Milan, Italy

Improving the district heating system with renewable energy and energy efficiency

ICLEI Local Governments for Sustainability

In order to meet its energy demands for heating and cooling, the city of Milan decided to expand the public district heating system with co-generation, combined heat and power plants (CHP). In addition, the city wished to increase the percentage of renewable energy used and its waste-to-energy solutions in order to reduce greenhouse gas (GHG) emissions. Through the application of high-efficiency technologies such as groundwater heat pumps, excellent results were achieved in improving efficiency and producing a steady energy supply.

117 ICLEI Case Studies May 2010

Abstract

The first district heating network in Milan was built in the early 1990s. A review of the system in 2006 showed the need for improved efficiency and a cleaner fuel source. A new plan for expansion was developed: the area covered by the network should be expanded and the network, combined with innovative technologies for thermal power production, would meet a larger percentage of heat and electricity demand. This approach formed the core of the network expansion plan developed in cooperation with the City of Milan and the A2A group, the city co-owned energy utility company.

The importance of an efficient and sustainable district heating system

Improving the efficiency of district heating systems and increasing the amount of energy produced from renewable sources offers multiple benefits for the city of Milan. In 2005, a third of the city's energy demand was used for residential and commercial heating purposes. This meant improved efficiency would result in saving not only resources but also money. Milan's geographic location means the surrounding mountains prevent the particulates in air pollution from dispersing. It is thus necessary to move away from polluting fuels to cleaner, renewable energy options. Furthermore waste-to-energy plants and ground water heat pumps offer the chance to improve energy security. Money saved on reduced energy costs could in turn be reinvested into the process to further improve energy stability and independence from imported fuels.

The Milan context

Milan forms the centre of the largest Italian metropolitan area, with more than 3.5 million inhabitants. It is situated in the most important production and strategic areas of Italy, with high-tech innovation companies, business enterprises and financial institutions, as well as an administrative centre. In order to address the issue of climate change, Milan has joined multiple international climate initiatives, including ICLEI's Cities for Climate Protection (CCP) Campaign, the ICLEI Local Renewables Initiative, the Covenant of Mayors in 2009 and the Sustainable Energy Europe Campaign (SEEC). In February 2009 Milan set the goal to achieve a 20% reduction of CO_2 emissions based on 2005 levels by 2020.

Population / Land area

1.3 million (2008) / 182 km²

Municipal budget

14 billion € (2008)

Local economy

Financial institutions, luxury goods, industry

Role of city in region

Administrative and commercial centre of the region

ICLEI supports and strengthens local governments which promote the generation and supply of renewable energy and energy efficiency in the urban environment.

CaseStudy117Milan.indd 1 11.05.2010 12:25:07

Case Study

Milan expands its high-efficiency district heating system – contributing to a stable, long-term urban renewable energy policy

The original heating network system in Milan was established in the 1990s. It was comprised of four power plants and served a population of 130,000 inhabitants. In 2006 it was decided to expand the system. The network heating development plan outlines ambitious targets to be reached by 2015, namely to extend the network to 240 km and serve 730,000 inhabitants. The thermal power provided by the city network would increase to 1,450 MWt, thereby actively reducing CO_2 emissions by about 163,000 per year.

These results will be achieved by constructing eleven new heating power plants (three of which are already operational as of May 2010) and expanding the four existing plants. The plants will use co-generation and a combination of co-generation and groundwater heating pumps to increase their efficiency and the percentage of energy created by renewable sources.

The municipal GHG reduction policy addresses two main issues:

- The reduction of direct emissions largely due to heat production in buildings, and
- The reduction of indirect emissions through the cogeneration of heat and electricity. Here the heating network plays an important role, avoiding the need to install oil heating systems where, due to safety reasons, methane-run systems may not be installed.

Photo: City of Milan

View of the Piazza del Duomo in Milan

Results

The measures implemented have been monitored since the end of 2006. By 2009 the following results were achieved:

- An additional 98,000 inhabitants were connected to the pipeline network, and the system now serves approximately 225,000 people;
- The network has been extended by 45 km, with a new total length of 86 km;
- 455 MW thermal power production;
- 30,500 tonnes CO2 emissions saved per year (based on average emissions generated in substituted boilers); and
- Reduction of 3 tonnes of particulate matter with a diameter less than or equal to 10 micrometers (PM10) per year.

The local media provided extensive coverage of the project, which improved the level of environmental awareness among citizens. A high number of citizens supported the project and also became district heating energy users. Many citizens also support the municipal policies, and also approve of the CHP system which is economically self-sustainable and thus no subsidies are needed.

CaseStudy117Milan.indd 2 11.05.2010 12:25:08

Lessons learned

Two key elements need to be considered well in advance – preferably beginning in the project conceptualisation stage:

1. Citizens need to be involved throughout the process, in particular they need to be provided with useful, concise information and updates, and
2. Coordination between all levels of planning is essential to ensure smooth implementation.

Various departments within the municipality and multiple stakeholders were involved in the process of expanding the district system. The development of a project group with all departments involved was useful. The *Programmi Integrati di Intervento* or PII (Intervention Integrated Plan) works to assess and ratify big urban development plans and involves the municipal departments related, such as the Territorial Development Sector and the Infrastructures and Public Works sector.

Credit: Giovanni Dall'Orto

View of the Via Dante in Milan

The positive resonance from citizens was due to them being informed of an eventual improved quality of life. The implementation of such a project involves changing infrastructure by installing a network of pipelines that lead to buildings where the energy is used. It implies interruptions in sensitive areas, often also in important connection roads. In such a city as Milan, where urban congestion is prevalent, road works are normally 'unwillingly accepted' by citizens. However, where it is linked to an expected positive change in their lives, there seems to be a higher acceptance for the temporary discomfort caused in the installment period.

The involvement of different levels of governance and stakeholders was a key factor in the successful development of the network heating policy. The collaboration between the A2A group and the City of Milan led to common objectives and methodologies, as well as a faster and clearer realization of the plan. In this regard the cost of laying down the pipeline net have been optimised, and transport disruption has been reduced.

A smart partnership between technologies

The utilization of groundwater heating pumps coupled with the co-generation technology represents the most innovative part of the project which enables a high level of efficiency.

The groundwater existing under the city has a constant temperature during the entire year. The heating pump absorbs heat from the water, which is colder, and transfers it to a higher temperature fluid. During the winter, hot water is directly used for heating in buildings, by means of heat exchangers.

On the other hand co-generation enables high levels of efficiency compared to traditional boiler systems. One of the best available technologies involves the use of waste burning plants which supply thermal power through the incineration of waste.

Coordination between involved actors: the Citylife Project

The historic neighbourhood "Polo Fieristico" in Milan is currently being renovated at the same time as a new exhibition complex is being built just outside Milan. Besides spectacular skyscrapers, public facilities and cultural venues, the quarter will be connected to the district heating program. The A2A group and Citylife, the company in charge of designing and implementing the renovation project, submitted a common agreement. It aims to supply the neighborhood with heating and cooling through the incineration of waste in winter using hot water coming from the waste burning plant and in summer through absorption refrigeration.

www.city-life.it/en

CaseStudy117Milan.indd 3 11.05.2010 12:25:08

Replication

The extension of the district network in Milan is an example that can be followed by many cities that need a stable heating and electricity source and need to reduce air pollution in the city centre.

What has been an important factor in the success of the project was the fact that the municipality of Milan together with the municipality of Brescia are the main shareholders of the local energy operator, A2A. This ensures that the local energy strategies of the utility are aligned to those of the municipality, easing the path to quick implementation.

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The Local Renewables project

The German Federal Ministry for Economic Cooperation and Development (BMZ) through the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH has funded the Local Renewables project. The project aims to support and strengthen local governments in promoting sustainable energy and to become model cities in their national and regional contexts. While Model Communities in India and Brazil received guidance and funding, the European cities of Bonn, Freiburg, Malmö, Milan and Växjö served as Resource Cities and provided their expertise.

www.iclei.org/local-renewables

Sources

- Sustainable Energy and Climate Action Plan, Municipality of Milan. Executive Summary, Dec. 2009

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