ConnectHeat
Community engagement for clean heat

THERMAL ENERGY COMMUNITIES:

A NEW CONCEPT, A NEW OPPORTUNITY

Introduction

Luigi Torreggiani – Sherwood magazine

A concept composed of four words indicates an intrinsic complexity. ***Thermal Renewable Energy Communities***: four words, those that form the subject of this Dossier, each with a notable weight. **Communities** are the center of our civil life; **energy** is the basis of all our activities; **renewable** energy is the imperative of the ecological transition necessary to address the climate crisis; **thermal** energy although less talked about is used to heat us and is also a type of energy that today generates numerous climate-altering emissions from fossil fuels: for this reason, its replacement with renewable sources fully enters into the objectives of decarbonization.

While the topic of electric Renewable Energy Communities (REC) is well-known and has been much debated for several years (also following specific regulations at both European and national levels), **thermal RECs represent a relatively new concept**.

This is a decidedly interesting opportunity for the inland areas of the EU territory, particularly the mountainous ones, where increaseddemand for heat corresponds to an equally large availability of forest areas and increasing rate of abandonmentin the Italian case. The socioeconomic opportunities of the wood-energy supply chain, both for the actors and for the final beneficiaries of the heat, have been known for some time, as are now many good practices found in these territories. The concept of thermal REC applied to this production area has not yet been properly explored. One project doing so is **a LIFE project called ConnectHeat (Community engagement for clean heat)**, which has worked in recent years with the aim of improving and strengthening the capacity of local governments to activate innovative community initiatives in the field of energy, particularly thermal energy.

Seven different European countries were involved: Belgium, Bulgaria, Croatia, Germany, Portugal, Spain and Italy.

In Italy, the **Energy Agency of Friuli Venezia Giulia** (APE FVG), a partner in the project, has focused on the study of thermal RECs linked to local wood supply chains in areas with a strong forestry vocation. From the reflections that arose, also following two webinars that **Compagnia delle Foreste and Sherwood** co-organized together with APE FVG (available on Youtube on APE FVG channel), it was clear that the presence of a thermal community could, for example, encourage associationism between forest owners, also with a view to a desirable collaboration between the public and private sectors. As regards the installation and management of the plant, it could also push some forestry companies that are particularly inclined towards innovation to grow, proposing not only the supply of wood chips, but also the sale of heat within the Community itself. On the consumption side, instead, it would make citizens aware of the value of a renewable and local resource, while also generating economic savings, social returns and benefits related to territorial maintenance. All this, if developed based on planning and certifications (therefore involving forestry technicians), could be carried out efficiently and in full sustainability.

For all these reasons we have seized the opportunity offered Italiy's participation in ConnectHeat - not only on behalf of APE FVG, but also thanks to the the consulting company **Ambiente Italia**, the beneficiary coordinator of the project - to bring this theme to the pages of the Sherwood magazine. It is a broad, dense and very complex topic, which would deserve much more space than what is available in this Dossier. We hope, however, that this Dossier can represent a first

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step, the beginning of a reflection on a new tool, still to be defined at a regulatory level (today in Italy only electric RECs are regulated), which can soon be transferred from theory to practice into the territories, along the path of the energy transition.

Uniting supply chains: from the forest to the thermal renewable energy community

Matteo De Piccoli and Manuela Ortis – APE FVG

The Life ConnectHeat project aims to develop Renewable Energy Communities (RECs) for heating and cooling in Europe. One of the Italian partners of the project, APE FVG - Energy Agency of Friuli Venezia Giulia - is engaged in the study and promotion of thermal RECs linked to local wood biomass: an interesting opportunity for the rural and mountainous territories of Italy that is presented in this first contribution to the Dossier.

Ensuring responsible forest management, creating job opportunities in mountain areas and meeting thermal needs in a sustainable and advantageous way: with these objectives, in 2022, ten organisations belonging to the energy field and distributed throughout Europe joined forces to work within a LIFE project called ConnectHeat - connectheat.ambienteitalia.it, the first European initiative for the development of heating and cooling energy communities.

Lately, there has been a lot of discussion about Renewable Energy Communities (RECs), but what are they? We are used to hearing about electric RECs: systems in which energy is shared in a "virtual" way, using the existing electricity grid for residents, municipal buildings or commercial/industrial activities within the same primary cabin. The goal is not economic enrichment, but the reduction of climate-altering emissions and the increase in energy autonomy and security thanks to renewables. In practice, self-produce what you consume, without resorting to resources from foreign countries that are often geopolitically unstable.

In 2023, in Friuli Venezia Giulia, 80% of energy consumption was met by fossil fuels and at the Italian level, 90% of the almost 62 billion m^3 of methane gas consumed comes from countries such as Algeria, Azerbaijan, Qatar, Libya and Russia. Unfortunately, the government's implementing decrees on RECs, long awaited, have placed more limitations than expected both for the establishment and management of electric communities, making the system very complex and difficult to implement: in March 2025, in Italy there were 212 active energy communities compared to over 2,000 in Germany.

RECs: not only electricity

Are RECs only limited to electricity? Not necessarily: we can also think of **a community that shares thermal energy generated by renewable sources that come directly from the territory where the energy itself is consumed**. It is precisely on this theme that the Energy Agency of Friuli Venezia Giulia (APE FVG) is working within LIFE ConnectHeat and beyond: we believe that the tools necessary for the development of thermal communities are abundantly mature and can provide an important contribution to the energy transition.

In particular, **the least polluting and most efficient solution for the production and distribution of thermal energy is district heating**, a mature technology, especially widespread in Northern Europe. This involves the production of centralized thermal energy (with the possibility of using waste heat, coming from industrial processes or similar) and distribution to users via insulated pipes, alongside a simple heat exchanger as an interface. The advantages include efficient use of primary energy, the reduction of pollutants and the lower cost of kWh compared to individual production.

Despite this, the diffusion of district heating in Italy remains marginal, standing at 3% of total thermal demand, compared to 14% in Germany, for example. We know that the energy transition is a long and complex process, but also a necessary one. To address this complexity we must understand the territory and the opportunities it can offer, finding tailor-made solutions and combining current knowledge with past expertise. Friuli Venezia Giulia is a predominantly mountainous region (43% of the

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total surface area) which has low population densities in the mountainous areas, reaching 10 inhabitants/km^2 compared to the Italian average of 200: a characteristic shared with many other inland areas.

Historically, wood is a resource of primary importance: this is demonstrated by the importance of the “fogolârs”, from focus larium, or “ancestral fire”, a characteristic element of Friulian culture and the heart of the home. It is an open fireplace that occupied the center of the room, where the family gathered to warm up, tell stories, discuss and cook.

Since the 1960s, the forest area in Friuli Venezia Giulia has increased on average by about 31 km^2 per year, going from a forest cover of 21% to 45% of the total. Most of this area, however, is private (60%) and unmanaged. It can therefore be deduced that this increase does not derive from virtuous practices, but rather from a progressive disinterest in private land: while public forests are managed for more than 70% of their extent, private ones are around 15%. Territories such as the mountainous area of Friuli Venezia Giulia Region, characterised by a high thermal demand despite the low population density (also an indicator of good dispersion rather than concentration of pollutants) and by the availability of local wood resources, can prove to be perfect environments for the use of biomass district heating.

The role of certification

Despite the above, in order to be sustainable it is not enough to use renewable energy. Often, in fact, the thermal generators used by families are obsolete, inefficient and polluting. As regards district heating networks, despite numerous good practices recorded in Lombardy, Piedmont and Trentino-Alto Adige, many plants still have several problems such as**the supply of raw materials that come from long distances and without a certification, the oversizing of the thermal power plant or distribution system and poor management of the plants**. This translates into higher costs and, at the same time, into a lower environmental sustainability. The problem is often upstream: planning should be carried out correctly and scrupulously already in the preliminary phase, while instead it is often neglected or underestimated. The same applies to assessing whether the heat demand is truly satisfiable, which must be assessed first of all on the availability of combustible biomass downstream of a cascadng use, and not vice versa. It is in this context that the fundamental piece to guarantee sustainability comes into play: certification, or rather, certifications. Mechanisms of this type are already available and can in fact cover all phases, from the forest to the house:

- **PEFC or FSC®** certifications guarantee responsible management of forestry assets, based on transparent and internationally discussed Sustainable Forest Management (SFM) criteria and indicators;
- once the potential in terms of retractable mass has been verified, the **Chain of Custody (CoC)** mechanism comes into play, always linked to sustainable forest management certifications: this way it is possible to trace the material in its various passages between one processing step and another and to guarantee that the finished product comes from well-managed forests;
- as regards processing waste and material that cannot be used for more noble purposes, the **BiomassPlus** certification comes into play, managed by AIEL – Italian Agroforestry Energy Association, which ensures the quality of the fuel by guaranteeing that the parameters necessary for good combustion are within the value ranges pre-established by a specific “class” of the fuel (calorific value, humidity, residual ash, size, etc.);
- the last step is heat transport. Biomass district heating systems can benefit from the **QM Holzheizwerke** certification mechanism (it will be explored in depth in this Dossier in the next articles) for which APE FVG is the reference in Italy. This quality standard for wood biomass district heating systems guarantees the environmental and economic sustainability of the “production plant - distribution plant” pair. Developed in Switzerland, Germany and Austria, the standard covers all phases of design,

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construction and management of the entire process, ensuring energy efficiency, low emissions, operational reliability and economic fuel logistics.

Thermal communities: an opportunity

Densely wooded areas, thermal demand, certifications: these are the basic “ingredients” to prepare “a good meal”: what is missing is the “right recipe”. This is where the concept of thermal energy communities comes into play. According to the European RED II directive (followed now by RED III), the aimes of RECs are the improvement of energy efficiency, the reduction of carbon emissions, the use of local and renewable resources, the increase of energy independence: all characteristics intrinsically guaranteed when the entire local wood-energy supply chain is covered by the appropriate certification systems.

Unlike electric RECs in which energy production and consumption occur directly and where the members are often at the same both producers and consumers (prosumers), in thermal communities things are a little different. In this situation **the Community can be formed both on the side of wood biomass production and on the side of consumption**; nothing prevents the two Communities from being separate, but it is necessary for them to communicate with each other.

On the consumption side, the pipe transporting hot water is the physical connection between production and users: this setup can automatically trigger the creation of a Community, which will then define price mechanisms and management of the thermal power plant on its own or through third parties. For the fuel supply, on the other hand, a forest area of appropriate size will be necessary, capable of supplying the demand and ensuring a “cascade” approach. To manage it, a Management Plan and one or more forestry companies will be needed.

In a context of land fragmentation this could work through a cooperative approach, implementing various forms of forestry associations, for example consortia, land associations, forest agreements, etc.

The potential would be enormous: the short and local supply chain would guarantee the stability of the fuel price, in the face of variations found in the price of gas or imported biomass; with adequate contracts there would be the opportunity to provide long-term work to local operators in the wood supply chain; through QM certification, which guarantees the economic sustainability of the plant, the efficiency of production and distribution would be maximized and costs further reduced.

Regardless of incentives and financing, the structure thus conceived would be self-sufficient: the economic-financial sustainability and the resulting cash flows, divided year by year for the duration of the plant (typically 20-30 years), can in fact be already estimated using all the ingredients listed above and available. This would make it possible, for example, to distribute the earnings to the owners who grant their portion of the forest, thus making it convenient to share the property and putting the REC on the production side in communication with the REC on the consumption side. The advantages would resonate throughout the territory: greater job opportunities, fight against depopulation, energy independence. It is calculated that for 1€ of turnover from the biomass district heating plant, 2.65€ are obtained in the territory, and that for every worker employed in the plant, 15 are created along the supply chain. In particular, the creation of a community would be very useful in the case of fragmented ownership: on the production side, in fact, it would stimulate good practices of associationism.

A virtuous example is that of **Stregna**, a small municipality in Eastern Friuli, which like many other mountain villages was afflicted by fragmentation of private property, depopulation and abandonment of the territory. The community of Stregna therefore decided to set up a **Land Association for the recovery of uncultivated land**, in their case giving value to the natural biotope of permanent meadows. Despite the difficulties encountered, including bureaucratic ones relating to the analysis of cadastral data and those relating to the identification of forestry operators, the model is a winning one: today there are 86 members who have shared 555 cadastral parcels, for a total of almost 145 hectares managed not only in the

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municipality of Stregna but also in those nearby of Drenchia, Torreano and San Leonardo - a small example to follow.

Thermal Renewable Energy Communities: operational tools and local strategies

Matteo De Piccoli – APE FVG

This second contribution delves into the specifics of how the Renewable Energy Community (REC) concept can be applied to heat production using local forest resources, suggesting some practical tools made available by the Life ConnectHeat project and beyond.

RECs are a tool introduced to address the issue of decarbonization. Although attention has focused primarily on the role of electric RECs, the thermal sector is far from lagging behind in terms of climate-altering emissions. Returning to the themes of the previous article, let's begin by considering the availability of renewable resources: **it is clear that in Italy, mountainous areas have the greatest biomass availability on the one hand and the greatest thermal demand on the other**. These are optimal characteristics for the implementation of short-chain district heating systems based on woody biofuels.

Development strategies, however, must always leverage the opportunities provided by local characteristics, especially with regard to production from renewable sources. Therefore, it is essential to utilize part of the region's forest resources without compromising their stability, their various socioeconomic functions, and, last but not least, without impacting biodiversity. Regarding the development of thermal RECs, the fundamental and interconnected concepts to understand are biomass district heating and the short supply chain, with the possible integration of solar thermal systems. This framework allows for the creation of multiple communities within a single local area: a production REC, a consumption REC, and possibly even a management REC.

Thermal community of production

The first step is to identify the forest areas within the territory in question: these will be distributed as public or private property. While public ownership is more immediate and direct, being the responsibility of a single entity, the same cannot be said for private ownership. The Italian forestry sector, as is well known, currently faces numerous challenges, including:

- land abandonment and fragmentation (and a lack of knowledge about associative tools);
- the vulnerability of unmanaged silvo-pastoral systems to the climate crisis;
- the lack of economic sustainability of forestry operations in non-productive areas (and the limited ability to market ecosystem services).

Herein lies the great opportunity of thermal production communities: **the ability to bring together different parcels and process them cooperatively, allowing for planning and certifying larger portions of forest in a single operation, minimizing costs, maximizing benefits, and respecting the unique characteristics of the area**. The main tools for identifying the most appropriate form of forestry association for each local situation have been explored in depth by another project, ***LIFE Climate Positive***, which developed a toolkit (www.lifeclimatepositive.it/toolkit) that, through a guided process, allows for the evaluation and implementation of the most appropriate form of forestry association among the various existing in the complex Italian landscape.

Only after mapping out the planning and certification process will it be possible to allocate the forest area to the most appropriate management, and then develop realistic estimates of the raw material that can actually be recovered and exploited in terms of heat production. This will require liaising with local stakeholders in the supply chain to assess the volumes of waste resulting from wood processing using a “cascade” approach.

For this reason, it would be important for the various intermediary operators to also obtain a Chain of Custody certification, part of the Sustainable Forest Management certification systems. Associations, planning, and certification: through these actions, **the production community would be able to enter into a**

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multi-year supply contract for the plant connected to the district heating network, guaranteeing employment for decades, enhancing local economies and expertise, and ensuring sustainable management, also from an environmental perspective.

Thermal community of consumption

Along with the production side, it will be crucial to conduct the necessary assessments regarding the consumption side. Here, the most suitable tool for the study, design, and operation of a biomass district heating system is the adoption of the QM certification system, which will be explored in greater depth in the next article. At this stage, it is important to examine all the parameters that ensure the system's economic and environmental sustainability. During a preliminary study, for example, it will be necessary to ask whether the thermal demand density is sufficient to ensure economic sustainability. If the answer is yes, the assessment and search for available users can proceed. This is a very delicate phase, and it would be important for institutions to directly engage in disseminating accurate information on the topic, debunking common misconceptions and raising awareness of the pros and cons of various technologies.

Let's remember an important detail: modifying a domestic system involves installing a heat exchanger, typically 15-30 kW, depending on whether it is used for heating or domestic hot water production. The heat exchanger is very small (typically no larger than 120x50x50 cm). Initially, it's a good idea to produce written documents certifying the parties' interest, while waiting a more specific supply contract. Once the parties and the system characteristics that allow for a price for the distributed heat have been identified, the actual creation of the community can be achieved. It is therefore necessary to identify and define the most suitable system, which usually involves a cooperative approach – the previously mentioned toolkit can also be useful in this case.

At the same time, it will be possible to produce **an initial rough estimate of heat demand and compare it with the available raw material from the production REC**. It is important that the availability of wood fuel from a local supply chain is sufficient to meet heat demand: otherwise, the plant would be oversized for the area, and alternative local energy supply solutions (e.g., integration with solar thermal) would need to be sought, or the project would need to be scaled down.

Only one community?

In Italy, the legal framework for thermal RECs is still essentially non-existent and unformalized; on the one hand, there are no specific guidelines or suggestions, but on the other, one can operate as one sees fit, maximizing the possibilities.

Once the two Communities are established, it is important to engage in dialogue between them: it is very likely that some members of the two Communities will not be the same. Those who own woodland may live in an area unsuitable for centralized heating, just as those who use district heating may not own forest land. Potentially, therefore, "producers," "consumers," and "prosumers" are identified, i.e., entities participating in both communities.

Regarding the management of the district heating system and the thermal power plant, this can be managed by the REC itself or by a qualified technician/professional. This assessment will certainly depend on the size of the system. For systems larger than 500 kW, the workload would be difficult to absorb through unpaid work, given the complexity of the task, so identifying a technician is recommended.

In short, depending on the various territorial contexts, two thermal communites in constant communication with each other (production side and consumption side) could be established, or otherwise a single, more structured one.

Technical and economical feasibility

This is the most important and delicate phase of the entire process, requiring dialogue between the various stakeholders. The output of this phase will allow us to understand the true economic sustainability of the project. On the one hand, there will be revenue from heat consumption, and on the other, expenditures for all the various stakeholders

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external to the community (forestry operators, wood companies, heating engineers, etc.).

Thanks to the technical-economic analysis, it will be possible **to analyze cash flows year by year, assessing the payback period compared to the initial investment, net of annual income and expenditure, for a period ranging from 20 to 30 years**. This process is significantly facilitated by the QM procedure, which minimizes risks and makes this phase more transparent and quantifiable.

While there is no claim to generate huge profits through thermal RECs, it can be said that in plants built according to the QM system and sourcing biomass from a local supply chain, **the cost per thermal kWh will certainly be lower than that of an "average" user**, without considering the positive impacts in terms of employment and economic benefits for the local area. District heating systems are characterized by high initial investment costs, but these are largely offset by their low risk and long operating life. It will be crucial that thermal demand does not decline over time, in addition to the need to identify appropriate dividend management during the technical and economic analysis. One of the key issues is obviously identifying who will make the initial investment.

There could be multiple answers: it could be the municipality, which invests to generate a benefit for the community; or a private investor who then manages the plant themselves, generating a profit; or a forestry company (part of the production REC) that invests to maintain a steady income over time; or it could even be the REC itself (particularly the consumption one), in which individual members decide to invest their own share and then, as an officially constituted REC, apply for a loan from a bank. Here too, there is no hard and fast rule or one-size-fits-all solution: aside from the basic concept of a "Renewable Energy Community" for thermal energy production, everyone is free to adapt their actions and roles based on their specific context.

Roadmap and barriers

The Life ConnectHeat project has developed tools to facilitate the creation of thermal RECs. Specifically, it is possible to refer to the results of the pilot projects implemented and the recommendations formulated to address the critical issues identified. A valuable support tool is the roadmaps developed for each pilot area, which outline the key steps to create the most suitable conditions for the establishment and deployment of thermal communities. These roadmaps will be made available on the project website (https://connectheat.ambienteitalia.it) in the coming months.

The QM system for designing and implementing efficient biomass district heating plants

Samuele Giacometti and Matteo De Piccoli – APE FVG

This article briefly presents a certification system created and developed in Switzerland, Austria, and Germany that can be a crucial element for the proper functioning of a biomass district heating network and, consequently, also for the development of a transparent and sustainable thermal Renewable Energy Community from every perspective.

The primary objective of any project involving the construction of a wood biomass district heating system is to achieve a full sustainability – in technical, economical and environmental terms. Unfortunately, in Italy, it's currently considered "normal" for such a complex system to operate without thorough quality management throughout the planning, financing, design, construction, commissioning, and optimization phases. Yet, the heat generators have their own quality certification, as do the piping, pumps, and all the components required to build the system. It goes without saying, of course, that the reference standards to which designers, installers, and plant operators must adhere are also in place. Furthermore, both the wood chips and the forests from which the wood is sourced, and the entire processing chain can also have their own quality certification, as described in the previous article in this Dossier. To harmonize and systematize all these components, a standard already used in Central and

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Northern Europe can be helpful: the **QM Holzheizwerke©** (hereinafter referred to as QM).

QM system

The QM quality management system is **the quality standard for wood biomass heating systems developed in Switzerland starting in 1998 and subsequently spread to Austria and Germany** with the contribution of partners from Baden-Württemberg, Bavaria, and Rhineland-Palatinate. Thanks to the European project *Interreg Central Europe ENTRAIN* (2019-2022), in October 2020 APE FVG became the first Italian member to join the international working group responsible for developing and maintaining the standard. With the support of the European Union, QM was also transferred to Italy, where it was named "**QM Impianti Termici a Legna**." The Agency is currently committed to promoting it and encouraging its dissemination at the regional and national levels (more information at www.ape.fvg.it/qm).

QM enables quality management during the design and construction of the plant, as well as the procurement of wood biomass (usually wood chips) and the subsequent generation and distribution of heat, to ensure that the following key objectives are achieved:

- reliable operation and low maintenance;
- high utilization rates and reduced distribution losses;
- low emissions under all operating conditions;
- precise and stable control systems;
- environmental and economic sustainability;
- supply of wood chips of the quality and quantity guaranteed by multi-year local and sustainable forest management contracts.

Given that wood biomass district heating systems can be unprofitable due to high investment costs, long payback periods, and the high investment risks associated with the complexity of the project, quality management according to **the QM system has proven over the years to help investors significantly reduce these risks**. In this regard, it is worth noting that since 2006, public funding for biomass DH systems in Austria, with or without a distribution network, has been conditional on quality management according to the QM standard.

Guidelines

The QM system is based on the so-called "**Q-guidelines**," which describe the operating procedures to achieve the objectives based on quality requirements, the result of careful monitoring of thousands of district heating systems. A dedicated step-by-step diagram (Figure 1) provides a general

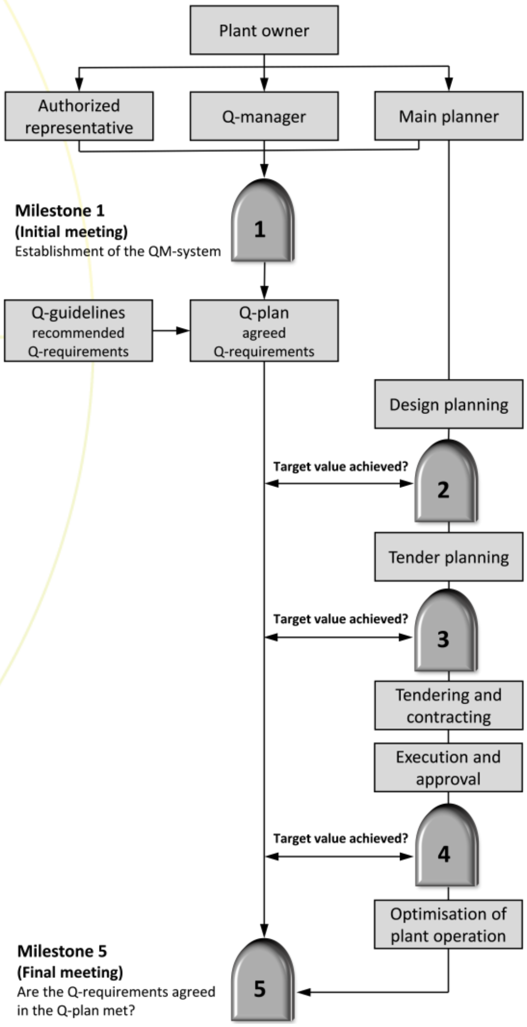

Figure 1

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overview of the quality management process, from concept to operational optimization.

The most important of these requirements is the "**linear heat density of the network**," calculated as the ratio between the "**annual heat demand**" (kWh per year - kWh/a) and **the length of the distribution network** (meters - m) that must be built to meet that heat demand.

This requirement has a lower limit of 1,000 kWh/(m*a). A second requirement is the efficiency value of the entire system, consisting of the heating plant and the distribution network. For the first one, a minimum efficiency of 85% is required, while network losses must not exceed 10%: this means that the overall annual efficiency of the system must be greater than 76.5% to meet the minimum requirements.

Levels of QM certification

To accommodate the varying needs and sizes of plants, this system is divided into different certification levels, including QMmini®, QM standard simplified (or QM vereinfacht), and QMstandard®:

- **QMmini®** - This certification level is specifically designed for small, monovalent biomass heating systems. It is intended for systems with a power threshold between 70 kW and 500 kW for monovalent systems. The QMmini® certification process is simplified, with reduced requirements and documentation burdens. The primary objective is to ensure a good basic level of quality for smaller systems, guaranteeing efficiency and compliance with minimum environmental standards. Verification procedures are generally more streamlined, focusing on the essential aspects for this type of system, which typically serves single buildings or small networks.

- **Simplified QM standard** - This category is positioned as an intermediate solution, designed for those facilities whose size or complexity exceeds the requirements of the QMmini®, but for which the application of the full QMstandard would be excessively burdensome. The process and documentation requirements are therefore more detailed than the QMmini®, but less stringent and complex than the QMstandard®. The objective of the simplified QM standard is to find a balance between the need to ensure high quality standards and the need to contain administrative effort and certification costs. The verification procedures are calibrated based on this intermediate complexity;

- **QMstandard®** - it represents the most comprehensive and rigorous certification level within the QM system. It is intended for larger and/or more complex biomass heating systems, such as large power plants for extended district heating networks, or systems with multiple generators and diverse users. The QMstandard® process is characterized by an in-depth approach that covers all phases of the project, including the drafting of a comprehensive and detailed "Q-plan" (Quality Plan). A distinctive feature is the in-depth verification of the operation and optimization of the system's performance after an initial operation period (generally one year).

It is essential to emphasize that the power thresholds, specific applicability criteria, and detailed requirements for each level are defined by the QM Holzheizwerke body and can be updated or interpreted with regional specifications.

Key players

According to the QM standard, the key players in the quality management process are **the plant owner, the designer, and the "Q-Manager","** appointed by the plant owner. This person is the point of reference for quality, accompanying the project development from the very beginning, when a pre-feasibility study is conducted to ensure compliance with the so-called "**Q-requirements**."

The Q-Manager organizes the initial meeting with the plant owner and designer, where the objectives to be achieved are established and recorded in a specific document called the "**Q-plan.**" During the design and

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construction of the plant, the Q-Manager then verifies the achievement of these objectives and, if potential deviations are identified, recommends corrective measures to the owner. Q-Managers are professionals with work experience and industry expertise who have completed a specific training course approved by the QM system. Another element that characterizes the QM system is the accurate definition of the plant's operational optimization procedure: after at least one year of operation and monitoring, it must be demonstrated that the plant has achieved the quality objectives specified in the jointly defined Q-plan.

The importance of monitoring

Thanks to collaboration with plant operators, which primarily involves exchanging data, APE FVG has been able to conduct an analysis in recent years in line with the QM standard for existing plants in the Friuli Venezia Giulia region. What clearly emerged is that those experiencing the greatest economic and management difficulties are also those that **do not meet the fundamental QM requirements, namely the Linear Heat Density greater than 1,000 kWh/(m*a)**.

These plants therefore owe their difficulties to an incorrect or, in the worst cases, a failure to assess an Annual Heat Demand during the planning phase and to a lack of correlation with the length of the distribution network. Too often, during the design phase, **attention tends to focus solely on the generator's peak power**, neglecting the actual grid load profiles throughout the year and on a single day.

Another frequently overlooked QM requirement concerns the Distribution Network Heat Losses, which often exceed 10% of the amount of heat sold to end users due to networks that are too long and constructed with oversized pipes.

Another problem encountered concerns **thermal power plants with oversized capacities compared to the base load of the winter season** and the tendency to cover peak demand with the same biomass generator, ignoring the actual load curve. An oversized wood biomass boiler, in fact, leads to difficult and non-linear operation, with multiple starts and stops and the consequent increase in costs, emissions, and inefficiency.

The QM recommends tracking heat demand by appropriately sizing the thermal power plant, operating it for 2,000 to 4,000 equivalent hours per year at maximum power, while **ensuring peak heat demand is met by properly sizing thermal storage tanks**. This strategy offers numerous advantages, from the greater cost-effectiveness of a solution consisting of a smaller boiler and a larger storage tank to lower emissions due to constant operation. It also allows thermal power plants to be built using the principle of boiler modularity, which ensures additional operational flexibility throughout the seasons. The possible addition of a properly sized solar thermal system also allows summer demand to be met without having to resort to solid fuel, providing important support in the spring and autumn seasons.

Conclusions

The above-mentioned issues highlight **the need to link the granting of any public funding for the construction of a district heating network to the QM quality standard**, in order to avoid repeating past mistakes. This funding should be minimized to encourage the construction of only those plants capable of generating the necessary profitability over the years to cover the investments made. These are the same issues that were initially encountered in Switzerland and Austria and which led to the creation of the standard.

Going back to the topic of thermal RECs, adopting the QM certification as a basic requirement will ensure that communities have an efficient and well-sized system that meets the fundamental requirements of each community: in addition to self-generation and energy sharing, it also ensures the reduction of climate-altering emissions and cost savings for users. In economic terms, by requiring a clear and structured division into phases and minimizing risks, the QM system effectively makes the project bankable: this means guaranteeing the expected profitability and financial sustainability of the operation.

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Community district heating: from thought to action

Riccardo Battisti and Chiara Lazzari – Ambiente Italia

To raise awareness and promote the most relevant examples of existing communities in Europe that have self-organized to produce thermal energy cooperatively, the LIFE ConnectHeat project has mapped some particularly significant good practices. This article briefly summarizes four interesting cases from Austria, France, Spain, and Italy (South Tyrol).

Renewable Energy Communities, established by the **European Renewable Energy Directive (RED III)**, which came into force in November 2023, were designed to enable local communities to produce, consume, and manage their own renewable energy sources. However, the implementation of RED III by Member States has been limited to electricity only, excluding heating and cooling.

Most active RECs, therefore, have been developed with only electricity generation and distribution in mind, a significant policy gap that limits their potential to fully contribute to the energy transition. This shortsighted vision not only significantly limits their potential to meet the European Union's climate goals, but also excludes a significant portion of energy consumption—heating and cooling—which is closely linked to energy poverty (through summer and winter air conditioning) and greenhouse gas emissions. Fortunately, however, reality is ahead of legislation. While RECs consistently focus on the electricity sector, **numerous initiatives already exist that engage local communities in the supply of renewable heat through heating networks or other collective solutions**, highlighting a clear lag in regulations compared to citizens' self-organizational capacity.

Examples of community-led projects in the heat sector have been operational for many years in several EU countries, including Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, and Sweden. All **these initiatives share a participatory approach to project development, for example through the creation of a cooperative to manage the supply of heat and/or cooling.**

However, this is not the only solution to ensure citizen participation. In other cases, the more technical and operational aspects have been entrusted to a more experienced external entity, such as an ESCo, a utility, or an engineering firm. However, **users have retained a role in deciding on certain aspects of the project, or have contributed financially to the investment**, obviously also providing for some form of financial return for their direct involvement. Another typical feature of these projects is that they provide heat through the massive and integrated use of locally available renewable energy sources, particularly residual forest biomass, often combining different exploitation technologies, thus making the entire system more flexible and resilient to unexpected changes in the market, energy and fuel costs, end-user needs, etc.

To raise awareness and promote the most significant examples of existing heating and cooling communities in Europe, the LIFE ConnectHeat project has developed and made available a map on its website - https://connectheat.ambienteitalia.it/hcc-map.

This article highlights four significant cases:

AUSTRIA – The pioneers of cooperative district heating

Güssing, a small town in southeastern Austria, has gained international recognition for its energy self-sufficiency initiative, which includes an innovative district heating system. Its goal is to reduce dependence on fossil fuels, stimulate the local economy, and utilize local renewable energy resources. The project was launched in the early 1990s, spearheaded by **the Municipality of Güssing in collaboration with the European Renewable Energy Centre Güssing**. Local residents, businesses, and public bodies provided active and financial support, developing a cooperative model for network management. Güssing's heating network therefore

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operates under a shared ownership model, with significant financial contributions from the community. The governance structure involves local stakeholders, ensuring transparency and long-term sustainability. The district heating system serves approximately 200 users, including residential buildings and small businesses, with a total demand of 5 GWh/year and a network length of 15 km. A 1,500 kW biomass boiler covers 80% of the energy needs, while a 1,200 kW biogas plant supplies 15%. The remaining 5% is supplemented by approximately 2,000 m^2 of solar thermal energy. The biomass, all locally sourced, consists of wood chips derived from forestry residues.

FRANCE – District heating and solidarity

In the French town of **Bourget-du-Lac**, a small initiative that at the beginning focused on a few buildings and collective housing units has evolved into **a more ambitious wood energy project, thanks in part to a collaboration with ForestEner, a major player in citizen-led heating projects in the Rhône-Alpes region**. The heating system recovers heat from the processes of the nearby paper mill, covering 10% of annual needs and 100% during the summer, and uses a 1,350 kW wood biomass boiler with a gas backup. At the same time, the municipality has engaged with local wood fuel suppliers, including one located just 10 km from the plant. Discussions are also underway to establish energy solidarity initiatives targeting social housing and student housing. These initiatives aim to create a small solidarity fund, drawing on profit margins to support further community-level energy projects. As highlighted by a recent study conducted by Energie Partagée, every euro invested generates 3 euros of economic benefits for the area and the local community.

The project had a total cost of €4.2 million, €3 million of which was subsidized by ADEME and energy efficiency certificates, while the remaining investment was covered by public shareholders and citizens. Heat production, entirely from local biomass, amounts to 4,000 MWh per year over a 3 km network, meeting the heating needs of approximately eight collective housing units, five municipal buildings, and six additional public buildings. An extension planned for 2026 should connect another 200 residential units.

ITALY – «Home energy»

With the motto "Energia di casa" - Home Energy, Azienda Energetica Prato Soc. Coop. (EWP) is one of the most interesting community district heating projects in Italy. It began in the 1920s with hydroelectric power, and in 1999 it expanded to include heat supply through a small district heating network in the central area of **Prato allo Stelvio (Bolzano-Bozen)**. The project was expanded in 2002 with a second district heating plant, incorporating biomass and biogas technologies. In 2011, the first district heating plant underwent substantial modifications to improve its efficiency and meet the community's growing energy needs.

User engagement was achieved through a cooperative company for energy supply management, which has grown to include more than 1,500 members and supplies almost 31,000 MWh/year of electricity and nearly 17,000 MWh/year of heat, using approximately 600 heat exchangers and also providing nearly 800 fiber optic connections as an additional service to users. The first district heating system includes a biomass boiler and a heat pump, supported by a backup boiler and a diesel cogenerator, while the second system includes two biomass boilers, a heat pump, three cogenerators

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(biogas, vegetable oil, and diesel), and a backup boiler.

SPAIN – Community-managed biomass

Our journey into examples of bottom-up district heating concludes in the Spanish village of **Sabando**, a small hamlet in the Basque Country between Bilbao and Pamplona. Here, **a small heating network is powered by forest residues managed by the villagers themselves, who administrate the communal forests under the supervision of the Provincial Council of Álava**. The network uses local biomass to provide heating and hot water to 24 houses. The total cost of the project was €550,000, funded primarily by the Basque government and the Provincial Council of Álava. Residents contributed with €90,000, covered by a ten-year loan, which allowed the community to implement this sustainable solution with a proportionate financial effort. The central biomass boiler that powers the network consumes approximately 300 tons of wood chips per year, representing a 30% to 50% savings compared to using gas. The solid biomass is entirely of local origin and comes from forests and wood processing residues. Short transportation distances and the use of waste wood ensure an environmentally friendly supply chain. The plant is complemented by a 5,000-liter heat storage tank. The approach adopted at Sabando also uses a renewable and local energy source, reducing dependence on fossil fuels and contributing to the decarbonization of the region.

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