



# Roadmap 2020 report for France

## A REPAP project managed by EREC

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# REPAP

# 2020

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Renewable Energy Policy Action Paving  
the Way towards 2020

Intelligent Energy  Europe

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## Project Description

*The specific objective of REPAP2020 is to facilitate the process of implementation of the RES Directive on a national level. The main target group of the project are Parliamentarians and Civil Servants in national administrations as well as national industry associations.*

*REPAP2020 aims at supporting their political work in the field of Renewable Energy - mainly related to the Renewable Energy National Plans.*

*REPAP will - in a first phase before the notification of the RAPs to the European Commission - accompany the development of the RAPs by offering good advice to the relevant authorities on the design of the RAPs. Furthermore, REPAP2020 will empower national industry associations to come up with their individual RES roadmaps, which will serve as an important tool to influence the drafting phase of the RAPs.*

*In the second phase the project will evaluate the RAPs in order to facilitate a constant feedback and learning process. REPAP2020 will show good policy practices and highlight missing pieces in the individual RAPs.*

*REPAP2020 also aims at creating a network of key players in the field and at offering a platform for the RES industry as well as for Parliamentarians (both EU and national Parliaments) and National Administrations in charge of energy issues. These key actors will be involved both as input providers and disseminating partners. REPAP2020 shall enable them to express their views on the political process and help to improve the upcoming political decisions on RES within Europe and especially on the Member States' level.*

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## I. *Introduction*

The Directive on the promotion of the use of energy from renewable sources was adopted under French presidency of the European Union. This ruling sets a “renewable energy” target for Union members, fixing a proportion of renewable energy levels in final energy consumption to be reached by 2020. For France, appendix I indicates that renewable energy sources must represent 23% of final energy consumption at this date.

Naturally, this target depends on national production levels of energy from renewable sources, but also the energy management programme in place.

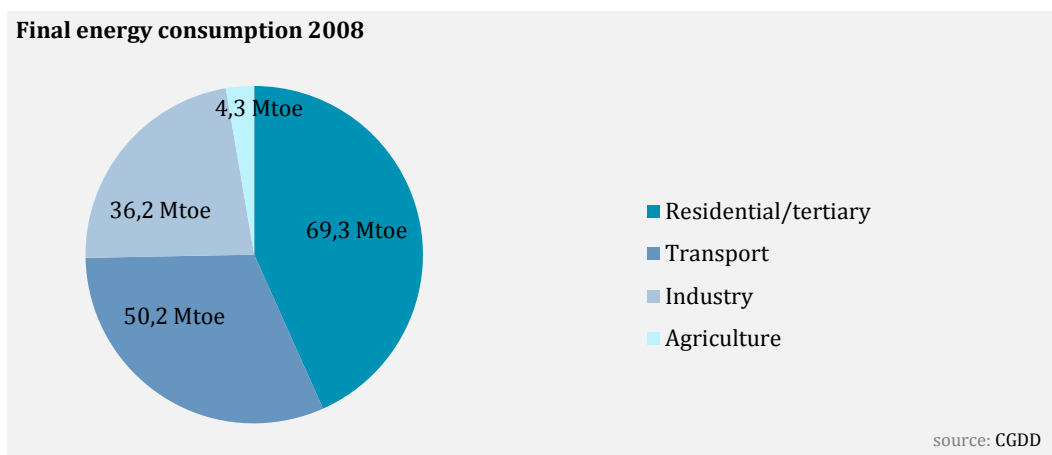
An analysis of the activity of various industries (i.e. wood and biomass, hydroelectricity, thermal and photovoltaic solar, geothermal, wind power and marine power) was undertaken in France during the first quarter of 2008 by the “renewable energy sources” operating committee, created at the request of the French President. This operating committee continued the work of the first phase of the “Grenelle” environment think tank, a new and original exercise launched in July 2007.

This operating committee was presided by Jean-Claude LENOIR (UMP) and Alain LIEBARD (President of the Renewable Energy Observatory) and brought together numerous representatives: employers’ associations and professional organizations, trade unions, non-governmental organizations, major energy companies, consumers’ associations and public authorities and bodies.

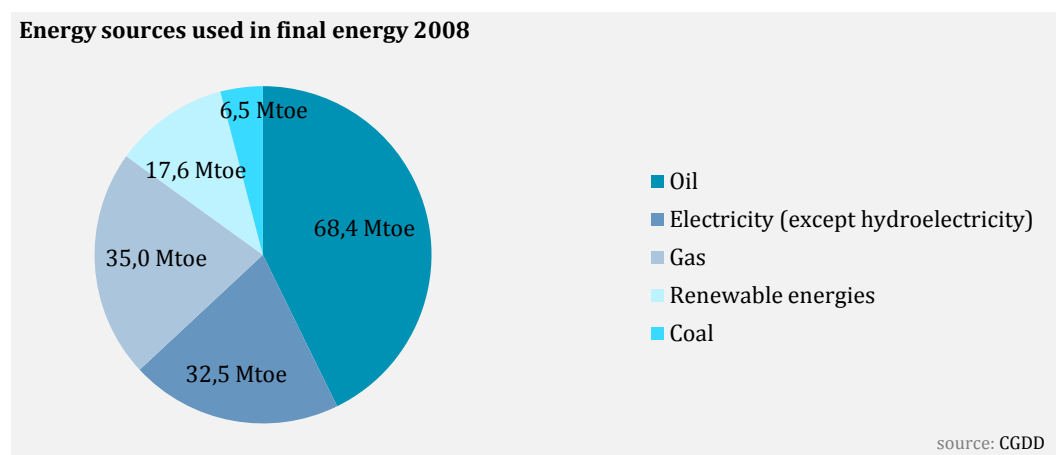
The committee also highlighted a number of holdbacks that needed to be tackled to reach the targets. The object of this present report is mainly to update the operating committee’s recommendations based on market observations at the end of 2007.

## ii. *The renewable energy situation in France in 2008*

According to the energy observatory, France consumed 175.3 million tonnes of petrol equivalent (Mtoe) in 2008, of which 160 Mtoe were for energy usage. Final energy consumption was used in four main sectors (residential/tertiary, transport, industry and agriculture) and can be broken down as follows:



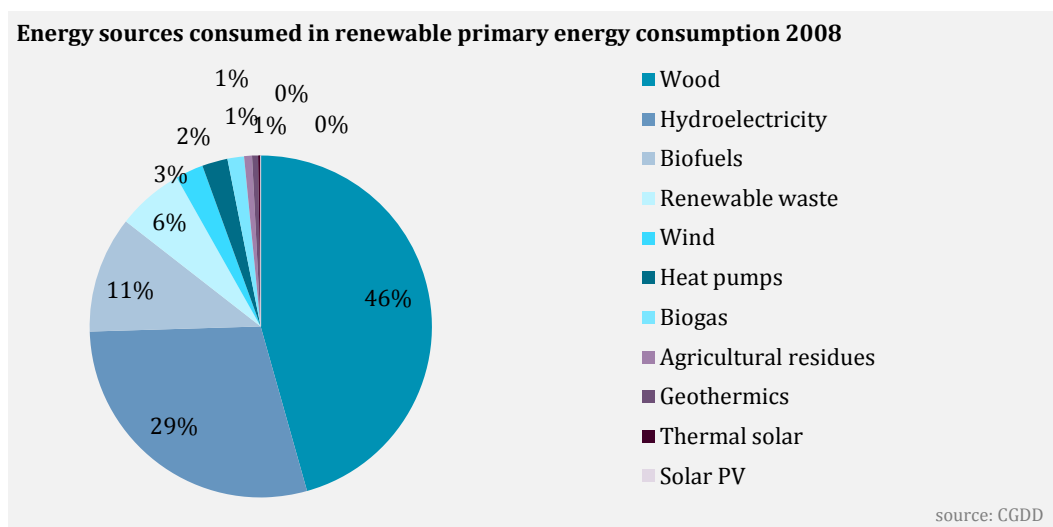
The energy sources used to meet the country's final energy needs are as follows:



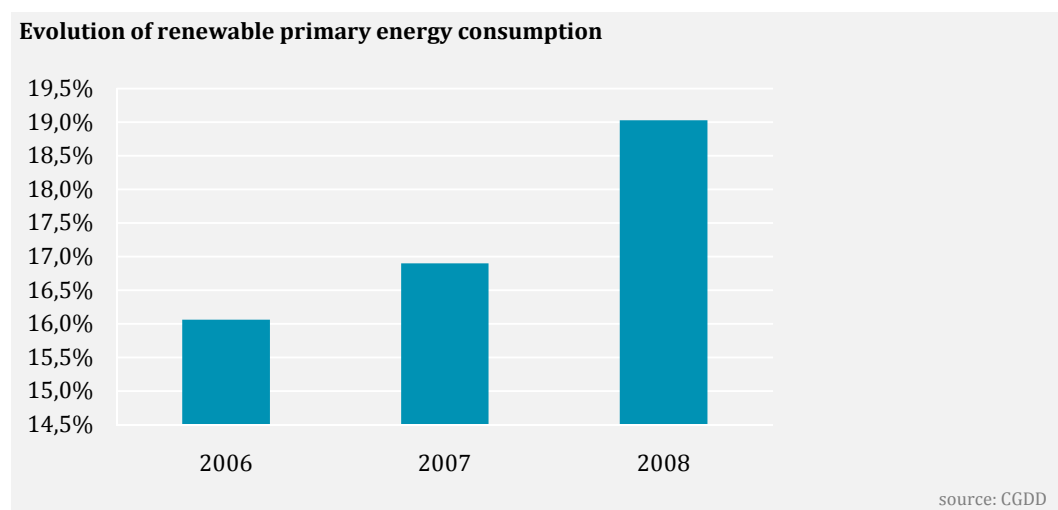
Renewable energy sources therefore represent 11% of final energy consumption for energy usage and 10% of final energy consumption all uses combined.

The various sources of renewable energy currently used in France are highly diverse. Nevertheless, there are two main sources employed today: domestic wood-fuelled heating (used in the residential sector) and hydroelectricity (mainly from dams).

The following chart gives a breakdown of the different renewable energy sources consumed in renewable primary energy consumption:



The chart under shows the recent evolution of renewable primary energy consumption:



Renewable primary energy consumption therefore rose from 16 Mtoe in 2006 to 19 Mtoe in 2008 (i.e. a growth rate of 19%). This increase is mainly due to:

- Significant increase in hydroelectricity production (+13.5%) linked to higher rain levels generating greater production levels;
- Very high growth in biofuels (+196%), resulting from a highly ambitious French government policy.

### III. *The growth of “renewable energy” markets*

The different renewable energy markets have developed significantly over the last few years. The following table shows the growth in these markets, using indicators adapted to each industry.

Recent evolution in selected renewable energy markets						
	Market 2006	Market 2007	Market 2008	Global 2008	Objectives 2012	Objectives 2020
Wind	810 MW	888 MW	950 MW	3 404 MW	11 500 MW	25 000 MW
Solar photovoltaic	14 MW	35 MW	105 MW	157 MW <sup>1</sup>	1 100 MW	5 400 MW
Thermal solar	300 000 m <sup>2</sup>	323 000 m <sup>2</sup>	388 000 m <sup>2</sup>	1 600 000 m <sup>2</sup>	3 000 000 m <sup>2</sup>	18 000 000 m <sup>2</sup>
Wood energy (domestic sector)	530 000 sells	430 000 sells	450 000 sells	6 000 000 appliances	7 300 000 appliances	9 000 000 appliances
Heat pumps	58 000 sells	70 000 sells	150 000 sells	350 000 appliances	1 245 000 appliances	2 000 000 appliances
Biomass collective and tertiary heat	0,06 Mtoe 400 boiler rooms	0,08 Mtoe 550 boiler rooms	0,09 Mtoe 600 boiler rooms	1,5 Mtoe	2,5 Mtoe	5,2 Mtoe
Hydroelectricity	93 MW	-144 MW	nc	25 000 MW	25 500 MW	27 500 MW
Biomass electricity	0 MW	0 MW	0 MW	300 MW	500 MW	1 500 MW
Biofuels (built-in quantity)	0,7 Mtoe	1,16 Mtoe	2,07 Mtoe		2,8 Mtoe	4,0 Mtoe

source: Syndicat des énergiesrenouvelables / ENERPLAN / AFPAC / ADEME / ERDF

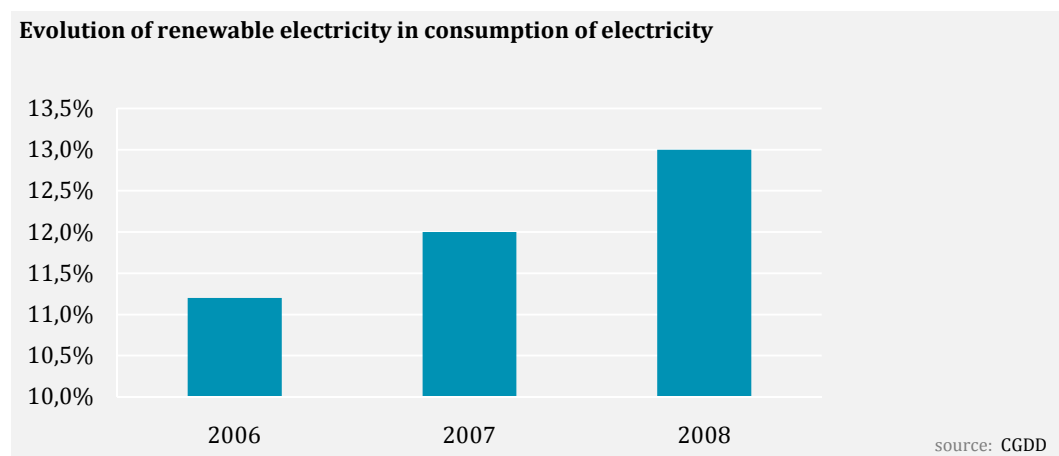
#### III.1. Renewable electricity

As we have seen, renewable electricity is currently in the form of electricity produced by dams.

The proportion of renewable electricity sources in final electricity consumption in France has been stable for some years. Although the wind farm industry has unquestionably taken off, increased consumption rules out a substantial increase of the percentage of renewable energy sources in overall electricity production.

<sup>1</sup> End 2008, 69 MW were connected to the grid and 88.5 MW were installed in roofs and waiting for connection.

The figure under shows the evolution of the share of renewable electricity in national electricity consumption:



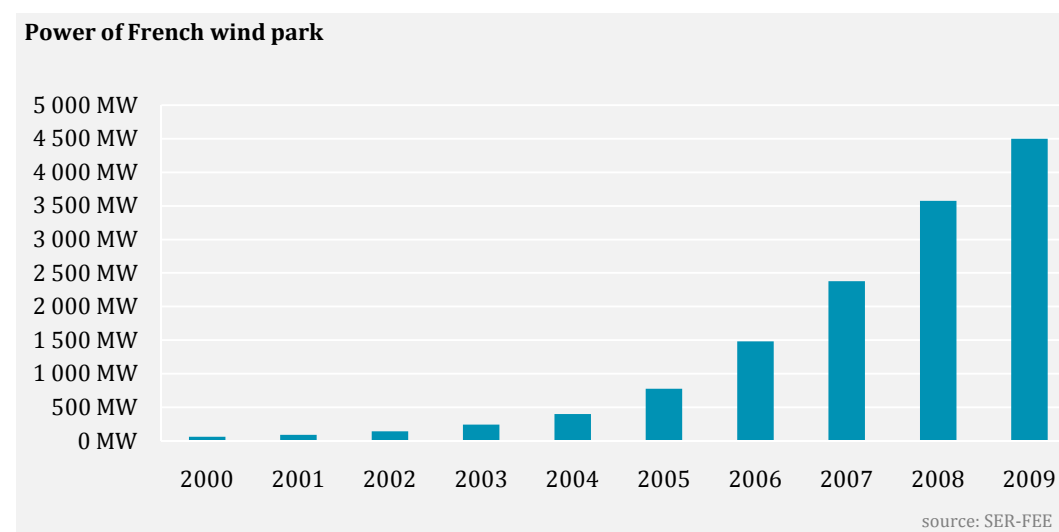
A breakdown of the different renewable electricity production sources is shown in the following table:

**Evolution of renewable electricity production by source**

	2005	2006	2007
Hydroelectricity	53 257 GWh	57 807 GWh	59 792 GWh
Wind	990 GWh	2 229 GWh	4 116 GWh
Geothermal	95 GWh	78 GWh	95 GWh
Solar photovoltaic	21 GWh	25 GWh	35 GWh
Biomass	3 788 GWh	3 756 GWh	4 094 GWh

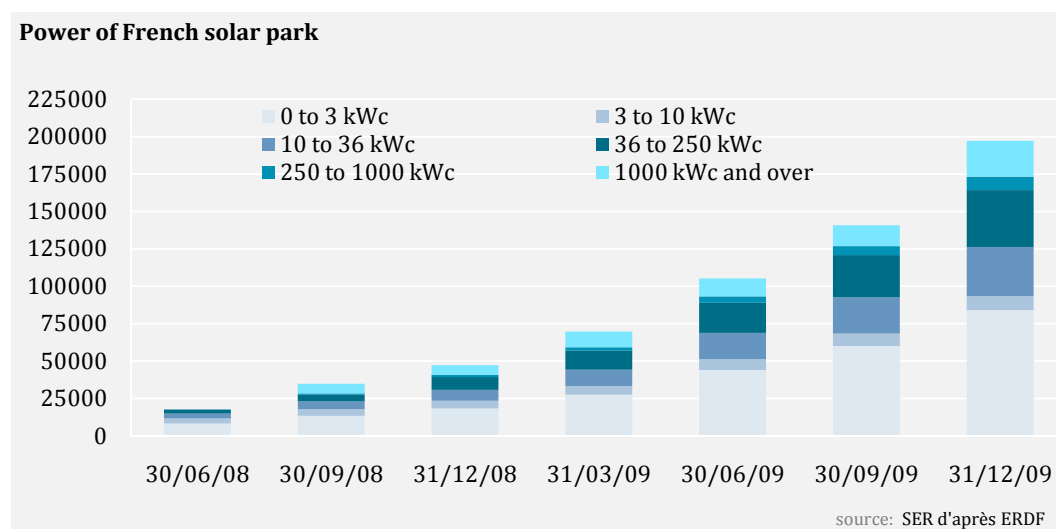
source: CGDD

Evolution of connected wind power:



The latest data indicate that at end 2009 French wind power stock attained connected power levels of around 4500 MW for production levels equalling 7.8 TWh (source RTE).

Evolution of connected photovoltaic solar power:

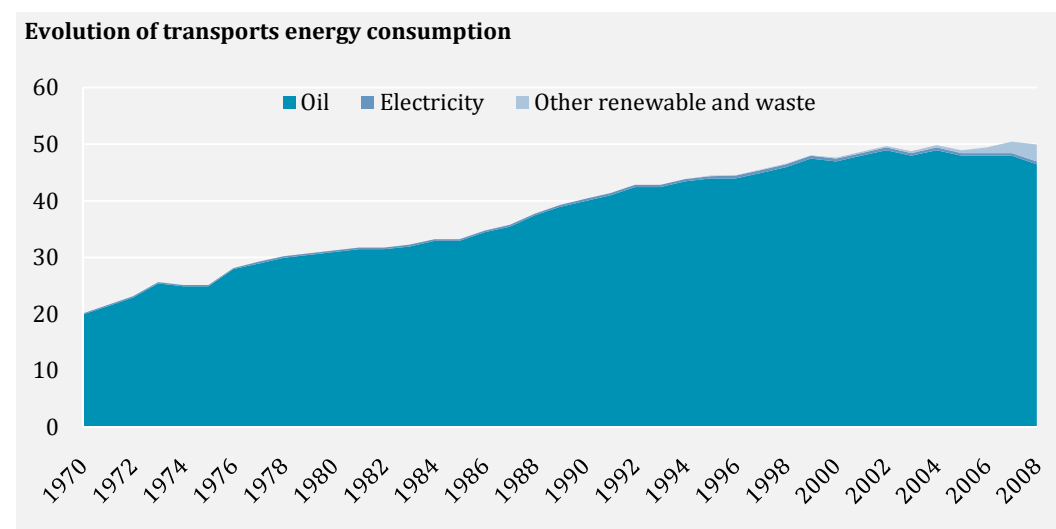


### III.2. Renewable heat

In 2006, heat generated from renewable sources represented around 12 Mtoe (except biofuels – see below). Wood fuel remains predominant, at 8.7 Mtoe, followed by solid urban waste (1.2 Mtoe or 6%), then heat pumps, at 0.5 Mtoe, biogas (0.3 Mtoe), geothermal energy in general, harvest residues and solar thermal energy, totalling a scant 0.3 Mtoe.

### III.3. Renewable energy sources in the transport sector

Biofuels are currently the only source of renewable energy that can substitute fossil fuels. Biofuel is fuel derived from plant-based raw materials (biomass). There are two main types of biofuel production: ethanol, which includes ethanol and ETBE (ethyl tert butyl ether) for vehicles that use petrol, and vegetable oil, with VOME (vegetable oil methyl esters) for diesel-fuelled vehicles.



## IV. 2020 targets for France

### IV.1. Building up to the 2020 targets

As mentioned in the introduction, on 26 December 2007, Jean-Louis BORLOO, the French Minister for Ecology, Energy, Sustainable Development and Spatial Planning, asked Jean-Claude LENOIR, Member of Parliament, and Alain LIEBARD, President of the Renewable Energy Observatory, to lead a working group called operational committee No. 10 on “renewable energy sources”. This operational committee gathered a large number of interested parties to draw up a road map for each industry. Its aim was to identify reserves of renewable energy production for achieving the additional 20 Mtoe required by 2020.

The following table summarizes each industry’s development and contribution to reaching this target:

Table resulting from the work of operational committee No.10 on “renewable energy sources”			
Renewable sector	Situation in 2006	Objectives 2020	Growth
Heating process	9,6 Mtoe	19,7 Mtoe	+ 10 Mtoe
Wood (domestic heating)	7,4 Mtoe (5,7 millions of appliances)	7,4 Mtoe (9 millions of appliances)	-
Wood and wastes	1,8 Mtoe	9 Mtoe	+ 7,2 Mtoe
Thermal solar, heating pumps and geothermal	0,4 Mtoe (200 000 housings)	3,2 Mtoe (6 000 000 housings)	+ 2,8 Mtoe
Electricity	5,6 Mtoe	12,6 Mtoe	+ 7,0Mtoe
Hydroelectricity	5,2 Mtoe (25 000 MW)	5,8 Mtoe (27 500 MW)	+ 0,6 Mtoe
Biomass	0,2 Mtoe (350 MW)	1,4 Mtoe (2 300 MW)	+ 1,2 Mtoe
Wind energy	0,2 Mtoe 1 600 MW (2 000 wind turbines)	5 Mtoe 25 000 MW (8 000 wind turbines)	+ 4,8 Mtoe
Solar photovoltaic	0 Mtoe	0,4 Mtoe (5 400 MW)	+ 0,4 Mtoe
Biofuels	0,7 Mtoe	4,0Mtoe	+ 3,3 Mtoe
<b>TOTAL</b>	<b>≈ 16 Mtoe</b>	<b>≈ 36 Mtoe</b>	<b>+ 20 Mtoe</b>

source: COMOP 10

This analysis calls for a number of remarks:

The analysis was made based on production reserves. France has the second largest wind reserves in Europe and three uncorrelated wind regimes, high levels of sunshine, widespread forests covering around 28% of the mainland area, and large surfaces of farming land that could be used to develop energy producing crops;

Although hydraulic reserves have been significantly exploited to date, there is a small-scale hydraulic reserve of around 2,500 MW;

Regarding domestic wood fuel, by developing stocks and renewing most older equipment, final consumption of wood fuel would be stabilized and domestic needs in the residential sector would be more widely covered;

An ambitious action plan to equip houses with thermal solar panels and heat pumps should be set up.

Taking all industries together, the objectives presented above will only be able to achieve 23% of energy from renewable sources by 2020 if an ambitious policy for managing energy demand can reduce final energy consumption by at least 10% by the same date.

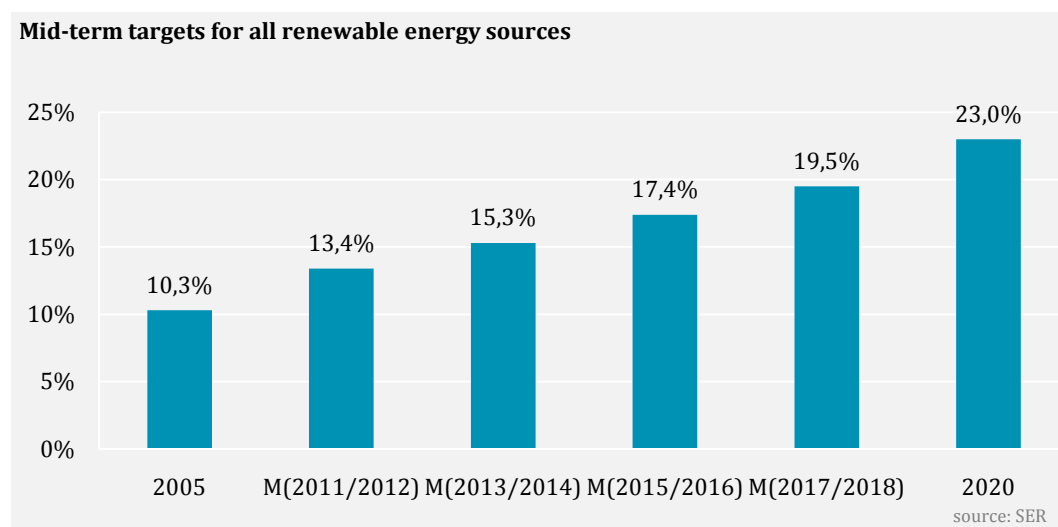
This significant reduction in consumption should essentially focus on heat and fuel requirements. Electricity demand may increase, since the following transfers of use are anticipated:

Increased use of heat pump-type technologies;

The use of electricity in the transport sector (electro mobility, targeting 2 million electric vehicles by 2020).

## IV.2. Mid-term targets

Mid-term targets for all renewable energy sources could be as follows<sup>2</sup>:



**Summary of the development of renewable electric energy sources and their share in overall electricity consumption, all sectors combined**

	2006	2012	M(2013/2014)	M(2015/2016)	M(2017/2018)	2020
Electricity consumption	514,0 TWh	542,7 TWh	550,0 TWh	559,5 TWh	569,0 TWh	581 TWh
Renewable electricity	65,4 TWh	91,9 TWh	106 TWh	120,5 TWh	134,2 TWh	149,2 TWh
Renewable electricity rate	12,7%	16,9%	19,3%	21,5%	23,5%	25,7%
Wind energy	2,2 TWh	23,2 TWh	34,1 TWh	42,3 TWh	50,5 TWh	58,6 TWh
On shore	2,2 TWh	23,2 TWh	28,0 TWh	32,8 TWh	37,6 TWh	42,3 TWh
Off shore	0 TWh	0 TWh	6,1 TWh	9,5 TWh	12,9 TWh	16,2 TWh
Hydroelectricity	60,3 TWh	61,5 TWh	62,6 TWh	64,0 TWh	65,5 TWh	67,3 TWh
> 10 MW		60,0 TWh	60,0 TWh	60,0 TWh	60,0 TWh	60,0 TWh
< 10 MW		1,5 TWh	2,6 TWh	4,0 TWh	5,5 TWh	7,3 TWh
Solar photovoltaic	0 TWh	1,1 TWh	1,9 TWh	2,9 TWh	3,9 TWh	5,2 TWh
Biomass	2,8 TWh	5,9 TWh	7,9 TWh	10,6 TWh	13,3 TWh	16,7 TWh
Geothermal	0,1 TWh	0,2 TWh	0,4 TWh	0,6 TWh	0,8 TWh	1,0 TWh
Others	0 TWh	0 TWh	0,1 TWh	0,1 TWh	0,2 TWh	0,3 TWh

source: SER

<sup>2</sup> M(n/n+1) is the average share of renewable energy sources between year n and year n+1.

<b>Summary of the development of renewable thermal energy sources and their share in overall heat consumption, all sectors combined</b>						
	2006	2012	M(2013/2014)	M(2015/2016)	M(2017/2018)	2020
Heating consumption (except electric heating)	65 600 Ktoe	62 129 Ktoe	61 261 Ktoe	60 104 Ktoe	58 946 Ktoe	57 500 Ktoe
Renewable heating	9 662 Ktoe	12 650 Ktoe	14 421 Ktoe	16 191 Ktoe	17 962 Ktoe	19 732 Ktoe
Renewable heating rate	14,7%	20,4%	23,5%	26,9%	30,5%	34,3%
Biomass	9 255 Ktoe	10 970 Ktoe	12 341 Ktoe	13 712 Ktoe	15 084 Ktoe	16 455 Ktoe
Domestic heating with wood energy	7 400 Ktoe	7 400 Ktoe	7 400 Ktoe	7 400 Ktoe	7 400 Ktoe	7 400 Ktoe
Other wood energy usings (industry, offices)	1 400 Ktoe	2 500 Ktoe	3 175 Ktoe	3 850 Ktoe	4 525 Ktoe	5 200 Ktoe
Heating from biomass cogeneration	0 ktoe	540 ktoe	1 005 ktoe	1 470 ktoe	1 935 ktoe	2 400 ktoe
Domestic wastes	400 ktoe	470 ktoe	577 ktoe	685 ktoe	792 ktoe	900 ktoe
Biogas	55 ktoe	60 ktoe	184 ktoe	307 ktoe	431 ktoe	555 ktoe
Geothermal	380 Ktoe	1 495 Ktoe	1 709 Ktoe	1 922 Ktoe	2 136 Ktoe	2 350 Ktoe
Deep geothermal energy	130 Ktoe	195 Ktoe	271 Ktoe	347 Ktoe	424 Ktoe	500 Ktoe
Middle geothermal energy	50 Ktoe	100 Ktoe	137 Ktoe	175 Ktoe	212 Ktoe	250 Ktoe
Individual heat pumps	200 Ktoe	1 200 Ktoe	1 300 Ktoe	1 400 Ktoe	1 500 Ktoe	1 600 ktoe
Thermal solar	27 Ktoe	185 Ktoe	371 Ktoe	556 Ktoe	742 Ktoe	927 Ktoe
Individual thermal solar	17 Ktoe	150 Ktoe	317 Ktoe	483 Ktoe	650 Ktoe	817 Ktoe
Collective thermal solar	10 Ktoe	35 Ktoe	54Ktoe	72 Ktoe	91 Ktoe	110 Ktoe

source: SER

<b>Summary of the development of renewable energy sources incorporated into fossil fuels and their share in overall fuel consumption</b>						
	2006	2012	M(2013/2014)	M(2015/2016)	M(2017/2018)	2020
Fuels for transport consumption	50 000 ktoe	45 714 ktoe	44 643 ktoe	43 214 ktoe	41 786 ktoe	40 000 ktoe
Biofuels	680 ktoe	2 800 ktoe	3 100 ktoe	3 400 ktoe	3 700 ktoe	4 000 ktoe
Biofuels rate in global consumption for transport	1,4%	6,1%	6,9%	7,9%	8,9%	10,0%

source: SER

## v. *Measures for achieving the targets*

### POLICY MEASURES

#### v.1. Measures on administrative procedures, regulations and codes

**Who are the administrative bodies responsible for authorization, certification and licensing procedures on national/or regional and local level? How should the competences be best defined and coordinated?**

Official authorisations for the development of renewable electrical energy are issued by the state (i.e. a central administrative body for authorisations for obligatory buy-back of electricity, and decentralised bodies for building permits). These bodies draw on various opinions (e.g. the *commissions des sites et des paysages* (landscape and sites commissions) for wind turbines). For high-power photovoltaic solar energy, building permits are issued by the Prefect in a similar process.

**For wind farms:** The first stage in a wind farm project is a development zone, or *Zone de Développement de l'Éolien* (ZDE), created in 2005 and in force from 2007. ZDEs are not spatial planning documents, but electricity authorisations. ZDEs are decided by the Prefect following propositions from towns or groups of towns based on three criteria: potential, landscape and electricity connection. Their objective is to plan wind farm development and protect landscapes, historical monuments and protected or outstanding sites. They set a minimum power limit for individual wind farms and a maximum limit for the total power of all the wind farms in the zone. ZDEs give access to a preferential buy-back tariff – a feed-in tariff -(see above). Although wind farms are in fact exclusively located within ZDEs, this does not result in a simplification of the authorisation process. Spatial planning documents have to be taken into account in the development of wind farms. Wind farms are ruled out in many local land development plans (*Plans d'Occupation des Sols* (POS)) and town planning schemes (*Plans Locaux d'Urbanisme* (PLU)); this is the case in zones A, N, NC and ND. As a result, land planning documents almost always need to be revised before installing a wind farm. In addition, the Montagne Act (law No. 85-30 of 9 January 1985) and the coastline Act (law No. 86-2 of 3 January 1986) reinforce protection and totally rule out the possibility of setting up wind farms.

All wind farm projects also have to apply for a building permit. Since law No. 2005-781 dated 13 July 2005, known as the “POPE” Act, an impact assessment and a public enquiry must also systematically be included in applications for permits to build wind farms with hub height above 50 metres. 27 different government departments must be consulted during the process and the procedure takes between 18 months and 5 years to complete. At the same time as the application for a building permit, the operator has to request permission for connection from the manager of the state electricity grid. Lastly, before installing a new electricity

production apparatus, several simultaneous steps need to be followed to conform with the law on electricity:

An authorization to exploit the electricity production installations in line with the measures of the decree of 7 September 2000;

A request for certificates opening rights to the obligation to buy back, in line with the terms of the decree dated 10 May 2001 relating to purchase conditions for electricity produced by operators that practise obligatory buy-back, modified by the decree dated 4 March 2009;

A request for a purchase contract from EDF, or a non-nationalised distributor if the installation is located on territory it covers, in line with the terms of the tariff regulation corresponding to the type of production.

These procedures are not interdependent and can be carried out at the same time.

N.B.: law No. 2003-590 of 2 July 2003 on town planning and the habitat obliges the operator to give financial guarantees for dismantling the wind turbines and restoring the site.

For renewable heat, local authorities decide on the location of production units (e.g. biomass, geothermal energy), based on projects' economics.

**Are there unnecessary obstacles or non-proportionate requirements detected related to authorisation, certification and licensing procedures applied to plants and associated transmission and distribution network infrastructure for the production of electricity, heating or cooling from renewable sources, and to the process of transformation of biomass into biofuels or other energy products? If so, what are they?**

The current wind power authorisation process in France causes significant delays. There are generally between 5 and 7 years from the development of a wind farm to its construction. Delays are made even longer by a system of tacit refusal. When the authorities do not reply to a building permit request for a given period of time, this means there is a tacit refusal. The practice is for developers not to demand the reasons for refusal, but rather to wait for the final notice, which may be positive. Thus some projects receive a response up to 5 years after the permit request was filed. These delays are unnecessary.

The bad quality of the law also leads to a high number of appeals. A recent SER-FEE study shows, for example, an appeals rate of around 40% on building permits. This results in legal instability that is harmful to the industry's development.

Another obstacle to wind farm development is the enormous amount of declarative planning documents called for, including the regional wind plan required by the law of 3 July 2003. The construction of a wind farm usually necessitates revising spatial planning documents.

This system is set to become even more cumbersome. Programming law No. 2009-967 of 3 August 2009 relating to the implementation of the "Grenelle" (environment think tank policy, known as "Grenelle I") requires planning documents be drawn up. These are renewable energy plans that establish preferential zones for developing

wind power. They must be done jointly by regional Prefects and the presidents of regional councils within one year starting from the law's publication. They aim to define "by geographical zone, on the basis of the region's potential, and taking national targets into account, the region's qualitative and quantitative objectives for developing renewable and intermittent energy potential on its territory". The method for defining these documents has been subject to two ministerial circulars to the Prefects dated 26 February and 19 May 2009.

These plans are currently being drawn up in most regions. Drafts that the SER has seen are characterised by a high level of diversity and methodology. In all cases, the plans only define very small areas as being "preferential zones" in the sense of the 3 August 2009 law (in some cases covering less than 10% of the region's territory).

A very close reading of the law of 3 August 2009 and of the draft law defining national commitment to the environment, could lead certain prefectures to exclude constructing wind farms outside of "preferential zones". Should this practice be confirmed, it would have significant consequences on the development of wind power and could, in two to three years, lead to a sharp slowing down of projects, perhaps a near standstill.

Lastly, the government has on several occasions announced that wind turbines would be classed in the nomenclature of Listed Constructions for the Protection of the Environment (ICPE). This would mean that all wind farms would have also to obtain a specific authorisation to operate. This cumbersome legal process is usually reserved to the most polluting industries. It will soon include three categories: installations subject to authorisation, declaration or registration. For authorisations, the procedure takes between 12 and 14 months, and includes an impact assessment, a public enquiry and a hazard assessment. In addition, each wind farm must receive a specific legal order delivered by the Prefect. Wind farms' operations could be stopped or adjusted at the Prefect's decision. The registration process, which should soon be in force, proposes a more flexible system, comprising a standard order for each type of installation. The procedure would nevertheless take 4 to 5 months. However, whenever there is an impact on other projects, the authorisation procedure would be used. The concentration of wind farms resulting from the new planning rules raises the risk that farms will almost systematically have to resort to the more cumbersome authorisation procedure.

Since wind farms are currently already subject to a public enquiry and an impact assessment, the ICPE listing would not bring any advantages in terms of environmental protection, but would lead to significant additional delays. Moreover, most spatial planning zones rule out the possibility of installing ICPEs. For new wind farms, this almost systematically results in the necessity of modifying local spatial planning documents, thus adding to the length and uncertainty of the procedure.

There is also the worry that the government's announcements will lead to a moratorium on wind power projects during the transition phase, with Prefects preferring to postpone rather than make a decision on wind farms fearing a change in the law.

**As a result, the already complex planning and authorisation process will become even more cumbersome, with what seem to be unnecessary or disproportionate procedures making it more difficult to reach national wind power development targets.**

**Is comprehensive information on the processing of authorisation, certification and licensing applications for RES installations available?**

Access to information is relatively straightforward. However, there have been frequent changes in regulations on authorisation for renewable energy over the past years. For wind power, the framework is not very stable and operators are faced with regulations that changed in 2005 (law of 13 July 2005) and then in 2009 (law of 3 August 2009) with extra procedures yet to be applied. For photovoltaic solar power, regulations are being devised. It appears necessary to stabilize regulations so that operators can work in better conditions. For heat, the procedures are well known (biomass boilers, geothermal energy, etc.); it is the economic framework that determines project development.

**Should the authorisation procedure take into account the specificities of different renewable energy technologies? If yes, how?**

Authorisations must of course take into account the specificities of renewable energy technologies, especially renewable electric energy.

**Should the renewable energy potential be taken into account in spatial planning?**

Renewable energy sources are local and decentralised. They are analysed according to local available reserves. However, the central authority in charge of energy has to balance local development plans so that the sum corresponds with the overall national objectives.

**Should timetables for processing applications be communicated in advance?**

Clear timetables set out at the beginning of the authorisation procedure, with deadlines for the various administrative acts to be processed help a project developer plan its investment. Currently, such established timetables do not exist or are not communicated to the interested parties, and depend on local administrations' willingness. The procedure would be more transparent if local authorities had a known deadline to answer to whatever the RES project.

**How many steps should be needed to obtain the final authorisation? Should there be a one-stop-shop for coordinating all the steps? Should a timetable for processing applications be communicated in advance?**

There is no one-stop-shop for obtaining authorisations for renewable electric energy projects, and this is a weak point in the existing system. For heating, work is decided locally, and the ADEME (French Environment and Energy Management Agency) is a good place for obtaining financial aid. Numerous steps are involved in constructing a wind farm (see above) and the average time for development and construction is currently around 5 to 7 years.

#### **For which small scale projects, should there be simplified and less burdensome authorisation procedures?**

Low-power photovoltaic solar energy ( $P < 3$  kWp) follows a simplified regime, but connection delays remain very long. For low-power heat (wood stoves, biomass boilers, heat pumps, thermal solar energy, etc.), getting authorization poses no particular problem.

Procedures are also simplified for domestic wind power, but there is insufficient public interest. The feed-in tariff is not high enough and leads to fairly long-term returns on investment, which discourages investment in the sector. The same can be said for small-scale co-generation using biomass.

### **V.2. Measures concerning Buildings**

#### **What measures should be introduced into the building codes to ensure the share of renewable energy used in the building sector will increase?**

Numerous measures have been introduced: extending building rights when equipment makes use of renewable energy sources, partial tax relief on purchases, loans at preferential rates for refurbishing old buildings, etc. However, the main measure is the ruling on lower energy consumption in new housing, which stimulates the use of renewable energy sources.

#### **How should an obligation for minimum levels of renewable energy in new and newly refurbished buildings be drafted to best ensure renewable energy integration in buildings? At what levels should it be set?**

As well as reducing consumption, it would be preferable to introduce a minimum level of renewable energy sources into the overall consumption of buildings. In 2012, the regulatory consumption of buildings will be 50 kWh/m<sup>2</sup>.year. The introduction of a minimum threshold of 5 kWh/m<sup>2</sup>.year of consumption from a renewable energy source would be an excellent measure to increase the consumption of renewable energy sources. To produce and consume this minimum threshold, consumers could use heat pumps, wood-fuelled or solar-fuelled equipment. In densely populated and urban areas, buildings could be linked up to district heating systems fuelled by renewable energy sources.

### **What is the projected increase of renewable energy use in the building sector until 2020?**

Currently, 15% of energy consumed in the building sector comes from a renewable energy source. It is likely that by 2020 this will have risen to 30%, partly thanks to the development of renewable energy sources, but also an overall reduction in building sector consumption. French regulations on heating also stipulate that by 2020, all new constructions shall be so-called “energy positive”. In other words, new buildings will produce more energy than they consume, partly thanks to the systematic incorporation of photovoltaic solar panels.

### **What measures should be taken to ensure that public buildings fulfil an exemplary role by 2012 ?**

Legislation to regulate public markets needs to be modified so that all constructions or major renovations of public buildings incorporate a minimum level of renewable energy sources.

## **V.3. Measures on Information**

### **How should specific information be targeted at different groups, as end consumers, builders, property managers, property agents, installers, architects, farmers, suppliers of equipment using renewable energy sources, public administration?**

The role of informing the public is ensured by ADEME (French Environment and Energy Management Agency), which has set up an information network called the “Energy information space”. It currently employs around 400 advisors whose role is to counsel individuals (final consumers) and those further up the chain (architects, consultants, installers, promoter-builders, etc.). There are not enough advisors to cope with the rise of renewable energy use in buildings. There is therefore a need to develop this network of highly appreciated advisors who provide information free from any financial pressure. At the same time, the state needs to develop courses on renewable energy within training in the relevant trades. It is vital that a heating engineer’s training should include information on systems that use renewable energy sources. The same goes for electricians, architects, etc.

### **How will you ensure that certification schemes or equivalent qualification schemes become or are available by 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps?**

France has made good progress in this area, with several existing initiatives, including:

Qualit’EnR (association) which issues renewable energy labels

Qualibat

Through the systems described above, France has set up quality labels so that consumers can be sure they are dealing with qualified, competent professionals when it comes to installing wood, solar and geothermal fuelled systems.

**How should guidance for planners and architects be provided to help them consider the optimal combination of renewable energy sources, high efficiency technologies and district heating and cooling when planning, designing, building and renovating industrial or residential areas?**

There exist some informations to take account optimal combination of renewable energy sources. But Government should ask ADEME to popularize a tool to take account RES in the method of calculation of buildings needs.

**What should be the role of regional and local actors in the design and management of programmes for information, awareness raising and training programmes for citizens on the benefits and practicalities of renewable energy sources?**

Local stakeholders are important. In France, regions are responsible for vocational training. We therefore need to encourage collaboration between renewable energy professionals and the regions to develop training programmes on renewable energy.

#### V.4. Measures on certification of installers

**Responsible body/(ies) for setting up and authorising certification / qualification schemes by 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps**

In France, several bodies exist (e.g. Qualit'EnR, Qualibat).

Qualit'EnR is an association that brings together industrial renewable energy professionals (SER) and installer organizations (ENERPLAN, CAPEB, FFB).

**Are such certification schemes / qualifications already available? Please, describe them.**

This association delivers certificates in different sectors (thermal solar, photovoltaic solar, heat pumps, biomass, etc.) Qualit'EnR's website address is:

**[www.qualit-enr.org](http://www.qualit-enr.org)**

To obtain one of the qualifications, applicants must:

Justify their basic knowledge of heating and/or electricity and/or roofing;

Take a specific training course (e.g. solar, wood energy);

Pass a test set by Qualit'EnR.

### **Specific measures at regional / local levels (where relevant)**

At different regional level, there exist qualification for geothermal installers (for example: drilling quality). All this qualifications should be homogenize at national level.

### **Are there specific trainings for case handlers in the different authorisation bodies?**

This association has set up a network of trainers who train installers on a programme validated by the association's founding members. The programmes are specific to the renewable energy equipment in question. Qualit'EnR is active in the European EUCERT project.

### **Is information publicly available on these schemes? Are lists of certified or qualified installers published? If yes, where? Are other schemes accepted as equivalent to the national/ regional scheme?**

The list of installers agreed by Qualit'EnR is available on the association's website thanks to a database system, meaning that final consumers can find an expert installer close to their home.

Currently, the number of qualified installers is:

- 12,000 installers qualified for thermal solar;
- 5,000 installers qualified for photovoltaic solar;
- 1,500 installers qualified for wood energy (boilers only).

The qualification for wood-burning stoves and fireplace inserts has been in place since 1 January 2010.

## **V.5. Measures on electricity infrastructure development**

### **How should transmission and distribution grids be developed to integrate renewable electricity while maintaining the secure operation of the electricity system? How is this requirement included in the transmission and distribution operators' periodical network planning?**

The rapid development of renewable electricity production is currently mostly in very rural regions that are relatively poorly equipped with electricity infrastructure. These new types of production technologies have led to grid saturation in certain zones with higher potential (Picardy, Nord and Baie de Somme, the south of the Aveyron and Tarn, etc.), and this will swiftly (before 2011) become one of the major

holdbacks to the development of renewable electrical energy, and in particular wind power.

To be able to continue developing renewable electrical energy sources, the electricity distribution grid needs urgent modernisation and renewable energy sources need to be favoured on the grid. Furthermore, it is also essential to develop and strengthen the grid infrastructure and grid lines in certain zones, specifically where problems are arising and in areas where RES projects are likely to be developed in the future.

This development can be achieved in different ways, for example by doubling lines, increasing voltage, changing conductors, installing underground lines, etc. Certain solutions have, as yet, been seldom used or not at all in France, like installing high-temperature conductors or extending the height of electricity poles.

Given the time needed for undertaking this kind of work, it is indispensable to start feasibility studies at a very early stage, which is currently being done. The high cost of this kind of measure cannot be met through an obligatory feed-in tariff, which does not cover this kind of development. For this reason it must be incorporated into the tariff for using public electricity grids (TURPE), which is currently being revised.

This means that the producer's invoicing should only cover connection and installation work so as to avoid incorporating the cost of reinforcing and developing the grid, which is covered by the TURPE.

For these reasons, it is urgent and vital to commence this reinforcement work and incorporate its funding into the TURPE so as not to penalise the development of renewable energy sources.

### **How will the development of intelligent networks and storage facilities be ensured?**

Energy storage is only really relevant for island networks (i.e. French overseas departments and territories). Note that France has 1.6 million inhabitants on three islands (Reunion, Guadeloupe and Martinique), mainly fuelled using fossil energy. This involves allocating subsidies to renewable energy systems in the overseas departments that have an energy storage system, since island grid managers cannot, by law, receive over 30% of intermittent electrical power at any given moment. This measure obliges a restriction on the injection of renewable energy sources that do not have a storage system.

On the mainland, the only solution for renewable energy is to reinforce the network, e.g. line construction, connection and transmission capacity (plus building stations).

Concerning so-called intelligent networks (smart grids), the concept is not really clear. Most phenomena called intelligent are set up in the transmission network. It is not worth taking this point further.

### **How should the interconnection capacity with neighbouring countries be reinforced?**

Projects are currently underway on interconnectors between France and Italy and France and Spain. Administrative procedures need to be made easier for the development of such grid assets.. It is important to carry out studies to identify reinforcement requirements (EWIS project of European grid managers on the requirements linked to developing wind power in Europe).

### **How should the grid infrastructure authorisation procedures be accelerated?**

It is not so much a case of accelerating the procedure as creating a better system for anticipating needs. The construction of a high-voltage line takes 10 years on average, and the key is to anticipate such developments. Grid managers have not anticipated any projects since the rise of renewable energy. Practically no reinforcements have been decided on. Sensitive areas have been known of for several years. For example, the development of wind power was programmed and is a given, however, there has been no anticipation of grid development requirements to date.

### **How should co-ordination between grid infrastructure approval and administrative planning procedures be ensured?**

There is currently no existing co-ordination procedure between project planning and reinforcement projects. Nevertheless, the “Grenelle 2” draft law foresees setting up connection patterns that are coherent with renewable energy development patterns. It will take time to put in place and reinforcements will be necessary during the transition period (connection infrastructure).

### **Should there be priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources?**

The “Grenelle 2” law anticipates reserving connection capacity. This decision is nevertheless probably rather late in the day.

### **How should the costs of connection and technical adaptation be shared between producers and transmission and distribution system operators?**

For connecting to the distribution grid, the cost is split: 60% for the producer and 40% for the grid manager (ERDF). This split does not apply to the transmission network. Reinforcement should be the responsibility of grid operators.

**How should it be ensured that transmission and distribution system operators are able to recover these investment costs? Should any modification of these cost-bearing rules be planned in the future?**

The cost is shared since it is re-invoiced to all of the network users. For the operator to be able to charge users, reinforcement projects must be accepted by the energy regulation commission. This, therefore, re-states the need for anticipating grid reinforcements.

**How should it be ensured that transmission and distribution system operators provide new producers wishing to be connected with the necessary information on costs, precise timetable for processing their requests and an indicative timetable for their grid connection?**

Up-to-date access capacity is posted on the TSO's (RTE) website. New producers can therefore get hold of information. For connection requests, a technico-financial proposal is provided by the grid operator (a document stipulating costs and delays). This is already in place.

#### V.6. **Priority/Guaranteed Access to the grid**

**Should priority or guaranteed access be ensured? Explain.**

Priority and guaranteed access must be ensured. For priority access, there is no competition between renewable energy and fossil energy because voltage levels are different for the different energy types. It is lack of reinforcement that holds back renewable energy connection.

Once again, the key is to anticipate the creation of well-dimensioned access capacity so that it will be available for renewable electrical energy. Feed-in-tariff corresponds to prioritizing injection.

**How should it be ensured that transmission system operators, when dispatching electricity-generating installations give priority to those using renewable energy sources?**

This question is not relevant in a Feed-in-tariff system.

**How should the transmission and distribution of electricity from renewable energy sources be guaranteed by the transmission and distribution system operators?**

This question is not relevant in an obligatory Feed-in-tariff system.

### **What grid and market related operational measures should be taken to minimise curtailment of electricity from renewable energy sources?**

When curtailments occur due to insufficient grid capacity or reinforcements, renewable electricity producers should be compensated.

## **v.7. Biogas integration into the natural gas network**

### **How should one ensure that charging of transmission and distribution tariffs is not discriminating against gas from renewable energy sources?**

Conveyance tariffs are the same for biomethane and natural gas. There are several different case types:

biomethane can be injected into the transmission grid. Transmission and distribution capacities must then be paid for, except of course for transmission-only customers.

biomethane can be injected into the distribution grid. This necessarily involves the cost of conveyance on the distribution grid. However, there is also a transport cost, since transport capacities need to be reserved for when the methanization unit undergoes shutdown periods. This is generally the case, whatever the duration. In this sense, the billing of transmission and distribution costs will not be any different for biomethane.

Should any assessment be carried out at national or regional level on the need to extend gas network infrastructure to facilitate the integration of gas from renewable sources?

There are two distinct case types:

In regions with an almost inexistent grid, like Sweden, the question of creating or extending networks is obvious. This involves considering the most appropriate mesh, whether regional, national or trans-national. It is impossible to establish a general rule, given the variety of geographical characteristics in the different countries, e.g. existing gas infrastructures, distribution of biomethane producers, potential development, geographical constraints, etc.

For regions like France, which has a history of developing gas infrastructures and an established widespread network, the question of extension is not relevant, except on a very local scale. The issue is rather how to bring closer or concentrate consumer zones' production means, and develop local uses for injected biomethane (eg bio NGV) to ensure the grid's long-term capacity to absorb the quantities of biomethane produced and so make production installations durable. This policy should in particular minimise biomethane flaring caused by very low-level consumption periods in gas grids.

## V.8. District heating and cooling infrastructure development

### **What are the needs for new district heating and cooling infrastructure using renewable energy sources and contributing to the 2020 target? How should these plans be promoted?**

The development of district heating systems is a major factor for reaching the 2020 goals. The cost of developing a district heating project fed by a biomass boiler or a geothermal borehole is higher than for a gas boiler. For these projects to be developed, project carriers need financial support.

This support is provided by ADEME, which has a budget of 1 billion Euros for three years to finance district heating systems fed by a thermal renewable energy source (geothermal, solar or biomass).

### **What are the planned contributions of large biomass, solar and geothermal facilities in the district heating and cooling systems?**

The contribution of thermal renewable energy sources (outside the private domestic sector) is currently the petrol equivalent of around 2 million tonnes. This production should rise to 10 Mtep by 2010 to meet the roadmap targets.

## V.9. Compliance of biofuels and other bioliquids with sustainability criteria

### **How will the sustainability criteria for biofuels and bioliquids be implemented at national level?**

Under the Renewable Energy Directive, Member states are obliged to elaborate a national scheme which the economic operators could use to prove the sustainability of their biofuel or bioliquid. At this stage, there is no national scheme in France. Economic operators are entitled to use voluntary scheme they have elaborated, provided this voluntary scheme has been recognized by the Commission first and through the comitology process.

Economic operators could favor the voluntary scheme in France.

### **How should it be ensured that biofuels and bioliquids that are counted towards the national renewable target, towards national renewable energy obligations and/or are eligible for financial support, comply with the sustainability criteria of Article 17.2-5?**

Under article 18-1 and 18-3, Member States shall take measures to ensure that economic operators submit reliable information and show that the sustainability criteria has been fulfilled through a mass balance system.

The main checking point may be at the custom level when fuels are put on the market, because there is already various control systems at this level.

**As far as protected areas are concerned, under which national or international protection regime should they be classified?**

It may depend on the type of protected areas. That's the physical status of the land that should count. In France, the sustainable development Ministry is in charge of the transposition process of the RED in French law.

**What should be the procedure for changing the status of land? With what frequency should changes in land status be registered?**

The evaluation should be made at least with the agriculture and environmental ministries. But, the changes should be overviewed by the EU. The frequency should be in line with the evaluation of voluntary scheme, ie every 5 years.

**How should the national verification of compliance with good agro-environmental practices and other cross-compliance requirements (required by Article 17.6) be ensured?**

The regulation is already active through the CAP regulation. No change to add to this.

**Should there be a voluntary "certification" scheme(s) for biofuel and bioliquid sustainability as described in Article 18(4)?**

All the options should be authorized, national system or voluntary scheme, but with the latter the economic operator may have more flexibility to design a system that is adapted to its economic constraints.

Furthermore, there can be several voluntary schemes for the same biomass, and they do not need to be certification scheme.

But, it is possible that biofuels with a sustainability proof provided by a certification scheme may have better commercial opportunities, but it will depends on the purchaser choice.

## VI. *Financial support*

### VI.1. **Support schemes for renewable electricity**

#### **What further improvements could be implemented to ensure reaching the target in the electricity sector?**

##### **For photovoltaic solar electricity:**

Current development is in line with the 2020 roadmap. If this development is to be sustainable, a stable economic framework that is legible over several years needs to be maintained.

##### **For wind electricity:**

Current development is insufficient to reach targets. This calls for:

- Not adding supplementary administrative layers;
- Increasing the feed-in tariff for less windy sites;
- Reinforcing the electric grid's access capacity.

##### **For offshore electric wind power:**

Providing attractive economic conditions, which is not currently the case. Planning reinforcement for transmission and electricity grids.

The level of Feed-in tariff should be improved. Indeed, different economic studies show that the current tariff is not sufficient (130 euros/MWh). A sufficient level is around 180 euros/MWh, taking into account the cost of connecting to the grid. If grid connection costs are wholly or partially mutualised, a lower feed-in tariff can be envisaged.

##### **For electricity from biomass combustion:**

With the new purchase tariff in effect since the end of 2009, it remains to be seen whether development will be swifter than with the call for tender system set up from 2005, which did not lead to the industry taking off.

#### **INVESTMENT AID:**

#### **What investment aid should be granted by the scheme? (subsidies, capital grants, low interest loan, tax exemption or reduction, tax refund). Who could benefit from this scheme?**

A significant financial aid system is already in place:

For renewable energy, it takes the form of feed-in tariffs and tax credit for individuals who buy photovoltaic solar systems;

For private renewable heating (wood stoves, biomass boilers, solar water heaters, heat pumps, etc.), a tax credit exists on the purchase of materials. The rate varies

from 25% to 50% depending on conditions and the technology. A no interest loan also exists for installing equipment that uses renewable energy sources into an older property;

For renewable heating in shared housing, tertiary housing and industry, the heating fund managed by ADEME provides investment aid.

### *IF YOUR COUNTRY HAS FIXED FEED-IN TARIFFS:*

#### **What should be the conditions to get the fixed tariff?**

The currently conditions are satisfactory.

#### **Should there be cap of the total volume of electricity produced per year or of installed capacity that is entitled to the tariff?**

For the moment, it does not seem necessary to cap the quantity of renewable electricity produced per year. In France, multi-annual investment programming is decided by the Minister for Energy, and sets the mid-term production targets for electricity from renewable sources. If the mid-term targets are exceeded (which is not the case), the Minister can suspend tariff advantages. On the other hand, if the mid-term targets appear not to have been reached, the Minister for Energy can launch a call for tender to accelerate renewable electricity capacity development.

### Should this be a technology specific scheme? What would be the tariff levels for each?

Article 10 of the 10 February 2000 Act provides that installations for producing electricity from renewable sources benefit from obligatory purchase of produced electricity by EDF. France has set up a support system based on a feed-in tariff set by the Minister for Energy. The following table sums up the various applicable feed-in tariffs.

Industry	Date the tariff was decreed	Tariff level in euros/MWh (Mainland France)
Wind power	17 November 2008	82€/MWh with possible decrease depending on hours in service (onshore) 130€/MWh with possible decrease depending on hours in service (offshore)
Biomass	Decree of 28 December 2009	From 125 to 150€/MWh depending on installation's energy efficiency and if power exceeds 5 electrical MW
Solar photovoltaic	Underway	Underway
Hydroelectricity	Decree of 1 <sup>st</sup> March 2007	From 60.7 to 102.5€/MWh depending on subsidies received
Household waste	Decree of 2 October 2001	From 45 to 50€/MWh + energy efficiency subsidy from 0 to 3€/MWh
Biogas	Decree of 10 July 2006	From 75 to 90€/MWh depending on power installed + energy efficiency subsidy from 0 to 30€/MWh + methanization subsidy of 2€/MWh
Geothermal power	Underway	Underway

### Should there be other criteria differentiating the tariff? How long should the fixed tariff be guaranteed?

15 years or 20 years, depending on the technology (20 years for biomass and solar photovoltaic).

### Should there be any tariff adjustment foreseen in the scheme?

Yes, tariffs should be regularly reviewed to take the trajectory into account as well as changes in the cost of materials.

### Should the scheme be periodically revised?

Yes.

### **Who should be managing the scheme?**

The government currently entrusts management to the Energy and Climate Department. This department needs to increase its staff to run the programme and roadmap.

### *IF YOUR COUNTRY USES A TENDERING SCHEME:*

### **What should be the frequency and size of the tenders? Which technologies should be specified?**

Calls for tender are used for electricity production from biomass (cogeneration). An initial tender was launched in 2005, a second in 2008 and a third in 2009. The government plans to launch a call for tender for the production of electricity from biomass every year to accelerate biomass electricity production. These tenders concern projects with a high power levels (over 12 MW). For projects with power between 5 and 12 MW, a buy-back tariff exists (which was reviewed at end 2009 and significantly increased). For offshore wind power, the government foresees setting up three calls for tender of 2,000 MW each by 2020 to reach the roadmap target of 6,000 MW.

### **Should it be integrated with grid development?**

Yes, but this is unfortunately not yet the case.

### **Should the scheme be periodically revised?**

The specifications of the call for tender need to be revised since the first calls for tender relating to biomass did not result in many projects. Most of the projects were abandoned because the rising cost of wood and raw materials over recent years caused the economic balance to shift.

## **VI.2. Support schemes for renewable heating and cooling**

### **What measures could be best to ensure development of heating and cooling renewable energy sources?**

At the end of 2008, the government made available a significant budget to support renewable heating (the heating fund). The budget totals 1 billion Euros over three years. This budgetary measure may be reviewed yearly and is therefore not stable. To reach 2020 targets, it would probably be more useful and safer to finance the heating fund from the recent carbon tax on fossil fuel (petrol, gas, etc.).

### **What support schemes could best encourage the use of district heating and cooling using renewable energy sources?**

The recently created heating fund is a good tool for encouraging the use of heating from renewable sources. Its performance should be sustained, and information campaigns aimed at local decision-makers should be done in parallel to raise awareness among public and private contractors.

## **VI.3. Support schemes for renewable resources in transport**

### **What should be the concrete obligations / targets per year (per fuel or technology)?**

The government has included clear obligations to incorporate biofuels in its Farming Orientation Act:

5.75% incorporation by 2010 (energetic value);  
7% by 2015;  
10% by 2020.

### **Should there be a differentiation of the support according to fuel types (biodiesel, bioethanol) and technologies (second generation biofuels, renewable electricity)?**

Tax allowances are not the same for bioethanol and biodiesel. For 2010, they range from 11 to 18 Euros/hl depending on the biofuel. The tax allowance is programmed to go down, from 8 to 14 Euros/hl in 2011. Ethanol receives the greatest tax allowance.

### **Please specify on which basis the biodegradable fraction of municipal solid waste and of industrial waste was calculated?**

The method for calculating the biodegradable fraction of waste results from the characterisation campaigns carried out by ADEME.

### **What measures could best encourage the use for energy purposes of unused arable land, degraded land, etc. planned?**

In a feed-in-tariff system or in an subsidies system, public authorities could give premiums for installations using biomass coming from arable land, degraded land, etc.

### **How should one encourage the energy use of certain primary material already available (like animal manure)?**

With premiums adding to subsidies or feed-in-tariff.

## VII. *Estimated costs & benefits of the renewable energy policy support measures*

### **What is the expected renewable energy use in ktoe?**

From the action plan, we can evaluate additional consumption as 20 Mtoe, or an additional 20,000 ktoe, by 2020, bringing total RES in consumption to 32 Mtoe (32.000 Ktoe).

### **What are the expected costs (in euro) of achieving the 2020 target?**

The provisional annual cost for 2020 is 3 billion Euros, divided between budgetary expenditure (tax credit and investment subsidies) and a surcharge on electricity consumers to finance the additional costs of producing renewable sources of electricity.

### **What is the expected GHG reduction (t/year)?**

Based on calculations, and depending on the traditional energy substituted, we can evaluate the reduction of GHG in 2020 (compared with today) as 66 millions tonnes of CO<sub>2</sub> per year.

### **What is the expected job creation?**

Using conservative hypotheses and existing ratios, we evaluate the number of jobs created to be 200,000. However, we have not evaluated the loss or destruction of employment in traditional energy sectors.

### **What is the avoided fossil fuel imports?**

The quantity of fossil energy avoided is similar to the quantity of additional renewable energy consumed, i.e. 20 millions tonnes of petrol equivalent.

### **What are the avoided external costs?**

External costs are:

The energy bill for purchasing fossil fuel that France does not possess. At 505 Euros for imported crude oil (source: DGEC 2007), we therefore avoid imports worth 10 billions Euros per year.

The evaluation of the cost of avoided CO<sub>2</sub>. If we take the cost of a tonne of CO<sub>2</sub> to be 100 Euros in 2020, we can evaluate the gain at 66 millions tonnes of CO<sub>2</sub> x 100 Euros = 6.6 billions Euros avoided.

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