

TOPIC n. 2. *Gestione sostenibile delle risorse e interazione uomo-natura*

The sustainable planning of biomass energy chain: the approach developed in Tuscany (Italy) for estimating potential supply of forest resources and programming of the "sustainable" demand of forest biomass

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Abstract

In Tuscany, the use of renewable resources is not new. The firewood is a common energy vector in rural areas; it's used because competitive with fossil fuel prices (diesel and LPG), and because most of the mountainous areas still not reached by the network of natural gas. In Tuscany are consumed around 1.4 million cubic meters of firewood for year, mostly in mountainous areas where there are more than half a million people (about 13% of the regional population). On the other hand, we have 1 million hectares of forest still underused, which may allow a joint production of firewood and wood chips.

In relation to the wide availability of forest land (wood index 0.45), in recent years we saw an exponential growth of heating district and cogeneration plants. Now, since 97% of regional wood production is represented by firewood. Therefore, the development of heating networks could lead to unexpected effects on forest enterprises. In addition, the exponential development of biomass cogeneration plants is increasing demand for chips, not always available locally.

For this reason, is necessary a proper planning of local investments in heating district and cogeneration plants, able to taking into account the actual availability of local biomass, the biomass of exogenous origin and the real presence of professional forestry enterprise. For this reason, it was found necessary to support the local authorities in correctly planning investments in the biomass chain and heat system, first of all, by estimating the biomass supply actually available. The *Green Energy Model (GEM): A GIS oriented model for the farm and the territory energy planning*, has been developed in order to assess biomass availability. The methodology includes both biomass resources growing models and economic models specifically developed. The methodology gives a realistic evaluation of the available forestry resources, since taking into account forestry production costs allows the identification of the wood surfaces with a positive stumpage price. Two main data results are available: the "virtual" production, which is the ecologically sustainable production, and the "real" production, which is ecologically and economically sustainable. The real production is, thus, associated to an ecological sustainability and also have a net positive revenue, taking into account the production (felling, machineries etc.) costs in comparison with the actual market price for woody biomass.

The methodology also analyses the potential heat energy demand, localising the areas where new plants could be installed, taking into account economic, territorial and competing markets (i.e. existence of a natural gas network). Matching offer with demand allows to identify the most suitable areas where to install new biomass to energy district heating plants. In particular, we

considered the results of the monitoring (ongoing) of six biomass district heating plants installed in Tuscany in the last years, for a total of 7.3MW of heating power. The monitored plant typologies vary from the small plug-in heating central to the double biomass boiler heating central. Nominal heat power ranges from 110kW to 850kW (double boiler). All plants use wood chips from short chain as biofuel. Particular attention has been devoted to monitor quality, characteristics and provenience of the wood chip provided to the plants, since the biomass quality has a strong influence on small and medium scale heating plants performances.

The aim of monitoring is to provide the plant managers with a set of suggestions and instructions in order to improve the overall plant efficiency and to optimise the biomass to energy chain. The main running parameters of the presently active plants have already been monitored and put into evidence the importance of a correct plant dimensioning and running in order to achieve a good overall efficiency.

The monitoring results, together with the results of the supply model, will support the definition of new governance policies and actions that will be defined by the local authorities (at province and regional level).