

ANALYSIS OF WOODY BIOMASS OBTAINABLE FROM ABRUZZO FORESTS

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ABSTRACT: Biomass has a strategic role in Italian politics of renewable energy. Among biomass, a major role is covered by wood products. In a Region with a significant presence of forests as Abruzzo, woody biomass could be able to reduce dependence on imported fossil fuels and at the same time to reduce CO₂ emissions. This paper analyzes the surfaces and volumes of each of the forest types present within the regional area (by major categories of inventory to the forest categories), in order to quantify the wood biomass obtainable from forest stands of Abruzzo, and the percentage of them to be allocated to energy purposes. This taking into account all the constraints related to environmental and Natural Parks found in the region. A energy comparison was performed between the wood chips (mixed between the forest species) and diesel fuel, in order to demonstrate the advantages attainable with the use of biomass with particular reference to the environmental point of view.

Keywords: biomass, CO₂ emission, wood.

1 INTRODUCTION

The use of renewable energy has increased steadily over time due to the need to mitigate climate change by reducing the use of fossil fuels [1]. Woody biomass represents an important source of renewable and sustainable fuel for energy production. Its increasing consumption is mainly related to the increase of global energy demand and fossil fuels prices, but also to the limited availability of petroleum and the situation of a lower environmental impact compared to other non-renewable fuels [2–4]. Increasing the use of biomass can help reducing greenhouse gas emissions [5], diversify energy supply, and create growth and jobs [6].

National forest inventories (NFI) are the primary source of forest information [7] and are recognized as important data source [8–10]. In Italy the second NFI was funded through the need to achieve the information requirements demanded by international agreements, and to collect data useful for the mandatory Kyoto Protocol reporting. For this reason the inventory was strongly oriented to forest carbon estimates and is called National Inventory of Forests and Forest Carbon Pools. The NFI was conducted between 2003 and 2007 but in 2008 and 2009 an additional field exercise was carried out to exhaustively survey all the forest carbon pools recognized by IPCC [11], with the exception of below-ground biomass.

Notwithstanding what written above Italian forests potential for woody biomass production is not fully exploited most of all in central and South Italy.

In particular in Abruzzo Region, one of the Italian ones with the highest percentage of forest cover, woody biomass is strongly underrated. According to this the present paper analyzed the surfaces and volumes of each of the forest types present within the regional area (by major categories of inventory to the forest categories), in

order to quantify the wood biomass obtainable from forest stands of Abruzzo, and the percentage of them to be allocated to energy purposes. This, taking into consideration all the constraints related to environmental and natural areas in the region. Moreover a comparison between wood chips usage and diesel one was done to evaluate the advantages of wooden biomass use both in economic and environmental points of view.

2 MATERIALS AND METHODS

The main database used in within this paper was Italian National Forest Inventory (INFC, 2005). INFC2005 was based on a three-phase sampling procedure with 13 m radius plots located at the intersections of a 1 × 1 km grid. Such scheme gave a statistical robustness to this dataset and can be used for further analysis.

As first step we analyzed data of forest surface subdivision into forest categories. The second step consisted in data analysis of management way within each forest category.

The following step consisted in suitable surface analysis for wood supply, thus excluding inaccessible areas, that is areas with excessive slope, too far from forest road network or located within A zones of Natural Parks (Integral Reserves).

Potential wooden biomass supply was then estimated considering a management cycle of 20 years and the biomass data of the INFC for the various forest categories. For what concerning coniferous stand we took in consideration a 60% biomass, retrieved from thinning interventions, which could be used for energetic purposes. For broad leaves high stands we considered only 30% of overall biomass could be used for energetic aims. Instead for coppices we stated 90% of total biomass

which could be used for energetic purposes.

Next step consisted in the estimation of the energetic potential of wooden biomass. This was performed considering a LHV for comminuted wooden biomass of 12.21 MJ/kg.

Finally a comparison in terms of emissions, considering modern boilers' characteristics for both fuels, was done between comminuted wooden material and Diesel in order to check the possible environmental advantages of using wood for energetic aims within Abruzzo Region.

3 RESULTS AND DISCUSSION

Results of surface, biomass and energetic potential analysis for what concerning the various forest categories in Abruzzo region are given in Table I.

Table I: total surface, available surface, retrievable biomass and energetic potential within Abruzzo Region forests.

Forest Macro-Categories	Total Surface [ha]	Available Surface [ha]	Wood biomass for energetic purpose [t/yr]	Total energetic Potential [GJ/yr]
Coniferous high stands	25312	10764	8777	107165
Coppices	131543	55939	72681	887434
Broad leaves high stands	115137	48962	52090	636071

As it is possible to notice the major contribution both in terms of surface and biomass quantity is from coppices but also broad leaves high stand could have an important role in the context of wooden biomass supply in Abruzzo. Obviously the results in terms of biomass quantity are reflected on energetic potential evaluation which is the highest for coppices.

Comparative results of emissions between wooden biomass and Diesel are reported in Table II.

Table II: emissions of wood chips and diesel

Fuel	CO ₂	CO	NO _x	C _x H _y	SO ₂
	mg/MJ	mg/MJ	mg/MJ	mg/MJ	mg/MJ
Wood chips	0	17	92	2	10
Diesel	87*10 ³	2,77	30	11	97

First of all an important clarification, CO₂ emissions for wood chips were considered "0" because, considering only combustion phase, burning wood causes only the release in atmosphere of the CO₂ forfeited by the plants for their growth. Obviously future and deeper studies will consider the entire life cycle of wood chips assessing also the emissions needed for biomass supply from forests. Considering other emissions wood presented higher

values for CO and NO_x but lower ones for C_xH_y and SO₂.

4 CONCLUSIONS

Evaluating biomass supply potential in rural context is a key aspect for the implementation and development of a feasible renewable energy system, allowing to evaluate the possible advantages and disadvantages of wooden biomass use in comparison to fossil fuels one in such areas. According to this we implemented a preliminary study based on literature data from National Forest Inventory in order to give to the reader a preliminary view on the specific topics focusing on Abruzzo Region context.

Notwithstanding Abruzzo is one of the Italian Region more covered by forests wooden biomass use is strongly underrated. A major use of wooden biomass for energy production could lead to a substantial improvement of the Abruzzo energy system consisting in a substantial decrease of CO₂ emissions.

Further studies would be aimed to the analysis of the life cycle with LCA or SIA considering also economical aspects.

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