ConnectHeat
Community engagement for clean heat

HEATING & COOLING COMMUNITY ENERGY DEVELOPER'S BLUEPRINT

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

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Executive summary

The Heating and Cooling (H&C) Community Energy Developer's Blueprint provides practical steps for creating H&C communities, drawing on lessons from six ConnectHeat pilot cases. It shows that the emergence of such communities depends on both systemic factors, like EU and national frameworks, and local conditions that interact in complex ways. A solid grasp of the legal, regulatory, and energy governance context is therefore essential, alongside knowledge of local plans and energy systems. The Blueprint is designed for municipalities, local authorities, utilities, cooperatives, and other potential developers, while also offering value to a wide range of local stakeholders.

The results of the ConnectHeat project are translated into steps that any new H&C community can follow in its emergence path. It emphasizes that a H&C community project does not need to start from scratch but can build on existing or ongoing initiatives. It outlines the steps needed to lay the groundwork for a new community, focusing on capacity-building and developing an engagement plan. It then guides readers through the planning phase, including the establishment of a Board, the assessment of technical feasibility, and cost–benefit analysis. Finally, it highlights the key steps for creating a solid business plan, offering practical advice on setting up a management structure, drafting a community roadmap, and assessing potential risks.

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1. Introduction

1.1. The ConnectHeat project – Connecting Europe's heat

The ConnectHeat project (connectheat.ambienteitalia.it), co-funded by the European Commission within the LIFE Clean Energy Transition program, supports the diffusion of low-carbon community-led energy models in the heating and cooling (H&C) sector. Those communities are able to ensure higher shares of local renewable energy sources (RES), access to cheaper and cleaner energy, positive impacts on local air quality, and socio-economic benefits.

The objective of diffusing these communities was achieved through structural cooperation between public authorities, citizens, and key stakeholders at both local and transnational levels, as well as through the development of knowledge and skills. It also involved the planning and implementation of six pilot projects in Belgium, Bulgaria, Croatia, Germany, Italy, and Spain, as illustrated in the map below (Portugal, mentioned in the map, could not develop its pilot case this time).

Figure 1: ConnectHeat's map of pilot cases

1.2. The Blueprint: Purpose and audience

This Blueprint allows the reader to dive into the practical steps supporting the creation of a H&C community. These steps, both in their identification and content, are directly derived from the 6 ConnectHeat pilot cases, and they can act as helpful references for the development of similar communities across Europe.

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Explaining why H&C communities emerge, or fail to emerge, means considering both systemic factors such as EU or national legal frameworks, and local conditions. Conditions at the local level are often closely intertwined with broader systemic ones. These different layers influence each other in complex ways, and their importance can vary from one country to another. This makes the emergence of H&C communities highly dependent on context.

A clear understanding of the legal, regional, and national regulatory framework is therefore a key enabling factor. Equally important is knowledge of the local energy governance system, including existing Sustainable Energy and Climate Action Plans (SECAPs), urban planning programs, and the specific characteristics of the local energy system.

This Blueprint targets all the potential developers of a H&C community, such as Municipalities, other local authorities, utilities, citizen cooperatives, energy communities, ESCOs, etc. However, its content may be helpful for all the other local stakeholders involved in the creation of such a local energy community.

1.3. Heating & Cooling: A key enabler of the energy transition

In Europe, H&C are responsible for more than 50% of energy consumption and greenhouse gas emissions. Although the decarbonisation of heating and cooling is underway, progress has been slow, and about 75% of the energy consumption is still produced with fossil fuels (Thomaßen et al., 2021). The decarbonisation of the H&C sector is therefore essential in the energy transition to reach Europe's ambitious 2050 targets (carbon neutrality), and there is a huge potential for action to increase energy efficiency and sustainability, both through measures to reduce end-use consumption and through the deployment of RES installations. Moreover, it can increase the overall efficiency of the energy system by enabling the use of district heating and cooling (DHC) based on RES and on the recycling of heat losses from a variety of energy conversion or industrial processes, as well as cogeneration plants.

The EU's strategy for decarbonization, driven by the European Green Deal, the Renewable Energy Directive III, the revised Energy Efficiency Directive, the Fit for 55 package, and the Energy Performance of Buildings Directive (EPDB), envisions transformative changes in H&C production, distribution, and consumption. Central to this transition are the integration of a high share of RES and waste heat into DHC systems and the renovation of the building stock, the single largest energy consumer in Europe, responsible for around 40% of the total energy. By leveraging biomass, geothermal, solar thermal, and waste heat, DHC networks are expected to become the backbone of urban heating. The modernization of these systems to 4th and 5th generation DHC, which operate at lower temperatures and maximize the efficiency of renewable integration, will be crucial.

The revision of the Energy Efficiency Directive in Art. 26 sets the criteria and objectives for reaching "efficient DHC". These goals foresee the use of increasing shares of RES, waste heat, and high-efficiency cogeneration, to meet intermediate targets, starting in 2027, and then reaching the final objective in 2050, when DHC networks must be operated using RES only, or waste heat only, or a combination of RES and waste heat.
Furthermore, within Art. 25.6, it also introduces the obligation, for Municipalities with more than 45,000 inhabitants, to develop specific local plans for H&C, thus recognizing a key role to local and regional public authorities in the decarbonization processes. Finally, the EPDB aims to achieve a highly energy efficient, zero-emission, and fully decarbonised building stock by 2050.

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2. Warmer (and cooler) together: H&C communities

2.1. Not only electricity: A policy and communication gap

Energy communities are not a new thing in Europe. The first ones appeared as early as the 1920s in Italy and Spain, to provide electricity in areas not yet covered by the electricity grid (Vansintjan, 2015). In the 1980s, a second wave of these energy communities started to produce electricity with RES. These renewable energy communities (RECs) were rising mainly in north-west Europe, and this second wave embodied the focus on environmental and social objectives that still mark RECs to this day. The third wave of RECs appeared in the 2010s as RECs are recognised and defined in EU law (Savaresi, 2019; Cobut, 2021) and this wave may be characterised by a diversification of RECs in terms of geographical focus, governance models, technologies, actors involved, activities, and related beneficiaries (Bauwens et al., 2022)

A revised Renewable Energy Directive (RED II) provided a formal definition of RECs, meaning a legal entity "which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects owned and developed by that legal entity" (European Parliament and Council of the European Union, 2018). RED II also requires Member States to establish an "enabling framework", aimed at facilitating the emergence and scaling of RECs but, as of 2025, the federation of renewable energy communities (Rescoop.eu) raises concerns regarding the transposition of REC provisions. The most recent revision of the RED (RED III) shall facilitate the expansion of REC activities, including energy sharing, supply, and H&C and further support for these activities is expected to come from the Citizens Energy Package.

However, the implementation of RECs at the national level has largely been limited to electricity only, excluding H&C. Most of the active RECs, therefore, have been developed considering only electricity generation and distribution, and this omission represents a significant policy gap that limits the potential of RECs to contribute fully to the energy transition. Despite the several ongoing initiatives involving local communities in renewable heat supply through heating networks, this narrow focus has limited the potential of RECs to contribute to the EU's climate goals. It has also overlooked a significant portion of energy consumption, the one related to H&C, which is closely tied to energy poverty (through the topic of space heating) and carbon emissions.

To bridge this gap, it is imperative to adapt and expand the strategic and regulatory frameworks governing RECs. The EU's Fit-for-55 package, alongside the updated Energy Efficiency and Renewable Energy Directives, provides a robust foundation for integrating renewable heating and cooling into the scope of RECs. Therefore, updating and expanding the regulatory framework to fully incorporate and duly valorise renewable heat is crucial for maximizing the contribution of RECs to the energy transition and ensuring a comprehensive approach to EU climate goals.

Finally, the fact that the current policy framework fails to recognise and support H&C communities properly feeds a "storytelling" gap in the sense that RECs are rarely linked to H&C and, instead, are more likely to be associated with electricity-related projects in the collective mind.

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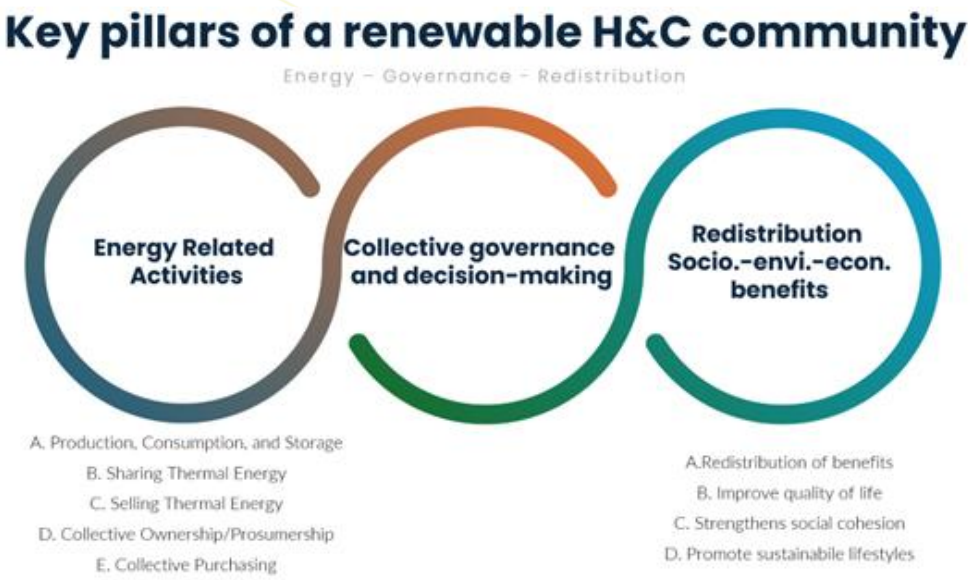
2.2. What is a H&C community?

A H&C Energy Community is a **low-carbon model** of H&C production, distribution, sharing and consumption, based on a **community-led approach**. As such, it must build on the following key pillars:

- Increased efficiency in H&C final uses
- High share of local RES for H&C needs
- Lower and more stable H&C costs
- Collective governance and decision-making
- Sharing and redistribution of economic, environmental and social benefits

Figure 2: Key pillars of a renewable H&C community



Like all community-led energy initiatives, a H&C Community is defined not only by the energy-related activities, but also by how it engages its members and uses the outcomes of their efforts to benefit the community as a whole. At the core of a H&C community is the principle of collective governance and decision-making, where members actively participate in shaping the community's direction, ensuring that all voices are heard and that decisions reflect the collective interests. This inclusive approach fosters a sense of ownership and responsibility among members, which is crucial for the successful and sustainable operation of the community. Additionally, the redistribution of economic, environmental, and social benefits plays a fundamental role. The community collectively ensures that the advantages derived from the projects (such as cost savings, reduced carbon footprints, and enhanced local resilience) are shared equitably among members. By ensuring that these benefits are shared, the community not only improves the quality of life for its members but also strengthens social cohesion and creates a replicable model for sustainability.

A renewable H&C community can thus build **on one or more** of the following models:

A. **Producing, consuming, and storing thermal energy:** Generating heat from RES, utilizing it within the community and storing excess energy for future use to enhance efficiency and reliability.

B. **Sharing thermal Energy:** Distributing the generated thermal energy to community members through systems like single-building setups or multi-building district heating networks.

C. **Selling thermal energy:** Selling surplus thermal energy to non-members, providing additional revenue streams for the community.

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D. **Collective ownership and/or prosumership:** Engaging members in collective ownership of energy infrastructure and plants or as prosumers, both producing and consuming heat and/or cool.

E. **Collective purchasing, measures and services:** Pooling resources to implement EE interventions (e.g. building renovation), buy technologies and/or fuels at reduced costs, making sustainable energy more accessible.

These activities show that aside from its sustainability goal, H&C communities' benefits are democratic. Those actors offer ways for citizens to directly participate and benefit from the energy transition. Interestingly, citizen engagement in H&C communities appears as a key element for success, as citizens are needed to deal with the complexity of these activities. Citizen engagement may help ease the social acceptance of these projects. In return, RECs provide citizens with energy literacy and with direct benefits, as citizens rapidly see the benefits of being engaged in H&C projects. Eventually more rapidly than with electricity production projects in which citizens are not directly connected with the electricity they produce, as it is usually sold to grid operators (Hartmann and Palm, 2023).

2.3. Clean, resilient and sustainable Heating & Cooling: Energy sources, technologies and interventions

The H&C sector provides a broad platform for the integration of many kinds of RES, energy efficiency measures, and enabling technologies. Solar thermal, geothermal, bioenergy, the recovery of excess heat from a variety of energy conversion, commercial and industrial processes, complemented with DHC, heat pumps, thermal storage, and measures to reduce H&C needs, are the backbone of a radically new, carbon-neutral, efficient, reliable, flexible, and user-oriented energy system.

Below, we provide a brief overview of the potential RES and technologies that can be used in heating and cooling communities. For more detailed information, especially related to energy production and costs, a good and recent source of information is the collection of technological factsheets developed within the Annex TS5 ("Integration of Renewable Energy Sources into Existing District Heating and Cooling Systems") of the International Energy Agency DHC programme, which is downloadable here: https://www.iea-dhc.org/2019-2024-annex-ts5

Solar thermal

This technology can be profitably used for medium and large-scale applications, also in combination with other energy sources. Hundreds of DHC networks using solar collectors were reported all over the world, with a massive use in Denmark and China, and with examples from Austria, Germany, Sweden, the Netherlands, France, Italy, Spain, and several other countries. Solar thermal plants can often cover the whole network load in the summer months, thus allowing the turn off of other heat-producing systems (biomass, solar thermal).

Biomass

The use of biomass for collective heating could be a good choice once some requirements are met. First of all, a local short supply chain should be ensured, thus avoiding unsustainable energy production and stimulating the territorial economy. Secondly, the best available boiler technologies, in terms of conversion efficiency and emission filtering and reduction, should always be used. The use of modern and efficient collective boilers that run on biomass is cheaper and more sustainable than having many individual systems. Lastly, the energy production by biomass can be combined in a synergic way with other sources, to reduce

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the fuel consumption and the related emissions, for example, by coupling these systems with a solar thermal plant, as described in the previous paragraph.

Geothermal

Shallow geothermal can be a convenient energy source for H&C community projects. Depending on the characteristics of the addressed area, the available temperature level could be high enough to directly feed the users or a DHC networks (as it happens, for example, in Finland or in some areas in the Italian region of Tuscany), or it could require the implementation of heat pumps to boost it properly.

Waste heat

In its most recent policy and strategic documents, the European Commission has stressed more and more the importance of a massive use of waste heat to decarbonise the H&C sector.

The use of waste heat cannot be regarded as RES but rather an efficiency technology but its relevance is key for H&C communities since it can be profitably combined with other local RES. Waste heat can be recovered from small and large industries or from activities in the tertiary sector. A special focus has been given in the last years, due to the development of IT infrastructures and services, to the possible heat recovery from data centers.

Heat pumps

The use of heat pumps could be a very good solution for collective H&C production, especially to increase the temperature level of heat sources coming from heat recovery in data centers, industrial processes, commercial buildings, or other possibilities. Heat pumps can also be profitably used in the so-called "aquathermal" solutions, where the primary heat source is water from rivers, lake and seas, thus showing low or medium temperature levels. In H&C communities bases on DHC, it is possible to include a collective heat pump as a central plant to raise the temperature to a level suitable for heating rooms and domestic hot water or, alternatively, foresee a solution with an individual heat pump in each building. A crucial point regards the sustainability of such solutions, since quite often we hear that electrification automatically implies decarbonization. For heat pumps to be truly sustainable, the electricity powering them must come from RES.

Thermal storage

Storing heat in community H&C projects could increase the efficiency of energy management giving more flexibility to production and distribution. Thermal storage can be designed with a daily or multi-daily time span, or they can even be built as seasonal storage, with large sizes, spanning from 50,000 to 500,000 m^3 water volume. Such devices, in the form for example of pits dug in the ground and filled with water, allow for storing surplus heat in the summer (produced, for instance, by solar thermal plants) and using it afterwards during the heating season. Another well-proven technology for seasonal storage is the use of boreholes (some tens of meters of depth) to store the heat directly in the ground without the need for expensive excavation works and huge volumes of water. The use of seasonal storage can allow for increasing the annual share of solar thermal in heating supply through a DHC network from around 20% to 50% or more.

Energy efficiency

But…H&C communities are not necessarily linked only to the use of RES or DHC networks. They could also rely on the implementation of energy efficiency measures for reducing H&C needs and final consumption. Particularly, they can be put in the driver's seat for energy renovation of buildings, including envelope retrofitting, more efficient technical systems and equipment purchase and installation, etc. For more detailed information related to measures for reducing H&C needs and final consumption, useful sources can be, among others, Build Up, the European portal for energy efficiency and renewable energy in buildings (https://build-up.ec.europa.eu/en/home), Buildings Performance Institute Europe (https://www.bpie.eu/),

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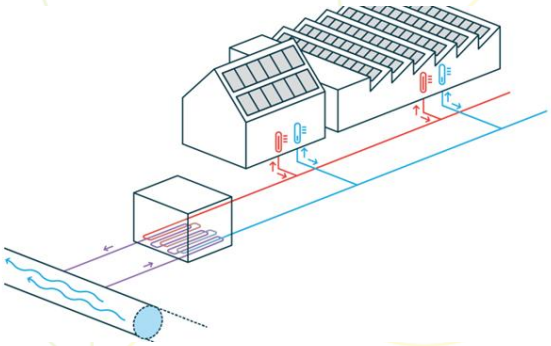
Smart Cities Marketplace (https://smart-cities-marketplace.ec.europa.eu/), Efficient Buildings Europe (https://efficientbuildings.eu/)

Box 1: Tip from ConnectHeat – Sources, technologies, and measures for H&C communities

The **ConnectHeat** pilot projects, including both DHC networks and alternative solutions for H&C supply, feature a very large variety of energy sources and technologies for providing heat to the consumers.
In the pilot case of **Anzegem (Belgium)**, for example, a DHC network is harvesting low-temperature thermal energy from a drinking water pipeline, with each building then equipped with its own heat pump for tailored heating, cooling, and domestic hot water needs. While the **Croatian project** in **Zagreb** focuses on heat pumps fueled by shallow geothermal energy, the **Italian pilot case in Gemona del Friuli** uses biomass and even waste heat recovery from the local crematory.

Visuals from the pilot case in Anzegem (Belgium)



In the case of **San Bartolomé de Tirajana** in the **Gran Canaria Island** (Spain), then, seawater for renewable heating and cooling will be prioritised, using water-to-water heat pumps connected to very low enthalpy coastal geothermal boreholes and, furthermore, both solar thermal and photovoltaic will be implemented on site.
Last but not least, in the city of **Plovdiv (Bulgaria)**, 6 passive houses will be equipped with ground-source heat pumps fed by five or six boreholes, and solar thermal collectors installed on each rooftop will generate energy for domestic hot water, stored in a shared thermal storage tank.

Unlike the previous pilots, the ConnectHeat pilot project in **Stuttgart**, focuses on improving energy efficiency in social housing buildings managed by the Stuttgarter Wohnungs- und Städtebaugesellschaft (SWSG). 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. 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.

To know more about the technical details of the ConnectHeat pilot projects, have a look here: https://connectheat.ambienteitalia.it/d4-2-implementation-of-pilot-cases/

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3. How to create H&C communities: a step-by-step approach

3.1 You do not have to reinvent the wheel

3.1.1. Step 1: Identify, explore, and tailor.

Identify, explore, and tailor existing approaches, methodologies, and models that have been successfully used in community energy or citizen-led initiatives within the electricity sector.

Energy Communities Repository - https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumers-and-prosumers/energy-communities/energy-communities-repository-products_en
The Energy Communities Repository is an initiative on behalf of the European Commission to assist local actors (including citizens, local authorities, and businesses) with setting up and advancing clean energy projects driven by energy communities in urban areas across Europe. It ended in January 2024, after two years of fruitful activity. In practice, the Energy Communities Repository provided three main types of services: Data collection & Analysis; Technical Assistance; Best practices and Toolbox.

Rural Energy Community Advisory Hub - https://wayback.archive-it.org/12090/20240320084824/https://rural-energy-community-hub.ec.europa.eu/index_en
Launched in June 2022, it focuses on assisting citizens, rural actors and local authorities in setting up a Citizen Energy Community or Renewable Energy Community in rural areas. Key activities through the hub include support for rural community and energy transition projects to identify best practice, providing technical assistance and networking opportunities.
Guidance documents and dissemination material are available through the hub, with a specific focus on challenges and solutions derived from energy communities' own experience and best practices. It also provides mapping of Rural Energy Communities across Europe as well as technical assistance to such initiatives and projects.

Citizens Energy Advisory Hub - https://citizens-energy.ec.europa.eu/index_en
The Citizen Energy Advisory Hub (CEAH) is a European Commission initiative at the core of Europe's citizen-centered energy transition. It's here to help everyone participate in a socially fair and inclusive energy transition, ensuring no one is left behind. Focusing on achieving affordable energy, widespread access to renewable technologies, energy efficiency and effective demand-response, it provides the right tools, resources and support to all European citizens

Citizens-led renovation - https://citizen-led-renovation.ec.europa.eu/index_en
Citizen-led renovation is an EU funded support service to empower communities and to put citizens in the driver's seat for energy renovations. It aims to assist energy communities to deliver citizen-led energy renovations and renewable energy installations, whether you have already one-stop shops for project developers in place or not. Depending on your needs, expectations and commitment, the project will give you the opportunity to access tailored support in terms of administrative, technical, and communicative assistance and co-implement citizen-led renovation projects in your community. The support service will help your community to overcome financial, legal, technical, and informational barriers to deliver future-proof residential buildings.

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ResCoop.eu networks **-** https://www.rescoop.eu/network/map/

Tip from ConnectHeat – Where can I get inspiration from?

Get in touch with and learn from the most relevant example of H&C community-led initiatives around Europe by exploring the **online map** developed by the **ConnectHeat** project. *https://connectheat.ambienteitalia.it/hcc-map/*

3.1.2. Step 2: You do not have to start from scratch!

The legislation about H&C RECs is lagging, but examples of community-led projects for H&C have already been operating for many years in several EU countries, such as Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, and Sweden. You do not have to wait for the perfect legal framework to start, you can build on already existing projects:

a) H&C communities may emerge alongside a more general H&C project
b) H&C communities may emerge as a result of a prior project
c) H&C communities may emerge from an already existing 'traditional' Energy Community, based on electric RES, interested in integrating thermal RES or H&C efficiency measures

3.1.3. Step 3: learn from others.

Get in touch and interact with ongoing LIFE projects or benefit from the results of already closed ones, focusing on community energy issues, energy efficiency and decarbonization in the H&C sector, policies and supporting measures for the exploitation of local thermal RES, particularly in DHC systems, tools for energy systems modelling and for RES potential assessment, etc.
Have a look at the **LIFE Public Database** here: https://webgate.ec.europa.eu/life/publicWebsite/search

3.2. Prepare the ground

In the next phase, the developer should create a **solid base of knowledge** and **involvement** for the detection of main challenges, barriers, and opportunities to the development and implementation of community-led initiatives in the H&C sector.

3.2.1. Step 1: Assessing the local context

Assess the local H&C context, mainly focusing on:

- The existing national, regional and local policies, regulations, strategies and supporting schemes influencing the H&C market dynamics and promoting the development of RES and EE measures and technologies and citizen-led energy initiatives.
- The local energy system (main features, use of RES and waste heat, diffusion of DHC, trends, critical aspects and evolution scenarios of the local H&C demand and supply).

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- The level of skills of the Public Administrations and decision makers in designing and implementing H&C strategies, in engaging local communities, in setting up and supporting citizen-led initiatives also through detection of best practices and ongoing initiatives.
- Already existing community-led initiatives and projects.

*Figure 3: **Map of heat demand density in the tourist centers of San Bartolomé de Tirajana,** from the pilot case in Gran Canaria, Spain.*

3.3.2. Step 2: create synergies with local stakeholders

Map target groups from the local H&C chain and reach, scout, and consult relevant local actors and key stakeholders within them with the aim to:

- Complement the local context analysis.
- Detect their know-how, awareness, relations/interactions with the energy context, energy transition, H&C, RES DHC, community energy topics, etc.
- Verify their potential interest, role, and contribution in future community energy project.

You can choose how to reach and involve stakeholders, for example, by phone interview, in-person meeting, questionnaires, working tables, etc.

For your investigations and interaction with stakeholders, you can refer to the items and issues proposed below, revising, integrating or adapting them according to specific local peculiarities and needs and to the type of actors to be involved.

- Level of awareness and know-how on climate change, energy transitions and H&C decarbonization issues *(RES H&C technologies, Renewables for heating and cooling, DHC, Local energy plans and strategies, legislations and regulations, incentives and financial tools)*
- Sectors/fields with main critical energy issues and/or energy emergencies at the local level
- More urgent interventions to overcome energy emergencies and criticisms at the local level
- Relevance of H&C for the belonging sector, association, company, etc. and more urgent interventions needed in the field.

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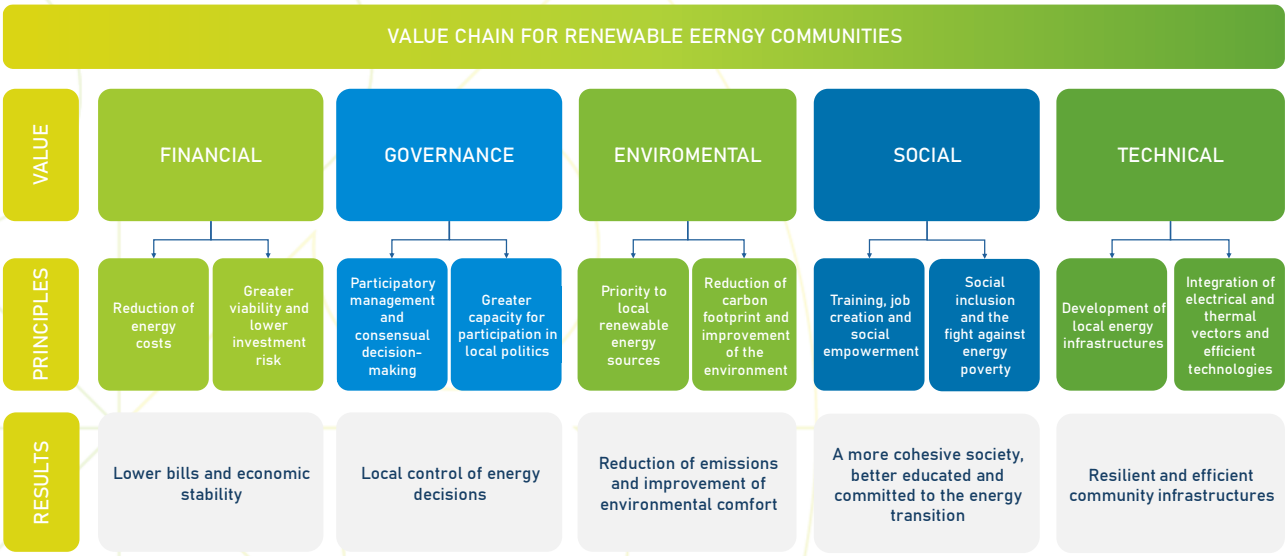
- Main obstacles for promoting and implementing energy measures and interventions at the local level
- Main obstacles for implementing energy measures/interventions in the belonging sector, company, association, etc.
- View on the potential of community energy initiatives in own municipality/region, particularly in the heating and cooling sector
- Key actors/stakeholders to involve and coordinate with for the development and implementation of energy projects and community-led initiatives
- The expected benefits and opportunities of community energy initiatives at the local level
- Possible contribution/role in the development of H&C projects and community energy initiatives
- Relevant experiences, best practices and projects related to energy transition, the H&C sector, and community-led initiatives.

Figure 4: value chain of RECs, from the pilot case in Gran Canaria, Spain.



3.3.3. Step 3: Identify and assess major barriers and challenges

Building on the regulatory, technological, socio-economic, and market local conditions detected in steps 1 and 2, identify and assess major barriers and challenges to community energy development to evaluate the local potential and identify possible 'hot spots'.

Tip from ConnectHeat – Beware of the toughest barriers and challenges

Within ConnectHeat, key barriers have been identified and evaluated in each involved target area relating to diverse aspects of the H&C community implementation process and reflecting context-specific challenges at both national and local levels.
The barriers were not limited to technological issues but also encompassed regulatory, financial, and practical considerations such as consumer involvement, business and financial models, information and

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know-how, societal aspects, local strategies and plans, local energy system assessment, and the local legal and regulatory framework, etc.
These shortcomings were addressed during the project, supporting a sound development of the pilot H&C community initiatives.

For more details, have a look at Chapter 2 of this document: https://connectheat.ambienteitalia.it/d2-3-community-energy-potential-and-pilot-cases/

3.3 How to start

Since H&C strongly depends on local conditions and there are no one-size-fits-all solutions, it is necessary to look at it from a systems perspective, stressing the need for integration of different technologies both on the demand and supply side and highlighting promising solutions for different use contexts. For this purpose, a shared view is needed and an integrated bottom-up approach should be followed taking into consideration all relevant actors in the local H&C chain (policy makers, energy suppliers, technology experts, urban-planners, industry, intermediaries, end users, and consumers), their interactions and needs on the main goals and pillars, to optimize efforts and resources. The integration of the different components and actors of the local H&C system and the building of synergies among them are required and H&C community initiatives must be planned locally.

Launch a **tailor-made engagement plan** targeting key local stakeholders from the local H&C chain (single private users, commercial and industrial consumers, social housing, PAs, waste heat providers, district heating utilities, etc.) with the aim of informing, strengthening know-how and building capacity, enhancing awareness, obtaining acceptance and finally committing in the H&C community energy project development and launch.

3.3.1. Step 1: Promote capacity-building

Promote a **capacity building program** to transfer balanced and objective information necessary to understand all aspects of the H&C energy community process, both technical and non-technical, possible problems/issues, and benefits as well.
A peer-to-peer coaching approach is to be followed to empower local stakeholders and key actors to concretely support community energy project set up, promoting the management and technical feasibility, along with the environmental and socio-economic sustainability. The training sessions have to cover key factors enabling community energy development such as, for example:

- Technological framework (including energy survey and modelling methodologies, state of the art of EE and RES measures and technologies)
- Legal/organizational framework (governance and partnership design, agreements and contracts models and templates)
- Cost/benefit analysis (environmental and socio-economic impacts and benefits such as energy consumption and CO2 emissions reduction, air quality improvement, job creation, lower energy costs, energy poverty counteracting, etc.)
- Financial tools and business models
- Non-financial cost–benefit analysis
- Analysis of real examples (barriers, enablers, lessons learned)

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Tip from ConnectHeat – Knowledge transfer & Capacity Building

A **toolbox of training materials** for public authorities and stakeholders involved in H&C communities is freely accessible on the **ConnectHeat**'s webpage.
It compiles insights from a series of events and webinars held throughout the project at EU, transnational and local level, where various aspects of community-led initiatives in the H&C sector were explored.
These events fostered valuable experience exchange and knowledge sharing, promoting the dissemination of best practices. The series concluded with an on-site visit to Breitenholz, Germany, offering participants an in-depth look at a functioning REC, its challenges, and its successes and with 3 online events focused on regional perspectives, covering Southern Europe, the Balkans, and Central and Eastern Europe.

You can access all the training materials and the event recordings here: https://connectheat.ambienteitalia.it/training-toolbox/

3.3.2. Step 2: the engagement campaign

Launch a **tailor-made engagement campaign** with the aim of mobilizing local stakeholders and key actors, enhancing awareness, and obtaining social acceptance. The campaign must integrate many activities such as communication, information, consultation and participation seeking, promote discussion, scout and identify needs, perspectives, ideas, concerns and integrate them in a common and comprehensive community vision, rationale and concept. Key guiding principles (inform, consult, involve, and empower) must underpin the engagement process, aiming to secure social acceptance. You can refer to the approach and steps proposed below, revising, integrating, or adapting them according to the local context and conditions.

Identification of specific target groups - Identify specific target groups among the mapped stakeholders. List the specific target groups and shortly explain why you focused on them. Provide a short description of the importance of the stakeholders and prioritize them into groups like: "High Power, High Interest," "Low Power, High Interest," "High Power, Low Interest," and "Low Power, Low Interest".

Information dissemination and awareness raising - Develop and distribute informational materials (brochures, pamphlets, and online resources) to obtain social acceptance and support from stakeholders. Adapt the communication material to each target group to ensure that the information they are collecting from you are relevat for their specific group.

Consultation and feedback collection - Organize consultation meetings and workshops to gather inputs from stakeholders. Facilitate discussions and collaborative problem-solving sessions. Create an online portal, FAQs session, or set up a helpdesk, for stakeholders to provide feedback, needs, perspectives, concerns and ask questions.

Local communication campaigns - Develop specific communication campaigns to mobilize local communities. Launch local communication campaigns at the start of the engagement process and continue throughout it. Use various channels like social media, local newspapers, and community events. Regularly assess the impact of these campaigns and adjust strategies as necessary, listing the criterias and set frequency of assessment

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Picture of citizens and local authorities engaging in their project, from the Intercommunale Leiedal pilot case, Belgium.

3.4 The H&C community project – the planning

In this step, the developer should identify and formally group the committed actors as founder members of the H&C community and assess its technical feasibility, economic viability, and overall sustainability based on the shared initial concept.

3.4.1. Step 1: The H&C community board

Evaluate the results of the engagement campaign and incorporate them into a shared, comprehensive vision, rationale, and concept for the H&C community. Identify the actors willing to commit to its concrete development and organize a workshop to engage them. The workshop can include interactive activities such as problem tree design, collaborative goal tree development, cause-effect or fishbone analysis, brainstorming sessions, mind mapping, and similar exercises. Form the H&C Board with key actors, formalized through a commitment document outlining roles, responsibilities, and benefits. The Board will drive the planning, scheduling, and launch of the community project.

Tip from ConnectHeat - Consumers and end users at the heart of the project

Consumers and end users are playing an increasingly active role in advancing RES and EE deployment in the H&C sector. They are directly affected by the energy system and the way H&C are produced, transported and used and may be sensitive to other factors such as local air quality, the reliability of energy access and the energy costs. In order to achieve the goals of a low-carbon H&C system, consumer participation and support may be critical. They can actively shape the local energy infrastructure by, for example, choosing RES tariffs, switching to green suppliers, investing directly in RES or EE measures or becoming prosumers by installing their own systems. Consumers' opposition to fossil fuel projects can be a driver for RES and EE measures,

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while opposition or indifference towards RES and EE can be a barrier. It is thus essential that consumers and end users are placed at the center of any engagement campaign and H&C community project or initiative development, and that their interaction and cooperation with energy providers and other key stakeholders is ensured.

Tip from ConnectHeat – The key role of Local Authorities

With their political mandate and proximity to citizens and territories, Local and Regional Public Authorities are well-positioned to foster and increase the use of RES and EE measures in the H&C sector. Thanks to their cross-sectoral responsibilities (decision makers and target setters, urban planners and regulators, service providers, building stock and public facilities owners and managers), they can indeed duly foster the integrated approaches needed to decarbonise H&C in all sectors, enhance the acceptance of RES and EE measures, and concretely boost the commitment and involvement of local communities. These authorities can thus show leadership and acquire a central role in promoting, developing, and launching any H&C community project or initiative.

Municipalities that take a leading role may also use their SECAPS, in addition to other strategic energy plans. They may specifically incorporate RECs as a strategic element in the decarbonisation process, as well as the necessary mechanisms to facilitate their integration. This involves everything from the transfer of land or infrastructure to the adaptation of local regulations to enable and streamline the deployment of H&C networks and solutions.

Tip from ConnectHeat – The promoters

The ConnectHeat pilot project in **Stuttgart** underlined that, even after an improvement of a building's standards and technologies, tenant's habits could lead to an energy consumption 30% higher than expected. This is due to habits such as thermostat settings and heating usage. Hence, it is key to engage with consumers to encourage them to use less heat and hot water by making their consumption visible, offering financial and non-financial incentives, and providing information on energy-saving habits.

Another pilot led **in Zagreb** collaborated directly with the students from a University where the H&C community has been developed. Students revealed themselves highly interested in participating in this initiative. Strong student interest led to a participatory model involving both students and staff, not just as consumers, but as investors and decision-makers. Supported by institutional infrastructure, the initiative promotes collective financing and local ownership. This approach highlights the potential of academic communities in driving energy transitions.

In the **Gemona del Friuli** pilot, public authorities play a leading role by initiating, funding, and managing the development of the district heating network. They own the main connected buildings, provide all capital investment through local, regional, and EU funds, and ensure that the project serves community needs rather than generating profit. In this case, public entities are the sole users of the heat in the initial phase, with pricing set to cover operational costs rather than to create revenue.

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3.4.2. Step 2: Technical feasibility

Select, model and dimension the technical solutions, starting from the H&C demand and supply in the pilot areas, integrating different possible survey methodologies depending on the specific situations (energy audits, bills analysis, questionnaires, etc.).

- Demand side analysis: Type and number of users, heating (and cooling, if applicable) consumptions and needs.
- Supply side analysis: Type of energy supply (heating only, heating & cooling, other), energy sources and technologies, amounts of energy produced, shares, etc. If a district heating network is included, also consider the network characteristics, the supply and return temperatures in winter and summer, etc.

3.4.3. Step 3: Cost/benefit analysis

Assess the economic viability of the selected technical solutions, considering:

- Both CAPEX and OPEX costs for the project, with a breakdown of the different items (e.g. different parts of the heating plants, DHC network, substations, planning, installation, O&M costs, etc.)
- Revenues - Analysis of the heat price to be applied to the users and of the cash flow, associated risks, other revenues, etc.
- Available funding sources (public, private, incentive schemes, etc.) and shares with respect to the total investment costs
- Key economic and financial parameters - Simple payback time, net present value, internal rate of return, etc.

Evaluate the overall sustainability of the project considering the expected **environmental and socio-economic impacts and benefits** at the local level (energy saving, CO2 emissions reduction, energy costs reduction, air quality improvement, job creation, energy poverty counteracting, etc.).

3.5 The H&C community project – the business plan

In this phase, the developer should analyse possible business models and select the most suitable one applicable to the specific situation outlined through the engagement process and the energy modelling.

3.5.1. Step 1: The business and financial model

Identify the organizational structures and investigate the most suitable financial schemes capable of attracting private investment by end users, local businesses, civil society groups or other stakeholders, fostering greater public engagement and ownership. Crowdfunding, cooperatives, foundations and community-based companies (hybrid forms of collective ownership with the participation of various types of entities) can have a major role in adding new sources of capital from widespread investors.

Focus on the opportunities for participation of H&C prosumers or consumers, as well as on the roles they could play, proposing possible solutions and verifying their consistency with the H&C market situation, the current H&C regulatory framework and its possible evolution, as well as the existing and planned incentive system.

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Tip from ConnectHeat – Models for a community-led approach

In the **Warmtenet De Voerman (Anzegem, Belgium)** pilot project the community approach lies in the establishment of a Thermal Energy Community governed through a co-ownership association composed of all connected residents and businesses. This structure ensures transparent decision-making, proportional cost-sharing, and democratic control of the infrastructure. End users are automatically enrolled upon purchasing a plot and gain access to a digital platform to monitor usage, manage billing, and receive performance insights. The project is spearheaded by Intercommunale Leiedal, the regional development agency, in close partnership with engineering consultants (De Watergroep). Leiedal is responsible for the phased development and coordination, while De Watergroep operates the thermal source infrastructure. Private owners invest in individual systems, promoting a cost-effective and decentralized rollout.

For the **Gemona del Friuli (Italy)** pilot project, while the definitive organizational and management structure for a fully-fledged community energy project is not yet finalized, the strategic intent is to lay the groundwork for a cooperative model. This model aims to foster broader community participation:
- Local Forestry Companies as Biomass Producers
- DHN Operator as Management/Operational (The cooperative itself could potentially take on the technical operation and management of the DHN, or it could contract a specialized third-party operator)
- Municipality and Mountain Community as initial promoters and owners of key infrastructure/land, ensuring public interest alignment, facilitating administrative processes.
- Owners/Managers of Connected Buildings, initially public entities, and later private building owners, would be the heat consumers and natural members of the cooperative, participating in its governance. Private Citizens, in a second phase, could become members, not only as consumers but potentially as investors in through collective financing schemes, or as active participants in the cooperative's governance.

Playa del Inglés (Canary Islands) community energy pilot project will adopt the legal form of a non-profit consumer and user cooperative. The purpose of the Energy Community will be the supply of renewable heat, cold, and electricity, for the use and consumption of the partners and of those who live with them. The community will have a democratic governance based on the principle of "one partner, one vote", which ensures autonomy in internal decision-making. 3 types of partners will be established:
- **Consumers** – Members using the heat network at a fair, stable monthly price.
- **Prosumers** – Members who both consume and generate energy.
- **Supporters** – Non-consumers contributing capital, facilities, or expertise.

The pilot project being implemented in the **city of Plovdiv (Bulgaria)** aims at establishing a Renewable Heating and Cooling Energy Community, where the residents of 6 passive houses – 4 houses x 135m2 and 2 houses x163m2 - will collectively generate, store, share renewable energy for heating, cooling, and domestic hot water and actively participate in energy management, decision-making, and operational oversight. Residents will benefit from lower energy costs, reduced maintenance expenses, and collective financial resilience through shared infrastructure. The energy community will operate in the form of a civil community of natural and legal persons (consortium) under the Obligations and Contracts Act (OCA). This form is widely used due to the following advantages:

The pilot project in **Stuttgart (Germany)** focuses on improving energy efficiency in affordable housing managed by the Stuttgarter Wohnungs- und Städtebaugesellschaft (SWSG) and involves tenants, landlords, and public institutions, working together to create lasting change. Financial incentives, such as vouchers or non-monetary rewards, were introduced to encourage energy savings among all tenants, including those receiving aid. The cooperative model is designed to reinvest the savings within the community and will be built around two key components:

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- The Building Community deciding how to allocate the savings, with options to reinvest them in further energy initiatives or support broader neighborhood energy and climate initiatives.
- The Energy Efficiency Network implementing energy-saving measures, fostering knowledge exchange among participants and managing the reinvestment and redistribution of savings.

In **Zagreb (Croatia)**, the pilot adopts a faculty-led model: the Faculties of Mining, Geology, and Petroleum Engineering and of Food Technology and Biotechnology will fully develop, operate, and manage the geothermal system. They will own the infrastructure, share the energy, and carry both operational and financial responsibility. An internal agreement will ensure fair distribution, while staff and students can join as investors, strengthening both financing and decision-making. The model drives self-sufficiency, local ownership, and empowerment within the university.

To know more about the governance structure and business models selected of the ConnectHeat pilots have a look here: https://connectheat.ambienteitalia.it/d4-2-implementation-of-pilot-cases/

Tip from ConnectHeat – Which funding mechanisms and financial resources?

The way H&C communities fund themselves is obviously a key aspect to consider when starting. The red thread is certainly that each H&C community has to look for funding opportunities in a vertical manner (from the EU to the local level) and horizontally (from corporate investment to crowdfunding campaign).
The following list summarizes some of the main funding sources and is not a ranking. Depending on the context, some of the elements presented last in this list may be a key enabler for your project:

European funding sources: H&C communities actively seek funding from various EU sources, including the European Structural and Investment Funds (ESIF), the Recovery and Resilience Facility (RRF), the Next Generation EU initiative, and the European Regional Development Fund (ERDF), all of which support sustainable energy infrastructure and decarbonisation.
National support instruments: At the national level, funding is available through programs specifically designed to support decarbonisation, energy efficiency, DHC and collective approaches in the energy sector. Some national support may directly target energy communities. Depending on the country, support may include mechanisms like carbon credits and green certificates.
Bank loans and green financing: Banks with a focus on ecological and developmental goals provide low-interest, long-term green loans to support energy projects. In some cases, contractors offer turnkey energy solutions with deferred payments covered by future energy savings.
Crowdfunding and private investment: Crowdfunding and crowdinvesting are emerging as alternative financing models, while corporate and private investors are increasingly interested in supporting community-based renewable energy projects.
Member contributions and cooperative funding: Revenue from energy community members, including mandatory membership fees in case of projects based on the cooperative model, forms part of the funding base, especially during early-stage development.
Public funds: Municipalities may also participate directly in financing, and in some cases, they play a leading role in both the investment and management of the H&C community.

3.5.2. Step 2: The management structure

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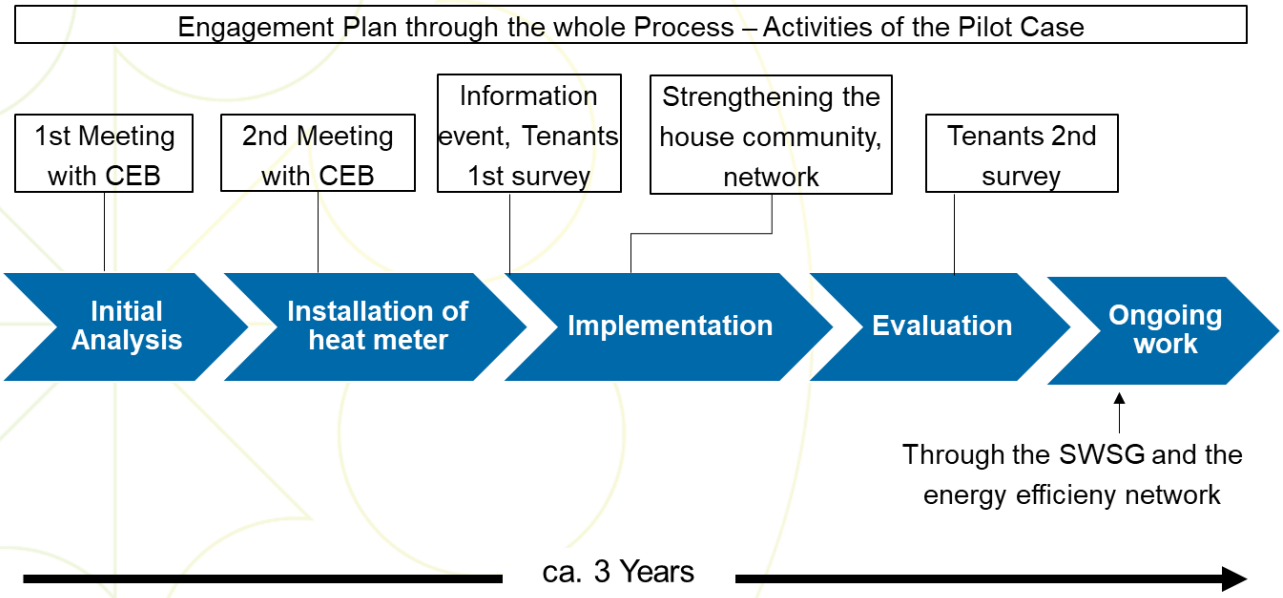
Define the management structure and procedures, i.e. the set of rules that will govern the overall management of the community:

- Administrative management (membership requirements, economic conditions for entry and participation, and for any new members/withdrawals, etc.)
- Financial management (specific focus on the rules for the distribution of incomes)
- Technical and energy management for the operation/maintenance of the plants and the equipment, including the definition of systems for monitoring and optimizing energy flows (withdrawals by member users and production by RES plants, adjustment of RES energy supply and demand, installation of storage systems).

3.5.3. Step 3: The roadmap

Set up the project roadmap identifying the key steps and phases for the project implementation and the launch of planned investments.Develop a communication campaign to promote the project, stimulate the inclusion of new members and/or new RES plants and also trigger new initiatives.

Figure 5: Project roadmap from the pilot case in Stuttgart



Reading support: CEB stands for Community Energy Board and SWSG stands for Stuttgart Housing and Urban Development Company (Stuttgarter Wohnungs- und Städtebaugesellschaft)

3.5.4. Step 4: The risk assessment

The roadmap should also highlight any critical risks that could impact project implementation—such as legislative changes, regulatory issues, elections, financing or demand risks, approval delays, or lack of necessary expertise, and propose strategies to address them.

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Tip from ConnectHeat – How to address the challenges?

Regulatory challenge

The development of H&C communities can encounter significant regulatory obstacles. Frequent changes in national or regional energy regulations, such as shifts in incentive schemes for renewable energy sources, can undermine project viability. Uncertainties also arise from evolving energy policies or changes in public administrations, which may delay the approval of necessary licenses or concessions.

In Italy, for example, the regulatory framework for thermal RECs remains less mature than for electricity-focused ones. This gap in legislation and support mechanisms adds further risk to project development. Additionally, there is a potential regulatory pitfall: energy communities that manage heating infrastructure might unintentionally fall under the classification of "heat suppliers," which would subject them to additional obligations such as offering social tariffs. To navigate this evolving landscape, it is essential to formalize and regularly review all legal arrangements, including easements and rights-of-use. Maintaining close collaboration with legal counsel and energy policy experts is key to staying compliant and resilient in the face of regulatory change.

Administrative challenge

Administrative hurdles include delays in obtaining property rights and necessary permits related to land use or building construction. Projects involving geothermal energy often experience additional setbacks due to the complex permitting processes required for drilling, construction, and environmental compliance. Moreover, securing access to public rooftops or obtaining concessions to carry out works on public roads can further slowdown progress. To mitigate these challenges, it is crucial to engage early with local regulatory authorities and ensure that all required documentation is submitted in a timely and complete manner. Collaborating with experienced consultants who know local regulations can significantly reduce the risk of compliance errors and bureaucratic delays. Additionally, project developers should prepare contingency plans that account for possible administrative setbacks, allowing for flexible and realistic implementation timelines.

Financial challenge

Financial viability is a critical aspect of establishing H&C communities. In the emergence stage, policy support and access to subsidies can play a vital role in helping projects get off the ground. Without these initial supports, many promising initiatives may struggle to become operational.

To strengthen the financial foundation of a project, developers should aim to diversify their funding sources by combining public grants, subsidies, and private investment. Building a compelling business case that highlights not only the economic potential but also the environmental and social benefits of the project can significantly improve its attractiveness to investors and funding bodies.

Citizen's engagement

Long-term citizen engagement is essential to the success of RECs in general, and particularly when H&C technologies are involved. These technologies often require behavioural changes among users, which are crucial to unlocking their full potential in terms of energy savings and emission reductions. However, many projects initially face limited public involvement, making it necessary to invest in building trust and fostering active participation over time.

To ensure smooth operation and long-term viability, it is also critical to secure agreements with all key stakeholders, including entities like end users, and network managers. Establishing a shared understanding among all actors strengthens both governance and user commitment.

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Effective solutions include providing clear onboarding procedures for new members, coordinating early with legal and notarial experts to establish co-ownership structures, and maintaining consistent communication and transparent reporting. Additionally, offering a user-friendly digital platform that encourages interaction can greatly enhance citizens' sense of ownership and ongoing engagement.

Market fluctuations

H&C communities are increasingly exposed to market uncertainties. The prices of technologies and raw materials are subject to volatility, driven by factors such as inflation and the broader geopolitical context. These fluctuations can significantly impact the financial planning and implementation of projects, as they may affect the stability of revenues and challenge the economic sustainability of energy communities.
To manage these risks, project developers need to integrate flexible financial models, monitor market trends closely, and consider long-term contracts or hedging strategies where possible.

4. Conclusion

Though a quite wide concept for energy communities was introduced by the Renewable Energy Directive, its transposition and implementation in Member States has been partial. Moreover, H&C supply is poorly introduced in these initiatives, which focus primarily on electricity-related projects. The original idea and spirit of RECs, on the contrary, should lead to really integrated solutions, able to properly use all the territorial resources. RECs are well designed to provide the community members with all their energy needs, thus not only electricity but also H&C and other services, such as energy efficiency measures, water supply, etc. H&C supply in energy communities, therefore, is an ally in supporting the energy transition, involving local communities and stakeholders, and ConnectHeat is a pioneer project in this field.

Three years after the ConnectHeat project started, there is a growth in interest from Local and Regional Public Authorities, national and EU policy-makers about H&C energy communities. This interest is driven by the democratic and sustainable impacts they have in the territories where they have been implemented. The 6 pilot sites provided valuable information regarding the planning, implementation, and functioning of these communities, and other follow-up cases benefited from these lessons, increasing and prolonging the project's impact, further supporting the decarbonization of the H&C sector in Europe. At last, we want to conclude by underlining that unlocking the potential of H&C in energy communities will require further regulatory reform, tailored financing tools, further successful demonstration projects, and dedicated capacity-building.

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