



ConnectHeat
Community engagement for clean heat

D4.2 IMPLEMENTATION OF PILOT CASE IN GERMANY

STEINBEIS INNOVATION GGMBH - SOLITES



The LIFE21-CET-ENERCOM-CONNECTHEAT project has received funding from the European Union's LIFE Programme under grant agreement N°101076258



D4.2 IMPLEMENTATION OF PILOT CASES		
Deliverable number	D4.2	
Responsible partner	STEINBEIS INNOVATION GGMBH	
Due date of deliverable	May 2025	
Actual submission date	June 2025	
Version/document history	02	
Authors	M. Neyhousser, A. Sohail, M. Berberich	
Reviewers	M. Neyhousser, A. Sohail R. Battisti, C. Lazzari – AMBIT	
Work package number and title	WP4 – Making the change – Pilot Cases, Policy Roadmaps and Blueprint	
Work package leader	Solites	
Work package participants	All partners	
Dissemination level (please select one)		
SEN	Sensitive, limited under the conditions of the Grant Agreement	<input type="checkbox"/>
PU	Public, fully open	<input checked="" type="checkbox"/>
Nature of the deliverable (please select one)		
R	Report, document	<input checked="" type="checkbox"/>
DEM	Demonstrator, pilot, prototype, plan designs	<input type="checkbox"/>
DEC	Websites, patents filing, press & media actions	<input type="checkbox"/>
DATA	Datasets, microdata, etc.	<input type="checkbox"/>
DMP	Data management plan	<input type="checkbox"/>
ETHICS	Deliverables related to ethic issues	<input type="checkbox"/>
SECURITY	Deliverables related to security issues	<input type="checkbox"/>
OTHER	Software, technical diagram, algorithms, models, etc.	<input type="checkbox"/>



Disclaimer

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor CINEA can be held responsible for them.



Table of Contents

Summary	4
1. Technical feasibility	5
1.1. Demand side analysis	5
1.2. Supply side analysis	7
2. Costs and benefits	9
3. Community model	12
3.1. Project roadmap	13
3.2. Risks	14



Summary

The pilot project in Stuttgart focuses on improving energy efficiency in affordable housing managed by the Stuttgarter Wohnungs- und Städtebaugesellschaft (SWSG).

Despite extensive refurbishments across Germany, energy consumption for space heating has stagnated since 2010, largely due to user behavior. Tenants' habits, such as thermostat settings and heating usage, significantly affect overall energy consumption, undermining the impact of improved building standards and technologies. SWSG observed a similar trend, where energy use remained 30% higher than expected after refurbishment.

The project encourages tenants to use less heat and hot water by making their consumption visible, offering incentives, and providing information on energy-saving habits. The project involves tenants, landlords, and public institutions, working together to create lasting change. Key technologies include smart heat meters, digital tools like apps and displays, and reward-based programs to motivate tenants. Educational campaigns provide practical tips on saving energy.

The project is expected to reduce costs for tenants, landlords, and public welfare institutions by promoting energy-saving behaviors. In Stuttgart the public welfare institution responsible to pay housing costs for tenants who receive financial support is the Jobcenter. Tenants can save up to 10% on heating and hot water costs through behavioral changes. Tenants who receive financial support have less motivation to save energy because they do not pay their heating costs directly, the Jobcenter does.

In the pilot project, financial incentives, such as vouchers or non-monetary rewards, will be introduced to encourage energy savings among all tenants, including those receiving aid. These incentives will initially be funded by the Stuttgart Innovation Fund, with plans to eventually implement a cooperative model.

For this cooperative model to work, regulations need to be changed so that tenants who receive financial support from the Jobcenter can keep part of the money they save through energy saving. This would give them a clear motivation to use energy more efficiently. The cooperative model is designed to reinvest the savings within the community.

The Stakeholder Advisory Group (SAG), consisting of SWSG, energy experts, and local authorities, are overseeing the project. The Community Energy Board (CEB) drives implementation, including SWSG representatives, property managers (acting as intermediaries between tenants and SWSG), and tenant representatives. The community structure includes an Energy Efficiency Network that fosters knowledge sharing and manages savings redistribution. The community decides how to allocate these savings, with options to reinvest them in further energy initiatives or support broader sustainability efforts in the neighborhood.

The pilot project is ongoing in the following steps:

- Initial analysis (done).
- Installing heat meters (delayed - ongoing by July 2025).
- Implementation phase (delayed - preparation ongoing, start of activities summer 2025).
- Evaluation (end of the implementation phase).
- Scaling of the pilot project (at the end of the project)



There are risks like tenants not being motivated, changing heat prices, rules about tenant incentives, and technical issues. But the project gives tenants a strong role in saving energy. By encouraging better habits, showing clear energy use, and giving rewards, the pilot project wants to cut energy use by 10% per home and save money for everyone. It also helps invest savings back into the community and could change rules so tenants on financial aid benefit too. The project supports key Sustainable Development Goals: clean energy (SDG 7), sustainable cities (SDG 11), and climate action (SDG 13). It builds a community-based model that can grow and last.

1. Technical feasibility

1.1. Demand side analysis

As seen in **Error! Reference source not found.** the total energy consumption for space heating in Germany stagnates since 2010 despite extensive refurbishments of buildings carried out across the country. These refurbishments were expected to reduce the final energy consumption for space heating to approximately 114 kWh/m²/a. However, this target was not met. One of the primary reasons for this discrepancy is likely the behavior of the users. User behavior plays a crucial role in energy consumption, as individual habits and practices, such as thermostat settings, ventilation habits, and the frequency of heating usage, can significantly influence the overall energy demand. Even with improved building standards and technologies, the effectiveness of these measures can be undermined if users do not adopt energy-efficient behaviors.

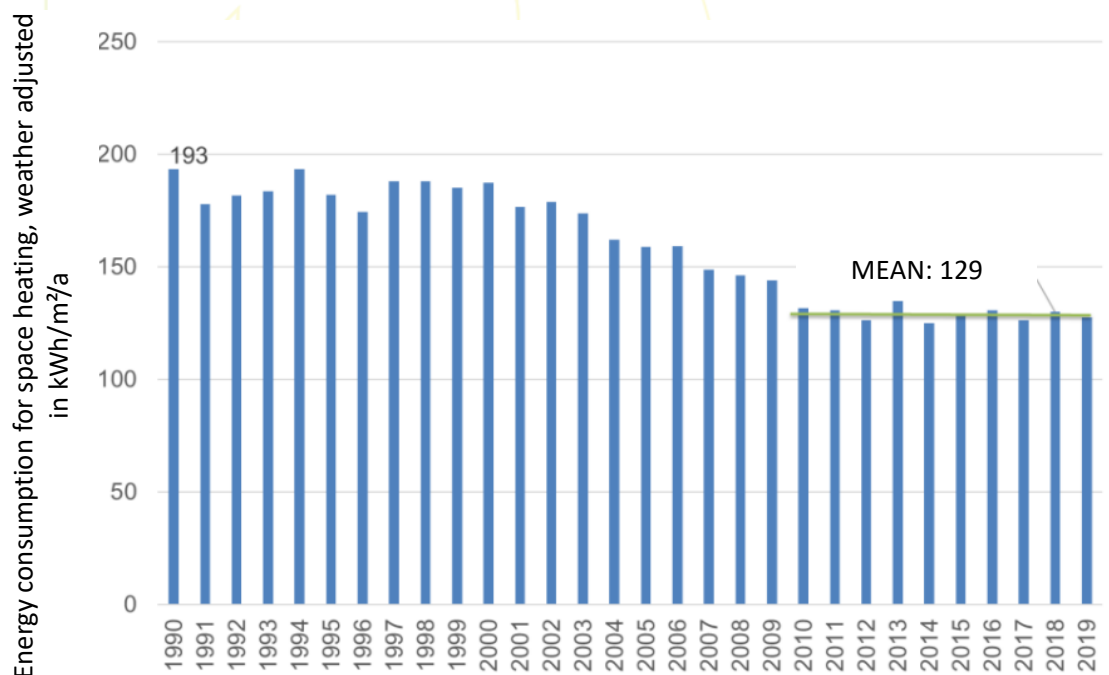


Figure 1: Development of space heating consumption (weather-adjusted) in Germany per square meter of living space

(Source: Federal Ministry for Economic Affairs and Energy: https://www.gdw.de/media/2021/01/21_01_13_gdw-kompakt_anreizwirkung_co2-preis_mit-beispiel.pdf)



A similar trend was observed by the SWSG. **Error! Reference source not found.** illustrates that, following refurbishment, energy consumption remained 30% higher than the expected energy demand for SWSG buildings.

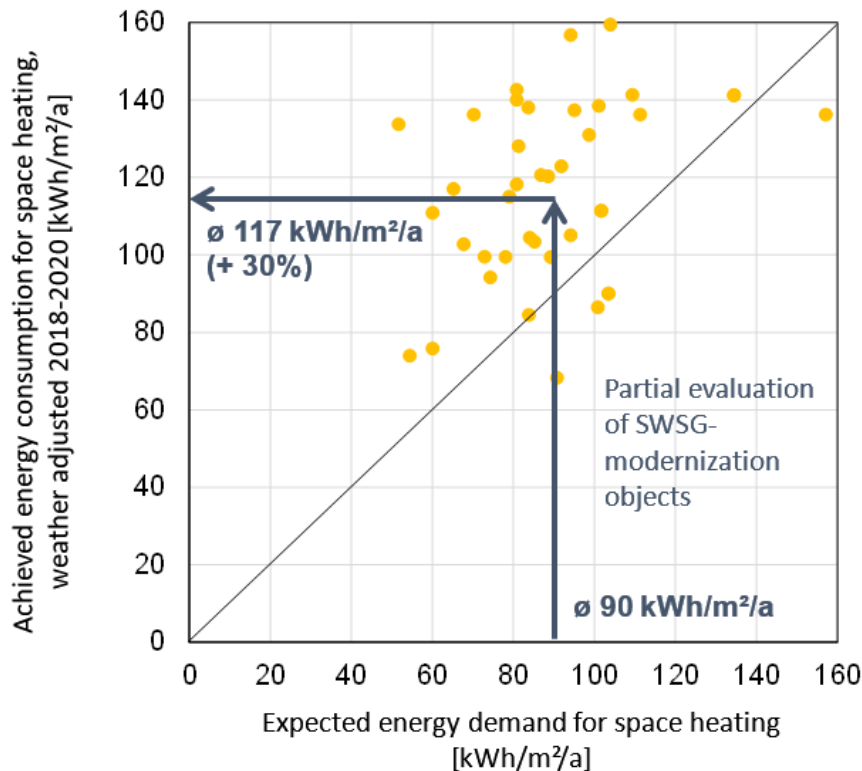


Figure 2: Expected energy demand vs. achieved energy consumption for space heating of houses of the SWSG (Source: SWSG)

Further analyses of the building stock of the SWSG were made. The pilot project focuses on 12 buildings. Some of the buildings are paired buildings (a and b), meaning they share identical envelopes and heating technologies. The 12 buildings were chosen due to their different building age classes. Building age classes categorize buildings based on energy standards: if a building has never been refurbished, its age class corresponds to its construction year, while refurbishment updates the age class based on its new energy standard. **Error! Reference source not found.** presents the mean heating and warm water consumption of these 12 buildings. Two key observations emerge: First, except for pilot buildings 1a and 1b, all buildings consume more energy than typical buildings of similar characteristics (red reference line, based on IWU data). Second, some pilots, such as "pilot 1", "pilot 3", "pilot 7", and "pilot 8" that are the paired buildings have different mean consumption. The only variable is the tenant's behavior. This underscores the significant impact of user behavior on heating consumption and highlights the potential of user awareness initiatives and behavioral changes.

Given these findings, analyzing the tenant structure is crucial. Who are the SWSG tenants? The tenant structure primarily comprises low- to middle-income households. The company focuses on providing affordable housing to ensure social diversity. This means that tenants include socially disadvantaged groups, low-income families, retirees, people with disabilities, workers with moderate incomes, young professionals, students, apprentices, families requiring larger affordable apartments, and migrants from diverse backgrounds.

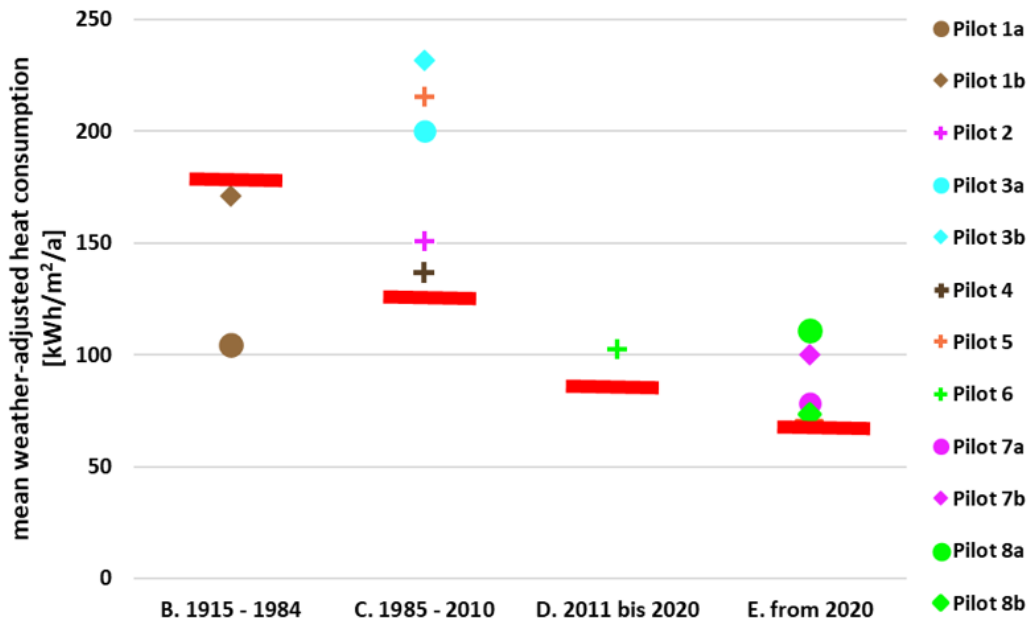


Figure 3: Heating and warm water consumption of 12 chosen buildings of the SWSG categorized by building age classes. Mean value for the years 2020, 2021, 2022 and 2023)

■ Represents the typical consumption of similar buildings (data from IWU – Institut für Wohnen und Umwelt)

1.2. Supply side analysis

The Stuttgart pilot case focuses on fostering a community that promotes user awareness and behavioral changes to reduce heating and warm water consumption.

Three categories of activities (Figure 4) will be implemented and analyzed for their impact throughout the project:

a) Daily information on heat consumption

Making consumption visible enables tenants to better understand how their behavior influences energy use. They can identify areas of excessive consumption and recognize opportunities for savings. To facilitate this, heat meters must be installed to measure heat and hot water usage. Additionally, a system to track and visualize this data, via a digital app, building entrance monitors, notice boards, etc., must be implemented. (see the calculation of the cost of the installation of heat meters at the end of chapter **Error! Reference source not found.**)

b) Innovative incentive system for tenants (Points for savings / Rewards- Vouchers etc.) Gamification

Different individuals respond to different types of motivation. Some are incentivized by financial rewards or gamified systems, while others require clear information on the environmental impact of their actions. By integrating a mix of rewards, education, and interactive challenges, broader tenant engagement is encouraged. In the Stuttgart pilot, financial rewards, a points-based motivation system, and educational sessions on energy-saving strategies will be employed.

c) Communication campaign



Effective communication is essential for behavioral change. Understanding tenants' existing knowledge and providing targeted education forms the foundation for meaningful engagement. This initiative will ensure that tenants comprehend the benefits of energy-saving measures, thereby increasing participation.

To reach as many people as possible, a combination of communication channels will be used. Direct communication will take place through door-to-door outreach, notice boards, and printed announcements. Additionally, digital communication via WhatsApp or other chat platforms will facilitate quick and interactive exchanges. Automated updates through the tenant app will further ensure that relevant information is consistently accessible. By using multiple channels, the campaign maximizes its reach and effectiveness, making energy-saving efforts more transparent and engaging for all tenants.

Together, these approaches, consumption visualization, gamification, financial incentives, and education, aim to reduce heating consumption and costs. The next chapter explores the impact of these savings.



Figure 1: Activities for awareness raising and reduction of heat consumption.

2. Costs and benefits

Implementing the activities described above leads to cost savings. Cost reductions are one of the primary motivations for tenants to adjust their energy consumption behavior. On average, tenants can reduce their heating and warm water costs by approximately 10% through behavioral changes, if heat prices remain constant.¹

However, this incentive does not apply to all tenants. Some receive financial aid, and their heating and warm water costs are fully covered by the Jobcenter. According to § 22 (1) SGB II, the Jobcenter reimburses the actual costs incurred, meaning that financial aid beneficiaries do not directly benefit from energy savings—the savings go to the Jobcenter instead. Since there is currently no mechanism in place to reward them for reducing their consumption, there is little to no incentive for them to change their behavior.

To address this issue, regulatory changes are necessary. One possible approach is to allow tenants receiving financial aid to retain a portion of the savings or to keep refunds from the energy provider without these being counted as income, like exemptions for earned income under §§ 11b ff. SGB II. Such a reform would create direct incentives for energy-efficient behavior.

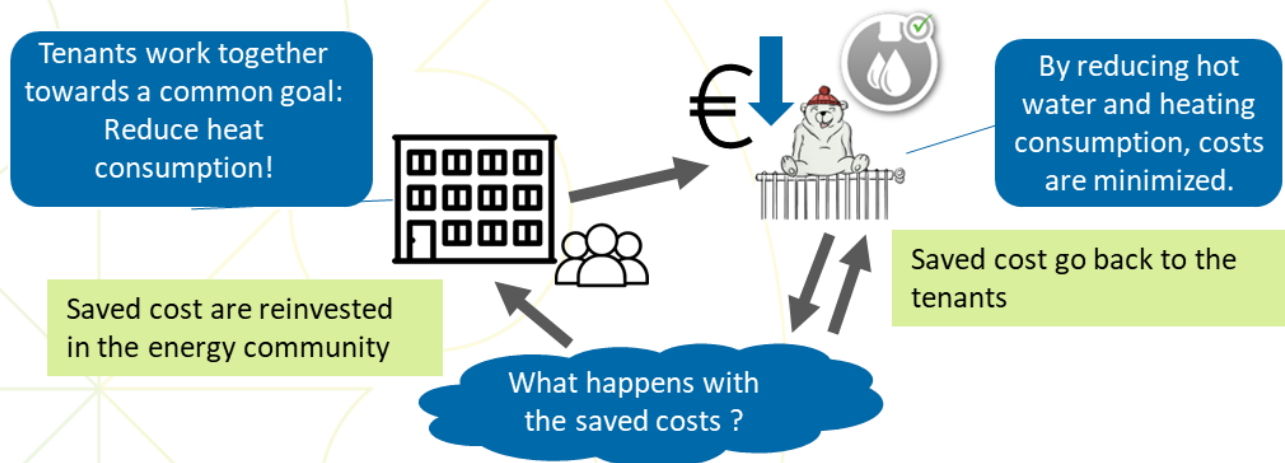


Figure 2: Activities of the community energy model in Stuttgart

The pilot project in Stuttgart aims to explore both the impact of the measures described and the feasibility of financial incentives for all tenants, regardless of whether they receive financial aid. These incentives will be provided in the form of vouchers and non-monetary sustainability-related benefits. For financial aid beneficiaries, § 11 (5) SGB II already allows financial bonuses to be exempt from being counted as income if they are linked to achieving specific goals, such as reducing energy consumption. During the initial years of the pilot project, these incentives will be financed by the Stuttgart Innovations Fund.

The table below calculates the savings for tenants, landlords and job center based on a reduction of 10 kWh/m²/a for an average apartment size of 65 m². Since 2023, the Carbon Cost Allocation Act (CO₂KostAufG) in Germany regulates how CO₂ heating costs are split between landlords and tenants. The law aims to incentivize landlords to improve building energy efficiency instead of passing all costs onto tenants. The cost-sharing follows a tiered model: the less energy-efficient the building, the higher the landlord's share. In average existing buildings, the split is typically 70% paid by tenants and 30% by landlords, which is also the assumption used in the following calculations. If CO₂ prices increase to €250 per ton, cost savings for SWSG

¹ Enste, Dominik H. / Hensen, Julia / Potthoff, Jennifer, 2023, Hilft Nudging in der Krise?. Verhaltensökonomische Maßnahmen für freiheitswahrendes Energiesparen, IW-Policy Paper, Nr. 2, Köln



could reach €220,000 per year, and the job center could save up to €150,000 annually (case 2). Figure 5 illustrates how landlords, tenants and the Jobcenter could reinvest these savings and it is further described in chapter **Error! Reference source not found.**

Calculation of potential of energy savings for tenants, landlords (here specifically the SWSG) and the Jobcenter.

Categorie	Annahmen
Energy reduction per year	10 kWh/m ² /a
Average apartment size	65 m ²
Szenarios	low, middle and high CO ₂ cost
CO ₂ -Cost-Split	30% landlords, 70% tenants
Number of apartments of the pilot case	12 buildings – 137 apartments
Number of apartments (SWSG)	18.800
Total number of rental apartments in Stuttgart	225.000
Number of households receiving financial aid (10% of tenants in Stuttgart)	22.750
Case 1	Pilot case Stuttgart
Case 2	SWSG
Case 3	All financial beneficiary households in Stuttgart

	euro/ton	ct/kWh gas (netto)	ct/kWh gas (brutto)
Scenario 1			
Co2 Price	55,00	1,10	1,32
Gas Price			11,00
Scenario 2			
Co2 Price	150,00	3,01	3,59
Gas Price			11,00
Scenario 3			
Co2 Price	250,00	5,02	5,98
Gas Price			11,00

Cost savings/Apartment/Year	Scenario 1	Scenario 2	Scenario 3
CO2 savings for tenants (Euro/a)	6,01	16,33	27,21
Energy savings for tenants (Euro/a)	71,50	71,50	71,50
CO2 savings for landlords (Euro/a)	2,57	7,00	11,66

Case 1: 12 buildings - 137 apartments - cost savings/Year	Scenario 1	Scenario 2	Scenario 3
SWSG savings – CO2 savings (Euro/a)	352,64	959,07	1.597,56
Jobcenter savings –10% of the tenants (Euro/a)	1.014,81	1.075,46	1.139,31

Case 2: SWSG – 18800 apartments – cost savings/year	Scenario 1	Scenario 2	Scenario 3
SWSG savings – CO2 savings (Euro/a)	48.391,20	131.609,40	219.226,80
Jobcenter savings – 10% of the tenants (Euro/a)	139.259,12	147.580,94	156.342,68

Case 3: all financial beneficiary households in Stuttgart	Scenario 1	Scenario 2	Scenario 3
Jobcenter savings (Euro/a)	1.763.261,50	1.998.234,88	2.245.629,75

After the EU Directive 2018/2002 metering for heating, cooling and hot water requires to be remotely readable by 2027. The SWSG has already installed, upgraded or is in the process of upgrading the individual heating, cooling and hot water metering in each apartment. This allows to track the consumption of the individual apartments. Most of the buildings need the installation of heat meters installed on the building level. Additionally, the cost for the interface for the visualization of the consumption must be programmed and hosted. It should be noted that the installation of heat meters is not solely for this project but also serves monitoring and billing purposes. Therefore, not all costs are fully attributable to the project. The following table presents the associated costs for the entire SWSG building stock (Case 2).

Cost Category	Cost Type	Unit Price (Euro)	Attributable Share (%)	Case 2 (845 Buildings, 18,800 Apartments) (Euro)
Installation of heat meters	Per Building	1.200	33%	334.620
Programming Interface	Onetime costs	40.000	33%	13.200
Programming of communication heat meters and interface	Onetime costs per heat meter	10	33%	2788,5
Automatic communication to tenants	Onetime costs	50.000	100%	50.000
Total (of attributable shares)				400.608,5

The following table shows the calculation of profitability for the SWSG for case 2. Depending on the scenario it would take from little less than 2 years to a little more than 8 years to amortize the investment.

Case 2: SWSG – 18800 apartments	Scenario 1	Scenario 2	Scenario 3
SWSG – CO2 savings (Euro/a)	48.391,20	131.609,40	219.226,80
Amortization period (a)	8,3	3	1,8

3. Community model

Figure 6 outlines the organizational structure of the pilot project. The Stakeholder Advisory Group (SAG) serves as a supervisory and consultative body, bringing together key local actors relevant to this pilot case. Its members include institutional landlords, housing companies, energy efficiency experts, public authorities such as the environmental and the social office of Stuttgart. The SAG facilitates the exchange of ideas, shares practical experiences and supports the adaptation and implementation of energy community measures. Since the beginning of the project 5 group meetings and 6 bilateral exchanges were organized and enabled continuous dialogue. The Community Energy Board (CEB) drives the implementation of the energy community. It includes SWSG representatives, property managers who act as key intermediaries between tenants and SWSG and selected tenant representatives. The composition ensures that both landlord (SWSG) and user perspectives (tenants) are continuously reflected in the project’s planning and execution. The CEB plays a central role in translating the ideas developed in the SAG into actionable measures within the energy community.

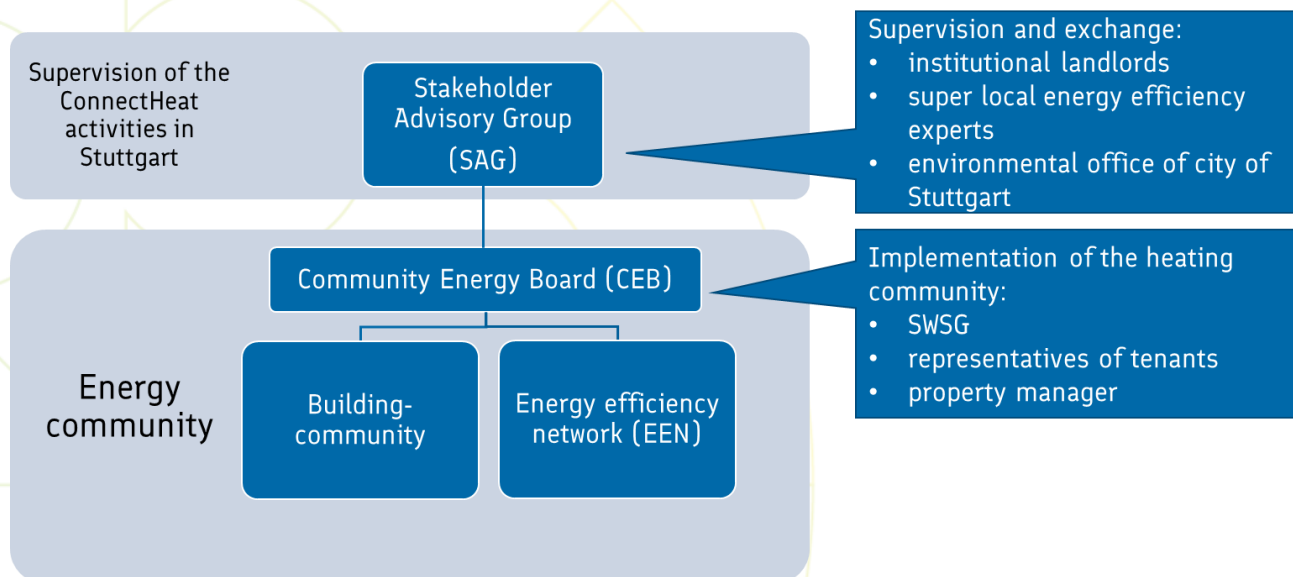


Figure 3: Organization of the pilot case in Stuttgart.

The actual participatory framework of the energy community is shown in Figure 7. It illustrates the project’s structure, which is built around two key components. The Building Community is the level on which the savings are calculated. Complementing this, the Energy Efficiency Network focuses on implementing energy-saving measures as described in chapter **Error! Reference source not found.** It fosters knowledge exchange among participants and manages the reinvestment and redistribution of savings, as detailed in chapter **Error! Reference source not found.**

The community may decide how much of the savings should be saved collectively and how contributions from landlords, the Jobcenter, and tenants should be allocated. Initially, funds may be reinvested within the community. In later stages, they could support broader neighborhood energy and climate initiatives.

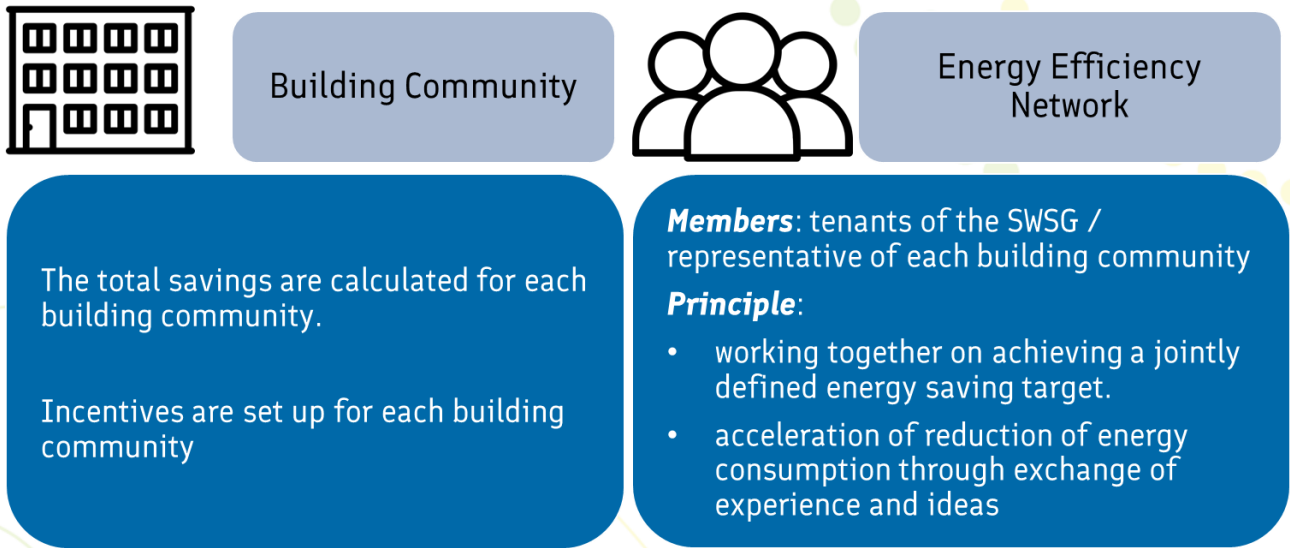


Figure 4: Participatory framework of the energy community.

3.1. Project roadmap

The project roadmap is presented in Figure 8.

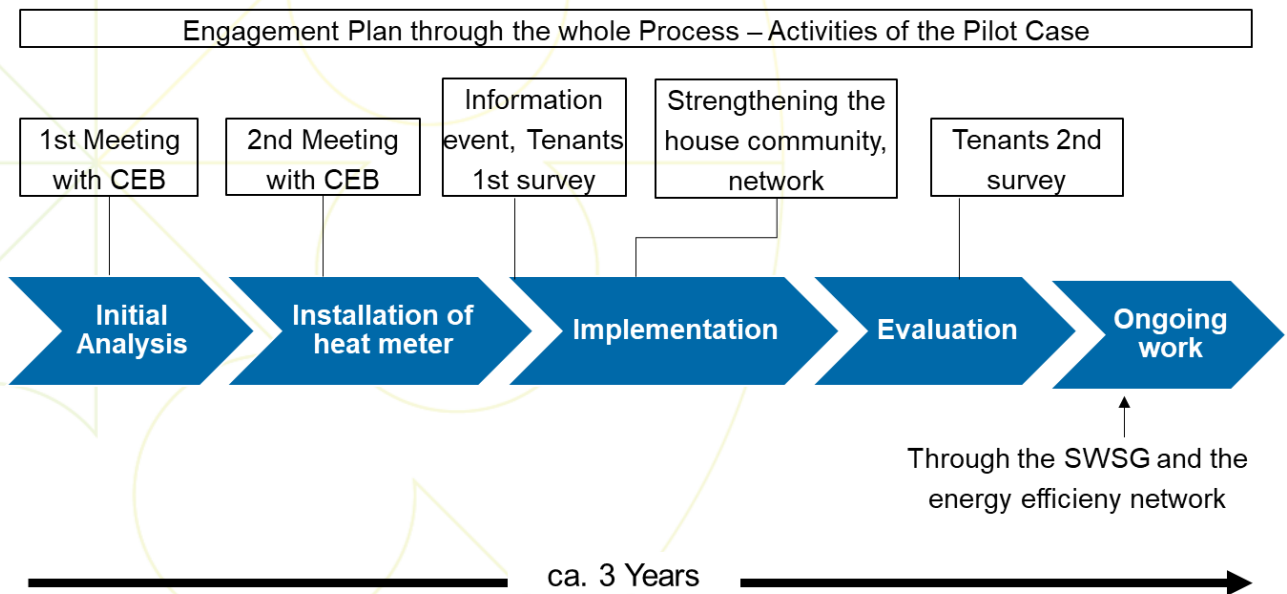


Figure 5 Project Roadmap

- **Initial analysis** of past consumption (3–4 years). This has already been done in 2024. **Error! Reference source not found.** shows the mean heat and warm water consumption of the 12 chosen buildings of the SWSG.
- The **installation of heat meters** is essential to determine the energy savings for each pilot building. This task is managed by SWSG in collaboration with the property managers. A site inspection was conducted by the property managers to define the technical specifications required for the installation. The



installation order has been placed, and the heat meters are scheduled to be fully installed by the end of July 2025.

- **Implementation phase:** Execution of heat consumption tracking, gamification, and communication activities over one heating period as described in chapter **Error! Reference source not found.**. The implementation phase is delayed due to the long time needed to prepare the installation of meters and to find the service companies to install them. Nevertheless, the preparations for the Implementation phase are ongoing. Firstly, an engagement plan was established back in 2024 as well as the creation of the CEB with its first meeting in March 2024 with the SWSG and the property managers were organized. Secondly the activities for the implementation phase were further developed (as seen in Chapter **Error! Reference source not found.**). The Kick-Off events for the implementation phase will take place in Summer 2025. In this period the tenants will also be addressed directly and will be asked to fill out the first survey.
- **Evaluation phase:** Assessment of whether savings meet projections (from chapter 3). The Evaluation phase will take place at the end of the implementation phase. The collected data as well as the 2nd survey answers will be analyzed to eventually adapt the community model to a sustainable model.
- **Ongoing work:** Scaling the concept to all SWSG buildings. The SWSG plans to spread the initiatives from the pilot case to all of its buildings.

3.2. Risks

The initiative faces several risks that could impact its success. A key challenge is missing tenant motivation to change, which may hinder participation in energy-saving efforts. Additionally, fluctuations in heat prices could lead to inconsistencies in projected savings, affecting financial planning and motivation. Regulatory barriers also pose a challenge, particularly concerning financial incentives for tenants supported by the Jobcenter, potentially limiting their ability to benefit from cost savings. Lastly, technological difficulties in the implementation of heat meters and the integration of consumption data could present obstacles to accurate monitoring and assessment.

Despite these challenges, the Stuttgart pilot case introduces an innovative, community-based approach that empowers tenants as active participants in the energy transition. By combining behavioral changes, transparency of consumption and financial or non-monetary incentives, the model has the potential to generate reductions in energy consumption (up to 10% per household), leading to long-term financial savings for tenants, landlords, and public institutions. In addition to the energy savings and improving knowledge about energy among tenants, the initiative offers a framework to reinvest collective savings into neighborhood sustainability, creating a multiplier effect that could benefit entire communities. It also creates a chance to social welfare regulations to enable energy-saving incentives for financially supported tenants.

This initiative significantly contributes to multiple Sustainable Development Goals (SDGs). By promoting access to the energy community for all tenants, it helps mitigate energy poverty and directly supports SDG 7 (Affordable and Clean Energy). Furthermore, it aligns with SDG 11 (Sustainable Cities and Communities) by promoting inclusive, affordable, and sustainable urban energy solutions. Additionally, through energy reduction and behavioral changes, the project contributes to SDG 13 (Climate Action) by reducing CO₂ emissions. By fostering a community-driven approach, this model ensures financial, social, and environmental sustainability while offering a scalable framework for broader implementation.