Promotion of residual forestry biomass in the Mediterranean basin

Setting up of integrated strategies for the development of Renewable energies

SITUATION REPORT ON FOREST BIOMASS USE

In Mediterranean region

Work package leader: Slovenian Forestry Institute

Table of contents

List of tables

List of pictures

SPAIN - VALENCIA REGION

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CONSELLERIA D'INFRAESTRUCTURES, TERRITORI I MEDI AMBIENT

Ayuntamiento de Enguera

1. Introduction

The Valencian Energy Agency is the entity of the Generalitat Valenciana attached to the regional Ministry of Economy, Trade and Industry, which aims at the management and implementation of energy policy in the area of Valencia region.

The Valencian Energy Agency carries out management and energy planning in accordance with the general guidelines of the Valencian Government, in coordination with the different authorities and within the framework of the common energy policy of the European Union, in order to achieve the following objectives: energy diversification, efficiency and quality of supply, energy saving, self-sufficiency, promotion of renewable energy, promotion of infrastructure, use of new technologies and respect for the environment.

The role of biomass in energy planning of Valencia is based in the European and Spanish planning, in accordance with:

- European Commitment 20/20/20 (March 2007).
  - Year 2020: EE.RR 20% / 20% energy consumption reduction / 20% CO2 emissions reduction versus 1990.

- Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
  - European Objective: 20% participation of EE.RR on gross final energy consumption in 2020.
  - Spanish Goal: 20% (Transposition through the Law 2/2011sustainable economy, art. 78).

- PER Renewable Energy Plan 2011 to 2020. Approved by the Government on 11/11/2011.

1.1 Potential of RES in the Valencia

This table is a summary of the study between the Institute for Small and Medium Industry of the Generalitat Valenciana (IMPIVA) and the Institute for Energy Diversification and Saving of Energy (IDAE).

In this study, based on the analysis and evaluation of existing potential, geographical factors, environmental conditions, requirements and economic feasibility of technologies and markets analysis, would setting out possible strategies to double the energy contribution renewable to primary energy consumption in the Valencia region in the period 1998-2010.

Table 1. Potentials for renewable resources

Type of uses	Situation at 1988		Proposed objectives 1998-2010		Final results 2010	
	MW	EP (tep)	MW	EP (tep)	MW	EP (tep)
THERMAL USES:						
Energy from biomass		183.121		39.757		222.878
Solar Thermal Energy		2.472		15.440		17.912
TOTAL THERMAL USES		185.593		55.197		240.790
ELECTRICAL USES:						
Wind	0	0,2	2.300	474.740	2.300	474.740
Hydraulic (*)	649	81.612	94	26.660	743	108.272
Energy from biomass	0	0	20	51.600	20	51.600
RSU assessment	0	0	10	22.933	10	22.933
Photovoltaic solar energy	0,6	84	13	1.986	14	2.070
TOTAL ELECTRIC USES	650	81.697	2.437	577.919	3.086	659.616
TOTAL RENOVABLES ENERGIES		267.290		633.116	3.086	900.40

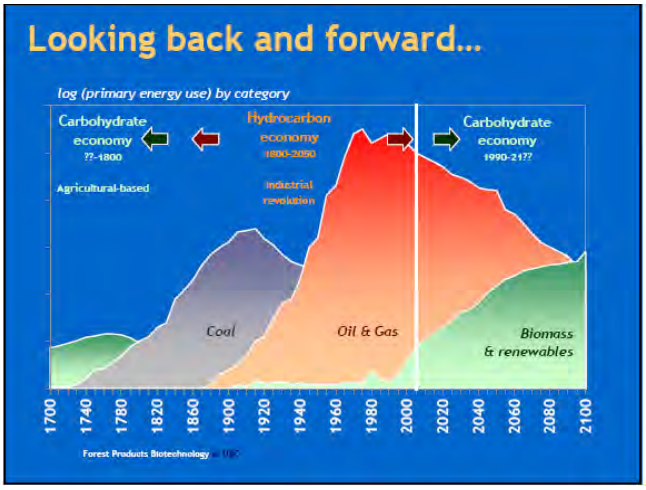
The global commitment to the use of renewable energy to combat energy dependence on fossil fuels on the one hand, and the use of cleaner energy, on the other, has created an emerging market for the use of forest biomass, which involves much more direct benefits to forestry. If the forests get into value, that currently is not, it would generate new business activity around them. This fact brings the one hand rural development that creates jobs and economic activity, and secondly, prevents forest fires.

Furthermore, the main purpose of the Valencia' forest policy, contained in Law 3/ 1993, Valencia Forest, is to ensure that Valencia forest ecosystems play the social role inherent in them, through the provision of services and sustainable goods to the population.

Therefore, the management of forests in Valencia region, including timber harvesting and forest biomass will serve for the structuring of the forest-industrial consumption of wood products, involving society in the use of renewable natural resources and as a form for sustainable development of rural areas.

2. Wood biomass market

Biomass has been throughout history the most important energy source for mankind. It is from the industrial revolution in the mid nineteenth century with the appearance of coal, and above all, from the first half of the twentieth century with the discovery of oil when developing the massive use of fossil fuels. Thus, the energy use of biomass decreased gradually and now presented in a very unequal world as a source of primary energy.



Picture 1. Primary energy use by category

Currently, over 80% of energy supply in Spain comes from fossil fuels, 13% nuclear, and about 6% of renewable energy. This 94% non-renewable has important environmental implications heavily dependent on external supplies.

Most of the biomass comes from the forestry sector, which has traditionally been used in the domestic sector through inefficient systems (use of firewood), but also boilers forest industries.

In the biomass consumption of traditional domestic uses is set high participation of forest industries (around 40%) and by-products of oil and nuts (8%.)

The period between 2005 and 2009, Spain has resulted in a time of transition and lays the foundations to promote the uptake of biomass sector. However, in this period, they have been higher expected development than results achieved.

Electricity generation plants that exist in Spain are scarce and most of the installed power plants come from industries that have secured their own fuel production. For example, paper industry and agro forestry industries.

Most of the disadvantages of using biomass as fuel is due to its low density and energy physics. Therefore it is very important the process of densification.

Compacted products having a diameter of less than 30mm are considered conventional as pellets and larger diameter briquettes. Compacted products not bonded are known for packages or bales.

3. Forests and wood biomass production

The Valencia region is located on the Mediterranean coast of the Iberian Peninsula. It borders Catalonia, Aragon, Castilla la Mancha and Murcia, and its area is 2.326.196 ha.

Picture 2. Location of Valencia region

According to data from IFN-3 (Forest National Inventory), forest area of Valencia region is 1,255,338.61 hectares, which represents 5% of the Spanish forest area, covering about 26 million hectares.

The location of the forest area occurs mainly in the mountains, and 61% of forest area is located over 600 m above sea level, basically in rural areas.

The wooded forest with tree cover exceeding 20%, occupies 680.069 hectares, while with sparse cover occupies 74.390 hectares, and 500.879 hectares are occupied by shrubs, scrub and grassland. 70% of forest area is dominated by conifers, 10% hardwoods and 20% a mixture of conifers and hardwoods. Conifers are principally *Pinus*

halepensis, Pinus nigra, Pinus pinaster, Pinus sylvestris, Pinus pinea, Juniperus thurifera and *Juniperus oxycedrus*. Dominant hardwoods are represented by *Quercus ilex, Quercus faginea, Quercus suber* and *Olea europea*.

The total number of trees is more than 656.7 million, of which 369.2 million are coniferous and deciduous correspond to 287.5 million.

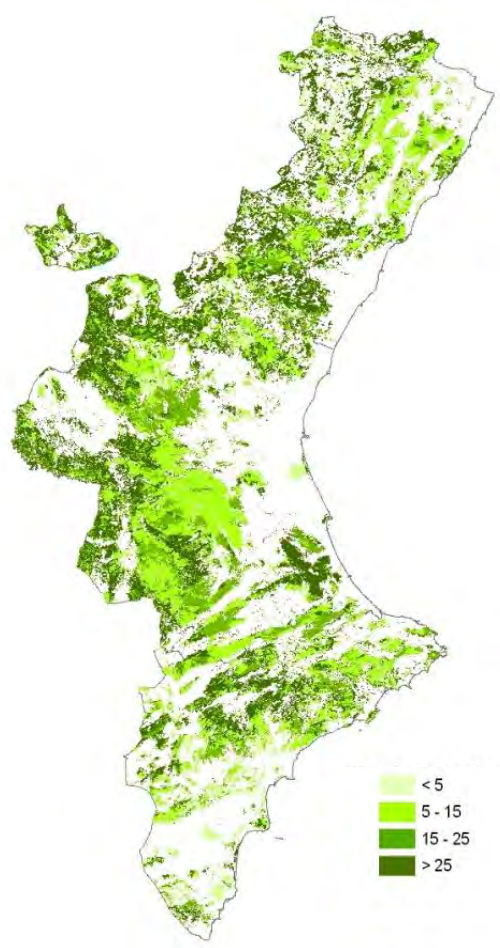
On the other hand, in Valencia region for decades, the legislative framework for natural heritage and forestry has been directed towards the protection and conservation of natural resources. Today, more than half the forest land is under some kind of protection and more than a third of it, they overlap two or more figures each with its instruments of planning, which complicate their daily management.

Although Valencia forest area occupies almost 60% of the territory, only contributes 0.03% regional GDP. We find the zero profitability of forest management. The scenario we find it is a general abandonment of forest activity as a result of high costs, the administrative difficulty and the low social recognition of forests.

This has led the lack of management of them, the increased risk of forest fires, the lack of specialized personnel in forestry work, and depopulation of rural hinterlands of Valencia region.

VAERSA, a Valencia public company, has prepared a document on forest biomass stocks of Valencia region, as a basis for planning of the possible uses of it.

The biomass of forest species has been estimated by quantifying the dry weight of organic matter (t/ha), from which we obtain a map with the distribution of the amount of dry organic matter in forest vegetation.



Dry matter (t/ha) conteined in wooded areas in Valencia Region (including trees and shrubs). Source: Preliminary work PATFOR, 2011 (not published).

To calculate the existing biomass in the Valencia Region, has been taking into account the information of the Forest Map of Spain 1:200,000 (MFE200, 1990), which provides data on forest systems, woodlands, and the 3rd National Forest Inventory (IFN3, 2008), which provides information on the wooded forest systems.

Based on information provided by these sources is calculated on the one hand, the dry matter stored in the non-forested areas, and on the other hand, it gets the dry matter of vegetation in wooded areas. Since the initial information is different in each case, different calculation methodologies have been used.

From the data of dry matter in non-forested areas (scrub) and dry matter in wooded areas (trees and shrubs), mapping is performed with the territorial distribution of dry matter stored in forest vegetation.

The possibility is the amount of resource that can be extracted from the forest without harming the stability and persistence of it. This calculation depends on the stocks and their growth.

For the annual allowable harvest, it has been used a theoretical model of forest management-oriented for timber industry in Valencia region, and forest biomass for energy generation. From this model, is performed, a map of the distribution of the possibility of utilization of wood and biomass.

From the dry matter in forest vegetation obtained in the previous section will be estimated the amount of wood and forest biomass to use. They will be applied the criteria of forest harvesting best adapted in the theoretical model of joint management of timber and forest biomass to the Valencian forests.

From the results is estimated the amount of wood and forest biomass that can be extracted sustainably each year using the criteria selected for calculate the possibility proposed in the management model.

Table 2. Criteria selected for calculating wood biomass potentials

CRITERIA	INDICATORS
Species that may be utilized	*Pinus halepensis, Pinus pinaster, Pinus nigra, Pinus sylvestris, Pinus pínea, Quercus ilex, Quercus faginea.*
Unallowable strata	Those who do not have as main species Pinus or Quercus ilex or faginea, i.e. those considered as allowable. Thicket or regeneration strata. The FCC strata <20%. Shrub strata.
Allowable fractions	Timber industry: trees of dbh> 22.5 cm Forest biomass for energy purposes: trees with dbh between 2.5 to 22.5 cm and normal residual biomass of the trees for timber harvesting.
Slope	<12,5 % 80% of actual biomass 12,5-25% 60% of actual biomass >25 % 20% of actual biomass
Protection figures	Microreservas are not exploitable

Criteria for the calculation of the possibility:

In this case, both the possibility for wood as biomass, is determined from the next formula (Madrigal, 2003), using data from the IFN3:

$$P = \frac{V}{d} + \frac{C}{2}$$

Where:
- P Possibility in t / ha / year
- d Duration of the period considered (age at maturity, etc.).
- C Current growth t / ha / year
- V Stocks (t / ha)

This formula applies to each of the strata defined as usable IFN3 as if they were management units. The shifts are set depending on the species, the stratum and the province.

Table 3. Species and cutting cycle

	SPECIES	CUTTING CYCLE
Castellón	Pinos mediterráneos	80 years
	Pinos de montaña	120 years
	Quercus	150 years
Valencia	Pinos mediterráneos	85 years
	Pinos de montaña	140 years
	Quercus	150 years
Alicante	Pinos mediterráneos	90 years
	Quercus	150 years

Next graphic shows the estimate quantity of the amount of wood and forest biomass that can be extracted sustainably each year (possibility) in Valencia Region. Source: Own generation based on data from the preliminary PATFOR version, 2011.

Table 4. Estimate amount of wood and forest biomass that can be extracted sustainably each year (Valencia region)

	TOTAL DATA				DATA MEDIA PER HECTARE			
	Allowable resource (stock)		Possibility		Allowable resource		Possibility	
	M (m^3)	B (t)	M (m^3/año)	B (t /año)	M (m^3/ha)	B (t /ha)	M (m^3/ha/año)	B (t /ha/año)
Castellón	5.915.753	5.379.255	183.058	63.906	29,5	27,3	0,9	0,4
Valencia	6.489.067	4.193.948	193.130	59.379	24,1	15,7	0,7	0,2
Alicante	2.014.710	1.552.847	60.518	19.340	19,8	15,3	0,6	0,2
Comunitat Valenciana	14.419.531	11.126.050	436.705	142.625	27,0	20,8	0,8	0,3

The capacity of the Valencian forest to produce wood and forest biomass capable of use is high. Based on existing stocks in the forest of the region we could extract, through sustainable forest management, 7 times more what is extracted now of wooden (59.938 m3/year) (INE, 2005), and more than 142.600 t/year of forest biomass could be exploited for energy.

Media surface data are lower than expected, due to the applied constraints, which are rather conservative. In the case of the possibility of forest biomass, restriction on use based on the slope makes these values even lower, because the amount of resource that is really usable is much lower.

4. Wood biomass production chains and wood biomass use

In Valencia region the management of forests areas is basically directed to protection and prevention against fires. Nevertheless from 2005 there have been executed some projects about the extraction of forest biomass in some forest areas of the region. It has permitted obtain some information of costs and performance.

In our region, the main operations of biomass exploitation are: thinning, cleaning, commercial exploitation residues, copice standars, burned residues and commercial exploitation.

Next table shows the obtained results of tone cost with silvicultural treatment for biomass, biomass exploitation and performance of some biomass use with grants.

Table 5. Cost of silvicultural treatment for biomass, biomass exploitation and performance of some biomass use with grants

MUNICIPALITY	**Extraction (Tn)**	**Surface (Ha)**	**Biomass (Tn/Ha)**	**Tone cost €/Tn**	**Treatment**
Vallada	2.675,19	43,49	61,51	454,87	Silvicultural treatment (for biomass)
Tuéjar	819,18	40,27	20,34	308,80	Silvicultural treatment (for biomass)
Ayora	1.062,76	45,66	23,28	313,00	Silvicultural treatment (for biomass)
Casa Cuesta	1.508,36	28,02	53,83	93,55	Silvicultural treatment (biomass use)
Pere Catalán*	1.374,25	128,75	10,67	41,33	Silvicultural treatment
Finca Forestal (latizal)*	1.740,00	77,02	22,59	46,50	Silvicultural treatment
Finca La Carrascosa*	241,92	63,00	3,84	48,49	Forest exploitation
Casa Honrrubia*	1.396,36	142,684	9,79	42,46	Forest exploitation
Casa Medina	1.069,95	142,75	7,49	51,00	Forest exploitation
Campo Arcís	1.610,00	223,40	7,21	51,00	Forest exploitation

*: Biomass Use with Valencian grants to increase biomass in value

Table 6. Description of processes in silvicultural treatments

	Silvicultural treatments			
	Shrub clearing	Pruning	Thinning	Copice standars
Processes	Extraction		Gather	
	Package		Extraction	
	Load		Chipping	
	Transport			

Table 7. Processes in biomass exploitation

	Silvicultural treatments	
	Shrub clearing and Pruning	
Processes	Biomass Extraction (Brunches and top cut *in situ*)	Timber extraction (with brunches and tops) Mechanic or animal
	Transport to gathering area (autoloader)	Chipping in gathering area
	Chipping in gathering area	

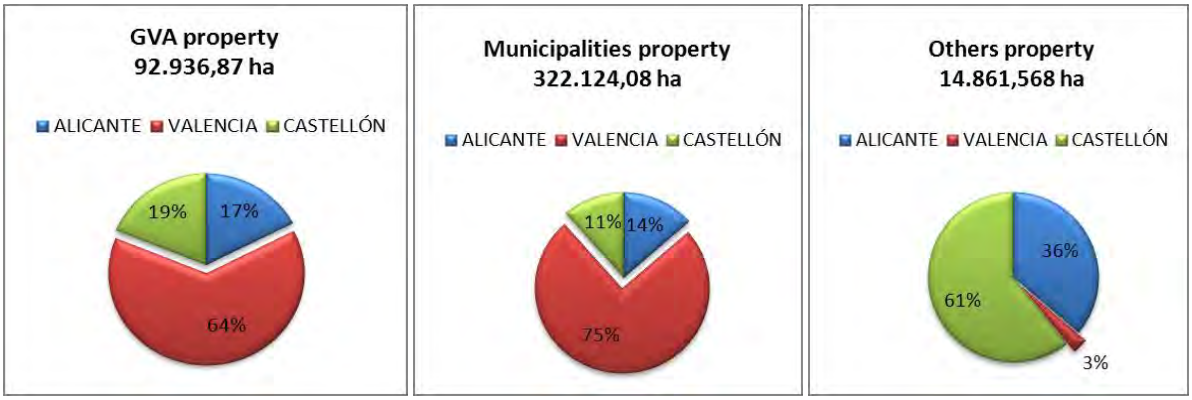
After analysing costs and performance of different treatments and conditions, we recommend (when possible) the extraction of full trees (with branches and top) to select them in gathering area.

The remains uses of commercial cuts are profitable when they are done jointly with the commercial exploitation of trunk and they are chipped in gathering area.

The unique remains of silvicultural treatments that are profit feasible for biomass exploitation are thinning and cleaning, when forest statement is polewood.

5. Socio-economic and others constrains

Of the total forest area of Valencia region, 34% (429,922.51 ha) is managed from the Administration, and the remaining 68% of the surface (826,416.1 ha) is privately owned, although supervised by the Administration.



Picture 3. Distribution of property of forest managed by the Administration

Private forest area has significant differences in the size of property, although it could be said that the average is a forest owner who holds a small forestry farm, in which are mixed agricultural and forest uses.

6. Existing policy measures (subsidy schemes,)

In Valencia Region there are two subsidy schemes for biomass investments:

1. ORDER of 1 December 2009, of the Department Environment, Water, Planning and Housing, approving the rules for a system of bonus for the enhancement of residual forest biomass on forest land of Valencia.

Within the scope of the Rural Development Programme 2007-2013, the Valencia Regional Council has established as one of the main axes of action the recovery of the forest potential with special emphasis on the use of forest biomass and its chain of use. Another main axe is forest adaptations to climate change, Mediterranean forest being among those more vulnerable to the effects of global warming.

In relation with the first axe, a subsidy line to enhance biomass value of forests in Valencia Region has been set.

From the data collected in the Forest Inventory of Valencia, it seems that the increase in forest area and woodlands has been important in the Region, producing a remarkable densification of woodlands.

This favours a great accumulation of combustible material, which is an important risk for the spread of forest fires and the control of forest pests and diseases. Therefore it appears necessary to promote structures less vulnerable to forest fires, linking forest management with fire fighting strategies. The recovery of forest activity, adding value to forest product, would be crucial. In this scenario, forest biomass could be used for board

manufacturing, forest mulch or substrates, and as energy in all types of industries. This would involve, first, the promotion and the maintenance of rural incomes, and second the existence of a business network, that could be very important in the rural setting.

Because of these issues, it has been decided to subsidize the withdrawal and enhancement of value of biomass, which proceed from forest fires, forest management, and improvement of forest structure, by granting a bonus of 51 Euro by tonne.

Beneficiaries of subsidies are forest owners or the enterprises, which carry out the works; in this instance, they must always have forest owner's authorization. In order to get the bonus, they are required to bring the biomass to a collection plant or a recovery plant, which must have been validated, for receiving waste from forestry.

Beneficiaries must also keep record of extracted tonnage in a notebook for each plot, and a control book to be signed by them and the staff of the plant, where the weight of biomass must be registered. This quantity will be used for calculation of the bonus, which can never exceed the amount requested in the application form.

2. ORDER 9/2011 of 16 May, the Department of Infrastructure and Transport, subsidies of the Valencian Energy Agency in renewable energy and biofuels for 2011.

The purpose of this program is to promote actions aimed at the exploitation of renewable energy resources and promote the use of biofuels. During fiscal 2011, aid given in this order may be financed by the Institute for Energy Diversification and Saving of Energy, under the terms established in the corresponding cooperation agreement between that body and AVEN. It also may be funded from the European Regional Development Fund (ERDF), through Operational Programme of Valencia 2007-2013.

Type of Aid: repayable grant up to 45% of eligible costs of the project. However, the intensity may be increased by up to 10 percentage points for aid awarded to medium-sized companies and up to 20 percentage points for aid to small businesses, individuals, municipalities, public entities and non-profit institutions.

Specifies subsidies for Biomass:

1- Facilities for the use (thermal and/or electric) of forest residues, agricultural, industrial raw materials from crops. Treatment teams in the field of biomass for chipping or packing, with the sole purpose of its use in energy processes, specific equipment and facilities for production of pellets/briquettes for energy use, investments in equipment and machinery for adapting specific tanker trucks for distribution and/or bulk supply of biomass for energy use.

Applications:

- Production of hot water (DHW).
- Heating and air conditioning.
- Indoor climate control.
- Thermal generation for industrial processes.
- Power Generation.
- Combined heat and power (cogeneration).
- Field Treatment (chipping and / or packaging).
- Manufacturing Plants pellets / briquettes.
- district heating systems (district heating).
- Adaptation of specific equipment trucks for distribution and / or supply of biomass.

Beneficiaries:

- Companies.
- Individuals.
- Councils.
- Public Entities.
- Entities and non-profit institutions.

Energy range:

- Production of thermal energy for domestic use or in buildings.
- Space heating systems with heat recovery and distribution.
- Industrial Thermal applications: installations of up to 10,000,000 Kca / h.
- Electricity generation: up to 10 MW installations.
- Cogeneration: up to 10 MW installations.

Mode:

- End user of energy.
- Through Energy Service Company (only in the case of thermal biomass plants for domestic use or in buildings).

2- Facilities for the use of solar thermal collectors and facilities hybrid of thermal collectors and biomass boilers, including tv-monitoring systems integration and visualization of the energy produced in new or existing installations.

Applications:

- Production of hot water.
- Heating and air conditioning.
- Indoor climate control.
- Water heating for industrial processes.

- Incorporation of tv-monitoring systems and / or display systems in new or existing installations.

Beneficiaries:

- Companies.
- Individuals.
- Councils.
- Public Entities.
- Entities and non-profit institutions.

Mode:

- End user of energy.
- Through Energy Service Company.

It is considered that an installation is hybrid thermal solar thermal-biomass when they share the basic elements of the installation and coverage of energy needs is mainly carried out from these two sources.

7. Main barriers for further development

a) Problems arising from the sustainable forest management:
- Heterogeneity of public and private forest ownership, which makes forest management area a lack of economies of scale.
- The forestry sector is no longer an active generator of jobs and wealth in many rural areas generally deserted and unprotected.
- There are little active policies derived from a forestry strategy, resulting in a very low level of management.

b) Problems arising from production and use of biomass resources:
- Resource heterogeneity (species, type of forest products, etc.), and physical conditions of the terrain (terrain clearance).
- Heterogeneity physical and chemical composition and energy resource (resource adequacy to the needs of energy transformation).
- Low presence of forest exploitation companies.
- Low technological development of equipment and limited adaptation of existing machinery to the conditions of the Mediterranean forest.
- Low degree of machinery in the forest industry.
- Difficult machining because of access to work area (lack of skid trails, poor condition of forest roads, low traffic density, etc.).

c) Problems arising from the logistics and transport in rural areas:
- No or few logistics operators.

- Lack of specialized machinery.
- Lack of a developed market of biomass distribution.
- Missing product demand and, consequently, lack of security.
- Instability in product availability in quantity, quality and price.
- Lack of development of waste pre-treatment systems for their suitability for industrial processing.
- Lack of specialized personnel.
- Lack of logistics infrastructure and storage space and quality grading and / or dimensional.
- Dispersion of information and lack of knowledge transfer based on the few experiences in different areas.

d) Problems arising from the transformation of energy resource and bioenergy markets today:
- High degree of heterogeneity of forest biomass.
- Lack of specific regulation for biomass heating systems in buildings, with consequent problems when designing, implementing and legalizing facilities in the domestic sector.
- Equipment less technologically developed than those used for conventional fuels (especially in the industrial sector thermal power generation and conversion systems heat-cold).
- Competition on price with other fuels, including biomass from other regions, countries or continents.
- Poor performance of power generation.
- High levels of investment.
- Lack of basic infrastructure in rural areas: industrial parks, facilities, etc.
- Potential operators Uncertainty about the profitability of operations.
- Difficulty of access and connection to the electricity grid in rural areas.
- Incipient development of a powerful energy market can absorb this production, especially of solid biofuels (pellets).
- Difficult to value cogenerated thermal energy due to the absence of district heating systems or industrial heating.

SPAIN – CATALONIA REGION

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8. Wood biomass market

Since at least for twenty years, the trend of the wood market has led to closing of small sawmills and the growth bigger. This trend has become more evident with the natural disasters of the last years, which have led to an offer of wood at low prices and, especially, from the start of the current economic crisis, in which the demand of wooden products has decreased significantly and has led to a lowering of roundwood prices.

At the same time, the high costs of exploitation (due to the increase of the cost of manpower and fuel) and the low investment in mechanization, lead to a low profitability of the forest harvestings, a decrease of the forest companies and workers and an abandonment of the forest management.

Facing this situation, the forest sector is paying more attention to the use of forest biomass for energy.

The new investments have to be oriented to the continuous improvement of the technology and the processes that take part in the implementation and development of the market chain of forest biomass. The beginning of the development of this sector has been characterized by the implantation of boilers from Central Europe (Austria), and by a system of supply of solid biofuels as pellets and high-grade wood chips.

The next steps to follow in the sector are the adaptation of the technology and some systems of organization that fit better in the feasibility of the use of the fuels, such as:

- The production of liquid fuels from forest products,
- Storage systems of solid fuels,
- Technology developed in the region, attending to local species and characteristics,
- Greater efficiency of the use of energy by transforming it with systems such as cogeneration and the tri-generation.

However, for the correct operation of the market it is necessary to assess the availability of the resource and its configuration, that is why both the private forest ownership,

companies and the forest administration have to acquaint with new formulas for the improvement of the business and the profitability.

The market of forest biomass in Catalonia is still little developed. According to data from the Catalan Energy Agency - ICAEN (personal communication) the installed thermal and electrical biomass-based power was in 2010 93,9 ktoe, only 30% of what was pretended to attain during this last decade.

The annual consumption of forest wood chips is about 15.000 tonnes, with selling prices between 70 and 90 €/tonne with a moisture content of 20-40% wet basis (CTFC, 2010), where the delivery uses to account some 10 €/t, depending on the distance; VAT applied to most of the transactions is 18%. The greater part of this consumption corresponds to direct consumptions for the production of heat, which is mainly concentrated in the domestic sector (consumption of firewood for heating, accounting some 120.000 – 150.000 fresh tones per year) and in the industrial sector (usually industries that use biomass to produce thermal energy for their production processes). The primary sectors (agricultural and livestock) and tertiary (services) also are consumers of woody biomass but to a lesser extent

The lack of consolidation of the market of forest biomass can be due to (CTFC, 2011): the social perception with regard to the forest management, the guarantee to the consumer (qualities, supply, etc.), poor formation and information of the involved sectors and few incentives from the administration (bureaucracy, scarce subsidies/help, fiscal aids, etc.). By other side, the production costs and the difficulties of its logistics complicates its implantation, compared to other types of woody biomass such as the residues of agricultural and urban pruning, the by-products of the wood industry or the agrifood by-products.

The last years there has been a significant increase of the number of companies that produce and deliver wood chips (in 2010 there were up to twenty companies); however, the quantity consumed is not sufficient to absorb all the wood chips and wood pellets that are produced, and therefore more than 80% of the biomass has been exported to other countries, mainly Italy.

One of the bases for the good orientation of the development of the market is to take into account the standardization and certification of the biofuels offered, since these processes guarantee the calm of the end user concerning the quality of the product. If this quality were not achieved, the operation of the heating system could get into trouble.

The ESCOs (Energy Service Companies), which are getting more active thanks to the funding line of the BIOMCASA project (IDAE, 2009), facilitate the customers the funding of the boilers, the acquisition and the management of the fuels. Thus, consumers (end users) avoid all the processes related to the installation of the heat production systems,

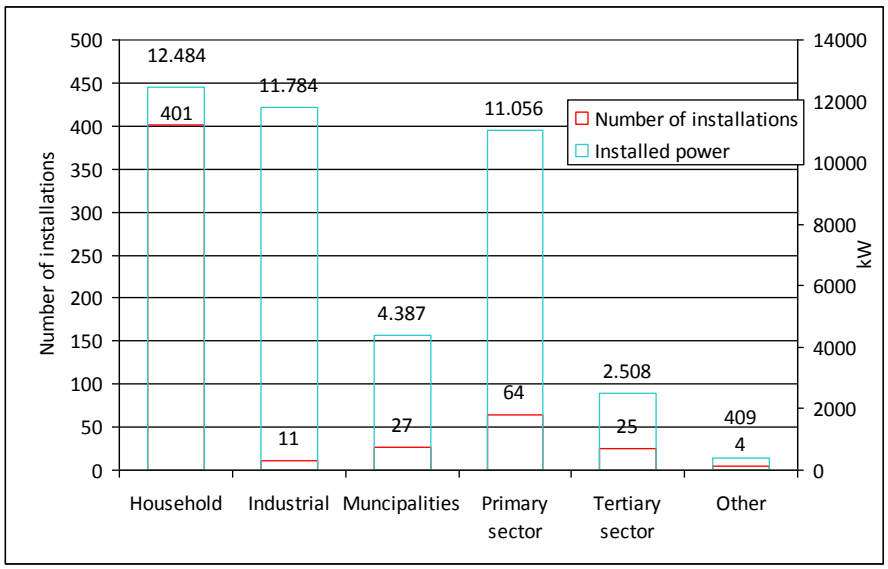
the supply of biomass, and receive support from those companies which control the system and have better knowledge of the network of the supply chain.

Regarding the production of thermal and electrical energy (cogeneration), there are promising initiatives (still in phase of development and execution). The main typologies are: district heating networks for distribution of heat in small neighbourhoods, cogeneration, gasification and trigeneration. And also technologies that allow to obtain energy in a decentralized way, and of local character.

There is general interest (in all the economic Catalan sectors) in promoting and support the market of forest biomass in Catalonia; in fact, there are currently some 11 projects of biomass plants (90 MWe) in an advanced bureaucracy stage and ready to its execution, to which can also be added 11 initiatives more, in a less advanced stage.

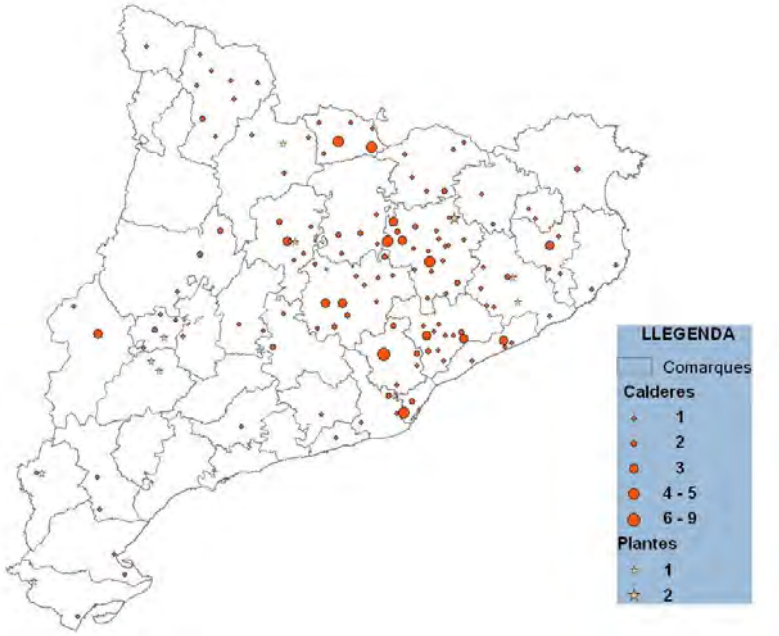
The PER (Catalonia Energy Plan for 2006-2015), foresees for 2015 an increase of the thermal uses in 50 ktoe and an electrical power of 63,7 MWe (Government of Catalonia, 2006). These data translated into tonnes of wood (foreseeing that 60% comes from forests) would involve a consumption of 560 thousand tonnes in 2015. It has to be taken into account that in 2008 the wood chip market moved 29.500 tonnes, of which 20.000 were exported to the Italian market (Rovira and Tussell, 2009).

The predictable future increase of the prices of the petrol derivatives and the fossil fuels, in addition to the need to improve the forest management of an important part of the forest area of Catalonia, can stimulate the harvestings of forest biomass for energy. The Catalan Energy Agency started in 2006 subsidising the installation of facilities of renewable energies, among them thermal energy facilities working with solid biomass. Between 2006 and 2008, this agency has subsidized 532 biomass installations, accounting a thermal power of 42.628 kWth (Picture 4).



Picture 4. Installations of thermal biomass subsidized by the Catalan Energy Agency during 2006, 2007 and 2008. Source: ICAEN (2010)

As it can be seen in Picture 4, more than 75% of the installations correspond to households. Geographically (Picture 5) it can be stated that most of the installations are located in areas where the forest area is relevant. The distribution concentrates especially in Central Catalonia, Western Pyrenees, zones with an important forest area, and the Plain of Lleida, region that concentrates an important agricultural activity generating residues which complement the forest biomass. In Tarragona, though, there is a lower density of installations than in the rest of Catalonia.



Picture 5. Geographical distribution of known biomass facilities (plants and boilers) consuming solid biofuels form forests, by municipalit (Source: Forest Harvesting and Biomass Dept. CTFC)

Compared to industrial facilities, the installed power of household installations is much lower; but this situation leads and must lead to an extended network of biomass production and supply. In that sense, the more installations, the better the logistic chain may be organized, resulting in more competitive prices for the end users and an increase exploitation and management of forests.

The most frequent power for pellet boilers ranges between 50 and 60 kW, whereas for wood chips ranges between 250 and 500 kW. Facilities consuming wood chips and pellets have a power ranging from 60 to 250 kW.

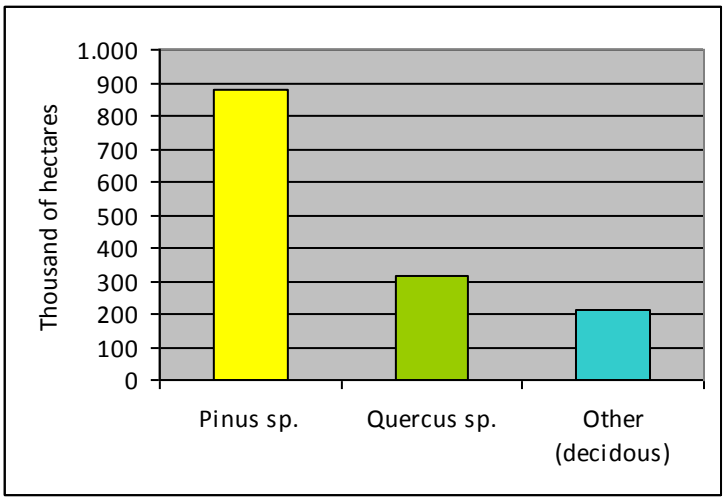
The extraction of forest biomass is a stimulus for the dynamization and the creation of employment in rural areas, even considering the possibilities of mechanizing the operations. Nevertheless, the effect on the employment depends on many factors, such as the source of biomass, the technical conditions of harvesting, the requirements of quality of the fuel and the production supply chain. This last determines mainly the system and the teams of work (Rodríguez, 2006).

Although the production chain of biomass has to be continuous along the year, the generated employment is generally seasonal, which, among other factors, makes it difficult to quantify the number of created jobs. In any case it can be estimated that the mobilization of 10.000 tonnes of green biomass for thermal energy creates 11,5 jobs.

The study "Renewable energies and generation of employment in Spain, present and future", elaborated by ISTAS in 2007, states that the employment in the sector of the forest and agricultural biomass can surpass the 88.000 workers in 2020.

9. Forests and wood biomass production

The forest surface in Catalonia in 2001 was roughly 48% of the total area of the region, whereas in 2007 was 61% (1.930.482 hectares are considered forest surface), where the forests themselves represented 51% (1.214.339 ha) of the total surface of Catalonia. The main species are coniferous (Picture 6).

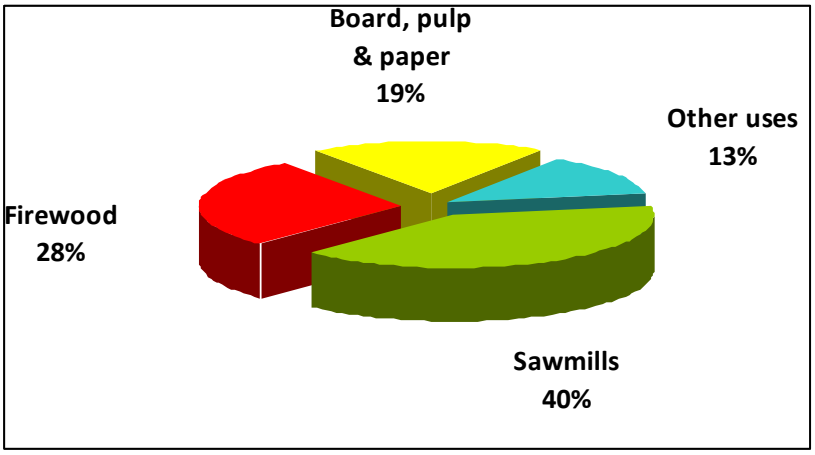


Picture 6. Surface of forests by groups of species in Catalonia, year 2009 (Source: CTFC (2010))

In the short term, the trend is that the forest surface increases and accumulates standing volume (and therefore increasing the risk of big forest fires), mainly because of the abandonment of the agricultural practices, grazing and other rural activities.

Although the annual increment is of more than 2,5 million $m^3 \cdot year^{-1}$ (IFN3-IFN2[1]), with an average amount of 2,61 $m^3 \cdot ha^{-1} \cdot year^{-1}$, the average of the annual harvested wood in Catalonia is between 600.000 and 880.000 m^3, destined mainly to roundwood industries (sawmills, pulp and paper and board industries), quite less of the sustainable available annual increment. The main destination are sawmills, 40% of the total extraction (Picture 7).

[1] IFN are the initials of the spanish wording for National Forest Inventory (Inventario Forestal Nacional)



Picture 7. Destinations of harvested wood in Catalonia, according to data from 2009 (Source: DAR (2009))

10. Wood biomass production chains and wood biomass use

10.1 Production chain of forest biomass

The supply chain of forest biomass for energy encompasses the production, harvesting, processing, until the final energy use.

The typical process of harvesting forest biomass is constituted by: felling, extracting, hauling, comminution, storage/drying and delivery. Depending on where the comminution takes place, the system can change, because comminution can be done in any place of the track of wood from forest to final plant.

The first phases comprise the felling, bunching and extraction. Logging residues (tree tops and branches) with a huge bulk volume should be densified at the beginning of the supply chain. Therefore, once the material is gathered in an accessible place for a self-propelled chipper/crusher, the material is comminuted and hauled until the storage area with a vehicle with closed load. In case of thinnings and precommercial thinnings (trees of small size and others with low quality) all the material is destined to bioenergy, and the harvesting system is full-tree. In that case, trees are felled but not delimbed (nor topped in most of the cases), extracted to landing where they can be left for a time for natural drying; afterwards, trees are chipped with a semi-mobile big chipper.

Although there is also technology for bundling bulky material, in Catalonia such kind of residues are not used, opting for a more lignified material that can be chipped at landing. This is due to the small mechanization of the harvestings in Catalonia and to need to harmonize the work of the bundling machine with the harvestings at a medium to large scale.

The costs of having the material at landing prior to comminution vary from 15 €/t50[2] in accessible and managed areas, up to 40 €/t50 in difficult, steep zones, according to consultations (Navarro et al., 2010).

In addition, the profitability of wood is low, the paid prices for raw material at industry range between 25 – 35 €/t50 (Navarro et al., 2010), together with the increase of the labour cost, fuel cost, the fragmentation of the forest ownership and the low investment in mechanization, means that forest harvesting in Catalonia have a low or non-existent economic profitability, and therefore diminishes the number of companies and forest workers, resulting finally in a progressive abandonment of the forest management.

An inconvenience of the whole-tree system is that tree tops and small branches should not be removed, because they generate a positive effect on the terrain (Codina and Navarro, 2010):

- Protection against the erosion (soil preservation and water quality)
- Return of an important part of the accumulated nutrients
- Maintenance and increase of the content of organic matter and carbon to the soil
- Reduction of the evaporation in dry periods
- Reduction of the risk of compaction by machinery and the impact of rain by constituting a brush mat
- Decrease of the development of weeds and its competition
- Direct contribution on the natural regeneration of the isolated forests

These profits are important in the Mediterranean forests, because in many cases soils are degraded by the erosion, forest fires, or an excessive extraction of firewood that has consumed an important part of the nutrients of the soil.

At the same time, it is recommended a low presence of leaves, bark and fines in the biomass, both in wood chips and pellets, since it conditions their quality and determines the good operation of the boilers, especially the domestic ones (Codina and Navarro, 2010).

With respect to the extraction of small trees from silvicultural treatments, the quality of the chips produced with them is lower and, therefore it could be necessary to delimb the trees in order to meet restricted quality requirements. This would reduce the profitability of the system at an extent that could make the system unprofitable, mainly because the small volume of the extracted stems.

[2] t50 refers to a tone with 50% moisture content wet basis, an approximation to green tone (just harvested material)

Some research on the supply chain of forest biomass is being done, working on improving the efficiency of the work, optimizing the installations, adapting the technology to the Mediterranean raw material and performing Life Cycle Analyses of the products; these tasks that have started recently and need further work.

10.2 Chain of production of the woody biomass from short rotation woody crops

Catalonia, thanks to its climatic characteristics and availability of lands and water has a big potential for short rotation woody crops. However, at present there are only 80 ha of poplar, distributed mainly in the provinces of Lleida and Girona. The most planted species are poplar and paulownia, this last especially in the province of Lleida. There are no official data, though, about woody plantations for bioenergy.

The main reasons why there are no extensive short rotation woody crops for energy are:

- there is not a strong demand to consume this wood.
- little knowledge about this by farmers
- plantations highly mechanized, because both plantation and harvesting are performed with very specialized machines
- lack of knowledge of the yield of the plantations of different species and clones and therefore lack of knowledge of the profitability of the plantation
- legal uncertainty (diffuse definition, feed-in tariff for the energetic crops, regional competences and involvement of several administrations)
- competition between biomasses

In Spain the yield obtained with plantations of poplar, in different climatic conditions, densities and rotation periods, varies from 6 to 20 odt[3]·ha^{-1}·year^{-1} (Sixto et al., 2007).

This variation in yield results makes it very difficult to realize estimations and studies of feasibility of the plantation, because the margin the farmer can get is so little that perhaps the plantation is not profitable if it yields few tonnes less than expected.

In addition, it has to be taken into account that the energy crops are interesting as long as the feed-in tariff for the generation of electrical energy with such biomass are still as high as they are now. This feed-in tariff has this value (reference feed-in tariff of around 15 c€/kWhe, whereas for biomass from forestry is around 12 c€/kWhe, original values stated in the Royal Decree 661/2007) because it was at first assessed that the production costs of such biomass were higher than the other biomasses.

[3] Odt: oven dry tonne, unit of mass after drying the material under specified conditions (e.g. EN-14774-1 standard) pursuing to eliminate as much water as possible and usually determined when the mass of the material is constant after two consecutive weights during the drying process. The oven-dry tonne is normally used as equivalent of the absolute dry tonne (COST FP0902)

Nevertheless, the definition of forest energy crop that describes the Royal Decree 661/2007 is so wide that is posing the possibility of fitting other types of biomass, as for example forest biomass, in order to obtain this interesting increase of the feed-in tariff. What is understood as energy crop is currently under discussion in the different regions of Spain, since the competencies of the definition in each region rely in their governments (Autonomic Communities).

On the other hand, there are different research lines dealing with forest energy crops, as for example, the determination of which species are most suitable in the Mediterranean area, as well as the plantation frame, the surface and the profitability of the plantations. At the same time, it is currently under evaluation the possibility of growing short rotation woody crops in agroforestry systems (sycamore combined with grass, valuable broadleaves or aromatic and medicinal plants).

10.3 Chain of production of woody biomass from other resources (vineyards, orchards, parks, other agricultural zones or urban areas)

In Catalonia, there are some 350.000 ha devoted to the woody plantations, including vineyards, olive trees, fruit trees (form pear trees to almond trees, etc.), of which it could be made energy use of the rests of pruning and the replacement of whole plantations. However all this potential, most of these rests are self-consumed, because traditionally all the uprooted trees (mainly pear tree and apple tree) have been used as firewood by the owners.

There are few vine-growers and companies that collect and manage those rests of pruning in order to use them as fuels. In general, the rests of pruning are withdrawn from the vineyard with collecting machines, then bunched and burnt under control. In some cases, this material is comminuted and left in the vineyard as organic matter or simply *mulching* between lines, and only a very reduced number of vine-growers collect the material, either without comminuting by means of bundlers or comminuted, placing the latter in big-bags for the subsequent transport

At the present moment, the woody agricultural residues do not have market value; by contrast, they must face the costs of their disposal. For this reason, any activity for its energy use could be considered as a profit.

It is estimated that the prices of the agricultural woody residues are:

- Stone of olive and shells of almond/hazelnut = €60/t
- Pruning of olive tree = 36-50 €/t
- Pruning of vineyard = 36-60 €/t

It is expected a cheapening of the prices and a better service in quality and rapidity in the next years, thanks to the technological developments and the extension of the domestic systems. Furthermore, the use of by-products of fruit industries, associated with big productions, such as the stone of olive, the shell of almond or the kernel of grape, allows to diversify the supply and to contribute to establish more affordable prices. However, there are few companies devoted to the comminution of these biomasses, and those who do it work at local level, delivering within much reduced radium. This fact is explained by the high costs of densifying this material of little volume.

Regarding the use of residues of pruning from urban areas, there is project in Barcelona is under development that will use rests of pruning in green areas of the town and also logging residues, accounting a total of 28.600 tonnes/year, producing 16.000 MWhe per year.

11. Wood biomass projects in Catalonia on

In Catalonia there are several initiatives promoting the production and use of solid biofuels at bigger scale. Table 8 shows the estimated power for the next years associated to those initiatives.

Table 8. Estimated power production in Catalonia

Power and CHP plants	
Type	**Power (MW)**
Power plant	64
Mixed thermosolar plan	22,5
CHP district heating plant	5,5
CHP plant	2 (estimated)
Pellet factories	1,34
Central	10
Total	**105,44**

Source: AFIB-CTFC

12. Socio-economic and others constrains

The potentiality of the sector is hindered by the slow growth of the biomass market.

The main weak aspects of the biomass market are:

- Logistics of the supply: high costs and multiple intermediate phases in the supply chain, with different agents involved
- Levelling of offer and demand: there is much more available biomass that what the current installations can absorb, thus being biomass currently exported to other countries
- Competition between biomasses
- Security of supply, especially on a large scale
- In the case of heating of households and in the tertiary sector, seasonality of the consumption
- Elevated costs of investment for purchasing and installing biomass boilers, in comparison to the conventional installations of fossil fuels of equivalent power

13. Existing policy measures (subsidy schemes,)

At present, the main lines for promoting biomass are:

- Royal Decree 661/2007, of 25th of May that regulates the activity of production of electrical energy from certain sources. It establishes, for groups and subgroups, a feed-in tariff in function of the origin of the biomass: energy crop, residues of the agricultural activities or from gardening, and logging residues and other material produced in silvicultural treatments in forest stands and green areas. Depending on the type of power plant, age and electrical power, the tariff ranges between 12,7754 and 17,1596 c€/kWh for the first 15 years and from then between 8,7110 and 13,3344 c€/kWh. This tariff has proved to be clearly insufficient for the start of the activity.
- Order AAM/251/2011, of 5th of October, which approves the regulatory bases of the subsidies to the sustainable forest management. These aids are in force in the period 2007-2013 and include silvicultural treatments, treatments for the recovery of the forest potential and prevention of forest fires and, within of the chapter of diversification of the rural economy, valorisation of the forest biomass, with aids to:
    - Treatment and extraction of forest biomass (5,15 €/m3 bulk volume)
    - Densification of the biomass at roadside (6,85 €/m3 bulk volume)

  - Agreements for the acquisition of a heating module by leasing, for forest biomass (124,20 €/kW/year) and coupling of the module to the heating system (6.315,55 €/unit)
  - Performance of studies for the evaluation of the availability of forest biomass (10.350 €/unit).

- Subsidies for projects of energy saving and efficiency, and installations of renewable energies. The Government of Catalonia, through the Catalan Energy Agency (ICAEN), offers a line of subsidies, which includes subsidies to execute installations for forest and agricultural biomass destined to thermal uses (production of heat and/or cold) by means of thermochemical processes. These subsidies reach a maximum of 45% of the eligible cost in public facilities and 30% for the rest of beneficiaries (year 2011). Annually, ICAEN receives between 500 and 600 applications for the installation of boilers working with biomass, and there is a budget of roughly 2 million euros.

14. Main barriers for further development

14.1 Limitations regarding the harvest of forests

One of the main barriers for a greater development of the forest biomass is the high costs of harvesting and extraction as a consequence, fundamentally, of the low mechanization of the forest exploitations and the lack of skilled labour. These costs depend basically on the geographic characteristics of the forest area, and in most of the forests of Catalonia the production costs of forest biomass for energy surpasses the threshold of price that can a plant can pay for in order to guarantee a minimum profitability (Government of Catalonia, 2006). However, in many cases it is necessary to carry out secondary works that allow the harvesting to be made, as operations of cleaning, arrangement of tracks for vehicles, transport, among other, which are net costs that in many cases are not covered.

At the same time, in Catalonia roughly 87% of the forest surface belongs to private owners, and 89,24% are estates of size under 10 ha. This fragmentation of the ownership makes unprofitable to realize harvestings and silvicultural treatments because of its low profitability. However, there is a trend towards the associationism in order to optimize costs and increase the gains (Navarro et al., 2010).

For an important part of the owners the forest activity is a secondary activity, which is used when their main activity (mostly agricultural) has difficulties to generate a proper income. This causes often an unsuitable exploitation of the Catalan forests where the temporary economic interests prevail over the silvicultural, which means an underexploitation of the forests.

Besides, there are a series of geographic limitations regarding protected areas which are under different regulations for its protection (such as Network Natura 2000, ZEPA (birds), Natural Spaces of Special Protection, Natural Parks or National Parks). In those

areas, in order to carry out a silvicultural treatment or a harvesting sometimes (depending on the type of protection) an official permission is needed.

The climatic limitations are also a factor to consider, because the snow can prevent the performance of forest operations (some periods in winter); but in other areas, the risk of forest fires determines when and how the forest activity can be performed (mainly during the months of summer). But the climate is not only affecting when a forest activity can be done; climate also affects flora and the ecosystems, and therefore the forest management may vary from a climate to another, thus determining how a forest operation can be performed, how much can be extracted, etc..

Another limitation is the orography, since the average slope of the Catalan forests is 46,6%, and has to be taken into account when using certain types of machines.

Most of the forest surface of Catalonia is treated manually and many sawmills and forest companies have an old and obsolete machinery. This fact, in addition to a forest road network which is not kept in good conditions, has resulted in a lack of use of machines with higher performance (forest harvester, forwarders), thus diminishing the profitability of the forest activity (Navarro et al., 2010).

Thus, the high costs together with the situation of the forest ownership (mostly private and of small dimension), and other limitations that hinder the profitability of the harvest supposes that the use of forest biomass for energy still has a lot of development ahead.

14.2 Limitations regarding the technology

According to the Catalan Energy Agency (ICAEN, 2011), the main limitations in the use of the forest biomass for energy are:

- The user is not connected to a network of biofuel supply, as the electrical or gas networks, and therefore it is necessary to manage the procurement of the biofuel
- Forest solid biofuels need space for storage
- It is necessary to foresee the supply logistics of the biofuel and validate the accessibility of the supplying trucks for the whole silo
- Even with the existence of numerous European standards referred to the qualities of biomass, there is still a lack of Spanish ruling the use and production of biomass for energy
- The low energy density of the biomass compared with the one of the fossil fuels makes the manipulation often difficult and increases the costs of transport and storage (it is necessary more space to store the same energy)
- The heterogeneity of some biomasses is a difficult fact to control because of the influence of the climatic conditions and its origin

- Often, the high cost associated to the drying processes of the biomass is a limitation to produce solid biofuels of quality
- In many cases, the absence of previous treatments of the products and by-products from forestry and agriculture causes a reduction of the quality of the biofuel
- The prices of the agricultural products and by-products are influenced by its seasonal character and by its spatial dispersion

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SPAIN – MURCIA REGION

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16. Introduction

The main framework related to the use of biomass in Spain is the new PER (Renewals Energy Plan) 2011-2020. This plan includes the design of new energy scenarios and the inclusion of objectives in line with Directive 2009/28/EC of the European Parliament and of the Council of 23rd April 2009 on the promotion of the use of energy from renewable sources, which sets binding minimum targets for the whole of the European Union and for each of the Member States. Specifically, the Directive sets a target of achieving a minimum quota of 20% of energy from renewable sources in gross final energy consumption in the European Union, the same target set for Spain.

In the biomass sector and according to their origin we can establish the following subsectors:

- Forestry: Biomass production sector generated in the treatment and use of the plant masses. Directly linked to the forest sector and its activities in the mountains.
- Agro-forestry: Sector producing biomass generated in the work of agricultural crops, woody and herbaceous, both in the work of pruning trees and in harvesting and collection activities of end products.

The products obtained can be used both for thermal uses such as for electrical purposes, this way we can make a second division according to its application:

- Thermal biomass: technology applications dedicated to the supply of heat for heating and / or industrial processes. It is clearly divided into applications for buildings and other industrial processes and applications.

- Electricity: applications for power generation and whether solely by cogeneration systems or systems of co-combustion.

17. Wood biomass market

Spain, like most of the developed countries, replaced most of the biomass-based consumption, first for coal in the late nineteenth century and then by petroleum fuel or electrical appliances during the twentieth century. In fact, this consumption was relegated to only some sectors directly related to biomass such as forestry and agro-forestry in some cases or ceramics. Apart from these sectors, the most consumption of biomass is focused on traditional systems for heating, DHW heating and cooking, as the old fireplaces or wood stoves.

Most part of the biomass comes from the forestry sector, which has traditionally been used in the domestic sector through inefficient systems (use of firewood in obsolete equipment), but also boilers.

The following table shows the distribution of biomass consumption by origin and applications in 2006 (for Spain), reflecting the importance of the uses of forest firewood and pruning of olive trees and other by-products of oil production sector. It also shows the importance of fuels from the forest industries, especially paper mills (black liquor and bark) in electricity production from biomass.

Table 9. Distribution of biomass consumption by origin and applications in 2006 (for Spain)

				Application	
	toe	Heat Power	Tn	Electric (ktoe)	Thermal (ktoe)
Stem wood	950.000	0,2500	3.800.000	0	950
Pruning wood	250.000	0,2500	1.000.000	0	250
Olive tree pruning Energy crops	400.000	0,2500	1.600.000	0	400
Cereal straw	100.000	0,3000	333.333	80	20
Black liquor	600.000	0,3000	2.000.000	600	0
Sawdust and shavings	450.000	0,3000	1.500.000	0	450
Bark	550.000	0,3200	1.718.750	170	380
Olive pomace	700.000	0,4000	1.750.000	250	450
Other foods	200.000	0,3200	625.000	0	200
Total	4.200.000		14.327.083	1.100	3.100

Table 10.

Table 11. Wood biomass potentials

Origin		Potential of biomass (Tn)	Biomass consumption in 2006 (Tn)
Forest Biomass	Wood harvesting residues	2.984.243	5.545.287
	Use of the full tree	15.731.116	
Agro biomass	Herbaceous residues	14.434.566	478.011
	Wooden residues	16.118.220	1.912.046
Herbaceous mass capable of implementation in agricultural land		17.737.868	0
Wooden mass capable of implementation in agricultural land		6.598.861	
Wooden mass capable of implementation in forest land		15.072.320	
Total Biomass Potential in Spain		88.677.193	7.935.343

Table 12. The objective till 2020 (for Spain):

Biomass (Tn/year needed)	Total 2020	Pure Power Plants	Cogenerating Heat and Power
Energy Crops	2.518.563	1.978.308	540.255
Agro Biomass	1.915.266	1.658.164	257.102
Frorest Biomass	2.283.926	1.872.222	411.703
Agro industrires Biomass	1.879.815	1.189.677	690.138
Forestry industries Biomass	1.264.785	749.447	515.338
Black liquor	1.772.481	333.305	1.439.176
TOTAL	11.634.836	7.781.124	3.853.712

Table 13. The biomass needed for this objective (2020)

Available biomass vs needed (Tn/year)	Pure Power Plants		CHP	
	Available	Needed	Available	Needed
Forestry (full tree)	391.462	1.978.308	0	540.255
Wooden mass for implementation in forest land	6.460.089		0	
Herbaceous mass for implementation in agricultural land	0		0	
Wooden mass for implementation in agricultural land	2.876.476		793.743	
Agricultural herbaceous residues	9.652.772	1.658.164	0	257.102
Agricultural wooden residues	5.147.870		0	
Wooden industries biomass	430.173	1.872.222	00	411.703
TOTAL	24.958.842	5.508.695	793.743	1.209.060

18. Forests and wood biomass production

The Region of Murcia covers an area of about 11,300 km^2 (3'23% of the Mainland Spain).

Lands are mainly covered by natural vegetation. Almost a half of its area is covered by trees, shrubs, herbaceous plants and other non-cultivated zones with any kind of vegetation not installed by man. The Region of Murcia contains 2.1% of the national woodland resources[4].

The largest forest landuse is located in the Northwest Region, Río Mula, Lorca Northern, Sierra Espuña, Cieza and Ricote, with an area of 225,900 ha. The area is predominantly mountainous with numerous hills and important woodlands. The dominant formation is the Aleppo pine forests, with a cover area of 102,409 ha. Pine forests are 65% private in the north of Murcia and less than 25% in the south of the Region.

Table 14. The approximate distribution of land use by «districts» and municipalities in the North-western Southern Region of Murcia:

"COUNTY" Municipally	**Natural vegetación**	**Improductive**	**Wetlands & water**	**Cereals**	**Vegetables**	**Fruit trees**	**Citrus**	**Olive trees**	**Vineyards**	**Almonds**	**Forced crops**
NOROESTE	130.322	1.379	1.040	53.259	7.267	8.741	0	2.065	905	14.397	0
Bullas	2.093	258	56	762	253	936	-	50	325	3.479	-
Caravaca de la Cruz	41.280	485	151	33.630	4.934	2.348	-	190	19	2.787	-
Cehegín	18.265	481	295	2.277	257	3.836	-	616	509	3.378	-
Moratalla	68.684	155	538	16.590	1.823	1.621	-	1.209	52	4.753	-
RÍO MULA	**28.916**	**327**	**501**	**12.492**	**481**	**4.946**	**740**	**301**	**429**	**23.622**	**0**
Albudeite	835	36	18	252	11	70	256	30	-	195	-
Campos del Río	2.311	56	19	972	181	330	34	12	-	813	-
Mula	24.425	182	426	11.233	289	3.716	409	259	429	22.013	-
Pliego	1.345	53	38	35	-	830	41	-	-	601	-

The main roles played by forest in Murcia are ecological, productive, recreational, landscape, and protective. The use of woodlands for forest biomass in the Region of Murcia is a limited resource, focusing on private owners and small areas. This is because the production of biomass that can generate the forest lands in Murcia has not been

[4] Spanish Renewable Energies Plan 2005-2010

promoted in a sustainable manner. Based on the analysis of our studies, taking into account the existing stocks and tree annual growths, Murcia Northwest are capable of generating sustainable biomass.

The use of forest biomass, in addition to the benefits of the generation of alternative and renewable energy, can achieve other objectives of great importance in forest management:

- Reduced risk of fire,
- Pest control
- Improvement protection and conservation of natural areas
- Job creation and rural development (promotion of agroforestry and rural economy)

According to our analysis, the sustainable production of potential biomass in the Northwest of Murcia Region is about 172.366T per year (public and private forest lands).

Based on these data, the rate of wood extraction could be of 30-35% growth, generating around 50.000 to 60.000 t per year of biomass. According to historical data of the General Directorate of the Environment, silvicultural treatments can generate about 20 t per ha. To satisfy a market of 60.000 - l50.000 t per year of biomass is necessary to treat 2,500 to 3,000 ha. Among the main silvicultural treatments applied in our forest-lands, the approximate areas to be treated per year are shown in the following table:

Table 15. Main silvicultural treatments applied in forest-lands (Murcia) and the approximate areas to be treated per year

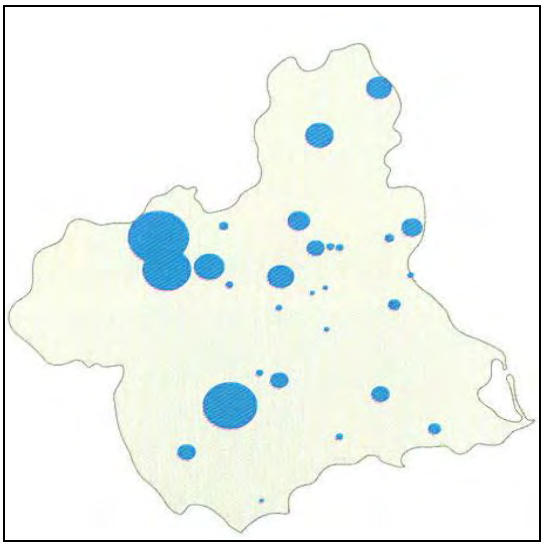
SILVICULTURAL TREATMENT IN WOODLAND	TREATMENT TYPE	ACTINO AREA
Fire belt	Fuel management	100-150km
Trail zone		
Fuel break		
High thinning	Forest harvesting and silvicultural treatments	1925h -2310ha
Preparatory cutting (Regenerative)		
Mixed thinning		
Selective cutting (Regenerative)		
Removal cutting (Regenerative)		
Low thinning		

As a main measure to promote biomass in the region of Murcia, General Directorate of the Environment in Murcia has prepared a legal document regarding "***Technical Guidelines and contents to include in the Technical Plans for Forest Biomass Management***" to research and develop technical plans for sustainable forest management*:* (approved in on 22 June 2011 and gazetted on 5 July 2011). This document is a legislative tool for forests management in the Region of Murcia, and therefore of the biomass.

Residual biomass is divided into agricultural residues, forest residues and industrial waste. The main resources available come from forestry and woody crops. Agricultural residues are divided into woody and nonwoody residues:

- Woody residues are mainly concentrated in the municipalities of Cieza, Murcia and Yecla and are basically composed of pruning and trimming waste, which means that they are only available on a seasonal basis. The approximate land surface of woody crops is more than 220,000 hectares and the total volume of residues available is 170,000 t, with an energy equivalent of more than 20,000 kW/year, which means an average yield of 0.12 kW/t. On the other hand, the Spanish Renewable Energies Plan (*Plan de Energías Renovables de España*) 2005-2010 (hereinafter, PER) estimates that the energy potential coming from woody crop resources in Murcia is 66,360 toe/year.[5]
- Nonwoody residues are concentrated in the municipalities of Caravaca de la Cruz, Jumilla and Lorca. These residues are not habitually employed for producing energy, but for other uses such as livestock bedding. The total land surface of nonwoody crops is approximately 115,000 hectares, producing about 64,000 t of residues that are potentially usable, the equivalent to an energy production of about 9,100 kW/year (15,460 toe/year according to the PER), with an approximate yield of 0.14 kW/t.
- Forestry residues come from work carried out on woodland, basically maintenance works and silvicultural treatments, fire management, scrub wood harvesting, etc…, since practically no woodland is used for its timber due to the lack of profitability of this activity in the Region of Murcia.

[5] TOE: Ton Oil Equivalent = 41.84×10^9 J and equivalent to 1.16×10^4 kW/h; 1kW/h = 36×10^5 J



Picture 8. Map of Production of Forestry Residues Region of Murcia

As we can see on picture 8, the forestry residues of the Region of Murcia are mainly concentrated in three municipalities: Moratalla, Caravaca de la Cruz (Northwest of Murcia) and Lorca, where 50% of the energy potential from this resource in the Region of Murcia is produced. As in the case of all the above-mentioned residues, the energy power of wood depends on the type of tree and on parameters such as moisture. However, as the following table shown, the production of forestry residues is 105,165 t/year, which means an energy potential of almost 42,000 kW/year (29,129 toe/year according to the PER), with an approximate yield of 0.40 kW/t.

Table 16. Production of forestry residues

Municipalities	Ha woodland	Trimming (t/year)	Tops & Limbs (t/year)	Total (t/year)	Total kW
NOROESTE	153,223	553,55	802,173	**1025,054**	**1014,499**
Moratalla	50,085	5,259	18,932	**24,191**	**9,638**
Lorca	41,492	4,357	15,684	**20,040**	**7,984**
Caravaca de la Cruz	29,354	3,082	11,096	**14,178**	**5,649**
Cehegín	15,316	1,608	5,789	**7,397**	**2,947**
Mula	11,852	1,244	4,480	**5,725**	**2,281**
Calasparra	3,153	331	1,192	**1,523**	**607**
Bullas	1,971	207	745	**952**	**379**
Region of Murcia Total	**224,952**	**22,862**	**82,303**	**105,165**	**41,898**

19. Wood biomass production chains and wood biomass use

Currently the management of forests mass is mainly focused on protection purposes and prevention against fires. As discussed in the previous question, the extraction of forest biomass in Murcia has been so punctual and in small areas. Therefore there is a lack of knowledge in the common practices of wood biomass production chains (as well as machinery used for production) from forests in the Region of Murcia because of the biomass use has not been promoted in a sustainable manner.

The main actions aimed at maintaining and increasing the forests mass (and, therefore, biomass) are:

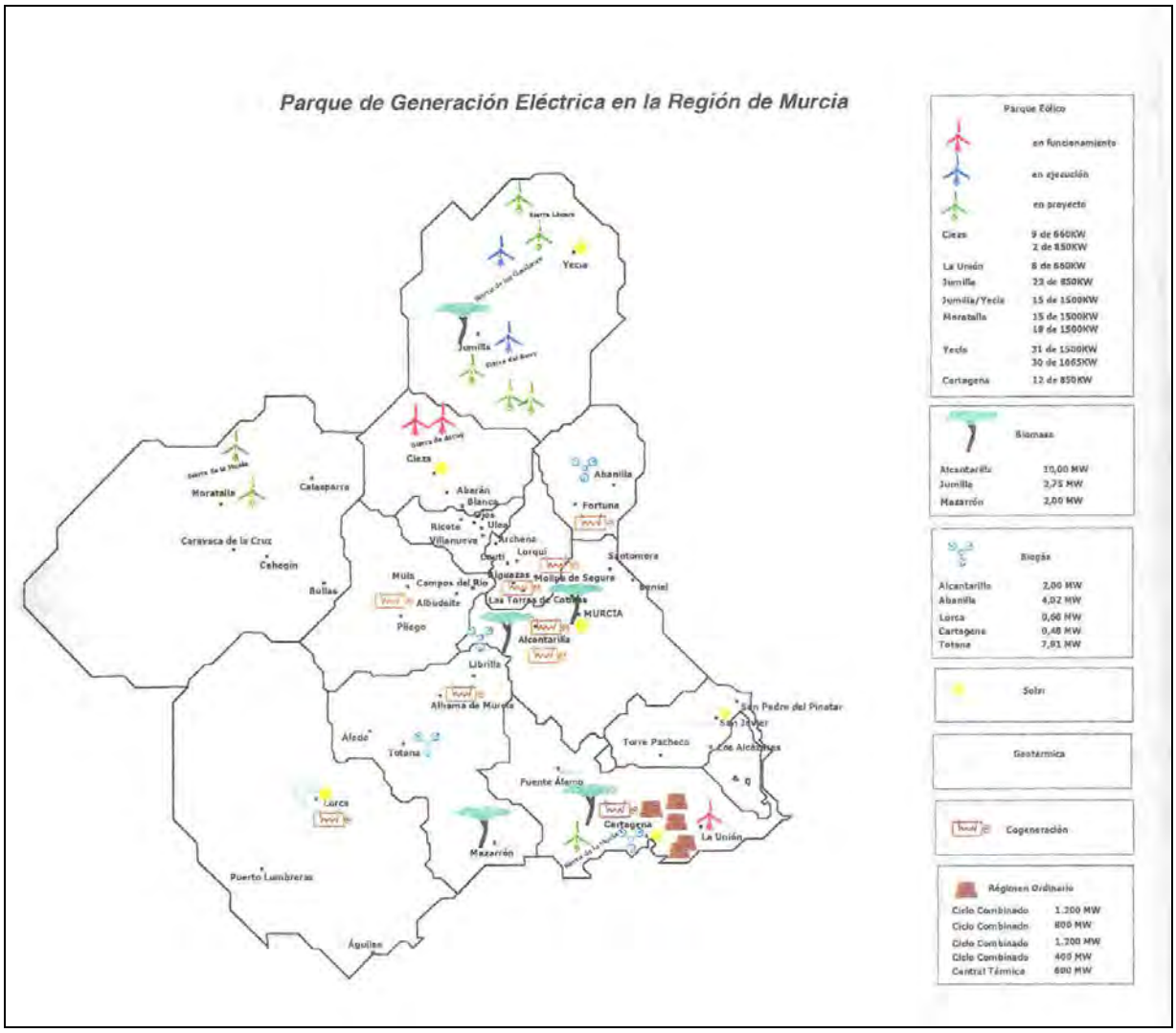
- Silvicultural Treatments: they are primarily focused on woodlands maintenance works and restoration and promotion of the establishment and on-going growth of the plant species present in the years immediately following an ecological disaster (encouraging the potential for self-regeneration). Silvicultural treatments are to be carried out both on an arboreal and ground level (aiding natural regeneration). Mainly using silviculture actions like thinning, pruning or clearing the undergrowth

- Reforestation: the planting of autochthonous species (subject to prior environmental assessment) in order to improve the existing density and promote biodiversity.

- Road Networks: since transport logistic is one of the most critical issues for the profitability of this activity, it is necessary to have a good knowledge on the road network in forests in order to plan the working methodology and equipment and to assess the actual biomass available. The analysis of road characteristics (road surface,

width, surface characteristics, road density, related elements as road narrows and amplitudes...) are basic data to design the activity. The aim is to plan the accessibility to forest cover and to calculate the cost linked with the extraction of biomass processes.

In the Region of Murcia there are 50 energy-producing companies[6]. However, no plant uses biomass as a feedstock. In relation to a future biomass market in the Region of Murcia is planning to set up two biomass plants.



Picture 9. Map of Distribution of Electrical Power Plants in Murcia

In planning for biomass plants is paying special attention to the pre-treatments that biomass can undergo, to adapt to current forest harvesting practiced in Murcia. Indeed, the yield of biomass is highly influenced by the treatments previously applied to the residues. Two types of treatments exist. Firstly, *homogenisation* treatments (processes of crushing, splintering, drying...) that give the raw material the right conditions (size,

[6] INE

moisture...); and secondly, *densification* treatments, which improve the property of the biomass to make it more compact and easily transportable. In a later phase, the biomass can be transformed by various thermochemical methods. These methods use heat as a source of transforming the biomass and are well adapted to dry biomass such as wood.

Economic cost is another variable that is influencing the biomass plant planning.The cost analysis is made bearing in mind the origin of the biomass and the type of use (thermal or electrical) for the domestic or the industrial sector, there being a great variation of prices and a lower cost if the use of the biomass is thermal.

There are various plans at national and regional levels, for the development of new energies. To be highlighted at a regional level, we have the Region of Murcia Energy Plan 2003-2012. The aim of this plan is related to the development of biomass, including renewable energy. The contribution of biomass to production of Renewable Energies in the Region of Murcia in 2012 will be about 20,2%.

The total investment in renewable energies for the period 2003-2012 is estimated at more than 1,000 million euros. Biomass and its by-products, in spite of representing an important source of energy, only receive 5.3% of the total investment, that is to say, 53.6 million euros.

Are also developing others programs that indirectly invest in forest biomass (such as aid private forest owners: development of technical plans and execution of work; promotion of technical plans for forest biomass management ...).

In spite of not being the most important source of biomass, residual biomass is the most widely used and developed for energy production in the Region of Murcia, because it avoids, in part, the logistical problems of natural biomass.

Residual biomass includes the organic wastes produced by agriculture and industry, plus the residues coming from woodland

As discussed in the previous section, forestry residues come from work carried out on woodland (silvicultural treatments, fire management, maintenance works, scrub wood harvesting, etc.). The Region of Murcia contains 2.1% of the national woodland resources[7]. But there are certain problems with respect to the forestry residues:

- Availability of the resource in quantity, quality and price::

It is difficult to ensure a stable production of large quantities of biomass for an established area; it is necessary to have in a sustainable way economic resources for improving the forest mass and for the prevention of fires.

- In some cases an alternative use exists:

Other uses, both traditional and industrial, limit the existing resources.

[7] Spanish Renewable Energies Plan 2005-2010

- Lack of pre-treatments for adapting the resource:

Great heterogeneity, both physical and in composition. Alternatives exist for homogenizing the resource or, if applicable, for facilitating its transportation (splintering and compressing)...

20. Socio-economic and others constrains

Main forest lands in Murcia Region are composed of pine forests (*Pinus halepensis*) which have an essentially protective role. These forests haven't got a productive function, because they are not profitable for wood market. Public property forest suppose a 42,18 % of the total surface and private property is a 57,82 % of the total.

Currently, biomass market is suffering a peak of big importance, and specifically northwest forests of the Region are clear examples of a chance of sustainable use for this end. Promotion of a regulated energetic use of the biomass implies a decrease in the risk of forest fires, and therefore, a saving in the common expenses of the destined budgets to prevention and extinction of fires.

Residual forest biomass is a product with little values that complements the current wood uses. The use with energetic ends gives this product a new choice, changing his consideration of residue of the forest activity by the one of resource with use possibilities. Besides, it is must be taken into account that in the Region of Murcia, in view of the protective nature in opposition to the productive function of their forests, it is possible to take advantage of the whole trunks for biomass purposes.

Useful biomass may come from silvicultural treatments: fire belts, firebreaks, pruning, cleaning and thinning of the forests and silvicultural mass treatments. Biomass from cuttings is divided into that from the trunk and that one from the top and branches of the tree. Biomass relation, in Murcia, for these two parameters is 1/1.

Being aware of that, public administrations must prepare and manage the probably market of wood and firewood use for local production of electrical and thermal energy, without obstacle of the applicable laws.

Current supply of firewood and wood of the southern forests of Europe could digress without problems to a potential biomass market with energetic ends, with multiple ecological, social and economic profits.

It is also important to adapt the different kinds of silvicultural techniques and uses, including the costs provision of the responsible execution of these techniques for continuous and stable biomass production. It's essential to evaluate the economic costs of silvicultural actions that performances that will generate forest biomass, so that a future energetic biomass market does not develop by expense of the ecological balance of our forests

At present, Murcia Region is developing the bureaucratic procedures for future grants for the forestry sector in order to mitigate desertification and fire prevention in regional private forests and for future for non-productive investments in private forest within Natura 2000 network in Murcia region, grants focused to the biomass use.

Some examples are:

- Approval of the Resolution of the Directorate General for Natural Heritage and Biodiversity by approving the instruction aimed to the interpretation of the existing General Rules for the Study and Drafting of Technical Plans for Sustainable Forest Management in the area of Murcia Region:

Technical plans are documents of forestry management and dasometric character which purpose is the sustainable organization of multiple use of forest that society demands. The study and preparation of technical plans of forest management is a demand for the normal exercise of the management of forests in Murcia Region.

-Approval of the Rules governing for Grants to Forestry Sector: During 2011 two orders have been approved which that corresponds to the regulatory bases for grants for the forest sector:

- Order of April 18th, 2011, of the Regional Ministry of Agriculture and Water, which sets the rules for grants to non-productive investments in private forests in the Natura 2000 network in the Region of Murcia.
- Order of April 18th, 2011, of the Regional Ministry of Agriculture and Water, which sets the rules for grants for the forestry sector in order to mitigate desertification and to prevent forest fires in private forests in the Murcia Region.

Currently, the call for these grants is waiting to be materialized through the financial support of FEADER funds, analyzing the financial viability of some of the measures of the Rural Development Programmes in the Region of Murcia.

On the other hand, it is necessary to mention the possibility offered by farms of fruit trees. Both for the production of pruning and the renewal of the trees, the annual biomass production is very important. Currently there isn't a use of energy from such biomass but it is burned in their own farms in order to destroy the matter and prevent the spread of pests.

A biomass energy use is desirable in this case, so that in the case of agroforestry farms, are also included in the objectives of the project.

21. Existing policy measures (subsidy schemes,)

21.1 At national level:

The BIOMCASA Programme: The program encourages companies, acting as Energy Service Companies, to contract with users the energy service to the needs and, having been previously authorized by the IDAE, to access a specific line of funding for their projects biomass.

To start this line of Financing, IDAE is developing a pilot phase with an initial budget of 5,000,000 €. Once this phase and, depending on experience, it will provide rights of permanent funding of the program seeking the participation of financial institutions.

The instrument through which to articulate the program is the Energy Services Company (ESCO), that is, companies capable of carrying out the design, installation, commissioning, operation and maintenance of facilities and of course also supply biomass, billing, usually monthly, for all these services on the basis of thermal energy consumed by the customer. This bill also includes the cost of the new facility.

Financing conditions:

- Type of interest: Euribor + 1,5%
- Maximum period: 10 years
- Grace period: 1 year

21.2 At regional level:

Grants for the investments in production of thermal energy for domestic, industrial or buildings using biomass as fuel. The costs of eligible items are equipment, and facilities, and associated civil works engineering projects. Grants of 30% of the investment amount.

Grants for the investment in specific machinery for the treatment of biomass for energy use in order to facilitate field collection and transport so as to reduce costs associated with transporting it. Grants of, in general 30% of the cost with several limits.

Table 17. Grants for the investment in specific machinery for the treatment of biomass for energy use

Machinery	Type	Maximum cost (€/HP)	Maximum grant
Packing Machine	Autodrive	1.000	30%
	Non auntodrive	500	30%
Chipper	Autodrive	1.000	30%
	Non auntodrive	500	30%

22. Main barriers for further development

The forest biomass use has been divided into different stages in order to better identify the barriers in this sector:

a) General barriers:

- Non-existence of a logistics market
- Competition of other fuels
- Lack of rules and regulations
- Lack of installations
- Lack of Biomass power station, and development of co-combustion installations.
- Lack of premiums
- Lack of studies

b) Resource availability

- Forestry residues
- Agricultural residues and energy crops
- Lack of appropriate pre-treatments and high costs
- Distribution and small size of farms

c) Barriers to the use of resources

- Lack of links between producer and producer of biomass energy.
- Resource management on a competitive basis
- Seasonality in the generation of the resource
- Immature Biomass market.
- Lack of coordination between the different authorities/administrations involved.
- Lack of incentives for the development of biomass in origin
- Authorizations for waste management.

d) Barriers to technology development

- Competition with conventional fuels.
- Lack of technological development, implementation and maturity for certain technologies and projects.
- Commercial technologies for electricity production.

e) Barriers to applications

- Financial support for fossil fuels.
- Lack of tradition in the thermal use of biomass by the social partners.
- Poor economic performance in relation to risk for some investors.
- Complexity and delay of administrative procedures.
- Deficiency in the power lines for evacuation of power generated from biomass.
- Barriers to the introduction of biomass cogeneration.
- Difficulties in the take-off of the co-combustion.
- Technical limitations established under the Special Scheme for power generation using biomass.

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PORTUGAL

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24. Introduction

24.1 Global analysis of national energy policies, their objectives and guidelines in national development plan, with particular emphasis on the use of forest biomass as a renewable energy source (FER)

The Portuguese energy policy encourages the production of electricity that is based on renewable energy using endogenous natural resources and started to take its first steps in 1988. But only in 2003 got a boost through the Ministers Council Resolution No. 63/2003, of 28 April, with the approval of the guidelines of "Portuguese Energy Policy", its objectives and measures relating to its implementation, revoking Ministers Council Resolution No. 154/2001, of 19 October, which had approved the E4 Program, Energy Efficiency and Endogenous Energies.

But it is from 2005, with the Ministers Council Resolution No. 169/2005, of 24 October, which approves the National Strategy for Energy, defining their objectives and their measures, revoking the Ministers Council Resolution No. 63/2003, of 28 April, which had approved the guidelines of "Portuguese Energy Policy", that is assumed, definitely, the focus on renewable energies as an important strategic objective for the development of the Country and begins to introduce a strong dynamics in the sector, with the ambitious legislative goals and resources to be allocated, attracting the interest to the business investment in this area. By 2010 were achieved notable gains the development of the "Cluster" of renewable energy, as well as the sub-sector using forest biomass as a renewable energy source (RES), as evidenced by the good results of indicators such as:
- The share of renewables in final gross energy consumption;
- The foreign dependence on imports and consumption of fossil fuels and their replacement by an increased use of endogenous energy resources, of renewable energy;
- The import balance;
-% Of GDP production from of renewable energy, among others (and some other indicators in other sectors that are interconnected or interpenetrating).

In 2010, the Ministers Council Resolution No. 29/2010, of 15 April, approves the National Strategy for Energy 2020 (ENE 2020), establishing, relatively to biomass, that

measures will be adopted to promote the production of forest biomass, ensuring meeting the consumption needs already installed and to install, in particular by streamlining and access to government support, promoting sustainable forest management certification and evaluating the use and promotion of energy crops, as well as the residual biomass of farming and agro-industrial activity for the production of energy (revoking Ministers Council Resolution No. 169/2005, of 24 October, which had approved the "National Energy Strategy"). With this Ministers Council Resolution it is clear that, despite keeping and even increasing the focus on renewable energies, with the need to create a new global framework to the National Action Plan for Renewable Energy, which was published in June 2010, derogates up in time the achievement of objectives and goals, by making it "slide" to 2020, what before was predicted to be achieved, on average, 5-6 years earlier. This fact is no stranger to several path errors committed, regarding the combination of sectoral policies and measures required, the analysis of markets – supply, external and internal competitors, the real need of support to investment and production subsidizing and tariffs subsidizing, on a first stage, while the "renewable" does not get size on the market, the prioritization of "wind energy" instead of "biomass", the efficiency of instruments and programs created to leverage and sustain energy policy and to solve the serious structural and investment problems in the forest sector, the evaluation of the financial resources to be allocated and forecasting future developments of international and national macroeconomic scenarios.

The economic and social crisis which began to settle in Portugal from the second half of 2007, but that began to experience truly worrying contours from 2010 and which from 2011 are dramatic, is reflected also in the economic and financial stability of the sector of renewable energies (and trust of the respective employers), particularly those using forest biomass as RES. In fact, there is great concern about the extent of the impact that the severe economic recession we are experiencing will produce, given the expectations, either for companies that are already on the market and for any subsidiary of such an economy, or for those who are about to start production, or even to others who have already made investments in projects, more or less any significance, and regardless of their level, now question whether the proceeding.

By analyzing the Memorandum of Agreement about the Conditionalities on Economic Policy, signed between the Portuguese Government, the International Monetary Fund, the European Central Bank and the European Commission, at May 17, 2011 (revised punctually in September and December 2011), which describes the general conditions of economic policy on the granting of financial assistance of the European Union to Portugal, In the context of the Excessive Deficit Procedure, for a three years period (see Annex A of Chapter 6.), the Program of the XIX Constitutional Government, approved on the National Parliament, at July 1, 2011 (See Annex A of Chapter 6.) and the Laws No. 64-A/2011 and 64-B/2011, of December 30, respectively approving the Major Options of the Plan and the General National Budget for 2012 (Annexes A and B of Chapter 6.), we can already see changes in global and sectoral policy orientation and budget and fiscal

policy. Fiscal measures have been taken that did not meet the principle of positive discrimination, leading to increased taxation and reduced incentives and exemptions, touching the agents of the row of "renewable", users and final consumers, as well as we can anticipate the decrease, In 2012 and following, of investment support and production subsidy. However, the objectives and goals of the ENE 2020 have not been revised.

Following is presented a "Summary of the National Policy on Renewable Energies". Its content is the more optimistic view of this policy, supported, mainly, by the National Action Plan for Renewable Energies (PNAER) - June 2010, under Directive 2009/28/EC and by the ENE 2020, documents developed, it can be said, in parallel. Its implementation will be hardly viable in much of its length; it will lack to measure the degree of failure, which is expected the lowest possible and with less repercussion in the economic and social life of businesses, families and Country, until the structural problems of sectors of economic activity are definitely solved, especially those in the forest sector that are those that cause a biggest constraint to the success of the Renewable Energies Policy, having the Forest Biomass as RES.

A more complete and integrated understanding of the analysis on current situation in the Country and in the Algarve, on policy regarding, strategies and measures for the development of renewable energies with the use of forest biomass, it is achieved by reading, complementarily, Chapter 6 and its Annexes.

24.2 Summary of the National Policy on Renewable Energies

Portugal does not dispose of resources or accessible fossils reserves, known so far. So, the role of renewable sources is essential to improve levels of safety,, at the same time that promotes the diversification of the energetic mix and contributes to increase the sustentabilidade associated to the production, transport and energy consumption. At present, more than 40% of the electricity produced in Portugal is based on the use of RES and around 20% of the final energy consumption is achieved with the use of renewable energy. Have been created, over the past years, a variety of financial and fiscal supports, for investment in renewable energies, much propelled by the creation of differentiated tariffs for electricity produced in renewable power plants, *feed-in tariff* (FIT), according to the degree of maturity of the various technologies available in the Portuguese market.

The national energy policy, Having in account the contribution of RES, has as main objectives:

• Ensure compliance with national commitments in the context of European energy policies on and combating climate change, by allowing that in 2020, in gross final energy consumption, 60% of electricity and 10% of energy consumption in road transport sector are from renewable sources;

• Reduce dependence on foreign energy, based on the consumption and import of fossil fuels, to about 74% in 2020, from an increased use of endogenous energy resources (estimated of reduction for a reference Brent equal to 80 usd / bbl);
• 25% reduction in the import energy balance (about 2000 million Euros) with the energy produced from endogenous sources, enabling a reduction of imports estimated at 60 million oil barrels;
• Consolidate the industrial "cluster" associated with wind power and create new clusters associated with new technologies of the renewable energy sector, ensuring in 2020 a GVA of 3800 million euros and creating 100 000 new jobs, in addition to the 35 000 allocated to production electricity with RES, estimating that the impact on GDP will increase from 0, 8% to 1.7%;
• Promoting sustainable development, creating conditions for the fulfilment of country commitments in terms of reducing greenhouse gases emissions, through increased use of RES and energy efficiency, with the goal to achieve in 2020, a additional emissions reduction of 10 million tons of CO2.

In addition to these objectives, the energy policy for RES through the ENE 2020, also establishes a set of specific measures in view of their promotion:
• Create, by 2012, a tariff fund balance contributing for minimizing variations in electricity tariffs, benefiting consumers and creating a framework of economic growth that supports the long-term use of renewable energies.
• Develop, during 2010, within the scope of the national strategic reference framework and of the other tools to support the economic development, support lines for investment in renewable energies, particularly solar thermal supporting, also aiming to increase exports on these areas.
• Update the micro-production Program, setting more ambitious targets and introduce a mini-production Program for projects with a power output up to 150 kW or 250 kW according to the technologies.
• Approve measures to promote the production of forest biomass, to ensure the consumption needs already installed and to install, through access to government support, of promoting sustainable forest management certification, evaluation and promotion of energy crops as well as the residual biomass resulting from agricultural and agro-industrial activities.
• Create, until the end of 2010, a system of planning and constant monitoring of demand and potential supply of energy in order to optimize the integrated management of available resources, improving security of energy supply and promoting a more efficient use and integrating the different renewable energies.
• Implementing the National Plan for High Potential Hydroelectric Dams (PNBEPH), the new water projects in progress and the power reinforcements of wind energy, by the introduction of a stabilizing element in the form of reversible capacity on the planned investments.
• Create conditions for the introduction and mass use of electric vehicle at the national level, enhancer of consumption of renewable energies produced, even placing Portugal

as a reference country in terms of testing, developing and producing electric mobility solutions.

24.3 Specific measures to promote the use of biomass energy

Being forest biomass, the type of biomass relevant in place of PROFORBIOMED, matters, in the context of its use as a RES, setting it as being the "biodegradable fraction of products, waste or debris of biological origin from the forest or from other plantations established for its production, aimed to the production of energy in biomass power plants."

Forest biomass has a high importance to the country by its transversality to forest management, producing neutral heat and energy regarding to CO2 emissions. The use of the forest biomass allows promoting professional management of national forests, helping to reducing related risks as well as for its sustainability. Biomass also has a major societal impact in the creation of stable employment, both direct and indirect, in less developed areas, thus contributing to the settlement of populations.

As are considered decisive measures, which reflect the general postulates and the goals referred to in paragraph 1, and without prejudice to what is presented below in more detail or in addition, that can be summed as follows:

i) Creation of a sufficient economic incentive for promoters of forest biomass plants in the sale of electricity produced;

ii) Reinforce the incentive systems linked to Support Funds, particularly the Permanent Forest Fund, to support, among others, forest certification, in order to promote and motivate a professional management and an increase in productivity of forests;

iii) Review, once again, the PRODER 2007-2013 and amend legislation in the forest sector to solve the serious structural problems of the Portuguese forest, particularly, among many, and as an example, the smallholding, by taking from now measures to encourage these areas the investment in afforestation, reconversion and improvement of forest stands;

iv) Promote, in all forms, the use of forest, agricultural and agro-industrial biomass, and biomass originated from waste, as well as from dedicated energy crops, also with the aim of relieving the pressure of demand on timber markets;

v) Create partnerships, particularly with the Autarchies, intermediate biomass collection parks and chipping biomass parks, to reduction of volume and facilitation of more economic transport, as well as intermediate biomass storage platforms that, in addition of contributing, equally, for the reduction of transport costs can also stimulate the installation of industries that produce biomass-derived with higher economic value.

24.4 Supply of biomass, both domestic and trade

Taking into account the estimated value for the available biomass potential in Portugal (forest and other), it is considered being ensured the conditions to fulfil the national goal established for the production of electricity in dedicated plants, fixing at 250 MW the installed capacity by 2020.

Anyway, bearing in mind that lie ahead other uses of biomass in particular the pellets production for heating, would be necessary a combined effort of public policy and private interests to enhance and ensure the availability of the resource. This effort has been developed through the promotion of forest associations, of measures to circumvent the forest owners absence, of the forest and its products certification, among other solutions, such as the promotion of energy crops, support systems for forest clearing and new fire prevention measures.

Given the demand for biomass for the different sectors - electricity, heating, cooling and transport - it is expected that the Country can meet most of the needs using the domestic supply of raw material. The only exception is in the transport sector, particularly in the production of biofuels, where recourse to the importation will reach a significant relative value. Indeed, in 2020, it is estimated that the imports for this use should reach 431 ktoe, representing more than 90% of the raw material used in biofuel production. In global terms, however, imports should not represent much more than 10% of biomass needs, it is estimated a value of 11% by 2020.

Measures to increase biomass availability, taking into account other biomass users (agriculture and forest based sectors);

Among the new sources of biomass are energy crops, particularly on arable land or degraded land, in a state of abandonment, of non-use or low productivity, or even, by reconversion of the species, also in low productivity sites.

Has been created a working group for energy crops (GTCE), led by the AFN, which includes public and private entities, of the forest, energy and environment areas, which aims to identify barriers and opportunities for the promotion of energy crops for the biomass production, particularly, through identification of most adequated species, type of associated cultural practices and respective impacts on the territory, besides non-technical barriers, in particular the regulations, so as to foresee its introduction in non-agricultural areas.

In order to promote energy production from renewable sources, Portugal has a system of differentiated tariffs for electricity produced in renewable power plants "feed-in tariffs" (Decreto-Lei No. 225/2007, of 31 May). The plants of energy recovery of biogas are covered by this remuneration system, although covered with different tariffs,

depending if the production of electricity is from biogas of the landfill component or using biogas from anaerobic digestion of solid urban waste, sludge from wastewater treatment plants, or sewage and residues from agriculture, livestock and food industry.

Only recently started to be equated the use of the biogas produced in landfills and in the management of solid urban waste, for other uses than the production of electricity, in particular, the production of biomethane for transportation and integration in the natural gas network.

Measures to improve forest management in order to maximize the extraction of forest biomass in a sustainable manner

Promoting and ensuring sustainable development of forest areas and of all the activities of the forest chain, optimizing the utilization of the productive potential of forest goods and services and of the associated natural systems, on the respect for their multifunctional values and the management promotion of the national forest heritage, particularly through the planning of forest holdings and stimulating and support to associativism, are among the main objectives of the national forest policy, consecrated in Basic Law of Forest Policy, Law No. 33/96, of August 17.

The organization of forest areas is made, in each region, through forest management plans in line with a multiple use and articulated with regional plans and places of planning. Therefore, the regional plans of forest management (PROF) are produced by the public authority legally responsible, the National Forest Authority, in collaboration with the holders of the affected areas, subjected to public consultation and approved by the Government. The PROF is therefore an instrument which establishes specific standards for utilization and exploitation of forested areas. On a scale of territorial intervention less comprehensive, Forest Management Plans (PGF), are fundamental tools for managing forest areas, that, taking into account the guidelines present in PROF, set in space and time, the interventions to be, having as objective the sustainable production of goods and the services which they provided and taking into account the various activities and uses of surrounding areas.

However, it is important to note that much of the total national forested area is in the possession of private owners, representing private property in Portugal, 2,8 million hectares of wooded forest, ie, 84,2% of the total, representing the public areas 15,8%, of which only about 2% are from the private domain of Government.

Since the high fragmentation of the property poses obstacles to obtaining minimum management areas, is the Government that shall boost the establishment of forest holdings with size which allows efficiency gains in its management, through incentives to the clustering of holdings and land reparcelling of properties, by discouraging their

fractionation. The Government, has therefore decided, to create the necessary legal framework for the establishment of forest intervention areas (ZIF), ie, continuous and demarcated territorial areas, mainly composed of woodland, subject to forest management plans and specific plans for forest intervention, with a single entity responsible for managing each of these areas, which may include "a minimum of 750 hectares and include 50 forest owners or forest producers (Decreto-Lei no. 127/2005, of August 5,amended by Decreto-Lei No. 15/2009, of 14 January).

In order to comply with the provisions of the Basic Law of Forest Policy and supporting of sustainable forest management, was created in 2004, the Permanent Forest Fund (FFP) (Decreto-Lei No. 63/2004, of 22 March). So, with its new Management Regulations and Supports for the Permanent Forestry Fund in force until 2012, approved by Portaria No 1338/2008, of 20 November, this fund aims to support projects of planning, management and forest intervention, of forest sustainability, research and technical assistance.

Another important tool for promoting of sustainable forest management is the process of forest management certification, ie, the management process accreditation through certification by the competent authorities.
With the certification, compliance with legal, social and environmental criteria is assured. This system, although voluntary, is a self-regulatory instrument, supported by representatives of the sector of biomass such as forest producers or forestry businessmen. However, since the entire chain of responsibility, from forest to consumer, is certified, the certification allows the producer to sell its product at a price nobler and / or access to markets that would otherwise be inaccessible.

So, one of the constraints to the use of forest biomass is its dispersion throughout the Country, making it difficult, sometimes, to access this resource, making its transport expensive. Has been contemplated, in the new National Strategy for Energy, ENE 2020, the creation of intermediate biomass collection parks, chipping of biomass, and intermediate storage platforms in order of making transport biomass more economically viable.

On the other hand, forest producer organizations (OPF) have, in the past two decades, played a key role in supporting forest management. Through cooperation and union of producers it is possible to overcome the structural problem of smallholding, allowing the creation of units large enough for a rational forest management, sustainable and economically viable. Thus, in order to promote the OPF, came into force the Portaria no. 118-A/2009, of 29 January, which approves the Regulation of Framework and Support to Forest Producer Organizations.

It is also considered of great importance to inventory existing resources and the system of property ownership. The Decreto-Lei no. 224/2007, of 31 May, which creates the

National System for Operation and Management of Cadastral Information, coordinated by the Portuguese Geographic Institute, intends to make possible the existence of real estate cadastre in Portugal, as an exhaustive set of data, methodical and updated, that characterizes and identifies the properties in the national territory.

Were also presented, in 2010, a complementary set of measures designed to further promote the increased biomass availability, focusing in particular:
i) Promotion of investment forest (afforestation, reconversion and upgrading of forest stands);
ii) In support of forest certification as a way of motivating and ensuring the professional management of forests and consequently increase their productivity;
iii) In the creation of a Biomass Observatory in order to monitor the use of biomass impact in the Portuguese forest and in the industrial sectors that uses wood and biomass;
iv) In promoting the installation of energy crops based on the results of the work of the GTCE.

Finally, with the aim of concentrating matters relating to the promotion of the exploitation of biomass for energy production, the ENE 2020 elected as one of the priorities in this area, the dynamization of the Center of Biomass for Energy, aimed at creating a research center certification and global coordination at the level of biomass.

Impact on other sectors - identification, qualification, quantification and monitoring for the future

The use of biomass should be done in a balanced manner, taking into account the various user sectors. It is being developed the Biomass Observatory to track and monitor specifically the biomass exploitation, in order to ensure sustainable operation and management of this resource. Although it is not being monitored the impact on other sectors resulting from the use of biomass by the energy sector, in the future, this will be a reality. Are sought thus answers, for example, to the kind of development envisaged in other sectors based in agriculture and forestry that could have an impact on use of energy and if greater efficiency / productivity could increase or decrease the amount of by products available for energy use.

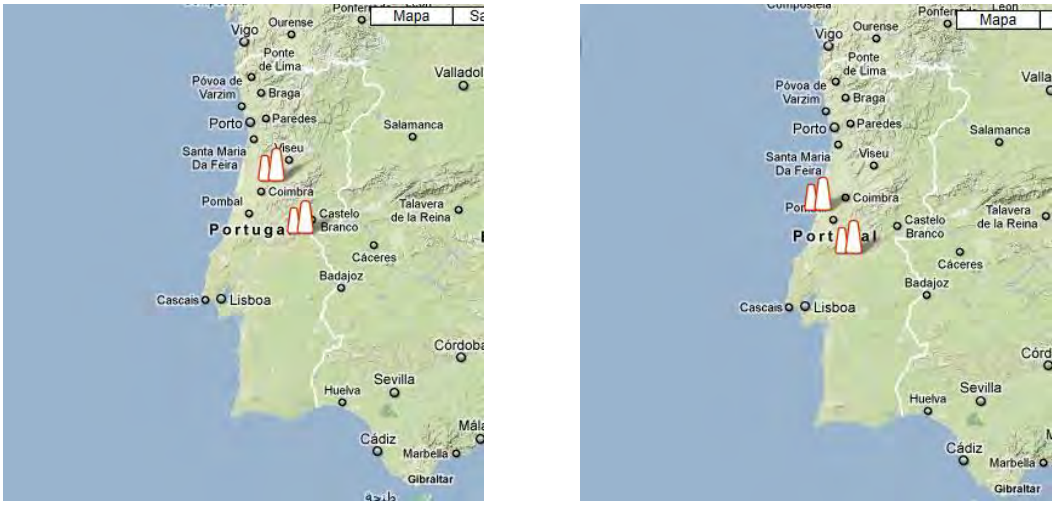
24.5 The National Renewable Energy Policy, the role of the Biomass on Energy Production and the Goals set by the European Commission, for Portugal

The Directive 2009/28/EC sets, for Portugal, the goal of 31,0% for the share of renewables in final gross energy consumption, to be achieved by 2020, implying an increase of 11,3% over the value recorded in the base year 2005, which was 19,8%. According to the latest available data, Portugal in 2008 reached 23,1%, reaching about 24% in 2010 and committing itself to reach 31% in 2020. The goal of 31% of RES by 2020 will be achieved by incorporating 60% of renewable energy in electricity (55,3% under the PNAER - National Action Plan for the Renewable Energy - 2010, using the Directive methodology), 30,6% in heating and cooling sector and 10,0% in the transport sector.

The biomass plays a major role in the energy production in Portugal. Currently, the installed capacities for electricity production is about 500 MW, it is expected, however, to achieve 958 MW by 2020, of which 436 MW from cogeneration.

Portugal has a specific goal for biomass power plants of, at least, 250 MW of installed capacity, which is expected to be achieved by 2013-2014. To this should contribute 13 plants that were awarded in public tenders (15 tenders in 2006, 2 not awards) for assigning of electricity production capacity, totalling 96 MW, for forest biomass thermal power plants, which are at different procedure stages (some already in operation), and it is expected that the entry into operation of most of all this potency is completed by 2014 (assuming that, one or another entity to whom has been granted a permit may not be able to meet the deadline and so the permit granted shall be withdrawal.

In picture 10 (a, b) can be seen the location of thermal power plants in operation and under construction. As can be seen, in the South of the Country they are still absent.



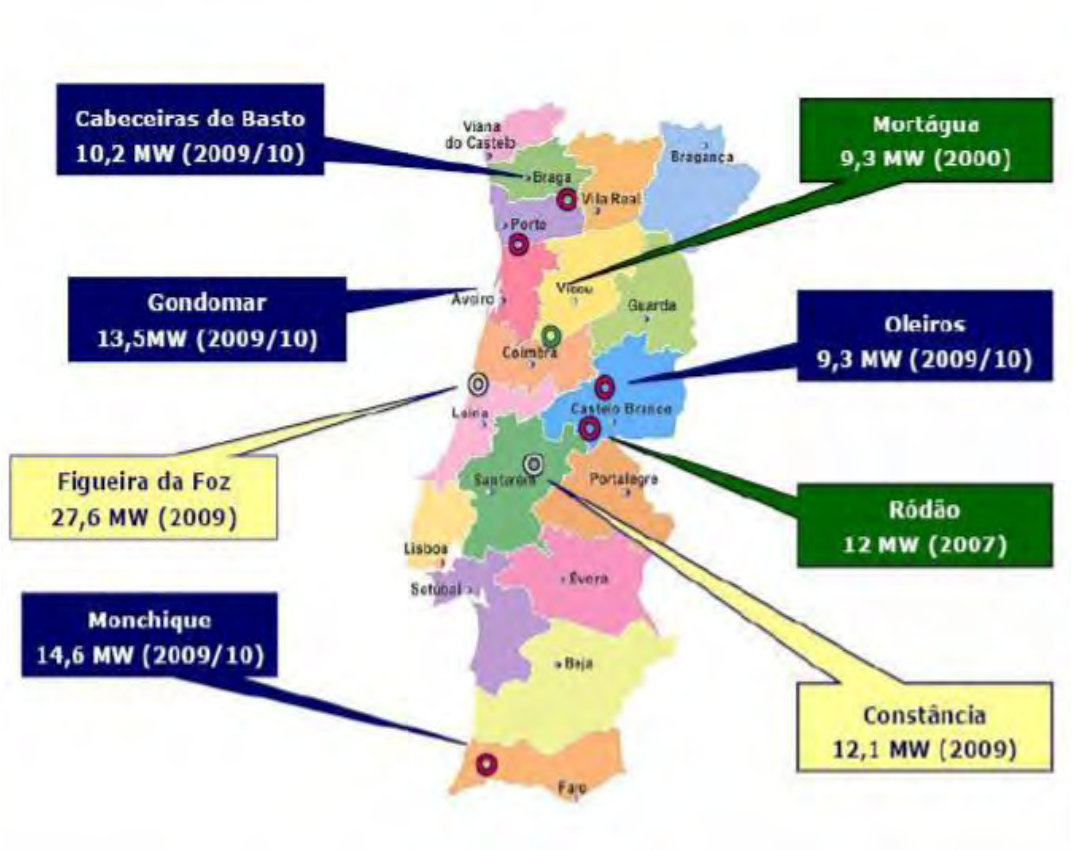
Picture 10. Thermal power plants in operation (a) and under construction (b). Source:http://www.a-nossaenergia.edp.pt/centros_produtores/mapa_centrosProdutores.php

As mentioned above, the license further south, Monchique, has come to be granted, but it wasn't installed.

Currently, and in operation, there are two biomass power plants, the Mortágua plant and the Ródão plant. The Ródão plant, with startup in 2007, has an installed capacity of 13 MVA, an annual production of approximately 90 GWh and a biomass consumption of 160 tons per year.

There are also nine cogeneration plants, installed in the forest sector industries that make use of biomass for heat production, like the Portucel, Amorim Revestimentos, Stora Celbi, Soporcel, SIAF and Companhia de Celulose do Caima.

Promoting the use of the biomass resource includes the cogeneration that in future processes and, when possible, should be promoted as RES in cogeneration plants with high energy efficiency, given the important advantages that carries for the overall system efficiency and energy exploitation. The allocated capacity at dedicated plants will be conciliated with the availability of forest biomass on the market, streamlining, wherever justified, the concentration of potency to achieve scale economies.



Picture 11. Outline drawing of the national planning for the distribution of thermal power plants. (Green - on production, yellow – on licensing , blue - on project)

25. Wood biomass market

25.1 General view on wood biomass market

Considering this program area, Algarve, there is no energetic use of forest residual biomass, or if existing, it is punctually done in small units.

To create the market for forest biomass in the region, it must be established the basic conditions that allow the stabilization of the binomial supply / demand:
-Ensuring the supply of the resource (biomass);
- Ensure the existence of business units, able to flow the residues and managed in the logic of the market;
- Encourage their use for energy through the Green Tariff (Tarifa verde), applied to renewable resources, equating it to other renewable sources;

Thus, based on the difficulties encountered, both in quantifying the biomass resource and identification of the current technology park, we will need, from now, to take some measures:
- Regional survey to identify the potential use of biomass for energy production

- Establishment of conditions to decrease the risk of forest fires;
- Regional survey of the industrial units of biomass for energy conversion and identification of investment needs for expansion and installation of new units;
- Support the regional industry in the adaptation, for all equipment aimed at better utilization of energy, both thermal and electrical, of the various forms of biomass;
- Establishing rules for access to National Electric Network (REN), matching the points of interconnection to the local concentration and generation of residues;
- Redefining (annual) the existing and potential small projects needed for better energy quantities available, according to the type of biomass;
- Fixing the value of the Green Tariff, similar to the one of the other renewable sources.

It is expected in future to achieve the implementation of a power plant in the region. The management of this will be ensured by a consortium, which comprises a national energy company (EDP) and a grouping of firms of exploitation of eucalyptus for paper paste (Altri).

25.2 Sources of wood biomass, wood biomass use, wood biomass standards and traceability status

According to Mendonça *et al* (2007), we present some tables, summarizing indicative quantities of forest biomass, according to the origin, distinguishing the production of forest biomass and the actual availability of this energy resource. Note that the data are estimated for the national level.

Table 18. Production of forest biomass

Residue type	Quantity (t/year)
Shrublands (uncultivated)	4,0
Shrubs (under-cover)	1,0
Production of firewoods	0,5
Branches and pecked	1,0
Total	6,5

Table 19. Potential availability of forest biomass

Residue type	Quantity (Mt/year)
Shrublands	0,6
Production of firewoods	0,4
Branches and pecked	1,0
Total	2,0

Table 20. Available potential of forest residues and wood processing for energy production

Source of residues	Quantity (Mt/year)
Forest	2,0
Wood processing industry	0,2
Total	2,2

As regards the use of biomass, the same is identified essentially as a resource suitable for thermochemical conversion. Bearing this in mind, we put the following options for use:
- Industrial furnaces and existing cogeneration facilities;
- Existing power plants;
- New power and energy units based on advanced technologies

25.3 Size of wood biomass market

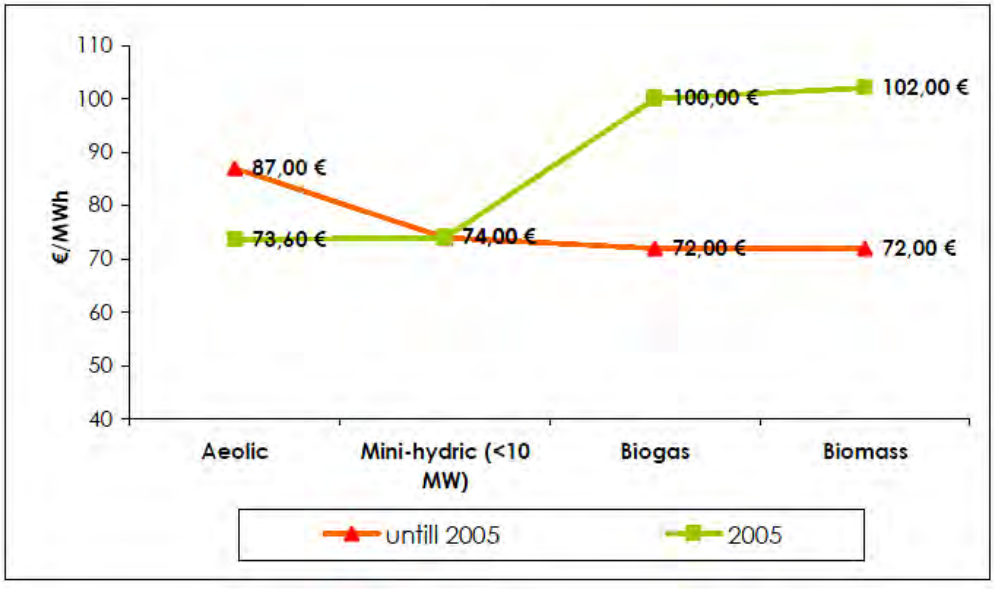
Business opportunities are placed in terms of routing resources, their management and logistics, and also in the ability to generate new resources dedicated to these technologies in Portugal. To this, should be created mechanisms of endogeneisation for the domestic industry, and noted that Portuguese scientific knowledge already allows the technology demonstration IGCC (Combined Cycle with Integrated Gasification) applied to biomass units. Still existing a potential development for future units, based on combination of fuel cells to national technology already developed for the gasification (Mendonça et al, 2007).

Biomass, even after processed, may have advantages over other fuels. Take the example of the briquettes, the lowest price that are out of the factory and packed in bags is 0.10 € / kg, ie 100 € / ton, with the briquette density of 0.88 kg / liter. To a calorific value of 18 MJ / kg, superior to biomass, a ton of fuel may be replaced by 2.25 tonnes of briquettes, ie the price equivalent of the briquettes will be of 225 € / ton, lower therefore to 422€ tonne of fuel. When comparing the commercial value of briquettes packed in bag (100 € / ton), with other fuels, like propane, the advantage of briquettes sharpens seen that the value of propane industrialist whose price is € 778/ton may be replaced 2.65 per ton of briquettes (18MJ/kg PCI), ie at a cost of € 265 (Andrade *et al*, 2009).

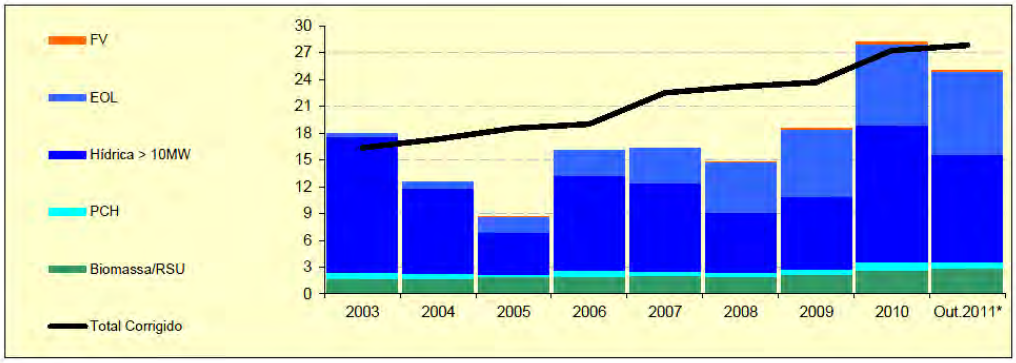
Currently this type of source of primary energy shows some growth, but however, and contrasting with the vast resources available in Portugal, falls far short of its potential.

The main difficulties in the utilization of biomass can be summarized to:
- High-cost of technologies;
- Environmental concerns of local populations;
- Nonexistence of infrastructure and resources market;
- Costs of collection, transportation and packaging of biomass;
- The most interesting features in terms of externalities (clearing of forests to prevent fires) are not the most economically interesting (hard packing and energetic value);
-The logging industry already takes advantage of its residues for other purposes;
-Requires a lot of hand labour, which in our case is relatively expensive.

Picture 12 is demonstrative of the evolution of prices of renewable energies in Portugal.



Picture 12. Evolution of prices of renewable energies in Portugal

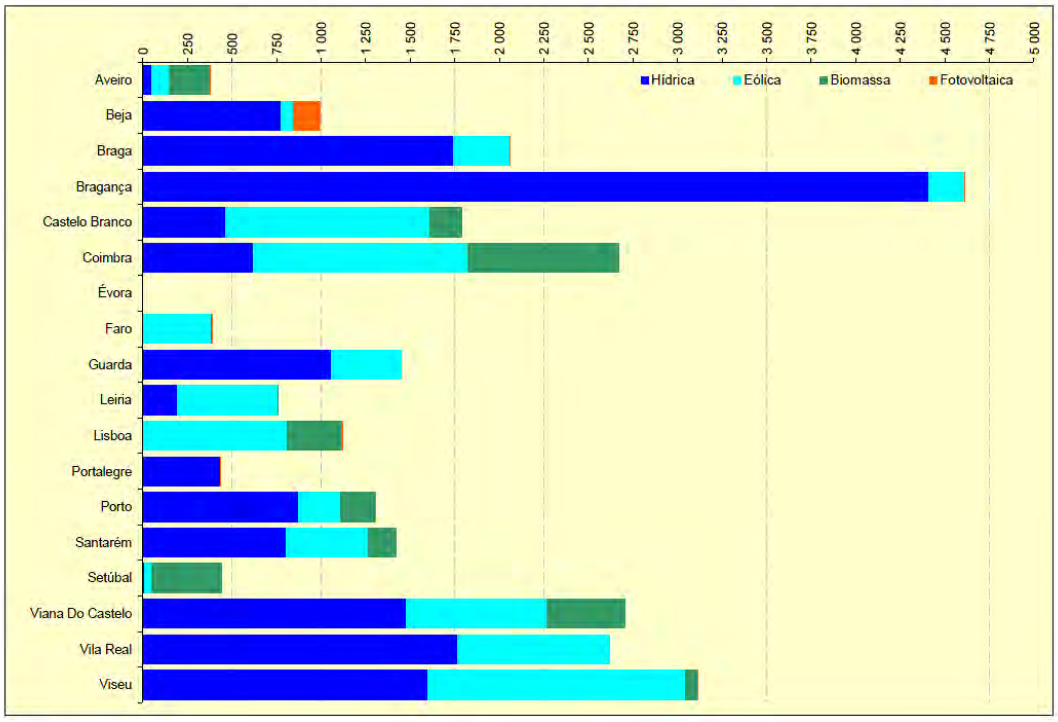


Picture 13. Evolution of energy produced from renewable sources (TWh)

Table 21. Historical development of electricity produced by renewable generation (GWh) in Portugal (Divisão de Estatística da Direcção Geral de Energia, 2011)

	2003	2004	2005	2006	2007	2008	2009	2010	Out.2011*
Hídrica Total	15 894	10 053	5 000	11 323	10 351	7 102	8 717	16 249	12 803
Grande Hídrica (>30MW)	14 303	9 065	4 454	9 897	9 406	6 190	7 547	14 306	11 247
PCH (>10 e <=30 MW)	822	487	265	702	504	478	618	1 045	797
PCH (<= 10 MW)	769	501	281	724	441	434	552	898	758
Eólica	468	787	1 741	2 892	4 007	5 720	7 506	9 078	9 190
Biomassa (c/ cogeração)	1 069	1 206	1 286	1 302	1 361	1 381	1 390	1 579	1 681
Biomassa (s/ cogeração)	43	52	64	78	149	146	311	612	684
Resíduos Sólidos Urbanos	523	475	545	532	498	441	458	455	457
Biogás	2	14	31	33	55	67	80	97	133
Fotovoltaica	3	3	4	4	24	41	160	213	260
Ondas/Marés	0	0	0	0	0	0	0	0	0
Total	18 002	12 590	8 671	16 164	16 445	14 898	18 622	28 283	25 207
IPH (ano base da Directiva - 1997)	*1,115*	*0,680*	*0,336*	*0,800*	*0,631*	*0,461*	*0,634*	*1,070*	*0,830*
Hídrica Total Corrigida (IPH da Directiva)	14 255	14 784	14 881	14 154	16 404	15 406	13 749	15 186	15 425
Total Corrigido	16 363	17 321	18 552	18 995	22 498	23 202	23 654	27 220	27 829
Produção Bruta + Saldo Imp. (GWh)	48 220	50 017	51 729	52 749	52 952	53 558	53 134	54 865	53 366
% de renováveis (Real)	37,3%	25,2%	16,8%	30,6%	31,1%	27,8%	35,0%	52,1%	47,2%
% de renováveis (Directiva)	**33,9%**	**34,6%**	**35,9%**	**36,0%**	**42,5%**	**43,3%**	**44,5%**	**50,2%**	**52,1%**

* Ano Móvel de Novembro de 2010 a Outubro de 2011. Em 2011, o valor da da Produção Bruta + Saldo Importador é provisório



Picture 14. Production of electricity from renewable sources, by district, in 2010 (GWh) Mainland Portugal (Divisão de Estatística da Direcção Geral de Energia, 2011)

As is visible in this last graph of Picture 14, the Algarve - corresponding to the District of Faro, unlike other districts of the country does not have electric energy production from biomass.

It should be noted the existing potential in Portugal to exploit areas walking to desertification, considering the opportunities of cultivation and promotion of energy crops, providing not only the supply of endogenous resources whose use permits the establishment of dispersed units of energy use, the leading to the creation of employment and value in deprived areas, contributing this way to keep the population in rural areas.

25.4 The main wood fuel producers and users

In Portugal, forest industry, such as pulp and paper industry, recognized the importance of Sustainable Management of the country's forest resources. They have been actively involved since the 90's in establishing the requirements for a sustainable forest management. They implement forest certification schemes and promote wood as a raw material of excellence.

The CFFP – "Conselho da Fileira Florestal Portuguesa", is responsible for the creation of the Portuguese Standard NP4406 – Sustainable forest management systems – Application of the Pan-European criteria for sustainable forest management. This entity

was also responsible for the development of the "Código de Boas Práticas para a Gestão Florestal Sustentável", as support in the implementation of NP4406.

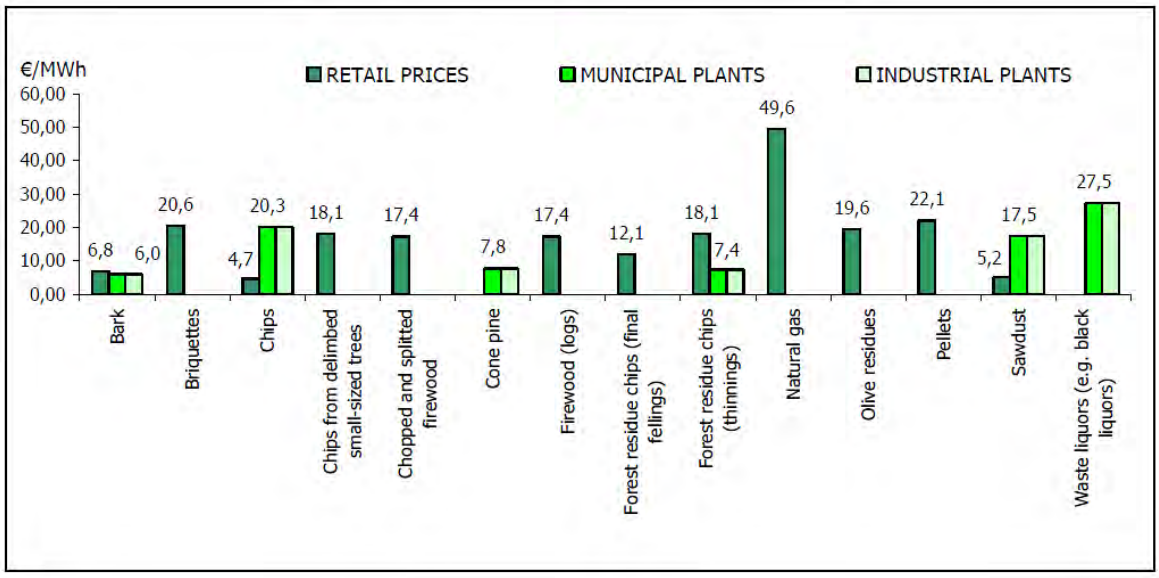
In 2004, the conformity of the sustainable forest management certification system (PEFC Portugal) was reviewed using the PEFC Council's mutual system recognition criteria. In December the system was formally recognized and therefore, can now be used by Portuguese forest owners. Nowadays the two certification systems in use are PEFC and FSC. In some cases both certifications exist.

Table 22. Current biomass users with capacity of more than 1 MW_{th} in Portugal

(Source: Direcção Geral de Geologia e Energia, 2005)

BIOMASS USERS	Amount	Unit
No. of biomass fuelled DH plants (> 1 MW)	-	pieces
Installed capacity of biomass fuelled DH boilers	-	MWth
No. of biomass fuelled CHP plants	9	pieces
Installed capacity of biomass fuelled CHP boilers	1 400	MWth
	371	MWe
No. of biomass fuelled power plants	5	pieces
Installed capacity of biomass fuelled boilers	119	MWe
No. of biomass fuelled plants in pulp & paper industry	7	pieces
Installed capacity of solid biomass fuelled boilers in pulp & paper industry	500	MWth
	332	MWe
Installed capacity of recovery boilers in pulp & paper industry	-	MWth
	-	MWe
No. of biomass fuelled plants in sawmills	2	pieces
Installed capacity of biomass fuelled boilers in sawmills	44	MWth
	8	MWe
No. of biomass fuelled plants in other industries	5	pieces
Installed capacity of biomass fuelled boilers in other industries	318	MWth
	119	MWe

This table 21 presents the characterization of national biomass users in 2004/2005. But don't mention Algarve in particular.



Picture 15. Fuel prices for different user categories in two different periods, December of 2004 and June of 2005.

Figure 15 shows fuel prices in different categories between 2004 and 2005.

Taking only the 557 industrial establishments of this economic activity, in the year 1999, that deliver the maps of residues to the Institute of Residues, it was reported more than 1,085,700 tons of "Industrial Residual Biomass", of which about 15% did not have went for the destination of recovery.

It would be interesting also to quantify the production of biomass resulting from agricultural activities as sources of opportunity, agricultural residues from the vineyard and the wine industry, the potential resulting from the pruning of the olive and olive pomace oil, biomass from the pruning of trees fruit and opportunities resulting from the processing industry of fruits and nuts, or the surplus crops of rice and wheat.

Stocks in the poultry industry (600,000 tons / year) creates a potential opportunity for energy recovery of residues also. It was determined by availability of meat, leading to foresee the possibility of their being installed in Portugal for additional production units for the flow of this energy resource with energy recovery.

25.5 Export/import of wood fuels

According the Regional Agency for Energy and Environment of the Algarve (AREAL) study (2006), Portugal imports about 85% of its energy, a percentage well above the EU average, which corresponds to an annual bill of more than 2 billion €. Oil imports dominates with a share of 71.2%, followed by coal (12.7%) and natural gas, since it was

introduced in 1997 has shown a steady growth and now currently stands at about 13,2%.

Even not taking into account the economic component, a crisis in international oil markets would lead to a supply problem hardly resolvable, if not quickly changed the paradigm of national energy.

26. Forests and wood biomass production

26.1 Review on forests (general information about forest (forest surface, wooded land surface, type of forests, forest production, ...)

The basic information about the Portuguese forest is contained in the National Forest Inventory (IFN). The latest edition of this work (5th IFN) was based on "(...) a digital aerial coverage conducted during the years 2004 to 2006 and field surveys conducted between December 2005 and June 2006." (AFN, 2010). The data refer not only to the entire Portuguese mainland but were also disaggregated by smaller territorial units (NUTS II and PROF regions), one corresponding to the region of Algarve. Thus, Table 22 presents the values of occupancy by category of land use, in the Country and in the region.

Table 23. Areas (ha) of different land uses in mainland Portugal and the Algarve region (Adapted from AFN, 2010)

Land use	Portugal		Algarve	
	Área (ha)	% of total	Área (ha)	% of total
forest	3458557	39	132209	26
shrublands	1926630	22	189315	38
inland waters	161653	2	17437	3
agriculture	2929544	33	128412	26
other uses	432050	5	32224	6

In the Algarve the dominant land use typology are the shrublands (189.315ha which represent 38% of the total region area), followed by the areas classified as forest (132.209ha - 26% of the Algarve territory), occurring the majority of the area (either of forest or of shrublands) at baseline, with no areas above 1000 m (the highest point of the region is located in the Serra de Monchique, with about 902 m), we only have distribution of forest areas and shrublands in the three lower levels. At level montane the shrublands area exceeds, albeit slightly, the area classified as forest.

The areas classified as "forest", in Portugal, are presented mostly in the form of forest stands (92% of total), the same happening in the Algarve region. The remaining areas

are distributed "other forested areas" (4% at national level and 6% in the Algarve), "burnt areas of forest stands" (3% nationally and 1% in the Algarve) and "shallow cut areas" (1% nationally and the same value in the Algarve).

In relation to groups of species identified in the national territory, the proportion is 62% of broadleaves (1,977,007 ha), 28% of resinous (874,922 ha) and 10% of mixed stands (323,419 ha).

In the Algarve, the relative position of each of the groups is similar, varying only the proportion where each one is: 68% of broadleaves (83 106 ha), 29% of resinous (35 486 ha) and 3% of mixed stands (3087 ha). As regards to areas of stands by dominant tree species it is observed some difference between national values and those that refer to the Algarve region. In the region it is observed a predominance of cork oak (27% of forest region area), followed by stone pine (25%), eucalyptus (21%), holm oak and other broadleaves (11%), occupying the maritime pine only 5% of the Algarve territory).

For the most representative species at national level (maritime pine, eucalyptus, cork oak and holm oak) most of the area has a pure composition (68, 69, 68 and 76% respectively). In the remaining species (except of the chestnut areas) the pure composition is always less than 50% of total area. Regarding the Algarve these proportions are maintained.

Finally, are presented the data on biomass per specie, carbon stocks and average productivity of cork. Once again, the data presented for the Algarve region are summarized in those presenting statistics considered representative.

Table 24. Biomass (k ton) per forest tree species (adapted from AFN, 2010)

Espécies	Portugal			Algarve		
	Biomassa de árvores vivas	Biomassa de árvores mortas	Biomassa total	Biomassa de árvores vivas	Biomassa de árvores mortas	Biomassa total
pinheiro-bravo	47237	2453	49690	144	54	198
eucalipto	34227	2025	36252	235	525	760
sobreiro	32647	2278	34925	632	526	1158
azinheira	10453	218	10671			
carvalhos	6292	235	6527			
pinheiro-manso	5213	112	5325	182	32	214
castanheiro	2231	176	2407			
acácias	686	30	716			
outras folhosas	4790	199	4989			
outras resinosas	927	36	963			

Main functions of forests

The functions of the national forest areas are defined in the Regional Forestry Plans (PROF). These are defined, in the legislation which regulates, as "sectoral instruments of territorial management, which establish the set of rules that regulate the interventions

in forest areas." The Algarve constitutes a region PROF. In each of the regions PROF were identified homogeneous sub regions where the priority were the five main functions considered:

Funcion of the conservation of habitats, species of fauna and flora and geomonuments - the contribution of forests for the diversity maintenance of the biological, genetic and geomonuments. Includes as main sub-functions the conservation of classified habitats , species of flora and protected fauna, of geomonuments and of genetic resources;

Production function - the contribution of forest areas to the material welfare of rural and urban societies. Includes as main sub-functions the production of wood, cork, biomass for energy, fruit and seeds and other plant and organic materials;

Protection function - the contribution of forests for the maintenance of geocenoses and anthropogenic infrastructures. Includes as main sub-functions the protection of the river system, the protection against erosion from wind and against water erosion and floods, the microclimatic and environmental protection;

Protection function - the contribution of forests for the maintenance of geocenoses and anthropogenic infrastructures. Includes as main sub-functions the protection of the river system, the protection against erosion from wind and against water erosion and floods, the microclimatic and environmental protection;

Function of forest-grazing, hunting and inland fishing -The contribution of forest to the development of hunting, fishing and livestock grazing. Includes as a sub-function key support for hunting and conservation of game species, the grazing, beekeeping and fishing in inland waters;

Function recreation, framing and aesthetics of the landscape -- The contribution of forestry to the physical well-being psychological, spiritual and social of citizens. Includes, as main sub-functions, framing urban areas and monuments, tourist resorts, tourist developments in rural areas and nature tourism, special uses and infrastructure, recreation and conservation of remarkable landscapes.

In the context of PROF Algarve are listed a set of management standards for each of the active sub-functions considered. Within the sub-function "Production of Biomass for Energy" is defined the following standards:

- Forest biomass removed in the work of preparing the land, clearing of weeds, cleaning stands, and pruning and first thinning, rarely provides products usable by industry. In these circumstances can be harnessed as a renewable source for energy.

- It is recommended, in areas with lower risk of fire and outside the critical period in terms of forest fires, set by ordinance of the Minister of Agriculture Rural Development and Fisheries, drying and compaction of forest biomass resulting from cultural operations and forest exploration, prior to its removal for energy, allowing the release of the finer elements - leaves, twigs and needles - which are the most nutrient-rich

- In the context of local strategies for forest fire prevention, with special emphasis on preventive forestry operations, the material resulting from the work of clearing the forest, thinning of stands and pruning, is a source of supply of biomass for energy must be considered that the export out of the system of carbon and nutrients will not jeopardize the fertility of the season. Intensify the programed management of fuels in areas of high fire risk creates greater availability

- On infra-structure of the area, under the forests protection against fires, vegetal material from cleaning management fuel tracks, as defined in relevant legislation, can be removed for energy production and should be ensured the management of fuels form more programmed, based in regional networks for defence of forest.

- If there is economic viability, use high density of trees in the stand installation, with the aim of supplying forest biomass for energy, resulting from pre-commercial thinning, favoring at the same time, the selection of trees for the future.
- The use of timber as a result of cutting and removal of invasive exotic woody, under local programs of control and eradication, long-term, is recommended.

- Integrate the process of systematic collection of forest biomass in a network of collection and sorting points in areas where there is a greater availability.

Restrictions:
- The removal of forest biomass must be integrated into municipal or regional strategies and integrated into management plans, should not be punctual.
- The cut should take into account the issues of soil conservation and water, protection of habitats and species with conservation value and landscape. (Source: PROF Algarve)

Review on forest biomass potentials, limitations (technical, ecological…) on wood biomass use.

Table 25. SWOT analysis

Strength	Weakness
- Creating a market that gives business value to a residue previously wasted, providing better prospects for profitability of forestry - Creation of local employment and contribution to rural development - Improvement of forest management in forest areas subject to abandonment - Contribution to reducing the risk of fire through the collection of waste from forestry, fuel management and cleaning of bushes and stands - Improvement of accessibility, monitoring and forest fires fighting - Contribution to risk reduction by biotic agents, such as disease and pest by disposing of residues that could pose a danger to plant health conditions of the stands - Forest Biomass is a renewable fuel, easy to burn and cleaner than fossil fuels - The energetic exploitation from FB contributes to the reduction of CO2 concentration in the atmosphere - The BF can be transformed into different types of fuels (eg. woodchips, pellets, briquettes), more or less advantageous depending on the intended use - Contribution to the use of endogenous resources - Contribution to the diversity of domestic energy sources - Reduction of national dependence on imported fossil fuels - Diversity of energy use (eg. electricity, thermal energy, biofuels)	- FB has a low calorific value, especially compared with fossil fuels - Lack of market and difficulties in the supply of FB - Need to scale to facilitate interventions - Logistics of collecting, transporting and transformation of FB is complex and expensive - Difficulties of storing FB - Characteristics of the Portuguese forest and ownership status , leading to high costs - Hard access and rugged Land morphology in large areas of the country, leading to high transaction costs for collection and transport - Reduced technological development and lack of experimentation - Poor awareness about specific equipment for the collection of biomass - Technological equipment still need adjustments in order to increase its technical efficiency and economic - Knowledge outdated of availability and FB for energy purposes, duly typified for their origin and geographical location - Negative effects of BF collection by breaking the cycle of nutrients and soil erosion (runoff and compaction by the use of heavy machinery) - Lack of knowledge about exploitation of FB (availability, models, methods of operation, profitability, etc.)

Opportunities	Threats
- Conjuncture of international politics and community in favour of the promotion of renewable energy, enhanced by the increase in oil prices and the environmental imperatives - Growing political awareness of the value and opportunities of biomass in the areas of emerging, environment, forestry and rural development - Existence of a national and European energy policy which provides for tax incentives, fixed tariffs and investment subsidies - Eligibility of public support in the next FEADER in terms of energy recovery from biomass - Great potential of Portugal for forest production and availability of large amounts of FB resulting from logging operations.- Disponibilidade de resíduos provenientes da fileira industrial do papel e do mobiliário - Growing importance of management tools and forest management (PROF's, ZIF's Plans and the Forest Fire Protection), providing for the management of fuel - Existence of know-how on the use of FB for energy, particularly for studies that have been made by the Research center CBE, as well as the pioneering experience of CTM in Portugal - Existence of technologies that enable the implementation of projects, for all operations, from collection to energy conversion - Increase installed capacity of power generation from BF 100 MVA, due to competition for allocation of injection capacity in the public power of the SEP and the receiving member to electricity produced in 15 thermoelectric plants to biomass distributed throughout the country. - Progress in the organization of forest owners, with an increasing number of organizations with expertise increasing - Contribution to reducing the risk of fire through the collection of waste from forestry, fuel management and cleaning of the stands (mostly resulting from the use of natural regeneration); - Improvement of forest management in forest areas currently subject to abandonment; - Job creation and capital gains at the level of logging - Progress in the organization of forest owners and a growing number of industry organizations - Existence of some experience in dedicated commercialization of logs and wood chips, with specific equipment and treatment in their parks, financed by the PO AGRO, which could serve as pilot projects; Existência de alguma experiência na área da - Knowledge gained from Thermal Power Plant of Mortágua, and others, particularly in the area of cogeneration in the area of supply and its relationship with industry players - Availability of technology for project implementation and dissemination of knowledge by the Biomass Energy Centre (CBE)) through studies conducted - Participation of forestry research in the monitoring of forest areas subject to residues collection, in order not to compromise the sustainability of the forest ecosystem.	- Lack of a joint policy for the biomass of forest, agricultural and animal and not strategic and operational coordination of the various types of biomass - Lack of information channels to justify the policies, incentives and technology to be used in the exploitation of biomass - Know-how still centralized in a few institutions - Divergence of interests regarding the various uses of biomass - Difficulty in supply by different sources and actors involved in forestry, which is not dedicated exclusively to the business of biomass - Competition in the market for several RES - Logistics costs high compared to other RES (collection, transport and processing) - Lack of scientific knowledge in support of the balance between the collection of biomass and bottom of soil fertility - Lack of a joint policy for the biomass of forest, agricultural and animal; - Outdated knowledge of the availability of forest biomass for energy purposes, duly typified for their origin and geographical location. The absence of this knowledge can lead to conflicts at the level of strategic planning for renewable energy and located non-sustainability of the forest resource - Divergence of interests about alternative uses of biomass, particularly in regard to industries sector grinders that consume the residues from the sawmill, and the use of biomass for energy purposes - Difficulties in supplying the existence of different sources and actors involved in forestry, which is not dedicated exclusively to the business of biomass - Lack of market for forest residues which did not create the tradition of collecting residues on a large scale - Difficulty in conjunction between the exploitation of timber and forest residues collection, not only by the absence of specific equipment for residues collection, as well as the limitations inherent in the property: type, size, and dispersion regime and topography - Ausência de circuitos de informação que fundamentem as políticas, os incentivos, a tecnologia a utilizar na utilização da biomassa - Lack of information channels to justify the policies, incentives, technology used in biomass use.

(Souce: Biomassa e Energias Renováveis na Agricultura, Pescas e Florestas PONTO DA SITUAÇÃO, JUNHO DE 2005 and BIOMASSA FLORESTAL Uma nova oportunidade para a Floresta e para os Proprietários Florestais Portugueses)

26.2 Current use of forests for round wood and wood biomass production

Forestry in Portugal

In a comparison of 10 years, ie from 2000 to 2010, the volume of imports decreased 10 to 40%, as well as the value of imports and domestic consumption of logs, while in terms of export quantity and value increased about 50%. For the lumber, the same comparison, these values remained roughly the same. The table 25 presents the values of final products of row wood in last years:

Table 26. Value (€) of the final wood products in the last decade

Unidade: 1000 euros		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mobiliário	Exportações	343.617	372.015	419.039	497.024	552.675	600.009	583.874	563.247	243.094	655.638
	Consumo Interno	812.189	843.983	856.023	850.639	819.460	791.338	746.392	760.632	347.616	762.716
Outros produtos de madeira	Exportações	31.788	34.905	37.734	32.612	25.836	25.101	27.295	23.596	19.898	29.547
	Consumo Interno	28.810	27.665	28.933	27.843	37.354	33.268	32.105	25.420	18.735	16.600
Obras de carpintaria para a construção	Exportações	24.085	34.815	37.830	42.030	52.837	60.127	54.747	70.214	63.958	43.044
	Consumo Interno	197.752	239.135	221.433	215.739	218.583	237.883	242.778	261.388	239.754	177.166
Embalagens de madeira	Exportações	17.186	19.356	18.033	14.364	15.710	19.547	20.205	24.331	20.264	15.344
	Consumo Interno	42.483	40.313	42.492	46.135	54.908	51.621	55.157	62.990	59.206	52.129

In Table 26 it is possible to ascertain the comparative figures in relation to wood pulp in Portugal from 2000 until 2010.

Table 27. Values of wood pulp in Portugal from 2000 to 2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Quantidades produzidas (1000t)	1.774	1.806	1.929	1.935	1.949	1.990	2.065	2.092	2.022	2.182	2.263
Quantidades exportadas (1000t)	969	980	962	961	933	762	1.038	1.040	945	1.149	859
Valor das exportações (1000euros)	583.852	462.557	412.544	383.729	355.804	311.209	452.110	458.923	432.027	387.909	336.972
Quantidades importadas (1000t)	94	163	140	128	110	76	68	82	85	92	36
Valor das importações (1000euros)	61.566	85.444	61.195	52.545	47.850	30.035	29.736	41.159	41.917	35.893	17.266
Consumo Interno (1000t)	899	989	1.107	1.102	1.126	1.304	1.095	1.135	1.161	1.125	1.441

According to the observatory for Forest Rows, paper and cardboard, exported, imported and domestic consumption was increased, with some exceptions.

Currently, in Portugal there are two large power plants that use forest biomass as main fuel: the central EDP 9 MW in Mortágua and the Centroliva 3 MW in Vila Velha de Ródão. Also Portucel Soporcel, in 2010, reached a gross production of electrical power 1.696GWh, which corresponded to 3.4% of total production of electricity in Portugal.

26.3 Wood biomass production from short rotation forests

The production of fast growing species in Portugal has no objectives to obtain biomass for energy. The main species of this type, exploited industrially in Portugal (including the Algarve) is the eucalyptus. The wood of this species is used almost exclusively for production of pulp, used by the industries of paper and cardboard.

In order to overcome the growing deficit of biomass in the country, measures are being studied to increase the supply of raw materials. AFN has recently set up (January 2010) a working group composed of different stakeholders, to identify the most suitable energy crops and ways of promoting their installation and still legal constraints to them in the country. This working group identified the energetic species better adapted to soil and climate conditions in Portugal (*Eucalyptus spp*., *Salix spp*., *Populus spp*. and *Paulownia tomentosa*). They also identified the legal instruments that restrict and constrain the process of afforestation of fast-growing hardwoods, short of revolution exploited (see section 29).

This working group presents recommendations for the feasibility at the national level, of the use of energy crops:

- Review of legislation;
- Production incentives;
- Support the mobilization of the national forest biomass;
- Development of energy crops;
- Support R &D;
- Developing research lines in three fields:
    a) Inventory
    b) Exploitability of the resource
    c) Effects of energy crops exploitation
- Need to develop models of supervision / monitoring biomass

(Source: Culturas Energéticas Florestais - Primeira Abordagem do Levantamento da Situação Actual)

26.4 Wood biomass in forest management plans

In Portugal, the Forest Management Plans (PGF) are regulated by Decreto-lei n.º 16/2009, 14 January. According to this law, a PGF is a tool for managing forest areas, in accordance with the guidelines defined in PROF, determines, in space and time, the availability of cultural and resource exploitation in order to produce sustainable goods and services they provided and taking into account the activities and uses of surrounding areas.
Its preparation is required for:

a) The public and community forestry and agro-forestry;
b) The private agro-forestry and forestry size equal to or greater than those defined in the respective PROF (in the Algarve this value is 50 ha);
c) The forestry and agro-forestry that intended to purpose for funds for national or community improvement and forest exploitation, production and trade;
d) The Forest Intervention Areas (ZIF).

In the Algarve, about 50,000 hectares are subject to PGF. Depending on the characteristics of forest exploitation and occupation, can be considered the use of biomass for energy purposes, along with other productions of timber, where economically feasible. In the Algarve it is not being verified because of the absence of units of utilization of this material.

26.5 Estimation of unused potentials from forests

Regarding the capacity of biomass production, in the country, there are some differences in values. For example, according to FAO data (in Torres, 2006), in Portugal there is a potential fuel for forest residues available in approximately 3.6 million tonnes of dry matter/year (corresponding to about 1.6 million toe - tonnes of oil equivalent), higher than that of Greece (1.2 million t), England (1.7 million tons), Switzerland (1.8 million t) Italy (3.2 million t) and Norway (3.5 million t) and slightly lower than other countries with much higher areas such as New Zealand (3.8 million tons), Spain (5.0 million t) and Australia (6.5 million t).

However, Campilho (2006) states that the annual availability of forest residues in Portugal amounts to over 5 million tonnes of dry matter (20% H), of which 2.6 million tons come from scrub which is not yet in the activity economic exploitation consummated and 2.5 million tonnes of residues from logging from the two main forest species in the country (1.4 million tonnes of maritime pine and eucalyptus 1.1 million t).

A proper evaluation of this issue must take into consideration the following aspects:
- In Portugal there is a large discrepancy between the potential availability and effective availability of residues in the forests. Given the difficult orographic conditions of much of

our territory, the small road network of the forest area, the high costs of extraction and transport of forest residues, it is acknowledged that in many situations, only a small portion of these residues will have economic viability for be harnessed to energy production. For example, three studies conducted by UTAD for the Northern region of Portugal, concluded that the biomass to be used varied from 43 to 65% of total output.

- A significant part of forest biomass is already used today for energy, such as the industries of pulp and paper, panels, particle board and, wood waste solid fuel ("briquettes" and "pellets") in clear expansion in Portugal;

- Sustainable forest management points to the contrary of the integral use of forest biomass. To ensure sustainable management of forest stands is recommended the incorporation of part of the woods and forest residues from logging, and not their full export;

- Although in a short / medium term, the use of forest biomass in Portugal go to be directed primarily to the power plants, should be borne in mind that biomass is a material capable of processing different types of biofuels, not only solid (briquettes and pellets) but also liquids (ethanol and methanol) or gaseous fuels (methane);

- The collection of scrub, for energy, can only make sense if associated with the opening or maintenance of tracks Fuels Management (FGC) associated to the National Forest Fire Protection (SNDFCI), and in a situation of proximity to centers use;

Considering the needs in the short and medium term, raw material supply for the future power plants and existing plants already consuming forest biomass, it is expected that the medium term, pressure on this energy source will become worse. We note then that, the one part, the effective availability of biomass with production feasibility energy be less than 3 million t / year and, secondly, that the needs will be above 4.4 million t / year.

The mobilization of biomass sources yet unexplored and production of new biomass will be the possible answer to a medium term, to ensure a sustainable supply. One solution to this lack of biomass will have to go through a strategy of producing raw materials based on sustainable energy crops as well as by mobilizing some of the potential, through direct actions to collect the stumps of pine and eucalyptus, the timber resulting from cleaning and weeding of plantations, in pine and eucalyptus, and the material of the cleaning of areas with weeds, such as acacias, among other measures.

The use of the clumps of eucalyptus and pine has to have special attention in the inert (sands, earths and stone). The introduction in the boiler of these materials may give rise to serious reliability and process efficiency associates among others to phenomena of

melting, may even oblige the stop's frequent central. This type of biomass requires a pretreatment which allows their proper cleansing, with the implicit costs of this process.

Thus it is concluded that the availability of biomass from forest residues are, in principle, insufficient for the needs of the country, which could call in question the achievement of initial objectives.

Therefore there is need to promote measures to increase the availability of the resource. Without realizing the increased supply of biomass power will determine a competition for resources unsustainable forestry industry already in place including the sawmill, the particleboard, pulp and paper, etc...(souce: Culturas Energéticas Florestais - Primeira Abordagem do Levantamento da Situação Actual).

26.6 Extraction and use of forest residues – common practice

The use of forest residues is accomplished, in general, by hand and in a complementary manner, resorting to the collection and transportation of the branches, pecking, cones etc. To the place of transformation after the operations of pruning, cleaning, or slaughter trees. The traditional cleaning of scrub, for obtaining biomass to for energy and to cattle bed, almost fell into disuse.

In specific situations, and very recently, are emerging enterprises with equipment to process and prepare forest residues for use as biomass. The most prominent case it appears in the areas of higher incidence of pine plague "wood nematode" where you must destroy all vegetal material that may be contaminated, or simply from cutting or forestry operations.

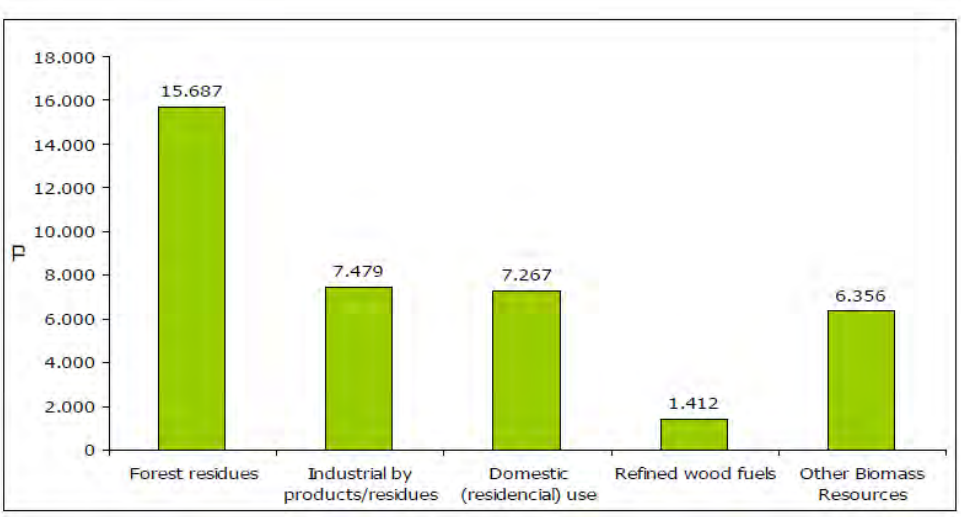
Note that there is a large paper industry that absorbs this biomass for heat and energy in their manufacturing process.

The firewood and charcoal in Portugal, which continue to market today have origins as diverse as olive, eucalyptus, cork oak and holm oak.

(Source: Biomassa e Energias Renováveis na Agricultura, Pescas e Florestas PONTO DA SITUAÇÃO, JUNHO DE 2005)

27. Wood biomass production chains and wood biomass use

The biomass market in the Algarve is still incipient, however, nationally, this market is developing, having already been installed two large power plants large and several small ones. Thus, biomass is used in the direct environment of thermal power plants.



Picture 16. Current energy use in Portugal (total 38201 TJ)

At the last decade the use of biomass as an energy source for heat and electricity production has been growing on industrial field, and decreasing at the level of the domestic uses. Currently, 31% of pellets production is exported to Italy. This can be explained because the pellets are a rather novel product in the residential heating markets. The annual pellet production in 2004 was of 3.888 tonnes (EUBIONET II, 2006).

The pellets and briquettes exportation are exclusively for Italy, there are no more available data of exportation volumes of biomass for other destinies. The same is applied for the heating biomass importation.

Although the existing studies address the production of biomass and energy at national level or in particular cases in the North of Portugal, there are no concrete studies to the Algarve region, showing a lack of accurate information about:

. Quantity of biomass available

. Typology of biomass usable

. Potential productivity and effective systems of the region;

In Portugal, there are still existing barriers for the use of the biomass as an energy source. In general, the forest management practiced in territory doesn't include the residues management, once there is no real market for it at this moment; what brings difficulties to the process of gathering and commercialization of this kind of RES.

The difficulties flow basically because of the lack of:

- Man labour on the rural areas,

- Appropriate equipment and specialized for the recovering of the forest biomass
- The inadequacy of the financial outlines of support to the Portuguese forest, generating instability in the offer-search circuit.

The non- existence of an heating market, especially in what refers to the biomass, is essentially due to the lack of search from the possible consumers.

28. Socio-economic and others constrains

28.1 Forest ownership status

As shown in more detail in Chapter 26, about 39% of the national territory is occupied by forest. In the Algarve region in particular, this value is approx. 26% and 38% are shrublands (IFN, 2005).

The private forest of cellulose industries amounted in 2003 to 250.000 ha. 86.000 ha were public forest and 420,000 ha communal forest (Mendes, 2004).

Most of the forest area belongs to the small non-professional owners, the owners who are at the same time small farmers, and to local communities (commons).

Table 27 shows the evolution of the distribution of forest areas, by type of ownership over the last century, in Portugal.

Table 28. Distribution of the area of forests and other wooded land by types of ownership (ha)

Types of owners	1928		1959		1974/82		1995	
	Area	%	Area	%	Area	%	Area	%
State forests	53662	2,3	58000	2,0	78000	2,6	40000	1,2
Communal forests	55954	2,4	145000	5,0	380000	12,4	180000	5,4
Private forests	2221824	95,3	2697000	93,0	2598000	85,0	3129000	93,4
TOTAL	2331400	100,0	2900000	100,0	3056000	100,0	3349000	100,0

Source: Mendes et al. (2004)

Relatively to the Algarve, more than 40% of woodland ownership represents smaller fractions that 5ha and about 25% have dimensions between 5 and 20 ha (Coelho, 2003).

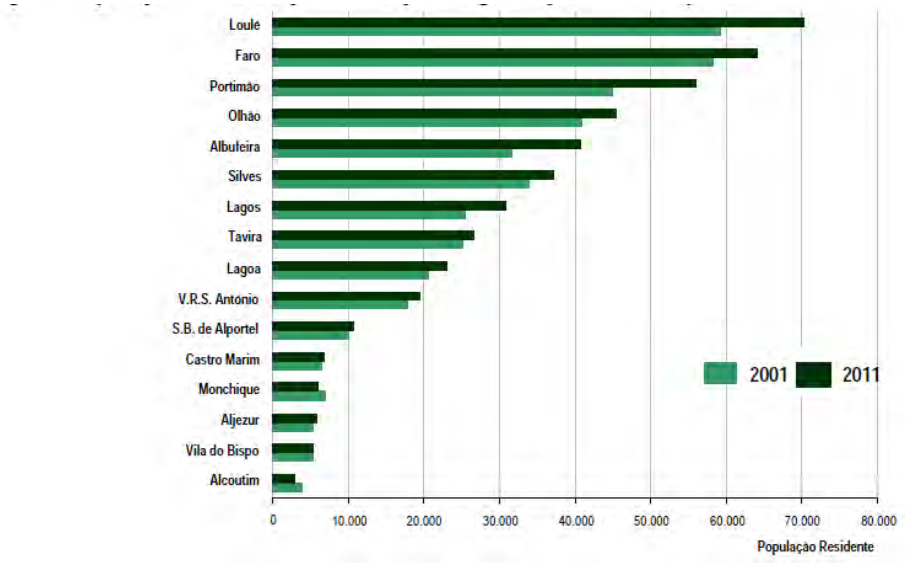
In summary, the grounds of public properties, the commons, land belonging to private companies of cellulose and large private properties, are regulated by forest management plans (PGF) and are ordered. In many cases of private ownership of small and very small size this is not the case. This is another feature of the forest area of the Algarve, the size of farms, small and much fractionated.

The forest area of the Algarve is inland and mountainous. Over the past decades this area has been exposed to abandonment and depopulation (Duarte, 2009). Although the Algarve has been in the last decade the region with the highest population growth rate of the country (Observatório do Algarve, 2011), as is visible in the graph (Picture 17) this growth was representative in the coastal municipalities, with the last 5 of the chart, remarkably oriented forest interiors, less significant, and even population decline in cases of Alcoutim and Monchique. The region has 451,000 inhabitants (Faro District) distributed.

The Algarve has a population density of 90 Hab. /km^2. From the data presented in the table 28, it is clear that the municipalities with representative forest areas have a lower density.

In the region, the active population remained practically unchanged over the last decade INE (2011). The sector of services dominates, accounting for 83.5% of GVA and absorbing 72.6% of the total employed population. This sector dominates the economy of the region as well, with tourism, assumed as a strategic component of the Algarve's economy.

In GDP per capita at current prices, the national average (15.8 thousand euros, index 100) is overcome by the Algarve, with rates of 108.



Picture 17. Resident population by municipality, in Algarve (2001-2011)

Table 29. Number of inhabitants and population density in the municipalities of the Algarve with representative forest areas:

Municipality	Nr. of inhabitants	hab./km^2
Alcoutim	2917	5,93
Aljezur	5884	16,45
Castro Marim	6747	21,54
Loulé	70622	81,43
Monchique	6438	16,29
São Brás de Alportel	10662	74,65
Silves	37126	51,39
Tavira	26167	41,26
Vila do Bispo	5258	30,06

28.2 Possibilities to enter energy market, Constrains in building legislation or in bureaucracy

There are some support/incentives within the exploration and production of biomass energy from the same. It is an example the support program PRODER action n. No. 1.3.3, "Upgrading and training of forestry companies ', which fits the Community measures' Vocational training and information actions" and "Adding value to agricultural and forestry products" defined in Article 20., subparagraphs a) i), b), subparagraphs iii) and Article 21. and 28. of Regulation (EC). No 1698/2005 of 20 September. This is aimed at established companies in the forestry sector and not the owners of sole proprietorships.

The Portuguese forest has several structural problems that hinder their full use and the consequent exploitation of the potential in the different aspects (economic, social, and environmental). Among them, we highlight the abandonment of rural and small-sized property. These factors obstruct sustainable forest management, leading to a progressive degradation of these areas and exposing them, with increasing severity and regularity to nature biotic factors (pests and diseases) and abiotic (forest fires). In this sense, the Portuguese forest policy has moved in order to promote sustainable forest management, by creating a set of measures to combat these limitations. Among them should be enhanced:
- to promote the creation of Forest Intervention Areas (ZIF), producer group / forest owners primarily in areas of small farms, grouping them into larger areas, managed by a single entity;
- Preparation of Regional Forest Plans (the Algarve region has such a document) which are included the general guidelines for organization and management of forest areas as well as the definition of the main tasks to be performed by them (the "production" includes the production of biomass for energy),

- Preparation of Forest Management Plans (PGF) (mandatory for ZIF and farms with areas over 50 ha - reference value for the Algarve region), which define the detailed timing of management operations to be carried out over a period of not less than 20 years,
-trict Plans and Municipal Forest Fire Protection which are defined in multi-year periods, the activities to be undertaken under the structural prevention in the different territories of the continent,
- t was also produced, in 2006, a guidance document entitled "National Strategy for Forests", which are presented to implement the strategic options with a view to maximizing the national forestry sector in the period 2007-2013.

The whole forest policy, which is based on the instruments cited above has as major objectives the promotion of sustainable forest management, based on a logic of multifunctionality of forests. This strategy will increase the economic value of forests through the exploitation of many resources produced on them.

It is intended to increase the profitability of these areas, fighting its abandonment and increasing investment made in them, promoting, in parallel to its effective protection.

In this scenario, the use of biomass is of effective importance, so a project like this will have a strategic impact that could be decisive.

29. Constrains in building legislation or in bureaucracy

We believe that the establishment of investment in forest biomass for energy or heat will result from:

- A political agreement between the government and strategic agro-forestry, energy, industrial and transportation;
- consultating private agents and associations, ie all partners or stakeholders need to take measures to meet the challenges of present and future of the eco-economy;
- Enhancement of endogenous resources to decrease external dependency on energy.

In Portugal, to evaluate the success of policies designed and developed in this area, we cannot focus only in the legislative initiative.

Referring to the most remarkable production of legislation (Annex I - Chapter 6. – National Law History applicable to the binomial "FOREST BIOMASS / RENEWABLE ENERGY" - Since May 27, 1988), we have:

- Lei de Bases da Política Florestal / Law on Forest Policy (1996);
- Programa de Eficiência Energética e Energias Endógenas/ Program for Efficiency and Endogenous Energy (2001);
- Kyoto Protocol (2002);
- Política Energética Portuguesa / Portuguese Energy Policy (2003, 2005 and 2010);
- Fundo Florestal Permanente / Permanent Forest Fund (2004);
- Measures to Support Maximization of Endogenous Energy Potential and Rationalization of Consumptions (2004);
- Programa Nacional para as Alterações Climáticas/ National Programme for Climate Change (2004, 2006);
- MIBEL – Mercado Ibérico de Energia Eléctrica/ Iberian Electricity Market (several since 2004 to 2010);
- Programa Nacional para Reduzir a Dependência Face ao Petróleo/ National Program to Reduce Dependence on Oil Face (2004);
- Fundo Português de Carbono/ Portuguese Fund for Carbon (2004);
- Plano Nacional para a Atribuição, Comércio de Licenças e Emissão de Gases com Efeito de Estufa/ National Plan for Allocation, Emission and Trading of Greenhouse Gases (several from 2005 to 2009);
- 15 Public Tenders for Forest Biomass power plants, from 2MVA to 11MVA (2006);
- Estratégia Nacional para as Florestas/ National Strategy for Forests (2006);

- Quadro de Referência Estratégico Nacional/ National Strategic Reference Framework (QREN) 2007-2013;
- Plano de Desenvolvimento Rural/ Rural Development Plan – PRODER 2007-2013 (8 reviwes);
- Código Florestal/Forest Code (2009);
- Plano Nacional de Acção para a Eficiência Energética / National Action Plan for Energy Efficiency (2008);
- Fundo de Eficiência Energética / Energy Efficiency Fund (2010);
- Measures for the Promotion and Utilization of Biomass for Ensuring Supply of Forest Biomass power plants, establishing, as an incentive, the remuneration for energy produced (2011);
- Memorandum of Understanding on Economic Policy Conditionality for the financial assistance of the European Union to Portugal in the context of the Excessive Deficit Procedure, for a period of three years (2011);
- XIX Constitutional Government Program (2011).

In addition to this framework, different legislation, only partially selected or not selected for the Annex I of the following areas or themes: QREN - Quadro de Referência Estratégico Nacional, framework for the implementation of economic and social policy in Portugal), Sistemas de Incentivos à Investigação & Desenvolvimento Tecnológico e à Inovação e respectivos Fundos de Apoio/ Systems Incentives for Research & Technological Development and Innovation and their Support Funds; Licensing Installation of Electric Power Production based on renewable sources; Market, Competition, Transparency and prices,from the EU and MIBEL (eg, revocation of contracts for purchase of electricity from 2004 to 2007 and the abolition of regulated tariffs for electricity sales in 2010), bureaucratization of the Administrative Procedure; Use and Management of commons; Defense of the Forest Fire; Certification of Sustainable Forest Management; Environment, Nature Conservation and Biodiversity; Planning and Urbanism; National Agricultural Reserve/ Reserva Agrícola Nacional and National Ecological Reserve/ Reserva Ecológica Nacional; Operation and Management of Cadastral Information/ Exploração e Gestão de Informação Cadastral; Increased Share of Energy from Renewable Energy in the Construction Sector; Promotion and Use of Biocombustíves through tax incentives, with shares of Exemption or lower rate, the application of tax on oil products (ISP); Incentive system in the state budget each year, through deductions from taxable under the Income Tax of Individuals (IRS), or application of the intermediate rate of Value Added Tax (VAT) to stimulate in particular the use by domestic consumers and businesses to purchase equipment for energy efficiency and environmental use of renewable energy, respectively; Tax Code of Personal Income (IRS), Income Tax of Companies (IRC), Value Added Tax (IVA) Code and Excise (CIEC).

Notwithstanding what was said in Chapter 1., But in reinforcing and complementary, we identify the causes of the existence of diverse and important difficulties to overcome in the "cluster" of Forest Biomass as Renewable Energy Source (RES).

In fact, despite all this statement of political principles and strategic objectives and corresponding targets successively in time and derogations from legal instruments, is not yet possible to say that the "cluster" of "Forest Biomass as (ERF) "is consistent, in a broader sense of the term.

We consider that the three major bottlenecks in the activity of this sector are as follows:

- The difficulty of supply
- The extreme conditioning funding
- And the lack of competitiveness in the market, this initial period, just without the subsidies

A telling example of these main bottlenecks is the fact that, after 15 Public Tenders launched for Forest Biomass power plants, among 2MVA 11MVA and performed in 2006 (13 adjudications) and with the requirement of Central get completed and put into operation by end 2003, celerity was only given to few buildings after the Government published Decreto-Lei nº 5/2001, de 10 de Janeiro, that defined the form of encouragement, subsequently adding significantly, the remuneration of the energy produced by the Centers of Forest Biomass, and predicting that in the end, some of the companies or consortia of some of the contest winners lose their opportunities for, in due time, built their Central.

In Annex II - Chapter 6 presents the changes in policy for economic development and social and fiscal policy, reflected in the promotion, enhancement and utilization of renewable energies, notably forest biomass as a source of energy production, since the signature of the Memorandum of Understanding on Economic Policy conditionality, between the Portuguese Government, the International Monetary Fund, the European Central Bank and European Commission on May 17, 2011.

The Portuguese area of the project PROFORBIOMED, region of Algarve, facing the same framework as the whole country, since the organization of the Portuguese state has no legislative-political differences at the regional level; there are no direct powers at local level for energy.

The inland Algarve (which has forest characteristics), with demographics presented in Chapter 5, presents a sluggish economic activity and a marked that fluctuates seasonality.

This area has a lot of land abandonment and the forests have the same structural problems of the rest of the country. However, we believe that some areas of the track São Bras - Loulé - Silves - Monchique - Aljezur can be pioneers and be an example of the

application and dissemination of technology for the use of forest biomass for energy, especially for heating of facilities and buildings.

Local authorities could activate incentives, as could be examples:

- The council rates and taxes tariff allows the creation of incentives for energy efficiency of houses and for domestic heating using forest biomass;
- Promoting the use of forest biomass as a renewable source of energy and income and contribute to the reduction of transport costs

The demonstration of feasibility can encourage the replication and the development of initiatives of information and dissemination, and support the agents of the forest row that are committed to a sustainable forest management.

The message that cleaning the forest and its correct management may become more viable with the use of forest biomass for energy purposes (without excluding other purposes), can motivate the bet on energy from forest biomass, such as business, towards reducing the energy bill of the country, the recovery of our indigenous resources and reducing the ecological footprint.

Future Prospects:

Under the current economic conditions the country and Europe, are scheduled changes and revisions that will affect investments in renewable energies such as biomass. In this context are scheduled the following actions:

To analyze the efficiency of support schemes for producers of energy in special regime;

The review of support schemes for renewable energy; It is anticipated a decrease in the value and duration of the incentive;

Revision of special regime support, which includes wind power, cogeneration, biomass and microgeneration, analyzing the efficiency of subsidies;

Publication, as provided in Decreto-Lei nº 5/2011, 10 January, of the statute with the typification of biomass and energy crops, and in this case, to safeguard food production and maintenance of environmental and social services;

A decision, regarding the entry into force the Forest Code (Decreto-Lei nº 254/2009 24 September), on the creation of a carbon tax that should have widespread application, continuing commitments to the Kyoto Protocol, and with the recommendations of the National Plan for Climate Change and the objectives of the National Energy Strategy, considering the externalities generated by CO_2 emissions, which should be reflected in energy prices

The review of PRODER 2007 – 2013, that until now has a very little application in forest issues, creating conditions of funding and support more favourable investments. This review may encourage the increasing of the availability of the resource "forest biomass", which is an important objective, namely to:

(1) Afforestation, conversion, upgrading, cleaning, planning and forest management;

(2) The recovery and diversification of production and forestry services;

(3) New measures to prevent forest fires;

(4) Energy crops, particularly on arable land, degraded land unused, or conversion of the species in low productivity sites;

(5) Certification of sustainable forest management and forest products, in order to motivate and ensure professional management, with a consequent increase in productivity;

(6) revitalizing the ZIF's, the promotion of associations and support organizations to support Forest, fighting effectively the smallholding and spraying of private forest ownership, through greater eligibility of applications for EU funds, reducing the minimum area subject to Forest Management Plan (FMP), currently 5 ha, so adapting the rules to the reality of smallholding of our forest;

(7) Training in integrated forestry operations, considering wood and residual forest biomass;

(8) Research and development (R & D) research and development (R & D), for good forestry techniques related to forestry operations, to reduce cutting costs and logistics of collecting biomass, etc..;

On the other hand, the agents of integrated chain of "Forest Biomass as a Source of Endogenous Renewable Energy", claim:

strengthening measures for the promotion and use of forest biomass in the market for home heating and service

the implementation of a Support Program, involving the banking and insurance companies, to specific lines of credit and financing for the creation of specialized funds, in order to overcome the reduced levels of liquidity and greater aversion to risk by Banking;

The resolution of the tariff deficit, with a "green tariff" competitive and stable domestic and external, ie with better remuneration of electricity produced from forest biomass. The history of energy tells us that none of these, of any kind imposed itself without an initial period of support tariffs in order to gain scale and be in a competitive market without subsidies. They consider that the benefits arising out of its

internalization and the incipient environmental externalities in the economy should be strengthened and translated into economic gain and the need for a vision of medium and long term, because it is expected that oil prices will continue to increase and costs production of renewable energy will continue to decrease, having to overcome the economic difficulties and continue to invest in "cluster" of renewable energy, particularly the forest biomass;

that the level of tax incentives, the excise duty, premium, VAT rates and budgeting and management of funds are able to obtain autonomous regimes and conditions as favourable as possible, to ensure the viability of investments, those already contracted (regardless of its state of execution) and futures, as well as the sustainability of an energy policy less dependent on the outside and more based on local resources and ensuring we fulfil our national goals and our international commitments in particular on energy, carbon and climate change.

30. Main barriers for further development

A study conducted by Mendonça *et a*l (2007), identify several types of barriers that limit access to forest biomass as an energy resource. The author also points out possible ways to overcome these same barriers.

In forest management, and still without a market for forest residues, there are obviously difficulties in collecting and marketing. These difficulties stem primarily from the scarcity of hand work in rural areas, related in part to the need of its development and promotion of new recruits, associated and currently constrained by the lack of a true logistics of biomass collection. This would be possible when there are several units purchasing this fuel and companies can invest in equipment suited to the conditions of exploitation of forest residues.

Regarding the nature and location of the forest area, the difficult physiographic conditions in the region, requires appropriate equipment conceived to collect biomass, which does not exist yet in the market.

On the subject of forest fires, it is recognized that the use of appropriate techniques for controlled fires to reduce fire risk, lead to the emission of greenhouse gases such as nitrous oxide, so that the flow of forest residues for energy purposes will lead to a situation of better emissions control: in addition to the useful component energy resource derived from the already environmentally advantageous in terms of fuel, when viewed in the logic of the Carbon Economy.

Regarding the creation of forest biomass market, it must be established the basic conditions that allow the stabilization of the loop supply-demand, so that the safety aspects in terms of providing the resource biomass deserve confidence; the existence of

business units capable of disposing of residues and managed in the market´s logics, are essential if we are to create this market.

Also as regards the growth of this market, it is noted that the biomass shall be given whenever considered in terms of incentive mechanisms for its use for energy purposes, through the Green Tariff, applied to renewable resources, equating it to other renewable energies. This tariff, now under revision and fixation of fair values to be paid, based on not only the economic costs arising from the use of these energy sources, but also environmental and social benefits that are related to the various endogenous sources and alternatives, should consider and reward the role that the various forms of biomass assume.

As for the residues of livestock and poultry sector, the problems are others, thinking that better monitoring and effective regulation of the issue of residues, provided that an associated improvement of the Green Tariff applicable to their energy recovery, provide the framework for business opportunities that lead to his neighbor and effective energy use.

As regards the recovery of residues generated in agriculture and agro-industrial, it is clear that must be started a deep reflection, which adds not only the bodies which govern the national agricultural production as the Sector Associations representative of such production, and leading to the progressive identification of authentic market niches for energy production, based on these residues or even, where appropriate, the implementation of dedicated plantations. These forms of biomass should be subject of quantification for further developments of energy production.

It would be profitable a close connection between the Ministries of Economy and Agriculture, in cooperation, involving the main agents of these private sectors.

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FRANCE

Prepared by: Nathalie Cavalles, Louis-Michel Duhen, David Gasc

Picture 18. Centre Régional de la Propriété Forestière Provence Alpes Côte d'Azur

Picture 19. ASSOCIATION INTERNATIONALE FORETS MEDITERRANEENNES

32. Introduction

32.1 European policy

The "Climate and energy package" sets a series of targets to be met by 2020, known as the "20-20-20" targets. One of them provides that 20 % of European Union energy consumption come from renewable resources.

32.2 French policy

The French environment program (« Grenelle de l'environnement ») provides that 23 % of energy consumption come from renewable resources by 2020. To reach this objective, the annual national renewable energy production has to double from 17 Million tones of oil equivalent (Mtoe) to 37 Mtoe. French experts have estimated that biomass should represent 45 % of the overall renewable energy effort. To reach this objective, three main devices have been implemented in France:

a. Under 100 toe wood energy project support
b. "Renewable heat fund": from 100 toe wood energy project support
c. CRE projects: cogeneration

32.3 Regional biomass cell

The regional biomass cell includes the ones in charge of regional planning, housing, environment, sustainable development, industry, agriculture and forest topics (DREAL, DRIRE, DRAAF). This biomass cell evaluates each regional energy project using biomass. It also monitors the use of biomass resources, prevents biomass uses conflicts and supports the structuring of the wood biomass sector.

32.4 Regional Council Policy

We have written a sheet about the AGIR program of the region council about renewable energy.

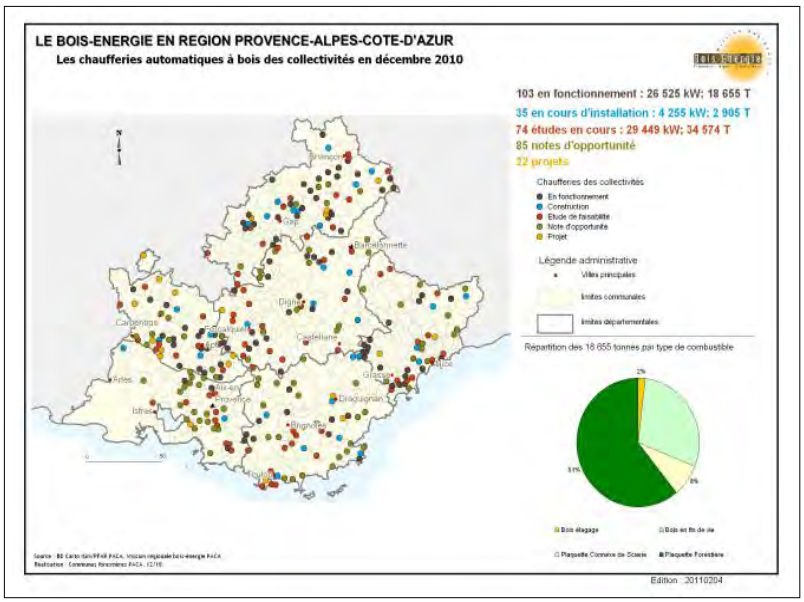
33. Wood biomass market

33.1 Pulpwood market

There is currently one main market in PACA region: the pulp mill in Tarascon (Bouches du Rhône). This mill is supplied for a fifth of its needs in the region (250.000 m^3).

33.2 Energy wood market

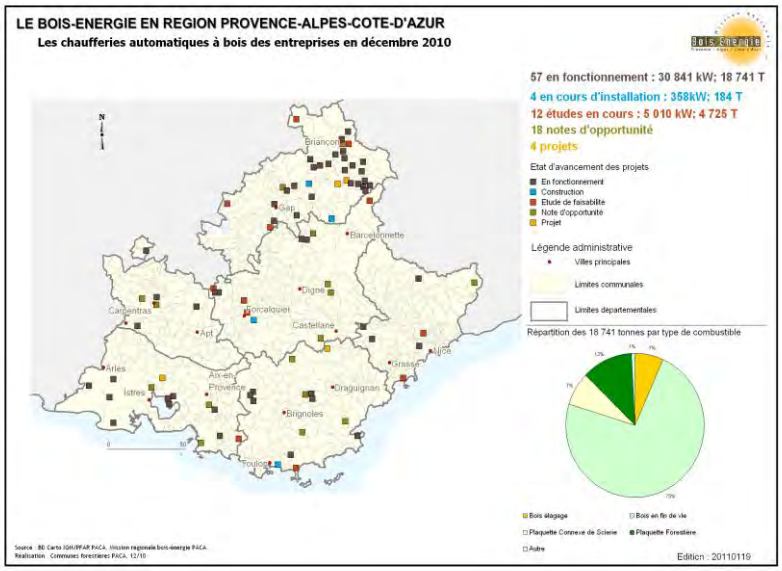
In 2010, 172 wood energy installations have been identified. These facilities consume 38 000 tones of biomass each year: 20.000 tones coming from forest and 13 000 tones of wood recovery. 113 new projects are under consideration or in progress.



Picture 20. New biomass projects are under consideration or in progress (source : MRBE)

These are essentially small boilers consuming homogeneous biomass in term of size and humidity.

But the region has also big boilers such as 3 greenhouses, 1 distillery and 1 extensive heating network for both a hospital and a school. These big boilers accept a more diverse biomass. That's the reason why the managers of these boilers try to source as much as possible with recovery wood which is much more attractive because of its lower price. Due to reduced availability of recovery wood, they will supply more and more with forest wood.



Picture 21. Company's boilers (source : MRBE)

33.3 Forest chips prices

Prix départ septembre 2011		PRIX € PAR Tonne DEPART	PCI retenu Mwh	PRIX € PAR Mwh DEPART	Indices*
Wood chips from forest sold all lenght then chipped on the cut area or on a specialized platform.	Moisture <30% and 40% among grading	77	*3,70*	20,81	100

So there is a wood energy chain in our region which is more and more growing. The challenge is to provide it with a resource from our forest.

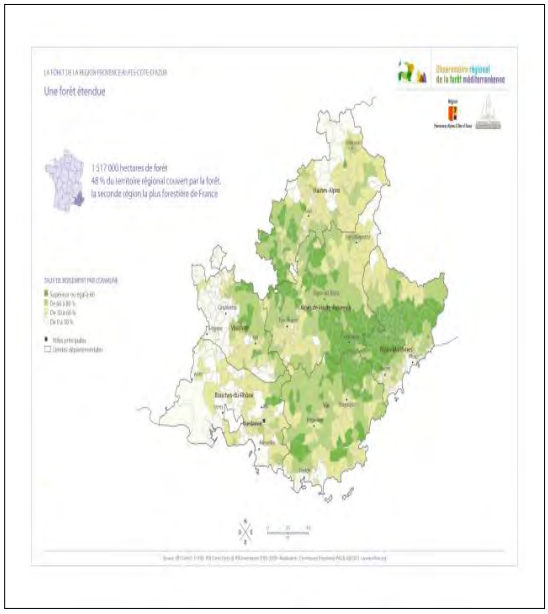
34. Forests and wood biomass production

34.1 Regional forest context

A forest area of 1.5 million ha (3rd french region). An annual production of 3.6 million m3/year.

50 % of softwood (mainly aleppo pine in southern area and scots pine and larch in mountain area)

50 % of hardwood (mainly oaks) source : MRBE
This forest is mainly private (average 70%, but 80% in Var). Public forests are owned by State (10%) or Municipalities or departmental.



34.2 Physical constraints

d. A nature xerophytic (low water), summer drought, irregular distribution of rainfall.

e. Land more or less superficial and mainly sandy or clay.

f. A marked relief

g. Physical operability: 27 % easy and 63 % difficult or very difficult (IFN)

h. Frequent forest fires and some cases of local biological regression (matorralization)

34.3 Social and economic constraints

i. Slow growth of tree between 1 and 5 m3/ha/year

j. Poor quality of wood

k. Difficult social acceptability of logging.

l. High urbanization increasing fire risk.

m. Often unprofitable logging due to steep slopes and difficult access to the forest.

n. A significant fragmentation of forest holdings: Private properties under 4 ha represent: 89 % of the number of private properties and 24 % of the total area.

o. Private properties above 25 ha must be equipped with a forest management plan (cf.PSG).It is a legal obligation. 41 % of the private forest is potentially subject to PSG.

34.4 Multifunctionality assets

p. Forest products: wood, cork, truffles, chestnuts, mushrooms…

q. Forest services: recreation, carbon storage, protection against erosion, water quality, water quantity …

r. Some of these goods and services are not currently marketed. The system of "payments for environmental services" advocated by various policy documents (FAO, ONU, European Union, French forest law) are not applied for the time being in PACA region, except a very few exceptions.

34.5 Forest management

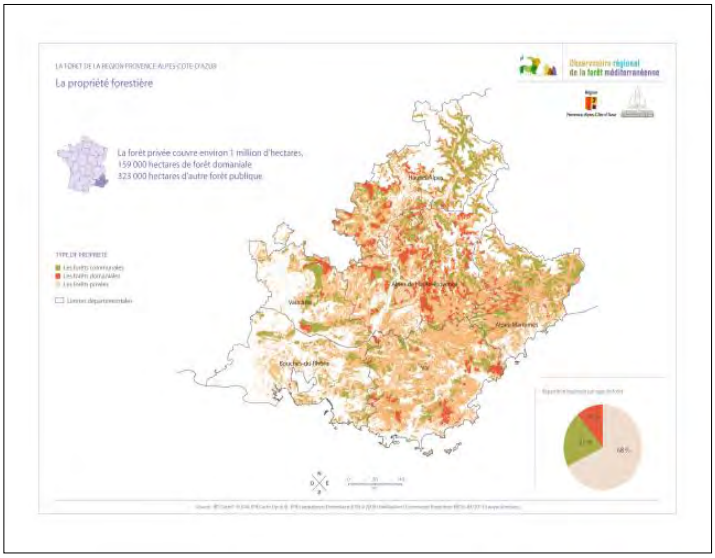
30 % of public forests are managed by a national structure : ONF thanks to public funds

70 % of private forests are managed by their owners.

The incomes are low: in part by wood income or other services such as hunting.

Hence, we note a lack of forest management.

source : MRBE



The two main stakeholders involved in the management of private forests in the PACA region are:

s. The regional center of the private property (CRPF): it promotes standards for good forest management to private owners (technical, economic, legal and financial) and approve forest management plans (cf.PSG).

t. A forestry cooperative financially supported by the state, the region and the CRPF. It promotes sustainable forest management. It is an economic operator preparing PSG, organizing cuts and supporting CRPF operations.

Because the majority of the resource is potentially available in private forests, the CRPF proposes to implement the Proforbiomed program in the PACA region. This program should help to find a way to implement sustainable management in private forest based on local authorities support and on the owners participation in the development of local energy wood projects by providing the wood of their forests. The new outlet provides by energy projects seems to be an opportunity to get more income to manage and protect forests.

34.6 Softwood production and harvesting

Annual softwood data for the PACA region:

u.	Natural production :	2 542 000 m^3/year
v.	Natural production suitable for industry :	1 276 000 m^3/year
w.	Volume harvested :	312 000 m^3/year
x.	Volume non harvested :	964 000 m^3/year
y.	% harvested :	**24 %**

(Source: IFN, DRAF/SRFB PACA EAB2003)

Public forest management plans and private forest management plans (PSG) allow knowing volumes that will be harvested in the coming years.

Unfortunately, PSG cover only 10 % of the total private forest area. If they would be made for all the properties above 25 ha, it would only cover 1/3 of the private forest.

With Proforbiomed, we will try to find a way to organize the energy wood supply coming from different groups of private properties.

34.7 Available and accessible energy wood resource

For the region

Despite significant exploitation constraints, all the local studies agree about the availability of additional biomass in forest for new energy projects.

A national study (Cemagref, FCBA) gives for our region an extra availability of additional biomass in forest for new energy projects of: 550.000 m^3/year.

A regional study (MRBE) gives for our region an extra theoretical resource of 723 000 m3/year, or 1 650 GWh/year or 144 000 toe/year.

For a local level

There are two different ways to evaluate the local available and accessible biomass.

Forest development plan *(PDM, CRPF, 2000)*

Three different steps: a descriptive document, a proposal of action and animation, implementation and support.

As part of Proforbiomed project, we will use this PDM tool (and maybe make suggestions to improve it) for our main pilot action (cf.PDM sheet).

Local wood supply plan (PAT, URCOFOR, 2008)

It is a decision support tool for collectivities to secure their local wood supply (cf.PAT sheet).

34.8 Unused potentials from forests

In the Var, the "Massif des Maures" area has significant cork oak stands. These stands should be thinned to improve the cork production and to meet the standards of defense of forests against fire (DFCI).

We find some wood products from the Mediterranean forest which have none outlet yet: little tree of cork oak composed of cork and wood harvested during thinning. As part of Proforbiomed program, we are going to separate both of them to find new outlets: energy chips for the wood, insulation for the cork.

Short rotation forest: The PACA region is not involved in short rotation forest process.

35. Wood biomass production chains and wood biomass use

35.1 Forest wood chips production

Two different supply chains coexist in the PACA region.

z. The first logic is to deliver logs to a forest platform. This platform conditions biomass with a wood fixed chipper.

aa. With the second logic, the wood chipping is made directly in forest. Then wood chips are delivered to a platform. Minimum of handling. No intermediate storage. Perfect synchronization between chipper and trucks required.

Wood chipping in forest remains limited because of:

bb. Regional forest habits;

cc. Available equipment locally;

dd. Small deposit area for roadside wood chipping.

Wood can be dried in the forest either on platform. Concerning the forest logs storage, there are parasite spread risks mainly during the period between April and September. Whenever possible, there should be cuts in the fall or early winter.

35.2 Hardwood logs

Hardwood logs are only used for individual heating. It is a profitable market for forest owners.

The exploitable coppice forests are consumed by forest owners or sold by loggers. 150 000 m^3 would be exploited in the PACA region and the demand is growing.

The regional wood energy mission (MRBE) thinks that we can't supply big wood energy installations with hardwood because of its sale price at least in the short and medium term.

35.3 Mediterranean issue: logging residues fate

In a non-Mediterranean or mountain area, the logging residues are let on the soil.
Organic matter decomposes and contributes to the enrichment of the soil.

In Mediterranean forests, the logging residues are seen like a mass of flammable fuel. But there are never been yet a proven relationship between the accelerate development of a fire and the presence of logging residues. For this reason among others, forest owners hesitate to exploit their forest. And some people would like to forbidden wood cuttings.

It costs a lot to chip the logging residues in forest. For some strategic area, there could be some public aids (around 700 euros/ha) to organize the chipping.

The whole tree exploitation may be a solution. But this exploitation must chip only trees that cannot be better valorised. As part of Proforbiomed program, we plan to conduct such operation to better appreciate the technical and economic viability of this solution.

36. Socio-economic and others constrains

We distinguish the constraints on the resource and those related to the economic context. There are additional available resources whose volumes vary depending on the assumptions chosen according to the constraints taken into account. These constraints are physical but above all social and psychological.

36.1 Constraints on the resource

As already mentioned in Chapter 3, the regional forest is under-exploited.

Physical constraints

ee. Slopes and lack of road network are the main obstacles.

ff. Private forests are developed on former agricultural land, that's why they are better served by road network than the public forest. But the stress persists over large areas due to local public roads not suited to carry logging trucks.

Social and psychological constraints

They apply primarily to private forests. The Mediterranean private forest is a young forest which is settled itself spontaneously in favour of agricultural abandonment. That's the reason why owners have no forest traditions and they did not integrate the fact that forests need to be cultivated with standard cuts. Interventions in the forest meet also other problems:

gg. Too much demand on the quality of forest work treated as gardening (heavy equipment refused, logging residues refused) in a tourist region;

hh. Because of fire risks, owners hesitate to cut trees : they don't want to let on the soil logging residues, thinking that they could contribute to supply forest fires;

ii. Although improvements are under way, a few operators still damage roads, reserved trees and don't pay on time the forest owners.

To face these resistances and the high fragmentation of forest holdings, it takes a lot of time to contact and motivate a large number of private owners with relevant arguments and solutions.

In this adverse environment, add the low or even the lack of income for the wood. For this reason, we have to find others arguments to mobilize wood and wood biomass in PACA region.

As part of the Proforbiomed program, we try to convince private owners with the following approach: “Support a local and environmental project. Promote renewable energy by providing wood from forest. At the same time, improve the forest potential and reduce its vulnerability to fire.”

36.2 Complementarities between pulpwood and energy wood

The outlet of the pulp mill in Tarascon allows maintaining a logging supply chain. But this mill has almost a monopoly wood market.

The wood energy development should not weaken the pulpwood market. This should go through a selection of products: wood with small sections and bad conformations for wood energy and the rest for other uses like pulpwood.

36.3 Wood energy sector: short and industrial circuits?

It seems that there are two different ways to develop the wood energy sectors: short circuit and industry. Currently in our region, only 20.000 tones of wood are consumed by boilers mainly in short circuits. However, the situation may change greatly depending on the implementation or not of units of cogeneration.

Short circuit and small boilers

This way of developing wood energy is strongly desired by local authorities (municipalities and region).

☺

jj. Possibility of political expression of territories

kk. Master of the harvest (but problems with framework of public procurement)

ll. Opportunity for local development

mm. Motivation of local stakeholders

☺

nn. Low wood consumption because of small units (boilers)

oo. Lot of energy to produce required biomass for small units (resistance to change of the local stakeholders, competition with other energy sources, incremental investment)

pp. Compatibility with public procurement rules :

If the leader of the wood energy project owns the wood and the boiler or if there are among the heating beneficiaries, a private operator = no problem to master the origin of wood;

If a private operator is involved in the operation, the project leader has to go through public procurement. For this reason, the local wood use is no more guarantee.

What can we do next?

Awareness has been implemented primarily to public prescribers (public buildings) to "show example" for others. But we often face administrative and commercial blockings.

For these reasons, this choice is going to change. Today, we could also support private wood energy project prescribers such as farmers, forest owner, health facilities, greenhouses…

Industry

These units may be functional in 2014. They will supply in part locally. The consequences can be both positive and negative.

☹

qq. Pressure on the resource: risk of unsustainable exploitation

rr. Imbalance of current economic circuit

☺

ss. Bigger wood consumption in an under exploitation area.

tt. Competition may increase the wood purchase price. It is a good point for producers businesses.

uu. Local employment

vv. Economies of scale for wood suppliers. Bigger outlets allowing the loggers to organize themselves and to proper.

Note: These cogeneration units may supply otherwise. It would remove these positive effects.

Unjustified antagonism?

Can these two circuits coexist? Are there sufficient resources?

In the current state, we find rather a synergy.

For example, a forest timer yard has allowed producing 3.000 tons of wood chips. Most of the wood not riddled has been consumed by a big industry unit in the Rhône valley. Only 10 % of the biomass have been riddled and dried to supply a local boiler.

Only a large wood outlet justifies specific forest exploitations. The supply of the local boiler could not have been possible without a larger outlet. This example shows that we have to well ventilate products to develop wood energy sector.

As part of the Proforbiomed program, we are going to work mainly with local authorities so that to integrate private owners to their biomass development project. With our subcontractor we are going to gather owners of neighbour forest parcels to provide

wood and we are going to watch how the process will work. We will take all measures to favour biomass outlets, but in a liberal context, we cannot ensure an outlet in the wood energy.

37. Existing policy measures (subsidy schemes,)

37.1 Technical support

The « regional wood energy mission » support technically public short circuit projects (cf.MRBE).

37.2 Financial support

French strategy to promote wood energy industry (cf CRE and BCIAT sheet).

Under 100 toe wood energy project support

ADEME (Environment and Energy Management National Agency) and European and local authorities give some grants for fuel wood production facilities and for wood energy plants. Those grants allow decreasing amortization charges and therefore costing of the final energy.

PACA region partners, also with ADEME, are willing to support the wood energy sector and especially to promote small installations.

Decision support: The wood energy feasibility studies are funded up to 50 % in construction projects and up to 70 % in rehabilitation projects.

Wood energy installation support: Only energy production units under 100 tons of oil equivalent (toe) per year (output boiler) are subsidized.

The aggregate maximum aid rate of the PACA region and ADEME is between 50 and 70 % depending on the project leader (competitive sector or not). It is calculated based on the toe levels. The aid rates are applied to the additional investment costs between a wood and a fossil fuels project. Maximum rates are achieved only if the project consumes forest wood.

Management of a “Renewable heat fund”: from 100 toe wood energy project t

This “Renewable heat fund” is performed by ADEME. This is a financial tool with two components.

ww. A regional component provides calls for project with at least a production between 100 and 1 000 toe per year (output boiler). In 2010, those projects were subsidized up to 50 %.

xx. A national component provides calls for project BCIAT (wood and heat for food and services industry). The renewable energy production of each project must be ***greater than 1 000 toe*** per year (output boiler). ADEME finances production that is measured throughout the life of the installation. Projects are funded in euro/toe, not a percentage of cost.

Only one BCIAT project and another lower power project have been selected in Provence Alpes Côte d'Azur region.

CRE projects: cogeneration

If renewable energy production capacity does not meet the objectives, the Energy Minister may use tenders whose implementation is entrusted to the national commission for energy regulation (CRE). To date, four successive tenders were launched. For the last and fourth tender in 2010, only facilities of biomass with power strictly greater than 12 Mwe were eligible.

In the Provence Alpes Côte d'Azur region (PACA), Two major projects have been selected by the national energy commission (CRE4) :

yy. Cogeneration unit EON (150 MWe) in Gardanne (Bouches du Rhône) : 700 000 tones

zz. Cogeneration unit INOVA (20 MWe) in Brignoles (Var) : 180 000 tones

The PACA region has a power generation deficit. Those two CRE projects that should be commissioned only in 2014, will allow improving the overall regional energy situation without, however, solving the electricity transmission problem.

38. Main barriers for further development

38.1 Pressure on the resource

The paper mill in Tarascon is the main outlet for pine forests of PACA region. The mill managers wish to secure its supplies from PACA region to overcome economic and social difficulties. It has both safe and a weakening impact on the softwood market by imposing its prices and conditions.

Wood energy could be a competitor use to its resource. That's why the paper mill could worry about the implementation of many wood energy projects:

aaa. Fear of reduced mobilized volumes. The resource is largely available but as we have already mentioned in Chapter 5, physical, social and psychological barriers are many.

bbb. Less control of forest loggers working with the mill.

38.2 By-products valorisation

In the Mediterranean region, the timber production is very low. Unlike others regions, the value of the logging is in recovery in pulp and in wood energy. Two consequences:

ccc. It's not very rewarding and motivating for the owners.

ddd. In case of pressure on the resource, a lower wood valuation could occur.

38.3 Multifunctionality of Mediterranean forest

In addition to social and psychological barriers mentioned in Chapter 5, Mediterranean forest is characterized by its multifunctional aspect and above all it is a quiet and a

natural place to relax. That's why forest exploitation is not always well accepted by local residents. They need to be reassured on the following points:

eee. Compatibility of logging with biodiversity;

fff. Fact that the wood resource is renewable in the context of forest sustainably managed, despite long cycles.

38.4 Lack of sustainable management «contract»

Forest management plans are the guarantee that cuttings have been planned in a sustainable way.

They exist for public forest but some of them would need to be updated.

But only 10 % of the private forests has a forest management plan on 120.000 ha (cf. PSG: obligation beyond 25 ha= 270.000 ha of private forest should have a PSG).

But 630.000 ha (properties below 25 ha) should also be equipped with a lighter forest management plan.

38.5 Professionalization of heating consultants, engineers and operators

We notice a significant number of non-working wood boilers often because of design flaws (civil engineering, access to the silo, sealing of the silo). Better supervision and more rigorous monitoring of wood energy project stakeholders are requested. Since the beginning of each project, wood chips suppliers should be involved to avoid that kind of problem and to better design the boiler and its access.

Wood chips producers supply with difficulty the exact required resource. It takes time to improve processes and the quality of the finished product.

However, the biomass specifications may seem very restrictive for a natural and heterogeneous resource.

The installation and maintenance of a biomass boiler is much more binding than for a fuel oil or gas boiler. Skills and voluntarism should ensure more often reliable services.

38.6 Mediterranean climate

Because of its climate, the Mediterranean area needs shorter heating season which may compromise the economic equilibrium of a project limited to only heat production. For example, a biomass boiler for a school will not be profitable at all. But if it is linked to a heating network for housings, it would be more easily possible.

In Mediterranean mountains areas, heating times are longer. So it should be more profitable.

But there is also the possible implementation of cogeneration units that produce electricity.

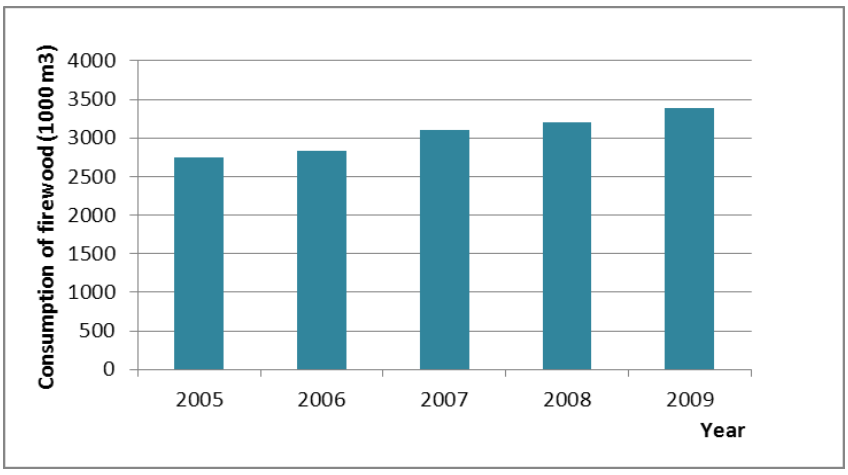
Always the same question: short circuit? Industry? Or both?

SLOVENIA

Prepared by: Nike Krajnc, Tina Čebul, Mitja Piškur and Janez Petek

39. Introduction

Wood is the most important renewable energy source in Slovenia. In 2009 more than 300,000 households used wood for heating and this number is still growing (picture 22). In Slovenia firewood is traditionally used for heating, in recent years also use of wood chips and pellets has grown. Use of wood biomass per year varies depending on the length of heating season and the lowest winter temperatures. In addition to the use of wood in households there is also increase of district heating systems. Most of the wood consumed for heating (80 %) comes from forests, while the remaining 20 % consists of other types of trees or roundwood from unwooded areas.



Picture 22. Display of firewood consumption for heating households in Slovenia from year 2005.

Statistical data on production and use of wood biomass are gathered at the national level because of small size county, as well as our estimates are made at the national level. That is why this report is for the entire country, not only for the selected region.

In Slovenia, the use of renewable energy is increasing; more than 80 % of it is from traditional sources, solid biomass and hydro energy. For year 2010 it is estimated that the share of renewable sources in electricity consumption was close to the target of 33.6 % (UMAR, 2011). Between 2009 and 2010 the production of renewable energy sources has increased by 8 %. Among those the highest increase was due to production of energy from biogas, for 80 % (Annual energy statistics, 2011).

For Slovenia it is determined that within the framework of EU objectives by 2020 should reach at least 25-percent share of RES (renewable energy sources) in gross final consumption. Based on this the Government accepted an Action plan for renewable energy sources for the period 2010 - 2020 in July 2010 (AN RES), which specifies the sectorial targets and measures for achieving the goals. Share of RES (including non-renewable industrial waste and hydro energy) in the year 2010 in final energy consumption, calculated according to EU methodology, was 19.4 %. The desired goal (25 % by 2020) will be difficult to achieve without a strong incentive to increase efficient use of RES (UMAR, 2011).

Increased use of RES brings many advantages to the country, because they are domestic energy sources that can help to reduce dependence on imported fossil fuels. In the process of exploitation in thermal power plants fossil fuels cause high pollution and environmental damage, which is far from the guidelines set by the EU energy and environmental policy.

Amongst renewable energy sources wood biomass represents 53 % and hydro energy 38 %. Most renewable energy sources (59 %) are consumed in heating purposes, the remainder for electricity production. Biomass is mainly used (95 %) for the production of heat, especially in households. The main problems are the conventional systems with out of date technologies with relatively low efficiency and high emissions. Modern technologies are applied progressively. Currently we have in Slovenia a large number of households with wood chips/logs/pellets/briquettes boilers. There are also a lot of houses/villages/ settlements connected to the biomass district heating systems.

In the Action Plan for Renewable Energy for the period 2010-2020 it is projected for Slovenia that in year 2015 the supply of wood biomass from forests and other wooded land for energy production should be 1,302,000 m^3 and 1,338,000 m^3 in 2020. Based on the analysis of timber flows and roundwood balances in Slovenia (KRAJNC / PIŠKUR 2006, KRAJNC / PIŠKUR 2008) we can conclude that around a quarter of roundwood, which comes directly from the forest, is used for energy purposes, but primarily to cover the needs of households.

Slovenia wishes to promote and hasten, among other renewable energy sources, the use of wood for the production of electricity in the ensuing few years, therefore in 2009, the government adopted two regulations: the Regulation on supports for the electricity generated from renewable energy sources (2009), which was amended in 2010 and

2011, and the Regulation on supports for the electricity generated in cogeneration with high efficiency (2009), which was amended in 2010 and 2011.

40. Wood biomass market

The market for all wood fuels in Slovenia is developing rapidly. The State has also contributed to this trend with co-financing the initial investments in modern boilers for central heating and support for the promotional projects. With the rising price of fossil fuels in recent years, wood as a domestic, renewable and affordable energy source become important again.

In Slovenia, all state owned forests are being certified with FSC certificate (244,000 ha) and also four major private forest owners with a total area of 15,600 ha have been certified through group certification. A total of 286,000 ha of certified forests, representing 21 % of all forests. Currently we do not have a national scheme or national brand for wood fuel.

An industry or wood fuel producers thinks that certification is expensive and complex process, but it is necessary to penetrate to foreign markets. More and more customers, especially from abroad, require a certificate of wood fuel quality and source of raw material. Certain domestic producers are also considering obtaining foreign trademarks for wood fuel. EnerLes is one of the major manufacturers of wood pellets in Slovenia, which already entered into the Gold pellets scheme, so their pellets can be marketed on the Italian market. There is increasing interest from wood fuel suppliers for laboratory analysis of quality of their wood fuel.

We estimate that the use of wood biomass in households has been slightly increasing, which is evident from the larger number of households using wood for heat production. Recent SORS data from 2011 shows that households consume 1,137,000 tons of wood fuels with a predominance of wood logs (1,100,000 tons). Households used about 1,500,000 m^3 of roundwood in 2009 and 2010 for energy purposes (including bark). Around 80 % of roundwood comes from forests, while the remaining 20 % consists of other types of trees or roundwood from unwooded areas.

Our study showed that the actual production of wood chips in 2010 was around 850,000 nm^3. According to data from the study in 2008 the production of wood chips increased significantly.

The production of pellets and briquettes has been relatively constant since 2006. According to data from the manufacturers of pellets and briquettes, yearly production amounts to about 55,000 to 60,000 tons. A new pellet production plant with smaller capacities started operating in 2011, and another larger pellet production plant with a capacity of 50,000 tons is being planned.

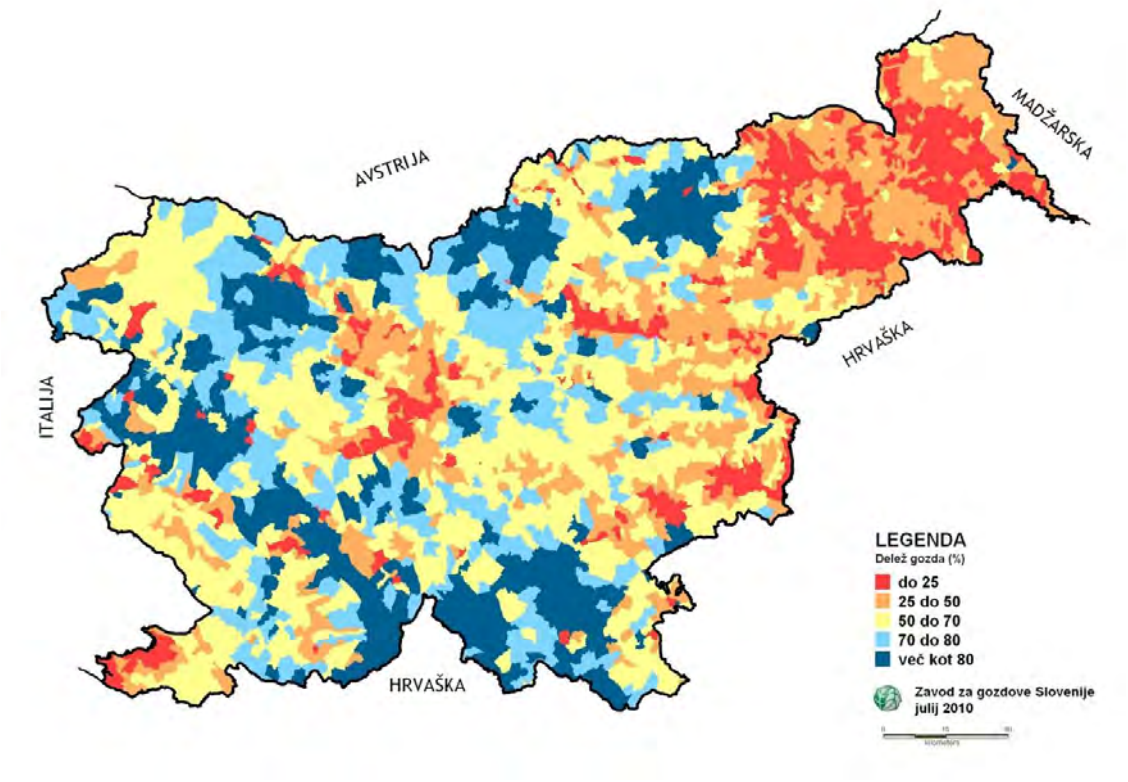
Wood fuel prices:

- Wood chips: P16 (M = 20 %): 56 €/t; P31,5 (M = 30 %): 57 €/t; P31,5 (M = 55 %): 9,5 €/t (green chips) (VAT not included).
    - Wood chips sellers are adding 5 € per stacked m^3 for transport in the range of 30 km.
- Firewood: L25: 115 €/t; L50: 115 €/t; L100: 105 €/t (VAT not included).
    - Firewood are usually sold as dry (M = 20 %).
    - Firewood sellers are adding 5 to 10 EUR per bulk m^3 for cutting L100 in L 50, L33 or L25.
    - Firewood sellers are adding 5 € per bulk m^3 for transport in the range of 10 km.
- Wood pellets: 6 mm (loose) (M = 10 %): 189,6 €/t (VAT not included).
    - Price for pellets from beech is 5 % higher.
- Wood Briquettes: loose (M = 10 %): 139,6 €/t (VAT not included).
    - Price for briquettes from beech can be 60 % higher.

The average transport distance of wood chips in Slovenia is 40 km. 18 % of all wood chips producers export wood chips abroad. In 2010 they exported 27 % of whole Slovenian wood chips production. According to external trade data (SORS), in 2010 278,400 m^3 of wood fuel was exported and 113,300 m^3 of wood fuel was imported.

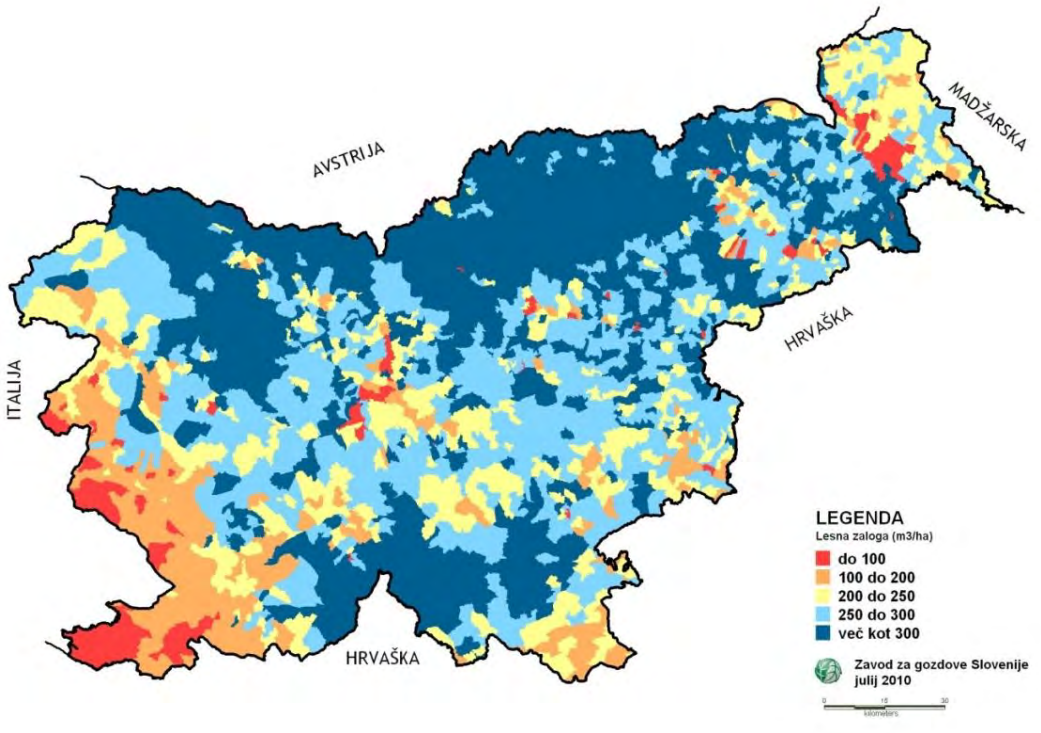
41. Forests and wood biomass production

Slovenia is among the most forested countries in Europe. We have 1,185,169 hectares of forest, which covers more than half of the country (forest cover is 58.5%) (SFS, 2010) (See picture 23).



Picture 23. The proportion of forest surface (in %) in Slovenia (SFS, 2010, WISDOM database)

Most of Slovenian forests are in the area of beech, fir-beech and beech-oak forests (70 %), which have relatively high production capacity. The growing stock in Slovenia is approximately 330 million m^3, of which 46.43 % coniferous and 53.57 % non-coniferous. Average growing stock is 279 m^3/ha (picture 24). Annually increment is about 8.1 million m^3 (6,85 m^3/ha), but in the last few years the annual cut was from 3.0 to 3.7 million m^3, of which 60 % coniferous and 40 % non-coniferous (SFS, 2010). The difference in numbers shows that in Slovenia the potential of our forests is not optimal exploited and that there are still unused potentials.



Picture 24. Growing stock (m^3/ha) in Slovenia (source: SFS, 2010)

Forest Act (1993) divides functions of forests in to production functions, environmental functions and social functions. Criteria for evaluating the functions are prescribed in the Regulations on forest management and silvicultural planning (1998). In Slovenia we have all types of forest functions, but the dominated is timber-production function, followed by the environmental functions and social functions. Forest functions are evaluated with three levels of emphasis; 1st level says that function determines forest management, 2nd level says that function significantly affects forest management and 3th level says that function only partly affects forest management. Forest functions are defined in forest management plans.

Production of wood chips from forest residues is not a common practice, the main barrier for using forest residues are economics and harvesting technology. In the producing wood chips from forest residues an important question is economy of the production (transport of forest residues to skidding trails or forest roads, producing wood chips on a forest road or trail).

In Slovenia, the use of chainsaw for harvesting is still the most common way, followed by tractor skidding. With such techniques removal of harvesting residues is time-consuming and difficult. However, at present we do not possess our own time studies or total cost estimations for producing green chips with these technologies. In last year's harvesting with special machines was introduced and we are in the process of estimation of costs for green chips production. We already have some case studies for production of green wood chips where cable-yards were used (alpine region). Measurements on test plots showed that we can produce up to 0,13 m^3 of forest residues

(for wood chips production) per each m^3 of roundwood harvested. According to data from new forest management plans we can conclude that the theoretical potential of wood biomass from forests in this year will reach 1,4 million m^3.

41.1 Short rotation plantations

One of the potentials for exploitation of wood biomass is also plantations of fast-growing trees, such as poplars and willows. These plantations could represent an important and cheap source of wood biomass for large users such as district heating systems and large power plants. In Slovenia there are two plantations of fast-growing trees, both founded in 2009, one in Velenje and one in Trbovlje, with a total area of 6 ha. Since these are the first such commercial plantations in Slovenia, we are monitoring everything that is and will be done in these areas. Measurements on the plantation in Velenje show good production of wood biomass (figure 4), while growth of plantation in Trbovlje is worse. Tree yield in Velenje after two years of growth is satisfying and we assume that after 3 years rotation it will reach the values written in the literature. More correct results will be available in the end of year 2012, when we will measure the plantation before the winter cutting. But we must point out that that plantations of fast-growing trees in our country are not very important, because we have a lot of wood suitable for production of wood biomass in our forests, as well as we do not have enough suitable land for the establishment of these plantations.

Picture 25. Plantation of fast growing willows in Velenje, January 2012

42. Wood biomass production chains and wood biomass use

42.1 Wood fuels production

In July 2011 study about state of the art of wood chips and firewood production was performed within the project *Biomass Trade Centre 2*. In our database we have data about 122 wood chippers all around Slovenia and 125 firewood processors and wood splitters. Data gathered for the wood chips production reflects the situation in our country, while we were unable to include all producers of firewood in our study; therefore we present only the results of wood chippers.

We divided wood chippers in to 3 categories according to their power – small power wood chipper, medium power wood chipper and high power wood chipper. In Slovenia we mainly have middle size chippers (capacity from 5 to 50 loose m^3/hour), according to our data there is 60 % of them. Large chippers represent 36 % and small chippers only 4 %. Most chippers are in osrednjeslovenska region, followed by gorenjska and savinjska region. Among the trademarks of small and medium chippers dominates domestic manufacturer Bider Bojan s.p. – Kmetijski stroji (picture 26) with 53 registered machines and Austrian manufacturer Eschlböch with 26 chippers. In the category of large chippers there are 11 Austrian chippers Mus-Max. In addition to these brands we also recorded trademarks: Heizohack, Pezzolato, Starchl, Jenz, Doppstadt, Bentele, Comptech, Junkkari, Willibald, Bruks, Woodsman and others.

Picture 26. Slovenian manufacturer of wood chippers- Bider Bojan s.p. – Kmetijski stroji

Despite the fact that by the number dominates medium chippers, the vast majority of all wood chips are produced with large chippers. The data show that the biggest producer

of wood chips is savinjska region, followed by osrednjeslovenska, jugovzhodna, pomurska, notranjsko-kraška and gorenjska region (picture 27). The result is logical given that these are the regions with a high number of large chippers with a capacity over 50 nm³/h. Production in other statistical regions is significantly smaller. The analysis also showed that the actual production of small chippers is negligible.

Picture 27. Statistical regions and recorded wood chippers in Slovenia

The data obtained in our study shows that the actual production of wood chips in 2010 was around 850,000 nm³. According to data from the study in 2008 the production of wood chips increased significantly. Production of wood chips in 2007 was estimated at 460,000 nm³. So over the past four years the number of chippers highly increased (97 %), from 62 to 122 recorded chippers as well as the production of wood chips (for 85 %). In 2010, 31 % of the input raw material for production of wood chips presented low quality wood, while the remaining 69 % consisting of wood removals and wood residues from wood processing industry.

According to SORS and SFI estimates, some 180.818 tons of wood biomass, which is 30 % less than in 2008, were used for energy and heat production for larger energy systems in 2010. The main reasons for this decrease were reduced use of wood biomass in two largest thermal power plants in Slovenia (co-incineration of wood and coal) and reduced use of wood biomass in industry (predominantly the wood processing industry). We estimate that the decreasing trend of wood biomass use in the wood processing industry has stopped and shall remain on a similar level also in the coming few years.

43. Biomass and energy production

Despite Slovenia is rich with the forest biomass, its energy exploitation is rather poor. Most of the biggest cities in Slovenia have installed district heating systems powered by natural gas or coal. The promotion of the biomass district heating systems on the national level started with the project GEF in the year 2001, in frame of it several district heating on the biomass were co-financed.

According the available data in Slovenia is installed more than 40 district heating systems in range of the 85 kW to max. 152 MW. Total power installed in all district heating systems in Slovenia is estimated at 235 MW with the heat production of 212 GWh/a and electricity production of 31 GWh/a.

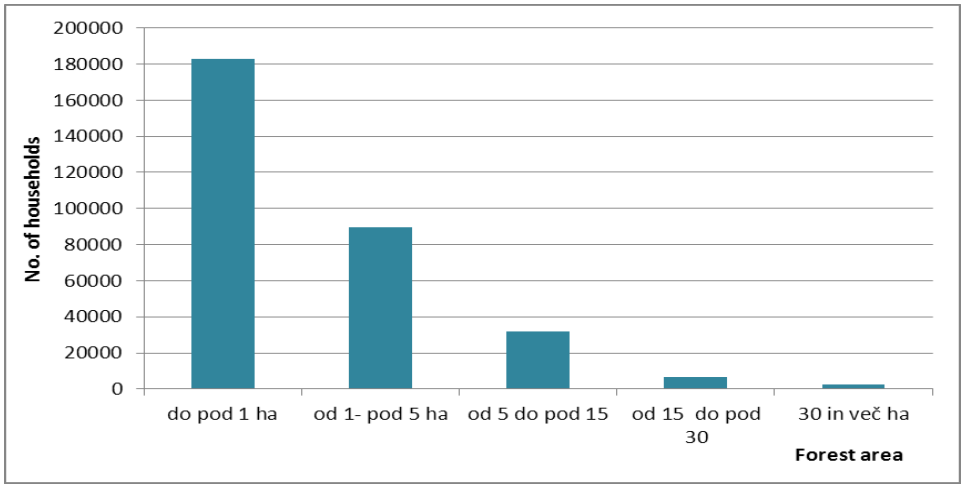
The biggest producer is TE-TOL Ljubljana with biomass power installed 152 MW. Its yearly production of the heat is 60 GWh/a, electricity production 31 GWh/a and with the wood chips consumption of 63,000 t/a.

Total wood chips consumption in Slovenia for the heat and electricity production is estimated at:

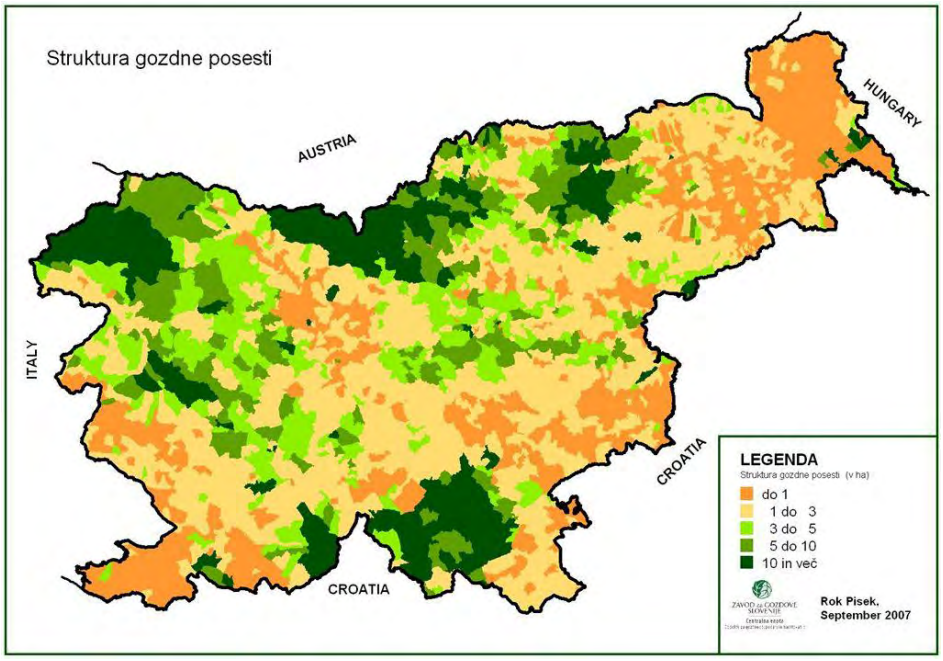
- 455,000 m^3/a or
- 114.700 t/a

44. Socio-economic and others constrains

74 % of Slovenian forests are privately owned and 26 % of forests are public (owned by the state or communes). Larger and undivided forest estates of state-owned forests enable good professional management. Private forest estates are small, with an average area of only 3 ha (picture 28) and even these are further fragmented into several separate plots (picture 29). For the great majority of these estates forests are not of economic interest. Private forest property is becoming even more fragmented as the number of forest owners is increasing. According to the latest data there are already 314,000 (with co-owners even 489,000) forest owners in Slovenia (SFS, 2010). The major fragmentation of forest property, the number of forest owners and co-owners, present a serious obstacle to professional work in private forests, to optimal timber production and utilization of forest potential.



Picture 28. Structure of the forest property (SOBIO, 2011)



Picture 29. Structure of the forest property (SFS, 2007)

The measures affecting trade in wood products and the wood products market also include individual measures from the Rural development Programme of the Republic of Slovenia 2007-2013. In the view of promoting the use of wood, the *following measures are most pertinent within the framework of Axis 1:*

111 - Training for persons engaged in agriculture and forestry, which may influence, indirectly through education of forest owners for safe forest work, the annual felling in privately owned forests.

121 - Modernization of agricultural holdings, which, among other things, enables co-financing of investments in renewable sources of energy for agricultural holdings needs.

122 - Improving the economic value of forests, which can have a positive effect on the wood products market, as it provides for co-financing of investments in modern forestry mechanization and equipment as well as in reconstruction and construction of new forest tracks and roads.

123 - Adding value to agricultural and forestry products, which also foresees co-financing of investments in processing and marketing of wood.
Within the framework of Axis 3, the following measures are particularly pertinent:
311 - Diversification into non-agricultural activities, where support is given to investments in production of energy intended for sale.
312 - Support for the creation and development of micro enterprises, where among other options, the co-financing for setting-up of enterprises for the production and sale of energy is foreseen.

45. Existing policy measures (subsidy schemes)

The ECO Fund grants loans for environmental investments through public tenders within the scope of the programme for granting loans for environmental investments of natural persons and sole traders. 305 loan contracts with natural persons were signed in 2010 for the implementation of different investment schemes in the area of efficient energy use and use of renewable energy sources, which also included 21 boilers run on wood biomass fuel with a total power of 504 kW. The Eco Fund also carries out a programme for granting nonreturnable financial incentives to natural persons for measures adopted in the area of efficient energy use and renewable energy sources, and on the basis of the Regulation on energy savings ensured to final customers. The Regulation introduces a collection of resources to increase the efficiency of energy use through its contribution to improving the efficiency of electricity and heat additions to the price and the price of fuels to increase energy efficiency. The beneficiaries of the incentive who through public tenders completed their investments in a timely manner and submitted the appropriate documentation, received a total of EUR 7,009,081 of non-returnable funds in 2010, which were used to fuel 6,943 investments, out of which 407 investments were used for boilers run on wood biomass with a total power of 10,4 MW. In 2009, 561 investments into boilers run on wood biomass with a total power of 15 MW were given financial support. Apart from support given for installation of boilers run on wood biomass, incentives for installation of wooden outdoor builder's joinery during renovation on housing buildings are also important from the viewpoint of wood use. In 2009, 1,415 investments with a total area of 24,613 m^2 were supported, while in 2010, the number of supported investments amounted to 617 with a total area of 10,147 m^2.

The programme of co-financing of district heating systems and the installation of boilers run on wood biomass is run within the framework of the Operational programme for environmental and transport infrastructure development for the period 2007-2013; the development priority »Sustainable Energy« and the priority orientations of innovative measures for local energy supply. In 2009 and 2010, 13 projects for district heating systems run on wood biomass were supported; combustion engines run on wood biomass were installed into 10 of these systems while 3 of these existing systems were expanded without the installation of combustion engines. State aid in the amount of EUR 6 million was used for the installation of combustion engines run on biomass with a

total power of 15,6 MW and more than 31 km of pipelines with 777 connections. The expected sales of heat from renewable sources are 54 GWh. In 2009 and 2010, 35 individual combustion engines run on wood biomass and 8 micro- district systems were co-financed. Financial incentives in the amount of EUR 3,6 million were used for the installation of combustion engines run on biomass with a total power of more than 38 MW, while the expected heat production from renewable sources is 90 GWh.

In May 2009, a new scheme in support of green electricity production came into force, with which the government wishes to promote and hasten, among other renewable energy sources, the use of wood for the production of green electricity in the ensuing few years. The renewed scheme includes the following two regulations: the Regulation on supports for the electricity generated from renewable energy sources (2009) and the Regulation on supports for the electricity generated in cogeneration with high efficiency (2009). The framework for this scheme in support of green electricity production is the EU Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market (2001).

In the process of adopting the Climate Change Act and within the scope of the public debate surrounding it, a 3rd draft was presented in February 2011. It includes the basic choice for the transition into a low-carbon society and represents one of the bases for the preparation of the Slovenia's Development Strategy up to 2020, the sector strategies and the short-term measure programmes. The goal of the proposed Act is to establish a legal framework within Slovenia to enable an appropriate, transparent, comparable and credible use of the carbon footprint for organizations, products and services. Carbon footprint could be used as one of the criteria for public procurement of products and services.

46. Main barriers for further development

The further development of production and use of wood biomass in Slovenia is affected by:

- The principles of forest management in Slovenia (guidelines, measures, targets in forest management plans)
- Technology of harvesting and use of wood biomass (equipment and qualification of forest owners and forestry companies for biomass production)
- Low average private forest holding and very fragmented possession
- - The market of wood fuels (relationship between costs of production and price of biomass or individual forest wood assortments on the market)
- - Socio-economic situation of forest owners
- - Lack of knowledge on efficient use of biomass as fuel and
- - Lack of confidence in the sustained supply of quality fuel.

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GREECE - *WESTERN MACEDONIA REGION*

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HELLENIC REPUBLIC
REGION OF WESTERN MACEDONIA

48. Introduction

The energy policy of Greece is heavily depending on imported oil for household purposes, industries operation, production of electricity in non-connected islands, transport etc. On the other hand, the production of electricity in mainly based on lignite, due to its extensive deposits found mainly in Western Macedonia and, at a smaller scale, in Peloponnesus. The late introduction of natural gas has initiated a diversification of the energy mixture, where the renewable energies share still remains low.

However, there is a great potential for the development of RES in Greece: according to Law 3851/2010 (in the adoption of specific development and environmental policies set by Directive 2009/29/EC), the national target for participation of RES in final energy consumption comes up to 20%, which is further analyzed in 40% proportion of renewable in electricity generation, 20% in heating and cooling needs and 10% in transport.

Today the total gross energy consumption in Greece is estimated at 22.4 Mtoe. According to the Greek Ministry of Environment, Energy and Climate Change, bioenergy in 2010 held approximately 9% of total consumed energy (biomass and biofuels are, together, about 5% of total). However, the development law for the promotion of RES does not equally promote bioenergy applications (such as pellets) and other RES technologies, as photovoltaic and wind energy are subsidized three times more than biomass.

In addition, a law from the 80's that was in force until recently, prohibited biomass use for energy purposes in Athens and Thessaloniki, the two biggest cities and made things difficult for pellets market increment. The change of this Law will allow the gradual increase of biomass market, but it will take time for the wider public to change the mentality in favor of biomass again.

49. Wood biomass market

49.1 General view on wood biomass market

The pellet market in Europe

The annual pellet production in Europe amounted to more than 7 million tons in 2008. Besides the established national pellet markets (e.g. Sweden, Austria), which are still growing strongly, additional pellet markets are emerging across Europe. This diversity regarding market development stages is accompanied by the development of heterogeneous demand and trade structures.

In countries such as Germany, Austria and Italy, wood pellets are exclusively used in heat production for the residential sector while the industrial use for power generation prevails in the United Kingdom, the Netherlands and Belgium. In Sweden and Denmark, both sectors are well established. In terms of trade, many of the developed national pellet markets depend on imports from countries with surplus pellet production. These are, besides Germany and Austria, mainly the Eastern European countries and Canada.

This heterogeneity, together with the fast increase of pellet demand leads to inconsistencies mainly concerning supply security. Already today, a shortage of raw materials for pellet production is reported from most of the European pellet markets and the broadening of the feedstock base, i.e. the use of residual wood, SRC (short rotation coppice) or agricultural biomass for pellet production, is becoming necessary.

The pellet market in Greece

- **Production**

The Greek pellet market just started to develop. The first production plant started in late 2006 when there was no consumption in the country. The total production during 2008 was 27.800 tons, while the installed production capacity was 87.000 tons.

There are some wood industries that have already started pellet production mostly by using their own wood by-products. Some other companies are starting their involvement in the market in 2009 by installing pellet producing machinery with the help of European subsidies.

However, pellet consumption in Greece, especially in households, remains on very low levels. Wood by-products are usually being used without any processing, mainly for heating purposes in the agricultural sector. There are many small and medium manufacturers producing boilers for biomass, which supply this market, also with pellet boilers.

The total consumption in 2008 was about 11,100 tonnes, which means that the per capita consumption was about 1 kg, one of the lowest in Europe. In order to underline

how small are these numbers it is worth mentioning that Sweden, which has the largest European growth of biomass pellets, produced in 2008, approximately 1.4 million tons of pellets, while per capita consumption amounted to 201,5 kg. (URL1)

Until now, the lacking domestic pellet demand in Greece forces the pellet producers to target European markets and to export the largest share of their production, Italy being the most important import market. Another consequence is that the pellet trading and logistic infrastructure is not being developed in Greece.

- **Quality**

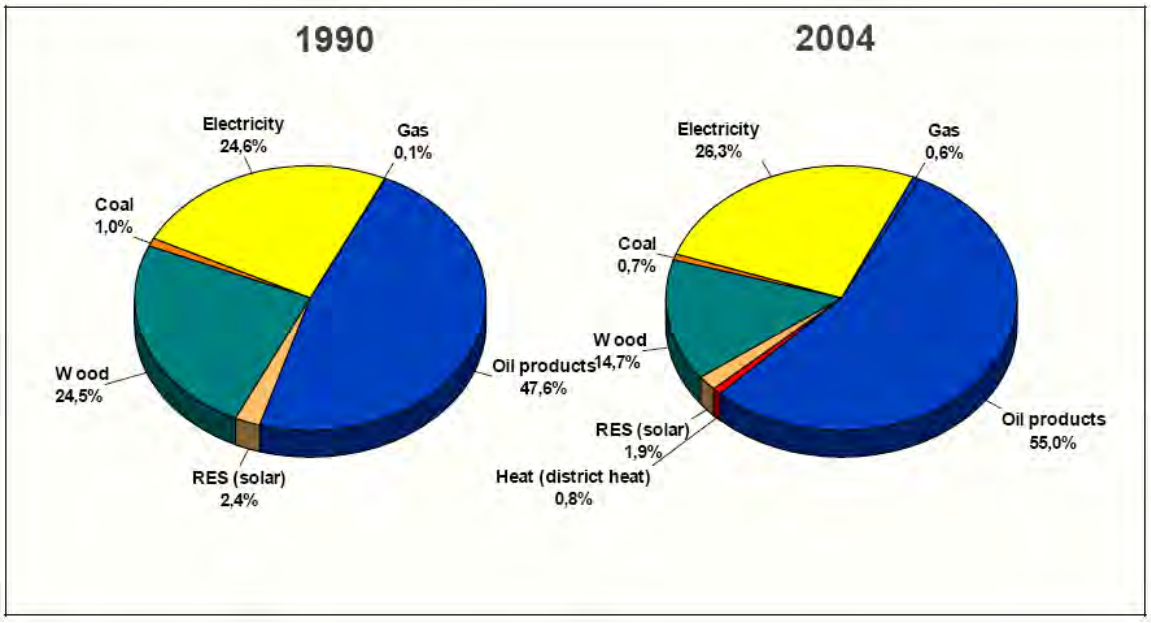
There is a quality standard based on the German standard DIN 51731, produced by the Greek Standardization Organization (ELOT) which indicates the biomass specifications for combustion use. However, there is no quality standard for pellet properties, which poses problems to the companies.

Quality standards are not applied in the Greek production industry, but the plants follow a certain production procedure provided by pelletizing equipment manufacturers. However, they are not certified officially. In addition, none of the companies assure the quality of their logistics. They do not provide official quality certifications which lowers the competitiveness of their products on the international markets.

49.2 Size of wood biomass market (annual wood chip production, fire wood production, wood biomass prices…)

Unfortunately there is a lack of overall statistics concerning heat demand in Greece. For the residential sector though, there is some available data presenting among other things, statistics for heat demand. The data presented below are from the "Odyssee-Mure" IEE project [8] and refer to years 1990 and 2004.

According to the project's findings, the energy consumption by fuel type in the residential sector in years 1990 and 2004 is presented in Picture 30. As it can be seen oil products are in 2004 the main energy source for households representing 55% (or 3,03Mtoe) of the overall consumed energy, against 47,6% (or 1,51Mtoe) in 1990. Electricity comes second with a percentage of 26,3% (or 1,45Mtoe) in 2004, while this percentage in 1990 accounted to 24,6% (or 0,78Mtoe) of the overall consumed energy.



Picture 30. Final energy consumption in households by fuel in 1990 and 2004 (Source: Odyssee – Mure IEE Project, "Energy efficiency Policies and measures in Greece 2006")

The 2009/28/EC Directive sets an overall target of 20% share of energy from renewable sources in the gross final energy consumption by 2020. For each country there are individual binding targets depending on the renewable energy potential and energy mix.

In Greece the final bioenergy consumption in 2005 was 4.4% (0,94 Mtoe) and is expected to be 10.1% in 2020. Out of this 0,7 Mtoe was produced by fuelwood, while the rest 0,24 by agricultural/forest/industrial (agro and wood) residues and biogas.

The National Strategic Reference Framework, Priority Axis 4 "Completion of the country's energy system and reinforcing sustainability" aims at ensuring the country's energy supply and its accession to international energy transport networks, the rational management of natural resources and the promotion of renewable sources of energy (URL1, URL2).

Lignocellulosic biomass is already demanded by established markets. Large quantities of wood harvested in forests are used by forest industries (eg. saw-mills, particle and fibre board industries) and their residues are directly converted to heat.

In Greece, The National Statistical Service does not keep any data either on fuelwood prices nor or refined wood fuels (pellets). The only information available is on wholesale prices of fuelwood by the General Division of Forests.

There is now a rather large international market in wood fuels both within Europe and between continents. The wood fuel which is primarily traded internationally is wood pellets. It has been estimated that more than 50% of global pellet production is traded internationally, as compared to 16% of coal, 29% of natural gas and 67% of oil.

Generally, as trade between countries increase, different national markets become integrated to an increasingly larger degree. This means that the consequences of events affecting supply or demand in a specific national market need no more be limited to this country. According to economic theory, if two markets are integrated by trade, prices in these countries will have a tendency to converge to a common level, and not differ by more than the cost of transporting the commodity between the two countries. As trade in wood fuels grows and the related markets become increasingly international, it can be expected that the prices will tend to converge over time (EUBIONET3, 2011c).

Biomass burning is the main contributor to renewable heating in the residential sector. Although biomass burning has such a prominent place in the RES heating production it is not backed up with the appropriate legislation. As mentioned in the previous chapter, according to a Ministerial Decision of 1993 (MD 103/1993/B -369) central heating systems using biomass as an energy source are not allowed in the two biggest cities of Greece (Athens and Thessaloniki). It is only allowed to have central heating systems with oil or gas boilers. Recently this measure has been resigned and from 2012 ongoing, the biomass burning in big cities is allowed. This exemption of biomass from the central heating systems was legislated of that line, because the burning of biomass didn't meet any environmental criteria and it contributed to having bad air quality in cities. Of course, big changes have occurred since then, as biomass boilers have become environmentally and energy efficiently.

Tables 29 and 30 present figures for the heat that derives from gaseous and solid biomass respectively for year 2005, according to the findings of another IEE project named "Thermal energy from Renewables – Therra". Solid biomass is mainly used for space heating in households, while biogas is used in CHP plants.

Table 30. Penetration of gaseous biomass in year 2005 (Source: Thermal energy for renewables – Therra project)

Heat from biogas, CHP plants	
Input method[1] (PJ)	0,168
Output method[2] (PJ)	0,193
National method[3] (PJ)	1,381

Table 31. Penetration of solid biomass in year 2005 (Source: Thermal energy for renewables – Therra project)

Heat from solid biomass stoves in households	
Use of solid biomass (ton)	2.036.000
Input method (PJ)	28,12
Output method (PJ)	16,87
National method (PJ)	29,39
Final use of solid biomass not in households	
Number of installations	2.460
Thermal output capacity (MW)	489
Use of solid biomass (ton)	656.264
Input method (PJ)	9,06
Output method (PJ)	6,34
National method (PJ)	9,15
Total	
Input method (PJ)	37,18
Output method (PJ)	23,21
National method (PJ)	38,55

49.3 The main wood fuel producers and users

Greek consumption is not covered by domestic production and, therefore, required the import of about 445,000 tons of pellets.

It should also be noted that so far biomass pellets are hardly utilized in residential scale heating sector, mainly due to the ban on burning biomass heaters in large urban centers (Athens, Thessaloniki and Salamis) which is in force during the last 18 years. Currently, under the CMD "Regulation of issues related to the operation of stationary sources of combustion for heating buildings and water" the termination of this unreasonable ban has been decided, a progress which is expected to increase the consumption of biomass pellets in residential heating systems.

In 2008, just a small quantity of biomass pellets was exploited in domestic industrial plants. On this basis, therefore, it was observed an excess quantity of about 17,000 tones, which was exported, mainly to Italy.

Table 32. Biomass Pellet Producers in Greece

Company Name	Location
Sakkas SA	Karditsa
Angelousis SA	Velestino
Bioenergy Hellas	Larissa
MAKI SA	Larissa
Alfa Wood	Nevrokopi
Ecoa	Katerini

The first plant pellets in Greece opened in 2006 and 5 more plants were installed until 2010. It is worth noting, moreover, that according to a report made by Mr. C. Nasikas, a Board member of the Hellenic Biomass Society (Hellabiom), in Kathimerini newspaper (01/10/2011), they are currently being built further 14 pellets plants in Greece so as to meet the expected increase in domestic demand.

So for the first time in Greece, a significant and quite promising progress in the biomass pellet sector is taking place[8].

49.4 Export/import of wood fuels

The total consumption of pellets is not covered by existing plants and, therefore, large quantities of pellets are imported from outside Europe. Sweden, Denmark, Belgium and the Netherlands introduced in 2008, cumulatively, nearly 3 million tones so as to meet their domestic demands. Also Italy, presented the same year imports of around 200,000 tones.

On this basis, the opportunity for Greek pellets production plants to operate outside its borders is provided. It should, however, be emphasized that a necessary condition for this is the production of high quality pellets and their conformation with European Quality Standards.

The high biomass costs, the limited land and water availability, the competition for food and the environmental constraints limit the technically available biomass supplies of the country.

Imports of solid biofuels are mainly refined wood in the form of pellets for domestic heating.

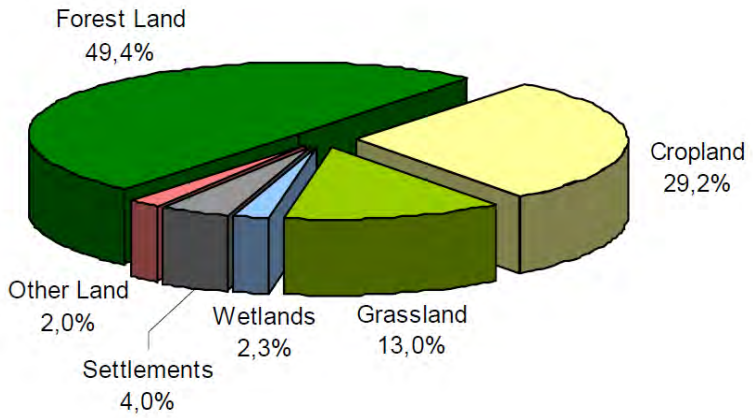
[8] www.biomassenergy.gr

Until now, the lacking domestic pellet demand in Greece forces the pellet producers to target European markets and to export the largest share of their production, Italy being the most important import market. Another consequence is that the pellet trading and logistic infrastructure is not being developed in Greece.

50. Forests and wood biomass production

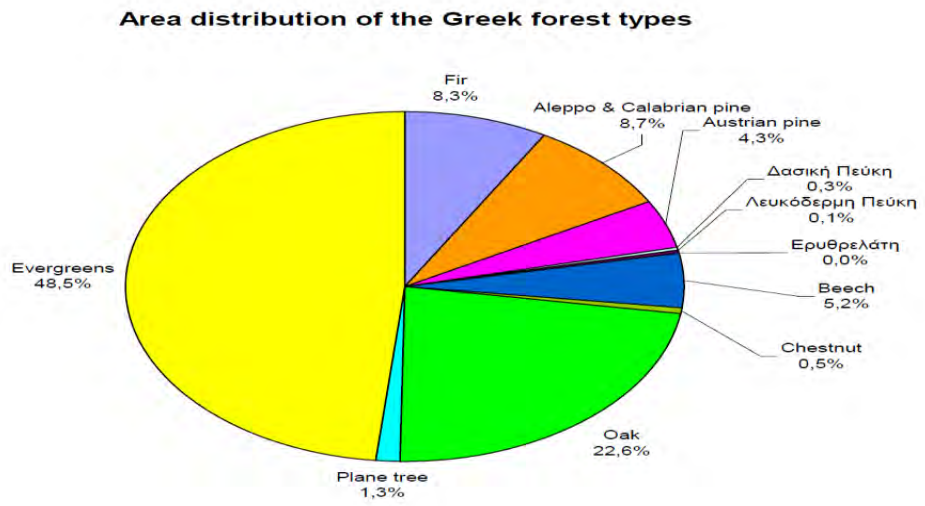
50.1 Review on forests

Forests in Greece, as in other Mediterranean countries, are characterised by shrub dominance. These are formations of evergreen shrub species (keep their foliage during winter) the most important of them being kermes oak (*Quercus coccifera*), strawberrytree (*Arbutus spp.),* lentisk (*Pistacia lentiscus*), mock privet (*Phillyrea latifolia*) and junipers (*Juniperus oxycedrus, J. phoenicea*).



Picture 31. Distribution of the area of Greece in 2000 by land-use category (MEPPPW, 2008)

Overall, they cover approximately half of our forests with main presence in areas of low or medium altitude, being able to reach about 1000 m. The other species however (oak, pine species, fir, beech, plane tree, chestnut) are very important as they cover extensive mountainous areas giving various products, protection to the soil and value to the landscape.



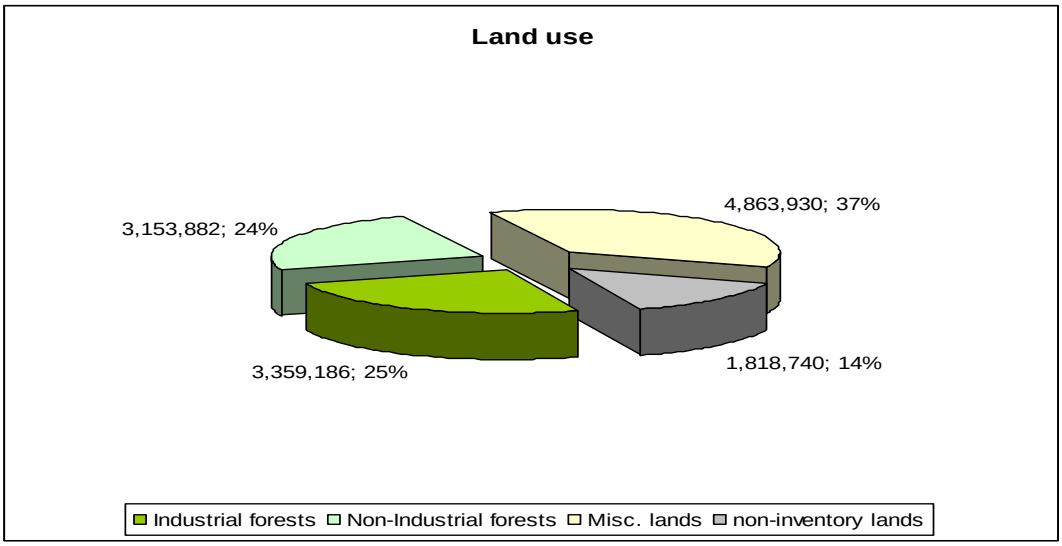
Picture 32. Area distribution of the Greek forest types (Yli, 2011)

In Greece, the only nationwide census for the forest areas has been contacted in 1992, by the General Directorate for the Forests and the Natural Environment, Ministry of Agriculture (GDFNE, 1992). According to this, in 1992, forests covered 6.513.068 Ha or 49.3% of the total area of the country. From this, 3.359.000 ha are industrial forests, whereas 3.153.882 are non-industrial.

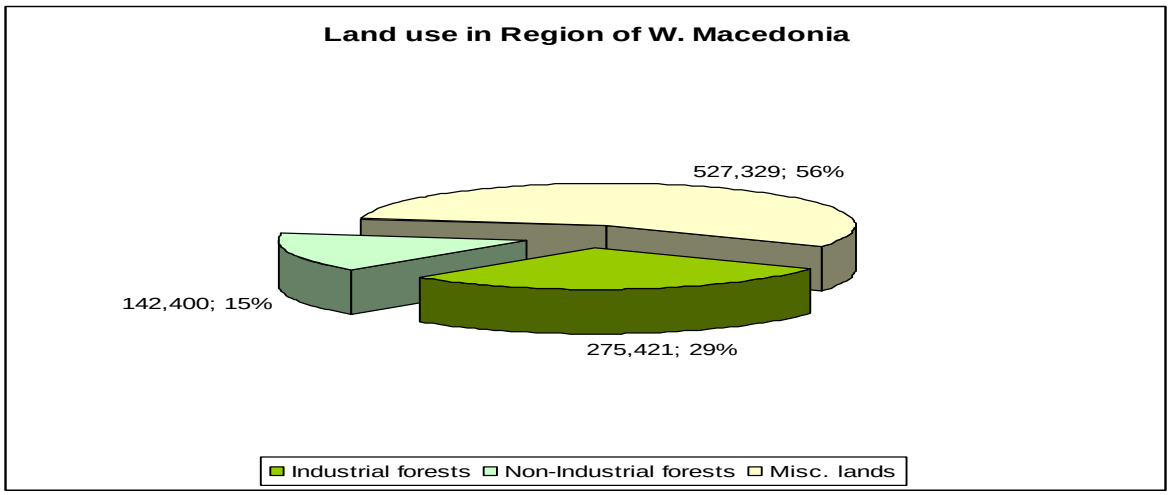
Table 33. Land use in Greece and in the region

Land Use in country	ha	%
Industrial forests	3.359.186	25,40%
Non-Industrial forests	3.153.882	23,90%
Total Forest Lands	**6.513.068**	**49,30%**
Misc. lands	4.863.930	36,90%
non-inventory lands	1.818.740	13,80%
TOTAL country area	**13.195.738**	**100,00%**

Land Use in W. Macedonia region	ha	%
Industrial forests	275.421	29,14%
Non-Industrial forests	142.400	15,07%
Total Forest Lands	**417.821**	**44,21%**
Misc. lands	527.329	55,79%
TOTAL region area	**945.150**	**100,00%**



Picture 33. Land use in Greece (1992)



Picture 34. Land use in Region of W. Macedonia (1992)

The region of Western Macedonia is divided into 5 forest districts: Kozani, Tsotyli, Grevena, Kastoria and Florina. The forest cover in the region is 417.821 ha or 44,2% of the total area. Most of the forests exist in Grevena district (57,3%) and the least in the combined area of Kozani and Tsotyli.

Table 34. Land use in W. Macedonia Region

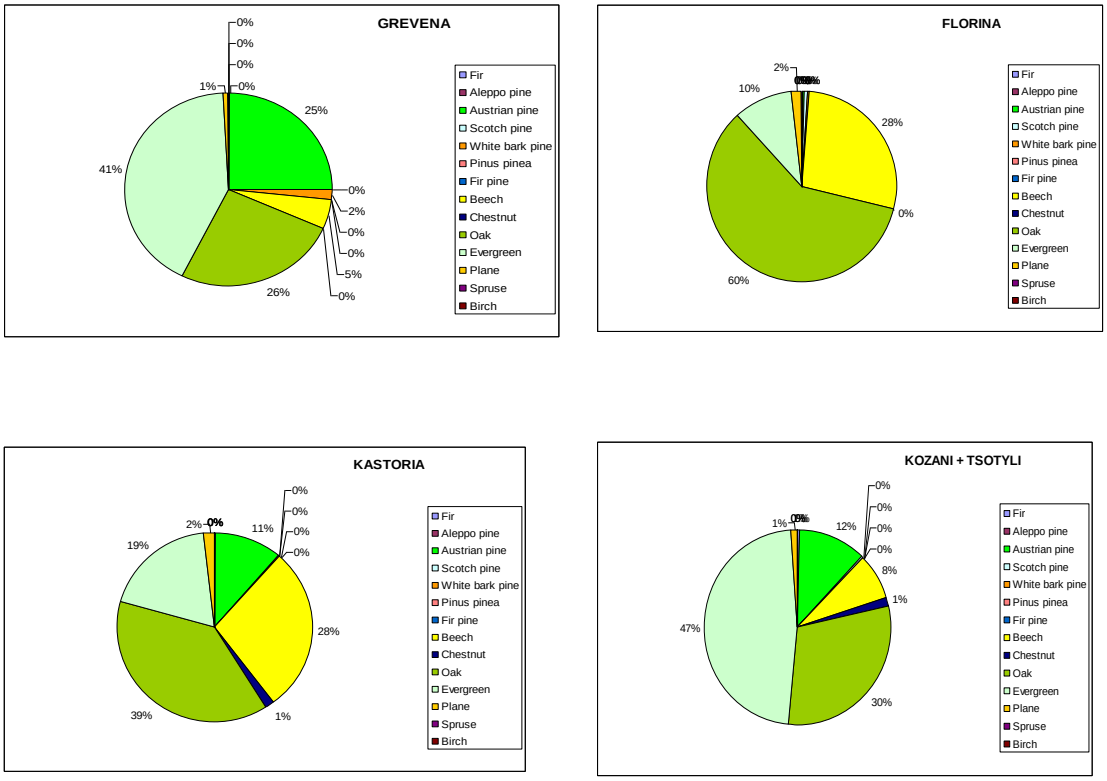
Land Use in W. Macedonia region	Industrial forests (ha)	Non-Industrial forests (ha)	Total forest (ha)	Total area (ha)	% forest area
GREVENA Forest District	77.277,00	55.431,00	132.708,00	229.090,00	57,93%
KASTORIA Forest District	64.260,00	14.996,00	79.256,00	172.010,00	46,08%
FLORINA Forest District	62.022,00	6.831,00	68.853,00	192.460,00	35,78%
KOZANI + TSOTYLI Forest District	71.862,00	65.142,00	137.004,00	351.590,00	38,97%
Total Forest Lands	**275.421,00**	**142.400,00**	**417.821,00**	**945.150,00**	

The major tree species in the region are Austrian pine, Beech, Oak and Evergreen. These add up to almost 97% of the whole forest area of the region.

Worth noting is the fact that the area is the major producer of Austrian pine (20,51% of the whole country), white bark pine (31.25% of the whole country) and beech (17.36% of the whole country).

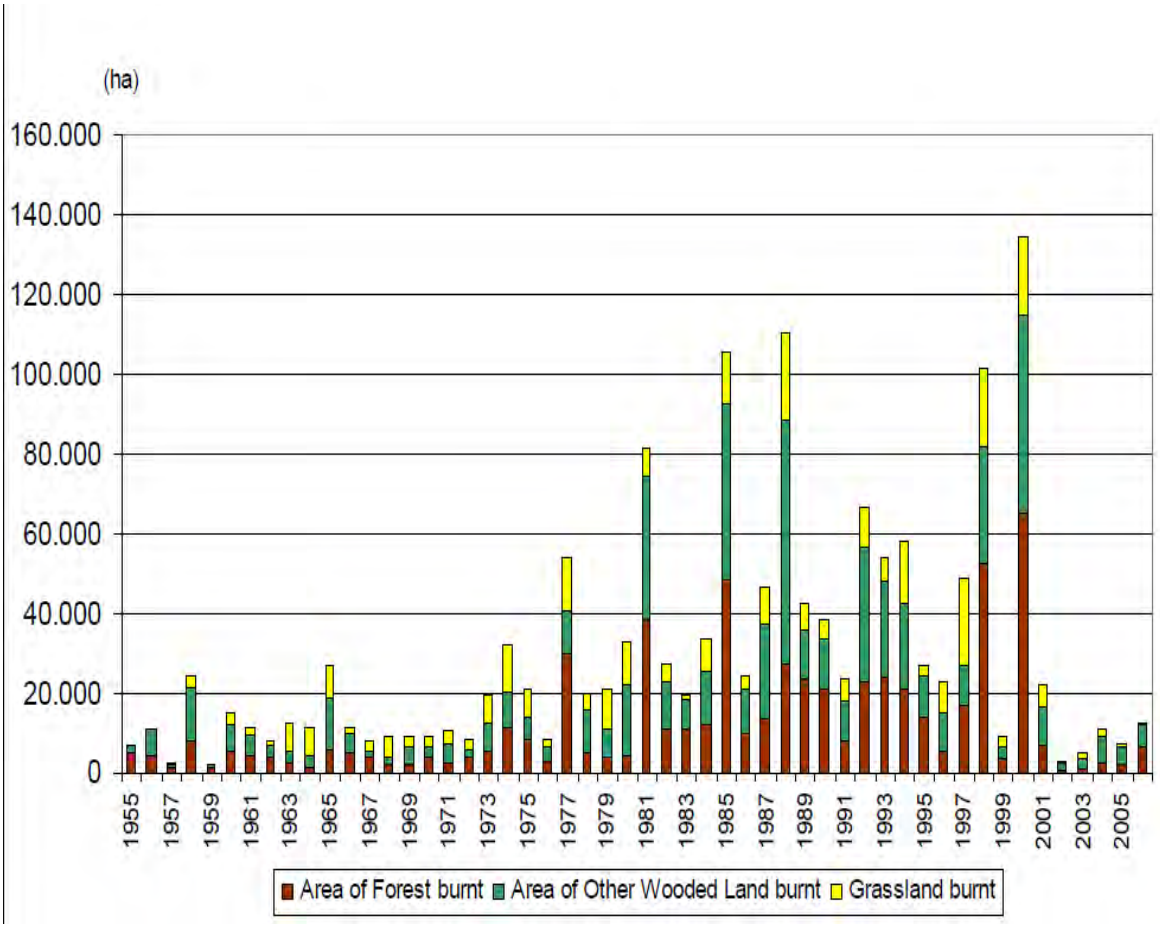
Table 35. Tree species

Tree species	Forest Districts (Area in ha)				Total region	Total country	% of country
	GREVENA	KASTORIA	FLORINA	KOZANI + TSOTYLI			
Fir	359	0	277	794	**1.430**	**543.308**	0,26%
Aleppo pine	0	229	0	106	**335**	**567.731**	0,06%
Austrian pine	32.860	8.881	108	15.933	**57.782**	**281.692**	20,51%
Scotch pine	0	0	318	106	**424**	**20.955**	2,02%
White bark pine	2.270	65	259	0	**2.594**	**8.300**	31,25%
Pinus pinea	0	0	0	0	**0**	**108**	0,00%
Fir pine	0	116	0	0	**116**	**4.762**	2,44%
Beech	6.370	22.249	18.988	10.840	**58.447**	**336.640**	17,36%
Chestnut	0	1.120	0	1.730	**2.850**	**33.081**	8,62%
Oak	34.168	30.202	40.906	40.733	**146.009**	**1.471.839**	9,92%
Evergreen	55.431	14.996	6.831	65.142	**142.400**	**3.153.882**	4,52%
Plane	1.250	1.398	1.166	1.620	**5.434**	**86.579**	6,28%
Spruse	0	0	0	0	**0**	**2.754**	0,00%
Birch	0	0	0	0	**0**	**1.437**	0,00%
Total region	**132.708**	**79.256**	**68.853**	**137.004**	**417.821**	**6.513.068**	

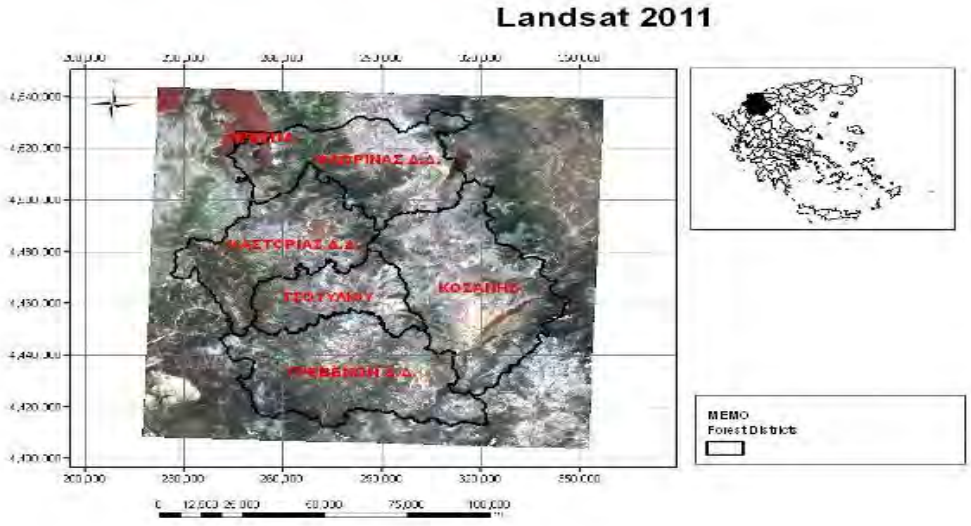


Picture 35. Tree species per Forest district in Region of W. Macedonia (1992)

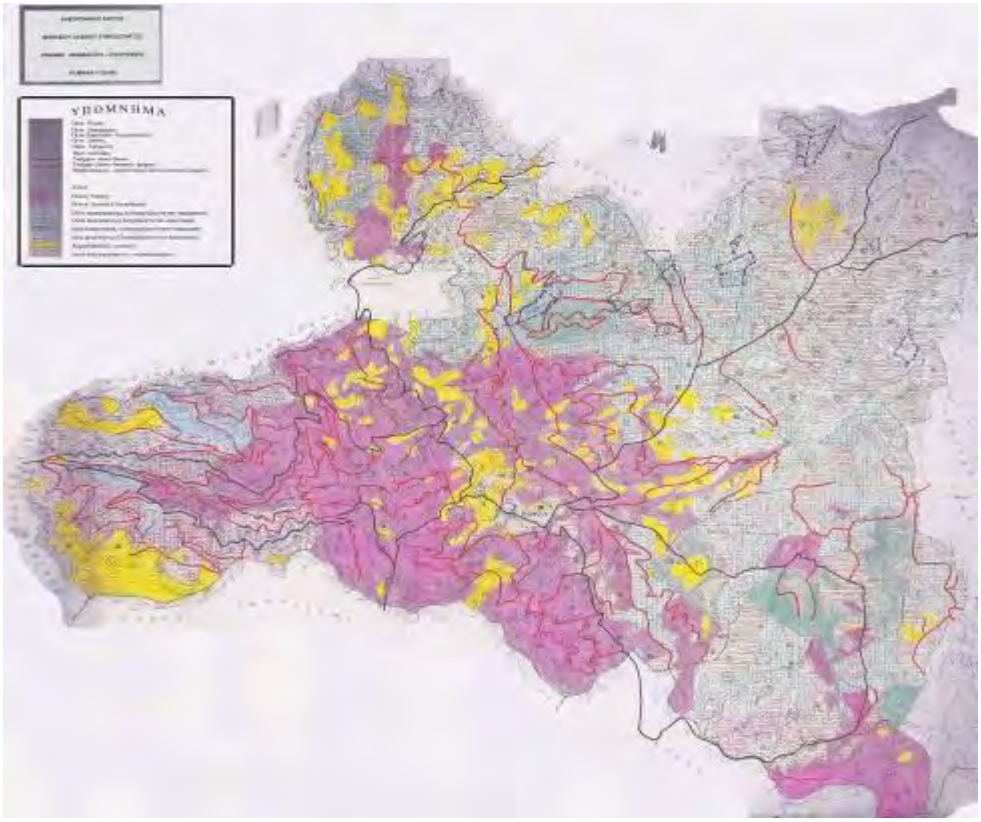
Comparing the total forest areas of 417.821 ha in 1992 with this of 319.596 ha (forest and partly forest lands combined) in 2008 we notice a reduction of 23,5%. A major cause for this is fire.



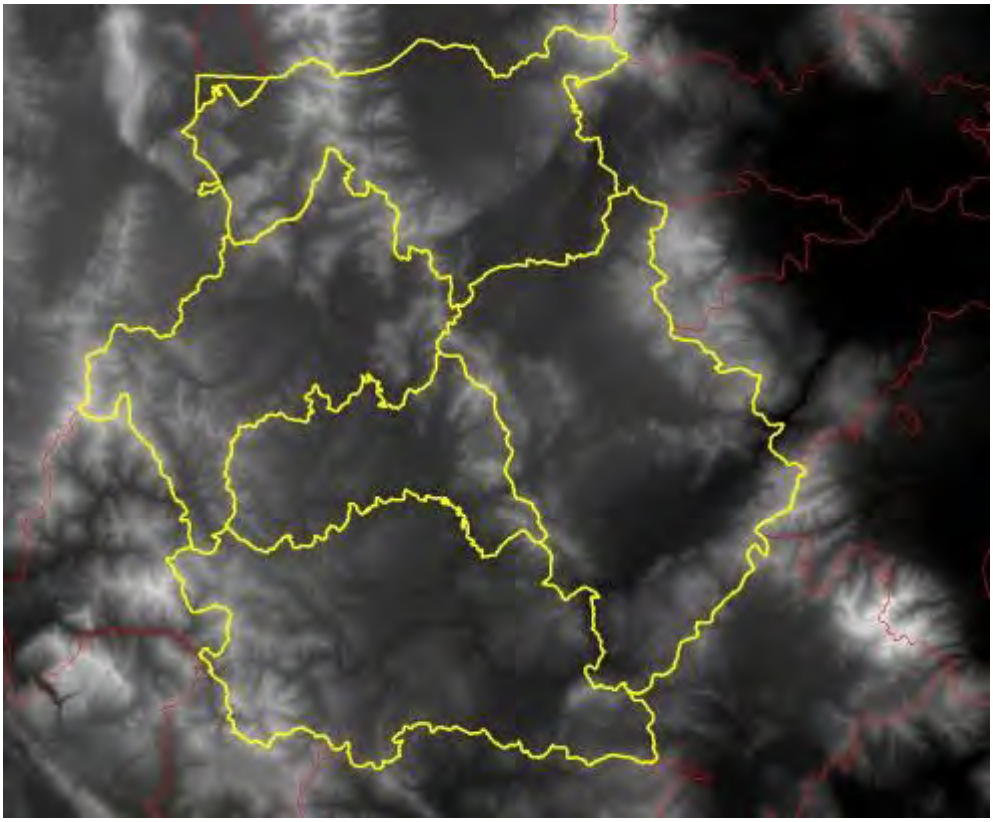
Picture 36. Areas of Forest, Other Wooded Land and Grassland burnt since 1955 (MEPPPW, 2008)



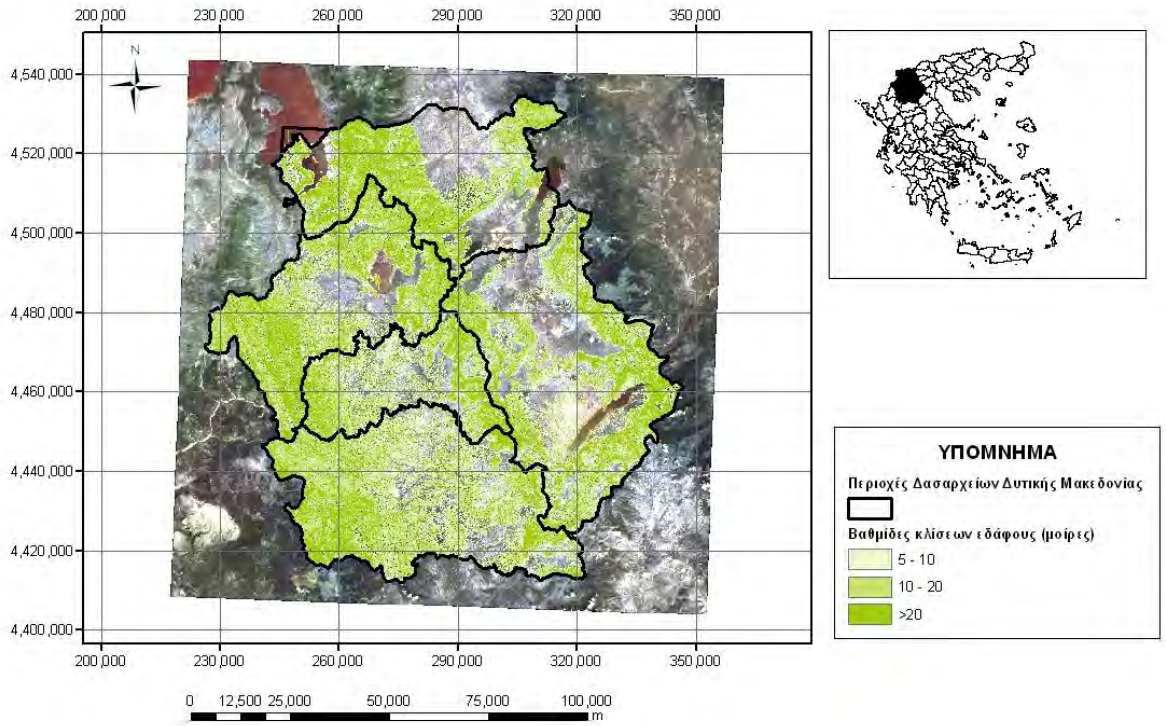
Picture 37. Forest Districts on top of Landsat satellite orthoimagery layer (2011). High anaglyph and forested areas are clearly depicted.



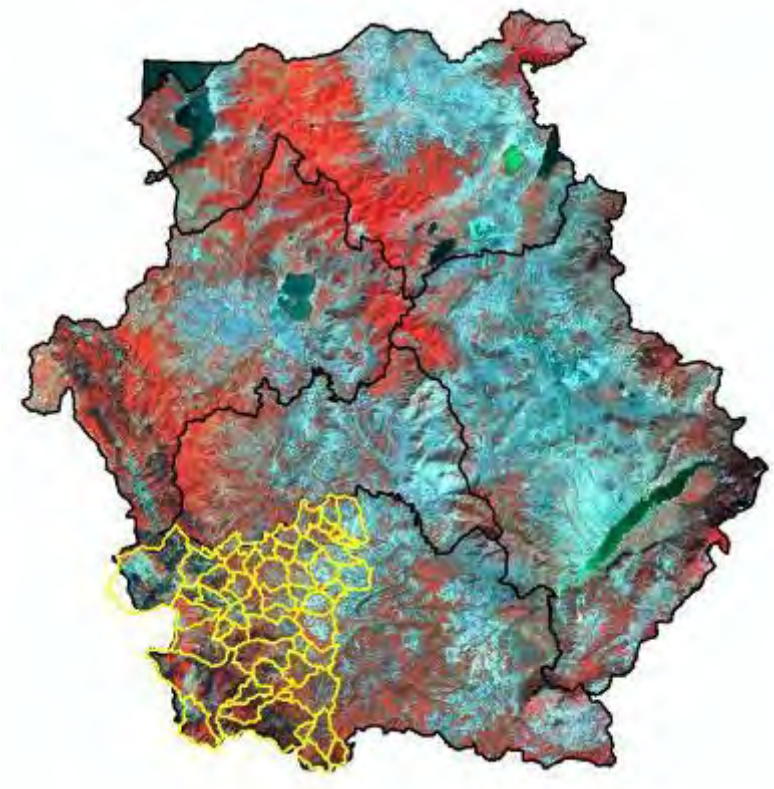
Picture 38. An example of a forest management plan.



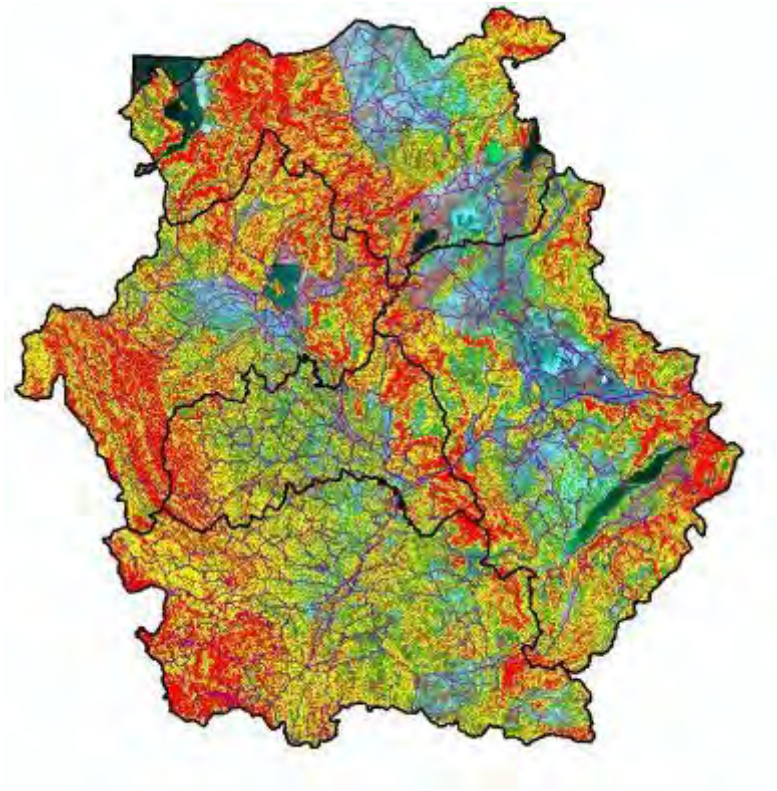
Picture 39. Forest Districts on top of global Digital Terrain Model. High elevations and steep slopes are depicted.



Picture 40. Slope map



Picture 41. The Near Infrared band (NIR) of the satellite imagery denotes with a good approximation the forested areas (here in red)



Picture 42. Road network (in purple) overlaid over slope map and over IR imagery. The area is characterized by a thick road network (here in blue) which is useful for wood transport.

Table 36. Land use in W. Macedonia Region

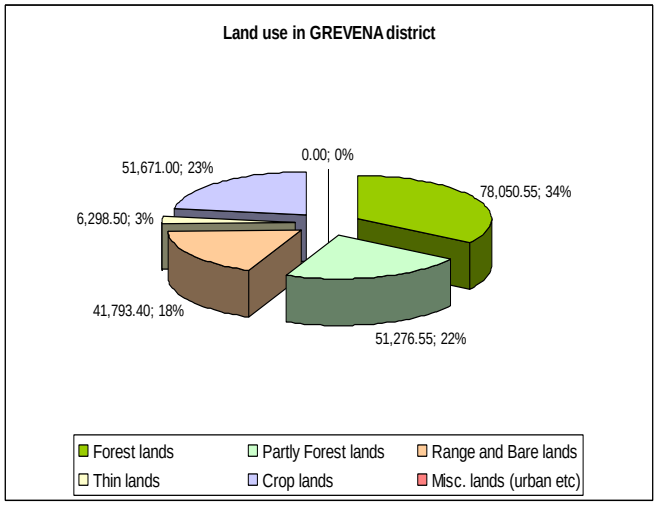
Forest district	GREVENA	
Land Use	**ha**	**%**
Forest lands	78.050,55	34,07%
Partly Forest lands	51.276,55	22,39%
Range and Bare lands	41.793,40	18,24%
Thin lands	6.298,50	2,75%
Crop lands	51.671,00	22,55%
Misc. lands (urban etc)	0,00	0,00%
TOTAL	**229.090,00**	**100,00%**

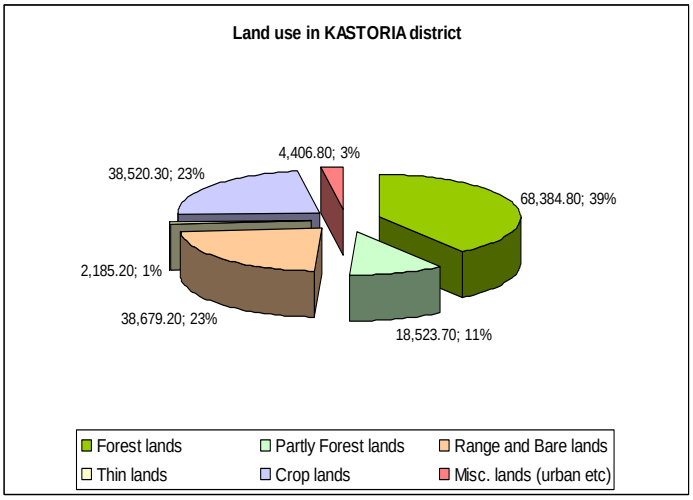
Forest district	KASTORIA	
Land Use	**ha**	**%**
Forest lands	68.384,80	40,00%
Partly Forest lands	18.523,70	10,90%
Range and Bare lands	38.679,20	22,70%
Thin lands	2.185,20	1,30%
Crop lands	38.520,30	22,50%
Misc. lands (urban etc)	4.406,80	2,60%
TOTAL	**170.700,00**	**100,00%**

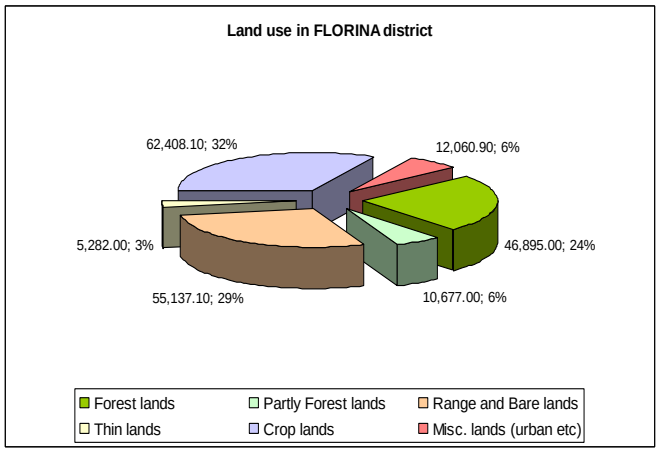
Forest district	FLORINA	
Land Use	**ha**	**%**
Forest lands	46.895,00	24,37%
Partly Forest lands	10.677,00	5,54%
Range and Bare lands	55.137,10	28,65%
Thin lands	5.282,00	2,74%
Crop lands	62.408,10	32,43%
Misc. lands (lakes etc)	12.060,90	6,27%
TOTAL	**192.460,10**	**100,00%**

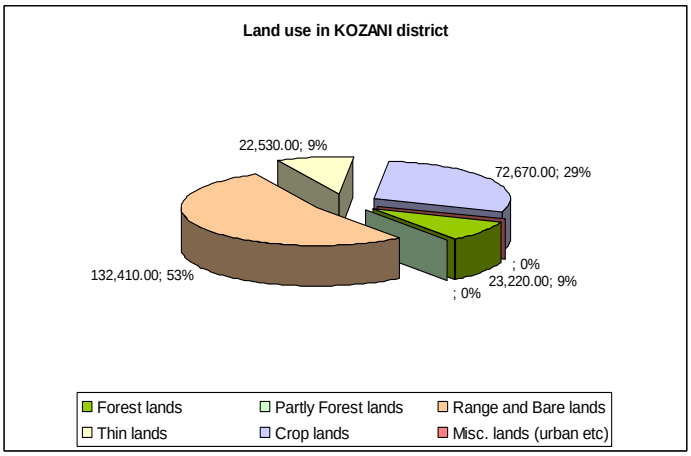
Forest district	KOZANI	
Land Use	**ha**	**%**
Forest lands	23.220,00	9,26%
Partly Forest lands		
Range and Bare lands	132.410,00	52,79%
Thin lands	22.530,00	8,98%
Crop lands	72.670,00	28,97%
Misc. lands (lakes etc)		
TOTAL	**250.830,00**	**100,00%**

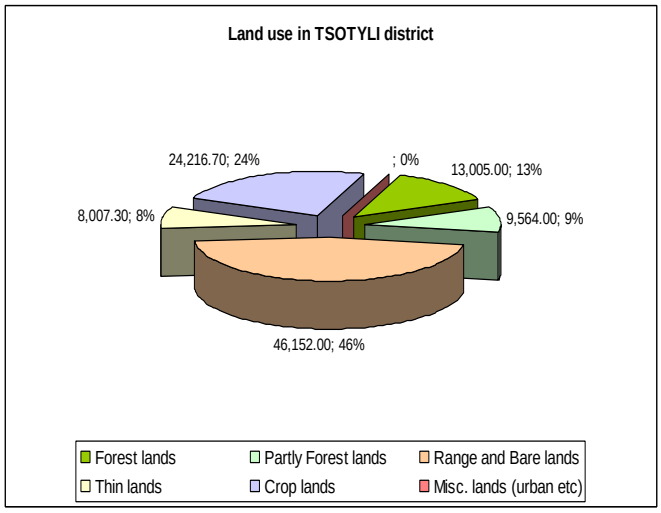
Forest district	TSOTYLI	
Land Use	**ha**	**%**
Forest lands	13.005,00	12,88%
Partly Forest lands	9.564,00	9,48%
Range and Bare lands	46.152,00	45,72%
Thin lands	8.007,30	7,93%
Crop lands	24.216,70	23,99%
Misc. lands (lakes etc)		
TOTAL	**100.945,00**	**100,00%**











Picture 43. Land use per Forest districts in Region of W. Macedonia (2008)

Table 37. Tree species

Forest district	GREVENA			
Tree species	**Forest area (ha)**	**Partly Forest area (ha)**	**Total (ha)**	**%**
Austrian pine	20.928,60	8.658,20	29.586,80	23%
White bark pine	1.485,45	598,95	2.084,40	1%
Fir	1.858,90	951,00	2.809,90	2%
Beech	4.177,30	1.820,50	5.997,80	5%
Oak	49.600,30	39.247,90	88.848,20	69%
Misc. species				
TOTAL	**78.050,55**	**51.276,55**	**129.327,10**	**100%**

Forest district	KASTORIA			
Tree species	**Forest area (ha)**	**Partly Forest area (ha)**	**Total (ha)**	**%**
Austrian pine	13.009	4.430	17.439,00	20%
White bark pine				
Fir	3.096	375	3.470,40	4%
Beech	12.875	4.385	17.259,10	20%
Oak	39.406	9.334	48.740,00	56%
Misc. species				
TOTAL	**68.384,80**	**18.523,70**	**86.908,50**	**100%**

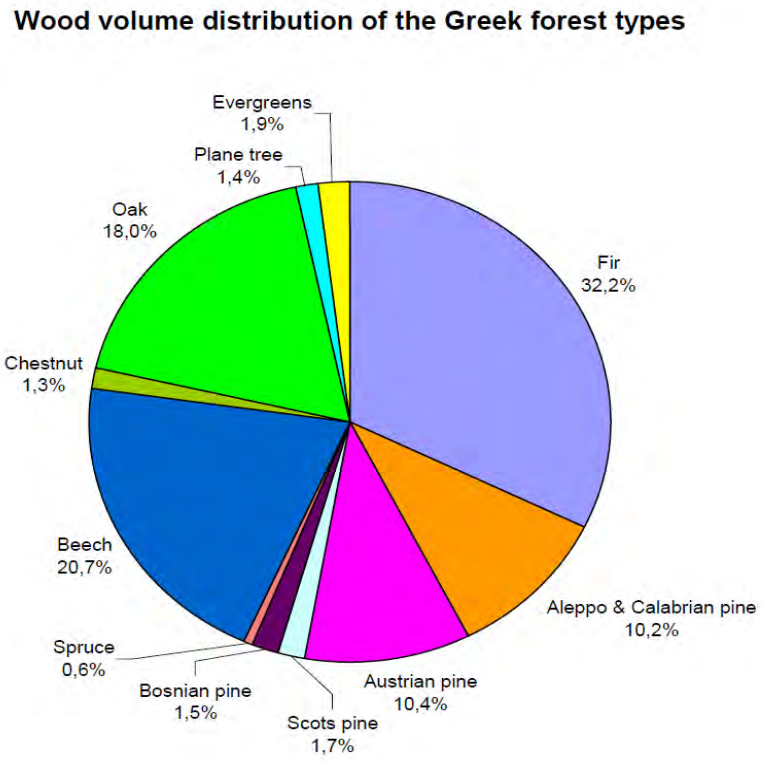
Forest district	FLORINA			
Tree species	**Forest area (ha)**	**Partly Forest area (ha)**	**Total (ha)**	**%**
Austrian pine	731,00	78,00	809,00	1%
Cedar tree		160,00		0%
Range lands	77,00	52,00	129,00	0%
Beech	22.110,00	2.940,00	25.050,00	44%
Mix	22.768,00	6.636,00	29.404,00	51%
Misc. species	1.209,00	811,00		4%
TOTAL	**46.895,00**	**10.677,00**	**55.392,00**	**100%**

Forest district	KOZANI			
Tree species	**Forest area (ha)**	**Partly Forest area (ha)**	**Total (ha)**	**%**
Austrian pine Scotch pine Fir	164,10	959,62	2.600,62	60%
Beech	117,82	136,20	1.314,40	30%
Mixed oak forests	31,25	91,50	404,05	9%
Misc. species				
TOTAL	**313,17**	**1.187,32**	**4.319,07**	**100%**

Forest district	TSOTYLI			
Tree species	**Forest area (ha)**	**Partly Forest area (ha)**	**Total (ha)**	**%**
Austrian pine	708,00	293,00	1.001,00	5%
White bark pine				0%
Fir	200,00	47,00	247,00	1%
Beech	2.695,00	273,50	2.968,50	13%
Oak	9.126,00	8.883,50	18.009,50	81%
Misc. species	276,00	67,00		0%
TOTAL	**13.005,00**	**9.564,00**	**22.226,00**	**100%**

50.2 Review on forest biomass potentials, limitations (technical, ecological…) on wood biomass use

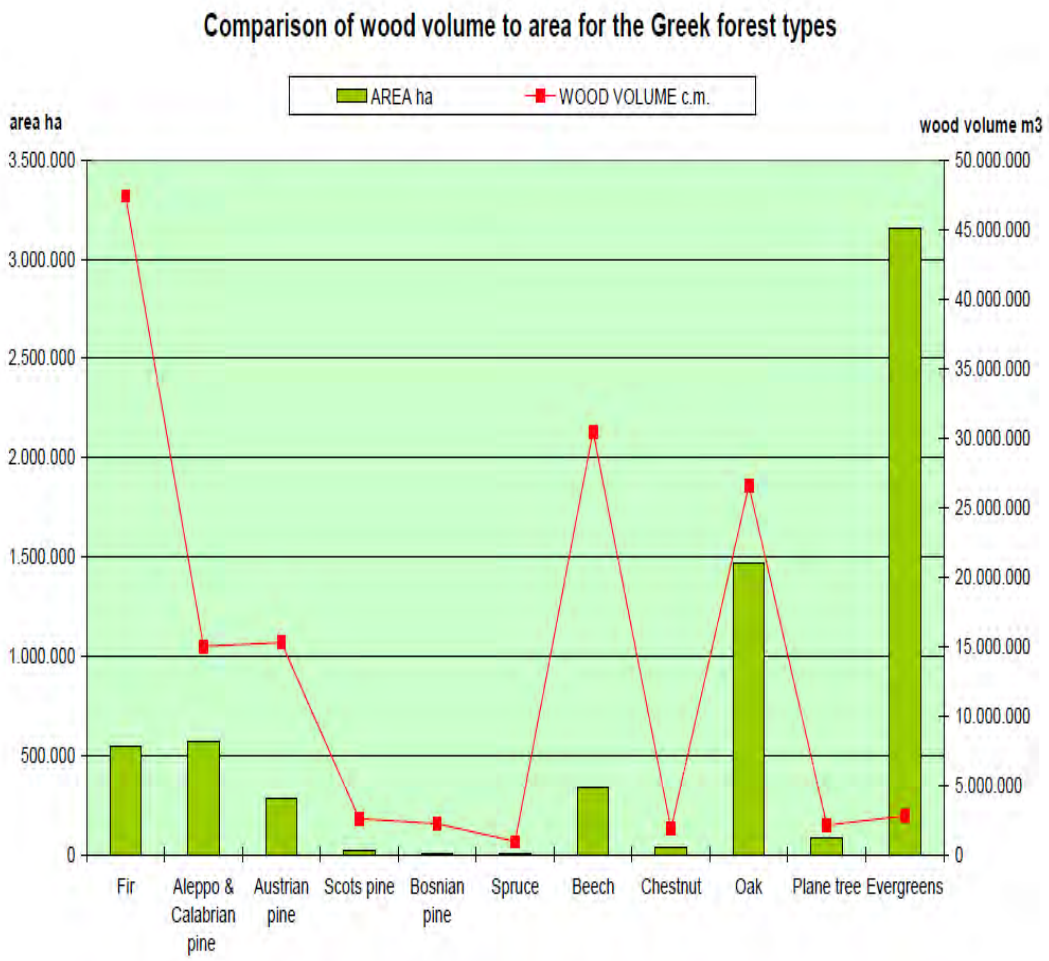
According to 1992 census (GDFNE, 1992) the merchantable volume of the industrial forests is 138.107.132 m3, for the whole country.



Picture 44. Wood volume distribution of the Greek forest types (Yli, 2011)

Wood volume is the total volume of wood found in a forest. The wood volume includes the entire trunk of living trees (merchantable trunkwood + apexes) but no branch wood. We note that the wood volume of the evergreen shrublands is insignificant as biomass quantity despite the fact that they cover half of the total forest land. On the contrary, the great value of fir, beech and oaks is apparent; these species occupy 8.3%, 5.2% and 22.6% of the area but 32.2%, 20.7% and 18% of the wood volume respectively.

The above observation is better illustrated in the following diagram where the wood volume is contrasted with the area covered and there it comes the conclusion that fir, beech and oaks are the most valuable species.



Picture 45. Comparison of wood volume to area for the Greek forest types (Yli, 2011)

50.3 Current use of forests for round wood and wood biomass production

According to 2008 data of the regional Forest districts, the total production of wood material is as follows in next table.

Table 38. Production of wood material

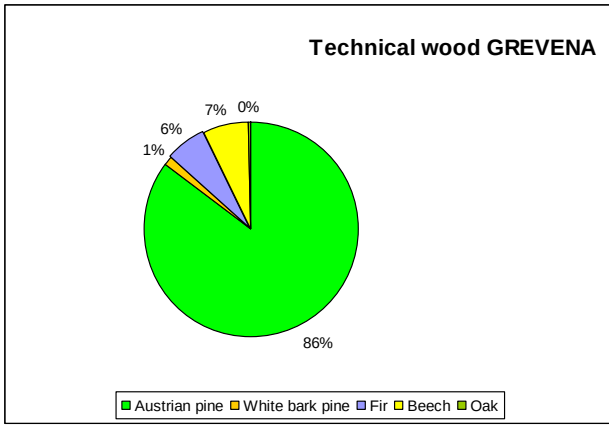
Forest district	GREVENA		
Volume in m3	Public	non Public	Total
Austrian pine	14.851,98	1.100,02	15.952,00
White bark pine	238,01	4,58	242,59
Fir	1.149,42	0,00	1.149,42
Beech	1.274,72	0,00	1.274,72
Oak	60,37	0,00	60,37
total of technical wood	**17.574,50**	**1.104,60**	**18.679,10**
Austrian pine	1.993,08	446,22	2.439,30
Beech	2.560,16	0,00	2.560,16
Oak	3.635,71	24.086,92	27.722,63
Plane	23,68	1,80	25,48
total of fuel wood	**8.212,63**	**24.534,94**	**32.747,57**
TOTAL	**25.787,13**	**25.639,54**	**51.426,67**

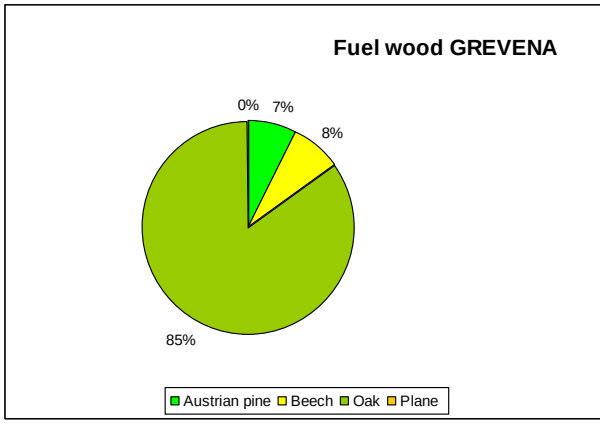
Forest district	KASTORIA		
Volume in m3	Public	non Public	Total
Beech	1.920,63	0,00	1.920,63
Fir	1.062,10	863,15	1.925,25
Austrian pine	7.996,03	5.781,03	13.777,06
total of technical wood	**10.978,76**	**6.644,18**	**17.622,94**
Oak	15.083,50	4.424,00	19.507,50
Beech	20.830,00	5.107,00	25.937,00
Softwoods	1.901,00	0,00	1.901,00
Aspen	258,00	0,00	258,00
total of fuel wood	**38.072,50**	**9.531,00**	**47.603,50**
TOTAL	**49.051,26**	**16.175,18**	**65.226,44**

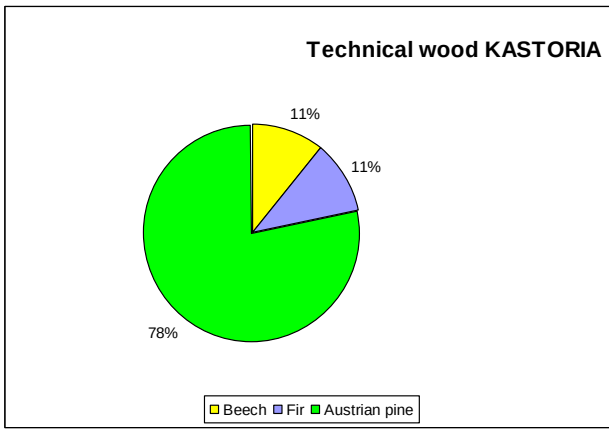
Forest district	FLORINA		
Volume in m3	Public	non Public	Total
Scotch pine	0,00	124,20	124,20
Austrian pine	0,00	166,63	166,63
Chestnut	0,00	1.549,67	1.549,67
Beech	1.517,52	3.083,98	4.601,50
Oak	62,43	74,66	137,09
total of technical wood	**1.579,95**	**4.999,14**	**6.579,09**
Scotch pine	0,00	15,00	15,00
Beech	11.247,01	24.562,45	35.809,46
Oak	10.721,23	22.491,53	33.212,76
Chestnut	0,00	124,08	124,08
Alnus glutinosa	80,40	115,20	195,60
Aspen	0,00	42,00	42,00
Evergreen	0,00	15,00	15,00
total of fuel wood	**22.048,64**	**47.365,26**	**69.413,90**
TOTAL	**23.628,59**	**52.364,40**	**75.992,99**

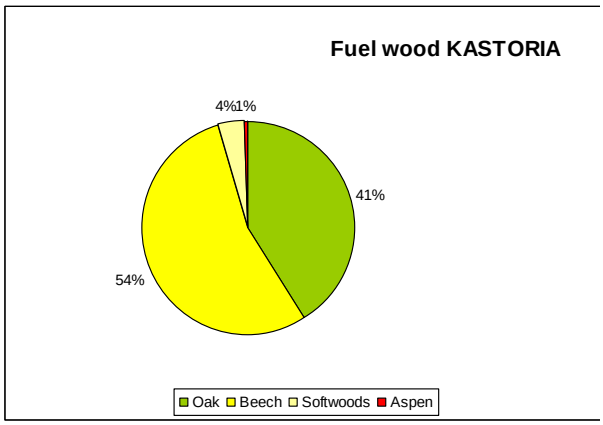
Forest district	KOZANI		
Volume in m3	Public	non Public	Total
Pine	11.257,94	0,00	11.257,94
total of technical wood	**11.257,94**	**0,00**	**11.257,94**
Beech	1.416,78	2.884,65	4.301,43
Oak	1.102,42	1.116,00	2.218,42
Pine	7.699,83	0,00	7.699,83
Plane	1.592,27	0,00	1.592,27
total of fuel wood	**11.811,30**	**4.000,65**	**15.811,95**
TOTAL	**23.069,24**	**4.000,65**	**27.069,89**

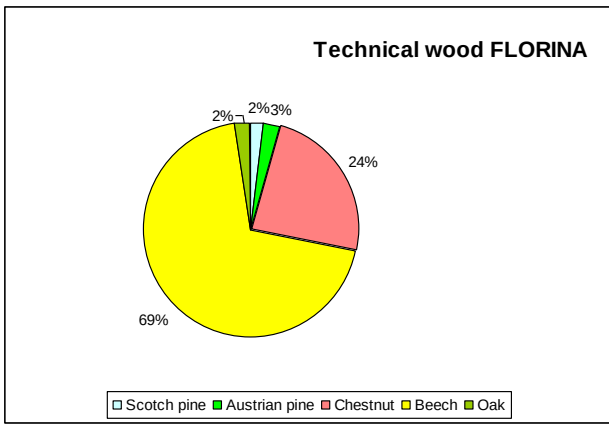
Forest district	TSOTYLI		
Volume in m3	Public	non Public	Total
Pine	756,47	0,00	756,47
Beech	1.600,89	0,00	1.600,89
Walnut	0,00	10,01	10,01
Chestnut	0,00	42,13	42,13
total of technical wood	**2.357,36**	**52,14**	**2.409,50**
Oak	1.485,12	3.798,12	5.283,24
Beech	1.349,16	1.367,16	2.716,32
Austrian pine	46,80	46,80	93,60
Chestnut	0,00	4,80	4,80
Pear tree	0,00	1,20	1,20
total of fuel wood	**2.881,08**	**5.218,08**	**8.099,16**
TOTAL	**5.238,44**	**5.270,22**	**10.508,66**

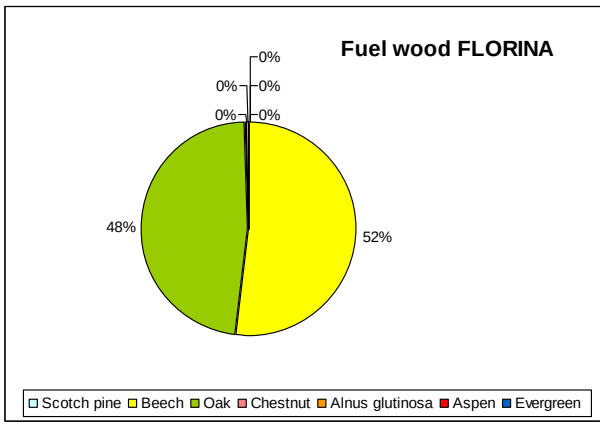

Technical wood GREVENA
7%
0%
6%
1%
86%
Austrian pine
White bark pine
Fir
Beech
Oak

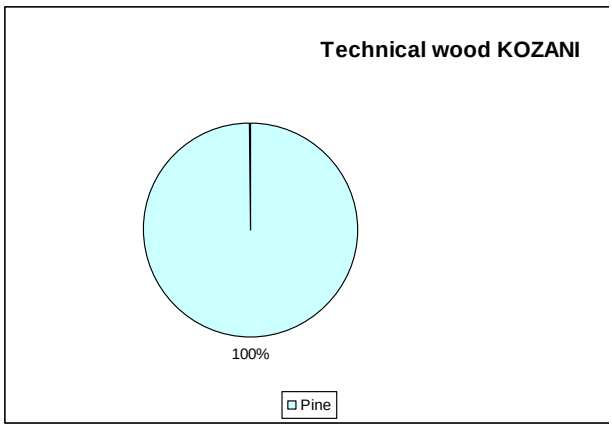

Fuel wood GREVENA
0%
7%
8%
85%
Austrian pine
Beech
Oak
Plane

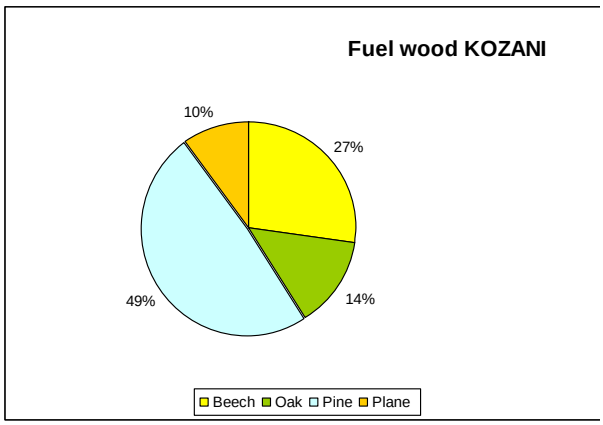

Technical wood KASTORIA
11%
11%
78%
Beech
Fir
Austrian pine

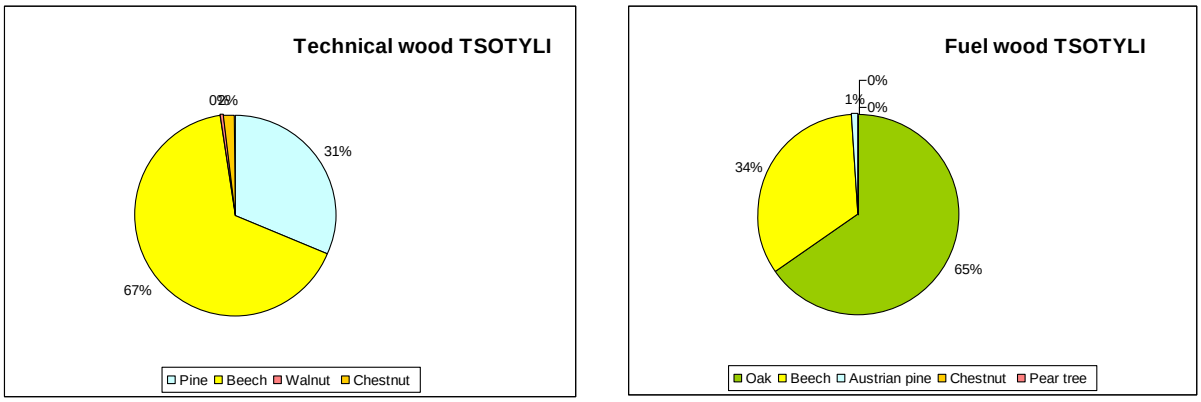

Fuel wood KASTORIA
4%
1%
41%
54%
Oak
Beech
Softwoods
Aspen


Technical wood FLORINA
2%
2%
3%
24%
69%
Scotch pine
Austrian pine
Chestnut
Beech
Oak


Fuel wood FLORINA
0%
0%
0%
0%
0%
48%
52%
Scotch pine
Beech
Oak
Chestnut
Alnus glutinosa
Aspen
Evergreen


Technical wood KOZANI
100%
Pine


Fuel wood KOZANI
10%
27%
49%
14%
Beech
Oak
Pine
Plane



Picture 46. Wood production in 2008

50.4 Wood biomass production from short rotation forests (development of SRF, type of SRF …)

There is currently almost no wood biomass production from short rotation forest although there was in the past a long-term policy for plantation of agricultural areas with wood forestry species. After 20 and 30 years of the relevant policy which resulted into the creation of privately owned forests with wood biomass potential, the produced wood could have many applications now. According to a relevant research that took place the last decade about the advantages and the potential of the cultivation of forestry species for wood biomass exploitation the following conclusions were reached:

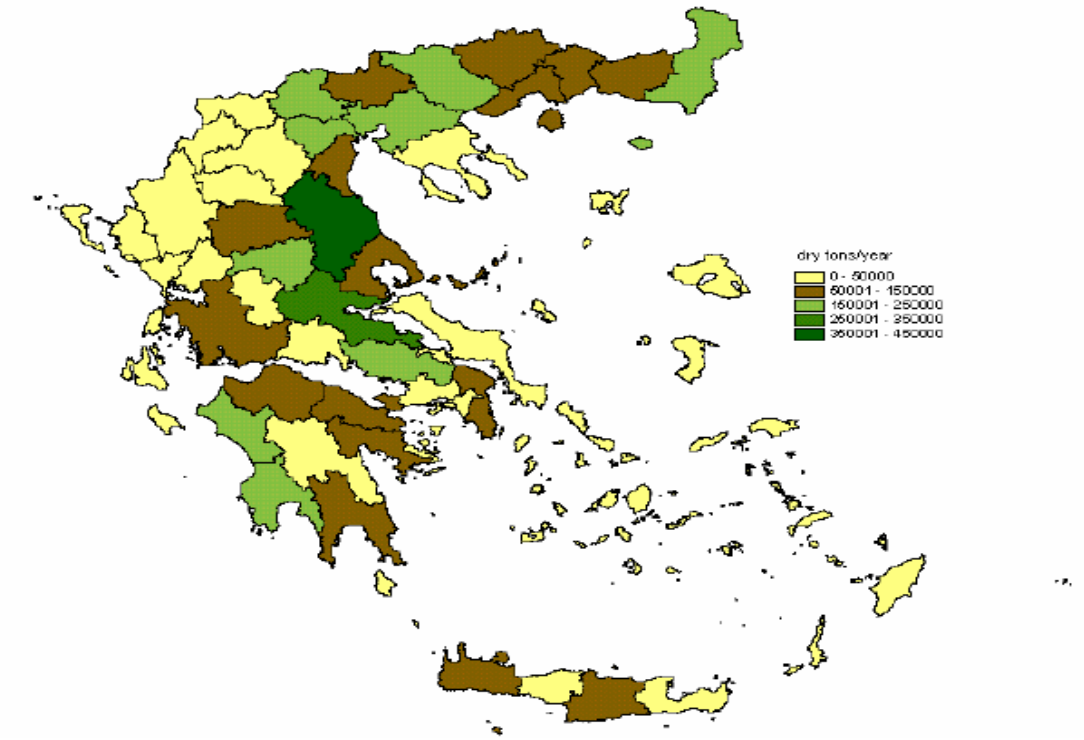
1) The results of the pilot plantation poplar clones in fast growing showed that large quantities of biomass can be obtained from selected domains clones.

2) The present investigation showed that a significant number of strands rounds gave adequate quantities of biomass which suggests the use of a view on a number of poplar clones in biomass plantations production, to reduce the risks from possible attacks and insects, fungus and increased biological stability.

3) Recovery and disposal (finding) of bio mass for multiple uses is also an important economic factor for the promotion and expansion of biomass plantations in agricultural areas and limits.

4) Use selected view and certified material poplar, finding and agricultural census and limit the areas and the provision of economic incentives are important factors affecting the production of biomass.

50.5 Estimation of unused potentials from forests



Picture 47. Geographical distribution of agricultural residues available quantities (ton/y) (Agricultural University of Athens, 2009)

According to the study of the Ministry of Agriculture for the wood industry sector the following information was pointed as results (Petinarakis, 1992):

- 680 sawmills were in operation and their theoretical capacity was recorded at 1.9 million m3/year of round wood. The use of round wood for the production of 1 m3 of saw wood was ranged from 1.42 to 1.48. The annual amount of processed round wood raised up to907 thousands m3 and the total annual quantities of produced saw wood was recorded at 624 thousands m3. Sawmill residues were estimated at the 283558 m3 (30% of processed round wood). 102100 m^3/year of these residues (sawdust and shavings) were used as raw material for wood by-products (e.g. particle boards) and 48200 m3/year as fuel for heat production in wood industry for drying and steaming of wood and space heating. The rest of residues 133258 m3/year remained without exploitation (or further exploitation was not defined).

- 48130 m3/year of wood were processed in 44 industries producing parquets. From this process, 19216 m^3/year of parquets were produced. 4100 m3/year of

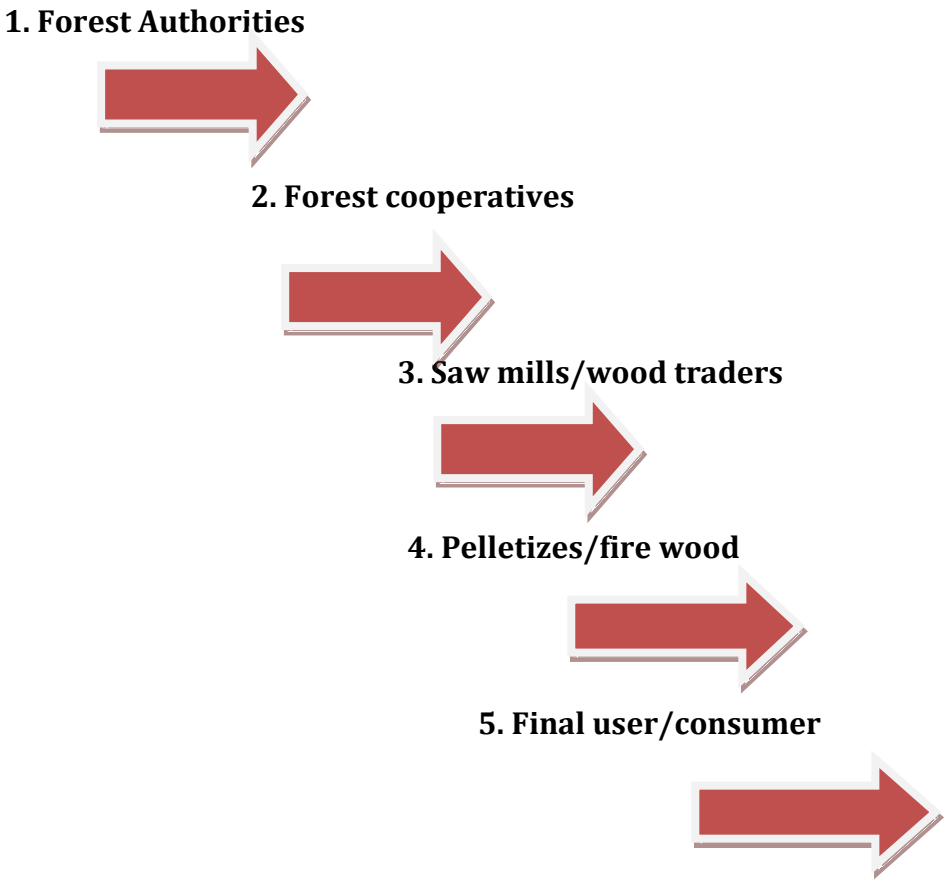
residues were used for wood by-products and 7600 m³/year for heat generation in these industries (to cover their own demands). Other 17394 m³/year remained without exploitation (or further exploitation was not defined).

- In 153 industries producing pallets, 102790 m³/year of wood were processed. From the total amount of residues 15300 m³/year were sold as raw material for wood by-products and other 3350 m³/year as fuel for space heating in order to cover their needs. The 38.6% of these industries do not use their residues for further exploitation or further exploitation was not defined.
- 129920 m³/year of wood were processed in 173 industries for the production of wood boxes. 5700 m³/year of wood residues were used as raw material for the production of wood by-products and other 6000 m³/year for heat generation. The 49.1% of industries producing wood boxes do not use residues for further exploitation or no such information was provided.

51. Wood biomass production chains and wood biomass use

51.1 4.1 Common practices of wood biomass production chains from forests

Common practices of wood biomass production chains in Western Macedonia



51.2 General overview of machinery used for wood biomass production and companies working in forests (harvesters, skidders, wood chippers ...)

Due to the difficult morphology of the Greek forest lands, not any heavy machinery is used for harvesting and cutting the wood biomass. The cutting of wood takes place using sawing machines whereas for wood extraction tractors and animals – in some cases- are used.

51.3 General overview on wood biomass use (district heating, household use)

1. The national plan for integration of RES in the energy balance: In Greece, according to Law 3851/2010 (in the adoption of specific development and environmental policies set by Directive 2009/29/EC), the national target for participation of RES in final energy consumption comes up to 20%, which is further analyzed in 40% proportion of renewables in electricity generation, 20% in heating and cooling needs and 10% in transport. More specifically, under Article 10 ("Application RES in buildings") of that Act, not later than 31.12.2019, all new buildings should cover the entire primary energy consumption in energy supply systems based in renewable energy, cogeneration, district heating systems and heat pumps. For new government and public buildings, the abovementioned requirement should enter into force no later than 31.12.2014.

Today the total gross energy consumption in Greece is estimated at 22.4 Mtoe. According to the Greek Ministry of Environment, Energy and Climate Change, bioenergy in 2010 held approximately 9% of total consumed energy (biomass and biofuels are, together, about 5% of total). With the implementation of the goals set for biomass penetration in the building sector, a partial independence from imported fossil fuels can be achieved, thus supporting Greek economy.

2. Availability of raw materials: In Greece, the agricultural sector is quite developed and contributes more than 5% of GDP, more than the EU average (1.8%).

Specifically in Greece, according to Eurostat, the total agricultural land area is 3,82 Mha, covering around 30% of the total territory. Arable lands occupy 16% of the total land and permanent crops 9% (second highest rate in the EU-27 together with Italy). So it becomes clear that each year they are produced as by-products of agricultural activities significant quantities of plant biomass, which operates as a material of zero value and discharged. The biomass pellet industry can be fed from this raw material and provide it added value so that it can be recognized as a major national energy source.

51.4 General overview on investments in wood biomass production and use (subsidy schemes)

The flagship of these programmes is the Development Law, which entered into force on 1 February 2011. The new Development Law discloses environmentally-friendly actions with satisfactory funding reaching up to 50% in many parts of Greece. Also, an important tool for the development of rural areas is the rural development programme, "Alexander Mpaltatzis". This programme is expected to place more than 2 billion. Euro by the end of 2011 and is designed to improve farmers ' income, and promoting quality products on the market and to shift to environmentally beneficial technologies. In conclusion, ESPA 2007-2013 (national strategic reference framework) is expected to provide targeted financial solutions in order to implement the best strategic choices of the country[9].

51.5 Forest residues production chains – do they exist and short description

Vast quantities of field agricultural residues are known to exist in Greece, either as by-products of primary agricultural activities (straw, tree prunings from olive trees, orange trees, vineyards, etc., referred to collectively, as field residues), or from secondary agricultural activities (secondary olive processing, rice mills, cotton ginning plants, etc., referred to collectively, as agro-industrial residues).

Currently, there is not any organised practice for the management of field residues and, hence, for their exploitation for energy production. The most common agricultural practice for the disposal of these residues is field burning, resulting in serious air pollution or in the spreading of large, uncontrolled fires. Recent government guidelines

Field agricultural residues

Two large categories of field agricultural residues can be defined: field crop residues and arboricultural residues.

(i) Field crop residues are the residues that remain in the field after the crops are harvested.

Depending upon the crop, the harvesting method and other parameters, field agricultural residues may include various plant parts such as stems, branches, leaves, chaff, pits, etc. varying in composition, moisture content and energy potential. The main crops producing considerable quantities of field crop residues in Greece are winter cereals, rice, corn, cotton and tobacco[10].

[9] bioamassenergy.gr

[10] http://www.pelletsatlas.info/resources/1153.pdf

(ii) Arboricultural residues are the residues that remain in the field after farming activities performed during the cultivation of perennial crops (prunings of grapes and trees) as well as from the final disposal of old trees or from the removal of whole grape or tree plantations.

The main arboricultural residue resources in Greece are grapevines, peach, almond, orange and olive pruning.

The total quantities of residues from the aforementioned crops were estimated using data such as the quantities of the main product produced per year for each crop, the cultivated land areas and coefficients that indicate the ratio of residues/main product or residues/hectare. The coefficients used to estimate the quantities and the energy potential of agricultural field residues derived from measurements, estimations and references.

The estimation of the quantities of agricultural residues available for energy production is based on the degree of availability which is different for each crop, varies from year to year and depends on several factors such as:

- ✓ the harvesting method
- ✓ the moisture content
- ✓ the demand of agricultural residues for non-energy purposes (cereal straw, for example, is used for animal feeding, animal bedding, as substrate for other cultivations, etc.).

Based on the above it is estimated that approximately 7,000 tons of field crop and arboricultural residues could be annually exploited for energy purposes.

52. Socio-economic and others constrains

52.1 Forest ownership status

According to 2008 data the forest ownership status in the region of W. Macedonia is as follows in next table.

Table 39. Forest ownership in Western Macedonia Region

Forest district	GREVENA
Forest ownership classes	**ha**
Public	48.899,55
Local authority	16.490,00
Church	600,00
Joint ownership	6.788,00
Private	5.273,00
Communal	
TOTAL	78.050,55

Forest district	KASTORIA
Forest ownership classes	**ha**
Public	55.326,80
Local authority	12.200,20
Church	222,20
Joint ownership	495,40
Private	140,20
Communal	
TOTAL	68.384,80

Forest district	FLORINA
Forest ownership classes	**ha**
Public	20.015,00
Local authority	18.270,00
Church	5,00
Joint ownership	6.046,00
Private	2.559,00
Communal	
TOTAL	46.895,00

Forest district	KOZANI
Forest ownership classes	**ha**
Public	11.018,00
Local authority	5.006,40
Church	70,00
Joint ownership	3.421,00
Private	3.704,60
Communal	
TOTAL	23.220,00

Forest district	TSOTYLI
Forest ownership classes	**ha**
Public	7.569,50
Local authority	2.854,30
Church	36,70
Joint ownership	885,50
Private	282,20
Communal	1.376,80
TOTAL	13.005,00

52.2 Possibilities to enter energy market

Small RES heating systems are eligible for a 20% tax reduction capped at 700€ per system. This applies to co-generation systems using RES for electrical and heating-cooling needs, the replacement of an oil burning boiler with a district heating installation or for a new district heating installation (URL3).

Existing feed-in tariff system and the relevant Power Purchase Agreement contract duration have been rationalized further, attempting to promote RES investments for which no significant investment interest has been exhibited so far. It eliminates any pricing differentiation for energy produced in the mainland or in the non-interconnected islands and provides for further increase of the tariffs set, in case the producer does not receive any investment subsidy or tax exemption/reduction. Power Purchase Agreement contracts are valid for 20 years for all RES units (EUBIONET3, 2011a, URL4).

Members of forest cooperatives are able to use fuelwood harvested in state or public forests, located in their living areas, in order to cover their heating needs. Fees or taxes for the exploitation of these fuelwood quantities, estimated by the forest management plans, are not required (URL5).

Farmers of "mountainous" or other "disadvantageous" areas are supported in their activities to cultivate energy crops. The level of the financial support depends on the age of the farmer and the location/type of the area (URL6).

52.3 Constrains in building legislation or in bureaucracy…

State policies in general do not provide supportive frameworks for bioenergy development. The development law for the promotion of RES does not equally promote bioenergy applications (such as pellets) and other RES technologies. In addition, a law from the 80's that prohibits biomass use for energy purposes in Athens and Thessaloniki makes things difficult for pellets market increment. Big steps have to be taken if the government wants this fuel to be used in the energy sector.

The new law on the Development of Renewable Energy Sources that the Greek Government applied (2005), does not promote biomass use for energy purposes (photovoltaic and wind energy are subsidized three times more than biomass), even though 80% of the Renewable Energy Sources in the European Union comes from biomass.

There is a law from the mid-80s that indicates certain fuels that can be used in the major cities of the country (Athens and Thessaloniki) and that prohibits the use of other energy sources (e.g. biomass derived fuels). So, the development of a residential wood biomass heating market is not possible in Athens and Thessaloniki. Therefore, almost half of the Greek population (10.964.020 people) is excluded from wood biomass use and this is a major drawback for the development of the market.

In general, the Greek energy policy is based on fossil fuels, which is proven by the fact that more than 90 % of the total energy consumption is derived from oil, natural gas and coal. The government does not support the diversification of energy sources. Naturally, wood biomass market is also affected by this policy.

53. Existing policy measures (subsidy schemes)

53.1 Possibilities for founding wood biomass investments

At present, there is no special subsidy scheme foreseen for biomass investments in Greece. Existing companies, namely in the manufacturing sector, can occasionally benefit from subsidies addressing the overall improvement of their operation, but not focusing solely on biomass use.

There are very few companies operating at the moment in Greece in the field of pellet production (see Table 12).

Table 40. Biomass Pellet Producers in Greece

Company Name	Location
Sakkas SA	Karditsa
Angelousis SA	Velestino
Bioenergy Hellas	Larissa
MAKI SA	Larissa
Alfa Wood	Nevrokopi
Ecoa	Katerini

This situation is expected to change, due to the ongoing economic crisis that forces people to seek cheaper ways to heat their households. A specific subsidy to support the establishment and development of companies producing biomass related products, from boilers to pellets, would definitely boost the relevant market and provide multiple added values to the local and regional economies.

Additionally, there is no specific National Forest Program or Policy in Greece that lacks behind in terms of management, development and even protection of forests. There is thus a clear need to better organize the entire sector and set the foundations for a sustainable development of the forest / wood / biomass sector, which demonstrates a good potential and can provide the country with a tool for economic development in these difficult times.

53.2 Subsidies schemes for households, farmers, companies

At present, there is no special subsidy scheme foreseen for biomass use in households, or for farmers or companies in Greece. Regarding the first, it was actually forbidden in the two major cities in Greece (Athens and Thessaloniki, hosting more than 2/3 of its population) to use biomass boilers! This situation has very recently changed, but it will take some time for the market to integrate this change and develop the appropriate networks for production, transport and distribution of biomass, in all forms available. However, due to the economic crisis, consumers are seeking ways to save costs and therefore, the integration of biomass boilers may follow an exponential increase in the following period.

Regarding the farmers, there is equally no special subsidy for biomass production yet, although there are signs of a changing situation, like the financial support of a pilot plantation of cardoon in the Region of Western Macedonia. The crop was then co-fired with lignite in the thermo-electric power stations, in order to test and measure the behavior of co-firing. The whole effort aims at eventually replacing a fraction of lignite in the combustion process, in order to increase the share of RES in the total fuel mix. The same purpose will be pursued with the scheduled co-firing of woody biomass with lignite, at a later stage, through the present Project.

Finally, companies can only scarcely benefit from subsidies for incorporating biomass installations within their facilities. For instance, one of the latest calls for the support of touristic units, called “Green Tourism”, allowed (but not pushed towards) the use of biomass boilers. Nevertheless, there is no special programme that would subsidize the use of biomass in companies and would, therefore, promote its extensive integration within the present market.

53.3 Green electricity legislation

In Greece, according to Law 3851/2010 (in the adoption of specific development and environmental policies set by Directive 2009/29/EC), the national target for participation of RES in final energy consumption comes up to 20%, which is further analyzed in 40% proportion of renewables in electricity generation, 20% in heating and cooling needs and 10% in transport.

More specifically, under Article 10 ("Application RES in buildings") of that Act, not later than 31.12.2019, all new buildings should cover the entire primary energy consumption in energy supply systems based in renewable energy, cogeneration, district heating systems and heat pumps. For new government and public buildings, the abovementioned requirement should enter into force no later than 31.12.2014.

Today the total gross energy consumption in Greece is estimated at 22.4 Mtoe. According to the Greek Ministry of Environment, Energy and Climate Change, bioenergy in 2010 held approximately 9% of total consumed energy (biomass and biofuels are, together, about 5% of total). With the implementation of the goals set for biomass penetration in the building sector, a partial independence from imported fossil fuels can be achieved, thus supporting Greek economy.

At the moment, biomass is mostly coming from residues of sawmills, wood and furniture industries. The relevant legislation (Presidential Decree 126/1986) allows only forest cooperatives to operate some minimum to moderate wood harvesting, mainly in the perspective of forest conservation and not in the sense of forest management and development. It should be noted that residues during wood cutting in forests are almost 30% of the total tree biomass and a good share of this could be used for pellets production. If national policies concerning wood residues could be applied, high quantities of wood feedstock would be available, mainly close to the big forests of the country (Epirus, Macedonia and Thrace).

54. Main barriers for further development

An important economical aspect that may influence market development is the continuously increasing diesel price. This motivates investors to get involved with other kinds of fuels, with a major focus on solid fuels. Thus, wood biomass is also going to evolve.

Another financial aspect that can be improved with the integration of wood biomass in the Greek energy market could be the reduction of energy imports, in terms of oil and natural gas imports.

In Greece, the main obstacle for further market development is the lack of political will. Governmental subsidies should be offered in order to develop and implement business plans. Also another factor that hampers pellet market development is the low public environmental conscience, the increase of which seems to be crucial.

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ITALY

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56. Introduction

The Directive 2009/28/CE on the promotion of renewable energy sources includes a goal of national growth in all sectors, leaving to the Member States the declination of sectorial measures for its achievement.

The development of renewable energy sources is presently one of the priorities of Italy's energy policy together with the promotion of energy efficiency.

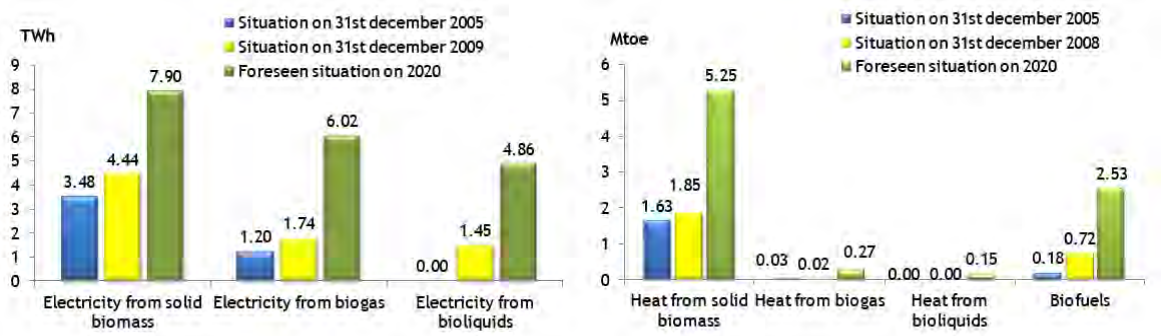
The objectives of such a policy are: energy supply security, reduction in energy costs for businesses and individual citizens, promotion of innovative technologies, environmental protection (reduction in polluting and greenhouse gases emissions), and therefore, ultimately, sustainable development. In the medium to long term, Italy aims to redress the balance of its energy mix, which is currently too dependent on imported fossil fuels.

According to the EC proposal by 2020, Italy is committed to:
• A 14% reduction of GHGs emissions with respect to year 2005. This overall target on GHGs emissions is shared between sectors covered by the EU - ETS and sectors not covered by ETS. The proposal sets a 21% reduction for the EU ETS sectors and a 13% reduction for all other sectors;
• A 17% share of renewable energy in final energy consumption. These targets are, on the whole, really challenging. The need to tackle the issue of environmental sustainability within a coherent framework, where security of supply and system adequacy can be assessed, as well as GHGs emissions is therefore compelling. Yet, a comprehensive set of measures to reach the targets and to guarantee security of supply is still missing.
Instead of a coordinated climate change and energy policy, Italy is pursuing a variety of different measures that need to be translated in a coherent action plan.

In 30 June 2010 the Italian Ministry for Economic Development published the **"Italian National Renewable Energy Action Plan"** nREAP (in line with the provisions of Directive 2009/28/EC and Commission Decision of 30 June 2009). This document states that, according to the baseline trend scenario of the PRIMES model, which the European Commission has taken as a reference point, Italy's gross final energy consumption in 2020 could reach a value of 166.50 Mtoe, compared with the value of 134.61 Mtoe recorded in 2005. The 2009 update to the PRIMES model, which also takes into account the effect of the present economic crisis, estimates Italy's 2020 gross final energy consumption at 145.6 Mtoe.
In a more favorable scenario, which takes into account more energy efficiency measures than the baseline scenario, Italy's gross final consumption in 2020 could remain within a maximum of 133.0 Mtoe. Italy's primary objective is therefore to undertake an extraordinary commitment to increase energy efficiency and reduce energy consumption. This strategy will also be a crucial factor in reaching the targets for reductions in greenhouse gases emissions and the proportion of total energy consumption to be covered by renewable sources. There are numerous support mechanisms already in operation to make up for the insufficient level of remuneration for investment in the renewable energy and energy efficiency sectors, which has so far been provided solely by market mechanisms. The specific measures that Italy is implementing to reach the targets are describes in the "Italian National Renewable Energy Action Plan"

56.1 Bioenergy and wood biomass from forests as renewable source of energy

The Italian Renewable Energy Action Plan has been submitted to European Commission on 30 June 2010.
In 2009 the use of biomass for energy purposes contributes for just 3.5% to the final national energy consumption (180.2 Mtoe); however, considering that its production reaches 6.2 Mtoe, bioenergy represents 29.5% of the whole amount of energy from renewable sources in Italy (21.1 Mtoe).
The National Renewable Energy Action Plan (nREAP) sets for bioenergy in Italy a target by 2020 equal to 9,8 Mtoe, capable to cover 19% electricity, 54% heating and cooling and 87% in transport fuel on the total consumption from renewable sources.
The amount of energy produced in 2009 (6,2 Mtoe) represents the 63.6% of the target set for 2020 by the nREAP. Such a target could seem ambitious, but is considerably smaller than the estimated potential (24 - 30 Mtoe, ITABIA, 2009) for bioenergy in Italy, able to cover up to 13-17% of the total energy demand (Pignatelli, Alfano, 2011).



Source: National Renewable Energy Action Plan, June 2010

Picture 48. Forseen growth of bioenergyin Italy

The biomass sector has a strategic role in the Italian policies of renewable energy: according to the nREAP biomass should become by 2020 the first source in Italy, covering 44% of the consumption of renewable, for a total of 22.3 Mtoe. Among the biomass, a priority is covered by wood products. ENEA has recently carried out a detailed census of national biomass potential. In Italy there is a huge amount of agricultural residues, both from herbaceous as well as woody crops, but only a little percentage of this potential can be actually converted into energy. In fact it seems quite difficult to collect the whole amount of such a biomass because it comes from a high number of little farms and often it is not easily reachable (slope of land, low road accessibility). Moreover, usually part of that biomass is utilized for others purposes (animal feed, fertilizer, household combustion).

The residues from agro-industrial sectors are often utilized for energy production in the same sites where they are produced.

The highest potential from forestry sector came from Centre-Northern (Toscana, Piemonte) and some Southern Italian Regions (Calabria, Campania) with large forestry areas, while arboriculture is totally concentrated in Lombardia and Emilia Romagna.

Italy has a huge energy potential that could derive from the anaerobic digestion of the fermentable residues such as Organic Fraction of Municipal Waste (OFMSW), cattle and pig manure, agroindustrial residues. The energy potential from OFMSW was about 1,330 millions Nm^3 biogas in 2006.[11]

[11] The CORINE programme (COoRdination of INformation on the Environment), was launched by the Council of the European Communities in 1985. Its primary aim is to dynamically inspect the state of the environment within the Community, in order to guide common policy,investigate its effects and suggest any corrective action. Within the CORINE programme, the CORINE Land Cover project is specifically aimed at surveying monitoring land cover, on a scale appropriate for Community needs, paying particular attention to landscape protection requirements. Carrying out this programme involves taking satellite images to create a digital map of land cover at a scale of 1:100,000.

Table 41. Biomass gross potential and installable power (ENEA Biomass Atlas)

Biomass source	*Potential (kt/year d.m.) *(10^6 m^3/year)*	*Installable Power (MW)*
Straws	15,710.9	2,461.3
Pruning	4,906.4	850.5
Forestry	2,180.6	377.9
Vinasse	627.9	108.8
Olive cake	692.0	120.0
Fruit shells	116.6	20.2
Rice husk	349.9	60.6
Cattle manure*	1,481.5	322.5
Pig manure*	345.8	75.2
Slaughtering*	43.1	9.4
OFMSW*	1,330.1	289.4

The 2005 National Forest Inventory indicates that Italy's forests today cover approximately 10.5 million hectares, and host 1.5 billion cubic metres of epigeal biomass (growing stock), the annual growth of which is approximately 30 million cubic metres. Within the inventory, the forested areas are distinguished, in accordance with the FAO definitions, between: forest (8,759,200 ha; 29.1% of Italian territory) or other wooded areas (1,708,333 ha; 5.6% of Italian territory).
When these data are compared with those of the National Forest Inventory, taken two decades earlier (in 1985 the recorded forested area was 8,675,000 ha, of which 2,161,000 ha was covered by shrubs and other minor small trees), it is clear that the forested area has expanded, due to afforestation and reforestation and, mainly in the last decades, in consequence of the process of natural recolonisation of abandoned agricultural land, especially in hilly and mountainous areas. This development is steadlily proceeding since the 1950s and is confirmed by the Corine Land Cover survey(1).

The **National Renewable Energy Action Plan** is an official document and is based on data recorded by ISTAT (the National Institute of Statistics). It is important to underline that these data are possibly underestimated. Several studies and investigations have highlighted this underestimation (Ciccarese et al. 2003; Cutolo, 2000; Magnani, 2005; Pettenella et al. 2011).

A recent study "**Le biomasse legnose a fini energetici in italia: uno *sleeping giant*?"** (Pettenella, Andrighetto, 2011) makes a new estimate on the consumption of wood setting it at about 8,3 Mtoe. These estimates lead us to believe that the assumptions made in the nREAP for the baseline are strongly underestimated: the gross production of energy from solid biomass in 2020 of 5.2 Mtoe assumed in the plan is probably a goal already achieved. The current consumption rate, estimated in the range of 18-22 Mt, is

not easily translatable in toe, since it should refer to the lower calorific value (LHV) of different wood fuels as a function of the facilities in which they are used.
An estimation made in the study approximates the production of energy from woody biomass to 6.7 Mtep. The national plan should then reconsider its assumptions and forecasts programmatic opportunities to better define the development of the first renewable source for energy production of the country.

57. Wood biomass market

The Italian Agroforestry Energy Association (AIEL) within the project Biomass Tradecentre 2[12] made a study on wood energy market. This document reports the main data of that study. For further details we refer to the sources of this document.

57.1 Wood Energy Market in Italy

Among renewable energies, Wood (wich includes logwood, chips and pellets) is already the second source in term of primary energy contribution (30% of RES).

In Italy the consumption of thermal energy for heating is significant, being estimated, in 2007, at 144 Mtoe. The 30% of heat is used in the domestic sector (45 Mtoe).

57.2 Logwood for domestic heating

In 2009, it has been estimated a logwood internal consumption of 19 million tons, which implyes that more than 4 million Italian households use log wood as energy source, each of them employing yearly, on average, more than 4t of firewood mainly for heating. This represents an economic equivalent of almost 2 billion euros. 73% of logwood is burnt in low-efficiency domestic heating systems like open fireplaces and traditional wood stoves. Only 7.5 % is used in modern heating appliances (innovatives stoves). 42% of final users produce by themselves the needed amount of logwood yearly used, while 32% buy it in the no-conventional local market (APAT, 2008).

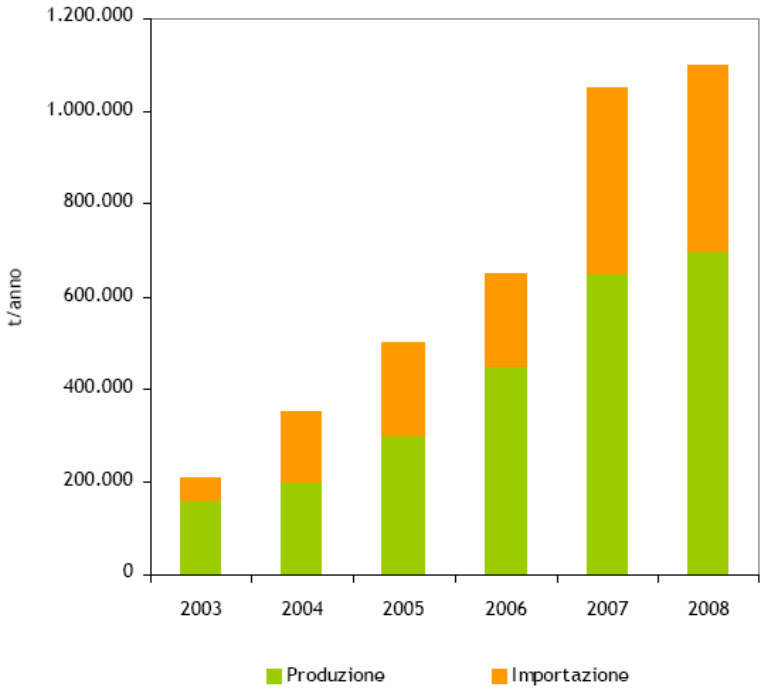
At national level, there not exist reliable data regarding both forest logwood exploitation and import addressed to firewood market.
A recent study has estimated a yearly forest exploitation of 5.65 Mm^3 and an import of 0.9 Mm^3 logwood (Pettenella). The logwood import is mainly from Eastern European countries (Slovenia, Croatia, Romania).

[12] http://www.biomasstradecentre2.eu

57.3 Installed pellets and other wood facilities: import and export

Currently, in Italy there are 85 pellet manufacturers that are manly of small to medium size. Most of them use their own sawmill residues (sawdust, shavings etc.) as raw material and sell the pellets inside the regions where the plants are located. The annual pellet consumption has grown from 150,000 in 2001, to approximately 850,000 tons in 2008, such as the production has grown from 160,000 tons in 2001 to approximately 650,000 tons in 2008.

All the pellet produced in Italy is sold entirely into the national borders, especially in the northern regions, which are the most relevant area for pellet production and consumption.
It has to be stressed that there is no pellets export, while the import level resulted in 2008 over 200,000 tons. Till 2008, it has been estimated that about 750.000 pellet stoves were installed in Italy (Paniz, 2009).



Picture 49. Internal production and import of pellets 2003-2008 (Paniz, 2009)

In 2009 the Italian market for pellets was in the third place (in terms of dimensions) in Europe, with over 1.2 million tons consumed annually, of which about 60% are produced internally, reaching a monetary equivalent of 250 million euros.
Recent Eurostat data processed by Annalisa Paniz (AIEL) show that Italy is the first EU market, in 2011 the consuption of pellet was more than 1.7 million tonnes, while the internal production was about 600.000 tons.

57.4 Chips: district heating and small-medium boilers

Table 2.1 below shows the number, thermal capacity and chips consumption of big district-heating plants operating in some italian regions and provinces. (thermal power range 0.51-20 MWt)

Table 42. District heating across Italy (Francescato, Antonini,2009)

Regions/provinces	N	MWt	Chips (t/y)
Bolzano	57	181	223,810
Trento	4	22.4	18,998
Lombardia	7	111.4	94,690
Piemonte	6	33.3	28,305
Valle d'Aosta	3	17.6	14,960
Emilia Romagna	1	6	5,100
Veneto	2	11.2	9,520
Friuli Venezia Giulia	3	6.2	5,245
Liguria	2	1.9	1,615
Toscana	1	6.5	5,525
Total	**86**	**398.4**	**407,767**

Table 42 below reports data referred to log, chip and pellet boilers with a capacity range from approx 4 to 500 KWt, wich are installed in some Italian Regions.

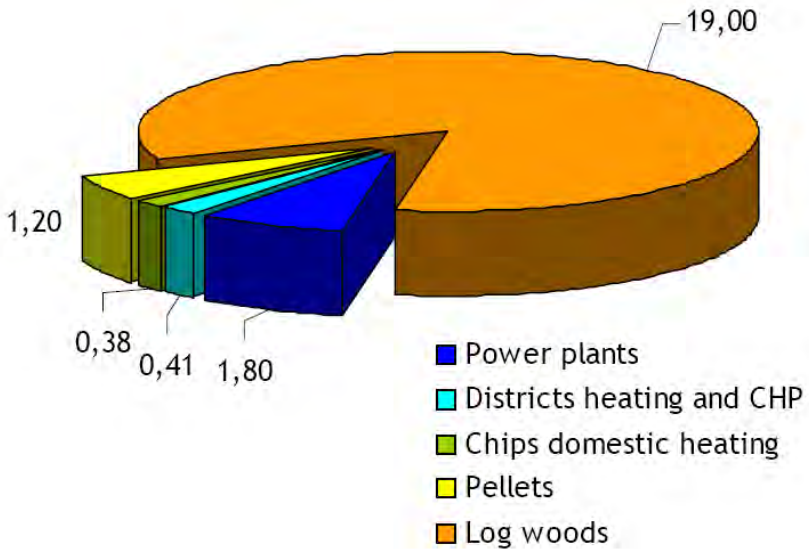
Table 43. Log, chip and pellet boilers across some italian regions (Francescato, Antonini, 2009)

Regions/provinces	N	MWt	Wood fuels (t/y)
Bozen province	7,000	295	251,041
Veneto	985	181.5	154,275
Piemonte	347	92.4	78,540
Toscana	181	44.0	35,184
Friuli Venezia Giulia	191	15.3	12,997
	8,704	**628.5**	**532,037**

In 2008 the everage capacity of electrical power plants was 10 MWe (GSE, 2009). In 2008 the total energy produced was 2,746 GWh and it is doubled between 2002 and 2003 (GSE,2009).

About 50% of biomass uses to supply power plants is solid woody biomass, amounting to 1.8 million tons per year.
Due to shortage of raw material, the Italian producers are forced to get the raw material from foreign countries, especially the Balkans, Romania and Bulgaria, or pellets from Austria, Germany and Slovenia.
Italy is one of the first countries importing wood biomass. Import growth was parallel to the progressive entry into operation of thermal power plants fired with wood biomass in the years around 1990 and 2000.
In Italy, 1 million tons woodchips are imported yearly (Pettenella, 2009) mainly to supply big power plants.
Therefore we can estimate that about 800.000 t woodchips supplied to power plants comes from national producers, mostly from wood industries and, at a lesser extent, from forest entrepreneurs and wood chips traders.

The wood chip enters into three markets:
-Large power plants (45 plants, total 450 MWe), which consume about 1.8 millions ton/year, of which 1 million imported,
-District-heating plants (86 plants, 400 MWt), in some cases with cogeneration (CHP) applications (18 plants, 13.5Mwe), with an annual mean requirement of 0.41 million tons.
-Boilers for domestic use, mainly concentrated in 5 regions (Trentino-Alto Adige, Veneto, Friuli Venezia Giulia, Toscana e Piemonte) where these boilers consume almost 0.4 million tons per year.



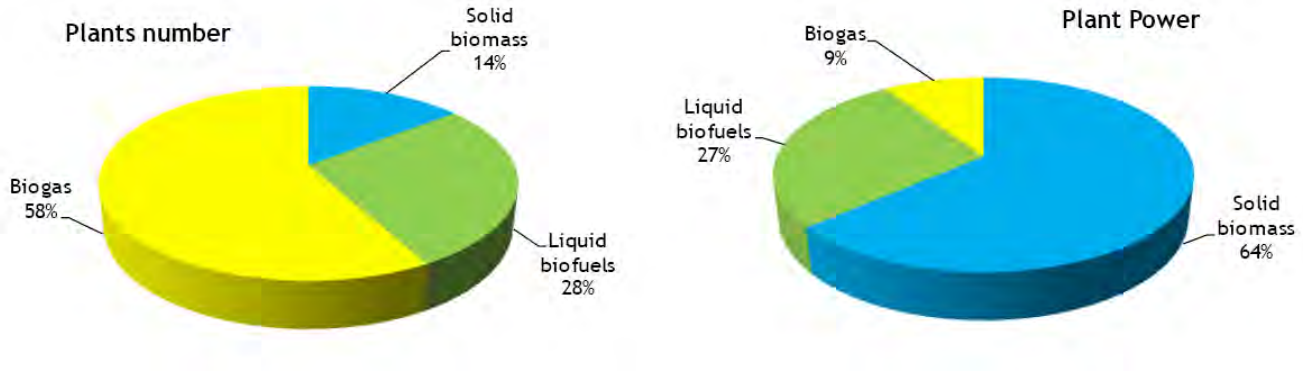
Picture 50. Wood fuels consumption in MT/y (AIEL,2009)

These markets have the economic equivalent of about 150 million euros. The Italian market sector of wood fuels used in modern and efficient equipment for small- and medium-size appliances shows a great growth potential.
The development and consolidation of this specific sector of the market is strongly linked to the presence of a widespread network of professional producers and distributors, offering the market products that meet the technical specifications of EU and quality marks.
Asd a matter of fact, the quality of wood fuels plays an important role in the equipment' burning efficiency as well as in reducing its emission factors.

57.5 Biomass plants operating and in project in Italy

A recent study made by ENEA (Pignatelli V. & Alfano V., Bioenergy industry and markets in Italy) gives some information about biomass plants operating and in project in Italy.

The following figures show data on plants connected with the national power grid, taken from the data bank of the Italian Electric Service Agency, GSE.



Picture 51. Biomass power plants in Italy, 31 December 2010 (GSE,2011)

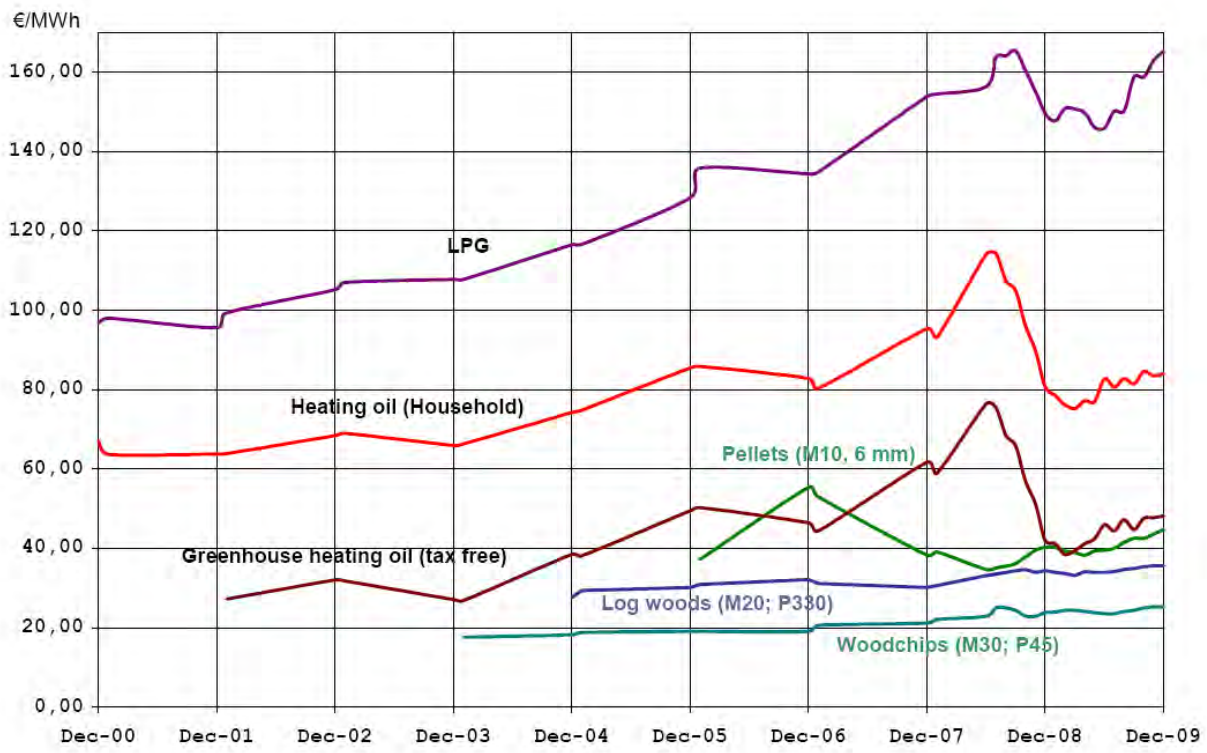
The operating solid biomass plants were 78 by 2010 with a total installed power around 1,440 MWe, but further 122 plants are today in project or under construction, with a total installed power around 785 MWe. The mean power installed per plant is around 11 MWe and 70% of these plants are located in the Northern Italy Regions.
The total installed power from bioliquid plants, including those in project, is around 2,560 MWe, few more then from solid biomass, but with an installed power per plant around 5.5 MWe.
The biogas plants connected with the power grid, excluding plants fuelled by landfill gas, were 78 by 2009, with a total installed power around 79 MWe. On 31 December 2010 these numbers rose to 313 plants, with a total installed power 209 MW (GSE, 2011). The mean installed power per plant is 720 kW.

Table 44. Biomass plants operating and projected in Italy (GSE 2010)

Biomass plants	*Operating*		*Project*		*Total*	
	n.	*MW*	*n.*	*MW*	*n.*	*MW*
Plants fuelled with solid biomass	78	1,436.9	122	784.8	200	2,221.7
Plants fuelled with biogas	149	617.6	323	1,947.0	472	2,564.6
Plants fuelled with bioliquids	313	209.2	181	146.8	494	356.0

57.6 Prices and competitiveness of biomass heat production

The following graph shows the wood fuels energy prices trend (€/MWh primary energy) in comparison with the most common fossil fuels for heating.



Picture 52. The wood fuels and fossil fuels energy prices trend (€/MWh primary energy)

The wood chips prices refer to high quality chips used in small– and medium-size boilers. The market of big district heating and power plants is characterized by lower prices because the low-quality chips usually requested. The price of low-quality chips in 2009 was around 50 €/t with a moisture content of 40% franco plant, corresponding to 18 €/MWh.
(Source: Francescato, V. et al. (2010) Biomass Tradecentres, publishable results pp 14).

57.7 Area, share and potential wood fuel supply from certified forests

Forests certified according to FSC (Forest Stewardship Council) and PEFC (Programme for Endorsement of Forest Certification schemes) standard in Italy cover an area of 742,839.49 hectares (ha), i.e. about 7% of the overall forest area assessed by the National Inventory of Forests and Carbon Sinks (INFC) (2007). FSC certified forests totalize 42.791,43 ha (FSC, 2011), while PEFC ones totalize 741.199,97 ha (PEFC, 2011). A total area of 41.697,99 ha in 3 different regions is certified under both FSC and PEFC standards.

Due to the average small size of Italian forest ownership, more than 92% of certified forests belong to group (FSC or PEFC) or regional (only PEFC) certification. As for the type of forests, semi-natural ones prevail in an almost excusive way (99,6%), the remaining part being represented by poplar plantations. Trentino Alto Adige is the leader region in terms of certified forest area: it hosts more than 70% Italian certified forests with 2 PEFC and 1 joint FSC/PEFC certifications. More generally speaking certified forests are basically concentrated (97%) in four regions, including North-East area (Friuli Venezia Giulia (FVG), Trentino Alto Adige and Veneto) and Lombardy.

57.8 Companies with FSC/PEFC Chain of Custody certificate

According to FSC (2011) and PEFC (2011) international databases, chain of custody certificate holders in Italy are 1.730: 1.153 hold an FSC certificate, while 577 organisations are PEFC certified. While PEFC figures already cover the total number of certified organisations, including those participating to group certifications, FSC figures shall be improved up to 1.259 to include the 106 sites covered by multisite certificates. To sum-up, 304 organisations hold a dual (i.e. FSC and PEFC) chain of custody certificate, while 849 hold one according only to FSC standards and 273 hold one according just to PEFC standards. During the last 2 years the total number of chain of custody certificates increased very much. At the present Italy ranks 4th at European level in terms of both FSC and PEFC certified organisations. With regard to the geographical distribution of certified companies, about 70% of certificates are concentrated in 5 regions (Lombardy, Veneto, Trentino Alto Adige, Emilia Romagna and Friuli Venezia Giulia), with 2 of them (Lombardy and Veneto) hosting about 50% of the total number of certified organisations. Generally speaking, PEFC certificates are mainly concentrated (74%) in the North-East and Lombardy, with a weaker role of Central Italy (13%) and a marginal contribution of Southern Italy (1,5%). Many reasons for this distribution exist, both in technical terms - presence of productive forests and industrial districts - and political ones - decisive direct and indirect support from regional and local authorities. The North-East and Lombardy prevail (64%) in the case of FSC as well, but here every single Italian region hosts at least one FSC certified organisation and Central (17,4%) and Southern (4,2%) Italy count together more than 20%.

57.9 National labelling schemes (e.g. Pellet GOLD)

Pellet Gold is the first and till 2011 the unique Italian pellet quality certification, created in 2006 by AIEL. It was the first step towards establishing a pellet quality certification system in Italy. Several quality standards and certification procedures in force at European level and in other countries (e.g. DINplus, Oenorm, European norm) were joined to create a specific quality scheme responding to the characteristics of the Italian market.

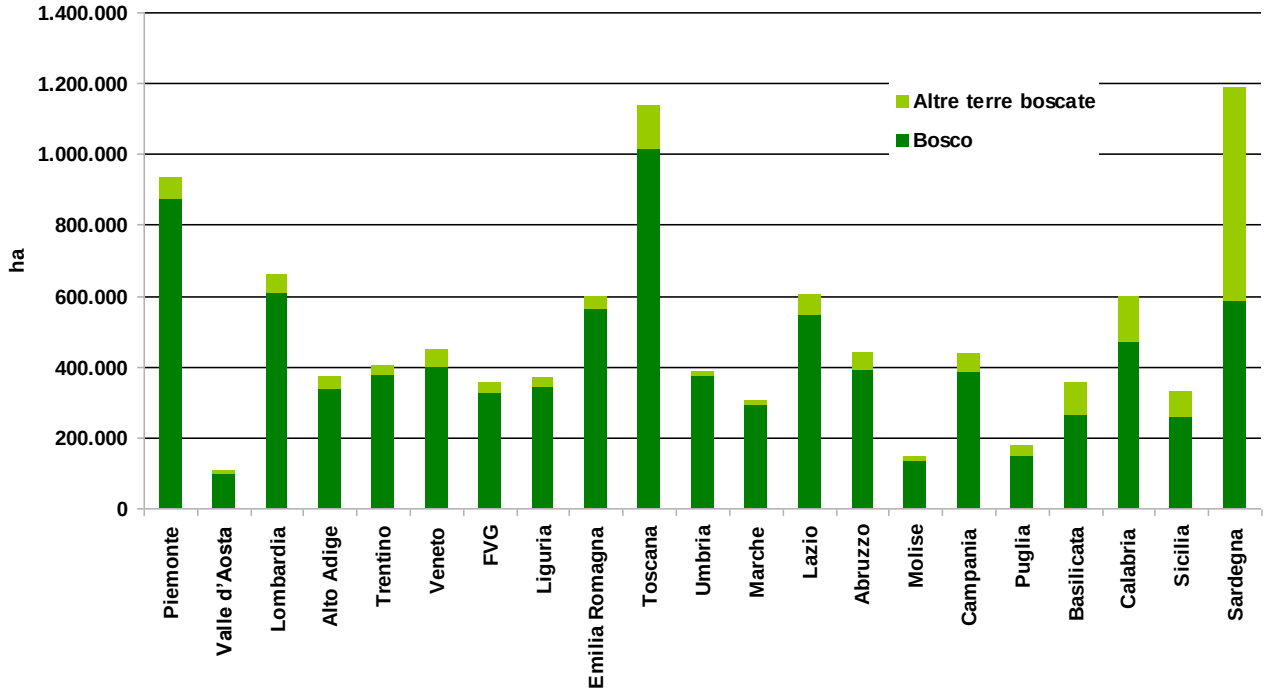
The quality requirements for pellet producers that wish to certify are laid down in the Pellet Gold manual, and its enclosures. Pellet Gold is a typical product certification. Pellets are certified at the beginning of production and need an annual recertification. Certified pellets have been endorsed with a quality/certification mark. AIEL is the owner of trademark and is also the inspection body that audits the pellet plants. The laboratory analyses of the pellets are carried out by an accredited laboratory.

Currently there are 12 Italian pellet producers with Pellet Gold certification. These are the most important Italian producers, covering over the 60 % of domestic production (around 600.000 t). In the coming future some of these companies wish to be also ENplus certified. For more information: www.pelletgold.it

58. Forests and wood biomass production

58.1 General information about forest

Italy is particularly rich in forests. According to the National Inventory of Forests and Carbon Stock (INFC, 2008) carried out by the National Forest Service (Corpo Forestale dello Stato), total wooded area covers 10,467,533 hectares, about 36% of national territory. Of this area, 8,759,200 hectares (83.7%) are classified as «forest» and 1,708,333 hectares as «other wooded land», i.e. forest areas with low density, such as scrubs, maquis, rocky or riparian woods. Italy is EU's sixth country for forest area, after Sweden, Finland, Spain, France and Germany. Figure 3.1 gives a distribution of the forest area among different regions.



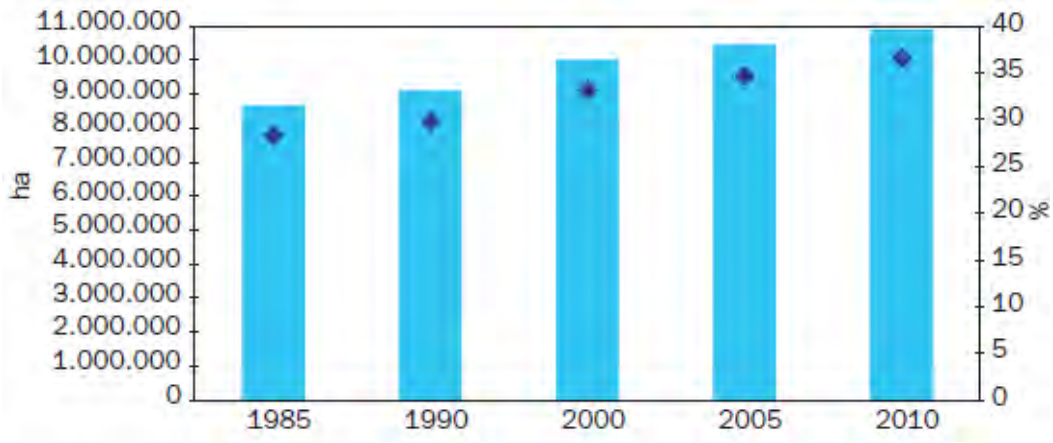
Picture 53. Italian forest areas among different Regions (INFC, 2008)

High forests cover about 25% of this surface, coppices more than 40%. The remaining 35% are both *"specialised production forests"* (i.e., plantations for timber or pulp production, tree farming, or non timber products woods: cork, chestnuts, etc.) and other wooden forests rarely managed.

Within high forests, conifers are dominant, both for extension and timber volume. The most important species is Norway Spruce (*Picea abies* Karst); also mountain Pines (*Pinus sylvestris* L., *Pinus nigra* Arnold, *P. laricio* Poiret) and European larch (*Larix decidua* Mill.) are well widespread. Most coniferous forests are located in the Alps (montane and subalpine Spruce, Fir, Larch forests), but some important conifer forests can be found also in the Southern Apennines (*Pinus laricio* Poiret). Broadleaved high forests are mostly beech woods (*Fagus sylvatica* L.), but also oak woods (especially *Quercus cerris* L.).

Wooded land area

With reference to the total wooden area, the national forest rate is approximately 36% and it is in a slow but steady increase (Figure 3.2).



Picture 54. Evolution of forest cover and forest rate in Italy from 1985 to 2010. (INFC, 2011)

Based on a long-lasting statistical survey of the Italian land use, it can be stated that such an extension of the woods has never been previously reached. Expansion of forest areas, a phenomenon which regards Italy as well as almost all European countries, is lasting since several decades and is expected to continue in the future. It is determined mainly by policies and measures of conservation and protection of existing forests, and by plantation forestry programs and, most of all, by the natural expansion of forests on abandoned croplands and grazelands, especially in marginal hilly and mountainous areas. By comparison of Corine Land Cover 1990 and CORINE Land Cover 2000, this changing rate of land use and cover is estimated at about 5,500 hectares per year.

Forest types

Among the several factors that account for the great diversity and abundance of vegetation in Italy, two can be considered of primary importance: the climatic changes occurred along geological eras and the present climate heterogeneity of the country. The latter is due to the broad latitudinal extension of the peninsula; to the great sea influence and; the high mountain ranges (the Alps, primarily, and the Apennines). Italian forests, according the syntaxonomical classification system, can be grouped within the following main types:

1. Mediterranean evergreen forest (*Quercetea ilicis*);
2. Mixed oak woods and other mesic forests (*Querco-Fagetea*, *Alnetea glutinosae*, *Salicetea purpureae*);
3. Montane beech woods (*Querco-Fagetea*);
4. Alps and Apennines pine woods (*Erico-Pinetea*, *Junipero-Pinetea*);
5. Boreal coniferous forests (*Vaccinio-Piceaetea*).

Potential vegetation of Italy comprises forest distribution from coastal and plain zones up to the higher elevations. However, the actual types prevalent in the Mediterranean region are scrub forests subjected, along the history, to various kinds of natural and

anthropogenic disturbances and degradations (i.e. intensive grazing and fires). Moreover, plain mesic deciduous forests, once abundant in the northern river valleys (i.e. the Po Valley, from Turin to Venice), have been cleared a long time ago and replaced by agriculture, industry and heavy urban settlements. Most of the wooded areas are therefore left on hills and mountain slopes.

In the Alps (especially in the inner, continental regions) subalpine pure or mixed forests composed by Norway spruce (*Picea abies* Karst), European larch (*Larix decidua* Mill.) and Stone pine (*Pinus cembra* L) form timberlines reaching 2100-2300 m of altitude. In the Apennines European beech woods (*Fagus sylvatica* L.) are the last stands (1800-2000 m) before transition to high altitude prairies.

58.2 Forest production

The INFC estimates that the total annual increment of the growing stock is around 36.7 million cubic meters (4.3 cubic meters per hectare). Among spontaneous species, Norway spruce and European beech have the greater average increments.

According to the data published by Eurostat, in 2009 about 7.6 million cubic meters of timber (under bark) were harvested from the Italian forests, or 20.2% of the total annual increment (37.6 million cubic meters)[13]. The amount of harvested timber decreased compared to about 8.7 million cubic meters harvested in 2005 (24.2% of the total annual increment) and more than 9.3 million cubic meters harvested in 2000 (equal to 27.0% of total annual increment). With regard to the rate of harvesting (ratio of cubic meters harvested and total forest area), the 2009 figure (0.7 cubic meters per hectare) has gradually declined from 2000 (0.9 cubic meters per hectare) and 2005 (0.8 cubic meters per hectare).

The non-wood forest products in 2007 showed a decrease in the withdrawal of some of them compared to 2000, albeit with some exceptions such as mushrooms and pine nuts. Probably these trends and exceptions are due to the process of urbanization and the loss of local traditions. However it is also to be remember that markets for most of non-wood forest products are highly informal and data reported are not always available and reliable.

The cutback of wood and non-wood forest products' removals can be interpreted as a lower pressure on forest ecosystems. Still, it has to considered that the re-establishment of productive activities, if conducted properly, can revert the abandonment of forest

[13] Since 2010 ISTAT, the National Institute of Statistics, has ceased to provide, inter alia, data on wood harvesting.

management , with positive effects also in terms of biodiversity and ecosystem services conservation.

Main functions of forests

In the part of Italy (mainly in northern regions), where forestry practices have a high standard, the silvicultural systems presently in use are based on the principles of a sustainable, "near-to-nature" forestry. Forest operations are carefully controlled and restricted, aiming both to timber production and to forest natural regeneration.

Clearcutting is forbidden by law in about 95% of the high-forests, which are subjected to restricted use, in order to protect soil and water conservation.

Currently, the most common silvicultural systems applied in alpine high forests (especially in coniferous forests) are *selection system* and *shelterwood system* (mainly group, stripe or edge systems). This kind of treatments has determined the shifting of many even-aged forests (developed from past clearcutting or afforestation) to unevenaged or irregular forests. In Beech high forests the most common practice is the *uniform system*. The opening of gaps or stripes by clearcutting is allowed only in stands composed by light-demanding species (larch and pines), in order to meet the ecological requirements of these species and guarantee the stand natural regeneration.

Coppice is largely widespread, especially with private owners. The most common system is clearcut, but for many species the law prescribes to leave some standards to favour seed production and sprouts regeneration in old stumps. The selection system is applied in many beech coppices, a lot of which are of public property (often mountain municipalities). Coppice with standards is a practice used sometimes only in some areas of central Italy for pure or mixed oak stands.

Although still common in Italy, coppice is currently considered an outdated silvicultural system. The reasons are that its products are largely surrogated by other manufactured items and especially it doesn't guarantee, as well as high forests, the multiple functions that public opinion expect from forests (soil-erosion control, landscape amenity and recreation). More and more old coppiced stands in Italy are subjected to conversion operations leading to high forest. Generally conversion begins with thinnings in coppices that are by large older than their usual rotation age. When stems are relatively old, soil has improved and seed production is abundant the shelterwood system can then be adopted. Another important aim of Italian forestry is to foster natural diversity and evolution in forests; therefore mixed forests are promoted and the spontaneous recolonization of broadleaved species in coniferous plantations is today strongly encouraged.

In the period 1990-2007, forest areas destined to preserve biodiversity has grown and attained about 3 millions of hectares, which means 30% of National forest surface. Primary forests amount 160,000 ha and consist in parks and environmental protected areas. Natural protected areas are 27.5% of the total forested areas, having been established at different administrative levels: national, regional and local. These areas

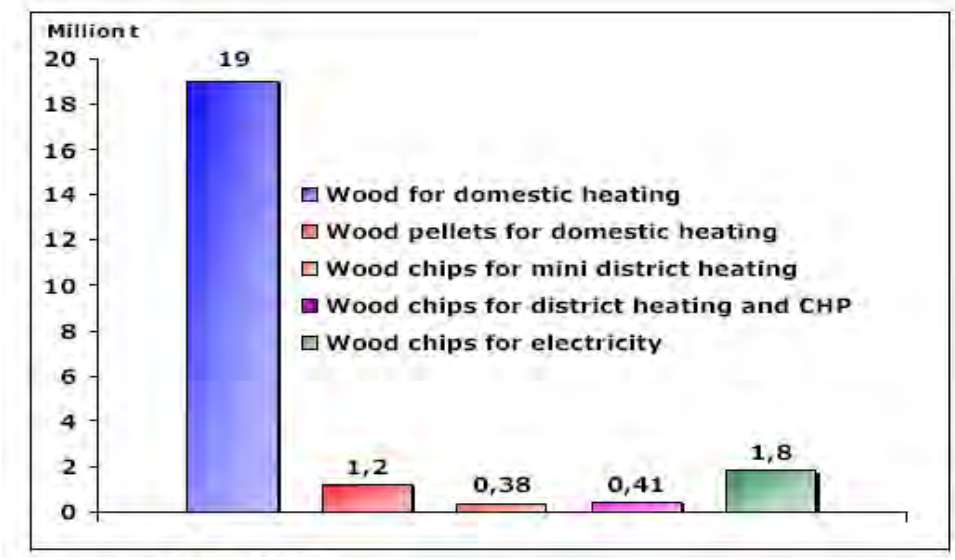
occupy 8% of the national territory. It should be noted that the flora of Italy is the richest of all Europe: vascular plants number 5,463, of which 712 are endemic. 22.2% of the National forested area is under NATURA 2000.

Review on forest biomass potentials, limitations (technical, ecological…) on wood biomass use.

Biomass consisting mainly of forest, agricultural and agro-industrial residues is commonly used to supply both electric and thermal energy in Italy. Quantifying in a precise way these types of biomass, deriving by discards and by products of heterogeneous productive activities, is an extremely complex operation, therefore it is impossible to know the availability on the market of energy. These biomass quantities can only be estimated, due to the fact that fuelwood is dominated by self-supply and the short-distance trade.

Fire wood in the households (over 50,000 TJ/y) and in industry (over 40,000 TJ/y), gives the most important contribution to the biomass thermal energy sector, while cogeneration plants produce 15,000 TJ/y and the heat production by means of district heating plants is about 2,000 TJ/y.

In 2009 the Italian Association for Wood Energy (AIEL) carried out a survey for estimating fuel wood utilisation in Italy (figure A). According to the survey about 83% (19 Mt/y) of the total woody biomass (22,8 Mt/y) has been consumed by the Italian families for domestic heating.



Picture 55. Fuel Wood utilisation in Italy (AIEL 2009)

A further survey carried out by Italian Biomass Association (ITABIA) estimates the annual quantity of residue biomass coming from agriculture, forestry, agro-industry, wood industry and urban waste: the total amount is more than 25 million tons of dry matter (it does not take into account significant quantities of biomass, which is today

inaccessible due to economic, logistical or market reasons); the following table summarizes quantity of available biomass deriving from each sector in terms of energy content (with good approximation): available biomass from forestry and wood industry is 4.3 Mtoe/y (18% - 14% of total amount), from firewood is about 2-4 Mtoe/year(8% - 13%).

Table 45. Goals of Bioenergy in Italy (ITABIA,2008)

Biomass	Potential Mtoe/year
Residues from agriculture and agro-industry	5
Forestry and wood industry	4.3
Urban solid waste	0.3
Animal breeding	10-12
Firewood	2-4
Energy crops (potential)	3-5
Total	**24-30**

58.3 Current use of forests for round wood and wood biomass production

Forest use activities, according to data recorded by ISTAT and published by Eurostat, are very few, and the last decades are characterized by a negative trend for the component of withdrawals timber industry, offset by a positive trend for the wood-based energy one.

Forest use for energy in 2009 was estimated at 4.9 M m^3, 65.7% of total withdrawals (7.6 M m^3) . This percentage has been increasing in recent years, owing to a process of de-specialization of timber production in favour of other activities of lower absolute value and lower final added value: in 1973, 43.8% of national production of timber was for energy use, while at present the composition of the withdrawals recorded by ISTAT returned to values similar to that ones of the early '60s.

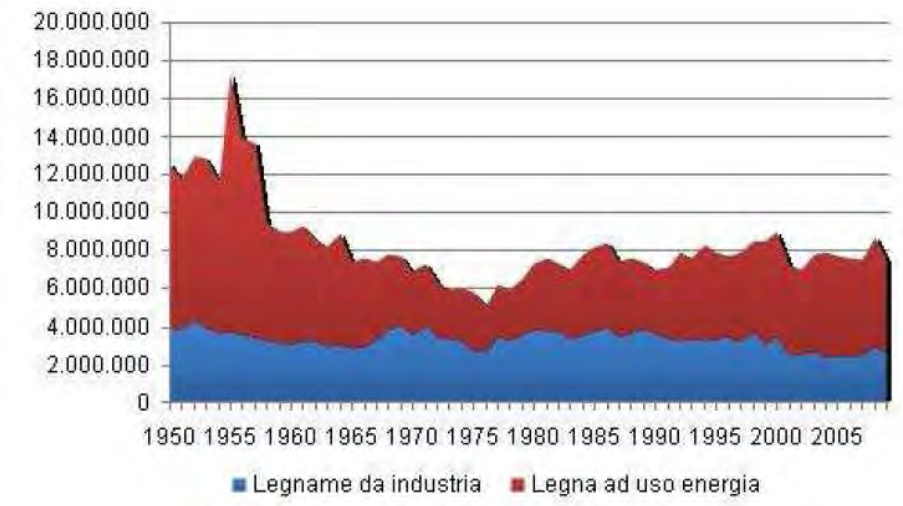
Compared to the EU average, Italian figures of the rate of wood harvested for energy use are slightly lower. In 2009 withdrawals in the EU have been 0.49 m^3 per hectare (Figure 3.3) of woodland, while in Italy they have been 0.46 m^3. However in other countries withdrawals of industry timber are, in quantitative terms, the most significant forestry production. It should be noted that processing the industry timber involves creation of significant quantities of waste (from 30 to 50% compared to the total processed wood) that can have a use for energy purposes. For the use of timber in the forest there not exist, therefore, a condition of strong conflict in the final destinations, while there is a synergy between the industrial processing of timber and the production of waste,

including that exploitable for energy. There are still very significant disparities in productivity of withdrawals for the direct purpose of energy production between Italy and other countries like France (1.64 m^3) and Germany (0.77 m^3).

According to ITABIA report "Goals of Bioenergy in Italy" (2008), the annual quantity of forest biomass that can be used for energy purposes amounts to around 13 million tons of wet matter, without reducing forest consistency, which corresponds to about 6.5 millions of tons expressed in dry matter (table B). Besides the overall availability of industrial residues, expressed as dry matter, amounts to around 8.4 Mt/year, of which 3.9 Mt come from agro-industry and 4.5 Mt/year from the wood industry.

Table 46. Withdrawals of wood for energy use in Italy and EU, Forest area and average withdrawals; (Calculations based on Eurostat and ISTAT data)

	Prelievi (1.000 m^3)					Superf.for (1.000 ha)	Prelievi medi (m^3/ha)
	2005	2006	2007	2008	2009	2009	2009
Italia	5.218	5.141	5.023	5.673	4.981	10.916	0,46
Unione Europea (27)	**85.490**	**88.976**	**83.682**	**85.469**	**86.429**	**177.757**	**0,49**
Italia/UE (27)	5,33%	4,95%	5,20%	6,64%	5,76%	6,14%	



Picture 56. Withdrawals of wood for energy and timber industry in Italy (1960-2009; in m^3)(Pettella 2011)

Table 47. Forest biomass can be used for energy purposes expressed in millions of tons of dry matter for each type of woodland, (ITABIA 2008)

Type of woodland	Forest biomass	Potential (kt/year of d.m.)
High forests (broad -leaved trees, conifers)	Branches, tops and small residues	1,800
Coppice woodlands (simple, compound)	Whole plant	4,700
Total		**6,500**

58.4 Wood biomass production from short-rotation forests (development of SRF, type of SRF, ...)

As far as woody energy crops are concerned, over 5.100 ha of land are dedicated to the cultivation of short-rotation plantations of poplar. These areas are mainly located in the Po valley in Northern Italy. These plantations provide woodchip mainly to large-size power plants in the north-centre of Italy and partly to the industry of panels for furniture manufacturing. An area increase dedicated to SRF of at least 3.000 to 5.000 ha is foreseen in the next 2-3 years, since several new biomass projects are currently under construction due to the reconversion of several sugar plants in consequence of the European reform of the sugar industry of 2005. All these are based on the supply of biomass from short rotation forestry.

58.5 Wood biomass in forest management plans: estimation of un-used potentials from forests

According to the National Inventory of Forests and Carbon (INFC) published by the State Forestry Agency (www.infc.it), the volume of stem and large branches amounts to 1,269 million cubic meters in the about 8.8 million hectares (ha) of Italian forests (average 144.9 m^3/ha), while the aboveground phytomass amounts to 874 million tons (dry weight), with an average slightly under 100 t/ha (99.8 t/ha). The data about Italy recently published by FAO (2009) in the last biennial report on the state of the world's forests (State of the world's forests - SOFO), only partially coincide with the INFC data. Obviously this data refers to the sum of different categories of the inventory. The exploitation of forest recorded by ISTAT is very small and, since 2005, is decreasing, especially for the component regarding withdrawals of timber for industry (excluding withdrawals out of forest), down from 2.5 million m^3 in 2005 to 1.6 million m^3 in 2007. According to the latest data published by ISTAT (Table 1), the total withdrawals in 2007 amounted to 5.6 million m^3 (4.9 m^3 not taking into account the withdrawals out of

forest), of which 65,3% of firewood (3.6 million m^3). These data were somewhat surprising if one takes into account the cyclical increase in prices that occurred in 2007 and 2008 and the fact that the decrease of the samples is in contrast with the European offer.

Table 48. Witdrawals of timber in the forest (A), outside the forest (B) and total (C), for matching (cubic meters, 2005-07) (Monthly Bulletin of Statistics)

A. In the forest

	Wood for industries	*Firewood*	***Total***
a. conifers			
2005	*1.170.854*	*386.656*	***1.557.510***
2006	*1.366.595*	*526.337*	***1.892.932***
2007	*1.163.934*	*398.673*	***1.562.607***
b. broadleaves			
2005	*1.315.288*	*4.830.928*	***6.146.216***
2006	*1.120.112*	*4.615.065*	***5.735.177***
2007	*494.764*	*2.870.312*	***3.365.076***
c. total			
2005	*2.486.142*	*5.217.584*	***7.703.726***
2006	*2.486.707*	*5.141.402*	***7.628.109***
2007	*1.658.698*	*3.268.985*	***4.927.683***

B Outside the forest

	Wood for industries	*Firewood*	***Total***
a. conifers			
2005	*50.210*	*20.975*	***71.185***
2006	*46.021*	*15.702*	***61.723***
2007	*51.444*	*9.484*	***60.928***

b- broadleaves			
2005	*481.040*	*434.905*	***915.945***
2006	*531.072*	*499.228*	***1.030.300***
2007	*221.775*	*354.180*	***575.955***
c. total			
2005	*531.250*	*455.880*	***987.130***
2006	*577.093*	*514.930*	***1.092.023***
2007	*273.219*	*363.664*	***636.883***

C. Total

	Wood for industries	*Firewood*	***Total***
a. conifers			
2005	*1.221.064*	*407.631*	***1.628.695***
2006	*1.412.616*	*542.039*	***1.954.655***
2007	*1.215.378*	*408.157*	***1.623.535***
b. broadleaves			
2005	*1.796.328*	*5.265.833*	***7.062.161***
2006	*1.651.184*	*5.114.293*	***6.765.477***
2007	*716.539*	*3.224.492*	***3.941.031***
c. total			
2005	*3.017.392*	*5.673.464*	***8.690.856***
2006	*3.063.800*	*5.656.332*	***8.720.132***
2007	*1.931.917*	*3.632.649*	***5.564.566***

Data on withdrawals of wood for energy use, published by ISTAT, report an amount of about three to five million m^3/year in the last 30 years. Several studies and surveys in the 90s showed that those data may be underestimated. (Ciccarese et al., 2003; Cutolo, 2000; Magnani, 2005). Recently Corona et al. (2007) have made a comparison between the surfaces cut at ground level of coppice in some central and southern regions as

detected by high-resolution satellite images, and those found by the forest inventory and published by ISTAT, with a ratio between the two estimates of 1.45. One can easily speculate that the cutting amount published by ISTAT corresponds to a real underestimation of the actual one.

59. Wood biomass production chains and wood biomass use

59.1 Common practices of forest wood biomass production chains

The Italian wood-energy chain, i.e the collection and disposal of wood material for energy use, represents a very important step in its market perspective. The low unit value of the product requires the choice of an adequate mechanization to ensure a high hourly productivity and reduce the operation costs.

The main sources of fuel supply are essentially three:

1 – The plants of little value derived from the first thinning of pine plantations and the felling of coppices;

2 – The residues of conventional forest harvesting, which represent an average 20-25% of the total epigeous mass. Added to these are the residues resulting from the pruning of other tree crops: forest plantations, agricultural fields and urban street trees;

3 - Material resulting from the use of artificial short rotation forestry plantations.

4 – Wood waste from primary processing (e.g. sawmills).

These intensive plantations with high planting density are cut every 2-5 years. The species more used belong to the genera *Populus, Salix* and *Eucalyptus,* as well as *Robinia pseudoacacia*.

The more convenient system for the production of forest biomass is to use the whole plant, which allows the exploitation of all the mass available. This is divided into three distinct operations: felling, skidding-concentration, chipping. Each operation is carried out with specific machines and methods, which vary with the type of intervention to be performed.

In the thinning of the artificial conifer plantations, the operation is generally performed according to a mixed geometric-selective approach, which provides a removal of a row of plants every predetermined number of rows and the selective removal along the file issued. This system, besides maximizing the productivity of the biomass, facilitates the dismembering because it creates an access to the corridors inside the plantation.

In the case of artificial plantations of broadleaves harvesting is performed through clearcut or selective cut, while in the case of coppices forest releases are left. In the collection of short rotation coppice one can adopt two different collection techniques: in

the first, the cutting and chipping are made separately; in, the second one combines these two steps in one operation, performed by the same machine.

For collection of pruning three different techniques can be adopted: the baling, the direct chipping (i.e. directly on harvesting site) and chipping at the log-yard.

Thinnings

The collection of biomass for energy occurs in the first thinning of pine plantations. The scheme provides for a mechanization of all the operations of collection.

The operation of demolition is carried out with a feller-buncher head, often applied to a tractor, an excavator or a wheel loader from 50-70 kW. In addition to demolition, the "feller" performs biomass concentration.

For the yarding are generally used articulated forestry tractors of 60-90 kW, equipped with rear calliper. These machines are fast and can be used by a single operator.

The use of the tractor with pliers is useful if the demolition is done with the "feller", which can be loaded with appropriate size.

The chipping is done with machines of high power (160-180 kW), and self-propelled. The type of wood chipper most widely used is the one-disc machine.

The wood coppice

The operation of demolition of wood coppice is very difficult to mechanize, given the shape of the stumps and the randomness of the ground. The evidence of mechanized felling give mixed results and the "feller" is not yet used in Italian coppice. The technique more used is the chainsaw.

The productivity is therefore limited, amounting to around 10-12 t/day for the team of two workers. Even during the logging, large articulated tractors are used, but the difficulty of forming large bundles makes essential use of the winch, possibly coupled to the clamp. The productivity is slightly inferior to that obtainable in the thinning of conifers.

In the case where the wood is on slopes greater than 35%, the use of the tractor becomes dangerous and it is better to use a crane cable. The tractor is used to transport the timber from the exhaust of the crane to the site of processing.

In most cases a forest cable crane is used. These can have an autonomous motor, or be connected to the power take-off of a tractor. The maximum length of the span reaches 350 m, and the line can be mounted in a few hours. The gross daily production is around 20 t/day, employing a team of 3 workers and harvesting an average load of 200-300 kg.

For chipping the same machines used in coniferous forests are employable, but productivity is slightly lower because the plants are smaller.

Harvesting and pruning residues and general overview of machinery for wood biomass production

The final residues or the use of the forests are a very important resource as they often are available free and already concentrated. Since burning is prohibited, one has to grind the branches with a brush cutter hammer facing a considerable cost.

The quantities obtained vary with the type of crop and the system of use: 2 to 8 t/ha for orchards pruning and up to 20 t/ha for forest harvesting.

The baling facilitates the handling of twigs, compacting them in discrete units of regular shape and size. It is especially useful where the quantities are limited and the concentration with a crane or a tractor would be ineffective. Moreover, the bales can be easily stored (event together with chippedwood), and eventually may be commercialized directly.

The packing of branches is obtainable by adaptation of normal agricultural machines or by a machinery properly made to this purpose.

Currently, three machines are used, all built in Sweden: the *Bala Press*, *Fiberpac* and Woodpac. The first is derived from packer for municipal solid waste and produces bales of an average weight of 500 kg. The other two are designed from scratch to package "logs reconstituted", cylindrical bales of the shape and size similar to those of a trunk. In this way, the bales can be handled with normal forest equipment. All three machines are mounted on the frame of a "forwarder" and fed with a hydraulic crane. The chipping is still the most widely method used to treat branches.

The site can be arranged differently according to working conditions, and this depends very much on the convenience of collection. The best case occurs when the plants are set up at the landing and the branches are accumulated at the edge of the square. In this case one uses a chipper towed or transported on a truck. A good chipper of 200 kW produces on average 60 t/day.

However, if the plants are set up on the bed of fall, there are two solutions: to bring the branches at the landing and proceed as described above, or go directly into the woods with the chipper.

The hauling of waste wood is a difficult task because the loose material is very cumbersome. The best way is to load the branches on a trailer with a high load capacity. In any case, the logging of the pruning is useful only over short distances. The wood chipping is done with self-propelled chippers mounted on the chassis of a forwarder or excavator.

Short rotation coppice (SRF) use

There are different machines to collect biomass in a short rotation coppice, Almost all come from Northern Europe, and many have already been tried in Italy, especially by the *CNR*, the *SAF* and *ISMA*. Several of them are derived from equipment already used in agriculture. Some have been designed *"ex novo"*. There are self-propelled, towed and taken (Spinelli and Kofman 1995). Among the machines that make the cut but no chipping, one should mention the prototype *Isma/Saf, HE All-rounder* and the *Bundler Salixmaskiner.*

The prototype *Isma/Saf* is the simplest, and consists of a circular saw applied to the power take-off of an agricultural tractor. A pusher is mounted on the tractor and directs the fall of the plants, which takes place perpendicular to the direction of advancement of the tractor. Then the plants are collected, brought to the sidelines and cut. The productivity varies from 10 to 35 t/h, according to working conditions.

HE The All Rounder is a self-propelled machinery of Danish design, which uses rubber tracks, has an engine of 80 kW and a weight of 5000 kg. The cutting device is constituted by a circular saw and is placed anteriorly. The plants are cut grasped by a conveyor, which starts the loading platform at the rear. When this is full, the machine goes on the sideline and operates the chute. The hourly productivity is around 7 tons.

The *Bundler Salixmaskiner*, built in Sweden, is a trailed machine that cuts the plants, collects and wraps them in a sort of "cigar". This is linked and is cut to size by a large hydraulic chainsaw. The bales are discharged to the ground and are retrieved by a tractor or a forwarder. Among the machines that make the cut and chipping, three models seem more promising: the *Claas Jaguar 695*, the *Austoft 7700* and the *Bender Salixmaskiner.*

The *Claas* is a German harvester mowing, specially modified for the use of short rotation coppice. The cutter bar has been replaced by two saw discs, designed to cut a row with twin internal distance of 75 cm. The plants are cut grasped by a series of hydraulic rollers and sent to the chopper drum. The chips are blown through a goose-neck, to be downloaded into a body driven by the machine itself, or by a tractor that travels alongside. The car has an engine of 230 kW and weighs 7900 Kg. Several field trials have confirmed the excellent operational capabilities of this machine, which achieves a productivity of 20 t /hour.

The *Austoft 7700* is a tracked loader mower of Australian construction, originally developed for the harvesting of sugar cane. Replacing the old cutting member with a pair of hand-held disks, the machine can be used for the use in short-rotation coppice. The operation and productivity are similar to those of *Claas,* but the Australian machine has a better mobility, particularly useful where the terrain is sloped or unstable. The Austoft has a power of 179 kW and a total weight of 9300 kg.

The *Bender Salixmaskiner* is produced by the same Swedish company that developed the *Bundler*. In this case, however, the operator has to be raised and it applies the attack front of a powerful agricultural tractor (at least 120 kW). The cutting member consists of a chain saw, suitably protected and mounted on a rectangular frame. The front of the cutting width is 165 cm and the machine can collect single rows, double rows and scattered plants. The shells are gripped by a chain conveyor, and pulled toward two horizontal rollers that bend them in two and send them to the chipper disc. Productivity is estimated at 10 tonnes/hour.

The machines described in this report certainly do not represent the average reality of the Italian case, where the level of forestry mechanization is still very low. However, the use of modern equipment is the indispensable condition for achieving an high labor productivity needed to bring down the cost of biomass fuel for industrial use. The use of such a machines undergoes to several limitations, including poor accessibility of Italian forests and the lack of forest planning.

60. Socio-economic and others constrains

60.1 Forest ownership status

In Italy, on the whole, 63.5% of forest area is privately owned, while 32.4% is publicly owned (about 4% of the surface has not been yet classified.) At regional level, the greater spread of private property is found in Liguria (82.3%), Emilia Romagna (82.0%) and Tuscany (80.0%), while Trentino shows the highest incidence of the publicly owned forests (72.2%). See 2 tables below.

Forest Estate Structure at National level is hardly dynamic. Despite abandonment and forest management extensification processes the average size of forest estates (both private and public) remains very limited. Average figures on the size of forest companies (in terms of forest area) are strongly affected by the incidence of small companies: those with an area lower than 5 ha represent 59.7% of the grand total, but – all together – only cover 6.4% of the national forest area. On average, companies owning less than 5 ha cover 0.76 ha. It may be assumed most of them are only occasionally managed or are not managed at all (APAT, 2003).

Table 49. Private wood in Italy by region, INFC 2008

Distretto territoriale	Bosco di proprietà privata									
	Proprietà privata individuale		Proprietà privata di società, imprese, industrie		Altri enti privati		Proprietà privata di tipo non noto o non definito		Totale Bosco di proprietà privata	
	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)
Piemonte	402 586	2.6	13 210	17.3	13 333	17.3	199 267	4.1	628 395	1.7
Valle d'Aosta	15 027	15.0	0	-	6 550	23.6	39 904	8.1	61 482	5.7
Lombardia	354 570	2.7	22 638	13.6	13 295	18.1	10 917	19.9	401 419	2.4
Alto Adige	204 364	3.1	1 512	49.8	31 433	10.5	378	99.8	237 687	2.7
Trentino	87 701	5.8	1 081	57.8	15 628	15.1	360	100.2	104 770	5.2
Veneto	223 095	3.2	4 078	30.1	31 856	10.6	8 560	20.7	267 590	2.7
Friuli V.G.	84 038	5.9	4 724	27.5	7 060	22.7	97 578	5.4	193 401	3.2
Liguria	264 115	2.3	14 289	15.6	7 328	22.0	6 961	22.6	292 692	2.0
Emilia Romagna	417 163	2.1	30 005	10.8	24 940	12.0	4 781	27.7	476 888	1.8
Toscana	609 341	1.8	171 146	4.3	26 015	11.7	58 178	7.7	864 680	1.3
Umbria	208 471	3.1	39 740	9.2	19 501	13.4	5 161	26.5	272 873	2.4
Marche	188 861	3.2	7 432	22.2	40 104	9.1	2 601	37.8	238 998	2.4
Lazio	240 304	3.2	12 527	17.0	6 607	23.5	16 442	14.8	275 880	2.9
Abruzzo	149 598	4.2	3 982	30.1	5 068	26.6	8 661	20.3	167 308	3.8
Molise	78 434	5.3	1 687	46.6	0	-	0	-	80 121	5.2
Campania	195 152	3.6	4 051	30.1	3 314	33.3	5 892	24.9	208 409	3.4
Puglia	79 240	5.8	8 545	20.9	388	99.8	5 398	26.4	93 572	5.1
Basilicata	153 952	4.0	746	70.6	0	-	1 859	44.6	156 557	3.9
Calabria	239 442	3.3	7 936	21.5	2 612	37.7	20 622	13.2	270 611	3.0
Sicilia	77 526	6.4	3 791	31.5	1 895	44.7	43 874	8.9	127 086	4.7
Sardegna	310 917	3.1	5 587	25.8	1 866	44.7	58 928	7.8	377 297	2.7
Italia	4 583 893	0.7	358 705	3.1	258 792	3.7	596 325	2.4	5 797 715	0.6

Table 50. Public wood in Italy by region, INFC 2008

Distretto territoriale	Bosco di proprietà pubblica									
	Proprietà statale o regionale		Proprietà comunale o provinciale		Altri enti pubblici		Proprietà pubblica di tipo non noto o non definito		Totale Bosco di proprietà pubblica	
	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)	superficie (ha)	ES (%)
Piemonte	21 337	13.6	203 104	4.1	7 719	23.0	8 485	21.8	240 644	3.7
Valle d'Aosta	1 156	57.3	34 260	9.1	1 541	49.6	0	-	36 957	8.6
Lombardia	20 945	14.3	174 425	4.5	3 967	33.3	4 408	31.6	203 745	4.0
Alto Adige	8 040	21.3	47 649	8.4	41 422	9.1	0	-	97 111	5.5
Trentino	14 547	15.6	190 788	3.3	62 774	7.1	0	-	268 109	2.4
Veneto	28 577	11.2	97 648	5.7	3 735	31.5	0	-	129 960	4.7
Friuli V.G.	37 531	9.5	87 697	5.8	2 973	35.2	2 230	40.6	130 431	4.4
Liguria	8 312	20.6	32 607	10.1	1 832	44.3	2 198	40.4	44 949	8.5
Emilia Romagna	56 951	7.8	26 849	11.5	1 103	57.8	368	100.1	85 271	6.2
Toscana	123 950	5.2	15 175	15.3	5 058	26.7	5 420	25.8	149 603	4.6
Umbria	30 967	10.5	21 751	12.7	45 246	8.6	737	70.6	98 701	5.4
Marche	31 587	10.4	18 580	13.8	1 858	44.7	372	100.2	52 396	7.8
Lazio	20 864	13.1	206 012	3.6	30 213	10.8	6 632	23.5	263 721	3.0
Abruzzo	19 909	13.3	189 822	3.5	5 068	26.6	9 023	19.9	223 822	3.1
Molise	7 934	21.6	43 727	8.2	781	70.5	0	-	52 441	7.3
Campania	8 470	20.7	157 980	4.1	6 590	23.5	1 841	44.7	174 881	3.9
Puglia	16 274	14.9	32 239	10.2	1 554	49.8	1 165	57.5	51 232	7.8
Basilicata	21 243	12.9	79 710	6.2	4 469	28.7	1 119	57.7	106 541	5.2
Calabria	64 146	7.3	100 370	5.7	9 328	19.9	17 164	14.6	191 009	3.8
Sicilia	87 876	5.9	32 623	10.5	1 895	44.7	6 444	24.1	128 839	4.7
Sardegna	64 539	7.4	127 950	5.2	5 104	26.8	3 731	31.6	201 324	4.0
Italia	695 153	2.2	1 920 967	1.2	244 231	3.8	71 336	7.2	2 931 688	1.0

60.2 Possibilities for farmers to invest in wood biomass chains (Rural Development Program)

The implementation of the Regional Rural Development Programs, which covers the period 2007-2013, will offer interesting opportunities for financing the agricultural enterprises, both public and private, who wish to invest and work in the sector of energy production from renewable sources. All Rural Development Program (RDP), provide a number of measures by which projects and initiatives can be financed.

PSR 2007- 2013 consists of 4 axes of intervention:

Axis I - Improving the competitiveness of agriculture and forestry.

Axis II - Improving the environment and rural development.

Axis III - Improving the quality of life of rural areas and diversification of the rural economy.

Axis IV - LEADER Approach

The axis I (competitiveness) welcomes all measures aimed at the human and physical capital in the agribusiness and forestry sectors, and production of quality.

The axis II (environment and land management) includes measures to protect and enhance natural resources, preservation of agricultural and forestry systems and highly valued natural and cultural landscapes of Europe's rural areas.

Axis III (diversification and quality of life) aims to develop local infrastructure and human capital in rural areas, to improve the creation of jobs in all sectors and the diversification of economic activities

In addition to these three axes, the LEADER axis aims to promote the method of bottom-up programming, based on a local approach to rural development, so far confined to the Leader Community Initiative, potentially extending it to all RDP measures. The intervention of the fourth axis is conceived in direct support of the third objective and it is also indirectly addressed also indirectly the other two axes..

The theme of energy produced from renewable agricultural sources is one of the few cross-cutting issues that can be found in the RDP, and mentioned in the first three axes of intervention. The choice of the size of financing may depend on the intended use of renewable energy produced: consumption or sale to a third party company.

In the case of small systems for business use, the measures contained in Axis I of the RDP are commonly used. Conversely, for larger systems on the market related to sales of energy and biofuels, the measures contained in Axis III will be chosen..

The RDP provides funding for various phases of production of energy from renewable sources: experimentation and innovation, the annual production of specialized crops for biomass, plant construction and acquisition of equipment, advice and training. As examples we can consider the measures contained in the Axes I and III aimed at the establishment of facilities for energy production, while aid for the construction of multi-annual crops are regulated in Axes I and II.

Lastly, one should remember that the use of the RDP is subject to restrictions, requirements and conditions of access, making it difficult to properly plan all the operation's phases. This restricts the range of possible choices and requires a preliminary phase of study as well as further steps that, sometimes, the single farm is unable to implement.

60.3 Constrains in building legislation and/or in burocracy

The nREAP states that the streamlining of authorization procedures represents an important step in the development of renewable energy sources. The Italian Legislative Decree No 387/2003 simplified the authorisation procedures for energy plants based on renewable sources and their infrastructures, allowing to file a single authorisation which has to be issued by the competent authority within 180 days since the application term. This single authorisation also covers all the works to connect the plants to the electric grid and to other network infrastructures, including infrastructures used to improve the dispatch of the produced energy. Under suggestion of the Ministries for Economic Development, Environment and Cultural Heritage, guidelines for the regional administrations (as provided for by the same Legislative Decree No 387/2003) have been approved. These guideline regulate authorisation procedures for electrical power plants fuelled by renewable sources under the National Renewable Energy Action Plan in coherence with Directive 2009/28/EC.

The aim of these guidelines is to ensure uniform treatment over the whole national territory, to establish deadlines for each stage, and to make more transparent the overall procedure. To this purpose, the Article 12 of Legislative Decree No 387/03 is quite significant: it states that regions should adapt their respective rules within ninety days after the guidelines' implementation, and that, in the event of failure to adapt the rules within this deadline, the national guidelines will apply. The process in question will therefore allow a step towards greater uniformity of the regulatory framework, minimising uncertainty and consequently reducing the potential for purely speculative applications. Law No 244/07 introduced the option for some plants, below a certain power and located on non-sensitive sites, to follow even simpler procedures such as giving notification or a commencement notice. This option was extended by Italian Law No 73/10 and the Community Law of 2009. Moreover, it is considered that for other cases the Services Conference tool will be adequate for ensuring coordination between the different responsible authorities. This tool could therefore be extended to large

plants other than those which produce electricity, whilst maintaining the intention to allow small plants on non-sensitive sites to follow the simplified procedures of giving notification or a commencement notice. Law No 99/2009 makes additional instruments available. Amongst other things it provides for the definition of standards, criteria and standardised procedures which the regional administrative bodies will have to adopt in order to identify the renewable resources available and to authorise the construction and operation of various types of plant. However, the division of national targets between the regions and related implementation methods, provided for by the same Community Law of 2009, will represent an useful guidance for the regions, which will therefore be encouraged to improve and accelerate their authorisation procedures in line with the commitments undertaken. A system for examining the policies and administrative procedures followed in each region could also be valuable , in order to encourage the exchange of good practices.

61. Existing policy measures (subsidy schemes)

61.1 General objectives of the European Community and commitments for Italy

In December 2008 the EU endorsed the European package "climate-energy", known as Strategy "20-20-20". The aim of the Strategy is to achieve, by 2020, three key objectives:

1. reduction by 20%, compared to 1990 levels, of greenhouse gases emissions,
2. achievement of the share of renewable sources of 20 percent compared to the gross final consumption,
3. improvement of the end-use efficiency by 20 percent.

Within this Strategy, the European Parliament and Council have approved the Directive 2009/28/EC on the promotion of energy from renewable sources[14].
The Directive sets binding targets with regard to the use of renewable sources: the achievement of 20% of the share of energy from renewable sources in gross final energy consumption (it was 8.5% in 2005, reference year) and 10% of the share of energy from renewable sources in energy consumption for transport in each Member State by 2020.
The Directive also sets a 10% share of "green" energy in transport and environmental sustainability criteria for biofuels. The Directive also lays down rules on joint projects between Member States, administrative procedures, information and training and the electricity grid connections in relation to energy from renewable sources.[3]

14

http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF).

For Italy, the commitments set by the climate-energy package and the Directive on the promotion of energy from renewable sources have resulted in a twofold binding target for 2020: the reduction of greenhouse gases by 14 percent compared to 2005 and the achievement of a market share of renewable energy equal to 17 percent of the gross final consumption (in 2005 this figure for Italy was 5.2%). Based on a reference scenario of high energy efficiency,, the final consumption of renewables by 2020 will settle at 22.6 Mtoe compared to the total amount of energy consumption equal to 133.0 Mtoe. (In 2010 the gross final consumption amounted to 172.0 Mtoe.)

Table 51. Italy: Indicative trajectory for the overall renewable energy share (%) for the reference years as mentioned in Annex I part B of Directive 2009/28/EC

Period	Annex I part B	NREAP			
		Template Table 3	First year	Second year	Average
	[%]	[%]	[%]	[%]	[%]
2011-2012	7.6	7.6	8.7	9.2	9.0
2013-2014	8.7	8.7	9.9	10.5	10.2
2015-2016	10.5	10.5	11.2	12.0	11.6
2017-2018	12.9	12.9	12.9	13.8	13.4
2020	17.0	17.0	17.0		17.0

For more detail on Italy see the country factsheet on page 205. The reference to Table 3 is to the Template, prepared by the European Commission and available for download at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009D0548:EN:NOT

Table 52. Projected total biomass electric capacity (MW) for the period 2005-2020, all biomass input categories

	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2020 [%]
Belgium	340	618	1290	2452	6
Bulgaria	0	0	109	158	0
Czech Republic	36	113	267	417	1
Denmark	777	1017	1837	2779	6
Germany	3174	6312	7721	8825	20
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.
Ireland	20	77	137	153	0
Greece	24	60	120	250	1
Spain	601	752	965	1587	4
France	707	1052	1895	3007	7
Italy	937	1918	2869	3820	9
Cyprus	0	6	10	17	0
Latvia	10	13	110	200	0
Lithuania	5	34	150	224	1
Luxembourg	9	13	36	59	0
Hungary	n.a.	374	420	600	1
Malta	0	3	23	23	0
Netherlands	1128	1430	2443	2892	7
Austria	976	1211	1228	1281	3
Poland	286	380	1530	2530	6
Portugal	476	647	907	952	2
Romania	0	14	425	600	1
Slovenia	18	51	83	96	0
Slovakia	49	118	225	280	1
Finland	2140	1790	2200	2920	7
Sweden	2568	2683	2799	2914	7
United Kingdom	1458	1920	2530	4240	10
All Member States (total)	15739	22605	32329	43275	**100**

More information on subcategories for biomass electric capacity is presented in Table 102 on page 118.
See Table 103 on page 119 for corresponding biomass electricity electricity production data.

The EU Parliament has approved a regulation that sets the average CO_2 emissions from new cars to 130g CO_2/km by 2012, to achieve more advanced technological improvements of the vehicles' engines. A further reduction of 10g should be sought through other technologies and the increased use of **biofuels**. The compromise also establishes a long-term goal for 2020, which sets the average emissions for the new cars fleet of 95 g CO2/km. Financial penalties are considered in case of exceedance of CO_2 emissions, and also incentives for manufacturers that use innovative technologies and small producers.

In particular, with regard to biofuels, the reduction of greenhouse gas emissions arising from their use must be at least 35%. In addition, with effect from 1 January 2017, this reduction must be at least 50% and by January 2018 the threshold rises to 60%; the Directive also sets out criteria by which to measure the reduction of emissions.

As regard for sustainability criteria (17(3)) the Directive states that:

Biofuels should not be produced from raw material obtained from land with a high value in terms of biodiversity, namely, land that in January 2008 or later had one of the following statuses:

- **primary forest and other wooded land**, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and ecological processes are not significantly disturbed;
- **areas designated by law or by the competent authority for nature protection purposes**, or for the protection of ecosystems or species rare, threatened or endangered, properly acknowledged, unless it is demonstrated that the production of that raw material did not interfered with those nature protection purposes;
- **grassland rich in biodiversity**, that would remain in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes, or non-natural grasslands, which cease to be in the absence of human intervention and which are species-rich and not degraded, unless evidence is provided that the harvesting of raw materials is necessary to preserve its grassland status.

In addition it is indicated as appropriate to monitor the impact of biomass cultivation, by examining the land-use changes, including displacement, introduction of invasive alien species and other effects on biodiversity (intro/78).

Agricultural raw materials cultivated within the European Community and used for the production of biofuels must be obtained in accordance with the requirements and standards under the provisions contained in Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers.

The Directive also provides that the Commission should refer every two years to the European Parliament and the Council on the impact of increased demand for biofuel on sustainability in the Community and third countries and the impact of EU biofuel policy on food security and price, particularly for the populations of developing countries, and other general issues related to development.

The reports will examine the enforcement of land use regulations. They also will control , both in third countries and in Member States that are a major source of raw material for biofuel consumed within the Community, if they have ratified and implemented the International Labour Organisation conventions.

Directive 30/2009 on biofuels for transport

This directive establishes sustainability criteria for biofuels use in transport and makes changes to the standards of transport fuels in order to facilitate the dissemination of biofuels. In particular, it changes Regulation 70/1998 ragarding the specification of petrol, diesel and fuel oil, and introduces a mechanism aimed at controlling and reducing emissions of greenhouse gases, changing the Directive 32/1999 of the Council as regards the specification of fuel used by inland waterway vessels.
In Annex 4 we report information on other Community interest for the issue of biomass-fuelled power plants.

61.2 National laws

Legislation in this area is highly complex and not always easy to read. The following are the main legislative measures enacted in recent years regarding bioenergy.
The Legislative Decree 227/2001, known as Forest Law, represents a reference value of general application that recognizes the critical need to link forest policy to be implemented, at national level, to the commitments made by our country in the international community and, in particular related to the concept of SFM (Sustainable Forest Management). This law fills the gaps in existing legislation, by introducing a suitable connection between the regulation of their industry and the environmental landscape, recognizing the importance of forestry in the active conservation of forest resources and establishing principles for the determination by the Regions, of rules to regulate the silvicultural activities and the legal definition of forest.
Based on the provisions of art. 3 of Decree 227/01, the 'Guidelines on forests' have been prepared (*DM 16 June 2005*), which are defined in support of Regions and Public Administration forest policies.
The Framework Programme for the Forestry Sector (Programma Quadro per il Settore Forestale, or PQSF), prepared in accordance with *Law No. 296/2006*, is the policy framework providing support to regional administrations to plan and legislate on forestry management coherently with the EU and international commitments and agreements. The PQSF identifies four priority objectives to be achieved between 2009 and 2019, including: protection of land and the environment by preserving and improving the protective functions of forests; maximization of the carbon sequestration; protection of the integrity and health of forest ecosystems; protection of biodiversity and landscape diversity.
The Ministry of Agriculture, Food and Forest Policies has issued the DM January 21, 2010 "Minimum criteria relating to good forestry practices" for the application of the

measure "Forest-environment payments". Such payments shall be granted per hectare of forest to beneficiaries who take over forest-oriented environmental commitments that go beyond the mandatory requirements.

61.3 Opportunities for funding wood biomass investments

Among the several CAP (Common Agricultural policy) measures, Council Regulation (EC) N. 73/2009 established common rules for direct support schemes for farmers under the common agricultural policy (CAP) and established certain support schemes for farmers, amending previous regulations. In particular, support under the single payment scheme shall be granted to farmers upon activation of a payment entitlement per eligible hectare including areas planted with short rotation coppice (SRC by definition of EC means woody tree species, perennial crops, that occupy the land for five years or longer and are repeated harvests).
The Commission Regulation (EC) N. 1120/2009 on detailed rules for the implementation of the single payment scheme regarding SRC, allowed Member States to define suitable varieties in the light of their climatic and agronomic suitability for the territory.
In Italy, according to the Ministry decree MIPAAF 09/11/2009, the following “taxa” are eligible for the support scheme: poplars, willows, eucalypts, alders, elms, sycamores, paulownias, robinias and Acacia saligna. Within this decree it needs to be highlighted, however, that the latter “taxa” are considered as invasive and pose threats to biodiversity.

Green electricity legislation

The major policy mechanism through which the Government supports the development of new renewable capacity is the **Green Certificates** system that introduced the obligation on electricity producers to supply the grid with a minimum quota of electricity produced by renewable energy sources.
A different dedicated scheme applies to the promotion of photovoltaic electricity, based on feed-in tariffs guaranteed for 20 years that vary in relation to the nominal power and the type of the installation.
Cogeneration is currently supported by different incentive schemes, rewarding both the production of heat and electricity. All cogeneration plants benefit from the **White Certificates** system while RES (Renewable energy sources) cogeneration plants are additionally entitled to receive Green Certificates to reward the green electricity produced. These supporting measures were already included in the trend scenario; an assessment of the planned measures to further support the diffusion of cogeneration plants and district heating systems indicates reductions of 0.55 MtCO2 per year respectively by 2020.

In the civil sector the package of the deployed policies aims at tackling energy efficiency through specific actions targeted both at existing and new buildings and at appliances. The most important regulatory measures affecting this sector, within the White Certificates framework, are contained into the legislation introduced to improve the energy performance of buildings, strengthening their thermal energy demand requirements. The implemented and adopted policies and measures should result in a reduction of 8.0 and 8.4 MtCO2 per year respectively by 2015 and 2020.

As far as the local measures are concerned, it is important to mention the Regional Energy Plan (PER). The PER is the main tool through which Regions can plan and address their intervention, included the structural ones, in energy sectors in their own territories and can also regulate the functions of the Local Agencies, harmonizing the important decisions at the regional and local level. The energy-environmental plans are designed to guarantee targets coherent with the national energy policy and to insure to the regional territory the development of a policy that respects the requirements of the society, the environment protection and health of the citizens. They constitute the reference background for the private and public subjects, who assume initiatives in the energy sector in their own territory.
The PER contains strategies, targets, specific rulings, available tools, legislative and normative references, and financial opportunities. All Italian Regions activated initiatives in the renewable energy sources field, through two main participation lines. The first one refers to the programs "Photovoltaic roofs" and "Solar thermal" following the decree of the Ministry for the Environment, Land and Sea issued in 2000. The second one works through specific measures of the Operative Regional Programs (POR) by the Structural funds of the Community Support Framework 2000-2006 of the European Union.
The Structural Funds contribute to realize the objective of economic and social cohesion of the EU. These funds are used to reduce the differences between the Regions of the Union and to promote equal professional opportunities of the various social groups. The action of the Structural Funds focuses mainly on a series of priority objectives. The general document that defines the strategic lines for the Structural Funds planning is the Community Support Framework 2007 – 2013 (QCS, in Italian), that contains an analysis of the initial situation, the strategy of interventions for the joint action of the European Union and of the State, the priority actions of intervention, their specific objective, the attended impact evaluation, the financial equipment, the identification of the Operative Programs and their conditions of realization.

Legislative Decree 387/2003, is the implementation in Italy of EU Directive 77/2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market and is aimed, among others, at the following objectives:

- promote a greater contribution of renewable energy sources to electricity production, through simplification of the authorization procedures (authorization

only at regional level), introduction of a guarantee of origin for renewable sources, increasing the share of green certificates required by 0.35% per year;
- encourage the development of micro-electric plants powered by renewable sources, through specific home energy subsidies (photovoltaics) and energy contracts with the electricity grid suppliers.

With specific reference to biomass, in line with European law and in contrast to the Decree 79/99 (which recognizes waste *tout court* among the renewable energy sources), the decree 387/2003 defines biomass as the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. Despite this, the incentive regime dedicated to biomass is also extended to the non-biodegradable waste (in order to help resolve the serious problem of waste disposal in Italy).

Legislative Decree 20/2007 is the implementation of the EU Directive 8/2004 on the promotion of cogeneration based on a valuable heat demand in the domestic energy market. It makes distinction between micro (<50 kW) and small energy generation (≤ 1 MW) plants. It states that the installation of a microgeneration or small generation plant, provided that it is certified, will be subject to simplified authorization rules. The Decree introduces the guarantee of origin of electricity from cogeneration and the possibility of net metering for systems of size up to 250 kWe.
The Budget Act 2008 and the related measures (Law 222 of November 29, 2007 and Law 244/2007) represent a real turning point in national energy policy in particular in relation to renewable energy sources.
They introduce the concept of short chain: energy generated from agricultural raw materials, farming and forestry, including byproducts, obtained within a radius of 70 km from the plant. Moreover they establish a certification of traceability for the agroenergetic (short) chain. In particular they introduce:
- Increased incentives and the duration of the green certificates.
- A multiplier as a function of raw material.
- Increased rates, generally, either through a reassessment of green certificates, which vary according to the specific renewable energy source, either through an extension to 15 years of the allocation of green certificates, as well as the setting to the same period of 15 years allocation of tariffs for plants that may benefit from the "energy account".
- Access incentives for plants "hybrid", that are powered both from renewable sources and non-renewable sources.
- Promotion for biomass plants that have accumulated up to 40% of the amount of biomass supply chains.
- Tax incentives, by the deduction of 55% from the gross cost, for energy efficiency measures.

It also states that the share of renewable energy to be introduced in the national electricity market will grow by 0.75% per year, thus providing a significant additional security for the sale of green certificates, as well as clearly establishing progressively more ambitious goals. From 2008 and until the attainment of the target of a minimum coverage of 25% of domestic consumption of electricity from renewable sources and subsequent updates arising from EU legislation, GSE (Gestore Servizi Energetici), at the request of the manufacturer, withdraws the Green Certificates, expiring in the year, more than necessary to fulfil the minimum requirement of the previous year, at a price equal to the average price recognized by the Green Certificates for the previous year as recorded by the Electricity Market Manager (i.e. the so called GME) and communicated to the GSE by 31st January each year.

In transposition of the Finance Act 2008, the Legislative Decree 18/2008 defines the new tools to support electricity produced from renewable sources, particularly biomass. The Decree provides that the production of electricity through plants powered by renewable sources, with the exception of solar energy, is encouraged by the issuance of Green Certificates, by applying multiplicative coefficients as a function of generation technology adopted. They are equal to 1,3 and 1.8 respectively for the production of electricity from biomass import, biogas from waste, and biomass from short chains. In addition, the electricity supplied to the grid, produced by biomass plants with average annual nominal power no greater than 1 MW, come into operation after 31 December 2007, are entitled, as an alternative to green certificates and upon request of the producer, to a fixed rate equal respectively to 180 and 280 Eur/MWh for plants powered by vegetable oil from non-EU/biogas from waste and other types of biomass (local or imported). In this regard the GSE shall determine the qualifying facilities and electric power plants, as well as the number of Green Certificates or the all-inclusive flat rate you are entitled.
In addition, plants fueled by renewable sources of nominal annual average not exceeding 200 kW, can access the exchange mechanism in place the conditions and arrangements referred to in that Decree.

Law 99/2009 aims at a true operating efficiency, and addresses many areas of energy from renewable sources sources, including: promotion of distributed cogeneration, measures aimed at encouraging small and medium enterprises to produce their own energy, strengthening the energy efficiency credits scheme, promoting new buildings with significant energy-saving measures and energy retrofits of existing buildings, providing incentives for energy service companies, and promotion of new high-efficiency products. In connection with the authorization only for plants using renewable sources (Article 12 of Legislative Decree 387/2003) decision-making power of regional governments are suppressed , in the absence of agreement at the Conference of the services. Finally, expanding the powers of the Authority to the "whole chain" of electricity and gas, it also imposes a new obligation to provide information annually to Parliament on the state of the art in the field of renewable energy plants.

As for the photovoltaic and biomass, through an amendment to Decree No. 387/2003, it is established explicitly that the applicant must demonstrate, before consent is given, its soil availability subject to intervention.
As for biomass and biogas, subsection 382-ter of Finance 2007 (Law 296/2006 is repealed), granting the possibility of choosing between green certificates and all-inclusive rate, as regards the production of electricity from biomass and biogas, authorized at a later date to December 31, 2007, under the conditions specified therein.
As for the all-inclusive rate for plants of less than 1MW, encouraged by former Fin ance 2008 (Law 244/2007), is deleted § 7 (relative to biomass and biogas produced by agricultural activities, farming and forestry by short chain), but the point is changed to 6 (to be "biodegradable waste, biomass, other than those referred to in the next step" changes to "Biogas and biomass, liquid biofuels excluded with the exception of pure vegetable oils traceable ..."), and the reference value is replaced (22 to 28).
In paragraph 8, which regulates the landfill gas and sewage gas purification processes, liquid biofuels are added, with the exception of traceable pure vegetable oils. The reference value is 18.
More information on biomass, with further changes made to the 2008 Budget, are the followings:
The Ministry of Economic Development will determine the way in which operators of the chain are required to ensure the provenance and traceability of the supply chain, including for purposes of salary and fees under the sole table 2 (and not more than 3, then in relation to the systems above 1 MW).
For solar and biomass, through an amendment to the Legislative Decree 387/2003, is explicitly provided that the applicant must demonstrate, before consent is given, its soil availability subject to intervention.
The obligation to feed-in renewable energy, and then the presentation of green certificates for their share obligation (Article 11 of Legislative Decree 79/1999), passes from the shoulders of the manufacturers / importers of non-renewable energy, to those of "subjects which conclude with Terna Spa one or more contracts for dispatching electricity levy". Since 2011, the renewable electricity must be entered in the system will therefore be calculated based on the previous year's production, but the energy taken from the network.
For facilities owned or operated by farms and powered by biogas and biomass – not considering liquid biofuels with the exception of traceable pure vegetable - entered into service after December 31st, 2008, access to comprehensive fee will be combined, as an exception, with incentives to national, regional and local.

The Law 102/09 provides for the issuing of green certificates for electricity associated with the heat produced by cogeneration plants "related to agricultural environments." The electricity produced by cogeneration plants coupled to district heating, to the amount of heat actually used for district heating, is entitled to the issue of certificates referred to in Article 11 of Legislative Decree 16 March 1999, No 79, as amended.

The Decree of the Ministry of Agriculture and Forestry in consultation with the Ministry of Economic Development of the April 1, 2010, outlines the procedures for demonstrating the traceability of biomass to produce electricity for the production of electricity by power plants from this source and the right to be supported by the issuance of Green Certificates, with the application of the multiplier k = 1.8, provided for in Article 1, paragraph 382-c of the Law No 296 of 2006.
The Decree implementing the Law of 27 December 2006, no 296 (2007 Finance Act), as amended by Law of 29 November 2007, no 222, conversion of the Decree Law of 1 October 2007, No 159.

The Circular of the Ministry of Agriculture and Forestry of the March 31, 2010 defines the traceability system of pure vegetable oils for the production of electricity to the release of the all-inclusive fee of 0.28 Euro per kWh provided by Law 99/2009. The procedure described in the Circular is required to ensure traceability of the entire production cycle of agricultural and forestry materials used. The computer procedures for compliance with the traceability requirements under Regulation 73/2009 are prepared by AGEA in order to fully exploit the infrastructure provided by SIAN (National Agricultural Information System). The computer procedures are also made in order to define a system encompassing other forms of incentives and able to support implementations related to the application of EC directives already issued.

62. Main barriers for further development

In the last years one of the biggest barriers to the development of bioenergy and biofuel production in Italy has been the lack of a stable and clear regulatory framework. Even so the interest in this field among operators is growing fast especially with small and large investors.

These limitations have been overcome thanks to the recent introduction of some important updates from the National support scheme for renewable energy and in particular bioenergy. Furthermore, the adoption of the EC Directive for the promotion of renewable energy, requiring member states to prepare National Renewable Energy Action Plans by June 2010, will hopefully represent a great opportunity for the further development of the Italian bioenergy policy to support the expansion of this growing sector.

Nevertheless, the introduction of sustainability criteria for biofuels contained in the recent EC directive for the promotion of renewable energy will probably drive the attention of bioenergy producers increasingly towards other oil feedstock. As a matter of fact, since 2009 some large energy producers are financing ambitious development projects of *Jatropha* plantations in several African countries, in an attempt to supply large quantities of *Jatropha* oil to their power plants in Italy.

With regard to pellet production, there is a large and growing market of pellet stoves for domestic heating. It will probably continue to drive the demand for pellets in Italy in the forthcoming years. During the last three years, discontinuous and fragmented supplies of feedstock for pellet production and large variations in the consumer's price have been an obstacle to the steady development of the pellet industry, as demonstrated by the national production that still remains well below the production capacity of the industry itself. The recent discovery of radioactive contaminated pellets coming form Lithuania has reinforced the awareness among operators over the need for a stronger standardization of quality regulations.

The adoption of quality norms (i.e. UNI/TS 11263:2007 norm based on CEN/TS 14961) and the development of a certification system (as that "Pellet Gold" label11) may create a more favourable background for pellet trade, that will continue to represent an important resource for producers.

As far as biofuels for transports are concerned, the scenario still remains quite unclear. The adoption of the Directive 30/2009 (see section 6.2) certainly represents an opportunity for the development of biofuels in Italy as well as in other EU member states. As the directive requires member states to prepare National Renewable Energy Action Plans by July 2010, an update and improvement of support measures for biofuel will be hopefully included in that tool.
It is noteworthy that key forestry variables, such as forest area, carbon stock and fuel wood removals and wood use are still far from having a coherent framework of information and suitable statistical quality. This can be a barrier for the implementation of policies, such those related to the rural development or energy, that should rely on a more solid information base.

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