

The intervention is to build a plant for the heat production from renewable sources, fed with biomass plant consisting of wood chips to be executed at the Hospital of Varzi (Pavia province - Italy).

The intervention includes works aimed at streamlining, and optimizing the renewal of the current system of heat production in hospital building and works to establish a system of urban heating for urban residences use in the surround.

The system installation is planned by the following main parts:

biomass central for heat production

gas methane power plant Central for heat production (as an alternative using diesel oil)

Distribution substation to serve hospital needs

District heating network service to other users

The elements of the system installation can be identified as follows:

- Storage facility and adduction solid fuel
- Heat production plant from biomass
- Adduction plant of gaseous fuel plant
- Adduction plant of liquid fuel in emergency situation
- Heat production plant with natural gas power
- Plant distribution of heat
- warming and processing plants for human use water

The implementation of the system installation project was scheduled in two distinct phases.

The first phase is the construction of thermal heat generation plant with a power output to 1,500 kW, including works needed for fuel storage and the completion of heat distribution system to serve hospital needs.

The second phase covers: the installation of a second boiler similar to the first, the station and substation renewal with installation of thermal generators for hot water and finally the establishment of district heating network serving customers other than hospital.

2 Construction structure

The biomass central subject of the following description was built in hospital area, alongside the existing heat production station of Varzi Hospital.

It consists of two one-level buildings made with reinforced concrete walls, filling, and concrete blocks intended to accommodate the storage woodchip (with related areas of transport) and boiler (with relative plant).

The structure is supplemented by external works, namely access ramps, sanitary sewers and pavement rounding areas realised with bituminous concrete.

The plant relies on stall foundations based on an underlying lean concrete. The woodchip deposit and the ditch with the tapes is a carrier-based construction rectangular approximately 18 x 6 meters: partly buried, is designed to withstand trucks weight and falling timber. The vehicle pour fuel directly into deposit through three trapdoors mechanical automated opening.



The underground part is protected by a double waterproof sheath, mechanically protected with soft PVC.

The main feature, and fundamental to the production cycle, are hackles handling the material and the inner wall made so as to leave a space below to allow the passage of the woodchip from the floor of the warehouse conveyor belt, located below, whose function is to link the heat power plant.

The above-ground, with 30 cm walls thick concrete blocks, supports the flat prefabricated coverage.

The structure is finished with plaster and paint only in the external front, being sufficient for functional finishing of the concrete blocks: only workers areas normal finishes are accomplished.

The heat power plant, also of rettangular size of about 18.5 x 9 meters, is partly buried with constructive arrangements described for the storage, and partly in elevation, presenting the same features of the former one.



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The local was designed to accommodate two generators with related installations.

The boiler was placed on a specific base at the center of the deck.

The rain waters are disposed of by a system of buried PVC pipes, with wells inspection, while inside there are greater dimension wells to dispose condensation, washing and processing water: because there is a difference between the interception level and conveying level, the wells are equipped with a pump lifting.

The production plant of central heat with steam boilers and burners for gas methane.

The steam produced in heat power plant is sent through lines located in the tunnel, to the hospital substation where there are two exchangers steam-hot water whose secondary is placed on collectors general distribution in the building.

The individual circuits to direct warming bodies are then operated by independent climatic controls or adjustment provided on the machine in case of thermal carriers.

The plant expansion on the existing secondary exchangers steam-hot water is typically closed cup.

Prospectus schematic of the project proposal
The following is a summary of the scheme as a whole.

Mechanical Works:

Constitution silo for biomass plant;
Design and installation of transport;
Realisation biomass heat generator;
Realisation of mechanical and thermoidraulic interface with existing plant.

Electrical Works:

Constitution electrical plant for service to biomass plant;

Works building:

Construction storage and central biomass plant;
Accomplishing tunnel for pipes connecting the substation

Design:

Execution practices and procedures of authorisation

Editors construction projects

Editors declarations of conformity and "as built" projects.



Reasons for design choices:

It should be pointed out the savings from taxation and therefore minors energy costs imposed on the structure served.

The following are at a glance the main reasons for the choice design adopted.

Security:

The solution adopted in part as required by current regulations, it meets the requirements and its implementation is complete with all necessary security and protections.

In addition were provided additional systems for the purpose of obtaining the maximum guarantee of safety, in particular:

alarms on the operation of biomass remote control administrated to be sent and displayed in real time.

Energy containment:

It should be noted that in general, with the solution adopted the enthalpy system is appropriate and not too high when compared with needs. The enthalpy values of the fluid carrier are best compared to thermal loads actually present.

The increase of overall performance is reported that is not modified the current combustion plant because the biomass plant is in addition to the original plant and therefore does not change its performance.

The benefits of biomass can also be sought in the use of renewable energy that in this constitute about 60% of the requirements.

With the adoption of the planned system of supervision and control and using programs designed properly, you can push the optimisation with a variable operating under the parameter of greater energy and economic convenience.

Emissions containment

The use of methane gas as fuel is kept in place and is flanked from biomass. The energy produced by woodchip is clearly no longer dependent of methane, which will act as support during periods of intense cold.

Emissions of the latter are within the limits set by existing legislation.

In this regard highlight that:



The energy from wood is neutral as regards the emission of CO₂

With the recycling of waste wood and used wood we can save raw materials and energy from fossil sources.

The expected emissions from biomass plant, and its comparison with what is required by DPCM (Italian Law) March 8, 2002, Enclosure III, are as follows:

PARAMETER EMISSION Enclosure III.

The emitted substances quantities come 08/03/2002 DPCM (Italian Law) values provided plant

CO mg/Nm³ 350 300

NO₂ mg/Nm³ 500 350

Dust mg/Nm³ 200 150

SO₂ mg/Nm³ * 200

* in natural biomass in the natural content of SO₂ has a value of emission under 10 ppm/m³

from the following calculation, taking into account the maximum consumption of biomass in the total management of the plant.

Production of ashes:

The ashes produced by the combustion are to be defined "ashes from biomass virgin", reusable in the natural cycle after chemical analysis of samples taken during the production cycle. In case of non-compliance ashes should be disposed of in landfills.

The quantity of pollutants maximum in ashes will be the following (starting temperature deformation > 1120 °C):

SiO₂ 15-20%

Fe₃O₃ 2-6%

P₂O₅ 2-6%

AL₂O₃ 3-6%

CaO 20-40%

K₂O 5-10%

The amount of ashes produced provided is about 46 tons/year.

Management improvements compared with the existing situation:

with the implementation of planned enhancements are achieved significant improvements in management activities especially through continuous monitoring provided by the supervisory system. The increase in total installed thermal power, in addition to already existing excessive size of boilers, let us make several reflections in terms of use of the plant, also in order to optimise the management.

Levels of noise:

The mechanical objects of plant will be able to guarantee the noise levels expressed by Italian law, beyond the specific requirements of individual components.

Requirements inside buildings

The requirements of Italian law are strictly complied.

In any environment that falls under the influence of new installations, the sound level during plant operation will not exceed by more than 3 dB that level of fund existing at the point of measurement when the facility is not working, particularly in areas where they are normally present people.

Requirements outside the building

Regarding the sound level of the exterior of the building, each unit will provide the levels comply with the demands of technical specification of the component.

The characteristics of noise, however, satisfy the Italian law.

Procedural Checks:

Compliance technical and administrative

It ensures the drafting of practices relating to works to be carried to the completion of the necessary authorisation from the authorities.

Modus operandi:

The methods of management suffer a substantial change as a consequence of the biomass plant.

The main changes are:

- 1) Use a primary thermal carrier fluid having temperature below 100 °C (hot water) when it is running the heat production. This condition involves sending a line-water boilers for heating substation in the downstream of the heat exchange that takes place between the steam produced at the plant of methane and hot water.
- 2) Changing the way of managing temperature inside the building (increasing hours of operation of the circuits and diversification of settings divided by area served).

The biomass plant, given the characteristics of ignition and starting, will be kept in service throughout the day, with parameters and operation of power for most of the time reduced to enable a network made regime morning without the re-ignition (manual) of the boiler.

In particular, during periods when the structure does not require delivery of thermal power, it is also programmed the continued operation of some line in order to satisfy a small amount of requirements to the generator (about 150 kW).

The settings, already on substation exchangers, the settings of new plant and the presence of staff conductors, however, allow an absolutely elastic management of the general functioning, in particular there are the following possibilities:

- 1) Main operation: biomass plant produces hot water, to cover the full needs of the building (periods of warmer days during any season and colder days in winter except for goodwill morning). The intervention of one of two heat exchanger with a methane-water boiler will serve only for those cold periods of the year for whom will need to provide, in the early morning, greater power to bring the plant up to speed.
- 2) Operation borne reduced or temporary periods of maintenance of biomass plant: the two generators to support methane-water boilers are sufficient as thermal power quantity to comply to the hospital needs.

The transition between modes 1) and 2) will be automatic through the use of thermal carriers at the service of exchangers in substation. The other modes will also be operated in automatic mode thanks to adjustments in the new plant.

Costs:

BUILDING WORKS	€ 183.447,86	
MECHANICAL WORKS	€ 376.474,54	
ELECTRICAL WORKS	€ 33.459,94	
TOTAL WORKS		€ 593.382,31
CHARGES OF SECURITY	€ 19.169,35	
DESIGN	€ 32.111,64	
TOTAL		€ 51.280,99
TOTAL WORK		€ 644.662,30
SUPERVISION OF WORKS	€ 10.107,10	
VAT 20 % ON DESIGN	€ 6.422,33	
VAT 10 % ON WORKS	€ 61.255,17	
FALL IN CONTRACT	€ 34.566,03	
UNCERTAINTY	€ 124.169,93	
TOT. SUMS AVAILABLE		€ 124.169,93
TOTAL		€ 768.833,23

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