



SWEET Call X-2020: SWEET EDGE

Deliverable report

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Summary

The 'Recommender Tool', developed as part of the SWEET EDGE project supports energy transformation processes by providing comprehensive data analysis functionalities. It offers an overview of energy demand and sources for municipalities, visualises data graphically and cartographically, allows for benchmarking renewable energy impacts, and enables users to create future scenarios.

The 'QUBE Process Model', developed in an Innosuisse project, consists of five socio-technical phases for the energy transition in residential neighbourhoods and may utilise the 'Recommender Tool' to inform stakeholders and guide energy transformation efforts. The focus of this deliverable lies on the suitability of the 'Recommender Tool', to support this process. For this, the first three phases of the QUBE Process, initialization, interest formation, and consolidation are analysed; the 'Recommender Tool' is at this point estimated not to be applicable in the realisation and operation phases of the QUBE Process.

In the initialization phase of the 'QUBE Process Model', the project's fundamentals and framework conditions are established. This involves forming a support group, activating relevant actors, conducting analyses, and establishing a network. The 'Recommender Tool' may aid in this phase by providing an overview of the municipality's energy data, helping to inform and activate various actors, and identifying areas for potential energy cooperations. During initial public workshops of the QUBE Model, maps of energy sources and consumption help stakeholders to discuss the local situation and the local QUBE Process may support the correction of outdated or incorrect data in the 'Recommender Tool'. To respect privacy and build trust, aggregated 'heat-maps' are recommended instead of data from individual buildings during the first neighbourhood encounter. The second phase of the 'QUBE Process Model', 'Interest Formation', involves creating interest groups of property owners and other stakeholders focused on energy cooperation. In this phase, the first technical measures are examined and rough data for estimating energy demand is defined based on data from individual households. The 'Recommender Tool' provides data on building properties and estimated energy demands, essential for impact analysis which can be used productively in this phase. To be more effective at the neighbourhood level the tool's data should be refined and calibrated with local and individual data for accuracy. The cooperative network of a QUBE process includes experts and authorities involved in decision-making, who may provide additional data to improve the information provided by the tool. The third phase, 'Consolidation', involves property owners, now organised in interest groups, consolidating solutions and collaborations with support from experts and facilitators. Guided self-organisation is key at this stage. Technical solutions are assessed for feasibility by specialised companies, and financing is secured by owners or funding authorities. The 'Recommender Tool' could be deployed in this phase with its scenario feature which could estimate the impact of renewable energy options on consumption, emissions, and investments. This helps in the discussion of technical solutions and the assessment of innovative measures. Financial estimates by the tool could also substantially support the process.

Based on experiences from various sub-projects within the QUBE project, there is potential for enhancing the 'Recommender Tool' to align with socio-technical processes as described in the 'QUBE Process Model'. This relates in particular to defining individual perimeters for specific neighbourhoods or sub-areas, which would facilitate targeted discussions and efficient overviews. The EDGE consortium is working on developing this feature. While the tool effectively compiles and visualises diverse data, the graphics can be challenging for laypersons to interpret without expert mediation. Therefore, the tool requires moderation to explain the relevance of its graphics for energy planning. The 'Recommender Tool' provides a solid overview of energy data for Swiss municipalities. However, features to guide users through later implementation phases are missing. Enhancements could include providing links, next steps, and processes for neighbourhood-based collective solutions, such as identifying locations for thermal heat storage systems.

In conclusion, the 'Recommender Tool' may significantly facilitate and support the QUBE Process phases. By compiling and presenting data from various sources clearly and accessibly, it provides crucial starting points for work within the QUBE phases and modules. The tool informs owners and experts about the municipality's situation and helps identify relevant neighbourhoods or sub-areas through its cartographic energy data representation. The tool's consolidated energy data presentation simplifies the development of technical solutions, saving time and costs. While the tool can present individualised options to some extent, more detailed and locally applicable scenarios require input from the EDGE consortium or other experts. One of the tool's major potential lies in making technical



innovations accessible and encouraging stakeholders to explore innovative transformation paths. If the tool continues to develop in terms of the aspects mentioned, it will be interesting to test its application in a more targeted way in Swiss neighbourhoods, for example in one of the SWEET LANTERN Living Labs.



Zusammenfassung

Das im Rahmen des SWEET EDGE Projekts entwickelte 'Recommender Tool' unterstützt die Energiewende durch übersichtliche Datenanalysefunktionen. Es bietet Gemeinden einen Überblick über den Energiebedarf und die Energiequellen, visualisiert Daten grafisch und kartografisch, ermöglicht ein Benchmarking der Auswirkungen erneuerbarer Energien und bietet den Nutzenden die Option, Zukunftsszenarien zu erstellen.

Das im Rahmen eines Innosuisse Projekts entwickelte 'QUBE-Prozessmodell' besteht aus fünf soziotechnischen Phasen zur Energiewende in Wohngebieten und kann das 'Recommender Tool' nutzen, um Stakeholder zu informieren und Bemühungen im Rahmen der Energiewende anzuleiten. Der Fokus dieses Reports liegt auf der Eignung des 'Recommender Tools' zur Unterstützung dieses Prozesses. Dazu werden die ersten drei Phasen des QUBE-Prozesses, Initialisierung, Interessenbildung und Konsolidierung, analysiert; das 'Recommender Tool' wird zu diesem Zeitpunkt als nicht anwendbar in den Realisierungs- und Betriebsphasen des QUBE Prozesses eingeschätzt.

In der Initialisierungsphase des 'QUBE-Prozessmodells' werden die Grundlagen und Rahmenbedingungen des Projekts festgelegt. Dazu gehört die Bildung einer Begleitgruppe, die Aktivierung relevanter Akteur*innen, die Durchführung von Analysen und der Aufbau eines Netzwerks. Das 'Recommender Tool' kann in dieser Phase hilfreich sein, indem es einen Überblick über die Energiedaten der Gemeinde bietet, zur Information und Aktivierung verschiedener Akteur*innen beiträgt und Bereiche für potenzielle Energiekooperationen identifiziert. Bei den ersten öffentlichen Workshops des 'QUBE-Prozessmodells' können die durch das Tool generierten kartografischen Darstellungen der Energiequellen und des Energieverbrauchs den Interessengruppen helfen, die lokale Situation zu besprechen und der QUBE-Prozess könnte bei Bedarf helfen, veraltete oder falsche Daten im Recommender Tool zu korrigieren. Um die Privatsphäre zu respektieren und Vertrauen aufzubauen, werden im Kontext eines soziotechnischen Prozesses bei der ersten Begegnung im Stadtteil aggregierte 'Heat Maps' anstelle von Daten einzelner Gebäude empfohlen. In der zweiten Phase des 'QUBE-Prozessmodells', der 'Interessenbildung', werden Interessengruppen von Immobilienbesitzer*innen und anderen Stakeholdern gebildet, die sich auf die Kooperationen im Energiebereich konzentrieren. In dieser Phase werden die ersten technischen Maßnahmen untersucht und grobe Daten zur Schätzung des Energiebedarfs auf der Grundlage von Daten einzelner Haushalte definiert. Das 'Recommender Tool' liefert Daten zu Gebäudeeigenschaften und geschätzten Energiebedarfen, die für die Wirkungsanalyse unerlässlich sind und in dieser Phase produktiv genutzt werden können. Um auf Nachbarschaftsebene effektiver zu sein, sollten die Daten des Tools verfeinert und mit lokalen und individuellen Daten justiert werden. Das kooperative Netzwerk eines QUBE-Prozesses umfasst Expert*innen und Behörden, die an der Entscheidungsfindung beteiligt sind und zusätzliche Daten bereitstellen können, um die vom Tool bereitgestellten Informationen zu verbessern. In der dritten Phase, der 'Konsolidierung', festigen die nun in Interessengruppen organisierten Immobilieneigentümer*innen mit Unterstützung von Expert*innen und Moderator*innen Lösungen und Kooperationen. Eine geführte Selbstorganisation ist in dieser Phase von entscheidender Bedeutung. Technische Lösungen werden von spezialisierten Unternehmen auf ihre Machbarkeit geprüft und die Finanzierung wird von Eigentümer*innen oder Förderbehörden sichergestellt. In dieser Phase könnte das 'Recommender Tool' mit seiner Szenario-Funktion eingesetzt werden, mit der die Auswirkungen erneuerbarer Energieoptionen auf Verbrauch, Emissionen und Investitionen abgeschätzt werden können. Dies hilft bei der Diskussion technischer Lösungen und der Bewertung innovativer Massnahmen. Auch die finanziellen Schätzungen des Tools könnten den Prozess erheblich unterstützen.

Basierend auf den Erfahrungen aus verschiedenen Teilprojekten innerhalb des QUBE-Projekts besteht das Potenzial, das 'Recommender Tool' so anzupassen, dass es an die im 'QUBE-Prozessmodell' beschriebenen soziotechnischen Prozesse angeglichen ist. Dies bezieht sich insbesondere auf die Definition individueller Perimeter für bestimmte Stadtviertel oder Teilbereiche, was gezielte Diskussionen und effiziente Übersichten erleichtern würde. Das EDGE Konsortium arbeitet an der Entwicklung dieser Funktion. Während das Tool verschiedene Daten effektiv zusammenstellt und visualisiert, können die Grafiken für Laien ohne fachkundige Vermittlung schwierig zu interpretieren sein. Daher muss das Tool moderiert werden, um die Relevanz der erstellten Grafiken für die Energieplanung zu erklären. Das 'Recommender Tool' bietet einen soliden Überblick über die Energiedaten der Schweizer Gemeinden, jedoch enthält es keine Funktionen, die die Nutzenden durch



spätere Umsetzungsphasen führen. Zu den Verbesserungen könnten daher die Bereitstellung von Links, nächsten Schritten und Prozessen für quartierbezogene kollektive Lösungen gehören, wie z. B. die Ermittlung von Standorten für thermische Wärmespeichersysteme.

Abschliessend lässt sich sagen, dass das 'Recommender Tool' die Phasen des 'QUBE-Prozesses' erheblich erleichtern und unterstützen kann. Durch die übersichtliche und zugängliche Zusammenstellung und Darstellung von Daten aus verschiedenen Quellen bietet es entscheidende Ausgangspunkte für die Arbeit innerhalb der QUBE-Phasen und Bausteine. Das Tool informiert Eigentümer*innen und Expert*innen über die Situation in der Gemeinde und hilft durch seine kartografische Darstellung der Energiedaten bei der Identifizierung relevanter Stadtviertel oder Teilgebiete. Die konsolidierte Darstellung der Energiedaten durch das Tool vereinfacht die Entwicklung technischer Lösungen und spart Zeit und Kosten. Das Tool kann zwar in gewissem Umfang individualisierte Optionen aufzeigen, detailliertere und lokal anwendbare Szenarien erfordern jedoch die Unterstützung des EDGE-Konsortiums oder anderer Expert*innen. Ein grosses Potenzial des Tools besteht darin, technische Innovationen zugänglich zu machen und Interessengruppen dazu zu ermutigen, innovative Transformationspfade zu erkunden. Wenn sich das Tool in Bezug auf die genannten Aspekte weiterentwickelt, wird es interessant sein, seine Anwendung in Schweizer Quartieren gezielter zu testen, beispielsweise in einem der SWEET LANTERN Living Labs.



1 Introduction

To reach the aims of the energy strategy, the share of renewable energies has to be substantially increased. The aim of the SWEET EDGE consortium is to increase the share of local renewable energy. The aim of work package 4 in the SWEET EDGE project is to demonstrate the applicability of the developed solutions in the framework of demonstration projects in the urban context in Switzerland.

Besides providing advanced technical solutions and ensuring their integrability in the Swiss energy system, a key step is to ensure that the developed solutions are adopted by the end-users. The QUBE project financed by Innosuisse investigated the driving factors for renewable energy transition in six cases in a Lucerne neighbourhood. The project under the lead of Lucerne University of Applied Sciences and Arts – School of Social Work developed a process for the initiation of cooperative renewable energy projects.

In this report, the suitability of the 'Recommender Tool', which was developed in the context of SWEET EDGE, to support this process is investigated and scenarios for the further integration of the 'Recommender Tool' in this process are described.

1.1 Occasion

It is a fact that the switch to and expansion of renewable energies in Switzerland is progressing too slowly to achieve the energy targets of the cantons and the federal government within the given time frame (Swiss Federal office of Energy SFOE, Energy perspectives 2050+). Cantons, cities and municipalities must therefore increasingly confront the question of which incentives, innovations, marketing strategies or regulations can be used to drive this change (cf. Bodammer et al. 2024: 4).

In particular, heating and cooling are key drivers since buildings cause around 40% of Switzerland's energy consumption and a third of its CO₂ emissions (Hess et al. 2022). In the residential sector, heating and cooling applications are responsible for 81 % of the energy consumption (Swiss Federal office of Energy SFOE, Swiss Overall Energy Statistics 2023). This significant influence underlines the potential of energy-efficient heating systems to reduce energy consumption and climate impact, particularly in older buildings in need of retrofit with fossil fuel heating systems. It further highlights the central role of the building stock in relation to the expansion of renewable energies. Due to the large numbers of residential buildings in private ownership, it is therefore essential that also owners of small and medium sized buildings are motivated to act and are enabled to take sustainable decisions for the retrofit of their building and energy system.

However, implementing changes in private buildings is demanding, as, in addition to possible technological challenges, there are numerous other hurdles regarding energy-related knowledge, financial resources, or established behaviours and too little independent information about alternatives and solutions. Thus, not only technological, but also cost-effective solutions are required – as well as a high level of social commitment. A crucial factor is therefore to convince building owners to invest in transformation. One of the possible means to do so is to involve them in the process of transition.

An important factor for activation is addressing neighbourhoods, with a focus on reaching out to small and medium residential property owners. Although individual owners can be provided with information or can research it themselves, it can be noted that the transformation rate is still too slow to reach the politically set energy goals. One may hypothesise that information as such does not provoke action. By addressing an entire neighbourhood, more people are reached, an exchange on possible solutions is launched and neighbours are incited by each other to take action. In particular, large-scale projects and solutions to increase the overall share of locally generated renewable energy, such as the installation of energy storage systems or a shared heating infrastructure, require the activation and coordinated participation of multiple stakeholders. Some technical solutions are only efficient if implemented at neighbourhood level. In such a process, the design of a technological solution is a relevant aspect in later stages of the process and must be developed in cooperation with owners, technicians and municipal or cantonal offices. However, this cooperation is not a trivial task and usually requires a guided approach. The use of transdisciplinary intervention methods is therefore highly suitable for optimising neighbourhoods in terms of renewable energies and bringing about socio-technical change.



The QUBE project¹, was carried out from 2021 to 2023 under the lead of the University of Applied Sciences and Arts – School of Social Work Institute of Sociocultural Community Development in the Wesemlin-Dreilinden neighbourhood, which is part of the city of Lucerne. The project was funded by Innosuisse and aimed to initiate and support neighbourhood-based energy cooperations (in particular for shared heating, but also for electricity generation). QUBE provides a socio-technical approach that includes all relevant stakeholders in the process of transition. The main outcome of the project was a generic socio-technical process, the 'QUBE Process Model', which is now available for further practical application.

The 'Recommender Tool' developed in SWEET EDGE might offer promising possibilities for application within a guided approach, as presented in QUBE. It supports the presentation of public data about neighbourhoods and the evaluation of the effects of different energy system options. In this the 'Recommender Tool' might inform and recommend lay people and experts on energy transformation which is important in transdisciplinary processes.

This report discusses the compatibility of the socio-technical process developed in QUBE and the 'Recommender Tool' and illustrates the influence that a socio-technical method can have on optimising neighbourhoods in terms of expanding renewable energies when it is supported by an application as the 'Recommender Tool'. In this report, we briefly describe the 'QUBE Process Model' and the 'Recommender Tool', then explain their objectives in the context of a neighbourhood-based transition to renewable energies, and outline how the 'QUBE Process Model' and the 'Recommender Tool' can work together. We discuss the phases of the socio-technical process in which the 'Recommender Tool' can be useful and reflect on how the tool could be refined and devised for this context, based on the structure and requirements of the 'QUBE Process Model'.

The results in this report can support the engagement of stakeholders in renewable energy projects at the neighbourhood level, thus helping to ensure that the implementation process is accelerated. With a view to further activities of the SWEET EDGE consortium, the results emphasise that collecting public data about neighbourhoods and assessing impacts of different energy system decisions provides important technical support for stakeholder activation processes.

1.2 Brief description: 'Recommender Tool'

The 'Recommender Tool' is a tool to support community officials, and the utilities or planners commissioned by the community to take sustainable decisions in energy planning. It has a simple user interface and is designed to support non-experts. The tool is primarily aimed at decision-makers at the municipal level (municipal representatives, utilities, planners, cantonal offices) and has the following objectives:

- to display (public) energy system data and estimate missing information to define the energy demand of the individual buildings in the community
- to estimate the impact of the integration of renewable energies in a municipality/region
- to recommend and visualize the effects of various designs and implementation features of the recommended system.

The tool thus provides an overview of the current state of buildings in a given municipality and creates scenarios that can serve as a guide for future planning. It stands out from other commercial solutions for similar problems in that it is free of charge and requires no input from users. Selecting a municipality is sufficient to obtain information about the current state and possible scenarios. It is also possible to modify the proposed scenarios by adjusting the scenario parameters (cf. Meyer et al. 2023: 2).

The structure of the tool is divided into three parts, the first of which consists of an analysis of the current state of a municipality in terms of energy sources, demands and currently not used local renewable sources (cf. Fig. 1). The tool provides diagrams and descriptions of buildings, including their age and information on the heating system, if available, on PV potential and installed PV systems, as well as on connections to heating networks. The source of this information are the publicly accessible data of the

¹ QUBE project Wesemlin-Dreilinden (Innosuisse). Duration: March 2021 to September 2023. Lead: University of Applied Sciences and Arts – School of Social Work, Institute of Sociocultural Community Development.



Federal Register of Buildings and Dwellings (Federal Statistical Office FSO: Federal Register of Buildings and Dwellings RDB) and geospatial data (Federal Office of Topography swisstopo, Federal Office for the Environment FOEN and Federal office of Energy SFOE). As a second part, the tool displays a visualisation of the contributions of the individual buildings to energy demand, installed and potential PV capacity. This map also could be expanded to display the suitability for retrofit (cf. Fig. 3).

The third part of the tool builds on this collection and presentation of data for a municipality and enables users to generate possible scenarios for future planning (cf. Fig. 2) and investigate the impact of these results (cf. Linder et al. 2023; Schilt and Schuetz 2024). For example, users can increase the share of installed PV systems, replace heating systems (e.g. with heat pumps) and simulate the expansion and creation of heating networks. The scenarios are compared using various key performance indicators (KPIs), the most important of which are operating and investment costs, the share of renewable energy sources and heating systems, and the degree of autarky (cf. Meyer et al. 2023: 2).

Based on this toolbox of visualisations and assessment functions combined with the dataset about the neighbourhoods and communities, dedicated information or assessment instruments for the consultation with the end-users could be implemented.

Willkommen auf der EDGE Recommender Seite



Figure 1: Screenshot Website 'EDGE Recommender', Landing page of the 'Recommender Tool'. The prospective user can select a community to start the recommendation process and then receives a list of the relevant energy data for the selected municipality (general information; Buildings, electricity; heating; mobility; CO2-emissions; potentials). In the example above the municipality of "Horw" is chosen for visualisation.

Szenarien

Hier können Sie Ihr Szenario zusammenstellen. Viel Vergnügen!

Wählen Sie den Anteil an fossilen Heizsystemen, den Sie durch Wärmepumpen ersetzen wollen.

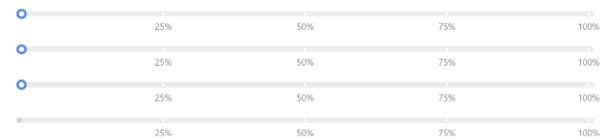
Wählen Sie den Anteil des totalen PV Potenzials auf Hausdächern, welches Sie nutzen wollen.

Wählen Sie den Anteil des totalen Wind Potenzials, welches Sie nutzen wollen.

Wählen Sie den Anteil des totalen Biomassen-Potenzials, welches Sie nutzen wollen.

Sollen thermische Speicher bei der Berechnung berücksichtigt werden?

Für welches Jahr soll das Szenario berechnet werden?



Szenario Berechnen

Figure 2: Screenshot Website 'EDGE Recommender': Scenario generator in the 'Recommender Tool'. Displayed is the current prototype at writing. New features will continuously be added.

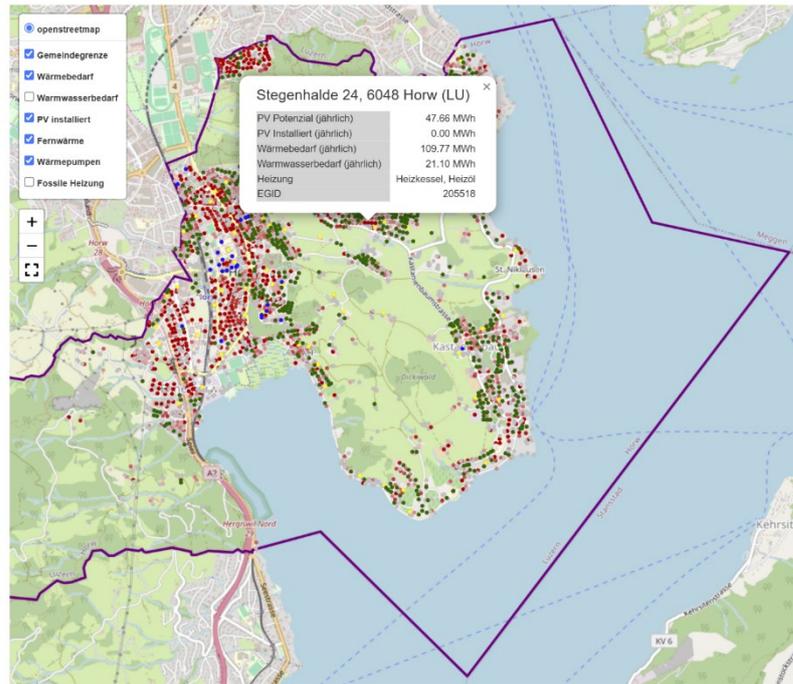


Figure 3: Screenshot Website 'EDGE Recommender', Map visualisation of installed heat pumps, buildings connected to a district heating system and installed PV capacity. For each building, a fly-out indicates the building properties as well as the modelled energy demand and installed and potential PV capacity.

1.3 Brief description: QUBE Project and 'Process Model'²

The QUBE project – (*Quartierbezogene Energiekooperationen* translates to *Neighbourhood-based energy cooperations*) – aimed to initiate, monitor and support energy cooperation projects at the neighbourhood level, primarily for shared heating but also for electricity generation. Assuming that municipalities, neighbourhoods and civil society actors will increasingly come into focus in the pursuit of CO₂ reduction, QUBE sought to design a process methodology that involves the relevant local stakeholders and tested it in practice to initiate, promote and accelerate socio-technical transformation.

Goals pursued were:

- to facilitate energy cooperation at neighbourhood level with a focus on shared heating
- to initiate a socio-technical transformation process utilising transdisciplinary intervention methods.
- to provide a socio-technical process model that enables the implementation of future neighbourhood projects with energy cooperation.

The QUBE project, funded by Innosuisse, was carried out under the lead of Lucerne University of Applied Sciences and Arts – School of Social Work³. The Lucerne University of Applied Sciences and

² The following chapter on QUBE, as well as all further references to the project and Process Model in the present deliverable, are based on the QUBE Project Report [1], the QUBE Summary Report [2] and a report on the Work Package 8 of the SWEET LANTERN project [3], which also addresses the 'QUBE Process Model'.

[1] Bodammer A. et al., "QUBE: Abschlussbericht des Innosuisse-Projekts Quartierbezogene Energiekooperationen", unpublished, Lucerne University of Applied Sciences and Arts, Lucerne, 2023.

[2] Bodammer A. et al.: "Quartierbezogene Energiekooperationen – Kurzbericht zum Projekt", yet unpublished, Institute of Sociocultural Community Development, Lucerne School of Social Work, Lucerne, 2024.

[3] Sturm, U. et al.: "Report on Living Lab Processes at Lucerne QUBE. [Sweet Lantern Deliverable Report 8.1]", Lucerne University of Applied Sciences and Arts, Lucerne, 2024.

³ The following partners were involved: the city of Lucerne, the canton of Lucerne, the local energy provider ewl, the planning and consulting offices BE Netz, Zurfluh-Lottenbach and OekoWatt, the Lucerne Energy Cooperative and the Wesemlin-Dreilinden neighbourhood association.



Arts research team consisted of researchers from the fields of socio-cultural community development, building and energy technology, architecture, and real estate⁴.

The project activities took place in the Wesemlin-Dreilinden neighbourhood, a residential area in the city of Lucerne with small and medium-sized residential houses from different periods of construction, in heterogeneous condition, and still predominantly heated by fossil fuels. The project developed and built on transdisciplinary intervention methods comprising the phases of awareness, activation, consolidation, and implementation. An important part of the project work was to establish a network of experts, authorities, companies, civil society actors and property owners.

In the course of the QUBE project four sub-projects⁵ were created. The sub-projects were set up in areas with a spatial concentration of owners interested in making a change. Geographical proximity is particularly important, because energy density has proven to be a technically decisive factor for the implementation of shared heating systems. Cooperative sub-projects were therefore only launched where several potential energy consumers were located sufficiently close to each other for the construction of a shared energy infrastructure that could be technically and economically feasible. Moreover, two 'satellite' areas⁶ were included in the project that were outside the initial project perimeter, which can be viewed as the first 'spinoffs' of QUBE.

The central result of the QUBE project is the 'QUBE Process Model', which was developed along the processes carried out in the sub-projects, reflecting and systematizing the outcomes. The 'QUBE Process Model' is a socio-technical model that focuses on cooperative measures in selected neighbourhoods or sub-areas and aims to supply the building stock with renewable energy for shared heating. The term 'socio-technical' refers to the interplay of technical innovations in buildings and systems that are initiated and implemented with the help of socio-cultural methods in a specific neighbourhood with the owners. Methodological modules used in the 'QUBE Process Model' were, among others, neighbourhood and stakeholder analysis, larger neighbourhood workshops (40-90 participants), workshops with project researchers and project partners (10-30 participants), exploratory sessions to identify and clarify interests (5-15 participants) as well as neighbourhood inspections with authorities from the areas of environment, construction and monument preservation. As a result of the project, the 'QUBE Process Model' is available for further practical applications and can also be adapted to collaborations in the field of electricity (cf. Bodammer et al. 2024: 3, 18; Sturm et al. 2024: 22).

From 2024 on the 'QUBE Process Model' is further developed and explored in the neighbourhoods of Kriens Kuonimatt and Horw Wegmatt within the QUBE II Living Lab Project, which is part of SWEET LANTERN⁷. SWEET LANTERN WP8 aims to promote the energy transition in existing residential and mixed-use neighbourhoods by engaging end-users and other relevant stakeholders in a bottom-up process to create local, context-specific renewable energy cooperations. The overall objective of WP8 is to provide a feasible and tested methodological toolkit for initiating and supporting socio-technical transformation processes for the creation of renewable energy cooperations at neighbourhood level.

⁴ The following institutes were involved in the project: Lucerne University of Applied Sciences and Arts – School of Social Work - Institute for Sociocultural Community Development; Lucerne University of Applied Sciences and Arts – School of Engineering & Architecture - Institute of Building Technology and Energy; Lucerne University of Applied Sciences and Arts – School of Engineering & Architecture - Institute of Mechanical Engineering and Energy Technology, Competence Centre Thermal Energy Storage; Lucerne University of Applied Sciences and Arts – School of Engineering & Architecture - Institute of Electrical Engineering, iHomeLab; Lucerne University of Applied Sciences and Arts – School of Engineering & Architecture - Institute of Architecture, Lucerne University of Applied Sciences and Arts – School of Business, Institute of Financial Services Zug.

⁵ Three of the four sub-projects took place in certain sections of the Wesemlin-Dreilinden neighbourhood in Lucerne: 'Garteneheim' (Wesemlin), 'Landschau/Ruflibergerstrasse' (Wesemlin) and 'Kloster und Institutionen' (Wesemlin). The fourth sub-project 'Einzelliegenschaften' supported interested owners who were geographically isolated and helped them to find individual solutions for switching to renewable energies.

⁶ The two 'satellites' are located in the neighbouring district of Hochwacht: the 'Friedberg' satellite sub-project and the 'Alter Friedhof' satellite sub-project.

⁷ SWEET LANTERN: WP8 Energy communities and cooperatives (funded by Swiss Federal Office of Energy (SFOE)), Duration: 2022 – 2029. Lead: Lucerne University of Applied Sciences and Arts – School of Social Work – Institute of Sociocultural Community Development ([SWEET Lantern: WP8 Energy communities and cooperatives | Lucerne University of Applied Sciences and Arts](#)). QUBE II is a Living Lab Project within Lucerne Living Labs ([Living Labs Luzern | Lucerne University of Applied Sciences and Arts](#)).



First project results were presented to the SFOE in the Deliverable Report 8.1 'Report on Living Lab Processes at Lucerne QUBE'.

In order to discuss how the 'QUBE Process Model' and the 'Recommender Tool' can work together, a brief description of the necessary framework conditions for implementing a socio-technical process is needed at this point as well as an explanation of the actors involved and their constellations.

1.3.1 Framework for the initialisation of a socio-technical process

The QUBE project identified general framework conditions that must be met to pursue the guided model process to initiate neighbourhood-based energy cooperatives (cf. Bodammer et al. 2024: 19):

- An occasion and incentives for renewal in the neighbourhood must be given:
 - From inside, e.g. expressed interest and or demand of the stakeholders in the neighbourhood or from outside, e.g. political goals, demands and / or funding opportunities.
- A support group for the strategic and content-related coordination of the process is installed:
 - In the best case, the group is composed of interdisciplinary experts with political support; the composition and anchoring vary from case to case.
- The aim is to realise joint energy projects in the neighbourhood in a self-organised manner:
 - The support group plays a strong moderating role in the beginning of the collaboration, but gradually withdraws during the process and the joint energy projects that are realised are implemented in a self-organised manner by the owners or a sponsoring body.

1.3.2 Actors and constellations and their significance for cooperative processes

Processes as developed in the QUBE project are based on the involvement and consultation of a wide range of stakeholders. This results in different roles and tasks as well as actor constellations (cf. Fig. 4), which are briefly outlined below as documented by QUBE (cf. Bodammer et al. 2024: 20f.):

- **Residents/house owners:** In a socio-technical transformation process towards cooperative renewable energies at neighbourhood level, building owners are the key players. They are carriers of local knowledge and are important for networking, financing and decision-making.
- **Institutional owners:** In addition to individual private owners who live in the neighbourhood, institutional owners, usually with large plots of land or buildings, are key players. As mostly larger energy consumers, they can be drivers of development.
- **Neighbourhood association:** As central hubs in neighbourhoods, neighbourhood associations are important players in supporting mediation and networking in a socio-technical transformation process.
- **Private (energy) companies:** Private and local (energy) companies are important project partners due to their roots in local economic cycles and expertise. They can support the owners in an advisory or planning capacity. They take on commissions.
- **Public authorities:** The public sector essentially regulates community life, provides the formal and political frameworks. It is an important partner in a socio-technical transformation process because politics and administration have a strong influence on the transformation.
- **Technical experts:** To develop technical options and variants or to make assessments, technicians are central as consultants in a socio-technical transformation process. In addition to the consultancy, they can be commissioned with feasibility studies or planning tasks in the course of the process.
- **Intermediary:** Mediation work is of great importance in a socio-technical transformation process. A mediator should be present throughout the process. For example, the support group (see 1.3.1.) acts as intermediary or brings in a mediator to facilitate the process. Later in the process, the client's representative or planner is such an intermediary with a focus on technical implementation.

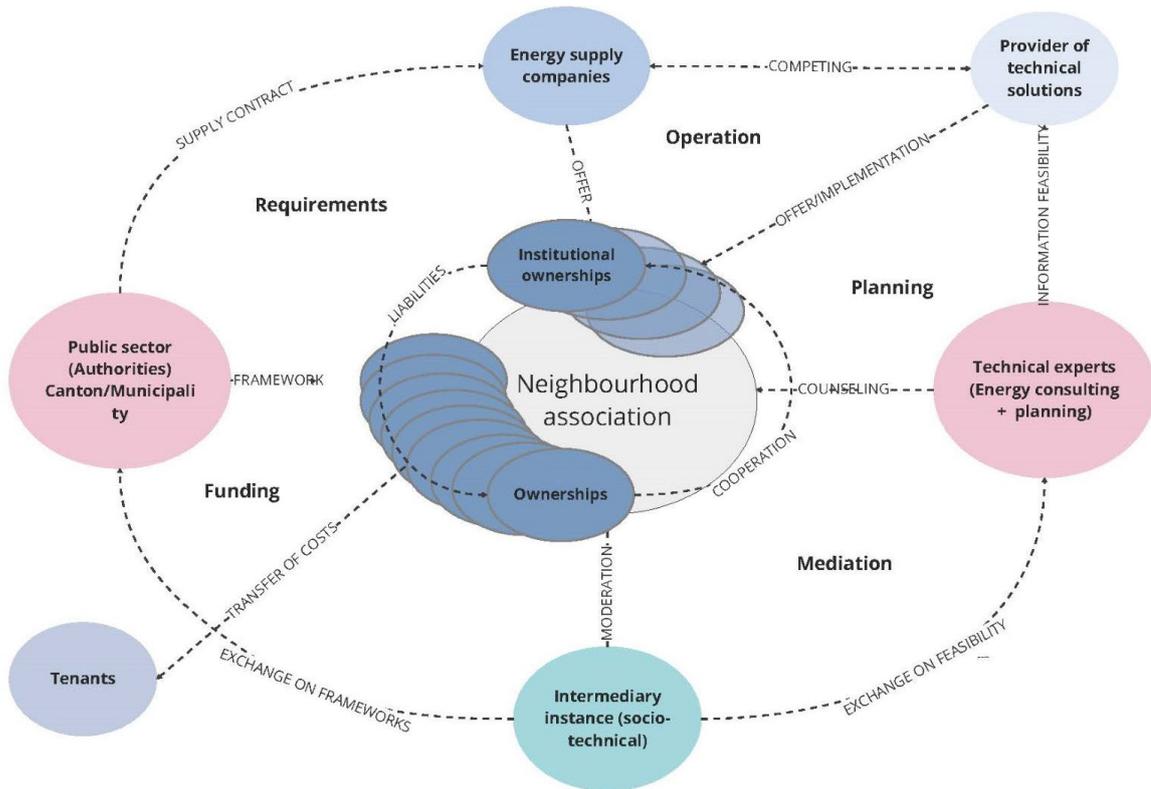


Figure 4: Overview of stakeholders and their interactions, © Institute of Sociocultural Community Development 2024.

With regard to the 'Recommender Tool' discussed here, it should be noted that a socio-technical process according to QUBE builds significantly on the different competences and levels of knowledge and data that the actors involved bring in. This results in a broad and complex spectrum of knowledge (specialist knowledge, political knowledge and expertise but also knowledge about the neighbourhoods concerned and its specific conditions and possibilities), which is continuously developed over the course of the process and ideally paves the way for successful implementation of renewables. The creation of such a knowledge-network is therefore indispensable for the success of a socio-technical process according to QUBE.

2 Use of the 'Recommender Tool' as part of the socio-technical 'QUBE Process Model'

In the previous chapter, the 'Recommender Tool' developed as part of SWEET EDGE and the 'QUBE Process Model' were briefly presented. In the following chapter, we will consider potential applications of the 'Recommender Tool' within the 'QUBE Process Model', as the tool provides different aspects of data analysis that could inform the QUBE Process and its stakeholders at different stages. We will then discuss the contribution that the 'Recommender Tool' can make to certain socio-technical phases of the 'QUBE Process Model', based on a more detailed presentation of the phases. We also identify where there is still potential for a stronger integration of the 'Recommender Tool' from a socio-cultural perspective.

2.1 Functionalities and modules of the 'Recommender Tool'

The 'Recommender Tool' offers various aspects of data analysis that allow for different possibilities to promote and use the provided information in a stakeholder process. The following aspects are key:

- **Availability:** In a first part, the 'Recommender Tool' provides a comprehensive overview of the energy demand and sources (buildings, electricity, heat, mobility, CO2 emissions and potential) of a selected municipality in an easily accessible visualisation and with minimal input from users (being only the name of the community) (cf. Fig. 1). This compilation enables laypersons and



experts to obtain a fast, elementary overview of the municipality and its status quo. This can serve as a guide for politicians and administration and, together with a benchmark, possibly lead to action.

- **Visualisation:** The 'Recommender Tool' collects data from various sources and visualizes it in graphics, but also in a cartographic representation (cf. Fig. 2) that allows the data for specific buildings to be searched directly. The potential of the municipality can be easily grasped. Visuals are a powerful means to project information. Furthermore, the visuals are finetuned according to the requirements of the cantonal authorities to be ready for the inclusion into a communal energy plan.
- **Benchmarking:** The above-mentioned points of low-threshold availability and the compilation and visualisation of energy data from the municipalities allows users to assess the impact of different renewable energy options in their municipality and compare to other municipalities.
- **Scenarios:** In a second part, the tool also offers the possibility to suggest scenarios for the future (cf. Fig. 3). Users can create their own scenarios and thus develop a feeling for the influence of a transformation on renewable energies.

As for today and as practiced in the QUBE project, the data for each neighbourhood was collected by either the research and technical team of the project, the municipality or cantonal authorities. The quality in which the data was provided and aggregated differed from sub-project to sub-project, from neighbourhood to neighbourhood, from municipality to municipality. The accessible and comprehensive way in which the data is presented by the 'Recommender Tool' offers a straightforward approach to initial data collection.

These aspects and their usage in stakeholder processes for energy transition will now be discussed in more detail based on the phases of the 'QUBE Process Model'.

2.2 Phases and modules of the 'QUBE Process Model'⁸

The 'QUBE Process Model' consists of several phases, each of which includes a social and a technical level. The transformation process initiated by QUBE extends along these phases and is divided into individual modules that represent the individual steps and measures of the transformation.

The 'QUBE Process Model' consists of a total of five phases with technically and socially oriented modules as well as various interfaces and dependencies. In this deliverable, we concentrate on the first three phases of initialisation, interest formation and consolidation, since the 'Recommender Tool' is not relevant or useful in the realisation and operation phases due to its functionalities. We also discuss the aspect of forms of financing, which the 'Recommender Tool' can also influence.

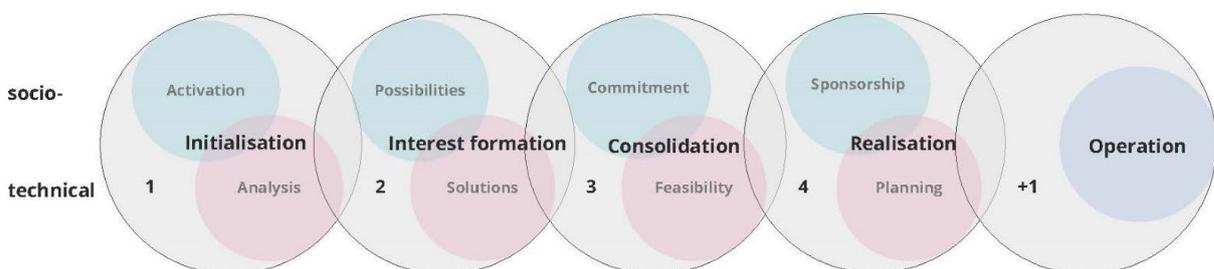


Figure 5: Sociotechnical phases according to QUBE, © Institute of Sociocultural Community Development 2024.

The modules in the 'QUBE Process Model' are to be understood as individual tasks and measures. These are either 'actor-centred' (social) or 'technical'. In addition, the phases encompass (in total 27 + 2) modules that are highly 'interactive', which means that many actors with different perspectives get into exchange. These modules usually appear in the form of workshops, or they involve advisory and decision-making tasks. All modules included in the 'QUBE Process Model' have been extracted and

⁸ Cf. Footnote 2.



systematised from the experiences in the QUBE Project. The process developed in QUBE is iterative: individual modules can be repeated, implemented at a different time depending on the situation, or even left out. The course of the process therefore depends on the respective needs and available options (cf. Bodammer et al. 2024: 23f.).

The following modules will be discussed below (for a more detailed description of the modules see Bodammer et al. 2023: 73 – 91)⁹:

- module 0 – project start
- module 6 – initial workshop
- module 8 – define perimeters
- module 9 – obtain energy data
- module 13 – determine rough technical clarification and variants
- module 15 – possibilities and target definition workshop
- module 18 – feasibility study

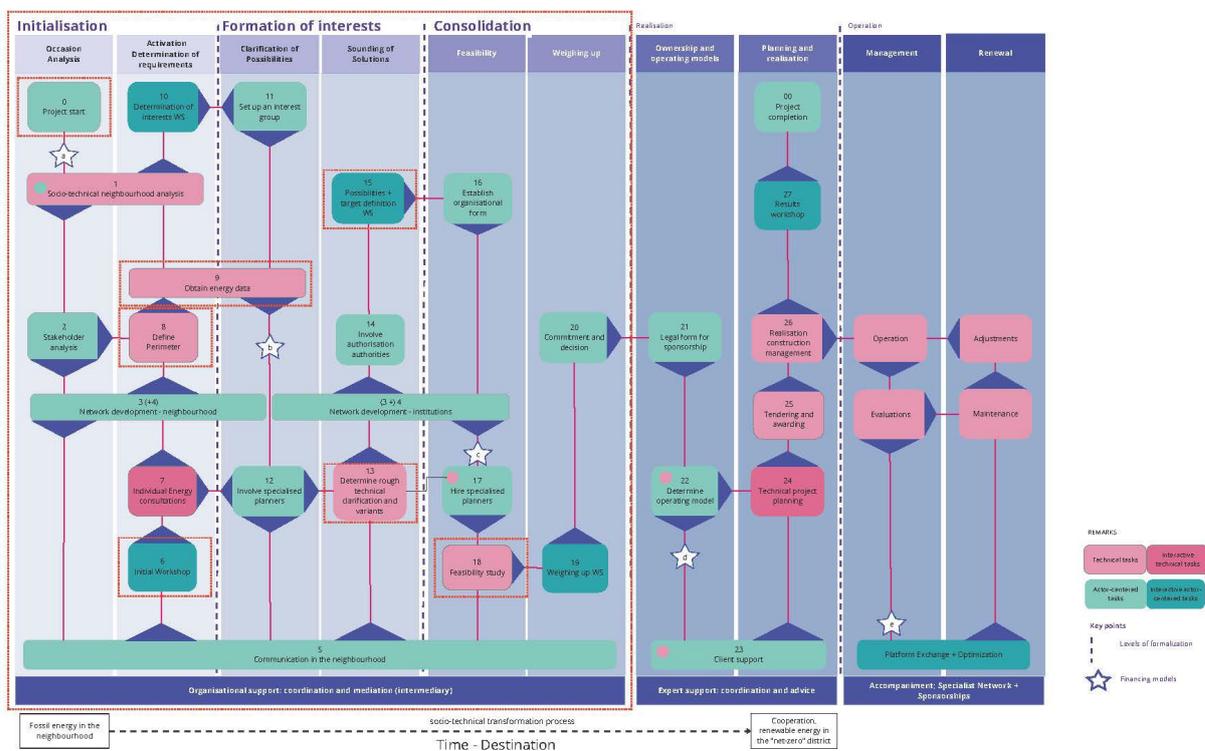


Figure 6: 'QUBE Process Model', red dotted lines mark the phases and modules in which the 'Recommender Tool' could be applied (see appendix for enlarged illustration), © Institute of Sociocultural Community Development 2024.

2.2.1 Initialisation

The first phase, 'Initialisation', deals with the fundamentals and framework conditions of the project process and encompasses the levels of analysis and activation. In this first phase, the project is launched with the formation of a support group (see 1.3.1), arising from a specific event or interest (e.g. initiative by owners, necessary energy-related renovations to the building structure, political initiatives). Relevant actors are activated, technical and socially oriented analyses are carried out and a network is established. The project goes public in an initial workshop in the neighbourhood with the owners and the socio-technical analysis is iteratively expanded with local knowledge. Perimeters for possible energy-efficient renovation measures are defined (neighbourhood, sub-areas, building groups) and communication in the overall neighbourhood as well as the coordination of the sub-projects is organised (cf. Bodammer et al. 2024: 26).

⁹ A complete list of all modules of the 'QUBE Process Model' can also be found in Appendix 6.2 on page 22f.



In this initial phase, the 'Recommender Tool', with its user-friendly operation and data visualisation, could help to inform and activate various actors (module 0 - project start). An overview of the situation in the municipality is provided by categorising various data (information about the municipality, buildings, electricity, heating, mobility, CO2 emissions and potentials) and by means of a cartographic overview of the energy data for all properties in the municipality. The 'Recommender Tool' could therefore simplify the process to identify relevant neighbourhoods or sub-areas for energy-efficient renovation (module 8 – define perimeters). From here, the neighbourhoods can be addressed individually, sections of the maps concerning specific perimeters can be used to estimate the processes' focus areas and identify who should be addressed within the neighbourhood.

The different colours of buildings which indicate the different energy sources within the 'Recommender Tool' make it easy to categorise the neighbourhoods or sub-perimeters. The possibility to quickly indicate energy-use helps to prioritise and in a rough manner identify areas of possible energy cooperations (module 9 – obtain energy data). Here maps are more suitable than charts, as the latter do not provide information about the spatial orientation of the process. Charts do not help to indicate areas of intervention but primarily help to understand how energy consumption and sources are related to other criteria such as building age. The geospatial data approach is essential for the neighbourhood processes.

In an initial workshop for the public (module 6 – initial workshop), to which all owners of a neighbourhood are invited, the maps of energy sources and consumption provide information for discussing the local situation. As the data used in the 'Recommender Tool' is based on RBD-data some of the given information might be outdated or not correctly shown. The workshops are an occasion where local knowledge can be used to correct the cartographies (module 9 – data acquisition). Stakeholders should be asked to note any changes.

Depending on how the neighbourhood is first encountered it is advisable not to use data that indicate the estimated energy use of each building but preferably 'heat-maps' that aggregate data based on street blocks. Privacy is an important matter and should be respected in the process as trust and sensibility are fundamental assets the cooperations will build upon in later phases.

2.2.2 Interest formation

The second phase, 'Interest Formation', is characterised by the formation of interest groups (by sub-area) consisting of interested property owners and/or other stakeholders in the matter of energy transformation. These groups can function informally as contact bodies, thus facilitating communication between the support group and the neighbourhood, or they can take on a coordinated form with responsibilities. This phase continues to explore the possibilities and solutions for change from a technical, financial, structural-spatial and motivational perspective. In a joint exchange, initial technical measures are outlined and the rough data basis for estimating the (energy) demand is specified with the help of data from the individual households. To implement this step, energy data for the municipality and the relevant properties must already have been collected (cf. Bodammer et al. 2024: 27).

In this phase the 'Recommender Tool' can contribute by providing planning data about building properties as well as estimated energy demands relevant for the impact analysis of the different options (module 9 – data acquisition). Here the energy-demand distribution and time series plots and building specific maps come into play. Experience also shows that at this stage more reliable and detailed data will be of use to assess the different possible solutions. The 'Recommender Tool' data will have to be refined and calibrated by local and individual data. The network established in the initialisation phase is further expanded and includes, in addition to the relevant and activated actors in the neighbourhood, experts and representatives of the authorities who are involved in the decision-making process as the process progresses (cf. Bodammer et al. 2024: 27). These stakeholders might provide additional information and data that can be added to the 'Recommender Tool'.

2.2.3 Consolidation

The third phase of 'Consolidation' is ideally realised by the owners, who are now organised in interest groups and supported by experts and facilitators as needed. The solutions and collaborations outlined so far are consolidated. As a rule, guided self-organisation is appropriate in this phase, i.e. the original support group supports the decision-making process for a technical solution and the coordination among



the owners, who start to develop their own organisational form. The technical solutions are examined for their feasibility; this feasibility study can be outsourced to specialised companies or planning offices. Financing is secured by the owners or funding authorities. The aim of this phase is also to create a joint declaration of intent (commitment) so that a (legal) body can be founded to implement the technical solutions in the next phase (cf. Bodammer et al. 2024: 28).

In the phase of consolidation, the scenario-feature of the 'Recommender Tool' could be of use. It offers the possibility to estimate the impact of different renewable energy options on energy consumption, share of renewable energy and emissions as well as required investments (module 13 – determine rough technical clarification and variants). In the QUBE process different possible technical solutions are discussed and the scenarios initiate these discussions (module 15 – possibilities and target definition workshop). In addition, solutions such as heat-storage systems can be virtually assessed and the effects of (renewable) energy consumption and reduction of CO₂ emissions can be quickly communicated. The potential of the 'Recommender Tool' therefore lies in introducing measures of different kinds, even innovative measures that are not normally discussed at this level, and to initiate further exploration and possibly commitment to their implementation.

Financing models also play an important role in this phase of the QUBE process, and the 'Recommender Tool' could provide relevant indications in this regard. The tool provides an estimation of investment and operation costs, which are based on averaged costs found in the literature and provided by implementation partners of SWEET EDGE. This feature would allow to use the tool within the consolidation phase (see module 18 – feasibility study). However, for specific communities, these values must be adjusted because local geological particularities might render groundwork more expensive or make it impossible to use certain technologies (e.g. wind energy solutions are not possible due to natural habitat protection). Therefore, the tool may be loaded with the actual expected cost data for a local solution. In particular, the cost structure of different financing models (e.g. installation costs for a utility may be higher, but therefore operation costs lower) can be entered and used for a comparison of the impact of different financing models. Therefore, the 'Recommender Tool' also may support this aspect in the consolidation phase.

3 Discussion of the 'Recommender Tool's' potential in stakeholder oriented cooperative processes

3.1 Provided potentials for stakeholder processes of energy transformation

As the explanations in the previous chapter have shown, the 'Recommender Tool' in its current form already offers several possibilities to facilitate, to simplify and to support the work in the three initial phases of the already established QUBE process. By compiling data from various sources and presenting it in a clear and accessible way at several levels, the tool provides important 'starting points' on which the work within the individual phases and modules can be built. These include informing owners and experts about the situation in the municipality in the first phase, 'Initialisation'. In addition, the tool can provide a starting point for identifying relevant neighbourhoods or sub-areas in this phase through its cartographic representation of the energy data of all properties. The 'Recommender Tool' also offers possibilities in the next phase of 'Interest formation'. The consolidated presentation of the relevant energy data can simplify the development of possible technical solutions, thus saving time and costs that would arise for a person tasked with researching and compiling the data. It should also be emphasised that the tool can be adapted to specific scenarios and thus offers the possibility of presenting individualised options during the phase of 'Consolidation'. At present, more detailed and below community-level scenarios cannot be generated by the 'Recommender Tool' automatically. Such scenarios would at present still have to be implemented via the EDGE consortium, which developed the 'Recommender Tool', or by other experts. In the phase of 'Consolidation' the scenarios may serve as initial orientation which measures to start with. The potential of the 'Recommender Tool' here is to make information on technical innovations (e.g. new storage options) accessible and to provide it to users even if in a simplified manner (cf. Fig. 8). More innovative measures can be introduced via the tool to the stakeholders and can help to animate them to take exceptional paths of transformation.

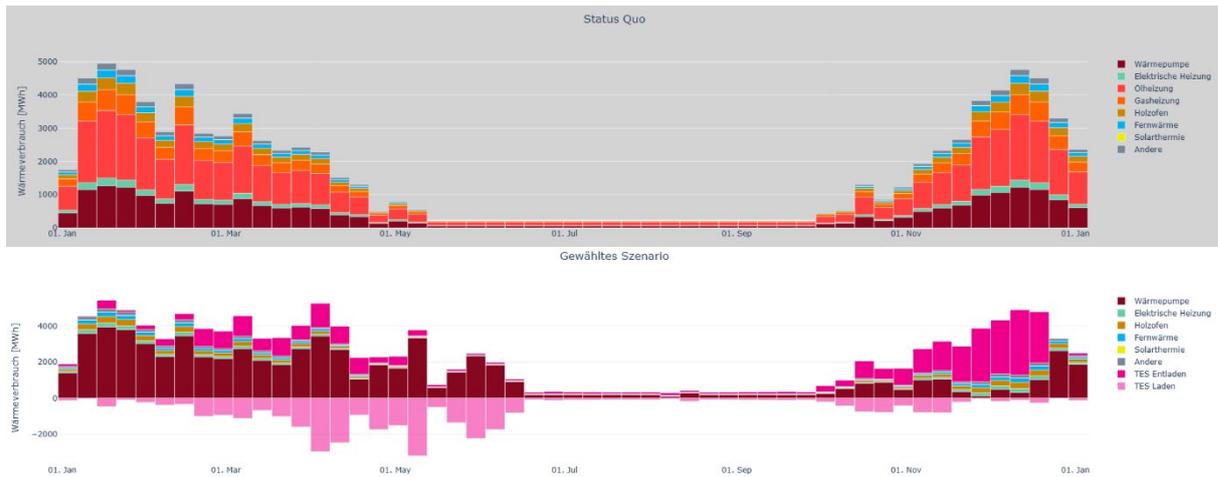


Figure 7: Screenshot Website 'EDGE Recommender', Comparison of heat demand/storage profiles in an exemplary scenario. In particular, the benefits of thermal storage (magenta/pink) can be explored.

3.2 Additional features of the 'Recommender Tool' to implement for stakeholder processes

Based upon the experience made in the different processes (sub-projects) of the QUBE project, it can be concluded that the 'Recommender Tool' has potential for further features that would enhance its compatibility with and usability for a socio-technical process like QUBE.

To discuss the possibilities in a specific neighbourhood or sub-area in a targeted and efficient manner and to obtain a corresponding overview, the option of defining individual perimeters by the users would be of great advantage. The development of such a function, which the EDGE consortium is striving for, would therefore be a great benefit for the use of the tool in the context of a socio-technical process. As mentioned, it should be noted that although the 'Recommender Tool' concisely compiles and visualises a variety of data and makes it accessible, the graphics are sometimes difficult to read, especially for laypersons without in-depth contextual knowledge. The graphics and charts therefore require mediation or translation by experts. For the practical application in socio-technical processes such as QUBE, this means that the tool requires facilitation through its different parts. It would be helpful if the legends in the tool not only described the graphics but also explain their significance for energy planning.

So far, the 'Recommender Tool' provides a solid overview of the energy data of all municipalities in Switzerland and thus forms a good starting point for working within a socio-technical process for cooperative transformation towards renewable energies. To make a contribution after the phases of initialisation, interest formation and consolidation, the tool lacks features to 'accompany users in their actions' during later phases of implementation. It would be useful for the socio-technical process if the tool provided links, next steps and processes to clarify the questions of how to proceed. Part of this could be that the 'Recommender Tool' produces suggestions for neighbourhood-based, collective solutions. For example, by making calculations with the aim of identifying the locations in the neighbourhood where a collective thermal heat storage system is possible and worth exploring. This function within in the planning stage would provide initial indications for targeted further work in the neighbourhood.

Another aspect that would promote the integration of the 'Recommender Tool' into a socio-technical process is the possibility of interactive use. It would be desirable to be able to feed qualitative data and 'local knowledge' from the work in the neighbourhoods directly into the tool. This would also allow to correct outdated or incorrect data in the tool immediately. It would also be an advantage to add the option to look into the past. A before-and-after comparison could show users previous effects and changes and motivate them for future change. A feature like this could also support the evaluation of the transformation process.



Finally, it would be handy to have the option of making the data and scenarios of the 'Recommender Tool' available as open data for further use and adaptation, thus creating an incentive for use by specialist departments and individuals, as well as specialised companies.

4 Conclusion

To conclude the discussion of this deliverable, we will take a look at the key practical lessons learned from the QUBE Project.

As the project work in QUBE and the resulting Process Model have shown, technical innovations alone are not enough to achieve an energy transition in residential neighbourhoods. Socio-technical change is becoming increasingly important, which means that social and technical elements are given equal weight. It is only through educating, sensitising and networking social actors that technical achievements can gain a foothold and be implemented on a broad scale (cf. Bodammer et al. 2024: 44).

At the same time, QUBE was able to illustrate that decentralised renewable energy systems can drive the energy transition forward and may increase the share of renewable energies and lead to decarbonisation of energy supply at neighbourhood level. The neighbourhood level offers the advantages of spatial proximity and direct communication, which is a prerequisite for decentralised, cooperative solutions. In particular, dialogue methods and procedures are suitable for activation in neighbourhoods, whereby QUBE was able to develop and systematise new ways of building cooperative processes with the developed 'QUBE Process Model'. QUBE thus contributes to socio-technical change (cf. Bodammer et al. 2024: 44).

As the discussion in the present deliverable has shown, the implementation of the 'Recommender Tool' in a socio-technical process according to QUBE could offer added value. The data provided by the tool meets the requirements of the stakeholder process developed in QUBE. The functions of availability, visualisation, benchmarking and scenarios help to provide information and communicate the data in the various process phases. The implementation of the 'Recommender Tool' could have a positive impact on the QUBE process and further strengthen its influence on the optimisation of urban neighbourhoods regarding the transition to renewable energies. The 'Recommender Tool' helps to achieve a cost-effective implementation of technologies when combined with a community-based approach. Its feature to integrate new technologies in its scenario part has the potential to enhance social acceptance of novel and emerging technologies. Nevertheless, the 'Recommender Tool' needs to be further developed and expanded for a smooth implementation, especially concerning the topic of interaction with the tool for certain locations by the users. Only in this way can the operational advantages of the tool be fully realised in the processes.

If the tool continues to develop in terms of the aspects mentioned, it will be interesting to test its application in a more targeted way in the context of SWEET LANTERN Living Labs and to identify other possible extensions.

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5.3 List of illustrations

Figure 1: Screenshot Website 'EDGE Recommender', Landing page of the 'Recommender Tool', <https://prototype.recommendertool.ch> (last access: 04 November 2024).

Figure 2: Screenshot Website 'EDGE Recommender', Scenario generator in the 'Recommender Tool', <https://prototype.recommendertool.ch> (last access: 04 November 2024).

Figure 3: Screenshot Website 'EDGE Recommender', Map visualisation of installed heat pumps, buildings connected to a district heating system and installed PV capacity, <https://prototype.recommendertool.ch> (last access: 04 November 2024).

Figure 4: © Institute of Sociocultural Community Development 2024: Overview of stakeholders and their interactions.

Figure 5: © Institute of Sociocultural Community Development 2024: Sociotechnical phases according to QUBE.

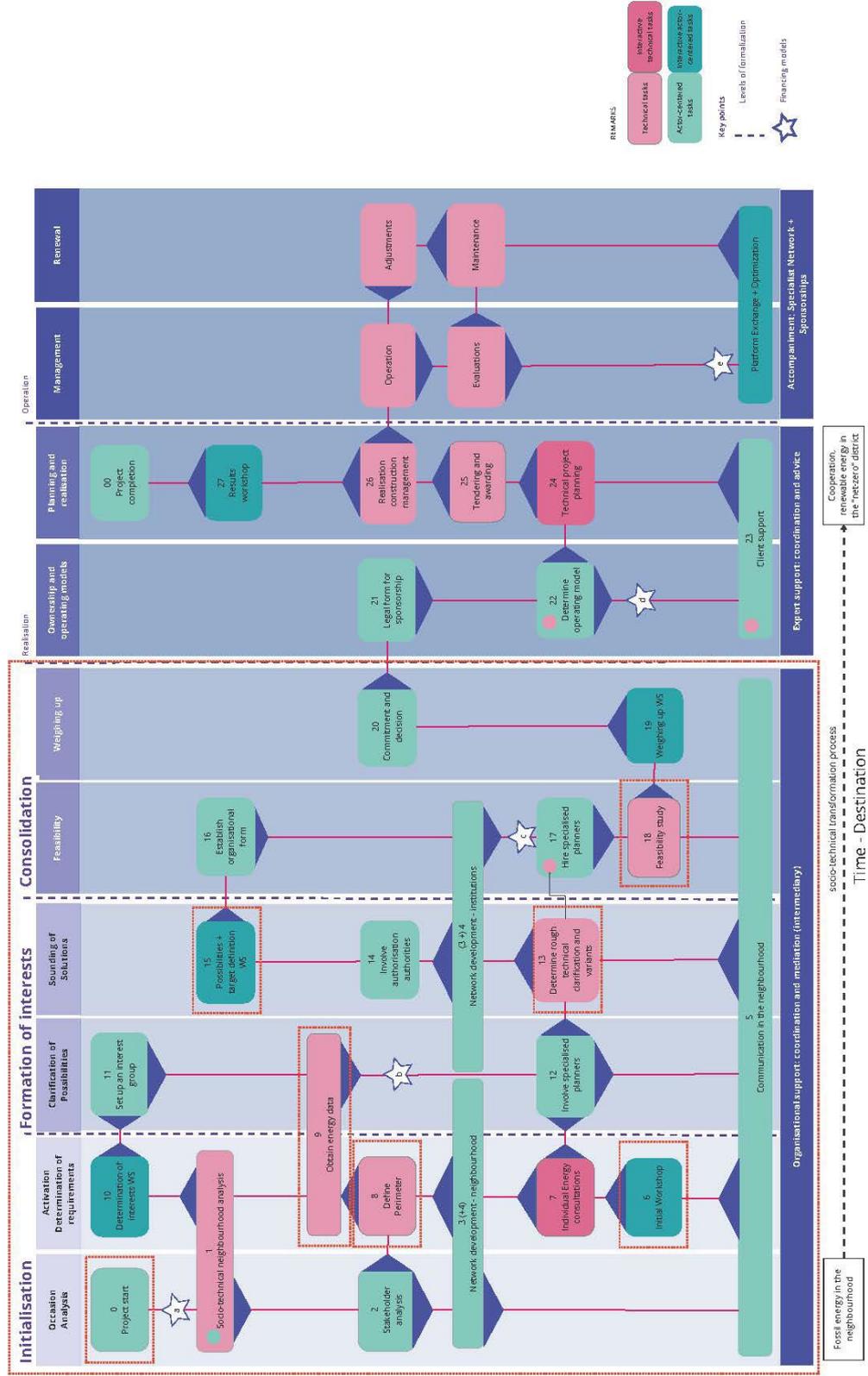
Figure 6: © Institute of Sociocultural Community Development 2024: 'QUBE Process Model'.

Figure 7: Screenshot 'EDGE Recommender', Comparison of heat demand/storage profiles in an exemplary scenario, <https://prototype.recommendertool.ch> (last access: 04 November 2024).



6 Appendix

6.1 Illustration 'QUBE Process Model' enlarged





6.2 Complete list of modules 'QUBE Process Model'¹⁰

Initialisation – modules 0 + 1 – 10

Occasion + analysis

- 00 – project start
- 01 – socio-technical neighbourhood analysis
- 02 – stakeholder analysis
- 03 – network development – neighbourhood
- 04 – network development – institutions
- 05 – communication in the neighbourhood

Activation + determination of requirements

- 06 – initial workshop
- 07 – individual energy consultations
- 08 – define perimeters
- 09 – obtain energy data
- 10 – determination of interests – workshop

Formation of interests – modules 11 – 15

Clarification of possibilities

- 11 – set up an interest group
- 12 – involve specialised planners

Sounding of solutions

- 13 – determine rough technical clarification and variants
- 14 – involve authorisation authorities
- 15 – possibilities and target definition – workshop

Consolidation – modules 16 – 20

Feasibility

- 16 – establish organisational form
- 17 – hire specialised planners
- 18 – feasibility study

Weighing up

- 19 – weighing up – workshop
- 20 – commitment and decision

Realisation – modules 21 – 27 + 00

Ownership and operating models

- 21 – legal form for sponsorship
- 22 – determine operating model
- 23 – client support

Planning and realisation

- 24 – technical project planning
- 25 – tendering and awarding
- 26 – realisation and construction management
- 27 – results – workshop
- 00 – project completion

Extra: Operation (without modules)

Management

Renewals

¹⁰ The numbering corresponds to the one used in the illustration of the QUBE process model.