadelmann	UNIBE	University	Bern	German	E: Political Science, Social acceptance, survey research, public opinion, individual behaviour and attitudes, public policy C: EDGE joint survey (lead), cantonal policy (data collection and analysis), social acceptance in the different EDGE regions	SURE

						WP1, WP2, WP3, WP8, WP9, WP10	
8	University of St. Gallen Institute for Economy and the Environment Rolf Wüstenhagen	UNISTG	University	St.Gallen	German	E: renewable energy management C: electrifying corporate fleets, electrifying agricultural transport, corporate power purchase agreements WP1, WP2, WP3, WP7, WP8, WP9, WP10	---
9	École Polytechnique Fédérale de Lausanne Laboratory of Environmental and Urban Economics LEURE Philippe Thalmann	EPFL-LEURE	University	Vaud	French	E: energy economics, climate economics C: General equilibrium modelling, employment effects, distributional effects WP7, WP8	SWICE
	ZHAW School of Management and Law Center for Energy and Environment CEE Regine Betz	CEE	University of applied sciences	Zurich	German	E: Energy and Climate economics, Electricity markets, Policy design, Distributional impacts, CGE modelling, C: Modelling of distributional impacts, analytical actor-centred model WP7, WP8	PATHFNDR, LANTERN
10	Hochschule Luzern, Institute of Mechanical Engineering and Energy Technology Philipp Schütz	HSLU	University of Applied Sciences	Luzern	German	E: Heating/cooling demand and energy systems modelling, recommender tool, pilot site management C: Recommender tool for communities to increase renewables and energy system modelling; pilot site orchestration for urban context WP1, WP2, WP3, WP4, WP5, WP6, WP7	EDGE, PATHFNDR, DECARBCH, LANTERN

11	Zürcher Hochschule für Angewandte Wissenschaften Renewable Energy Jürg Rohrer	ZHAW	University of Applied Sciences	Zurich	German	E: PV, storage alternatives, Power to Gas, Vehicle to Grid, Swiss energy system C: Coordination of techno-economic analysis, role of storage for integrating high shares of decentralized renewables, lead WP5 WP1, WP2, WP3, WP4, WP5, WP6, WP9, WP10	---
12	Berner Fachhochschule Laboratory for Photovoltaic Systems Christof Bucher	BFH	University of Applied Sciences	Bern	German	E: PV inverter testing, PV components testing, Long-term PV Monitoring, PV oriented buildings, PV2X, EV2X, PV grid connection C: operator recommendations, (distribution) grid models, dis- and aggregated PV production profiles, dis- and aggregated load profiles, expertise in PV potential, expertise in (distribution) grids WP1, WP2, WP3, WP4, WP5, WP6, WP9, WP10	---
13	Paul Scherrer Institute Bioenergy and Catalysis Laboratory Oliver Kröcher	PSI	Research Institute	Aargau	German	E: waste, biomass, bioenergy, process development and upscaling C: provide data on waste and biomass, workshop on optimal bioenergy use, develop pilot and demonstration projects WP1, WP2, WP5, WP9, WP10	---
14	Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft Sustainable Forestry Vanessa Burg	WSL	Research Institute	Zurich	German	E: Biomass, bioenergy C: Biomass resources WP2, WP3, WP9, WP10	---
15	Spin-off SUNWELL Annelen Kahl, Sharma Varun	SUNWELL	Spin-off company	Vaud	French	E: Solar Energy Potential, particularly in the alpine area	---

						C: Alpine solar energy potential, feasible installation locations for PV farms WP3, WP6, WP9, WP10	
16	Basler & Hofmann AG Peter Schwer	B&H	Engineering company	Zurich	German	E: PV Wind Norms Engineering C: Expertise Support WP4, WP6, WP9, WP10	---

Table 5-2: List of cooperation partners

Additional cooperation partners						
Previous cooperation partners (no longer cooperating)						
N°	**Cooperation partner** • Legal organisation's name • Group/laboratory • Name of the representative	**Short name**	**Type of organisation**	**Canton or country**	**Language region of CH**	**Expertise and contribution** E: Expertise C: Contributions List of work packages
17	Swisspower AG Manfred Dirren	n.a.	Private sector	Bern	German	E: Coordination of joint projects between energy providers C: Contribution to P&D projects
18	Energie Wasser Luzern Ricarda Vogt	n.a.	Private sector	Luzern	German	E: Operator of energy system in Lucerne, Challenges of pilot project QUBE C: City energy provider and utility involved in P&D project QUBE WP4
19	Zukunftsregion Argovia Eifert Matthias	n.a.	Private sector	Aargau	German	E: Insights in challenges of utilities (in particular in Aargau), enabler for projects for renewable energy in the interface between technology providers, communities and utilities C: Connection to different cities to be used as P&D projects, scaling of results in Aargau WP4, WP5, WP6
20	Eniwa Samuel Pfaffen	n.a.	Private sector	Aargau	German	E: Operation of energy system in Aarau, challenges for utilities and their solution C: Consulting for scaling of demo projects WP4, WP5
21	Energie Wasser Bern Jürg Balsiger	n.a.	Private sector	Bern	German	E: operation and optimization of district heating networks, operation of electricity grids, mobility C: P+D Project Energiezentrale Forsthaus WP1, WP4
22	SWL Energie AG Markus Blättler	n.a.	Private sector	Aargau	German	E: Insight on energy consumption in the region of Lenzburg

						C: Operator of P&D project in Lenzburg WP4
23	Rigitrac Traktorenbau AG Sepp Knüsel	n.a.	Private sector	Schwyz	German	E: Electrification of agricultural vehicles (electrical tractor) C: Development and delivery of an electrical tractor WP5
24	Laveba Thomas Keel	n.a.	Private sector	Sankt Gallen	German	E: Biogas plants, wood pyrolysis, agri-PV C: Realization of pilot projects in the field of agriculture: biogas plant, wood pyrolysis plant, agri-PV plant, charging stations for electrical vehicles WP5
25	Swisspor Christian Röthenmund	n.a.	Private sector	Aargau	German	E: Building and storage system insulation materials and solutions C:- Consulting for building façade retrofitting and large-scale storage material selection WP4, WP5, WP6
26	Gemeinde Davos Philipp Wilhelm	n.a.	Local public administration	Graubünden	German	E: Public administration at local level C: Support for development of local P&D project
27	Heim AG Heizsysteme Joel Heggli	n.a.	Private sector	Thurgau	German	E: Wood pyrolysis, CHP (combined heat and power) C: Engineering and delivery of wood pyrolysis plant WP5
28	energie-cluster.ch Jürg Kärle	n.a.	Private sector	Solothurn	German	E: Insight into network to lower co2 emission between science, development and schools/unis C: Ambassador for contact to renewable energy companies WP4, WP5, WP6
29	diePROJEKTFABRIK GmbH Roland Limacher	n.a.	Private sector	Luzern	German	E: Execution of renewable energy projects, contacts to renewable energy solution providers and end-users C: Support in pilot site development and operation WP1, WP4
30	Stiftung Alpines Energie Forschungs Center Ivo Schillig	n.a.	NGOs/non-profit	Graubünden	German	E: Research and Outreach on Alpine Energy Systems C: Help with with Alpine P&Ds; Platform for dissemination of results
31	AEW Energie AG	n.a.	Private sector	Aargau	German	E: Operator of energy systems in urban and midland context

	Marcel Kränzlin					C: Operator of P&D project in Möhlin-Rheinfelden WP4
32	ecocoach AG Pirmin Reichmuth	n.a.	Private sector	Schwyz	German	E: Energy management systems C: 2nd Life battery application, energy management solution to integrate electrical vehicles WP5
33	South Pole Carbon Asset Management Ltd. Patrick Horka	n.a.	Private sector	Zurich	German	E: Financing of renewable energy projects C: Information exchange with consortium members WP7, WP8, WP10
34	Siemens Schweiz Smart Infrastructure Ingo Herbst	n.a.	Private sector	Zurich	German	E: eMobility, distribution network design C: Impact calculation eMobility, coupling of ROADMAP2025 and EDGE WP1
35	EVTEC AG Dominik Mock	n.a.	Private sector	Lucerne	German	E: Charging stations for electric vehicles C: 2nd life battery storage for WP5, bidirectional charging solutions for WP5 WP5
36	Axpo Solutions AG Christian Heierli	n.a.	Private sector	Aargau	German	E: Large-scale energy provider, producer and trader C: Muttsee P&D partner

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