ConnectHeat
Community engagement for clean heat

D4.2 – IMPLEMENTATION OF PILOT CASES – ITALY

AGENZIA PER L'ENERGIA DEL FRIULI VENEZIA GIULIA

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

D4.2 – IMPLEMENTATION OF PILOT CASES – BELGIUM

Deliverable number	D4.2
Responsible partner	AGENZIA PER L'ENERGIA DEL FRIULI VENEZIA GIULIA (APE FVG)
Due date of deliverable	May 2025
Actual submission date	June 2025
Version/document history	02
Authors	M. De Piccoli, M. Mazzolini, M. Arteni, M. Ortis
Reviewers	M. Neyhousser, A. Sohail R. Battisti, C. Lazzari – AMBIT
Work package number and title	WP4
Work package leader	Solites
Work package participants	All partners

Dissemination level (please select one)

SEN	Sensitive, limited under the conditions of the Grant Agreement	☐
PU	Public, fully open	☒

Nature of the deliverable (please select one)

R	Report, document	☒
DEM	Demonstrator, pilot, prototype, plan designs	☐
DEC	Websites, patents filing, press & media actions	☐
DATA	Datasets, microdata, etc.	☐
DMP	Data management plan	☐
ETHICS	Deliverables related to ethic issues	☐
SECURITY	Deliverables related to security issues	☐
OTHER	Software, technical diagram, algorithms, models, etc.	☐

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

Disclaimer

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

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

Table of Contents

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

Summary

Gemona del Friuli, a town at the foot of the Friulian Alps (272 m a.s.l., 2488 HDD, climate zone E) and part of the "Comunità di Montagna del Gemonese," is undertaking a significant energy project. The initiative involves a biomass-fueled district heating network. While initiated with the ambition to foster a community energy model, its development offers critical insights into the complexities of realizing Thermal Renewable Energy Communities (Thermal RECs), particularly highlighting the challenges of a top-down approach versus a truly bottom-up, community-led process.

The project is embedded within the "Green Community" framework of the Gemona Area Mountain Community (also involving Artegna, Trasaghis, Venzone, Montenars, and Bordano municipalities). The strategic vision aims for a development that balances the use of the area's energy and environmental resources, intended to trigger virtuous economic and social growth processes. The use of local energy sources is identified as the primary driver, with the project originating from the opportunity to recover waste heat from the local crematorium to serve the nearby school complex.

The process towards establishing a community-based energy model has been an instructive one, underscoring the often significant gap between initial intentions and on-the-ground implementation. While the project was originally conceptualized with the spirit of a community energy initiative, its actual design, proposal, and subsequent management have, to date, been led by public authorities, namely the Municipality and the Mountain Community. This meant that the critical first step of deeply engaging citizens and potential end-users from the project's very inception was not realized as envisioned. The aspiration for a more broadly community-driven approach then encountered substantial obstacles along the way.

A significant factor was the tight deadline imposed by the NRRP funding (March 2026), which considerably accelerated the design and implementation phases, unfortunately leaving insufficient opportunity for comprehensive public involvement and thorough consultation processes. These challenges were further compounded by bureaucratic difficulties and instances of institutional resistance encountered at various levels, making a participatory model harder to achieve in the initial stages.

Consequently, the Gemona pilot in its current form, should be viewed less as a direct blueprint for how to develop a Thermal REC from scratch, and more as an important, albeit not yet fully successful, attempt that offers valuable lessons. It highlights potential pitfalls and underscores critical considerations for future endeavors, particularly the imperative of a foundational, bottom-up community approach where citizens are integral to the process from the earliest conceptual stages, rather than being presented with a largely pre-defined project. Despite this top-down initiation, it's important to recognize that public bodies like the Gemona Area Mountain Community and the Municipality of Gemona del Friuli remain key promoters of the project. Furthermore, the crucial technical support provided by APE FVG, including the QM Holzheizwerke quality certification, is fundamental. This certification ensures the efficiency, reliability, and long-term economic viability of the technical system, which, regardless of the initial engagement model, remains a vital pillar for the bankability and transparency of any future REC that may evolve from this foundation.

Potential for Future Community Structures

- Forestry Community (Potential Production REC): A key, and still viable, community-oriented aspect is the planned creation of a "Forestry Community." This aims to involve public and private forest owners in the management of local forest resources according to principles that ensure their long-term health and productivity, for a short supply chain of certified wood chips (PEFC/FSC for management, BiomassPlus for fuel). This element holds the potential to stimulate forestry associations and local businesses.

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

- Initial Users and Future Expansion (Path to a Consumption REC): In its first phase, the network will serve public buildings (schools, gyms, municipal swimming pool). While these initial connections are institutionally driven, the project has been designed with provisions for future connections by private users. This creates an opening for the later development of a broader "consumption REC," potentially evolving into a more genuinely community-managed entity.
- Thermal Prosumerism: The technical design includes the innovative recovery of waste heat from the local crematorium (managed by ALTAIR), a feature that aligns with the "prosumer" concept, transforming waste into a community resource.

Promoters, Developers, and Stakeholders

The project is spearheaded by the Gemona Area Mountain Community and the Municipality of Gemona del Friuli as its main promoters. The technical design has been entrusted to COGENERA srl, while APE FVG provides essential technical support and is responsible for the QM Holzheizwerke certification. Key stakeholders who will benefit from this initiative include educational institutions, sports facilities, and the municipal swimming pool. Indirectly, the citizens using these public facilities, the local forestry sector, and the broader environment will also experience positive impacts.

Technologies and Interventions

Technologically, the project centers around a new heating plant to be constructed near the crematorium. This facility will house two 450 kW biomass chip boilers and three 15 m³ thermal storage tanks, complemented by a wood chip storage area designed to hold more than a week's supply of fuel. A district heating network will then distribute the generated heat to the connected buildings. A significant intervention is the implementation of a crematorium heat recovery system, designed to capture and utilize energy from the combustion fumes that would otherwise be lost.

Costs, Benefits, and Financial Resources

Financially, the project's cost is approximately €3.5 million. This is divided into a €1.327 million portion managed by the Municipality, funded through regional grants, and a €2.216 million portion managed by the Mountain Community, financed by the NRRP program. The expected annual energy demand, following a downscaling due to challenges in engaging a wider initial user base, is around 1,650 MWh. The benefits are manifold: it will enable a complete conversion from fossil fuels (natural gas) to renewable energy sources for the connected users. The heat recovery from the crematorium is estimated to provide about 1,500 MWh/year of thermal energy and will also save approximately 51 MWh/year of electricity currently consumed by fans for fume cooling. Furthermore, the project will lead to a reduction in greenhouse gas emissions and local air pollutants, while stimulating the local economy through the development of a short wood supply chain and the creation of employment opportunities.

The Gemona del Friuli district heating project, while facing challenges in its community engagement aspects, serves as a critical case study. It underscores that for Thermal Renewable Energy Communities to succeed, genuine citizen involvement from the earliest stages is paramount. To facilitate citizen engagement then, local administrators must be transparent. The project's technical merits and the provisions for future private connections, however, hold the promise that it may yet evolve into a more comprehensive community energy model, offering valuable lessons for similar initiatives across Italy and Europe.

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

1. Technical feasibility

The technical feasibility of the Gemona del Friuli district heating project has been assessed through a detailed analysis of both energy demand and supply-side considerations, guided by the principles of the QM Holzheizwerke quality standard. This methodological approach ensures that the system is designed for efficiency, reliability, and long-term economic viability, focusing on accurate demand assessment, optimal sizing of generation and storage components, and efficient network design.

1.1. Demand side analysis

It is important to note that the project was initially conceived with a significantly larger scope. The original vision encompassed a thermal demand approximately three times higher than the current estimates, planning to include major public facilities such as the local hospital and several high schools. However, the project was ultimately scaled down to primarily focus, in its current phase, on buildings owned by the Municipality of Gemona. This reduction occurred because the Municipality was the only entity that consistently upheld its initial agreements and commitments. Other potential key users, particularly the high schools, despite numerous contacts and information provided over several years, did not demonstrate a sustained or concrete interest, ultimately withdrawing when definitive decisions were required. This lack of broader commitment, likely compounded by institutional or bureaucratic complexities, meant that the will or possibility to proceed with the project in its entirety did not materialize.

The initial phase of the district heating network is set to connect several key public and sports facilities within Gemona del Friuli. These users primarily include the Palazzetto dello Sport (IPSIA gym), the Piscina Atlantis (swimming pool and wellness center), the Palestra GemonAtletica, and newly planned constructions: two new school gyms and a new middle school. The total estimated annual heating demand for these initially connected users is approximately 1.650 MWh. This figure was determined after a downscaling from initial, broader projections, due to challenges in securing commitments from a larger pool of potential users within the project's tight timeframe.

The methodological approach for quantifying this demand involved:

- For existing users (like the Palazzetto and Piscina Atlantis), consumption data was derived from actual historical energy bills (gas and electricity) and monthly consumption records, providing a realistic baseline.
- For future users (the new gyms and the new middle school), heating needs were estimated based on their design specifications and energy performance targets (e.g., nearly Zero Energy Building - nZEB standards), as provided by the local authorities.

The primary energy need is for space heating and domestic hot water (DHW). Cooling requirements are not a planned service of this district heating network. The QM methodology emphasizes a thorough understanding of these load profiles throughout the year to correctly size the supply-side components.

1.2. Supply side analysis

The energy supply for the district heating network is designed as a hybrid system, combining renewable biomass with waste heat recovery, and supported by significant thermal storage. This approach is central to the QM Holzheizwerke philosophy, aiming to maximize the use of available energy sources efficiently.

Primary Energy Sources & Technologies:

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

- Biomass (Wood Chips): The core heat generation will come from two identical wood chip boilers, each with a thermal capacity of 450 kW. These are modern, low-emission units, likely featuring moving grate technology and flue gas recirculation for optimized combustion, as indicated by the example of a Schmid UTSK Visio model in the project documentation. These boilers are planned to operate primarily during the "cold" seasons and winter.
- Waste Heat Recovery from Crematorium: A significant and innovative component is the system to recover waste heat from the local crematorium's combustion fumes. The crematorium operates two cremation lines. Studies indicate an average useful thermal power recovery potential of 571 kW_{th}, translating to approximately 1.500 MWh of thermal energy per year. This recovery is based on the crematorium operating one line for about 10 hours a day, 6 days a week, as per information from the facility's operators. The heat recovery system will capture energy that is currently dissipated by mechanical ventilation (fans), thus also saving electricity.
- Thermal Storage: To optimize the entire system, three thermal storage tanks, each with a capacity of 15.000 liters (15 m³), totaling 45.000 liters (45 m³) of hot water storage, will be installed. This substantial storage capacity is crucial for several reasons: it allows for the maximum utilization of the intermittently available heat from the crematorium, it enables the biomass boilers to operate at or near their optimal load for longer periods, improving efficiency and reducing emissions from frequent start-stops or low-load operation and it is designed to cover the base load demand during summer (primarily for DHW and the swimming pool) using primarily the recovered heat from the crematorium, thereby minimizing or even eliminating the need for wood chip combustion during these low-demand periods.

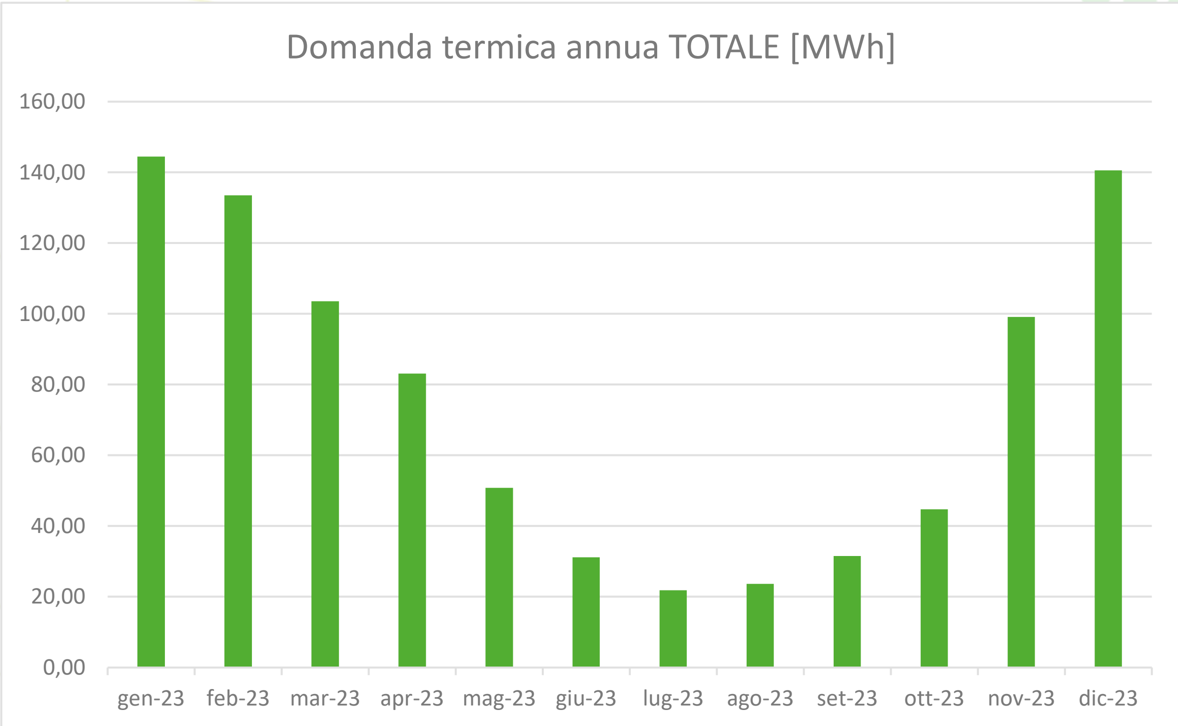
The distribution of heat throughout the network will be accomplished using pre-insulated underground pipes, with the main pipeline featuring a diameter of 100 mm (DN100). In its initial phase, the network will span approximately 700-750 meters, as detailed in project documentation. It is engineered to operate with a supply temperature around 90°C and a return temperature near 65°C, achieving a temperature differential (ΔT) of 25 K. The hydraulic design of this network boasts a capacity of approximately 1.5 to 1.8 MW. This capacity not only meets current needs but also strategically provides a margin for future expansion, potentially accommodating an additional 450 kW boiler and thereby enabling the connection of more users, including private residences, in subsequent project phases.

The design of the supply-side infrastructure was rigorously guided by the QM Holzheizwerke standard, a methodological approach that influenced several key decisions. For instance, the biomass boilers were dimensioned not merely on peak demand, but by considering the annual heat demand curve and the significant contribution from the crematorium's recovered heat; the crucial role of managing peak loads is assigned to the thermal storage system. This approach also ensured that the network would achieve a high linear heat density, calculated at approximately 2.2 MWh/m*a, which is well above the QM minimum threshold of 1.0 MWh/m*a and indicative of good economic viability for this section of the network. Furthermore, careful planning was undertaken to maintain low heat losses within the distribution system, aiming to stay below the QM target of 10% of the total heat supplied. The integration of the waste heat source from the crematorium was prioritized, with the biomass boilers tasked to supply the remaining energy and cover any peak demands. The selection of appropriate boiler technology and emission controls was also made in line with environmental standards. Finally, the fuel storage for wood chips was designed to provide over a week's autonomy at nominal power, a measure intended to minimize logistical disruptions.

This comprehensive analysis indicates that the proposed system is technically sound and has been designed with a clear strategy for efficient and reliable heat generation and distribution, leveraging local renewable resources and innovative heat recovery.

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

USER	MANAGER	SUPPLY [MWh/a]	ACTION	DEVICE EX ANTE
School gym 1	Municipality	350	DH	Methane Boiler
Municipal Swimming Pool	Private	750	DH	Methane Boiler
New Gym 1	Municipality	100	Building from scratch + DH	/
New Gym 2	Municipality	80	Building from scratch + DH	/
Gym 2	Private	220	DH	Methane Boiler
New Medium School	Municipality	150	Building from scratch + DH	/



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

2. Costs and Benefits

The economic and societal impacts of the Gemona del Friuli District Heating System (DHS) have been evaluated considering its unique public funding structure and its long-term objectives for the community.

2.1. Evaluation of CAPEX and OPEX Costs

The total Capital Expenditure (CAPEX) for the project, encompassing both Batch 1 (managed by the Mountain Community) and Batch 2 (managed by the Municipality of Gemona), is €3,542,884.88 (VAT included). Batch 1, managed by the Mountain Community, accounts for €2,216,051.42 of this total, while Batch 2, managed by the Municipality of Gemona, accounts for the remaining €1,326,833.46. These figures cover all aspects of the project, including the heating plant construction (biomass boilers, crematorium heat recovery system, thermal storage), the district heating network piping, user substations, as well as planning, design, supervision, safety, and administrative costs.

Operational Expenditures (OPEX) are anticipated to cover the ongoing running of the facility. These will primarily consist of biomass (wood chip) procurement costs, which the project aims to stabilize through the development of a local Forestry Community. Other significant OPEX components include electricity for plant operations (pumps, controls), regular quality assurance and maintenance (Q&M) activities for all system components as per the rigorous QM Holzheizwerke standards, ash disposal, insurance, and general administrative overheads. The QM standard also mandates ongoing monitoring and operational optimization, which will form part of the OPEX.

Revenues, Heat Price, and Cash Flows

The District Heating system (DHS) will be partly funded through public funding. The pilot will be carried out in two phases: batch n.1, funded by governmental and EU Next Generation Europe funds, concerns the local Mountain Community, which is a public entity; while batch n.2, funded by the Municipality of Gemona and the Friuli Venezia Giulia Region, pertains to the Municipality of Gemona.

Initially, heat energy will be sold exclusively to public entities (such as schools, public gyms, and the municipal swimming pool) under the condition that the price paid must be lower than the cost of purchasing energy through public procurement platforms. In this context, with investment costs fully covered by public grants, the prices for utilities connected to the DHS will be kept below market rates, as no profit needs to be generated in this initial phase. The revenue generated from heat sales will primarily be required to cover the ongoing OPEX (biomass procurement, Q&M) and the long-term amortization/replacement fund for the plant components. Detailed cash flow projections for this initial phase are centered on cost recovery rather than profit generation. Associated risks include potential fluctuations in biomass prices (though the local Forestry Community aims to mitigate this), variations in actual heat demand from the connected public users, and unforeseen maintenance needs.

In the last months, some problems have arisen due to the augment of the costs relative to the second batch due to a change in the plant's building design. Within this context, the administration is working on a Project Financing solution with other actors, potentially those who could manage the biomass plant. APE FVG is not involved in this specific Project Financing process so far. This development could influence the future revenue structure and management model if private investment becomes part of the operational phase, potentially introducing different cash flow expectations and risk assessments.

Available Funding Sources

As stated, the project's CAPEX is fully covered by public funding:

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

- **Batch 1 (Mountain Community):** Funded by **governmental and EU Next Generation Europe (NRRP) funds**. This accounts for approximately **62.5%** of the total CAPEX (€2.216.051,42 / €3.542.884,88).

Category	Amount (€)
A - WORKS	
A1 Works subject to tender rebate	939,195.55
Of which civil works	99,951.14
Of which mechanical works	817,898.61
Of which electrical works	21,345.80
A2 Safety costs not subject to rebate	25,337.52
Total work amounts	964,533.07
B - FUNDS AVAILABLE	
B1 Contingencies, damages, price revisions	48,226.65
B2 VAT on works (A) 10%	96,453.31
B3 Incentive for technical functions art. 45 D.Lgs 36/2023	19,290.66
B4 Technical expenses - design D.L.	118,039.21
B5 Technical expenses - CSP/CSE	32,281.29
B6 Technical expenses - geologist	-
B7 Technical expenses - structural and plant testing	16,140.65
B8 Technical expenses - administrative testing	7,173.62
B9 Technical expenses - consultancy	-
B10 Surveys, assessments, connections	20,000.00
B11 Material tests	4,000.00
B12 ANAC contribution – allocation item B.4	35.00
B13 ANAC contribution – allocation item A	660.00
Total funds available	362,300.39
TOTAL PROJECT (A+B)	1,326,833.46

- **Batch 2 (Municipality of Gemona):** Funded by the **Municipality of Gemona and the Friuli Venezia Giulia Region**. This represents approximately **37.5%** of the total CAPEX (€1.326.833,46 / €3.542.884,88). No private funding for the initial investment is currently part of the core financing, although the aforementioned Project Financing discussions for cost overruns or future operational management might introduce a private financial component later.

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

Category	Amount (€)
A - WORKS	
Works subject to tender discount	1,428,314.05
Of which civil works	625,312.35
Of which mechanical works	693,313.40
Of which electrical works	109,688.30
Safety costs not subject to tender discount	70,000.00
Total works amount	1,498,314.05
B - FUNDS AVAILABLE	
Contingencies, damages, price adjustments	116,070.53
VAT on works (A) 10%	149,831.41
Incentive for technical functions art. 45 Legislative Decree 36/2023	30,000.00
Technical expenses - project management (D.L.)	220,468.54
Technical expenses - CSP/CSE	64,949.52
Technical expenses - geologist	18,676.09
Technical expenses - structural and plant testing	25,854.18
Technical expenses - administrative testing	13,909.38
Technical expenses - consulting	63,282.72
Surveys, verifications, connections	10,000.00
Material testing	4,000.00
ANAC contribution - B.4 allocation	35.00
ANAC contribution - A allocation	660.00
Total funds available	717,737.37
TOTAL PROJECT (A+B)	2,216,051.42

Key Economic and Financial Parameters

Given that the initial investment (CAPEX) is fully covered by public grants and the initial operational phase serving public entities is designed to be non-profit, standard commercial financial parameters such as Simple Payback Time (SPT), Net Present Value (NPV), and Internal Rate of Return (IRR) are not the primary metrics for this stage. The QM Holzheizwerke standard, which guides the project, inherently aims for long-term economic viability and efficiency. Should the system expand to include private customers and adopt a different revenue model, a full financial analysis using these parameters would become more pertinent. For the current phase, the key economic objective is the provision of heat to public facilities at a cost demonstrably lower than their existing alternatives, thereby generating savings for the public purse.

2.2. Wider Benefits to the Territory

The project is poised to deliver a wide array of benefits to the Gemona area, extending beyond the direct economics of heat supply:

- **Energy Saving:** A significant reduction in annual primary energy consumption is anticipated, amounting to **1,056 MWh/year**. This saving stems from the higher efficiency of a centralized system compared to individual boilers and the strategic use of waste heat.
- **CO2 Emissions Reduction:** The aforementioned primary energy saving translates to an estimated reduction of **270 tons/year of CO2 emissions** (based on replacing methane, calculated at 255 kg of CO2 per MWh of methane saved). Furthermore, the dedicated heat recovery from the crematorium is projected to avoid an additional approximately **366 tons of CO2 annually** (as detailed in Annex 3), which includes savings from avoided electricity for fume cooling and further methane replacement. The cumulative CO2 reduction will therefore be substantial.

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

- **Lower Energy Costs for Public Users:** A core aim is to supply heat to schools, gyms, and the swimming pool at a price point below current market rates or public procurement platform costs. This will alleviate budgetary pressures on these public services.
- **Air Quality Improvement:** By replacing multiple, dispersed natural gas boilers with a single, modern biomass plant adhering to the QM standard's stringent emission controls, a notable improvement in local air quality is expected. This includes reductions in pollutants such as NOx, CO, and particulate matter (specific pollutant reduction estimates from the crematorium heat recovery are detailed in Annex 3).
- **Job Creation and Local Economy Stimulation:** The initiative, particularly through the establishment of a local Forestry Community for biomass sourcing and the ongoing operation and maintenance of the plant, is expected to create and sustain local employment. Broader studies on biomass district heating suggest a positive multiplier effect on the local economy.
- **Energy Poverty Counteracting:** While initially focused on public buildings, the provision of more affordable heating can ease the financial burden on these community institutions. Any future expansion to connect private households at favorable rates could more directly contribute to counteracting energy poverty in the region.
- **Increased Local Energy Independence and Security:** Utilizing locally sourced wood biomass and recovering waste heat significantly reduces the Gemona area's dependence on imported fossil fuels, thereby enhancing its energy security and resilience against external market volatility.
- **Valorization of Local Resources:** The project champions the use of regional forestry products in a cascading manner and innovatively transforms a previously untapped waste heat stream from the crematorium into a valuable energy input for the community.

2.3. SWOT Analysis

Strengths (S)

The project's strengths are notable, beginning with the aim to provide lower energy costs for users, as public funding and an initial non-profit operational model are designed to keep utility prices for connected public bodies below current alternatives. A significant environmental impact reduction is another key strength, achieved through the use of renewable biomass, waste heat recovery, and a centralized plant with modern emission controls, which will lead to reduced CO2 and air pollutant emissions, including a primary energy saving of 1.056 MWh/year. The project also excels in its utilization of local and renewable resources, by leveraging regional forestry biomass and recovering otherwise wasted heat from the crematorium. High technical standards and efficiency are ensured by adherence to the QM Holzheizwerke quality standard, which underpins robust design, efficient operation, and long-term reliability. Furthermore, the calculated high linear heat density of approximately 2.2 MWh/m*a, well above QM thresholds, indicates good economic potential for the network section. Finally, strong public backing from the Municipality and Mountain Community, with secured public funding for the initial capital expenditure, provides a solid foundation.

Weaknesses (W)

However, the project also faces certain weaknesses. A primary weakness was the initial downscaling of its scope, with the thermal demand reduced to about one-third of the original plan due to difficulties in securing commitment from all initially targeted stakeholders like the hospital and high schools; this has impacted the overall scale and potentially the initial economies of scale. Coupled with this was the limited initial community engagement, as the tight NRRP deadline accelerated the design phase, making it a top-down initiative in its early stages rather than a truly bottom-up REC. The current dependence on public entities as initial users

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

might also limit revenue diversification at the outset. Managing publicly funded infrastructure inherently brings operational complexity and potential bureaucracy. Lastly, the non-profit model for the initial public users means revenue is primarily for OPEX and amortization, which could limit funds for rapid, self-financed expansion or major upgrades without further grants.

Opportunities (O)

Despite these weaknesses, there are significant opportunities. A major opportunity lies in the future expansion to private users and the potential formation of a genuine Thermal REC, as the network is designed with capacity for growth. The development of a resilient local forestry supply chain through the "Forestry Community" can ensure a stable, local, and responsibly managed biomass supply, which in turn will boost the local rural economy. The project, particularly with its QM certification, also has the potential for replication and scalability, serving as a learning case and a model for similar initiatives in other rural or mountainous areas. It offers increased energy independence and security for the community by reducing reliance on volatile external fossil fuel markets. There is also the opportunity for the integration of further renewable technologies, such as solar thermal, in the future to further diversify the energy mix. Finally, if future expansion actively involves citizens, it can foster greater community awareness and participation in local energy solutions.

Threats (T)

Nevertheless, the project is exposed to certain threats. Fluctuations in biomass price and availability could pose a risk, although the local Forestry Community aims to mitigate this. Technical and operational risks, such as unforeseen issues with the plant, heat recovery system, or distribution network, are always a consideration. Changes in public funding policies or future support for renewable heat or operational subsidies might impact long-term financial planning. Public perception challenges, including concerns about biomass combustion regarding emissions or traffic for fuel deliveries, need to be managed proactively and transparently; here, the QM standard's focus on low emissions is crucial. There's also the threat of failing to attract future private users, as the long-term economic model might depend on expanding the user base, and lack of interest or high connection costs for private users could be a hurdle. Lastly, institutional and bureaucratic hurdles, as experienced in the initial phase, can continue to be challenging and cause delays when navigating administrative processes and securing agreements across different public bodies.

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

3. Community Model

The development of the Gemona del Friuli district heating project, while currently spearheaded by public authorities, holds the long-term ambition of fostering a genuine community energy model. This section outlines the current operational context and then explores a more detailed hypothesis for a future cooperative structure, addressing organizational aspects, financial schemes, citizen participation, the project roadmap, and identified risks.

3.1. Current Organizational and Management Structure & Initial Financial Approach

In its present phase, the entities involved in the Gemona del Friuli project are primarily public authorities. These include the Municipality of Gemona (which owns key connected buildings like schools, gyms, and the swimming pool) and the Comunità Montana del Gemonese (Mountain Community). An athletic association is also among the initial beneficiaries. It's important to note that, excluding any utility company that might be contracted to build and operate the District Heating Network (DHN), none of the primary public stakeholders are profit-oriented in this venture. All the buildings initially connected, regardless of their specific ownership or financial standing, provide multiple fundamental services to the local community, a community whose reach extends far beyond the administrative borders of the single municipality.

The project's financial resources for capital expenditure are entirely public. Batch 1 is funded by governmental and EU Next Generation Europe (NRRP) funds through the Mountain Community, while Batch 2 is funded by the Municipality of Gemona and the Friuli Venezia Giulia Region. In this initial publicly-funded phase, heat will be sold exclusively to public entities. A key condition is that the heat price must be lower than the cost these entities would incur purchasing energy through standard public procurement platforms. With investment costs fully covered, the heat price for these public users will be set to cover Operational Expenditures (OPEX) – such as biomass procurement, quality management, and maintenance (Q&M) – and the long-term amortization of the plant, rather than generating profit.

3.2. Envisioned Future Community Model: A Cooperative Approach

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 integrate various local actors and foster broader community participation, especially as the network potentially expands to include private users. This aligns with the principles explained in resources like the LIFE Climate Positive toolkit, the local trainings and webinars and the Sherwood articles, which emphasize the importance of local strategies and associative models for managing territorial resources like forests.

Potential Legal Form and Stakeholders

The most promising legal structure appears to be a multi-stakeholder cooperative. This cooperative could bring together:

- Local Forestry Companies / Biomass Producers (Production-Side CER): This crucial component could take various forms, drawing inspiration from the associative mechanisms detailed in the LIFE Climate Positive toolkit. The process of establishing such a "Forestry Community" would ideally follow a comprehensive, structured approach.

  It would begin with a thorough understanding of the local context, involving an initial analysis of the territory, mapping forest areas, clarifying land ownership patterns (which are often fragmented), and

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

carefully assessing the needs and the willingness of both public and private forest owners to engage in collaborative efforts. Following this, clear and shared objectives for the association would need to be meticulously defined. These goals could range from ensuring a reliable and consistent supply of certified biomass for the DHN, to promoting sustainable forest management practices in line with recognized standards like PEFC/FSC, improving overall forest maintenance and health, creating valuable local employment opportunities, and actively enhancing vital ecosystem services. A cornerstone of this process would be proactive involvement and transparent communication with all potential members. This would entail organizing workshops, information sessions, and ongoing dialogues to build trust, foster a collective vision, and address any concerns. Only then, based on the specific local context and the agreed-upon objectives, would an appropriate associative legal form be chosen. Italian law provides a spectrum of options for forest owner associations, including Consorzi Forestali (Forestry Consortia), which are often public-private partnerships suited for coordinating harvesting and silvicultural activities; Associazioni Fondiarie (Land Trusts/Associations), voluntary groups aimed at overcoming land fragmentation by pooling land for joint management; Cooperative Agricolo-Forestali (Agricultural-Forestry Cooperatives), which can directly manage harvesting, processing like chipping, and marketing of forest products including biomass, with members sharing in the economic benefits; and Accordi di Foresta (Forest Agreements), which are contractual arrangements for collaborative forest management. Other forms, such as temporary associations of purpose (ATS), might also be considered for specific projects.

Once the legal form is selected, the next critical phase involves defining the statute and internal regulations. These foundational documents would meticulously outline the governance structure, operational rules, member rights and responsibilities, and decision-making processes. This would be followed by detailed economic and financial planning, including the development of a robust business plan that estimates costs (for management, harvesting, administration) and potential revenues (from biomass sales, payments for ecosystem services, etc.), alongside identifying potential funding sources or investment needs. With these elements in place, the formal constitution of the association would occur, likely involving a notarial act for structures like cooperatives or consortia. Subsequently, the focus would shift to the organization of activities and ongoing management. This involves setting up efficient operational structures, clearly defining roles within the association, meticulously planning forest management activities such as harvesting schedules and silvicultural treatments, and managing contracts for services and sales. Crucially, a system for continuous monitoring and evaluation would be implemented to regularly assess the association's performance against its economic, environmental, and social objectives, allowing for adaptive strategies as needed. Finally, to maintain engagement and promote the model, the association would prioritize communication and dissemination of its results, sharing successes, challenges, and lessons learned with its members and the broader community. The chosen associative form would ultimately define the specific governance, member responsibilities, and benefit-sharing mechanisms, ensuring their collective role in the sustainable harvesting of local wood, the production of certified wood chips (meeting BiomassPlus quality standards for fuel), and guaranteeing a reliable, short-supply-chain feedstock for the DHN plant. This comprehensive approach directly addresses the need for local resource valorization and could provide stable, long-term work for local operators.

- DHN Operator (Management/Operational CER): The cooperative itself could potentially take on the technical operation and management of the DHN, or it could contract a specialized third-party operator (ESCo or utility). If managed by the REC, it would require building or acquiring the necessary technical expertise.

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

- Municipality and Mountain Community: These public bodies, as initial promoters and owners of key infrastructure/land, could be founding members or key partners in the cooperative, ensuring public interest alignment, facilitating administrative processes, and potentially providing ongoing support.
- Owners/Managers of Connected Buildings (Consumption-Side CER): 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, as the network expands, individual citizens could become members, not only as consumers but potentially as investors in future expansions through collective financing schemes, or as active participants in the cooperative's governance and community initiatives.

Governance and Citizen/User Participation

- A cooperative structure would inherently promote democratic governance (e.g., one member, one vote). An elected board could represent the diverse stakeholder groups. Key decisions regarding heat pricing (within the established cost-recovery framework initially, potentially evolving with private users), service quality, investment in upgrades or expansion, and the distribution of any eventual surplus (e.g., reinvestment into the community, further heat price reduction) would be made through member participation in general assemblies. Clear bylaws and internal regulations would be essential to define membership rights and responsibilities, decision-making processes, and financial management. Citizens and final users could play concrete roles by:
  - Becoming members of the biomass supply cooperative (or the overarching multi-stakeholder cooperative), contributing to sustainable forestry practices and benefiting from local resource management.
  - Participating as consumer-members in the overarching DHN cooperative, influencing service and pricing.
  - Potentially investing in future expansions through community shares or local financing initiatives.
  - Engaging in awareness and educational activities related to local energy and resource management.

Collective Financial Schemes for the Cooperative Model

While initial CAPEX is publicly funded, a mature cooperative model could leverage various financial mechanisms:

- Membership shares and annual fees.
- Revenue from heat sales (initially covering OPEX and amortization; future sales to private users could generate a surplus for reinvestment or community benefit).
- Access to specific incentive schemes or grants available for established Renewable Energy Communities.
- Community-based financing (e.g., crowdfunding, local energy bonds) for future projects or expansions.
- Partnerships with ethical banks or financial institutions that support community-led initiatives.

3.3. Project Roadmap

The stringent deadlines imposed by PNRR funding, requiring the completion of the executive project by mid-2025, combined with significant bureaucratic delays, have severely limited the time available to properly

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

involve the local population in the initial planning process. These delays, particularly in securing approvals from central administrations, have compounded the challenge of adopting a fully participatory approach from the outset, leaving little room to engage stakeholders meaningfully within the set timeframe.

To address these constraints while preserving future community potential, a strategic decision was made to oversize the network within the technical and efficiency limits allowed by the project.

This approach aims to future-proof the system, enabling it to accommodate potential expansions and adapt to broader community needs in the future. The intention is to revisit more intensive citizen engagement and network integration strategies at a later stage, when the necessary time and resources can be allocated to ensure a thorough and inclusive process. In this way, the project attempts to balance the urgency of meeting funding deadlines with the longer-term goal of fostering genuine community participation and ownership.

Currently, the project for the thermal power plant and district heating pipeline has been assigned and the technical design developed. At this stage, the project proponents are awaiting confirmation of funds following some non-structural changes that impacted the final economic assessment. Once these funds are confirmed, the project can be tendered, and construction can commence. Importantly, all necessary permits for construction have already been obtained.

3.4. Risks

Several critical risks could affect the project implementation and the future development of the community model:

Financing Risks:

The most pressing current risk is the inability to fully offset the variation in project costs due to certain administrative requests made after the project's initial submission and costing. While Project Financing is being explored, its success is not guaranteed.

Supply Chain Risks:

There is no complete certainty about successfully implementing a fully local and resilient biomass supply chain due to potential administrative resistance or difficulties in organizing the "Forestry Community" effectively.

Demand Risks (Future Expansion):

While initial public users are secured, the success of future expansion to private users (crucial for a broader REC) depends on their willingness to connect, which can be influenced by connection costs, perceived benefits, and trust in the system.

Regulatory and Legislative Uncertainty:

The framework for Thermal RECs in Italy is not as developed as for electrical RECs. Future legislative changes or lack of specific support mechanisms could pose a challenge.

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

Governance and Management Capacity:

Establishing and managing a multi-stakeholder cooperative effectively requires clear governance, active participation, and potentially specialized management expertise, which may need to be developed or sourced.

Public Acceptance and Engagement:

Overcoming initial limitations in public involvement will require dedicated efforts in the future to build trust and encourage active participation in the REC.

Despite these risks, the foundational work, the secured initial funding, and the inherent benefits of local, renewable heat provide a strong basis for the project's implementation and its potential evolution into a more comprehensive community energy initiative.

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