In the industrial sector, improving the efficient coupling of different energy demands (electricity, heating, and cooling) is key to sustaining decarbonization efforts, enhancing system flexibility and cost savings. This work is part of the Horizon Europe FLEXIndustries project, which is founded on a holistic strategy for deploying energy efficiency and flexibility solutions across six industries, with improved integration into energy networks.

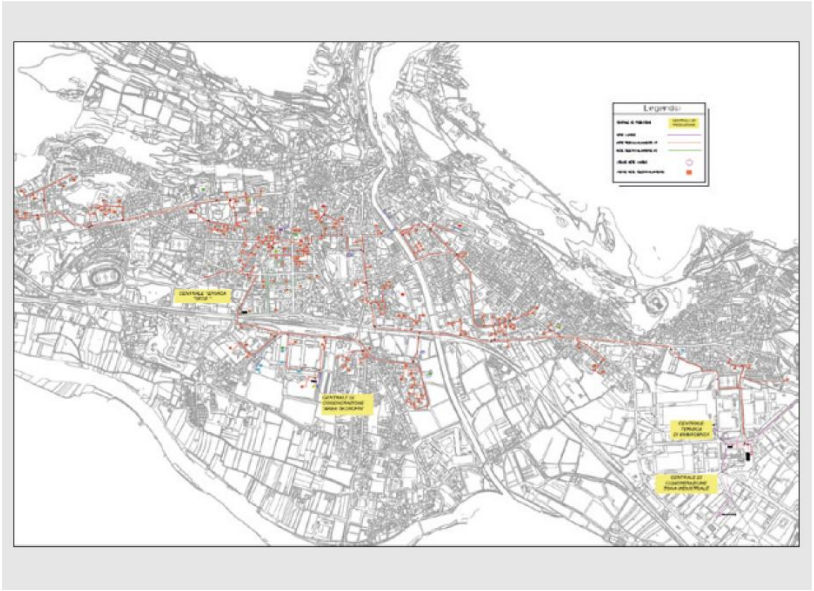
The Italian demonstrator is the pharmaceutical company SUANFARMA Italia located in Rovereto (TN, Italy). The industrial facility is characterized by energy-intensive production processes and by several energy services and utilities demands, including electricity, heating, cooling, and technical gases. Its complex energy system, constituted by multiple energy vectors, combined with its proximity to the district heating (DH) serving the city of Rovereto (operated by Novareti), makes it an ideal site to showcase the full potential of synergic collaboration between companies that share decarbonization efforts. Specifically, on one side the pharmaceutical site's need for process cooling (10 °C) and on the other side the district heating's need for hot water (90°C) aligns seamlessly with the deployment of a double effect (MW-scale) high-temperature heat pump for combined heating and cooling production.

The proposed project is a flagship example of sector coupling, effectively linking industrial cooling and urban heating demands. It features an innovative, industrial high-temperature heat pump specifically designed for environments with strict safety standards, including the use of a non-flammable (classified as A1) refrigerant and with a low GWP of 239. Its ability to meet both the 90 °C heat demand of the district heating network and the 10 °C cooling requirement of pharmaceutical processes with a single compression stage is technically advanced and uncommon. Designed and manufactured by HiRef as part of the FLEXIndustries project consortium within the Italian cluster coordinated by Fondazione Bruno Kessler, the heat pump delivers 0.99 MWth of cooling at 10 °C and 1.25 MWth of useful heat at 90 °C.

Figure 1: High temperature double effect heat pump at the Suanfarma Italia industrial facility

The heat pump system was commissioned on May 15th 2025, and the commissioning of the district heating (DH) connection is expected by the end of May 2025. Once fully operational, the system will supply, during the period from 01st of June 2025 to 31st of May 2026, 3.9 GWh/year to the DHN and 3 GWh/year of useful cooling to the industrial site.

Novareti owns and manages the district heating system of the city of Rovereto in Italy (18 km of network and 177 users), which includes various heat production plants and two heat distribution networks, one with superheated water (115-65°C) and one with hot water (90-60°C).



The cogeneration plants called “Cogenerazione Zona Industriale” and “Cogenerazione Tecnofin”, in addition to an emergency heating plant, guarantee the energy needs of most of the public users, and many private users, of the city of Rovereto. The heating plant called “Sede” also satisfies the energy needs of the users of the district heating network created by the Azienda Servizi Municipalizzati (ASM) of Rovereto back in 1985, taking part of the energy from the main district heating network created in the late nineties of the last century.
The two cogeneration plants in Rovereto, fueled by natural gas, produce combined and simultaneous electricity and thermal energy. The latter is fed into the district heating network in the form of superheated water and conveyed to end users for sanitary uses and for winter air conditioning.
The various heat production plants are equipped with modern systems for the continuous control of emissions into the atmosphere, a systematic energy control and continuous remote surveillance of correct operation.
During 2020, the first phase of the renovation of the plant “Cogenerazione Zona Industriale” was implemented, with the installation of a new 4.5 MWe and 4.5 MWth cogenerator (in operation from 2021), replacing the previous 15 MWe gas turbine-based cogenerator. In 2021 the renovation was completed with the replacement of 3 diathermic oil boilers, with a total useful 25 MWth, to produce steam, with two direct flame boilers by 8 MWth each one, to produce this time superheated water.
Of importance for the management activities and possible expansion of the district heating network was the start of the calibrated thermo-fluid dynamic modeling of the existing network, with the aim of evaluating the residual energy transport capacity and thus optimizing its fluid distribution.
In 2023, the project to refurbish the high-efficiency cogeneration unit of the plant “Cogenerazione Tecnofin” was implemented, with the replacement of the natural gas internal combustion prime mover and the related electric generator. In addition, a heat pump was installed to recover a portion of the thermal energy deriving from the cooling of the combustible mixture, which was previously dissipated into the environment.

1. Network Overview:
    - Network Location: Rovereto (Italy)
    - Primary Thermal Power Plants:
        - Plant: CT-1 Centrale termica sede
        - Plant: CT-2 Cog. Zona Industriale
        - Plant: CT-3 Centrale termica di emergenza
        - Plant: CT-4 Cog. Area Tecnofin

2. Plant Details:
        - CHP Engines: CT-2 Cog. Zona Industriale
            - Electrical Power: 4.5 MW
            - Thermal Power: 4.5 MW
        - CHP Engines: CT-4 Cog. Area Tecnofin
            - Electrical Power: 2.4 MW
            - Thermal Power: 2.3 MW
        - Boilers:
            - Boiler CT-1: 4.9 MW
            - Boiler CT-2: 16.0 MW
            - Boiler CT-3: 19.0 MW
            - Boiler CT-4: 10.0 MW

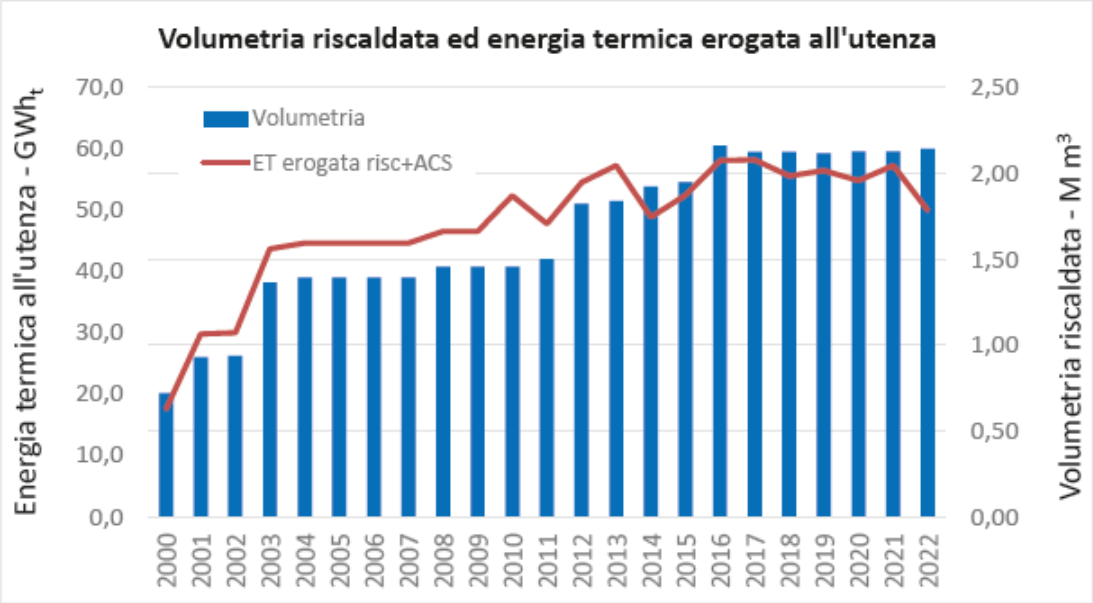
CENTRALI DI PRODUZIONE DELL'ENERGIA TERMICA [denominazione, tipologia, anno di entrata in servizio]

	Denominazione	Tipologia	Numero di unità	Potenza totale MW_e	Potenza totale MW_t	Anno di installazione
CT-1	Termica Sede	Caldaie di integrazione e riserva	3		4,883	1985
CT-2	Cog. Zona Industriale	Motore Alternativo a Gas	1	4,502	4,504	2021
		Caldaie di integrazione e riserva	2		16,000	2021
CT-3	Termica emergenza	Caldaie di integrazione e riserva	2		19,000	2020
CT-4	Cog. Area	Motore Alternativo a Gas	1	2,433	2,314	2008
		Caldaie di integrazione e riserva	2		10,000	2008

        - TES Unit: 0 m^3
        - Operational Season: Year-Round
        - Fuel Type: Natural Gas and Electricity

3. Energy Supply and Demand:
    - Peak Thermal Power: 30.5 MW
    - Yearly Energy Supply: 50.0 GWh/y
        - From CHP Units: 57%

- From Boilers: 43%



ENERGIA TOTALE EROGATA ALL'UTENZA	Residenziale (MWh)	Terziario (MWh)	Industriale (MWh)	Totale 2022 (MWh)
Energia termica	21.055	27.492	1.446	49.992
Energia frigorifera	-	-	-	-
Energia per processo				

Anno 2021 (MWh)	Incremento (MWh)
57.283	-7.291
-	-

- Network Length:
  - Total: 24 km
  - Without Final Connections: 18.4 km

ESTENSIONE RETE - Scavo	Tm/Tr (°C)	2022 (km)	2021 (km)	Δ (km)
A vapore				
Ad acqua surriscaldata	115-65	17,533	17,533	0,000
Ad acqua calda	90-60	0,852	0,852	0,000
Totale rete calda		**18,385**	**18,385**	**0,000**
Ad acqua fredda				

Extension miles refer to actual network miles, net of utility connections and disconnections.

- Number of Users: 177

SOTTOCENTRALI D'UTENZA	2022 (N.)	2022 (MW)	2021 (N.)	Δ (N.)
Per solo riscaldamento	60	17,426	58	2
Per riscaldamento ACS	117	37,04	117	0
Per usi di processo				
Totale	**177**	**54,466**	**175**	**2**

the number of utility subcenters indicates the actual number of active served facilities. The power of the utility subcenters shown is the contracted power.

VOLUMETRIA UTENZA	Residenziale (m^3)	Terziario (m^3)	Industriale (m^3)	Totale 2022 (m^3)	Anno 2021 (m^3)	Incremento (m^3)	Fabbisogno specifico kWh/m^3
Volumetria riscaldata	796.169	1.179.132	167.910	2.143.211	2.125.608	17.603	23,33
Volumetria raffrescata							

4. Operating Temperatures:
   - Winter:
     - Supply Line: 100°C
     - Return Line: 62°C
   - Summer:
     - Supply Line: 86°C
     - Return Line: 57°C

5. Emissions and Energy Source:
   - Equivalent Emission Factor (Year): 448 gCO2eq/kWhth
   - Energy Supply Sources:
     - From Cogeneration: 57%
     - From Renewables: 0%