



# REPORT 2008

## GOALS OF BIOENERGY IN ITALY

# Key elements for 2020 objectives

CARRIED OUT  
BY ITABIA

The leitmotiv of the **2008 Report** is to assess, using original research instruments, whether national objectives are congruent with European directives and with the **sector's potential in Italy**, and to examine the gap between current situation and the **objectives for the next decade**, suggesting which political and technical tools may be adopted to fill the gap. This **compendium** provides a brief overview of the key elements included in the 2008 Report.

SUSTAINABLE ENERGY EUROPE



# 2008 Report

In 2004 **ITABIA** drafted, on behalf of the Italian Ministry for the Environment, Land and Sea (MATTM), a comprehensive report on “*Biomass for Energy Production and the Environment*”, which not only provided statistical data on biomass energy use in 2003, but also outlined the principles, concepts, perspectives and directions of the sector, with a systemic and holistic view of bioenergy.

MATTM, in the framework of the “Sustainable Energy for Europe 2005-2008 (SEE)” campaign (www.campagnaSEEItalia.it), has once again commissioned **ITABIA** with the drafting of an updated report as of 2008.

The **2008 REPORT**, if compared to others national recent studies, takes into consideration the following additional aspects: description of the main sustainability criteria and indicators for the definition of “best practices”; monitoring procedures for the technical, economical, and environmental assessment of bioenergy projects; recommendations and strategies for the viability and uptake of bioenergy chains.

The ongoing lively debate, taking place at all levels, about the varied and complex world of biomasses and their energy use has shown that there are conflicting trends, such as:

**1) the drive to globalize programmes**, resources, markets, which clashes with many local operational situations that lack adequate means, show little interest in interchange and are thus more “closed in” in the “short-range”;

**2) the intention to make bioenergy** a significant budget item in energy and environment budgets, which is often hindered and nullified by opinion movements and harsh and indiscriminate popular opposition that is against any widening of horizons;

**3) the setting of ambitious programmes** and goals at supranational level, while energy/environment plans are parcelled out locally and show little conformity with general objectives.

National and international institutions are thus undertaking actions to create a more rational and coordinated framework for the sector, by setting up and developing cooperation networks, methods of communication, goals for the next decade and binding directives.

The international activities of the **Global Bioenergy Partnership** and the **World Bioenergy Association**, the new European Draft Directive on Renewable Energy Sources and the “*Sustainable Energy for Europe 2005-2008 (SEE)*” campaign, the Italian Government Position Paper of September 2007, all go in this direction.

Basic concepts focus on three pairs of key elements:

- > **resources/efficiency**, that is the maximum possible exploitation of currently available biomasses by using innovative technologies that are highly efficient both in the raw material supply phase and in the end-use conversion phase;
- > **market/good practices**, that is the selection of successful chains and best practices which favour the increase and marketability of resources, technologies and products;
- > **sustainability/guarantees**, that is the assessment of bioenergy market compatibility with the geographical territory and socio-economic characteristics of the area.

Italy's position in relation to the above elements is fairly satisfactory. The growing interest in the use of biomass as an energy resource and the almost unanimous acknowledgment of the advantages that can be gained from

the proliferation of bioenergy in the Italian economy, are strengths that place Italy at the same level as other European and non-European nations. The ongoing developments, particularly in the use of biomass for heating and electricity, reveal Italy's strong industrial background and great research potential. Nonetheless, bioenergy is not yet used in many market applications and has not yet fully developed its potential.

This is due to a complex number of factors and obstacles, which delay its development. Very briefly, the weaknesses of Italy's biomass system can be summarized as follows:

- > **Little attention to successful chains** (district heating, district cooling, co-combustion, co-generation) both in terms of energy conversion efficiency and in terms of social acceptability;
- > **Weak systemic approach of the projects** (few connections with agriculture and forestry);
- > **Unreliable basins of biomass production** (little attention to condition of agricultural and forestry soil) particularly in the mountains;
- > **Difficulty in developing** multiannual supply chain agreements among sector operators (shortage of company consortia or associations encompassing agricultural and industrial producers and companies dealing with supply, first biomass conversion, plant management and maintenance and, finally, distribution of electric and/or heating energy produced);
- > **Unrelated legal and technical norms** (there are about 100 norms in Italy) and temporal instability of regulations;
- > **Little involvement of local populations** (little perception by the population of direct benefits related to the use of biomasses as a source of energy).

In view of the transposition of the

# Resources/Efficiency

next **European Directive on Renewable Energy Sources** - in which biomass and bioenergy will play a highly relevant role - the attention of public and private institutions and bodies is focusing on the aims and objectives to be reached at 2020.

The Italian Government **Position Paper "Energy: issues and challenges for Europe and for Italy"**, submitted to the European Commission in September 2007, estimates (amongst other things) that primary energy supply from the different biomass categories by 2020 for the production of electricity, heating and biofuels shall be:

<b>Electricity</b>	3 Mtep
14.50 TWh/year with an installed power of 2,415 MWe	
<b>Heat</b>	9,3 Mtep
<b>Biofuels</b>	4,2 Mtep
<b>TOTAL</b>	16,5 Mtep

The route to be followed to achieve 16.5 Mtoe by 2020 can be chosen after analysing the current situation. The report provides the following biomass primary energy consumption for 2005:

<b>Electricity</b>	1,35 Mtep
<b>Heat</b>	1,88 Mtep
<b>Biofuels</b>	0,30 Mtep
<b>TOTAL</b>	3,53 Mtep

These data do not include self-produced and self-consumed biomass outside commercial circuits, namely for domestic heating use. **ITABIA** has carried out an in-depth study on this use by drawing on and processing partial data from various sources. Results have shown that primary energy consumption for heating was about 4 Mtp, instead of 1.88 Mtoe, amounting to a total supply of primary energy of about 5.65 Mtoe in 2005. To achieve the 2020 objectives, current raw material consumption will need to be tripled. That is why the national situation ought to be examined in relation to the aforementioned key elements. ■

**T**wo types of resources - and their efficiency of use - are to be considered: raw material and conversion technologies. With regard to raw material resources, the potential of the different biomass sources - expressed in primary energy - available in Italy is estimated to be 24-30 Mtoe/year, which is divided in the following way:

<b>BIOMASS</b>	<b>Mtoe</b>
<b>RESIDUES</b>	
Agriculture and agro-industry	5
Forestry and wood industry	4.3
Urban green spaces	0.3
Animal residues	10-12
<b>FUEL WOOD</b>	2-4
<b>DEDICATED CROPS</b>	3-5
<b>TOTAL of POTENTIAL RESOURCES</b>	24-30

There is, however, substantial **inefficiency** in the collection, conversion and supply of biomass to the energy conversion plants, and that is why only **30-35%** of potentially available biomass can be actually used today. This low efficiency stems from some of the aforementioned weaknesses of the "biomass system", such as :

- > Limited systemic approach of the projects
- > Unreliable basins of biomass production
- > Difficulty in developing multiannual chain agreements among sector operators

Technological and engineering **resources**, on the other hand, include a set of mature technologies that are very flexible and can be adapted to local contexts. Namely: For **SHORT CHAINS** that can be developed in the agricultural sector, ei-

ther at company or small district level, the following technologies have reached market maturity:

- > Small domestic heating boilers;
- > District heating from lignocellulosic biomass;
- > Small-scale co-generation (ORC cycle) from lignocellulosic biomass;
- > Electricity and biogas co-generation;
- > Electricity and vegetable oil co-generation;
- > Trigeration from vegetable oils.

For **AGRO-INDUSTRIAL CHAINS** that rely on a close relation between agriculture and industry and are based on a large-scale organization, consolidated technologies

are available for:

- > Production of electricity and heat from solid biofuels (pellets and chipped);
- > Production of biodiesel;
- > Production of bioethanol.

End-use conversion efficiency varies greatly according to the type of system; below is an assessment of the orders of magnitude:

<b>Domestic heating</b>	30%
<b>District heating</b>	80%
<b>Electric power</b>	15-25%
<b>Co-generation</b>	60%
<b>Trigeration</b>	50%



# Market/Good Practices

Except for the individual domestic heating sector, the other chains have no real unassisted market as yet. Public aid has nonetheless allowed the installation of a number of relevant systems, as reported in the table below.

**MAIN SYSTEMS INSTALLED IN ITALY**  
(preliminary estimate)

Sector	N°. of systems	Production Cap.
District heating	100	380 MW <sub>th</sub>
Electricity (solid biomass)	40	420 MW <sub>el</sub>
Electricity (solid urban waste R.S.U.)*	65	600 MW <sub>el</sub>
Electricity (biogas)	420	280 MW <sub>el</sub>
Production of Biofuels	10	1,3 Mt/a

\*Source: GSE 2007

These installations include some cases of excellence, which are mentioned in the full Report and provide an indication on the most advantageous way to repeat the initiatives in other contexts. With this intention in mind, **ITABIA** has developed and used an original study plan, based on 3 "macro areas" (legal, technical and economic), 18 "study keys" (process of energy conversion, collection-stocking-transport, agricultural practices, etc.) and 70 evaluation parameters (performance of conversion process, chain energy assessment, CO<sub>2</sub> assessment, repeatability, etc.). This study plan has shown that there are various cases of excellence in the different sectors.

Depending on the context, investment and management costs and related proceeds vary largely according to raw material, technology and end uses.

Comparative studies performed by **ITABIA** on the various energy chains, have shown that development opportunities should focus mainly on the production of heat from lignocellulosic

biomass and on co-generation from oilseed crops, particularly when energy management is strictly related to the agricultural facility that produces the biomass.

The economic evaluations made have led to forecasting the following development trends for some of the chains concerned, namely those related to lignocellulosic solid biofuels.

## **DOMESTIC HEATING WITH SMALL INDIVIDUAL BOILERS**

The already broad diffusion (30,000 MW installed) of medium-sized, small- and very small-sized devices is expected to entail a significant improvement in efficiency; in fact, most of the small-sized boilers used today produce an average yield of about 30% compared to the 80% yield that can be obtained with current technologies.

## **DISTRICT HEATING**

District heating, on the contrary, has only recently started to spread and its use is expected to grow and develop further because of its strong economic, environmental and social benefits and of the measures taken by the regional Rural Development Plans (PSRs).

## **CO-GENERATION FROM LIGNOCELLULOSIC BIOMASS IN SMALL-SIZED PLANTS**

It is not easy to forecast the degree of development of these systems, due to uncertain future trends of investment costs on the electrical part. However, we can expect the technology to develop rapidly, in light of current norms and incentives which favour microgeneration and the consequent "short chain".

## **PRODUCTION OF ELECTRICITY FROM LIGNOCELLULOSIC BIOMASS IN LARGE-SCALE PLANTS (>5MWE)**

Due to the high costs of installation (and of fuel biomass), development is expected to regard mainly the compulsory amount of renewable electricity that large producers of fossil electric power are required to supply on the market (*Legal Decree 387/2003*).

## **TRIGENERATION FROM LIGNOCELLULOSIC BIOMASS**

Only a few hundred kW of trigeneration plants have been installed to date. The system's potential of development is high (broad areas of application for cooling of environments and conservation of agricultural commodities), but high installation costs (for the electrical and refrigerating parts) may slow down the development.

## **BIOGAS HEATING AND CO-GENERATION**

Biogas system for heating and co-generation in Italy are developing continuously, owing to the installation of new systems and the setting up of new businesses specializing in the supply of entire systems and/or components. The production of biogas, after methane purification of 95/98%, can have excellent prospects for use in haulage and in natural gas distribution networks.

## **AUTOMOTIVE BIOFUELS**

The creation of the Italian Technological Platform on Biofuels as a Forum bringing together sectorial stakeholders, the adoption of implementation decrees in line with the 2008 Budget Law, which calls for the mixture of increasing amounts of biofuels in equivalent fossils, pave the way for a clearer route to be followed in view of the transposition of the new European directives. ■

# Sustainability/Guarantees

**P**rogress made with biomass technologies in recent years has encouraged a remarkable improvement in quality and efficiency of energy conversion processes and has thus facilitated the reduction of air pollution emissions. The environmental benefits of modern biomass district heating systems have become clear once they have replaced hundreds of small, obsolete and polluting diesel heating boiler systems.

The downside is the still widespread household use of stoves, fireplaces and boilers based of old technologies that do not comply with environmental standards. The practical effects of the technological improvements that are available for these installations are still scarcely visible.

It would be recommended for local and regional Administrations to take action in order to renew the wood boilers and stoves that are being used in their regions. This would entail remarkable savings of raw material and would give local administrations greater credibility in terms of their environmental awareness.

The sectors most involved in the analysis of sustainability/guarantees are agriculture and forestry.

#### The former is experiencing:

- > Lack of a non-food agriculture policy integrating all the non-conflicting uses of agricultural land;
- > Re-settlement of abandoned lands (around 2 mln ha) that are undergoing marginalization and desertification, by planting high-yield ground crops or trees (particularly recommended are fructan plants, such as Topinambur, which produces up to 20 t/ha of dry

substance, entails no cultivation costs, and its capacity to absorb CO<sub>2</sub> is 10 times higher than that of an ordinary forest).

#### The latter is characterised by:

- > Inaccessibility of most Italian woods;
- > Inadequate professional training;
- > Forestry companies with modern equipment are almost inexistent.

**A necessary feature of each chain is the Monitoring Plan**, based on indexes of efficiency, which provides state and local administrations with an objective assessment of results in relation to set objectives. The Plan is also necessary and highly effective in developing new implementation plans in line with the 2008 Budget Law on **chain standardisation and certification**.

It is particularly difficult to set out a Monitoring Plan on the energy use of biomass due to the nature of the resource, which, contrary to other energy sources, must be produced, collected and transported. Therefore, the analysis of the fuel chain plays a fundamental role: The figure above shows a simplified outline of the chain, which however is much more complex, involving a number of actions and retroactions among the various components.

Indeed, the formulation of fuel supply strategies is important both for economic and environmental reasons. Economically, they can help reduce fuel costs by influencing the numerous and complex chain variables; environmentally, they contribute to identifying management methods that can help minimize potentially negative effects on ecosystems and enhance positive ones.

The complexity of the system becomes even more evident if we analyse the production of biomass energy from the environmental point of view. This analysis highlights a peculiar situation not only with regard to conventional energy sources but also with regard to renewable sources, due to the following reasons:

- a) environmental impacts are not confined, but affect the whole of the chain from production, to transport, stocking, energy conversion and use;
- b) they affect more productive systems: for instance, biofuels are derived from agriculture (fuel production and supply) and industry (conversion and use);
- c) some impacts cannot be easily quantified, such as for example the benefit of energy crop cultivation in marginal hill areas, **soil erosion and lack of humus**. ■



# Legislation

## BIOMASS USE

Legislation on biomass use ought to take into account both environmental protection and energy saving.

With regard to environmental protection, the legal framework is set by the **Kyoto Protocol** and EU's provisions on "emission trading", which aim at promoting the use of renewable energy sources and biofuels.

With regard to energy saving, measures for the promotion of energy efficiency need to be adopted in the distribution and consumption of electricity and gas. The measures that have been implemented to reach the objectives of electricity and energy efficiency are respectively the **Green Certificates** and the Energy Efficiency Titles or White Certificates. The 2008 Financial Law lays down the foundations for slightly increasing in the value of Green Certificates for electricity produced from biomass that is obtained either locally or as a result of chain agreements.

The legal framework, herein only briefly outlined, requires the streamlining of laws and administrative regulations that can ensure greater stability for investors, by providing national Guidelines on the most important issues concerning the sector.

The opportunity to set up the legal framework for biomass energy is given by the European Directive, currently in its draft form, which lays down the objective of reducing emissions by 20% by 2020, of saving energy and using renewable energy sources, which must be taken into account by the national energy Strategy set forth in Legislative Decree 112/08.

In this context, directive transposition in the future national legislative decree may not only allow to implement Directive provisions, but it may also (if flanked by a delegated law) allow to design a coherent and rational legal framework that supports, rather than hinders, operators.

## BIOFUELS

The proposal for a directive on the promotion of the use of renewable energy, approved on 23 January 2008 by the European Commission, would represent a significant step forward in European politics for a more rational use of resources.

The set objectives regard the renewable sources to be used in the production of electricity, heat and in the transport sector. As for the latter objective, the directive sets a very ambitious target of incorporating biofuels (biodiesel and bioethanol) in traditional fuels. Indeed, if the damage caused by fossil fuels is to be limited and their consumption reduced, the best way forward is to develop biofuels.

The risk that the public opinion

may see biofuels not as a means to control petrol and diesel prices, but as a way of creating tension on food prices, must be avoided, **because this is not the country's purpose**. This problem is particularly common in some developing countries where energy crops for biofuel production are cultivated in tropical areas that have been deliberately deforested.

Therefore, the questions raised by **FAO** and **OECD** on the need to promote the development of energy producing crops must not be minimized, but rather carefully analysed and the sustainability criteria of biofuel production need to be carefully assessed.

It will be thus necessary to promote a balanced development of biofuels without affecting Italy's vocation for food crops, which is characterised by traditional and niche productions. So, on the one hand oilseed crops for biodiesel production may be cultivated in rich soils, whilst, on the other, second generation biofuels, such as waste frying oils, or third generation biofuels may be developed, in order to avoid clashes with the use of food crops.

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## DIRECTIONS FOR DEVELOPMENT

In order to ensure the adequate use of biogenic resources in future socio-economic contexts, public and private bodies need to define the integrated directions they intend to follow for bioenergy, the environment and land, by guaranteeing:

- 1) a legislation that is effective and stable over time
- 2) chain standardization and certification
- 3) reorganisation of agricultural and forestry sectors
- 4) the pursuit of successful chains
- 5) the promotion of demand

## AGRO-ENERGY SUPPLY CHAIN

Inter-professional agreements are regulated by community legislation to safeguard what appears to be the weakest link of the chain - the agricultural producer, providing an instrument that sets an exception to the ban to restrictive competition agreements.

This instrument allows organisations of agricultural producers to lay down, on behalf of their members, the minimum conditions that are to be met by the conversion industry.

The norm on chain agreements is laid down in **Legislative Decree n. 102 of 27 May 2005** on the "*Regulation of agro-food markets*", which provides for the definitions and requirements of organisations of agricultural producers and associations of producers' organisations, and sets out the provisions regulating chain agreements. Framework contracts are regulated through chain agreements.

**The Decree of the Italian President of the Ministers Council (DPCM) of 5 August 2005** sets forth the provisions for sector roundtables, implementing article 9, paragraph 2 of legislative decree n. 102 of 27 May 2005 and article 20 of Legislative decree n 228 of 18 May 2001, on the agro-food roundtable. The subsequent DPCM of **23 February 2006** set up the roundtable for bioenergy.

Inter-professional agreements take on particular importance in the agro-energy sector since they provide a guarantee to farmers who need to be certain that their investments can provide profitable and stable results over time.

Community directives in this sector

have ratified the obligation to incorporate a certain percentage of bio-fuels in fossil fuels, whilst Italian Law 81/2006, subsequently changed with the 2007 Budget Law, sets out the obligation to incorporate a percentage of biofuels produced from agriculture into fossil fuels.

In compliance with the aforementioned provisions, the associations representing biodiesel and bioethanol producers (Assocostieri and Assodistillatori) have conclud-

ed inter-professional agreements with agricultural organisations for the development of agro-energy crops.

The agreements do not bind the farmer to signing a contract with the conversion industry, because their aim is to set a framework that lays down the main criteria for setting up individual contracts.

To date, these agreements have not been entered into due to the sudden increase in cereal prices and red tape obstacles.

## ITABIA

**ITABIA** (Italian Biomass Association) is a not for profit Association founded in 1985 with the aim of promoting the diffusion of efficient and environmentally-sound biomass production and conversion systems for energy and industrial purposes. Most of **ITABIA's** activities concerns the transfer of knowledge to public and private bodies, research centres, manufacturers, agro-forestry entrepreneurs, etc.

**ITABIA** has established an efficient net of key persons and bodies able to support the actions and giving help for the achievement of expected results. In fact, **ITABIA's** membership is composed of about one hundred specialists coming from scientific institutions, public bodies and industries with special interest in biomass sector.

**ITABIA** has the capacity of establishing and of co-ordinating national teams having the task of defining strategies, and implementing action plans. From the operational point of view, **ITABIA** usually organises seminars, workshops, meetings where all the results attained by other partners, as well as information coming from other sources, are disseminated. Special means are currently utilised like, ITABI@NET (newsletter for **ITABIA's** members) and the WEB site. **ITABIA's** experience covers a wide range of topics from biomass production, to biomass recovery and utilisation. Itabia has been actively participating in several international networks - most of them promoted and financed by the European Commission - together with different stakeholders in order to face the problems from different point of view. Actually **ITABIA** is collaborating with the Italian Ministry for Agriculture and Forest Policy and with the Ministry for the Environment and Territory for implementing National Programmes and Action Plans for the deployment of biomass energy. **ITABIA** promoted the foundation of the European Association for Biomass (AEBIOM).



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