The International District Energy Climate Awards 2011

Awarding those who lead the way in providing clean, sustainable, district energy solutions.

1. Cover page

1.1. Name and location of the system.
Torino District Heating System (Torino Sud – Torino Centro – Torino Nord)

1.2. Name of the owner and type of ownership.
IREN ENERGIA S.p.A. (100% Gruppo IREN)
AES Torino S.p.A. (51% IREN ENERGIA, 49% ITALGAS)

1.3. Name, address, phone number & e-mail of the person submitting the application.

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2. Motivational letter

The district heating development Plan in Torino began from the 1980 as established in the strategic targets of Piedmont Region, Torino's Provincial Administration and coherently with the Torino's Municipal Energetic Plan.

During these 30 years, IREN Group has designed and built the "Torino Sud – Torino Centro" district heating network that, matched with the new project "Torino Nord", will provide district energy to more than 60% of the city and 560.000 inhabitants.

IREN Group and AES Torino jointly propose their candidacy to the "The International District Energy Climate Awards 2011" with **an expansion project of the district heating system** (begun in 1980) that has as milestone the construction of a new 400 MW CHP plant called "Torino Nord" that will be put in service from the next heating season.

3. Summary and logos

IREN Group is a multi-utility quoted on the Italian Stock Exchange born 1st July, 2010 from the joint venture of IRIDE Group and ENIA. It operates in several sectors as electrical energy, district energy (1st Italian operator), gas networks, water networks, trash services and service management to municipalities.

AES Torino was born from the joint venture of AEM Torino (nowadays IREN Group) and ITALGAS S.p.A. in order to actuate the project of the Torino's Municipality to manage the public services (gas and district heating distribution) in an integrated way.

IREN and AES Torino have jointly realized a project of development of the district heating network that, during years, has reached about 410.000 inhabitants (45% of Torino) producing roughly the 90% of the needed thermal energy with high efficiency CHP Plants and with savings of about 189.000 Tep and with a CO_2 emission reduction of 438.900 tons.
With the new CHP plant the district heating system will reach 560.000 inhabitants (60% of Torino).
Thanks to this energetic infrastructure Torino is a candidate in the SMART CITY European programme.

IREN Energia logo

AES Torino logo

4. Application description

IREN Group is a multi-utility quoted on the Italian Stock Exchange born July the 1st, 2010 from the joint-venture of IRIDE Group and ENIA. It operates in several sectors as electrical energy (production, distribution and sail), district energy (1st Italian operator), gas network (distribution and sales), water network, trash services and service management to municipalities.

IREN is managed as an industrial holding with head quarter in Reggio Emilia, operational quarters in Genova, Parma, Piacenza and Torino and other single business companies.

Thanks to its assets, the large capital expenditure involved, the achieved leadership in all its business areas and, above all, to its territorial root, IREN is now the 2nd multi-utility Italian group and the 1st one as far as district heating is concerned.

AES Torino was born from the joint venture of AEM Torino (nowadays IREN Group) and ITALGAS S.p.A. in order to actuate the project of the Torino's Municipality to manage the public services (gas and district heating distribution) in an integrated way.

AES Torino, established in march 2000, became operational on the 27th September 2001 with the conferring of this main assets:

- Torino gas network (from Italgas)
- District heating networks of Torino and Moncalieri (from AEM Torino: nowadays IREN Group).

AES Torino has as main activities the natural gas distribution and the transportation, the distribution of heat for the district heating network and the operation & management of the district heating network. The main area of intervention is the Torino's urban area, in this area AES is the technical reference for the Public Administration toward a social and economical development of the Community.

4.1. System history

The district heating development project in the Torino's urban area began from the 1980 as determined in the strategic targets of Piedmont Region, Torino Provincial Administration and coherently with the Torino's Municipal Energetic Plan.

During these decades, IREN Group has designed and built the "Torino Sud – Torino Centro" district heating network that, matched with the new project "Torino Nord", will provide district energy to a total heated volume of 54.000.000 m^3 in Torino and a total of 59.000.000 m^3 in the municipal area.

In the 1980 AEM Torino (nowadays IREN Group), thanks to a technical leading working group with skilled people from Torino's Polytechnic and ENEA (National Agency for Energy and new technologies), determined the ***"Strategic plan for the development of the cogeneration and the district heating in Torino"*** (see Figure 1) that established that:

- cogeneration should be established in two important production centers: one in the south (Moncalieri CHP Plant - see figure 4) and one in the north of the city besides a possible connection of other CHP plants already existing in these areas;
- the district heating network should be designed with such criteria that allow, in the future:
    - the interconnection with a large diameter feeder (called transportation network) of the cogeneration centers;

- the possibility to exchange heat with other plants located in the area also the one used for storage and integration during the morning peak;
- the construction of a "distribution" network from some points (called thermal load centre) of the transportation network to connect the thermal users.

Thanks to the realization of this project Torino has now a district heating system from CHP plants that reached about 45% of Torino with a reliable scheme such in the most important "district heated" Cities.

Short history of the development of the DH-project in Torino

The First Strategic development plan for CHP and district heating in Torino is shown in Figure 1.

Le Vallette

In 1982 AEM Torino (nowadays IREN Group) succeed IACP in the management of an existing Heat only Boiler Plant that heat the "Le Vallette" district and built a new CHP plant with diesel generators.
This plant was then modernized in 1992 with a post-combustion system. Now this plant gives heat to about 3.000.000 m^3 (heated volume) and 30.000 inhabitants of the quarter.

Mirafiori Nord

In 1988, after the first experience in "Le Vallette" Plant, AEM Torino (nowadays IREN Group) built a new CHP Plant for district heating in "Mirafiori Nord" district.
This plant had a catchment area of 2.250.000 m^3 (heated volume) and 20.000 inhabitants and was the first core of the wider project of Torino Sud district heating network.
In 1999 this district network was connected directly to the Torino Sud DH network that now is an integrated system.

Torino Sud

The Torino Sud district heating network was put in service in 1994 and expansion by expansion reached, in Torino Sud area, 27.000.000 m^3 (heated volume) and 270.000 inhabitants with many large consumers like hospitals, trade show centers, etc.
For this reason Torino Sud DH network has, besides "Mirafiori Nord" Plant, two more point of integration and storage plants (HOB): "Moncalieri" HOB and "BIT" HOB.

Torino Centro

In 2001, after the joint venture with ITALGAS S.p.A and the establishment of AES Torino S.p.A., the district heating network and gas network development plans were revised in order to have an integrated plan of development that provide for a district heating development in two different areas of Torino called "Torino Centro" and "Spina 3" to reach 44.000.000 m^3 of heated volume.
To reach this goal:

- IREN Group:
  1. built a new CHP Plant so called "3° GT" (in service since 2005) in Moncalieri;
  2. repowered the old CHP plant in Moncalieri (in service since 2008);
- AES built the new district heating network with heat exchange substations (called "Torino Centro" about 10.000.000 m^3 of heated volume).

Then was also built a new integration and storage HOB plant "Politecnico" in order to reach the target of 36.000.000 m^3 (heated volume) and 360.000 inhabitants.
This new HOB plant was looked after above all from an architectural point of view and now is an important element of the modern Architecture in Torino.

Torino Nord

In 2006, seizing the opportunity and the targets of Torino's Municipality to further develop district heating network in the northern part of the City and foreseeing the ageing of Vallette CHP Plant, IREN Group determined to follow up on the district heating system development planned out in the '80 with a new project called "Torino Nord".

This project consist in:

- saturation of the "TORINO Centro" DH network;
- construction of new DH network in the North-West area of the city;
- build a new CHP Plant for 400 MW_{el} and 220 MW_{th}, fed by natural gas in the northern area of the city and disposal of the old "Le Vallette" CHP plant.

When this project will be finished the district heating system will heat 54.000.000 m^3 (heated volume) and 540.000 inhabitants more than 50% of the City.

The network extension will allow an optimum use of the Moncalieri CHP Plant. The put in service of this new plant is forecast for October 2011 for the heating season 2011-2012.

The metropolitan AREA project

During the evolution of projects and constructions in the Municipality's Area, Torino provincial administration (with backing of IREN Group and under the Piedmont Region's supervision) realized the "***Development Plan for district heating in the Metropolitan Area***" that:

- sets down guidelines to plan the future development of district heating both for the Municipality and the metropolitan areas;
- accommodates the IREN Group's plans born in 1980 to other private-enterprise ventures.

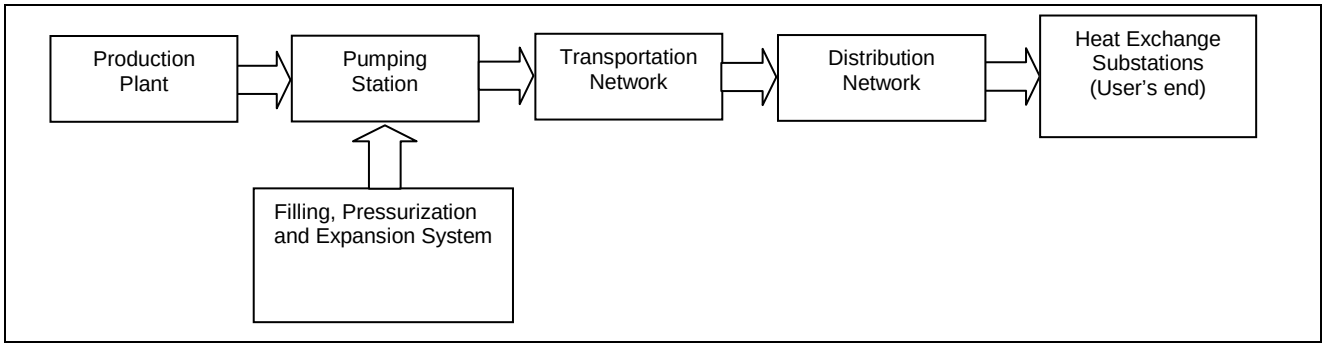
From this point of view some new strategic ventures like the Gerbido Incinerator and new facilities that can produce surplus of heat to put in district heating networks both in Torino and in the metropolitan area has become very important.

From this study outcrops the definition of "***integrated system***" for the Torino's metropolitan Area that can gather the synergies of these new projects and the existing ones (to develop before 2020) and can provide about 84.000.000 m^3 of heated volume (equal to 840.000 inhabitants) with a CHP high efficiency heat production and more than 80% of the needed thermal heat.

The actual District Heating System in Turin

The existing district heating network (2010) includes the following:

- pumping stations (with their filling, pressurization and expansion systems) in the premises of the production plants;
- heat transportation network;
- the heat distribution network;
- the heat exchange substations at the user's end.



The nominal pressure of the pipe system is equal to 1600 kPa. The maximum supply design temperature is 120°C, the return temperature is 70°C. The total length of the network is about 400 km of double pipelines, divided in transportation network (from DN400 to DN800 – 60 km) and distribution network (under DN400 – 340 km). The district heating network as roughly 3.650 point of connection (district heating substations).

Thermal power of existing system
The existing district heating system serves a user base equivalent to about 410,000 inhabitants with a peak load of about 1.000 MW. An example of a daily load curve are illustrated in the Figure 3.

The connected production plants have the following thermal capacity:

- Moncalieri 520 MW (cogeneration – 2x260 MW)
  141 MW (boilers – 3x47 MW)
- BIT 255 MW (boilers – 3x85 MW)
- Mirafiori Nord 35 MW (boilers – 2x15 MW+ 1x5 MW)
- Politecnico 255 MW (boilers – 3x85 MW)
  60 MW x 2,5 h (3x800 m^3 stored)

The two CHP sections of Moncalieri plant are in operation since 2005 (the first one) and 2008 (the second one). The "Mirafiori Nord" Plant is in operation since 1988, "BIT" (heat only boiler) plant since 1994 and "Politecnico" (heat only boiler) plant since 2005.

Regulation of the Network
The network's delivery capacity is determined by the user by the opening of of a regulation valve present in the heat exchange substation.
Base heat production happens in cogeneration while peaks are covered by heat from the boilers.

Pumping System
Water circulation in the system is guaranteed by a series of pumping stations located in each production plant and by some booster pumps located along the network. The pumps guarantee a minimum Δp of 350 KPa in areas which are unfavourably served by the heat transport network.

Filling, Pressurization and Expansion System
Each of production plants connected to the network (the Moncalieri, Politecnico, BIT and Mirafiori Nord plants) is supplied with a filling, pressurization and expansion system which can operate autonomously or in conjunction with the other plants.
Taking into account the differences in altimetrical level, a system composed of pressurization pumps and expansion valves with a storage tank was set up which regulate on the basis of a pre-defined average pressure value.

The "Torino Nord" Project and Expansion of the Network
The objective of the "Torino Nord" district heating project is the expansion of heating service in the northern area of Torino and foresees the following:

- a natural gas-fed cogeneration thermoelectric plant called "Torino Nord";
- a pumping station with a filling, pressurization and expansion system installed at the "Torino Nord" plant;
- the expansion of the district heating network and the construction of a repumping station
- the construction of a heat exchange substation complete with a pumping station for the "Le Vallette" area.

The "Torino Nord" network will be interconnected with the existing network described in the previous point. Thus, a single system which will serve the equivalent of 560.000 inhabitants with a peak heating power of 1.350 MW, will be obtained.
The expected combined load curve and an example of a daily load curve are illustrated in the attachment.

The "Torino Nord" plant will have the following installed heating power:

- Torino Nord 220 MW (cogeneration – 1x220 MW)
  340 MW (boilers – 4x85 MW)
  120 MW x 2,5 h (6x800 m^3 reserve)

IREN Group carried out the preliminary design of the whole system with the help of Termis software. The project started in 2009 and the plant is expected to be operational in time for the 2011-2012 heating season.

4.2. Energy data

The electrical Energy cogenerated form the plants connected to the district heating network, during 2010, was 3.900 GWh.
The thermal Energy in the network, in 2010, was 1.700 GWh, and about the 90% was made with high efficiency CHP plants. The thermal energy to the users (with a net loss of 14%) was 1.500 GWh.

The main fuel is natural gas (in 2010 about 810.000.000 m^3); the "Vallette" plant (will be out of operation in 2011) used also gasoline (80 t) e oil (10.300 t).

The primary Energy used in 2010 is 8.000 GWh.

The 2012 waited results (with the new project of Torino Nord) are:

	2010	**2012**
Electrical energy (CHP)	3.900 GWh	5.900 GWh
Thermal Energy in the network	1.700 GWh (90%CHP)	2.200 GWh (96% CHP)
Thermal energy to the users	1.500 GWh	2.000 GWh
Primary Energy used	8.000 GWh	11.700 GWh

4.3. Environmental benefits

Based on the 2010 district heating system energetic data and with the foresee for 2012 (with the new Torino Nord CHP plant in service) the environmental benefits acquired are:

	2010	**2012**
Saved primary energy	189.200 Tep	269.600 Tep
CO_2 emission reduction	438.900 t	627.100 t
NO_x emission reduction	560 t	800 t
SO_x emission reduction	900 t	1.350 t
CO emission reduction	570 t	830 t

4.4. What makes our programme outstanding and innovative

The most important features of the TORINO SUD-CENTRO-NORD project are:

- Plan of the project with the Municipality, Piedmont Region and Torino's Provincial Administration since 1980 and the skill to pursue this planning during years;
- Strategic agreement with the gas distribution Company for a synergic plan for the development of the district heating system;
- Valuable architectural integration of Politecnico HOB Plant in a central area of the City (see fig. 5-6);
- Technical and administrative skills to design and manage the very high changes in hydraulic and thermal load in the network during peak-hours (see Fig. n. 3) with suitable pumping systems and heat extraction from CHP plants.

4.5. How the programme has improved the quality of life of your community

Torino's district heating system is a significant element for the development of the City itself and for the improvement of the life condition of the inhabitants from many points of view, but above all for:

- Energy: savings and better primary energy resources use (above all Natural gas);
- Environment: reductions in gas emissions (above all CO_2) both locally and nationally as settled in Kyoto agreement;
- Employment: improvement because of the remarkable investments for the construction of plants, network and DH-substations;
- Economy: with big savings on energetic consumptions and, for this reason, on foreign fuel import (oil and gas) improvements on national balance of payments can be reached. District heating helps also users to save money both for energetic consumptions and for managing and maintenance of the DH-substations.

4.6. What the challenges were our faced and how they were overcome

The challenges faced and won for the construction of the District Heating in Torino were:

- the beginning of the project was in 1980 when district heating was likely unknown in Italy so there were a certain distrust of this kind of service. To beat this distrust AEM Torino (nowadays IREN Group) had study suitable commercial proposals and had to maintain very high efficiency in operation and service to the users;
- construction and insertion of plants (even if HOB plants) in central areas of the city (i.e.: Politecnico Plant see figure 5 – 6). The success was possible with an efficient action of information, sharing and involvement of inhabitants.
- Cover of the daily thermal load with very high flow and power transients because of the users' habits (not yet modified even if there were different efforts were made to) that needs suitable pumping systems and very reliable heat extraction system.

4.7. How the programme was financed

The development of the district heating project II was financed both with IREN Group own funds, with European financing trough BEI and national financing.

5. Attachments

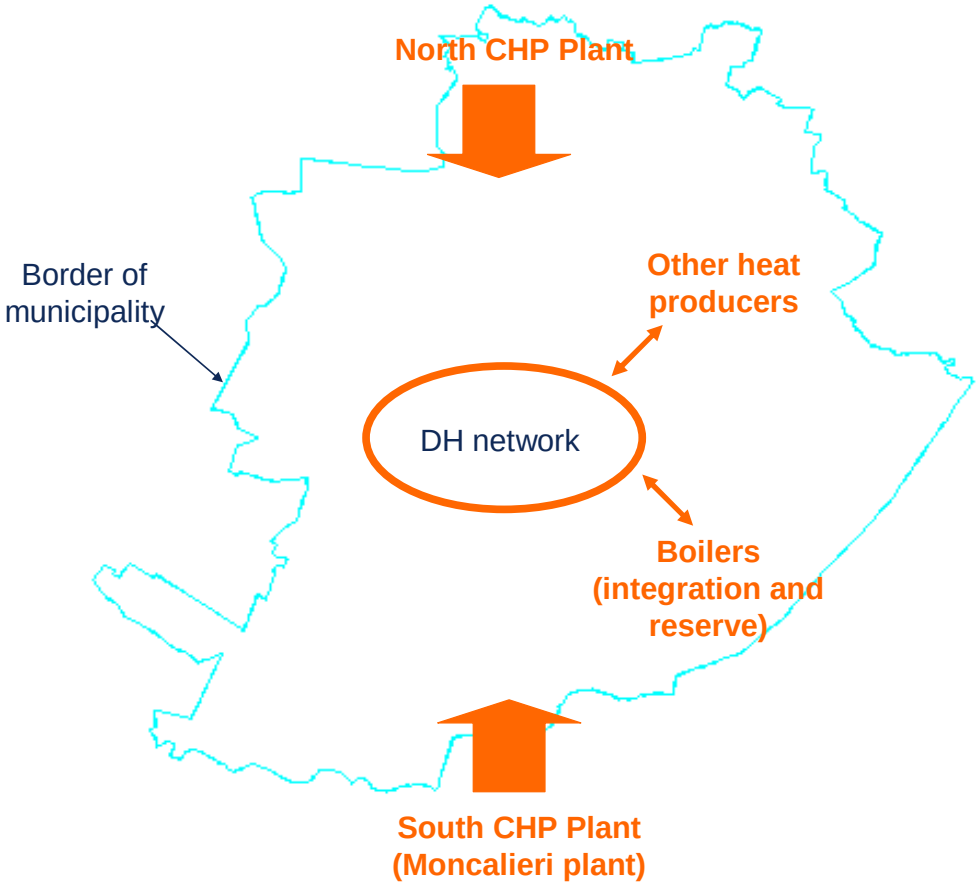


Figure 1 – First Strategic development Plan for CHP and district heating in Torino

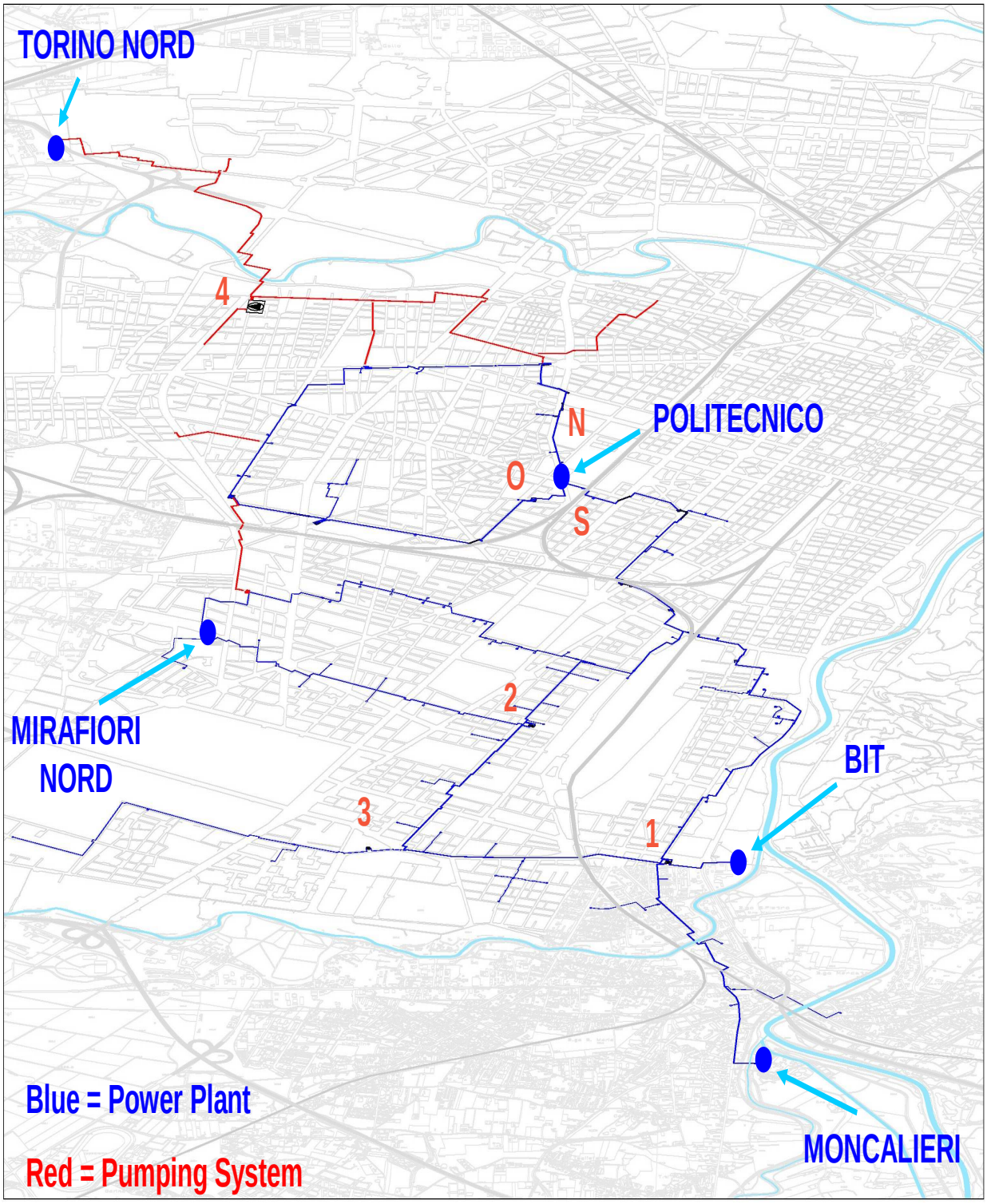


Figure 2 – Torino district heating network's scheme

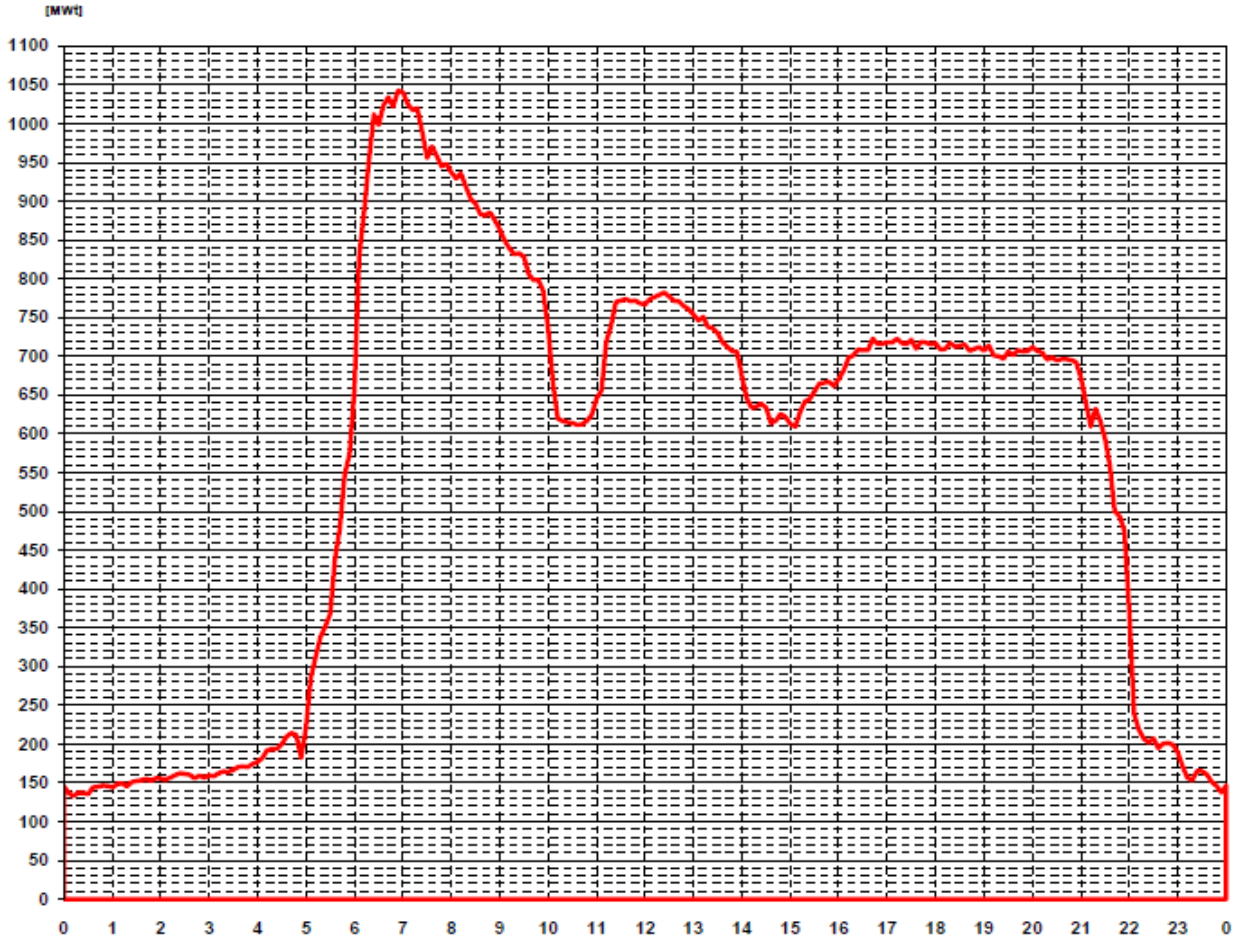


Figure 3. Maximum Daily Curve 2010 (18th December 2010 – Thermal Energy: 13.515 MWh, Max. Thermal Power: 1.043 MW, Max. flow: 15.256 m^3/h*, Min. external temperature: -9°C)*

Figure 4 – "Moncalieri" CHP Plant

Figure 5 – "Politecnico" Heat only Boiler Plant (Integration and storage)

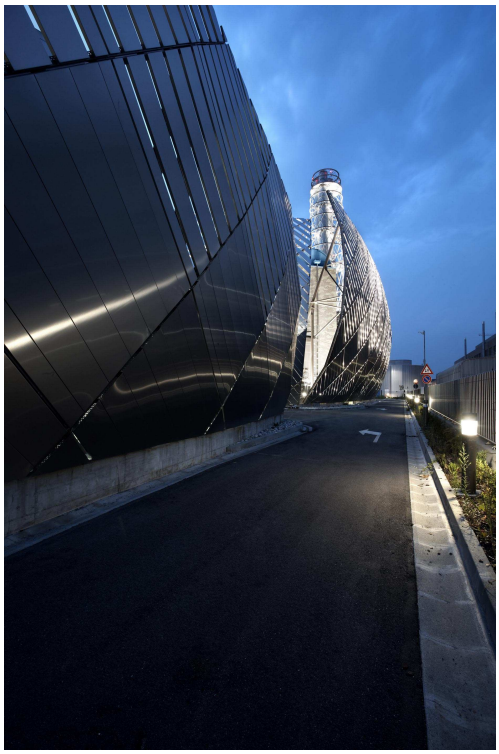


Figure 6 – "Politecnico" Heat only Boiler Plant (Integration and storage)

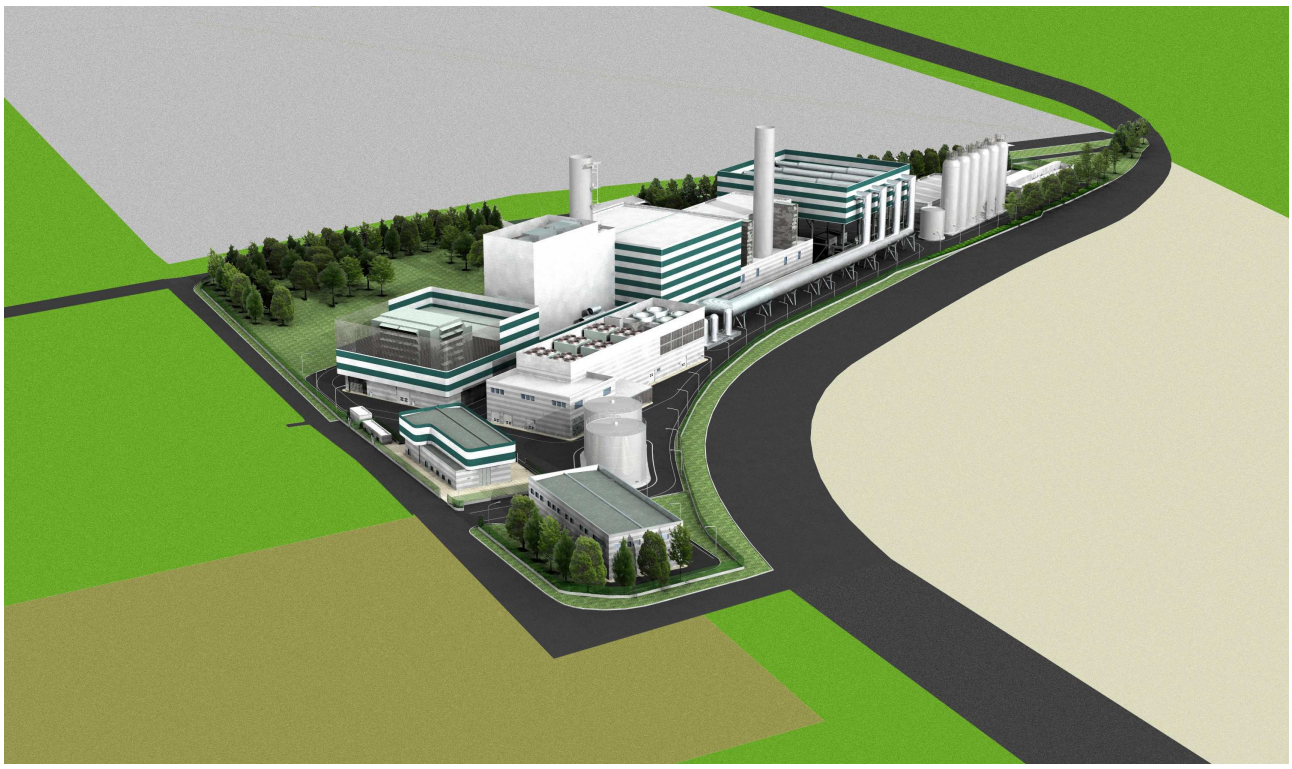


Figure 7 – CHP "Torino Nord" Plant (in service from october 2011)

5.2. Letter of support from the community served

The original letter (in Italian) will be sent in the coming days.

Egr. Sig.
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Oggetto: The International District Energy Climate Awards 2011

The district heating development in the Municipality of Torino is a City Administration target since 1980 and enabled to achieve valuable goals in sustainable development, energy efficiency and air quality improvement.

The project “Torino District Heating System”, presented to *The International District Energy Climate Awards 2011* shows what done and the benefit achieved in line with local and national Policy to reach the European 2020 targets.

Now Torino is the 1st District Heated City a record that, thanks to “Torino Nord” Project now under construction, is bound to consolidate yet since 2011, year in which Torino is candidate to become European Smart City.

Best Regards.

Torino, 31 marzo 2011

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