The value of Forest Biomass

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Climate change, largely caused by increased energy demand, is a global cause for concern.

The Value of Forest Biomass, which is the third volume in the collection entitled The Values of ENCE, aims to show the advantages and the potential of a resource which is undoubtedly the most powerful, beneficial and accessible renewable energy option to cope with our Society's present and future challenges.

In addition to the environmental benefits of the cultivated forest, described in *Sustainable Forest Management and Eucalyptus,* forest plantations offer a productive option with great social value, enabling degraded rural areas to be structured and so revitalising the countryside. There is no doubt that they offer us a natural and renewable resource which if developed in an organised and responsible way in any event will mean that territorial structure will have to be readdressed; above all, however, they represent a real opportunity as an energy option in order to comply with international requirements for cutting CO_2 emissions and the struggle against climate change.

Spain enjoys a series of unique characteristics which can make us a touchstone at global level in sustainable forest development. We have our own renewable resource within our reach - a resource which is beneficial for nature and which can balance our energy dependency as a country.

ENCE boasts over 50 years of experience managing this production model, an advanced business model in research and forest development, operating three industrial plants capable of generating biomass-fuelled electricity equivalent to the annual consumption of approximately 400,000 households. This production accounts for over 40% of biomass-fuelled renewable energy produced in Spain.

The idea of *The Value of Forest Biomass* is thus to share this expertise and to provide a simple and concise description of the advantages of energy production based on forest biomass crops, a natural and renewable resource which is the best alternative to meet our Society's demands for energy.

ENCE plans to increase its biomass-fuelled renewable energy in Spain by 210 MW. With this investment plan, ENCE's installed power would amount to be 390 MW.

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what are renewable energies and biomass?

Renewable energies are so called because they are obtained from ***natural sources*** which are virtually ***inexhaustible***.

Renewable energies include hydroelectric, solar, wave, wind, geothermal energy, as well as ***biomass.***

Biomass is an organic material which ***arises from biological processes*** which are either spontaneous or are intentional, such as crops..

Forest biomass derives from ***wood grown*** by means of forest management practices, wood residue and hillside clearing.

Forest energy crops are forest plantations which have a ***(short) harvest period*** of two or three years, depending on the species, climate and soil.

Forest biomass is a natural and renewable energy

What are renewable energies and biomass?

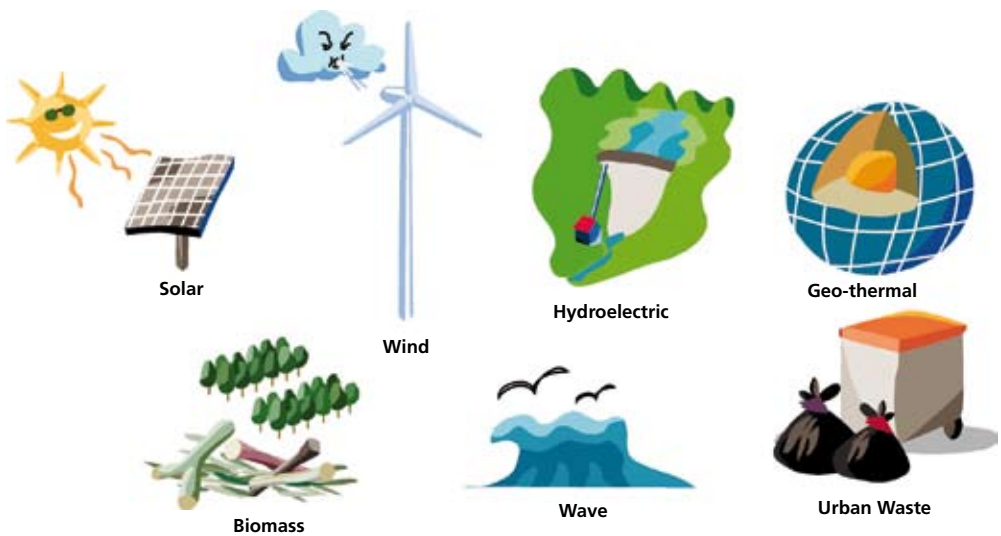
We can split energy sources into two major categories:

- **Fósiles,** como son el carbón, el petróleo, el gas natural o la energía nuclear.
- **Renewable energies,** such as hydroelectric, wave, geothermal, solar, wind and biomass y la biomasa.

SOURCES OF FOSSIL FUELS

Coal | Oil | Natural Gas | Nuclear Energy

RENEWABLE ENERGY SOURCES



Solar | Wind | Hydroelectric | Geo-thermal | Biomass | Wave | Urban Waste

Renewable energies are so called because they are obtained from natural sources which are virtually inexhaustible, some because of the huge amount of energy they contain and others because they can be regenerated by natural means.

Biomass

Biomass is an organic material arising from a biological process which can either be spontaneous or intended.

Biomass can be divided into two main groups, depending upon its origin:

Forest biomass

Biomass deriving from forest management practices (selection of shoots and sanitary cutting) and that used from wood residue (branches, bark, treetops and stumps or (roots).

Depending on the size of the forest biomass particle, it can be bulk (whole), pre-ground, ground or chipped.

What are forest energy crops?
Forest energy crops are forest plantations which have a harvest period of two or three years, depending on the species. They are managed in virtually the same way as forest crops for other industrial applications.

Residual biomass

Biomass deriving from livestock residue (slurries), agricultural waste (residue of grains, cotton, etc), tree and woody residue (from pruning, changes of variety/species) and industrial residue (rejected wood, dull edges, residual lignin, etc).

Biomass can derive from forest management practices (forest) or from tree residue (residual)

A natural and positive process

R&D / Nurseries | Plantations and Forest Management | Use of wood and biomass

Forest development and climate change

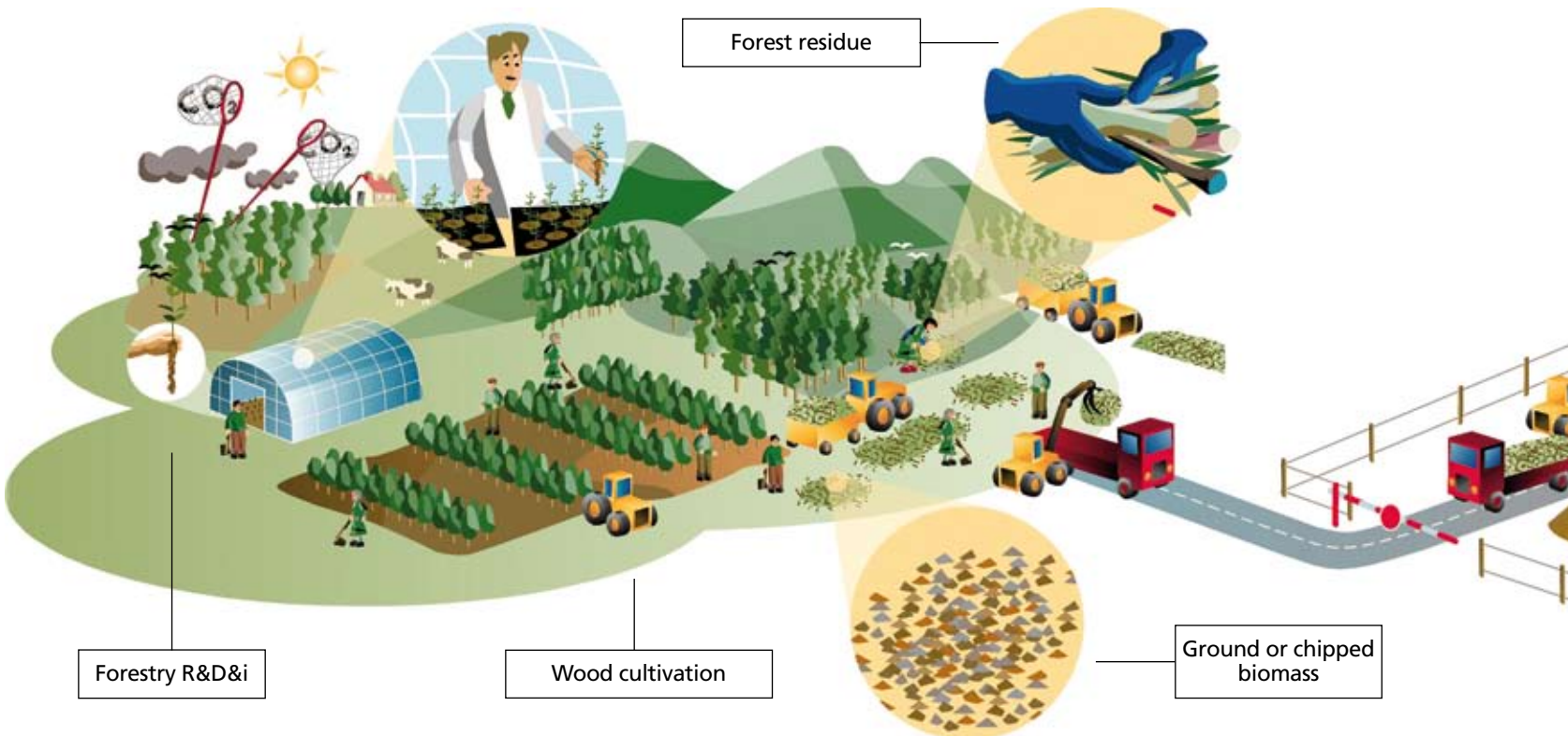
ENCE creates, looks after and uses forest masses, regenerates degraded hillsides and protects natural forests, thus retaining millions of tons of CO_2 and making an active contribution towards fighting climate change.

Energy crops

Energy crops are forest or agricultural plantations used for energy production.

Forest plantations

Forest plantations are mass deposits of CO_2.



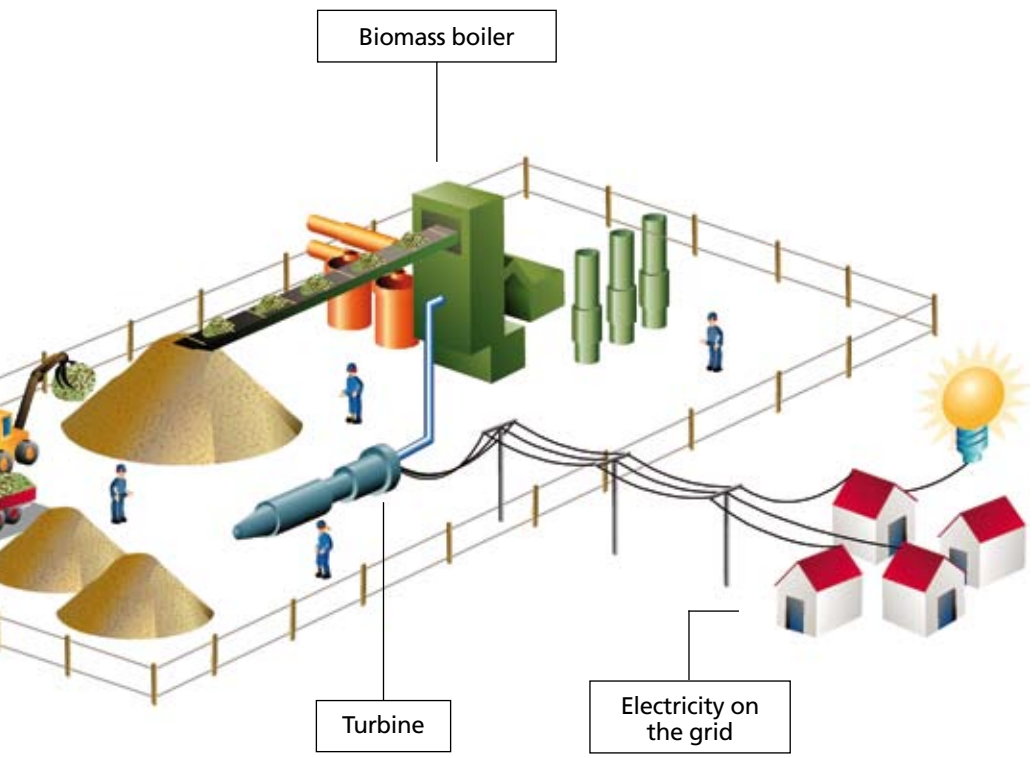
Transportation | Production of renewable energy | Distribution to grid

Energy

Biomass is used as a fuel to obtain the steam which drives the turbine from which electricity is generated

Biomass as an energy source

Forest biomass is a natural and renewable energy source.



Generating 1 MW of energy with biomass means:

11 jobs
direct, subcontracted, indirect

91%
10 jobs in the rural and forest medium

9%
1 jobs in the industrial field

\+ 9 induced jobs

Planting and cultivation of
250 hectares of irrigated land

A surface area equivalent to 250 football pitches

1 hectare = 1 football pitch

8.000 MW h
of renewable energy

Equivalent to the annual electrical consumption of approx. 2,500 households

Capture of **6.250 Tn** of CO_2 per annum

Climate change, sustainability and advantages of forest biomass

- ***More than half of the CO_2 given off*** is due to ***electrical generation*** and methods of ***transport.***

- ***Governments and international institutions*** attempt to promote ***measures geared towards reducing*** what are known as ***Greenhouse Gases (GG)*** and which promote the use of renewable energies.

- ***Spain established renewable energy targets*** for 2010 ***which it has failed to comply*** with and the European Union has set even more demanding targets.

- Energy production by means of ***forest biomass*** offers ***environmental, social and energy efficiency advantages*** making it unique with regard to other renewable energies.

did you know that?...

- Forest crops act as ***mass deposits of CO_2*** and their use for energy purposes would enable European Union targets to be met.

- Development of forest biomass promotes - more so than any other renewable energy - the ***creation of jobs and the revitalisation of rural and agricultural areas.***

- Development of forest biomass ***would improve Spain's balance*** of payments through reducing the import of fuels and CO_2 emission rights..

- Forest management of biomass ***reduces the risk of forest fires*** and expenses associated with preventing and extinguishing them.

- Biomass is a the most stable of all renewable resources, capable of ***producing energy 24 hours a day*** given that it is not dependent on wind, sunshine or flowing water.

- ***Biomass*** is also ***manageable***.

- ***Spain*** has ***unique conditions*** for the ***natural productive development of biomass.***

Climate change, sustainability and advantages of forest biomass

Spain has only executed 13% of its biomass-fuelled generation capacity estimated for 2010

Climate change, which is largely caused by increased emissions caused by the higher energy consumption worldwide, is a global cause for concern.

Over half of the CO_2 given off to the atmosphere derives from electrical generation and transport, two sectors in which steps are being taken to promote **more ecological alternatives such as biomass** and biodiesel.

Governments and international institutions attempt to promote measures geared towards reducing what are known as Greenhouse Gases (GG).

In 2005, Spain set growth targets relating to biomass-fuelled energy for 2010, targets which have not been met: only 9% of the estimated generation power has been executed. 152 MW of new projects between 2004 and 2009 compared with 1,695 MW estimated new installations.

In 2009, the European Union published the **20/20/20 Plan** , compelling Spain to prepare a new renewable energies plan in 2010 which might enable it to reach the new targets set by the European Union (see summary in Appendix, page 41).

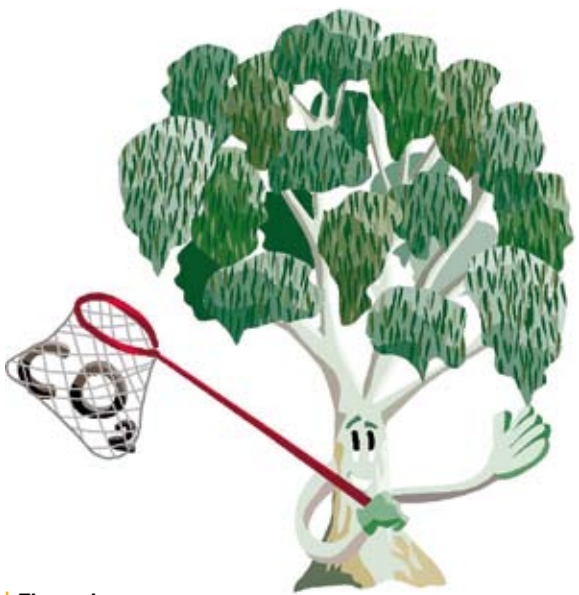
Forest biomass as an energy source

Specifically, electrical generation by forest biomass poses three major advantages which make it **unique when compared to other renewable energies:**

1. It is the most **environmentally-friendly source of renewable energy** and multiplies the reduction of emissions when compared to fossil fuels.

2. Given that its productive potential can be cultivated and strengthened, **it is the renewable energy which creates the greatest employment** per unit of energy produced, while cultivating biomass also creates wealth and social cohesion, particularly in degraded rural fields and areas, thus providing an alternative to agricultural labour.

3. **It is the most stable of all the renewable energies,** capable of producing energy 24 hours a day: it does not depend on the wind blowing, the sun shining, or water flowing; it is the cheapest to produce, and our country has unique characteristics for its development, which would help to bring down Spain's energy imports.



Electrical generation by means of forest biomass creates wealth and social cohesion, reduces energy imports and is environmentally-friendly.

Biomass-fuelled electrical generation would mean savings of up to 12 Million Tons of emissions of CO_2

1. Environmental Advantages

In addition to the environmental advantages deriving from sustainable forest management, described in *Sustainable Forest Management and Eucalyptus,* where a concise summary is presented of the positive impact in terms of capture of CO_2, biodiversity, water balance and forestry, forest biomass used as an energy source is able to meet four environmental demands directly relating to Society's current priorities:

- Compliance with environmental targets established worldwide.
- Mass capture of emissions of CO_2..
- Fewer forest fires on our hillsides and their reforestation
- Reutilisation of forest, agricultural and industrial waste.

Compliance with environmental targets established worldwide

By developing energy with biomass, Spain would be able to comply with the environmental targets set out in the international agreements for the reduction of greenhouse gases.

With regard to the **Kyoto Protocol:**

- The **objective of the EU** is to reduce Greenhouse Gas emissions by 8% between 1990 and 2012.
- The **target of Spain:** Greenhouse gas emissions equivalent to ~330 M Tn CO_2 (15 % increase with regard to 1990).
- **Biomass-fuelled generation would imply** a saving of up to 12 Mn Tn of CO_2 emissions if taking advantage of its entire generation potential in Spain, compared with 5 Mn Tn of the targets set out in Spain's Renewable Energies Plan (Plan Español de Energías Renovables, PER) 2005-2010**.**

With regard to the **2020 Plan:**

- The **target of the EU** is that 20% of final consumption of gross energy should derive from renewable sources (the current degree of penetration is 9.1%).
- The **target of Spain** is the same; in our country, biomass could cover a significant part of the Directive's target for Spain: 19% if 100% of its potential is taken advantage of for electrical generation and up to 70% if its potential for thermal generation is taken advantage of.

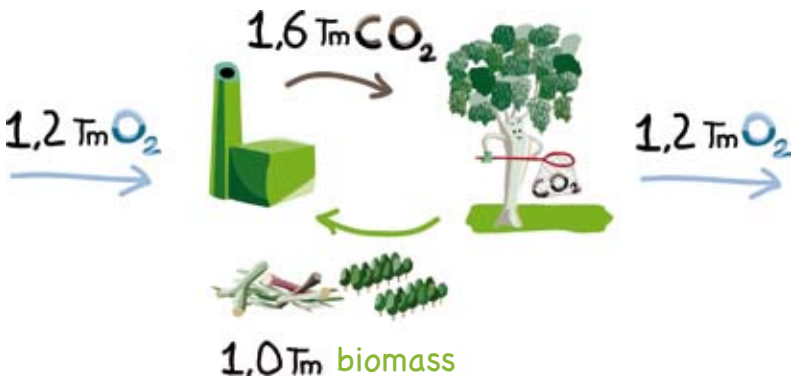
Mass capture of emissions of CO_2

Biomass presents a **positive balance in the capture of emissions of CO_2.**

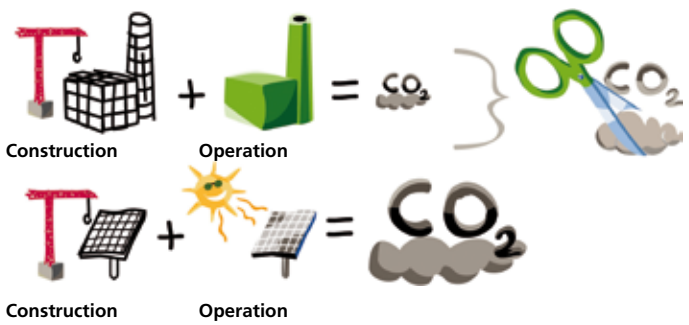
Plantations of forest crops act as **mass deposits of CO_2.**

The CO_2 emitted in energy generation **is lower than that captured** from the atmosphere previously by forest crops.

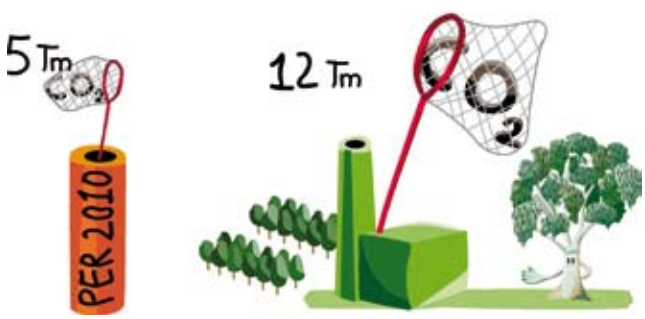
Furthermore, the CO_2 capture process **is particularly efficient in energy forest crops**



Furthermore, **the complete cycle of CO_2 emissions** in building and operating a biomass plant is more favourable than with other renewable energies.



The development of biomass-fuelled energy in Spain would imply savings of up to 12 Million Tons of CO_2..



The amount of CO_2 captured from the atmosphere is higher than that given off when generating energy with biomass

Spain's target of reducing its CO_2 emissions by 5 million tons would be increased to 12 million tons if biomass were used to generate energy.

The risk of forest fires would fall by 70% with the management of forest biomass on our hillsides

Reduction of forest fires and reforestation

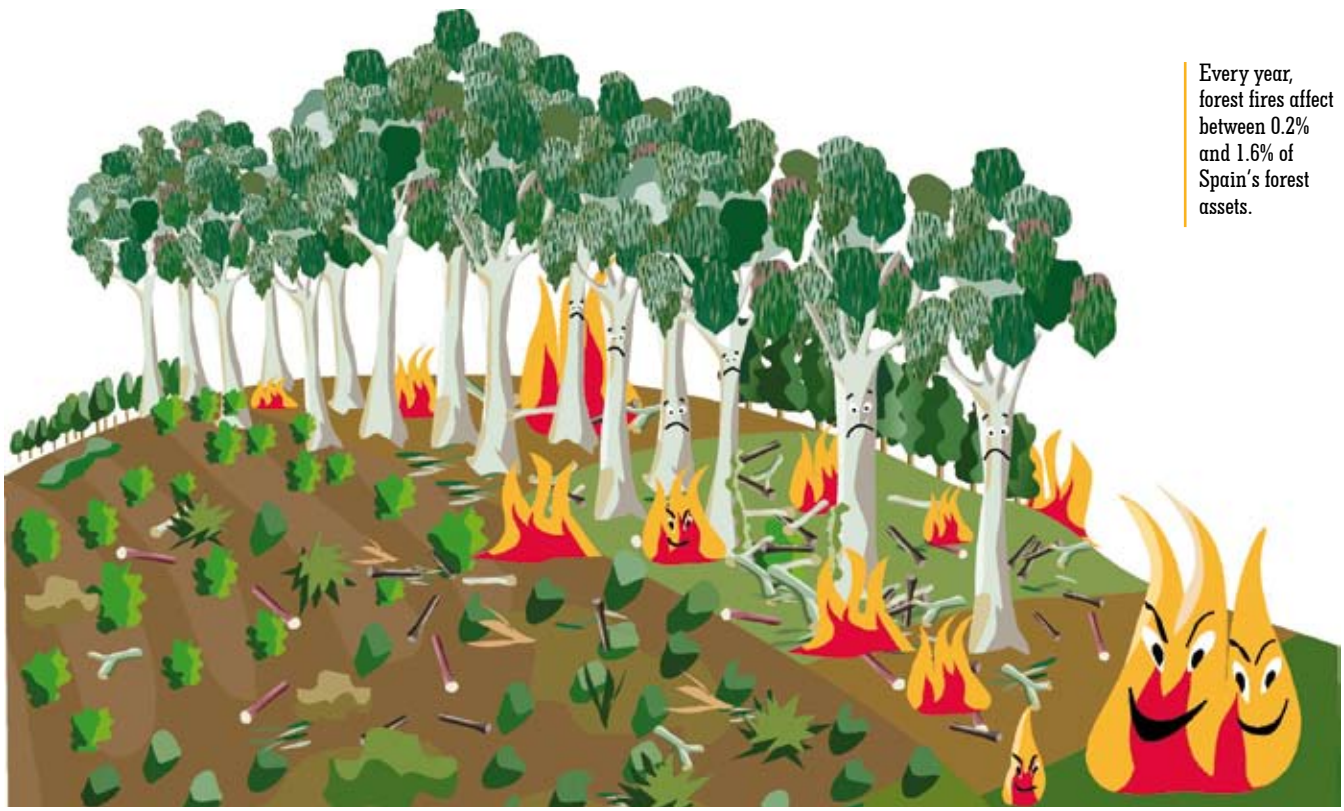
Sustainable forest management, specifically that relating to the gathering and cleaning of the biomass which builds up in woodland, **offers three extremely valuable environmental advantages:**

- Reduced risk of forest fires.
- Improved use of spaces.
- Supporting the natural regeneration of the primary mass.
  - Lesser risk of forest plagues.
  - Increased quality of trees.

As far as reducing forest fires is concerned, forest biomass management **would enable the risk of forest fires to be reduced by 70%.**

Every year, forest fires affect between 0.2% and 1.6% of Spain's forest assets. Biomass means forest fires can be prevented due to regular forest cleaning, the gathering of agricultural waste and the pruning of fruit trees.

In ENCE's woodland, in which forest residue is gathered for biomass, the percentage of forest surface area which has suffered forest fires is 71% lower than that registered in the total national forest surface area.

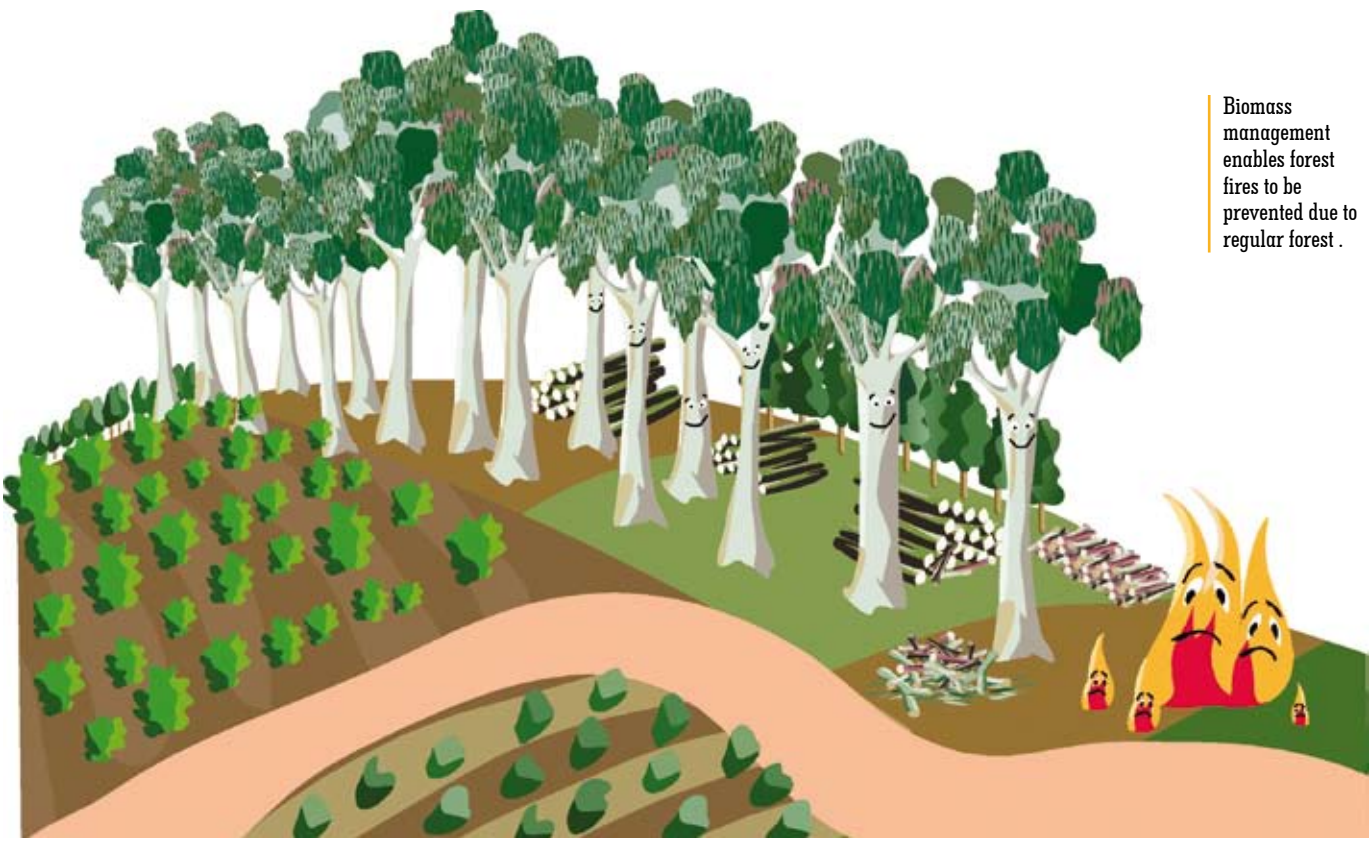


Every year, forest fires affect between 0.2% and 1.6% of Spain's forest assets.

Reutilisation of forest, agricultural and industrial waste

Furthermore, with regard to the reuse of forest, industrial, agricultural, livestock and agro-industrial residues, the use of biomass has an impact upon:

- **The reduction of spillages** and uncontrolled burning of agricultural waste.
- **Closure of the hillside-industry chain,** eliminating residues from lack of market or shortfall of technology, thus resolving problems of accumulation and elimination.
- Less risk of contamination.
- Reduction of visual contamination.
- **Taking advantage of residues** after their conversion in the energy production process.
- **Reducing costs** of industrial treatment.
- Increased **value of woodland**.



Biomass management enables forest fires to be prevented due to regular forest .

2. Social and Economic Potential

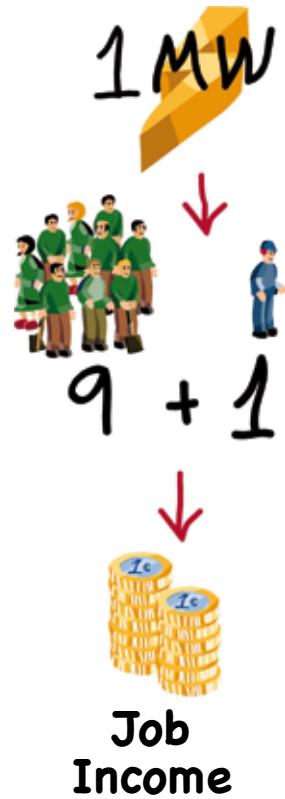
The latest studies performed regarding the socio-economic impact of biomass development in Spain reveal surprising positive results.

Biomass could help to improve Spain's balance of payments

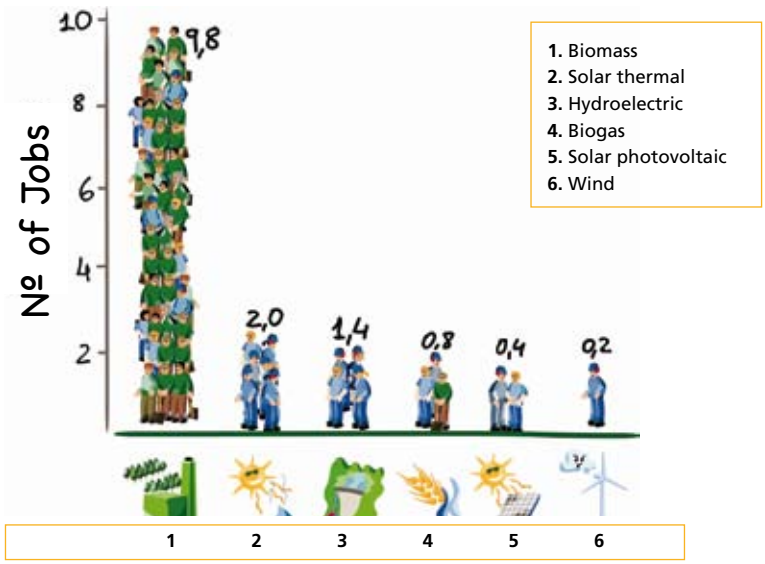
Did you know that?...

...Development of energy with biomass could create 2,000 million euros of job income and more than 80,000 jobs?

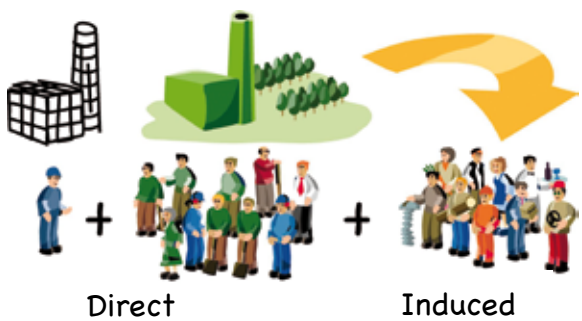
Biomass development means nine induced jobs can be created through each MW installed. Over 90% of the employment created by promoting biomass-fuelled energy is rural and forest-based.



EMPLOYMENT BY MW AND ENERGY TYPE



This contribution towards creating jobs is particularly valuable in the current setting, given that the agricultural sector is one of those most affected by unemployment in Spain.



Developing energy with biomass enables jobs to be created in the agricultural sector, thus proving beneficial to society in general.

… Developing biomass helps to promote cohesion and the development of the rural environment in a context of reduced subsidies?

Subsidies to the rural sector are falling very sharply:

- EU support funds to agricultural activity in Spain have fallen by 9.5% from 2005-2008.
- From 2013, there are uncertainties about European subsidies.
- This reduction is prompting farmers to abandon their crops.

Development of biomass-fuelled generation is an alternative which can be used to maintain agricultural and forest activity in Spain.

- Generation of incomes in a setting of falling grants and subsidies.
- Projecting certainty into the rural medium, installing assets which can ensure that incomes will be maintained over more than 25 years.

Reaching the installation levels estimated in the PER would imply €84Mn of annual revenue in the rural medium, with a potential of €225Mn.

€225 mn of revenue in the rural medium

Did you know that?...

Did you know that?...

...Taking advantage of biomass could be an important way of contributing to national investment?

70% of investment in biomass is carried out with national suppliers.

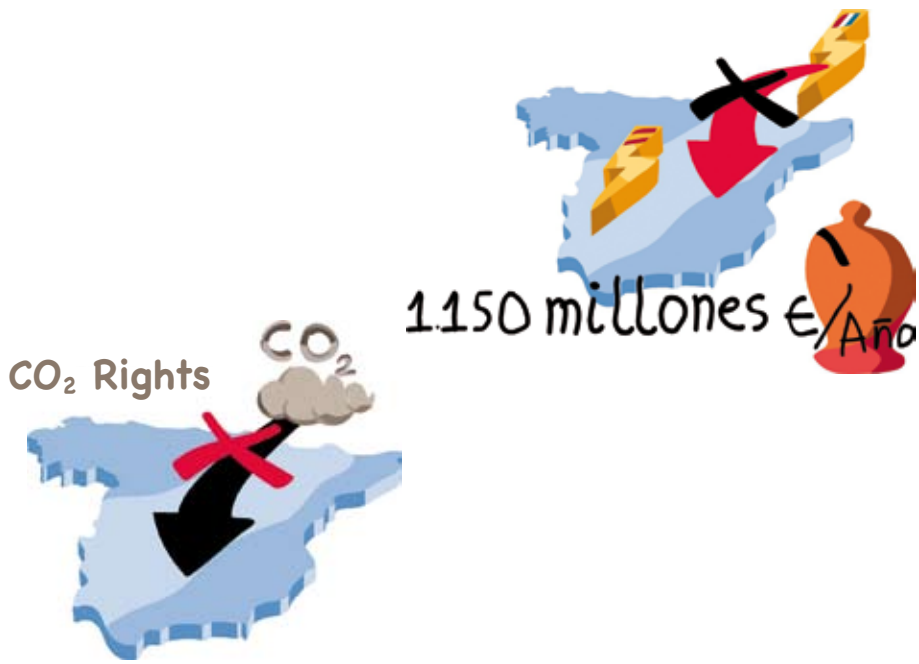
Furthermore, biomass generates VAT payments, unlike wind and solar energy.

...Spain invests 2-4% of GDP in energy imports in the context of a deficit balance of payments?

Biomass could help to improve the balance of payments by €1,350 Mn/year if all its potential is fully realised.

- Developing biomass could eliminate €1,150 Mn/year of energy imports.
- Developing biomass could eliminate €200 Mn/year of imports.

Thanks to biomass it would be possible to reduce the cost of energy imports and CO_2 rights.



Did you know that?...

…the potential use of forest biomass in Spain would enable approximately 14,500 jobs to be created?

Spain has 6.5 million tons of forest residue on its hillsides, residues which are not taken advantage of; it would also be possible to make use of 350,000 hectares of energy crops which would provide 7 million tons of green biomass per annum.

Taking all this into account, it would be possible to install 1,296 MW of renewable electrical generation power, which would give rise to 14,256 jobs.

…Development of forest biomass could enable forest fire expenses to be reduced to €104 Mn/year?

Every year, the Government and the Autonomous Communities spend €650 Mn on forest fires. Forest fires give rise to economic losses of ~€900Mn per annum.

Development of forest biomass could enable forest fire expenses to be reduced to €104 Mn/year, if all the potential were realised

Biomass would enable national and autonomous administration to save costs relating to forest .

Biomass is an alternative which can be used to maintain agricultural and forest activity in Spain

… current regulation leads us to export biomass abroad, which implies a high cost of opportunity for Spain?

Spain exports in the region of 375,000 tons of timber, sawdust, woods and musts to other countries. These exports were made to countries which are developing generation with biomass.

This export represents a very significant cost of opportunity:

- Lower contribution to compliance with Kyoto and Plan 20/20/20 targets.
  - 250-300 GWh of electricity are not generated from renewable sources in Spain.
  - This does not prevent the emission of 105,000 Tn of CO_2 in Spain, as the equivalent amount of electricity has to be generated with fossil fuels.

- Lower contribution to socio-economic development in Spain:
  - The investment necessary for generation with biomass to process a volume equivalent to the exports amounts to €98 Mn.
  - 370 direct jobs and 338 induced jobs, with job incomes of €9.5 and 8.6 Mn / year, respectively, are not created.
  - In addition to the job incomes, the rural medium loses out on income of €16.6 Mn/year.
  - The use of biomass exported for electrical generation in Spain would have improved Spain's balance of payments by €12.3 Mn/year.
    - €10.4 Mn due to lower energy imports.
    - €1.9 Mn due to lower imports of CO_2 rights..

- Lesser contribution towards stability of the energy supply:
  - Use of biomass exported in Spain would have enabled the installation of a further 37.6 MW of biomass, which would help to cover peak demand and grid stability.

The export of 375,000 Tn of wood means that Spain does not take advantage of benefits which would be generated if biomass-fuelled energy production were promoted in Spain.

3. Stability and Energy Autonomy

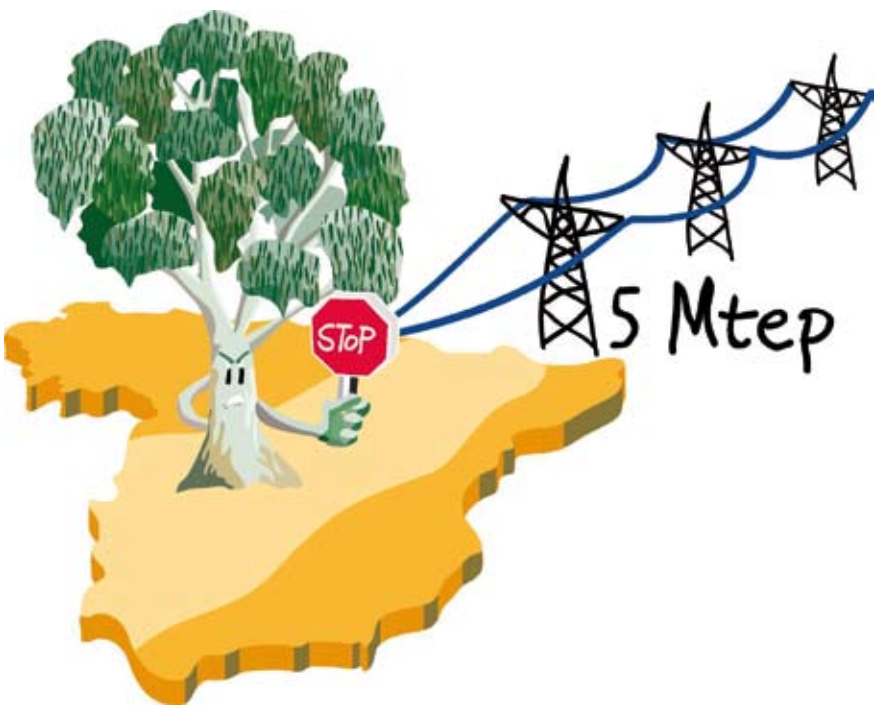
Biomass is able to produce energy 24 hours a day

Biomass is a the most stable of all renewable resources, capable of producing energy 24 hours a day given that it is not dependent on wind, sunshine or flowing water. It is manageable, unlike wind or solar.

Did you know that?...

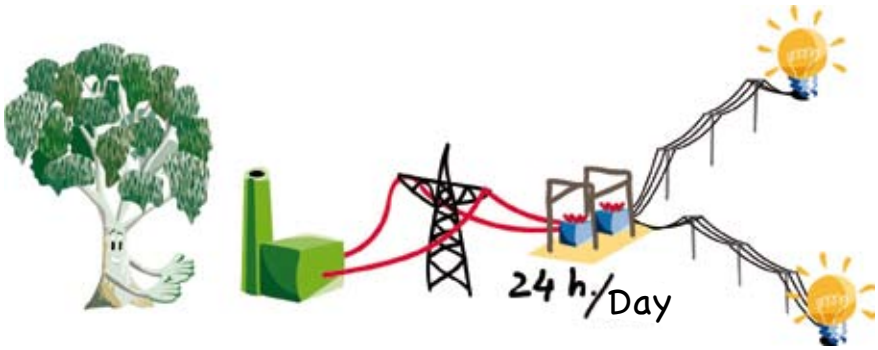
Biomass could lower Spain's high degree of energy dependence on countries abroad

If all its potential were harnessed, biomass could prevent up to 5 Mtep/year of energy imports.



Biomass is the renewable energy which contributes most to grid stability

Biomass is the only renewable source with guaranteed energy supply to the grid. In many cases, biomass can be installed close to the centres where it is consumed, thus reducing grid losses.



Furthermore, generation with more balanced distribution enhances reliability and prevents saturation.

- Improved system response in the event of a shutdown in a plant (vs. co-combustion or development of large plants).
- Lower degree of saturation of the transmission and distribution grid, due to the greater proximity between generation and consumption.

Energy supply to the grid is guaranteed with biomass

Biomass is the most stable renewable energy in energy supply to the grid.

ENCE as producer renewable energy with biomass

- For over fifty years, ENCE ***has produced renewable energy*** with ***biomass*** deriving from process forest residue.
- With 180 MW of installed capacity, ***ENCE is the largest Spanish producer*** of renewable energy with ***biomass***.
- In ***2009, ENCE*** started up the ***largest biomass plant in Spain***, with installed capacity of 37 MW and an annual consumption of 380,000 tons of forest biomass.
- Every year, ENCE ***manages 3.5 million m3 of wood***, tantamount to operating a woodland surface area of 350,000 hectares.
- ENCE has the ***largest amount of proprietary woodland in*** Spain and unique experience in sustainable management and in the development of forest energy crops.
- ***ENCE's activity in R&D&i*** , seeking the best species and techniques applicable for improving crop productivity, makes it a ***global touchstone in terms of applied forest research.***

ENCE as a producer of renewable energy with biomass

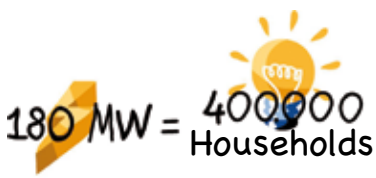
Due to its leading position in the European eucalyptus pulp industry, ENCE is most known for manufacturing paper pulp.

But in fact ENCE's activity as a company goes far beyond that: it is a company which specialises in creating and cultivating forest masses, maintaining them and obtaining wood and biomass which it also uses to generate renewable electrical energy.

Did you know that?...

- ENCE is the largest Spanish producer of renewable energy with biomass.

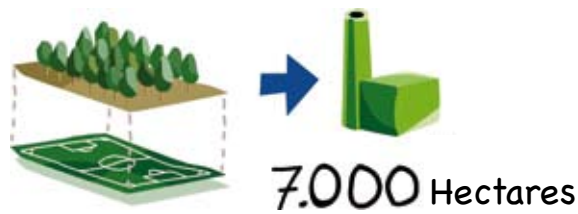
- It manages over 80,000 hectares of woodland, over 50,000 of which are proprietary.



- With 180 MW of capacity, it generates energy equivalent to the annual consumption of 400,000 households.

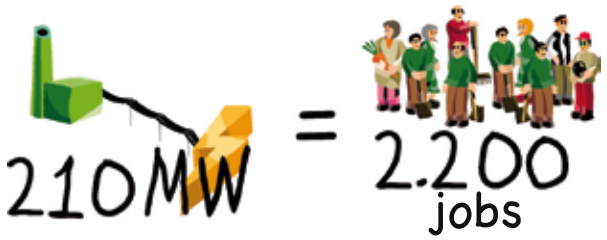
- It operates over 3.5 million m3 of wood every year.

- For over 50 years, ENCE has produced renewable energy with biomass deriving from process residue.



- It currently has in the region of 7,000 hectares planted with forest energy crops.

- It investigates 10 forest species especially appropriate to see which are the best energy crops in our country.



- ENCE has a Plan to install 210 MW of renewable energy with biomass in Spain, which would give rise to 2,200 jobs in the rural and forest medium.

30 Hectares

- It has over 30 hectares of forest test plots for research and development.

8 million

- It operates the most advanced nurseries with over eight million "baby trees" which are being prepared to be energy crops.

ENCE is the leading biomass-fuelled energy company in Spain

For over 50 years, ENCE has been generating renewable electrical energy with residual forest biomass from the pulp manufacturing process.

The company has an installed capacity of 229 MW, 180 MW of which use biomass as a fuel, making ENCE the largest Spanish producer of biomass-fuelled renewable energy.

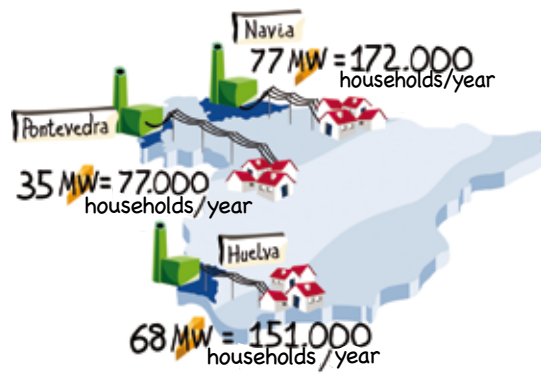
Largest Spanish Producers of Energy with Biomass

Company [1]	MW
Ence	**180**
Rest pulp-paper industry [2]	60
Valoriza	43
ECYR	32
Acciona	25
Rest fragmented in small plants	140
Total CNE (January 2010)	480

Source CNE / ENCE own information. Referring to Groups b6 and b8.
(1) Referring to plants in operation. Does not include projects under execution.
(2) Torras Papel, Zicuñaga, Pastguren, Smurfit, Sangüesa.

ENCE currently produces energy in its industrial plants of Huelva, Pontevedra and Navia (Asturias).

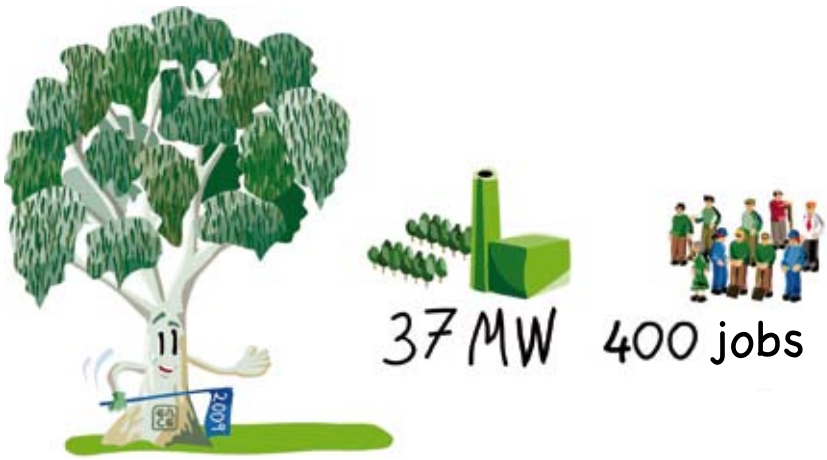
- The **ENCE Pontevedra** plant has an installed capacity of **35 MW** , capable of generating electricity tantamount to the annual consumption of 77,000 households.
- The **Navia plant** has a forest biomass plant with power of **37 MW** , the largest in Spain, and also has **40 MW** of installed capacity with biomass from the process. 77 MW capable of generating electricity equivalent to the annual electrical consumption of 172,000 households.
- The Huelva plant has **68 MW** of installed capacity with process biomass and **49 MW** of co-generation with gas and biomass. The energy generated with process biomass is equivalent to the annual electrical consumption of 151,000 households.



In 2009, ENCE started up the largest biomass electrical plant in Spain

With installed power of 37 MW, this plant is associated with the management of 380,000 tons of biomass per annum, giving rise to the creation of 400 jobs (direct, indirect and induced).

In 2009, 400 jobs were created through the installation of the Navia plant



ENCE is an expert in forest management and the largest Spanish owner of proprietary woodland

- ENCE manages approximately 3.5 million cubic metres of wood for its plants.

- In Spain, it manages over 86,000 hectares of woodland (approx. 50,000 hectares are owned).

- This experience in management of forest assets is applicable to the development of energy crops and the obtaining of forest biomass.

Forest research and energy crops

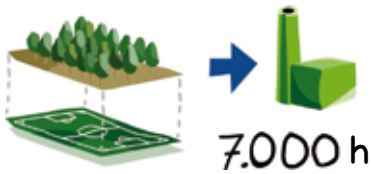
Unlike residues, forest energy crops have a potential efficiency higher than any other renewable source, allowing the competitiveness of biomass as an energy source to be increased.

Through important investments in applied research, ENCE seeks the best species and techniques in order to obtain the highest possible yields from its forest energy crops and so optimise biomass development in Spain.

Forest energy crops have a greater potential efficiency than any other renewable source

Did you know that?...

ENCE is the world leader in forest innovation and research applied to energy crops?



- It currently has in the region of 7,000 hectares planted with forest energy crops.

- It investigates 13 forest species which are particularly appropriate to be potentially the best energy crops adapted to the different land conditions existing in Spain.

- It operates the most advanced nurseries with over 8 million "baby trees" which are being prepared to be energy crops.

- ENCE has achieved important breakthroughs in genetics with eucalyptus and the development of energy crops and specific machinery.

- It has over 31 hectares of forest test plots for research and development.

- It has over 20 researchers exclusively dedicated to innovation and development.

Forest research applied to energy crops

ENCE es el líder mundial en I+D+i forestal aplicada a cultivos energéticos

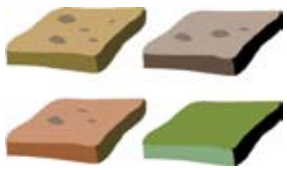
Which forest species are chosen to be investigated as energy crops?

Those which have:

- The greatest vigour and the most precocious growth.

- The highest capacity for accumulation of energy per unit of weight.

- The highest capacity for regrowth.



- Greater strength to adapt to different conditions (agricultural and marginal terrains).

Did you know that ENCE has already researched and chosen the best species from a list of thousands and thousands?

For over 20 years, ENCE has been dedicated to applied forest research; specifically in energy crops, the company has selected three genera (with different species) which owing to their characteristics are the most appropriate to be grown in accordance with the soil and climate conditions:

- Eucalyptus
- Poplars
- Leucaena

Eucalyptus

Poplars

Leucaena

ENCE develops specific research lines for each one of the selected species:

- Ecology
- Reproductive material and rooting of species
- Plagues and illnesses (insects, fungi and bacteria which attack leaves, stem and the trunk)
- Forest management techniques
- Situation in Spain

ENCE is currently carrying out advanced experiments with 13 forest species which are potentially ideal in order to be used as energy crops.

ENCE invests in R&D in order to obtain better species

Investigation of plagues and illnesses.

Study of reproductive material and rooting of species.

Machinery used for forest collection.

R&D of forest management techniques..

ENCE's energy plan in Spain

ENCE has a plan to **increase its renewable energy with biomass in Spain by 210 MW.** With this investment plan, ENCE's installed power would amount to be 390 MW.

We are now in the process of building the largest forest biomass plant in Spain, in the province of Huelva; it will have 50 MW of installed power, equivalent to the electrical supply of around 600,000 households.

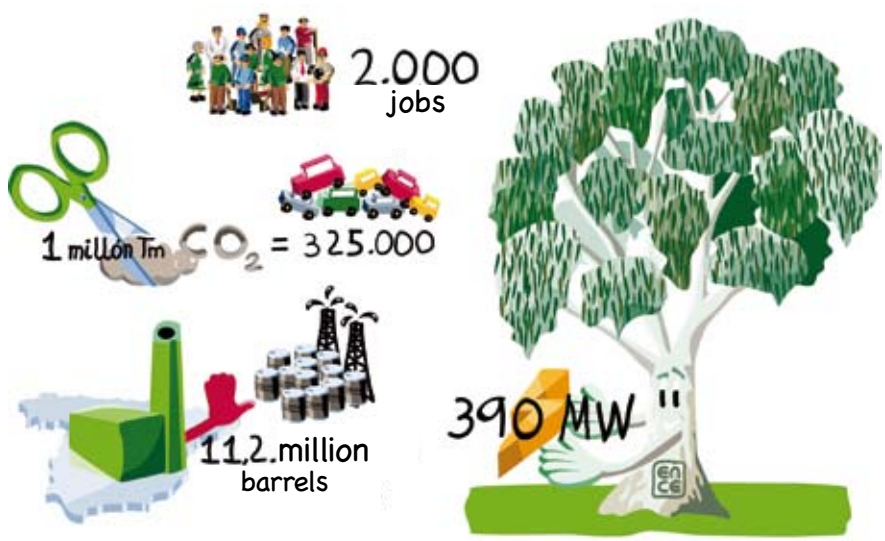
The generation of this new capacity will be associated with **energy crops and independent power plants.**

ENCE's plan is to build **10 electrical power plants** with biomass over the next four years, entailing an investment in the region of 500 million euros.

ENCE's plan includes installing 210 MW of energy with biomass over the next four years

Did you know that?...

- By installing this new capacity, **ENCE will be able to generate over 2,000 jobs** (direct, indirect and induced) through starting up the production of thousands of hectares of forest energy crops.
- **390 MW** is the same amount of energy used to supply the annual consumption of around 600,000 households.
- This electrical production has the **potential to reduce emissions of CO_2** by over one million tons a year, equivalent to the annual emissions of 325,000 cars.
- This electrical generation with biomass **would enable a reduction in imports of 1.5 million tons of oil**, or, to put in another way, 11.2 million barrels.
- This project **would allow Spain to reach a good part of its targets** for biomass-fuelled electrical generation.



APPENDIX

Energy targets in Europe and the situation in Spain

Energy targets in Europe and the situation in Spain

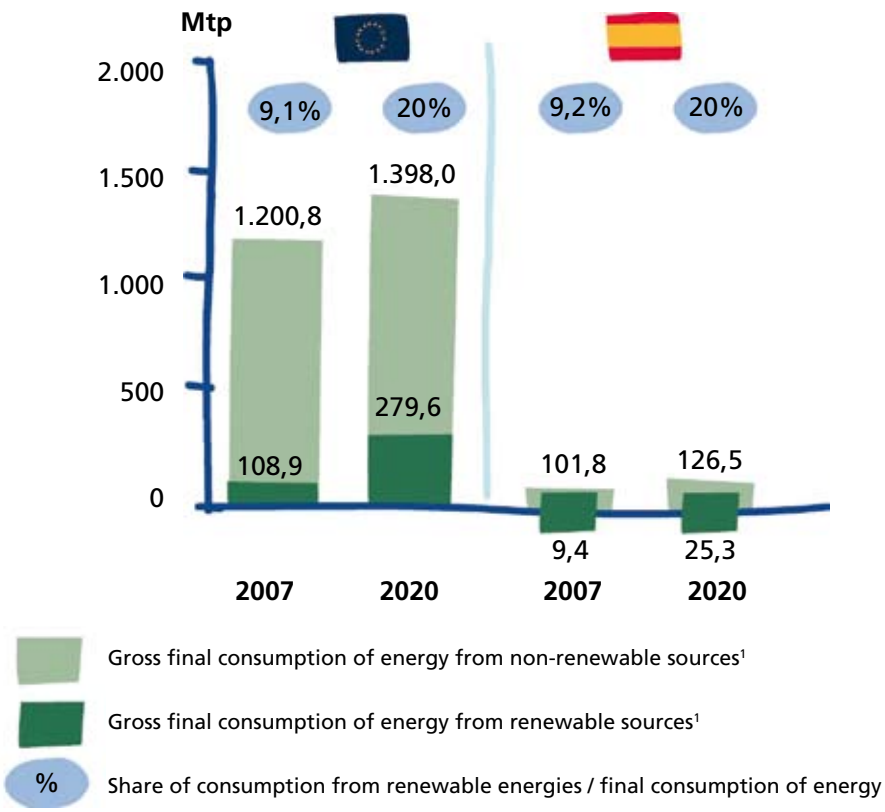
In 2009, the European Union published the **20/20/20 Plan,** which sets out the **new targets** for the generation of renewable energy for 2020:

- 20% of primary energy must be produced from renewable sources.
- Atmospheric emissions of CO_2 must be reduced by 20%.
- Energy efficiency must be increased by 20%.
- 10% of fuel for transport must be produced from renewable sources.

Each member state will have to notify the European Commission of its national plan of action.

In the 20/20/20 Plan, the energy generated from biomass plays a fundamental role

OBJECTIVES SET BY THE DIRECTIVE FOR THE EU-27 AND SPAIN



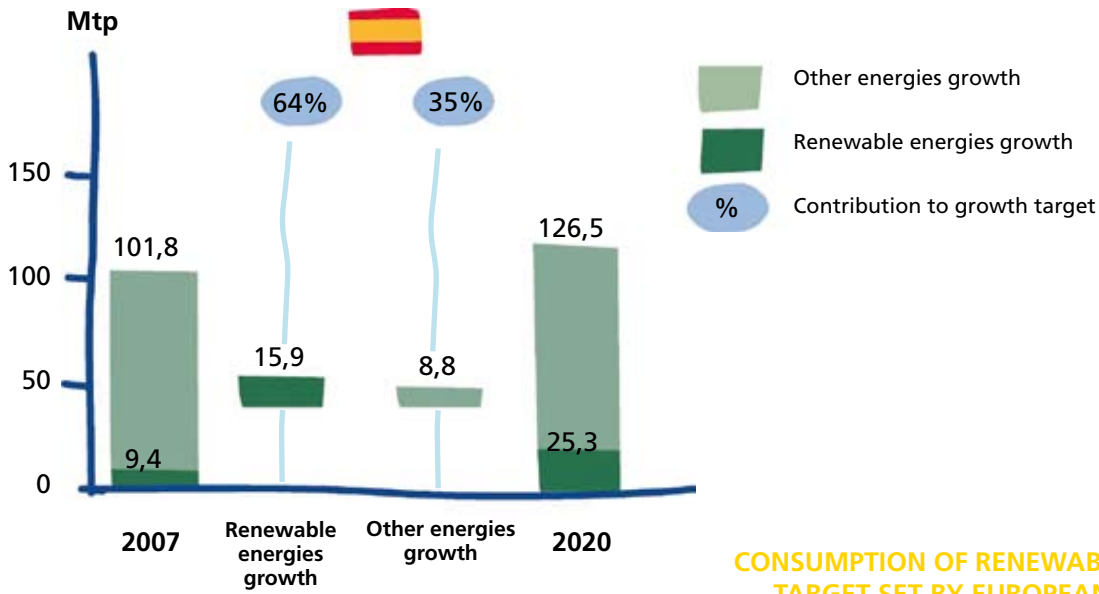
1. Data calculated using the methodology proposed in Directive 2009/CE.
Source: Eurostal, European Energy and Transport-trends 2030.

This new target means that Spain has to draw up a new Renewable Energies Plan, given that the PER 2005-2010 has not met its targets and the new demands for Spain are even higher.

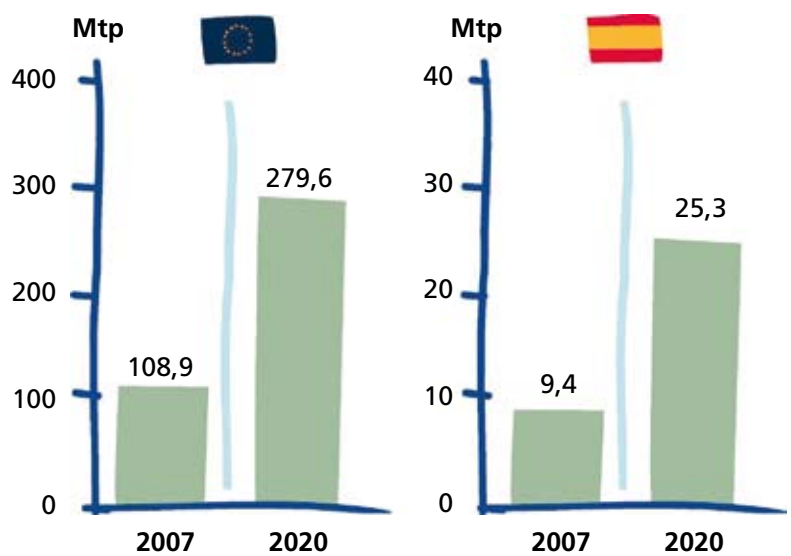
This plan is a **unique opportunity for Spain to promote development in forest biomass** in our country and to take advantage of the social, economic and environmental advantages associated with its production and exploitation.

In order for Spain to comply with the EU objectives, 64% of growth in electrical production in Spain has to derive from renewable energies, as against 86% for the entire EU.

GROWTH IN RENEWABLE ENERGIES FROM 2007 TO 2020



CONSUMPTION OF RENEWABLE ENERGY VS. TARGET SET BY EUROPEAN DIRECTIVE



Generation with biomass can play a decisive role in Spain's meeting its targets.

Biomass can achieve up to 70% of the targets set out for Spain in the EU Directive.

The data contained in this publication are based on the study entitled "Regulatory framework for the stable development of electrical generation with Biomass in Spain" performed by the Boston Consulting Group (BCG) in October 2009.

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