

# Biomass Use In Brianza

Promotion of district heating systems in the district of Brianza, Italy

Approved by the European Commission under the Sixth Framework Programme

Boccardi A. (1), Cozzini M. (2), Dall'ò G. (1), Dal Verme M. (3), Jossart J. (4), Moretti L. (5), Riva G. (3)



1. Associazione Rete di Punti Energia, Milano (Italy),
2. Ingea Consulting S.r.l., Milano (Italy),
3. CTI - Italian Thermotechnical Committee, Milano (Italy),
4. European Biomass Association - AEBIOM, Louvain-la-Neuve (Belgium)
5. Pubblidam S.r.l., Monza (Italy)



Ingea Consulting

## District of Brianza

The district of Brianza (province of Monza and Brianza) is a flat area with a surface of 363 km<sup>2</sup> and a population of 730,000 people, located just north of Milan, north of Milan, characterized by a **strong population density** accompanied by a pronounced environmental sensitivity. The district is historically one of the most dynamic and innovative industrial areas in Italy, having 120,000 people employed in the industry, out of which 12.5 which 12.5 % work in the **wood and furniture sectors**, that produce high quantity of biomass. Taking in consideration all these factors, a project started to develop and disseminate knowledge on the rational thermal utilization of biomass, both for heat for heat generation and for co-generation, feeding district heating networks. These goals constitute very important aspects of the European Union and Italian energy policy, in terms of least cost renewable energy exploitation, reduction of CO<sub>2</sub> emissions, energy supply security, energy efficiency and and environmental improvement at local level in highly polluted residential areas.

## Inventory on Heat demand

An analysis of the best opportunities to install district heating systems has been carried out:

- Among the 50 municipalities, selection of those counting more than 10,000 inhabitants
- Statistical analysis of the following parameters:
  - Population distribution density
  - Buildings with central heating systems
  - Presence of hospitals, schools and other public structures



## Biomass availability

Preliminary survey on material produced in Brianza, aimed to identify the suitable biomasses

Selection of the materials considering the following elements:

- National and European regulations
- Amount locally produced
- Quality, homogeneity

Analysis of the actual biomass market and evaluation of the amount of materials available for the purposes of the project

## Selection of technologies

A wide analysis of the proven and innovative available technologies, for combustion plants and for exhaust purification, pointing out the preferable alternative for the main technical challenges. The most interesting technology for small-scale biomass CHP plants in the power range of up to 2 MWe resulted to be the *Organic Fluids Rankine Cycle* (ORC), which has recently been developed and successfully applied specifically for district heating systems.



Characteristics of the materials	Origin of the materials	Availability at the actual market conditions (t/y)	Av. moisture content (%)	LHV d.m. (MJ/kg)	Energy content (GWh/y)
Virgin wooden biomass	Agricultural residues	900	40	15.7	2.2
	Vegetal wastes from gardens and parks	9,450	40	15.7	22.2
Treated wooden biomass	Woodworking, packing	31,150	15	16.7	119.6
<b>Total biomass for DH use</b>		<b>41,500</b>			<b>144</b>

This amount is roughly enough, in the climatic conditions of Brianza, to supply heat to residential buildings for about 32,000 people. **The long term potential may considerably increase, through a better biomass management.**

## Systems configuration

The search for the best opportunities to install district heating systems lead to three typical opportunities for district heating:

Integration of biomass heat into expansion of DH system of Monza (120,000 inhabitants), presently fed with 6 gas motor, with a total output of 6.1 MW electrical and 6.4 MW thermal. The potential heat demand increase is 300 GWh/year. This energy demand exceeds the biomass availability, whose role has to be limited to small cogeneration units for the base continuous production, in winter and summer, evaluated as 15 GWh/y for the first construction phase and 45 GWh/y at long term.

New DH system for the town of Lissone, 36,000 citizens, centre of the woodworking manufacturing sector. It represents the typical distributed DH with small capacity CHP, which consumes the locally produced biomass and is replicable in other 10 centres counting more than 20,000 inhabitants. The system may heat 2,100,000 m<sup>3</sup> of relatively big buildings (average volume 5,500 m<sup>3</sup>/building) and will request a heat production for the grid of 67,000 GWh/year. Three cogeneration units with Organic Rankine Cycle technology, having the following performance, are foreseen:

o Input capacity	MWt	3*10
o Net electrical power	MWe	3*1.5
o Nominal heat output	MWt	3*7.0
o Total efficiency	%	85
o Thermal energy produced by cogeneration	GWh/y	61
o rate of the total production utilization	%	90
	h/y	2,900
o Net electricity production	GWhe/y	13.1
o Biomass consumption	GWh/y	89

New DH system for the town of Villasanta, 13,000 inhabitants, for a selected group of building, for total volume of 500,000 m<sup>3</sup>. It is a small distributed DH system using simple boilers fed with virgin wooden biomass.

## Main barriers

– The actual uncertainty about the development of legislation, particularly on waste management; the upcoming harmonization of the national regulations with the European directives and the standards produced by CEN/TC 335 hopefully will solve the present main difficulties.

– High costs of transportation through the grid, because of the relatively warm climate and of the modest density and average size of the buildings (5,440 m<sup>3</sup>/building). A representative parameter is the linear load per meter of pipeline of Lissone:

Building volume offered	m <sup>3</sup> /m	76
Thermal energy yearly supplied to customers	kWh/m	2.2
Specific investment per transported energy	€/MWh	270

– Uncertainty on the main incentives for renewable energy sources: electricity Green Certificates, for the electricity produced, and White Certificates, for the heat offered to the customer. The legislation on the matter is being defined, but still remain a high risk related to the long term market provisions.

**The evaluation of the economic sustainability is now under development.**