ACTIVITIES RELATED TO RENEWABLE ENERGY & ENERGY EFFICIENCY

MARKETS, EMPLOYMENT & ENERGY STAKES

SITUATION 2006-2007 – PROJECTIONS 2012

Agence de l'Environnement et la Maîtrise de l'Energie
Direction Exécutive de la Stratégie et de la Recherche
Service Observation Economie et Evaluation

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SUMMARY

Introduction

This publication is the first of a series in which ADEME intends to follow the annual changes in markets and activities relating to renewable energy and measures for increasing energy efficiency in the residential and transport sectors.

The description of markets and activities, and their evolution, in the 2006-2007 period is supplemented with figures on the production and sale of energy from renewable sources and the energy savings resulting from the measures mentioned above.

These changes are also placed in perspective relative to the Grenelle's objectives for the environment as set out in the various planning documents and the Grenelle I bill.

This study covers the entire range of renewable energy production systems, with the exception of large hydro-electric systems and the various forms of energy from the sea. As concerns improvements in energy efficiency, this first instalment limits itself to the existing residential sector: wall, window and roof insulation, condensation boilers and other equipment specifically targeted at cutting the consumption of electricity in the home. The markets connected with new housing and increasing energy efficiency in the production sector (agriculture, industry and energy - production and heating networks - and the tertiary sector) are excluded.

As regards transport, the only markets covered are those concerning the creation of new rail networks (including urban public transport: trams, tram trains and the underground), rolling stock and the new registration of classes A and B vehicles.

The study has two main parts.

A summary of the main results from 2006 and the evolution in the 2006-2007 period, as well as the prospective for the 2012 provided by the Grenelle programme for the various areas covered.

Around twenty 3-4 pages sheets, each describing the markets followed, grouped together into three areas:

- Development of renewable energy (equipment markets, production and sale of energy).
- Improvement of energy efficiency in the residential sector.
- Improvement of energy efficiency in transport.

An annex presents the sources and hypotheses used along with the methods of calculation. The publication ends with a glossary.

Despite the care taken over the proposed evaluations, a certain number of limitations and imperfections in the study were unavoidable given that it is the first in the series. The first of these concerns the boundaries of the study, which will be completed in subsequent publications. The second concerns the evaluation of markets and activities. The figures available are often incomplete and therefore in some cases evaluations have to be based on hypothetical figures.

With this publication, ADEME hopes to contribute to the following of the implementation of the Grenelle project: the regular updating of the market assessments and of their changes should provide a means of monitoring whether or not the country is genuinely committed to building an economy and a society capable of responding to the challenges presented by climate change.

This work would not have been possible without the collaboration of engineers from the various departments of ADEME, or the contributions of a number of professional bodies, most notably the *Syndicat des Energies Renouvelables,* and the DGEMP. Data used are those available until June 2008.

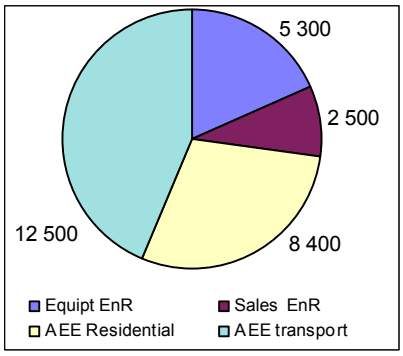
Summary [1]

The Current Situation: A Dynamic Market... A Production System Under Construction...

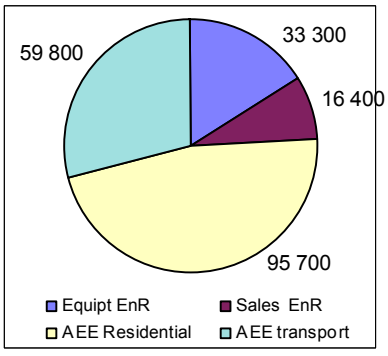
In the area studied, the market for goods and services contributing to the development of renewable energy and the improvement of energy efficiency was worth around 28.6 billion Euros in 2006 and 33 billions in 2007. Taking account of imported equipment and supplies, the corresponding production was worth 25.8 billion Euros. There are 205,000 full time equivalent jobs in these activities, a figure comparable to the number of individuals employed in the automobile construction industry.

Energy from renewable sources (other than large hydro-electricity) produced reached 11.4 million toe, while energy savings resulting from measures taken in 2005-2006 are estimated at 0.9 million toe.

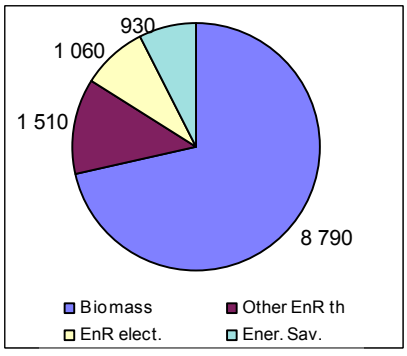
Market Distribution (million Euros)



Distribution of Employment (full time equivalent)



Distribution of Energy Produced and Saved in ktoe.



Current 2006 market prices;
Equipt EnR: markets for equipment used in the development of renewable energy, including installation;
EnR th/elect: thermal/electrical renewable energy; Ener. Sav. Energy savings; AEE: Improvement of energy efficiency (residential and transport sectors

Except renewable energy markets, the demand from households directly accounts for 60% of the market: spending on increased energy efficiency in the home and heating systems, purchases of equipment with better energy performance, including special vehicles. The demand from businesses accounts for 24%: 6.2 billion euros of investment (railway goods and systems for renewable energy production) and exports account for 12% (3 billion). Local government demand is more modest: 1.1 billion euros on public transport infrastructure (tramways).

Production is slightly higher than the domestic market, with the excess of foreign trade in transport equipment (railway equipments and classes A and B vehicles) compensating for the deficit in other areas: equipment destined for use in the production of renewable energy (- 300M€), supplies and materials for use in insulation materials and other equipment for home use.

The production fabric is characterized by the coexistence of a few large groups, several dozen medium-sized manufacturers of energy producing equipment (boilers, wood heating tools, solar powered systems, heat pumps, various equipment for the development of renewable energy production, etc.) and thousands of small businesses in the construction and civil works sector (insulation work, window fittings and installation of heating equipment and systems).

With insulation materials (Saint Gobain), as with railway rolling stocks fabrication (Alstom), French companies occupy the top positions in the world. Automobile manufacturers take advantage of the specialization of their production in small cars to gain a strong position in the market for low-consumption vehicles.

[1] This summary presents in a slightly modified form the principal results of the study, already published in the electronic letter Stratégie & Etudes n° 13 (ADEME July 2008)

Renewable Energy Development: A production system under construction.

At the same time that the large energy producers, both in France and abroad, are massively investing in renewable energy, (the stock exchange capitalization of the new energies branch of EDF was 2.8 billion euros, with a turnover of €562m in 2007), the production of equipments, with which France had experienced a significant lag, is now progressively establishing its structure.

The different segments of the photovoltaic industry are progressively extablisehd, from the production of silicium (SILPRO) and the solar cells and panels(Tenesol) to the coverings allowing their integration into or onto a building. This industry should take advantage of new strongly increased purchase tariffs and high levels of R&D. As far as wind energy is concerned, which has long been confined to the production of small-strength air-generators, several projects for the production of high-powered air-generators are now in the pipeline, while the industrial development would have the support of producers of high-performance materials (Rollix, Alstom), as well as their purchases of foreign producers (Ecotecnia by Alstom and Multibrid by Areva).

In the different areas of heating equipment (wood-powered, boilers, heat pumps, and solar thermal) the growth of the market over recent years has encouraged the emergence of an industrial offer of standardized systems able to be fitted by qualified installation professionals.

Despite these areas of progress, France's renewable energy industry is still behind those of some other European countries: in 2007 Germany's renewable energy industry, which employed 250,000 people (including indirect employees), had a turnover of 10.7 billion euros for the production of equipment (France: 4.6 billion), of which 4.7 alone was for photovoltaic and 2.2 was for wind energy, while sales of renewable energy reached 14 billion.

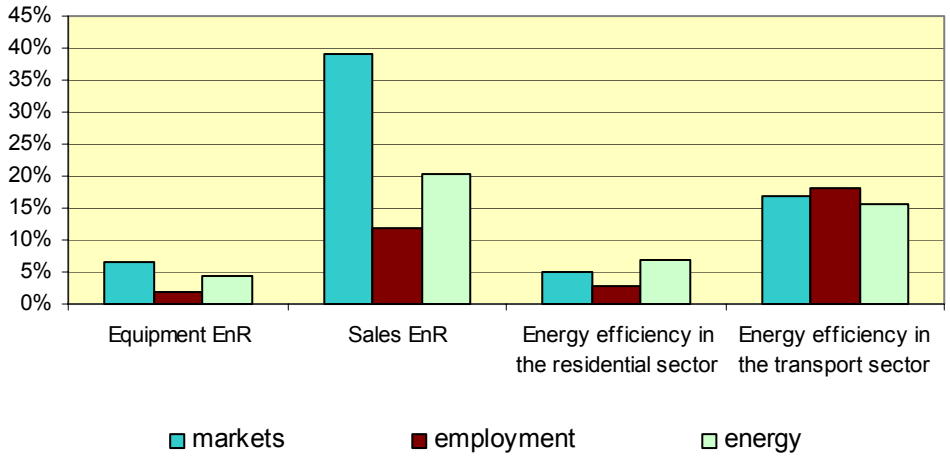
In 2006, exports of air generators from Denmark and Germany reached 944 million euros and 592 million euros respectively.

Changes 2006-2007: slight weakening in renewable energies

After a 2006 marked by high rates of growth in wind energy, solar heating, heat pumps, wood fire heating etc, the development in energy production capacity fell away in 2007; the growth in current market prices of equipment for the development of renewable energy was 12%. At constant prices, the growth in the market was 6.4%, the growth in the production was 5.5%, while employment rose only by 2%, due to a growth in labour productivity estimated at +3.5%.

As a result of the inertia due to the predominant share of biomass (wood) energy, the production of energy from renewable sources only grew by 4% in toe. However, energy sold increased by 20% in toe and by 41% in value due to the effects, in particular, of bio diesel imports. During the same period, the energy savings achieved as a result of energy efficiency measures implemented throughout the year in the residential and transport sectors increased by 8%.

Changes 2006 / 2007



EnR: renewable energy; the energy shown for EnR equipment is the total energy produced;
Energy shown under improvement of energy efficiency shows annual energy savings;
Market changes are shown at constant prices, energy is in ktoe and employment in full time equivalent

The growth of the market (+4.9 billion euros at current prices) is 52% due to the improvement in energy efficiency in the transport sector: a significant progression in the infrastructure programmes relating to

transport (trams and railways), construction of new railway materials and low-consumption vehicle sales, particularly in class B.

The Market for Domestic Heating Equipment slows down.

Overall, the three areas concerned with domestic heating solutions based on renewable energy sources (biomass, solar heating and heat pumps) only grew by 2% at current price levels. This slowdown is explained fundamentally by the fall in sales of biomass heating appliances (-15% against the first 3 quarters) and weaker development in solar heating than in previous years, despite heat pumps maintaining their positive development. The context of winter 2006-2007 could explain the weakening of the market. Another hypothesis is a reduction of the momentum created by the tax credit, while prices, which remained high, could have prevented the spread of these systems to the majority of households.

Of the other two large markets linked to the development of renewable energy (wind energy and the construction of bio fuels production units), only windmill energy continued its growth (+18%), which however was still lower than that of the previous year, while investment in bio fuels production plants remained stable at a high level (around €400m). In the "smaller" sectors, the market for photovoltaic equipment doubled between 2006 and 2007 and almost caught up with the solar thermal market.

Sales of energy saving equipment (condensation boilers, class A+ domestic appliances and energy-efficient light bulbs) are progressing at 14% at constant and current prices, prices having remained stable globally. There is no specific information available on the evolution of markets linked to the improvement of energy efficiency in the residential sector. Based on the changes in the production of materials and supplies in this area (insulation material and windows) and the general activity in the home improvement sector, it is estimated that these markets have experienced a slight growth in volume (3.3%), while prices increased by around 4%.

Promising projections, translating into a strong progression in employment relating to the activities studied... but requiring a significant financial effort on the part of households.

The projections drawn up for 2012 by the various working groups and committees for Grenelle are for strong market growth in all areas.

Renewable energy: markets in strong growth

Between 2007 and 2012 the markets for equipment used in the production of energy from renewable sources should increase by an average of 22% at 2007's constant prices. Five markets should reach or surpass the 2 billion euros mark: wind energy (4.2 billion), biomass heating equipment (3.6 billion), photovoltaic (2.8 billion), heat pumps (2.4 billion) and solar thermal (2 billion). These projections are based on the objectives set out by the Grenelle Operational Committee on renewable energy development (Comop no.10), taking into account the 2007 situation. Their achievement requires a change in the current trend of weakening in these markets observed in 2007 and a total spending in the period 2008-2012 of 26 billion euros for households (on domestic heating systems based on renewable energy sources), of which around 15 billion would be an "extra cost" above that of "standard" solutions, and investment spending of 17 billion euros by producers of energy for sale (wind, photovoltaic, biomass, etc.).

With such an effort, Grenelle's goals would be achieved. Production of energy from renewable sources would reach 18.9 million toe (as compared with 11.4 in 2006), a growth of 7.5 million toe, close to the objective of 7.6 million toe. Biomass would retain top position, but would only account for 53% of the total as opposed to 78% in 2007. The largest increases in absolute value would be those of biomass (1.9 million toe), followed by wind and bio fuels with +1.8 and +1.7 million toe respectively. Heat pumps would also grow by 0.9 million toe.

The renewable energy sector would account for 120,000 direct jobs, more than double the figure for 2007. Of these 120,000 jobs, around 35,000 would be dedicated to the production of energy for sale in the market or for maintenance of domestic heating equipment. 85,000 would be dedicated to the production, distribution and installation of related equipment.

Improvements in energy efficiency in the residential sector: Savings in 2012 equal to 13% of 2005's overall consumption.

The markets linked to the improvement of energy efficiency in the residential sector (including high-performance products specifically intended to reduce electricity consumption) would increase by 19% as a yearly average, reaching the level of 22 billion euros in 2012; the impact of the measures taken in the period 2006-2012 would be 5.6 million toe, equal to 13% of the year 2005's total domestic energy consumption (44 million toe).

The cumulative spending in this period would exceed 75 billion euros, most of which would be borne by households. In the final year, annual spending would reach 21 billion euros; including domestic heating equipment based on renewable energy would take the total spending of households in this sector to 29 billion euros in 2012, not deducting the various forms of public aid.

The number of workers directly engaged in activities linked to energy efficiency improvements in the residential sector would be around 215,000, of which around 88,000 correspond to the extra growth in activities linked to improved efficiency over and above standard solutions.

While the sustained high and increasing price of fossil fuels constitutes an extremely favourable factor in the development of renewable energy and energy saving, one of the primary limitations remains the high price of the proposed alternatives. The structuring of production networks and the extension of markets, in conjunction with the development of training in the installation of this household equipment, are the main cost-reducing factors. However, the weight of the expenses falling to households, in a conjuncture marked by the weakness of their purchasing power, highlights the need for innovative financial solutions to this situation. There is a need for widely-available loans whose repayment conditions are linked to the savings achieved on energy consumption.

Summary of Changes

	2006	Changes 2006/2007	2007	Changes 2007/2012 (aarg)	2012
Markets (in millions of euros)					
EnR	8 069	16%	9 380	20%	23 720
AEE	21 477	12%	24 090	14%	45 980
Total	29 546	13%	33 480	16%	69 700
Employment (full time equivalent)					
EnR	50 210	6%	53 460	17%	119 490
AEE	154 940	8%	168 010	14%	320 490
Total	205 140	8%	221 470	15%	439 980
Energy (in thousands of toe)					
EnR	11 360	4%	11 860	10%	18 880
AEE	930	57%	1 460	35%	6 420
Total	12 290	8%	13 320	14%	25 300

Markets are in 2007 prices

EnR: renewable energy; production and installation of equipment and renewable energy sales.

AEE: Improvements in energy efficiency (residential and transport sectors). Information on energy corresponds to savings achieved in the course of the year as a result of measures taken since 2005.

aarg: average rate of annual growth.

1 SUMMARY OF MAIN RESULTS

1.1 Context

1.1.1 Targets, objectives and regulatory framework

For many years the international community, the European Union and France, aware of the threat posed by global warming resulting from entropic activities and, in particular, the burning of fossil fuels, have set out strategies, targets and policies regarding the development of energy from renewable sources and the improvement of energy efficiency.

At the European level, these strategies have taken on the emblematic form of the stated “three times twenty” objective. Between now and the year 2020, the intention is

- To reduce greenhouse gas emissions by 20% in comparison with their 1990 levels, a figure which could later be reviewed and raised to 30%, if an international agreement is achieved,
- To achieve a 20% energy saving in relation to the 2005 level estimated by the European Commission.
- To produce 20% of all final energy consumption from renewable sources.

At the national level, since the start of the 2000s, there have been numerous texts containing similar objectives: the 2004-2012 Climate Plan, revised in 2006, an Act setting the direction for energy policy, the 2005’s heating regulation, etc.

The Act of 2005 July 13th setting the direction for energy policy (known as the POPE Act) set out a new framework for future energy policy. Its objectives, incorporating or surpassing the relevant European directives, were as follows:

- Reduction in the intensity of energy usage by 2% per year between now and 2015, then by 2.5% per year between 2015 and 2030;
- Reduction in greenhouse gas emissions by 3% per year to reach “factor 4” by 2050;
- Production of 10% of France’s energy requirements from renewable sources by 2010;
- Production of 21% of electricity consumption from renewable sources between now and 2010;
- 50% growth in the production of renewable heat energy between now and 2010;
- Increase in the use of bio fuels to 2% in 2006 and 5.75% in 2010.

The POPE Act also provides three schemes for encouraging energy saving and the development of renewable energy:

- The “Energy for Development” plan to boost developing countries’ access to energy services;
- The “Southern Face” plan for buildings should allow the installation of 200,000 solar water heaters and 50,000 solar roofs a year by 2010;
- The “Earth Energy” plan to achieve savings of at least 10 million tonnes of petrol and equivalent imports by 2010 by increasing the contribution of bio fuels and biomass to the production of heat

More recently, the Grenelle Environmental Plan confirmed France’s commitment to quarter its greenhouse gas emissions by 2050 - relative to 1990 levels - and to keep its greenhouse gas emissions below 140 million tonnes (of CO_2 or equivalents) from that time onwards.

The Grenelle I Act proposes, in particular:

- To arrange a break aimed at reducing buildings’ energy consumption, currently accounting for 40% of all final energy consumption and for a quarter of all greenhouse gas emissions. This plan is expected to contain ambitious standards for the construction of new builds as well as establishing a legal and financial framework for the renovation of existing buildings.
- To reduce the transport sector’s greenhouse gas emissions by 20% by the year 2020 through a “long-term sustainable transport policy” giving priority to rail freight transport, improving the environmental and energy efficiency performance of cars and accelerating the strengthening of urban public transport networks.
- To put in place a regulatory and financial framework encouraging the use of carbon clean technology, energy saving and the development of energy from renewable sources. This will be

achieved in particular through supporting the production of heat energy from renewable sources and the use of forestry resources (The Heat Fund).

More specifically with regard to **buildings**, several main lines of action have been proposed as part of the Grenelle project:

- Wider spread of low energy consumption new builds from 2015 (BBC 50 kWh (primary)/m2/year) and movement towards passive buildings (BEPAS) with heating requirements less than 15 kWh/m^2/year with the potential to become energy positive (BEPOS) in 2020 through the use of renewable energy;
- The implementation, within 5 years, of the plan to have around 1/3 of new builds as low-consumption and in the 2008-2012 period at least 25% of all housing to be BBC (Low Consumption Buildings) and 10% BEPAS or BEPOS.
- Adoption of a new "Heating Regulation" in 2010 (specifying very high energy-efficiency performance) and, in 2015, of the low energy consumption Heating Regulation (BBC);
- A reduction of 12% in 2012 and 38% by 2020 of the consumption of old housing; change from 240kWh/m^2/year energy consumption to 210 in 2012 and 150 in 2020. For the tertiary sector the objective of this plan is to reduce consumption to 80 kWh/m^2/year. Creation of "BBC-renovation" and "BBC-compatible" labels;
- The launch of a major professional training programme, and a research programme, specifically aimed at reducing costs.

In **transport**, the principal measures associated with the goal of reducing emissions are:

- To increase the non-road freight market by 25% between now and 2012 through the introduction of three new major "rail motorways": the Alpine Line, The Perpignan-Luxembourg Line and the Mediterranean Line. It is also planned to create new sea lines on both the Atlantic and Mediterranean coasts with the goal of transferring 5 to 10% of the traffic concerned to these new lines. Finally, there is the planned creation of the large scale Seine Northern Europe canal, expected to provide a traffic transfer of 4.5 billion tonne kilometres a year;
- To lay 2000 kilometres of High Speed Lines (LGVs) between now and 2020 and 2500 further kilometres of additional LGVs in the long term;
- To reduce average CO_2 emissions by cars from 176g CO_2/km to 130g CO_2/km between now and 2020, in particular by means of a research programme into the development of "clean" vehicles;
- To move in 15 years from 329 km of collective transport lines on clean sites (TCSPs) to 1800 km through the use of 2.5 billion state credits, with the first instalment of 12 billion between here and 2020 on the condition that these programmes are accelerated.

In the **energy** sector, the targets set aim for:

- A reduction in energy consumption through the use of taxation measures favouring more economical product choices, the extension of labelling, strengthening of energy certificates and the removal of the most energy-consuming products;
- 20% of 2020's energy being renewable, an increase of 20 million tonnes of petrol equivalent (toe).

This final objective has been declined by the Operational Committee on the development of renewable energy under the form of intermediary objectives for increase by 2012 (in ktoe).

Thermal Energy	**5 100**
Wood biomass	1 640
Heat pumps	1 000
Bio fuels	2 120
Solar thermal	160
Others (biogas, waste and geothermal)	190
Electric Energy	**2 540**
(Small scale) hydro-electric	100
Wind	2 060
Photovoltaic	95
Biogas, wood biomass	270
Geothermal	11
Total	**7 640**

1.1.2 Instruments

Taxation measures

➢ Tax Credits

This is the leading measure in terms of managing the demand for energy in the residential sector. Created by 2005 Budget Law, it provides those who acquire the most energy efficient equipment, including insulation equipment and materials and appliances using renewable energy, with tax credits (either in the form of a reduction in the tax paid or through reimbursement) equal to 50% of the value of these purchases, under the condition the installation is made by a professional.

The initial trends in 2007 with regard to the use of tax credits on energy saving appliances[2] and appliances using renewable energy confirm the previous conclusions on the effectiveness of this measure: the tax credits on sales and installation of the different categories of equipment (wood heating appliances, heat pumps, individual solar thermal or photovoltaic installations) increased spectacularly, although the sale of wood heating appliances does seem to have reached a plateau.

The estimated total budget cost was €400 million in 2005 and €950 million in 2006. A total of 1.9 billion euros has been allotted for 2007 and 2.4 billion for 2008.

➢ Taxation on bio fuels

The partial cancellation of domestic taxation on bio fuels (TIC, ex TIPP) has been allotted a budget of €610 million in 2007 and €1.09 billion in 2008.

Table 1. **Summary of taxation measures favouring renewable energy and energy saving**

	2006	2007	2008
Exoneration of TIPP on bio fuels	259	610	1 090
Tax credit for spending on energy saving	990	1 900	2 400
Tax credit for vehicles using GPL, GNV, etc...	15	20	20
VAT reductions on heating networks	5	10	10
Memory items			
VAT reductions on home improvements	*4 360*	*5 000*	*5 400*
Exceptional amortization for renewable energy equipment	*n.a.*	*n.a.*	*n.a.*

In million of euros : source : PLF 2008 Evaluation of ways and means

Purchase prices and energy saving certificates

➢ Purchase prices

The mechanism for compulsory purchases of electricity produced by independent installations is very old; it was established in 1955 as part of a decree encouraging (mainly hydro-electric) installations of under 8 MW. Legislation on 10th February 2000 extended this system to include renewable (or co-generating) electricity producing installations of less than 12 MW. Legislation on July 13th 2005 setting the goals for energy policy (the POPE Law) once again made changes to this legislative framework.

Purchasing Tariffs

Upon the application of this legislation the tariffs of these purchasing obligations were thoroughly re-evaluated throughout 2006 with a view to encouraging the use of renewable energy, particularly from sources such as photovoltaic, geothermal, biogas and methanisation technology.

[2] See First 2007 tendencies of the tax credit Observ' ER for the ADEME January 2008

Table 2. **Compulsory purchasing tariffs (basic, excluding specific cases)**

Stream	2001/2002 arrêté	2006/2007 arrêté
Hydro-electric	55 to 61	607
Biogas	45 to 57	75 to 90
Methanisation	46	95 to 110
Land-based wind energy	838	82
Photovoltaic energy	152	300 to 550
Geothermal	76	120
UIOM	45 to 50	
Biomass	49	

In €/MWh, source DGEMP

The 2006/2007 tariffs from arrêtés do not apply to contracts already in force at the time of application. The previous tariffs still apply to these contracts.

Information on compulsory purchases

The obligation for EDF and local electricity distributors to purchase electricity produced from renewable sources results in compensation, calculated based on the difference in the reference cost of electricity. For renewable energy in general (excluding cogeneration), the surcharge for EDF on compulsory purchases in Metropolitan France was in the region of €70 million in 2006. It should remain at this level in 2007.

The main reason for this stagnation in contrast with the rise in quantities sold is the increase in the reference price of electricity. This has increased by 26% between 2005 and 2007, surpassing the average purchase price for small-scale hydroelectric and incineration. With present tariffs the predicted weighted average purchase price of electricity from renewable sources for 2008 is around €69/MWh. By the end of May 2008, the average reference price of electricity, based on three months term in the current market, will have reached €84.2/MWh, equal to the cost of electricity produced by wind power. In the current market situation only purchases of electricity produced by photovoltaic power should result in compensation.

Table 3. **Average purchase price of electricity and reference price**

	Average purchase price						
	Reference price	Hydro-Electric	Wind	Incineration	Biomass, biogas and PV	Others	Weighted average
2006	55.1	55.1	84.5	50.3	64.0	86.3	61.5
2007	63.6	55.0	84.3	51.0	93.0	93.0	63.4

€/MWh; Source : Energy Regulation Commission (ERC); PV = Photovoltaic

➢ Energy saving certificates (CEE)

Coming into force on 1st July 2006, this legislation obliges energy suppliers to achieve or help their consumers achieve energy savings in residential and tertiary sectors. The extent of this obligation is determined by the type of consumer and the type of energy used.

The goal for 1st July 2009 is to reach 54 TWh *cumac*[3]. On 31st December 2007[4] the total from CEEs was 9.5 TWh which, at the halfway point in the project, is only 17.6% of the stated objective. The extremely strong growth in the first two months of 2008 (4.5 TWh or 8.3% of the stated goal) is a sign of the strengthening of this mechanism; the continuation of this rate of growth would result in the target being met and surpassed by July 2009 with the level reaching around 90 TWh by the deadline. In the following two months, March and April, growth was only 1.2 TWh (15.2 TWh by May 1st 2008. According to the DGEMP newsletter, however, the 20 TWh mark was surpassed during the month of May.

In general, the total of CEEs delivered is far lower than the energy savings calculated in this study into these activities: for example, the 125,000 condensation boilers sold in 2006 should translate into the delivery of

[3] Cumac: present amount of the energy saving carried out by equipment over its lifespan

[4] See : Assessment of the CEE ; newsletter of the DGEMP

11.9 TWh[5] of certificates. The total certification for condensation boilers on 1st May 2008, however, was only 3.1 TWh.

Table 4. **Information on energy saving certificates as of May 1st 2008**

	% of total	TWh
Individual condensation boiler	20.7	3.1
Individual low temperature boiler	15.8	2.4
Window or french window with insulated glass	7.7	1.2
Air / Air heat pump	6.9	1.0
Insulation of roof	6.7	1.0
Collective condensation boiler	6.7	1.0
Individual solar powered water heater	5.5	0.8
Air / Water heat pump	3.6	0.5
Collective low temperature boiler	2.9	0.4
Wall insulation	2.7	0.4

Based on the 10 most frequently used operations in certification of energy efficient activities; total on 1st May : 15.2 TWh

Other measures or instruments

Numerous other measures have been implemented to support the policies set out for developing renewable energy sources and increasing energy efficiency. These include:

- The establishment of quality labels for renewable energy such as Qualit'EnR, QualiSol, QualiPV, QualiPAC and Qualibois, intended to guarantee the quality of the installation.
- Energy standards for home appliances, specific vehicles, etc.
- The *bonus malus* system with regard to ecological impact.
- The establishment of specifically targeted sources of funding: the "sustainable development" deposit as a replacement for the CODEVI, notably used to finance energy saving work in old buildings. Funding of energy saving work through lease (Sofergie, proposed by Natixis). Loans at favourable rates of interest proposed regionally.
- The training programme, in the context of the climate change plan, whose goal is to train at least one member of 10% of building firms within three years.
- Research schemes (the CNRS energy programme, the national initiative on new energy technologies, Predit, Prebat ...); put in place of competitive focus points within the energy sector: DERBI, Tennerdis, S2E2, Capenergies, etc. and specialised research centres: INES, the centre for climate and environmental research ...

[5] With an average amount of certificate of 95 MWh per condensing boiler (operation BAR-TH-6)

1.2 Overall presentation of markets: 2006 / 2007

1.2.1 The situation in 2006

Markets

In 2006, the markets studied accounted for a total turnover of 28.6 billion euros, of which around 25% was in markets linked to renewable energy sources and 75% was in markets associated with increasing energy efficiency in the residential and transport sectors.

Table 5. **Total sum and distribution of markets in 2006**

	Total	Proportion
Markets linked to renewable energy sources	**7 700**	**27%**
Development of renewable energy sources	5 300	18%
Renewable energy sales	2 500	9%
Markets linked to improving energy efficiency	**20 800**	**73%**
Residential sector	8 400	29%
Transport sector	12 500	44%
Total	**28 600**	**100%**

In million of euros ; totals are rounded to the nearest hundred million euros

Of this total, a little over 12 billion (44%) are connected with transport, whether public: creation of rail transport infrastructure, tram networks and associated equipment; or purchases of vehicles in energy classes A and B. This evaluation is only partial and does not account for the entire range of measures aimed at improving energy efficiency in the transport sector: river transport networks, etc.

The improvement of energy efficiency in the residential sector (insulation of existing buildings, condensation boilers and appliances aimed at reducing specific energy consumption: low energy lamps, class A+ refrigerators and washing machines) account for 8.4 billion euros. This estimate only takes into account measures resulting in a real improvement in energy efficiency and excludes, for example, the installation of TH < 8 windows. Furthermore, as indicated, it does not take into account the markets linked to the improvement of energy efficiency in new housing, nor in buildings destined for use in the tertiary sector, industry or agriculture. The improvement of energy efficiency of production processes (motors, heating, etc.) is also excluded.

When, in the case of work on openings, roofs, condensation boilers and high performance household appliances, only the “extra cost” alone is considered, which is linked to the increased energy efficiency of the measures put in place in comparison to standard solutions, this estimate is reduced to 4 billion euros.

Markets linked with renewable energy sources, worth a total of 7.7 billion euros, consist of two different types of markets: markets for equipment and markets for the sale of renewable energy.

The total value of the equipment market is 5.3 billion euros, including the cost of engineering, technical studies and installation services (construction and civil works). This breaks down into 2.7 billion in household spending on the purchase and installation of domestic heating appliances using renewable energy (heat pumps, wood heating appliances and solar thermal heating), 1.9 billion euros businesses’ investment in the production of renewable energy for sale (wind, photovoltaic, bio fuel production plants, etc.) or for their own needs, and 0.7 billion euros worth of exports of appliances or components. The “extra cost” of domestic heating solutions based on renewable energy as opposed to those using electricity, gas or fuel is estimated at 1.7 billion euros.

Sales of energy from renewable sources (without VAT or other taxes on products) are worth 2.5 billion euros, of which 1.7 billion is accounted for by wood and bio fuels. The additional cost of production for energy from renewable sources, measured as the amount supported by EDF in its role as electricity distributor and the value the tax breaks afforded to bio fuels is estimated at around 0.33 billion euros.

➢ Market distribution by components and acquisition sector

The markets for equipment can be broken down into the markets for the appliances themselves, evaluated by the "factory or customs price" and distribution services (commerce and transport), setup and installation (construction and civil works), including technical studies.

Overall, equipment and appliances account for 42% of the market, the same percentage as that of construction, setup and installation services (including engineering). The distribution of equipment and appliances and the sale of renewable energy share the rest of the market fairly equally with 7% and 9% respectively.

Table 6. **2006 market distribution by components**

	Value	Distribution
Equipment and appliances	12 100	42%
Construction, setup and installation of appliances*	11 900	42%
Distribution of equipment and appliances	2 100	7%
Energy sales	2 500	9%
Total	**28 600**	**100%**

In million of euros; amounts are rounded to the nearest hundred million euros; *including engineering and technical studies

With their purchases of durable consumer goods and work to improve energy efficiency in their homes, households are the main sector of direct demand in this market, followed by businesses (investment in the production of renewable energy, equipment and rail transport infrastructure) and local government (investment in tram infrastructure). For their part, exports account for 12% of demand.

Table 7. **2006 market distribution by acquisition sector**

	Value	Distribution
Households	15 800	60%
Businesses: investment	6 200	24%
Exports	3 000	12%
Local government	1 100	4%
Total	28 600	100%

In millions of euros; amounts are rounded to the nearest hundred million euros; excluding renewable energy

Production and employment

As has been indicated, although the domestic market for appliances and energy efficiency improvements in the home is generally well documented, the same is not the case for production and foreign exchanges, which often involve products with unidentified energetic performance specifications, barring some exceptions, in their classifications. The analysis of the production sector and external exchanges is the result of estimates based on interviews, analysis of available data on businesses and, in some cases, of existing studies (for example, into wood heating appliances) or data and statistics relating to industry or foreign trade.

Table 8. **2006: Production, imports and exports**

	Value	Distribution
Production	25 800	90%
Imports	2 800	10%
Market total = Resources	**28 600**	**100%**
Exports	3 000	11%
Domestic market	25 600	90%

In millions of euros; amounts are rounded to the nearest hundred million euros;

In 2006, overall production was slightly greater than the market, with the net balance of foreign trade in transport goods (around 750 million euros) more than compensating for the balance of renewable energy equipment (-270 million euros) and on energy efficient appliances and equipment in the residential sector (-285 million).

It should be noted that within this production, as well as within the market, only one part actually corresponds to an increase in activity: in facts the purchase of energy efficient heating systems for households, including domestic heating systems based on renewable energy, is a substitute for the purchase of standard systems; the same is the case for household appliances and replacement of openings.

➢ Employment

Overall, activities producing goods and services involved in the development of renewable energy sources and increasing energy efficiency, including the production of renewable energy for sale, are directly responsible for the employment of 205,000 individuals in full time equivalent. This total does not include those employed in the informal wood production sector. It only accounts for those directly employed in activities under review: for example, it excludes agricultural employees involved in the production of bio fuels.

Table 9. **Direct Employment in 2006**

	Production sector jobs			
	Equipment	Energy	Services	Total
R.En	11 200	16 400	22 100	49 700
Residential AEE	17 400		78 200	95 700
Transport AEE	17 500		42 300	59 800
Total	**46 100**	**16 400**	**142 600**	**205 100**
of which exports	10 600			10 600

R.En: Renewable energy; AEE: improvement of energy efficiency; number of jobs rounded to the nearest hundred; employment in the maintenance of energy systems included under energy production (370 jobs); new jobs linked to the running of public transport included under services linked to transport (500 jobs)

Including related indirect employment, that is to say employment linked to the intermediary consumption of the activities listed (for example, agricultural jobs resulting in the production of primary materials used in the production of bio fuels, those supplying the automobile or rail industries, etc.), the total number of jobs rises to 280 000[6].

Inversely, if only the number of jobs related to an increase in activity are taken into account, the number of jobs falls to 117 000.

Energy

In 2006, production of renewable energy reached 11 360 ktoe, of which 91% was in the form of thermal energy. 45% of this thermal energy was sold for a total value of 2.5 billion euros.

Table 10. **Energy production in 2006**

	Thermal ktoe	Electric GWh	Total ktoe
Energy production	10 300	11 720	11 360
Auto consumed energy	6 060	1 850	6 220
Energy sold	4 240	9 870	5 150
Value of energy sales €M	1 870	610	2 480
Average price (€k/unit)	440	60	480

Units rounded to the nearest 10

Almost 80% of this energy comes from wood, with the three other main energy sources (bio fuels, small-scale hydro-electric and UIOM) each contributing 4 to 5% in 2006.

The measures aimed at improving energy efficiency put in place over the course of the year resulted, with the exception of rail transport but including trams, in energy savings of 490 ktoe, of which 86% was linked to measures aimed at improving energy efficiency in the residential sector. The accumulated energy savings over the years 2005 and 2006[7] were 0.9 million toe.

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[6] The order of magnitude of the employment obtained by integrating the whole of indirect employment would be 350.000 jobs.

[7] The year 2005 was selected as basic year for the calculation of energy saving

Table 11. **Energy savings in 2006**

	Thermal ktoe	Electric GWh	Total ktoe
Savings as a result of the year's sales	460	350	490
Cumulative savings as a result of sales since 2005	870	700	930

In 2005, the total energy consumption in the residential sector was estimated at 44.4 million toe; savings linked to energy efficiency measures in the year were equivalent to 0.9% of consumption. Energy savings linked to transport were far more modest, with only 75 ktoe of savings estimated as a result of tram development and the sale of A and B energy classes vehicles. This amount represents just 0.14% of the 50.8 million toe consumed by the transport sector as a whole in 2006. This result must be placed in perspective, considering that only a small proportion of the total pool of vehicles is affected by the measures in question: 356 000 vehicles pertaining to the A and B energy classes were sold, amounting to only 1% of the total pool (35 million currently in circulation).

Businesses

After a long period in which only a few pioneering companies continued to invest in the renewable energy and increased energy efficiency markets following the petrol "counter shock", the growth of the market - boosted by public policy since the beginning of 2000 - has led to progressive development of production apparatus. This development, however, remains behind the progress made by other countries.

It is in the area of renewable energy in particular - except bio fuels - that this deficit is most noticeable. Major energy companies who had invested little in the production of renewable energy are now attempting to recover this deficit, particularly in the wind power and photovoltaic sectors, whether by buying developing or foreign companies or investing in the fabrication of equipment in this area through sister companies.

The most significant development has occurred in the wind power sector. A few months after having bought Canadian Ventus for €86 million, Suez bought the Compagnie du Vent for €321 million, while Poweo went forward with the acquisition of Espace Eolien Developpement. In the fabrication sector, Areva purchased Multibrid, a German firm specialising in sea-based wind turbines and Alstom Ecotecnia, a Spanish firm producing wind turbines.

In the photovoltaic sector, after the increase in Tenesol and Photowatt's production capacities, the number of projects has multiplied to provide the country with a complete supply chain, from the production of silicium to specialised components. At the same time, energy firms (Séchilienne, Poweo) and institutional investors (CDC) are getting involved in energy production by putting in place ground-level centres.

Apart from this involvement of large energy companies, numerous SMEs (small and medium enterprises) are making progress in the development of equipment for various sectors: wood heating systems, solar power, heat pumps, small scale hydro-electric power and geothermal power with the support of public organisations and recently created competitive poles.

The stock market capitalisation of the ten or so firms specialising in renewable energy reached 5.9 billion euros, with the three largest firms specialising in energy production (EDF EN 2.8 billion, Séchilienne Sidec 1.5 billion, Theolia €860 million), rather than in the production of equipment. After a period of strong growth from 2004-2007 (Séchilienne Sidec and Theolia's operations were multiplied by 7 to 10 times between 2004 and 2007), operations had a tendency to stagnate, or even fall slightly, with the exception of a few particular cases.

Despite these recent developments, the industrial renewable energy sector is still well behind the level reached by other countries.

Table 12. **Renewable energy in Germany**

	Investment (€M)	Energy Production (€M)	2006 Employment	2007 Employment
Geothermal	601	50	4 200	4 500
Biomass			95 400	96 100
Biomass electricity	1 034	2 328		
Biomass heating	1 348	1 572		
Hydro-Electric	70	1 130	9 400	9 400
Wind	2 195	3 504	82 100	84 300
Solar			40 200	50 700
Solar thermal	725	-		
Solar photovoltaic	4 675	1 855		
Non-merchant sector			4 300	4 300
Total	**10 700**	**14 000**	**235 600**	**249 600**

Source: development of renewable energy sources in Germany in 2007 (BMU March 2008); employment including indirect employment

In other areas, large international firms are well placed: Saint Gobain is the world leader in insulation and should certainly benefit from the growth in the market for improving energy efficiency in the residential sector through its market offer of insulation products and glazing. The convergence between solar power and the demand for these appliances in the building industry has given rise to a number of applications of this technology developed by firms such as Lafarge and Arcelor and various SMEs.

Alstom is the leading firm in the supply of solutions for railways and tramways; automobile constructors and national equipment providers are well placed to take advantage of the market's turn towards vehicles emitting less CO_2.

1.2.2 Overall development 2006-2007

Markets

With an overall growth rate of 17%, at current prices, the markets linked to renewable energy and increasing energy efficiency experienced strong growth between 2006 and 2007.

The markets connected with renewable energy experienced the strongest growth (+21%), particularly in sales of renewable energy (+41%). It is, however, the improvement in energy efficiency in transport that makes the most significant contribution to the growth of markets as a result of the strong growth in the sales of railway materials and classes A and B vehicles.

Table 13. **Market development 2006-2007**

	2007	Increase 2006-2007	Change 2006/2007
Markets linked to renewable energy	**9 400**	**1 600**	**212%**
Renewable energy development	5 900	600	118%
Renewable energy sales	3 500	1 000	412%
Markets linked to increasing energy efficiency	**24 100**	**3 300**	**157%**
Residential sector	9 100	700	86%
Transport	15 000	2 600	205%
Total	**33 500**	**4 900**	**172%**

In millions of euros; values rounded to the nearest hundred million euros

At constant prices, the developments in the market remain strong, particularly with regard to renewable energy sales with the average price remaining stable due to the proportion of wood energy. The increase in prices would be highest in the market for equipment for renewable energy production (+5%), in particular as a result of the high global demand for wind power, while photovoltaic prices would be stabilised. In the

residential sector, the rise in the price of work on houses is partially compensated for by stability in the price of energy efficient goods and appliances (household appliances and low-energy lamps[8].).

Table 14. **2006-2007 market changes at constant prices**

	Current prices	Price index	Constant prices
Ren En Equipment	118%	50%	64%
Ren En Sales	412%	16%	390%
Residential IEE	86%	33%	51%
Transport IEE	205%	30%	170%
Total	**172%**	**33%**	**135%**

Details on the calculation method provided in the methodology section of the annex

Production and Employment

Production

In the majority of sectors, production follows changes in the market. This parallel is mostly due to the significant role played by domestic activities such as distribution, construction, fitting and installation. The lower growth in production of renewable energy compared to the market should be noted, however, which is due to imports of bio diesel. A similar phenomenon is present in the transport sector due to the fall in French producers' part in the market for class B vehicles.

Table 15. **2006-2007 production changes**

	2007	Increase 2006-2007	Change 2006/2007	
			At constant prices	At current prices
Renewable energy	**8 100**	**1 300**	**18.4%**	**14.4%**
Renewable energy development:	4 800	500	10.7%	5.5%
Production of renewable energy for sale	3 300	800	32.1%	30.0%
Increasing energy efficiency	**21 600**	**2 700**	**14.3%**	**11.7%**
Residential sector	8 500	700	8.4%	4.8%
Transport	13 100	2 000	18.5%	15.1%
Total	**29 700**	**4 000**	**15.4%**	**11.8%**

Amounts and increases measured in millions of euros at current prices; values rounded to the nearest hundred million euros

Employment

The development in production has resulted in an increase of around 16,000 jobs; of this total, 65% are connected to the production of transport equipment and infrastructure (rail track and rolling stock, including trams).

Table 16. **2006-2007 employment changes**

	2007	Increase 2006-2007	Change 2006/2007
Renewable energy	**52 300**	**2 600**	**5.2%**
Markets connected with renewable energy development	34 000	600	1.9%
Production of renewable energy for sale	18 300	1 900	11.9%
Increasing energy efficiency	**169 200**	**13 700**	**8.8%**
Residential sector	98 500	2 800	3.0%
Transport	70 700	10 900	18.2%
Total	**221 500**	**16 300**	**8.0%**

Number of jobs rounded to the nearest hundred

8 Prices' evolutions are to be considered with prudence; taking into account the aggregate level to which they are characterized they can integrate a "quality effect", due to the rise in quality of equipments, in particular in the wood bases heating appliances (estimate of 7,5% on the basis of the trend of the former years)

Overall, the change in employment (+8%) is less than that in production (+12% at current prices). This difference is due to the increase in labour productivity over this period, estimated based on available trends (see methodology).

The table below charts the changes in the market at current prices against those in the employment market.

Table 17. **Changes in markets, production, prices, productivity and employment**

	2006	2007	Change
Total market value at current prices (€ million)	28 600	33 500	172%
Imports (€ million)	2 800	3 800	333%
Production value at current prices (€ million)	25 800	29 700	154%
Price	1 000	1 033	33%
Production value with prices held constant at 2006 levels (€ million)	25 800	28 800	118%
Average productivity (€M per f/t employee)	126	130	35%
Employment	205 100	221 500	80%

Corresponding tables for each major sector can be found in the methodology section of the annex

This difference is particularly marked in the sector production renewable energy for sale, and is accounted for by the strong growth in relatively "expensive" (see below) non labour intensive renewable energy sources (wind power and bio fuels- excluding jobs in agriculture).

Energy

Production of energy from renewable sources

Measured in *toe*, production of renewable energy only increased by 4.4%. This result is due to the fall in fuel wood: according to the DGEMP, this production would have fallen by 3.5% as a result of warmer climate meaning less demand for heating in the home. Production of thermal energy from other sources accounted for 40% of the total. Excluding small-scale hydro-electric, the increase in electricity production from renewable sources was 42%, with electricity from wind power sources in creasing by 92%.

Table 18. **Change in renewable energy production 2006-2007**

	2007	2006-2007 increase	2006/2007 change
Electrical energy (GWh)	**14 470**	**2 750**	**23%**
from wind power	4 200	2 010	92%
from other sources	10 270	740	8%
Thermal energy (ktoe)	**10 550**	**250**	**2%**
wood-based	8 480	-310	-4%
from other sources	2 070	560	37%
Total (ktoe)	**11 860**	**500**	**4%**

Energy savings

Energy savings as a result of measures put in place over the course of the year increased by 8% in comparison with 2006. For their part, cumulative energy savings resulting from measures in place since 2005 increased by 57%.

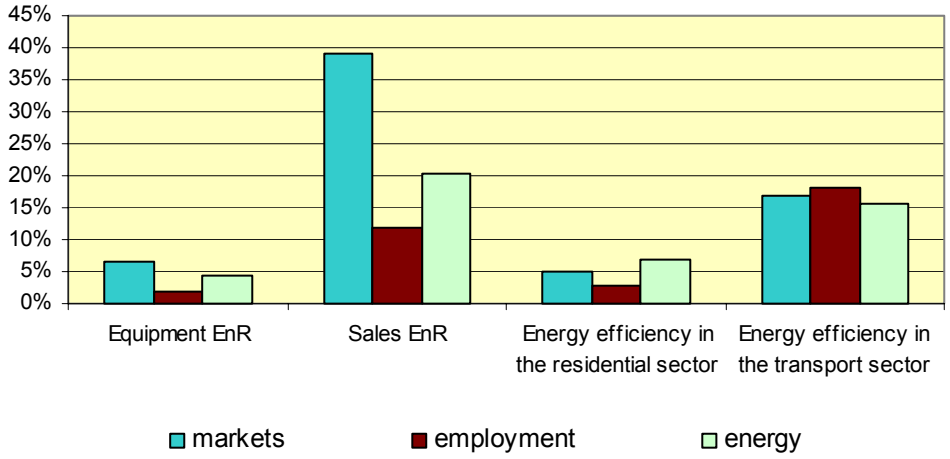
Table 19. **Changes in energy savings 2006-2007**

	Year 2007 measures	Change 2006/2007	2007 cumulative measures	Change 2006/2007
Residential sector (ktoe)	**450**	**7%**	**1 240**	**56%**
from electricity (GWh)	420	18%	1 110	60%
from insulation and heating (ktoe)	410	6%	1 140	56%
Transport (ktoe)	**90**	**16%**	**220**	**63%**
Total (ktoe)	**530**	**8%**	**1 460**	**57%**

Rounded to the nearest 10 units

The strongest increase was that connected with electricity consumption and is connected to the strong rise in the sale of low energy consumption light bulbs.

Summary of 2006/2007 percentage changes



EnR: renewable energy; the energy shown for EnR equipment is the total energy produced;
Energy shown under improvement of energy efficiency shows annual energy savings;
Market changes are shown at constant prices, energy is in ktoe and employment in full time equivalent

1.2.3 2006 – 2007 changes by markets

Renewable energy

➢ Markets providing equipment for the development of renewable energy production

The main markets are wood-based heating appliances and wind turbines, which together account for just over 62% of the market.

Table 20. **2006-2007 changes in the markets providing equipment for the development of renewable energy production**

	2006	Change 2006/2007	2007	% Distribution
Wood-based heating equipment	2 080	-5.3%	1 970	34%
Wind power	1 420	20.2%	1 700	29%
Heat pumps	430	40.3%	600	10%
Bio fuels	220	106.1%	440	8%
Solar thermal	370	21.1%	440	8%
Photovoltaic	480	-11.7%	430	7%
Biogas	40	247.4%	140	2%
UIOM	90	-30.8%	60	1%
Small scale hydro-electric	30	108.0%	70	1%
Geothermal	120	-73.4%	30	1%
Total	**5 260**	**11.8%**	**5 880**	**100%**

In millions of euros at current prices; values are rounded to the nearest ten million; percentages are calculated as exact values.

According to available sources, the domestic market for wood-based heating equipment experienced a decline in 2007, with their value falling by 5%. After several years' strong growth, the number of domestic appliances sold effectively fell in 2007 (-15%). This fall is partially compensated by the change in prices: in the 2003-2006 period, prices rose by an average of 15% per year, more due to an quality increase of products available than a pure rise in prices.

The domestic market supplying equipment for the development of the wind-power market grew by 18%. Around half of this growth is due to the increase in wind turbines installation (888MW as opposed to 810MW in 2006), with the other half taking place as a result of an increase in unit prices. These prices, which rose from €1.25 million per MW to €1.35 million, rose in response to excess world demand for the products exceeding production capacity.

The increase in heat pump and solar thermal system installation experienced a relative slowdown after several years of extremely strong growth. The domestic market for solar thermal power grew by 14%. This growth was the result of an 8% increase in installations, including Overseas Regions (DOMs), and a 5% increase in prices. The domestic market for heat pumps grew by 24%, the assumption being that this was due to a slight fall in prices as a result of the industry's restructuring of its market offering.

Powered by the strong increase in the purchase price of electricity, the installation of photovoltaic systems has risen by 165%. The trend towards falling prices, which are high in France, is compensated for by the increasing number of more expensive integrated systems.

The other renewable energy markets have experienced contrasting developments; the market for energy producing systems based on urban waste followed that for the construction of incineration and methanisation plants. Investments in the production of bio fuels are at a relatively high level, but experienced little change from 2006 to 2007. The value of biogas was also pushed up by the increase in purchase prices. The changes in the geothermal and small scale hydro-electric equipment were of little significance due to the small size of these markets.

➢ Employment linked to renewable energy development

Changes in employment levels are determined by changes in the volume and labour productivity of production activity. It is possible that the method used for calculating employment figures could exaggerate falls in the level of employment: in facts, a short-term fall in the volume of production is not automatically accompanied by a proportional fall in employment, but by a decrease - or smaller increase - in the level of production per employee which is impossible to measure. This could be the case for the production of wood-based heating installations.

With only 2% growth, employment increased very little. This development resulted primarily from the fall in the number of jobs connected with wood-based heating installations. Appliances for the home market effectively experienced a 15% fall in the number of units sold, only partially compensated for by the development of the markets supplying the industrial and tertiary sector markets.

In contrast, jobs in the manufacture and installation of other renewable energy sources rose by 19%, with particularly strong growth in the photovoltaic sector reflecting the overall growth of the market. With 1,000 new jobs in 2007, stronger real growth in the sector producing heat pumps, this field of renewable energy development passed the 2,000 direct employee mark by the end of the year, in addition to 450 indirect employees.

Table 21. **Employment changes linked to renewable energy development 2006-2007**

	2006	% change	2007
Wood-based heating appliances	**16 620**	**-15%**	**14 140**
Others	**16 700**	**19%**	**19 830**
Wind power	6 300	10%	6 910
Bio fuels	2 430	-1%	2 410
Photovoltaic	1 100	95%	2 130
Solar thermal	1 930	21%	2 340
Heat pumps	3 450	29%	4 430
Small-scale hydro-electric	200	85%	370
UIOM	350	-34%	230
Geothermal	260	-14%	230
Biogas	690	12%	770
Total	**33 320**	**2%**	**33 970**

Figures rounded to the nearest ten.

Transition from markets to employment

	2 006	2 007	change
Total market value at current prices (€ million)	5 300	5 900	11.8%
Imports (€ million)	900	1 100	16.9%
Value of production at current prices (€ million)	4 300	4 800	10.7%
Price	1000	1048	4.8%
Value of production with 2006 prices held constant	4 300	4 600	5.5%
Average productivity (€ million per f/t job)	0.130	0.135	3.5%
Jobs	**33 300**	**34 000**	**1.9%**

➢ Renewable energy production

Between 2006 and 2007, production of renewable energy rose by 4%. This weak growth is explained by the fall (-4%) in production of wood-based thermal energy[9]..

Wood aside, production of thermal energy rose by 560 *ktoe* (+37%), of which 472 *ktoe* came from bio fuels. Production of thermal energy from heat pumps and solar thermal sources experienced respective increases of 33% and 22%, reflecting the increase in renewable energy installations in 2007.

Production of electric energy experienced a more significant increase of 2750 GWh (+22%). A relatively weak increase (7%) in small-scale hydro-electric energy, which in 2006 accounted for over 50% of production, was noted, while during the same period production of electricity from other renewable sources increased by 41%, mainly thanks to wind power, which almost doubled its contribution with an increase of 2 TWh. Other than biogas, all other contributions were purely anecdotal.

Table 22. **2006-2007 development of renewable energy production**

	2006	Change 2006 - 2007	2007	Variation
Thermal energy (ktoe)	**10 300**	**2%**	**10 550**	**250**
Wood biomass	***8 790***	***-4%***	***8 480***	***-310***
Other thermal	***1 510***	***37%***	***2 070***	***560***
Heat pumps	200	33%	270	70
Bio fuels	700	67%	1 170	470
Solar thermal	50	22%	60	10
Biogas	60	7%	60	0
UIOM	310	2%	320	0
Geothermal	180	3%	190	10
Electrical energy (GWh)	**11 720**	**23%**	**14 470**	**2 750**
Small-scale hydro-electric	***6 010***	***7%***	***6 420***	***410***
Other electrical	***5 710***	***41%***	***8 050***	***2 340***
Wind power	2 190	92%	4 200	2 010
Photovoltaic	30	31%	40	10
Biogas	560	21%	680	120
UIOM	1 600	1%	1 620	20
Geothermal	80	10%	90	10
Wood biomass	1 250	14%	1 430	180
Total (ktoe)	**11 360**	**4%**	**11 860**	**500**

➢ Renewable energy sales

While the quantity of renewable energy (given in toe*)* sold grew by 20% between 2006 and 2007, the value of sales increased by 41%. This difference stems from the change in the composition of these sales. In the market for thermal energy, sales of high-price bio fuels (€850/tonne) grew strongly (+97%) while the quantity

9 The precision of the evaluation of the thermal energy production starting from wood is weak: one does not have yet the results of the 2006 « housing survey » which could inform about the park of the residences equipped with wood based heating appliances; most of the production is non market and badly known; finally the improvement of the energy efficiency of the apparatuses for a few years could have uncoupled wood consumption and effective energy production.

from wood-based sources (€320/toe) only grew by 4%; in the electric energy sector, wind power (€85/MWh) grew more strongly than hydro-electric (€55/MWh). The analysis of these changes reveals a very mild change in prices: the **volume** index increased by 39% and the **price** index increased by 1.4%.

Table 23. **2006-2007 changes in the value of energy for sale**

	2006	Volume index	Price index	2007
Wood energy	950	3.6%	1.0%	990
Bio fuels	750	97.0%	1.5%	1 510
Small-scale hydro-electric	330	6.8%	1.1%	360
Wind power	190	91.9%	0.3%	360
Others	260	6.1%	4.4%	290
Total	**2 480**	**39.2%**	**1.4%**	**3 500**

In millions of euros at current prices

Sales of bio fuels increased more than their production due to relatively large imports of bio diesel necessary in order to achieve the targeted incorporation rate. In 2007, the total subsidy from which bio fuels benefited in terms of tax breaks would have been €540 million.

For its part, the total value of purchase surcharges on renewable energy, compensated for by the "compensation charges for the public electricity service" paid by consumers, should remain steady at around 70 million euros, with the increase in charges on wind power compensated for by the fall in those on hydro-electric power, whose purchase price has fallen below that of the market reference.

Table 24. **Changes in quantities and prices**

	Quantities (*toe*)			Average price €/*toe*		
	2006	Change 2006/2007	2007	2006	Change 2006/2007	2007
Wood energy	3 150	4%	3 260	300	1%	305
Bio fuels	700	97%	1 380	1 070	1%	1 090
Small-scale hydro-electric	520	7%	550	640	1%	650
Wind power	190	92%	360	980	0%	990
Others	590	6%	630	440	4%	460
Total	**5 150**	**20%**	**6 185**	**480**	**18%**	**565**

➢ Employment in the production of energy for sale

Almost 70% of direct employment linked with the production of energy for sale is concentrated in two main areas: production of bio fuels and production of wood-based energy. In the latter, employment is stable due to the development of the sales of wood energy. Employment in bio fuel production grew strongly in response to the increase in the quantities produced. It is, however, possible that this increase has been overestimated, with the increase in units produced attributable to a marked improvement in labour productivity.

In small-scale hydro-electric power production, the number of jobs grew very little as it is linked to the number of installations in place. Employment in the other energy-producing sectors grew by almost 19%, essentially as a result of the effects of changes in the wind power sector.

Table 25. **Changes in employment in the production of energy for sale 2006-2007**

	2006	Changes 2006/2007	2007	Distribution %
Bio fuels	2 230	65%	3 680	20%
Wood energy production	8 780	1%	8 880	48%
Small scale hydro-electric	3 500	1%	3 530	19%
Others	1 870	19%	2 230	12%
Total	**16 390**	**12%**	**18 330**	**100%**

Rounded to the nearest 10; jobs in maintenance of heat pumps and solar thermal installations, as well as jobs linked to collective heating sources, are included (1,100 in 2006 and 1,500 in 2007).

Agricultural jobs linked to the production of bio fuels are not included; they would add around another 5,000 jobs to the total. On the other hand, jobs in the maintenance of non-merchant energy production systems,

solar thermal installations, heat pumps (estimated to add the equivalent of a further 500 f/t jobs) are included, as well as those in tertiary sector and communal wood-powered heating systems, estimated at around a further thousand.

Improvement of energy efficiency in the residential sector

➢ Markets

The estimation of the growth in the markets linked to increasing energy efficiency in the residential sector for the 2006-2007 period is delicate. With a few exceptions, there is really no recorded evidence of the changes in these markets. The results presented below are drawn from hypotheses based on the sum of available data (see respective sheets).

For insulation work (walls, roofing and replacement of windows), a 3.3% increase in volume was calculated (the increase in the number of works averaged +3.8% between 2004 and 2006 according to *Sofres* and 6.1% between 2005 and 2006) and a price increase of 4% (estimate of the change in prices in renovation work between 2006 and 2007 according to the construction statistical office (SESP); 4.2% annual change[10].

Sales of condensation boilers grew strongly over the last few years, from 30,000 units in 2004 to 125,000 in 2006. According to *GFCC* figures, the increase for 2007 should have been around 12%. The estimate for prices was of a slight increase (3%), after the strong growth of the preceding years.

Table 26. **Changes in the markets linked to increasing energy efficiency in the residential sector 2006-2007**

	2006	Change 2006/2007	2007	% distribution
Wall and roofing insulation	3 080	9%	3 360	37%
Improvement of openings	3 820	6%	4 060	45%
Heating (condensation boilers)	710	15%	820	9%
Specific electricity use	740	12%	830	9%
Total	**8 360**	**9%**	**9 070**	**100%**

In millions of euros at current prices; values rounded to the nearest 10 million euros

In terms of the reduction of “specific electricity” consumption (here limited to lighting and a part of households’ electrical domestic appliances), sales of low-energy consumption light bulbs (compact fluorescent lamps) should have increased by 23% and those of class A+ household electrical appliances (refrigerators and washing machines) increased by 14%.

The market can be broken down into products which, by their very nature, are targeted towards improving energy efficiency (internal wall insulation) and other products for which the improvement of energy efficiency is only one of the reasons for their purchase. In the latter case, this improvement in energy efficiency results in an “extra cost” in comparison with the standard solution (for example, the installation of TH ≥ 8 glazing when replacing windows, installation of insulation materials in the course of re-roofing, choosing a condensation boiler instead of a standard one, etc.). The estimated value of the additional spending in such cases is around 4.1 billion euros.

[10] SESP info Rapides d’avril 2008. It will be noted that the figures do not specifically relate to improvement of energy efficiency works.

Table 27. **Residential sector: estimated value of surcharges on high energy performance solutions relative to standard solutions in 2007**

	Total spending	Additional spending	Additional spending / total spending %
Internal wall insulation	**1 800**	**1 800**	**100%**
Other Measures	**7 060**	**2 340**	**33%**
boilers	820	220	27%
roof insulation	1 460	360	25%
windows	4 060	1 450	36%
electrical appliances	530	150	29%
light bulbs	180	160	85%
Total	**8 860**	**4 140**	**47%**

Spending accounts for the domestic market only, **not including exports** (€220m)

The markets are split between on the one side, equipment and supplies, valued at factory or customs prices and on the other side distribution margins, fitting and installation services.

Table 28. **Changes in the markets linked to increasing energy efficiency in the residential sector (by type of activity)**

	2006	Change 2006/2007	2007
Goods and supplies bought on their own (factory or customs price)	1 000	12%	1 200
Distribution margins on equipments and supplies	800	12%	900
Fitting and installation	6 500	8%	7 000
of which included materials and supplies (estimated)	2 600	7%	2 800
Total	**8 400**	**9%**	**9 100**

In millions of current euros, rounded to the nearest 100 million euros, including exports of equipment and FOURNITURES

The estimated value of equipment (including distribution margins but not including exports) provides a maximum estimate of spending eligible for tax credits, which potentially amount to a little over 2.3 billion euros (i.e. 50% of the purchase cost, including distribution margins).

➢ Production and employment

According to the hypotheses made, production will have progressed in line with the market, with the increase in imported products (low-energy consumption bulbs and refrigerators) compensated for by the increases in exports (of washing machines and insulation materials). Taking into account the change in prices and the increase in productivity, employment growth is estimated at 3%.

Table 29. **Changes in employment linked to improving energy efficiency in the residential sector 2006-2007**

	2 006	2 007	change
Total market value at current prices (€ million)	8 400	9 100	8.6%
Imports (€ million)	490	540	10.5%
Value of production at current prices (€ million)	7 900	8 500	8.4%
Price	1000	1034	3.4%
Value of production (constant 2006 prices) (€ million)	7 900	8 300	4.8%
Average productivity (€ million per equivalent f/t employee)	0.082	0.084	1.8%
Employment	**95 700**	**98 500**	**3.0%**

➢ Energy savings

The measures put in place in 2007 should result in additional savings of 450 *ktoe*. Overall, the accumulated energy savings - since 2005 - amount to almost 1.2 million *toe*.

Table 30. **Changes in energy savings linked to improved energy efficiency in the residential sector.**

	2006	2007
Energy saved: annual measures	**420**	**450**
Internal wall insulation	180	190
External roofing insulation	60	60
Windows	60	60
Condensation boilers	80	90
Household electrical appliances	3	3
Low energy consumption light bulbs	30	30
Energy saved: cumulative measures since 2005	**790**	**1 240**
Internal wall insulation	360	550
External roofing insulation	120	190
Windows	120	180
Condensation boilers	130	230
Household electrical appliances	5	8
Low energy consumption light bulbs	50	90

In *ktoe*; values rounded to the nearest10 *ktoe*, except for household electrical appliances.

In comparing these energy savings with the corresponding spending totals, analysed in terms of the extra cost paid (see table 27) and taking into account the life expectancy of the various measures concerned, it is be possible to evaluate the relative efficiency of the various measures in terms of their cost per *toe* saved. At first glance, and taking into account hypothesis and approximations made, it appears that household electrical appliances and replacement of windows are less cost efficient than the other measures.

Increasing energy efficiency in the transport sector

➢ Market changes

The three components of this market are growing rapidly.

Table 31. **Changes in the markets linked to improving energy efficiency (IEE) in the transport sector**

	2006	Changes 2006/2007	2007
Infrastructure	3 390	31%	4 450
Railway materials	2 650	24%	3 290
Private class A and B vehicles	6 430	13%	7 280
Total	**12 470**	**20%**	**15 020**

For the year 2007, in millions of euros at current value; values rounded to the nearest 10 million euros

Reminder: The value of work taking place in infrastructure creation for rail and tram transport is estimated by distributing the provisional value of the projects identified across the period in question; the values for the year 2007 and onwards, at constant 2007 prices, are based on an expected increase of 4.3% in the price of infrastructure works between 2006 and 2007.

Table 32. **Changes in the transport infrastructure market 2006-2012**

	2006	2007	2008	2009	2 010	2011	2012
Railways	2 320	3 180	3 220	3 340	3 820	4 080	4 330
Tramways	1 070	1 270	1 400	1 200	1 260	1 330	1 410
Total	**3 390**	**4 450**	**4 620**	**4 540**	**5 070**	**5 410**	**5 730**

In millions of euros; 2006 and 2007 at current prices; 2008-2012 with 2007 prices held constant

According to *Insee (National statistical office)*, the turnover for railway rolling stock production increased by 26% between 2006 and 2007, while according to according to *Eurostat* figures, exports of railway rolling stock increased by 22%.

New registrations of class A and B private cars increased in number by 12% between 2006 and 2007. However, according to the *ADEME* publication "*private cars in 2007*", French constructors' market share decreased.

Table 33. **Registration of energy classes A and B private cars (number of vehicles)**

	2006	2007	Evolution
A	39	322	726%
B	356 342	398 936	12%
Total	**356 381**	**399 258**	**12%**

➢ Employment

Employment linked to the production of transport infrastructure, railway (and tram) equipment and class B vehicles increased by 17% between 2006 and 2007; growth was particularly strong in the creation of transport infrastructure (+23) and in the manufacture of railway rolling stock.

Table 34. **Changes in employment linked to IEE in the transport sector 2006-2007**

	2006	Change	2007
Infrastructure creation	28 200	23%	34 800
Manufacture of rolling stock	9 000	20%	10 900
Manufacture of specialised vehicles	22 100	8%	23 800
Exploitation of new tramways lines	500	140%	1 200
Total	**59 800**	**18%**	**70 700**

Number of jobs rounded to the nearest hundred.

Table 35. **Factors in the changes in employment linked to IEE in the transport sector**

	2 006	2 007	Change
Total market value at current prices (€ million)	12 500	15 000	20%
Imports (€ million)	1 400	1 900	36%
Value of production at current prices (€ million)	11 100	13 100	19%
Price	1000	1030	3%
Value of production (2006 constant prices) (€million)	11 100	12 700	15%
Average productivity (€ million per equivalent f/t employee)	187	183	-2%
Employment (not including tramway exploitation)	59 300	69 500	18%

The fall in productivity is due to a structural effect: the most labour-intensive sectors (infrastructure creation and the car distribution) are those in which production has increased most, while inversely the car construction, for which productivity is highest, has shown little growth.

➢ Energy savings

It has not been possible to calculate the energy savings linked to measures for improving energy efficiency in the transport sector in their entirety; only those connected with urban public transport (tramways) and private cars were able to be estimated. They seemed particularly weak in relation to the goals for reduced energy consumption set by Grenelle for the transport sector.

Table 36. **Energy savings linked to tramways**

	2006	Change 2006-2007 %	2007
Annual savings linked to services	11	34%	15
Cumulative energy savings since 2005	22	67%	37

In *ktoe*

Energy savings linked to the sale of class A and B private cars were estimated by taking the difference between the average energy consumption of these vehicles and the average energy consumption of the other classes and multiplying this by the number of class A and B vehicles and the conventional average distance travelled according to the type of vehicle. Cumulative savings were based on the pool of class A and B vehicles sold since 2005.

Table 37. **Energy savings linked to specialised vehicles.**

	2006	Change	2007
Savings as a result of the year's sales	63	12%	71
Cumulative savings as a result of sales since 2005	114	63%	186

In *ktoe*

1.3 Projections

Presentation

Work associated with the Grenelle environmental programme generally has its final goals in 2020, with an intermediary stage at 2012: power installed or energy produced from renewable sources, rate of reduction of energy consumption, development of public transport networks, etc. For each market - except for improvement of energy efficiency in the transport sector, which has no documented operational programme - these goals were used, as is the analysis of trends, to build the development schedule for 2012. These projections are not forecasts. They are essentially aiming to provide a frame of reference in following future development in the various markets and to assess how this growth corresponds to the goals of the Grenelle programme.

1.3.1 Overall projections

➢ Markets

The following table summarises the goals established for the main markets by 2012.

Table 38. **Market changes 2007-2012**

	2007	aarg	2012
Renewable energy	***9 400***	***20.4%***	***23 700***
Renewable energy development	5 900	21.9%	15 800
Sales of renewable energy	3 500	17.6%	7 900
Improvements in energy efficiency	***24 100***	***13.8%***	***46 000***
Residential sector	9 100	19.4%	22 000
Transport	15 000	9.8%	24 000
Total	**33 500**	**15.8%**	**69 700**

In millions of euros at 2007 prices; values rounded to the nearest hundred million; aarg: Average annual rate of growth

Overall markets would experience strong growth, with a growth rate of around 20% in renewable energy (equipment and energy sales), 19% in markets related to improving energy efficiency in the residential sector and 10% in the markets relating to the improvement of energy efficiency in the transport sector. In this last case, the method used to calculate growth introduced a bias: only those projects which are currently identified were taken into account. Following the Grenelle programme, new infrastructure projects are going to appear, with the plan being to lay 2000 kilometres of new high speed lines between now and 2020. The development of new public transport should result in the creation of 1,500 kilometres of new lines in the next 15 years, etc. As indicated, the projections have not taken into account these specific objectives.

In the residential sector, the expected growth of the market for work on improving the energy efficiency of existing homes, only studied here, is based on the Grenelle programme documentation with an expected increase in value of 8.6 billion euros at constant prices between 2007 and 2012 (or an average annual growth rate of 17%).

These goals have been translated into the different categories of intervention set out by the Permanent Observatory for the improvement of energy efficiency in the home (OPEN), according to the decomposition used for the characterization of markets and employment in 2006 and 2007.

One of the hypotheses involves the widespread installation of energy-efficient windows, the other being a gradual increase in the amount of insulation works at a rate of 19% at constant prices, which would also cover the increase in external insulation and “heavy” rehabilitation specified by Grenelle.

For their part, sales of energy efficient appliances develop in line with projections taking into account the increase in their purchase rate in the household market.

➢ Production and employment

There have been no specific projections for foreign trade (imports and exports), which are supposed developing so as to maintain their current contribution with respect to the domestic market and production. As a result, production follows the market. Taking into account the hypotheses formed with regard to the

change in labour productivity of different activities (following the trends of the 2001-2006 period), based on national data (production per employee), employment grows a little less quickly than production.

The increase in employment in the different areas of activity studied would be around 219,000, with the greatest increase in absolute volume taking place in the market related to the improvement of energy efficiency in the residential sector with more than 117,000 additional jobs, followed by the renewable energy market (+67,000 jobs, of which 52,600 would be in the manufacture, distribution and fitting of equipment and appliances).

Table 39. **Changes in direct employment 2007-2012**

	2007	Change (aarg)	2012	Increase (absolute values)
Renewable energy	***52 300***	***18%***	***119 500***	**67 200**
Renewable energy development	34 000	21%	86 600	52 600
Sales of renewable energy	18 300	12%	32 900	14 600
Improvements in energy efficiency	***169 200***	***14%***	***320 500***	**151 300**
Residential sector	98 500	17%	215 700	117 200
Transport	70 700	8%	104 800	34 100
Total	**221 500**	**15%**	**440 000**	**218 500**

Number of f/t equivalent jobs rounded to the nearest hundred.; aarg: average annual rate of growth

Jobs involved in the use of the new tram lines (4,900 in 2012) are included under the heading of transport employment. Jobs relating to the maintenance of heat pumps, solar thermal units and wood-powered boilers in the public and tertiary sectors (totalling 6,950 in 2012) are included under employment linked to the sale of renewable energy.

On adding the figure for first degree indirect employment (linked to intermediary consumption by the activities specified), the total increases to around 610,000 jobs.

➢ Energy production

With a growth rate of 10%, the production of renewable energy would increase by 7 million *toe* between 2007 and 2012, 4.8 million in the form of thermal energy (bio fuels and heat pumps) and 2.2 million in the form of electrical energy, of which 82% would be from wind power.

Table 40. **Changes in renewable energy production 2007-2012**

	2007	aarg	2012	Comop n° 10
Electric (GWh))	14 500	22%	39 400	*
Electric (ktoe)	*1 300*	*22%*	*3 500*	*2 865*
Thermal (ktoe)	10 600	8%	15 400	15 450
Total (ktoe)	**11 900**	**10%**	**18 900**	**18 315***

2007 and projections for 2012, including small-scale hydro-electric's contribution of 123*ktoe* in 2012.
COMOP no.10: 2012 target not including hydro-electric energy.

➢ Energy Savings

The measures implemented in the 2005-2012 period in the area relating to improved energy efficiency in the residential and transport sectors resulted in savings of 6.3 million toe by 2012, representing 75% of the increase in renewable energy production. These savings are most significant in the residential sector: a total of 5.4 million toe. They represent 12% of the total energy consumption by the residential sector in 2005, in concordance with the Grenelle objectives (12% reduction in the consumption of existing housing by 2012[11]).

[11] See Synthesis report of Grenelle's Group 1

Table 41. **Changes in energy savings 2007-2012**

	2007	aarg	2012
Measures put in place in the year			
Residential sector	400	20%	1 100
Transport	100	12%	200
Total	**500**	**19%**	**1 300**
Savings by 2012 due to measures implemented between 2005 and 2012			
Residential sector	1 200	35%	5 600
Transport	200	30%	800
Total	**1 500**	**35%**	**6 400**

In *ktoe*; values rounded to the nearest hundred *ktoe*

In the transport sector, the savings calculated are much smaller - barely 800,000 *toe* for the entire range of measures implemented over the period, or 1% of the sector's energy consumption in 2006. As indicated earlier, this poor reduction in consumption is a result of the partial accounting of measures for improving energy efficiency in this sector.

1.3.2 Projections for the different markets

➢ Renewable energy

Markets

For markets linked to the development of renewable energy, projections are made directly on the 2007 situation and targets provided by COMOP n.10, *energy by energy*, etc. (see sheets on energy).

Table 42. **Changes in markets linked to renewable energy development 2007-2012**

	2007	aarg	2012	Proportion in %
Wood powered heating	1 970	13%	3 610	23%
Wind power	1 700	20%	4 210	27%
Photovoltaic	430	46%	2 800	18%
Heat pumps	600	32%	2 420	15%
Solar thermal	440	35%	1 970	12%
Bio fuels	440	-20%	140	1%
Biogas	140	8%	200	1%
UIOM	60	7%	80	1%
Small-scale hydro-electric	70	23%	200	1%
Geothermal	30	44%	190	1%
Total	**5 880**	**22%**	**15 830**	**100%**

In millions of euros at 2007 prices; rounded to the nearest ten million, aarg: average annual rate of growth

Markets for the production of domestic heating equipment (heat pumps and solar thermal units) grew at a sustained rate (over 30% per annum). Wood-based heating appliances grew by 13% annually, while wind power achieved an average annual rate of growth of 20%. The market for photovoltaic equipment exploded (multiplying 7 times in size in 5 years). The unit values of these 5 markets range between 2 billion euros (solar thermal) and 4.2 billion euros (wind power). The market for wind power equipment became the most important, ahead of wood-powered heating.

The values of other, far weaker markets (less than 200 million euros per annum in 2012), experienced contrasting developments: the required number of bio fuel production units should be in place by 2012, and as a result the market fall sharply; the creation of incineration units should be stabilised. Despite some development expectations, the value of the small scale hydro-electric and geothermal markets remain limited.

Overall, for the 2008-2012 period, the cumulative value of the domestic market should be around 47 billion euros, with 26 billion coming from domestic heating equipment (solar thermal, heat pumps and wood-powered heating) for households, 17 billion from wind power and photovoltaic (investment by firms in

production of renewable energy for sale) and 3.6 billion from other forms of renewable energy (geothermal, small-scale hydro-electric, biogas, etc.).

Employment

Employment linked to the production of equipment and installations for the production of renewable energy increases by 53,000. This development concentrates in the same areas of domestic heating equipment (heat pumps, solar thermal and wood-based heating equipment), wind power (+9,100 direct jobs) and photovoltaic (+11,000 direct jobs).

First degree indirect employment would amount to 30,000 (13,000 in 2007). Overall, in 2012, including indirect employment, the production, distribution and installation of equipment will create the equivalent of 70,000 jobs in full time equivalent.

Table 43. **Changes in employment linked to the development of renewable energy 2007-1012**

	2007	aarg	2012	2007 - 2012
Wood based heating equipment	14 100	11%	23 900	9 800
Wind power	6 900	18%	16 000	9 100
Heat pumps	4 400	31%	17 000	12 500
Solar thermal	2 300	39%	12 000	9 700
Photovoltaic	2 100	44%	13 100	11 000
Bio fuels	2 400	-21%	700	-1 700
Biogas	800	11%	1 300	500
Waste incineration plants	200	4%	300	100
Small-scale hydro-electric	400	22%	1 000	600
Geothermal	200	42%	1 300	1 100
Total	**34 000**	**21%**	**86 600**	**52 600**

Direct employment at f/t equivalent; rounded to the nearest hundred jobs; aarg: average annual rate of growth

➢ Energy sales

At constant 2007 prices, i.e. without taking into account the effect of changes in prices, bio fuels, wind power and wood energy will account for 83% of renewable energy sales. It is photovoltaic energy, however, that will have the highest growth rate, multiplying 60 times in size between 2007 and 2012, ahead of wind power (+43% average annual growth). In absolute terms, the value of wind power will increase most (+1.8 billion euros).

Table 44. **Changes in energy sales 2007-2012**

	2007	Aarg	2012
Photovoltaic	10	130%	490
Wood energy	990	6%	1 310
Bio fuels	1 510	15%	3 070
Small-scale hydro-electric	360	4%	440
Wind power	360	43%	2 150
Geothermal	100	10%	160
Biogas	50	17%	100
Waste incineration renewable energy	140	4%	160
Total	**3 500**	**18%**	**7 890**

In millions of euros at 2007 prices; rounded to the nearest ten million euros; aarg: average annual rate of growth

Overall, the value of energy sold will be multiplied 2.2 times. In terms of *toe*, however, the quantities sold will only increase by 70%, with the changes in market composition (an increase on the part of photovoltaic energy and bio fuels) resulting in an increase in the average price per *toe*.

Under 2007 conditions, subsidies encouraging renewable energy in the form of compensation for surcharges on EDFs and tax breaks on bio fuels would respectively reach values of 700 to 800 million (essentially in photovoltaic and wind power) and 1 billion euros by 2012. The increase in the price of fossil fuels and, consequently, of the market reference price of electricity should, however, reduce these values.

Employment in the production of market renewable energy

Employment in the production of market renewable energy should increase by almost 15,000 jobs between 2007 and 2012, or grow by 80% - more than the quantity of energy produced. The strongest increases will be in employment in the bio fuels and wood energy sectors, with the other sources of renewable energy being far less labour intensive.

Table 45. **Changes in employment linked to the production of market renewable energy 2007-2012**

	2007	aarg	2012	2007- 2012
Wood energy	8 900	9%	13 900	5 000
Bio fuels	3 700	19%	8 700	5 000
Small scale hydro-electric	3 500	4%	4 300	700
Wind power	500	35%	2 100	1 700
Heat pumps	300	33%	1 400	1 000
Geothermal	600	10%	1 000	400
Solar thermal	100	30%	600	400
Biogas	100	20%	300	200
UIOM	500	2%	600	100
Photovoltaic	10	69%	100	100
Total	**18 300**	**12%**	**32 900**	**14 600**

Direct employment at the equivalent of full time; rounded to the nearest hundred jobs; aarg: average annual rate of growth

These jobs include those in maintenance (heat pumps and solar thermal installations), as well as jobs in the wood energy sector linked with the use and maintenance of public and tertiary sector heating units, estimated at a total of 5,000 in 2012 (consumption of wood energy by the public and tertiary sectors multiplied by 5).

➢ Markets linked to improving energy efficiency in the residential sector

Markets

For the markets linked to improving energy efficiency in the residential sector, projections were based on the increase in the amount of activity as a result of the Grenelle programme documents, without assuming however that the distribution of increases would be identical.

Table 46. **Changes in markets linked to the improvement of energy efficiency in the residential sector 2007-2012**

	2007	aarg	2012
Insulation	7 400	17%	16 000
Walls	1 900	17%	4 200
Roofs	1 500	17%	3 200
Openings	4 100	16%	8 600
Condensation boilers	800	30%	3 000
Specific electricity use	800	29%	3 000
Total	**9 100**	**19%**	**22 000**

In millions of euros at 2007 prices; values rounded to the nearest hundred million euros; aarg: average annual rate of growth

The results shown are only for information: in effect, the Grenelle objectives - expressed in terms of the number of housing refurbishments in various categories, particularly “heavy” ones - cannot be directly

translated into the categories of activity used to describe these markets in 2006 and 2007, i.e. the typology taken from *Sofres* and *OPEN* studies.

In terms of openings (windows), the growth in the number of energy-efficient windows in place (which should reach 100% in the 2008-2009 period in line with new regulations) corresponds with a 16% year average growth in the market. For condensation boilers, projections are made based on an adjustment of the proportion of condensation boilers out of the total number of boilers sold: according to this calculation, this proportion will reach 80%, as opposed to 5% in 2004 and 19% in 2006. The same is the case for the proportion of A+ standard household electrical appliances, which is projected to increase to 70%. Sales of low-energy consumption light bulbs followed the *Syndicat de l'éclairage*'s forecasts until 2010 then remained stable at 70 million units.

The cumulative value of these markets in the period from 2008-2012 is 79 billion euros, almost completely (77 billion) accounted for by households[12]. Of the value paid for by households, the extra cost corresponding to "improvement of energy efficiency" would account for around 55%.

Employment

The number of jobs in connection with improving energy efficiency in the residential sector is expected to more than double between 2007 and 2012. It will reach 216,000 jobs in 2012 versus 98,000 in 2007. First range indirect employment will reach 60,000 and jobs corresponding solely with "improving energy efficiency" will reach 90,000 (not including those employed in distribution).

Table 47. **Changes in employment connected with improving energy efficiency in the residential sector 2007-2012**

	2007	Aarg	2012
Insulation	87 200	15%	176 500
Walls	17 400	16%	35 900
Roofs	16 200	15%	33 100
Openings	53 500	15%	107 500
Condensation boilers	6 000	28%	20 900
Specific electricity use	5 400	28%	18 300
Total	**98 500**	**17%**	**215 700**

Number of jobs rounded to the nearest hundred; aarg: average annual rate of growth

Energy savings

Overall, condensation boilers and high-performance appliances should contribute 37% of energy savings, while they will account for 24% of cumulative spending over the period studied.

Table 48. **Changes in energy savings linked with improvements in energy efficiency in the residential sector 2007-2012**

Annual savings resulting from measures taken since 2005	2007	aarg	2012
Insulation	900	31%	3 600
Walls	500	31%	2 100
Roofs	200	31%	700
Openings	200	35%	800
Condensation boilers	200	45%	1 500
Specific electricity use	100	40%	500
Total	**1 200**	**35%**	**5 600**

In *ktoe*; rounded to the nearest hundred *ktoe*; aarg: average annual rate of growth

12 The balancing item (2,2 billion €) corresponds to exports

➢ Improving energy efficiency in the transport sector

Markets

For markets connected with improving energy efficiency in the transport sector, the distribution of investments in infrastructure building projects supplies the level of funding required in 2012. The market for equipment follows that of infrastructure work. The market for classes A and B new private cars is projected in the same way as that for condensation boilers, through a model of the proportion of newly-registered classes A and B private cars; according to this calculation, this proportion will increase to 30%, as opposed to 10% in 2002 and 20% in 2006.

Table 49. **Changes in the markets linked with improvements in the energy efficiency in the transport sector 2007-2012**

	2007	aarg	2012
Public transport, railways and tramways	7 700	6%	10 500
Specialised class A and B vehicles	7 300	13%	13 500
Total	15 000	10%	24 000

In millions of euros at 2007 prices; rounded to the nearest hundred million euros; aarg: average annual rate of growth

Employment

The development of markets should result in an increase of 30,000 jobs engaged in the creation of infrastructures, manufacture of rolling stock and private cars emitting less than 130grCO_2/km. Indirect jobs would reach a total of 70,000.

Table 50. **Changes in employment linked with improvements in the energy efficiency of the transport sector 2007-2012**

	2007	aarg	2012
Infrastructure creation	34 800	5%	43 500
Manufacture of rolling stock	10 900	4%	13 000
Manufacture of specialised vehicles	23 800	13%	43 500
Sub-total	**69 500**	**8%**	**99 900**
Employment connected with usage of tram lines	1 200	33%	4 900
Total	**70 700**	**8%**	**104 800**

Jobs rounded to the nearest hundred; aarg: average annual rate of growth

Energy savings

As has already been indicated, energy savings related to energy efficiency measures in the transport sector are relatively small.

For private cars, the saving made is calculated by the difference in consumption by vehicles emitting less than 130 grCO_2/km (class A and B) and those emitting more (class C and above), multiplied by the number of vehicles and average kilometres covered annually. This difference is relatively small, around 11 *toe* per million kilometres[13].

For trams, the number of annual passenger kilometres is multiplied by the difference between the energy consumption of trams and special vehicles (52 *toe* per million passenger kilometre). Based on the number of kilometres put into service in the course of the period studied (315 km according to project planning), the final year estimate is for 2 billion additional passenger kilometres.

Although the measures described only account for part of the story, a swift increase in these measures will be needed to reach the targets set (20% reduction of energy consumption in the transport sector).

[13] All things being equal, the projections result in a share of the classes A and B private cars in the whole of the park of 13%.

Table 51. **Changes in energy savings linked to improvements in energy efficiency in the transport sector 2007-2012**

	2007	aarg	2012
Specialised vehicles	190	31%	720
Tramways	40	24%	110
Total	220	30%	830

In *ktoe*; energy savings in the current year are the result of measures taken since 2005;

Market Changes

	2006	2006 at 2007 prices	Changes 2006 - 2007 at constant prices	2007	aarg 2007-2012	2012
Renewable energy	**7 742**	**8 069**	**169%**	**9 383**	**20%**	**23 721**
R. En. Equipment	**5 261**	**5 548**	**64%**	**5 880**	**22%**	**15 834**
Solar thermal	366	384	153%	443	35%	1 972
Photovoltaic	215	219	942%	425	46%	2 803
Wind power	1 418	1 531	113%	1 704	20%	4 215
Wood powered heating equipment	2 080	2 237	-119%	1 970	13%	3 607
Heat pumps	482	459	301%	597	32%	2 423
Bio fuel production units	425	436	18%	443	-20%	141
Small-scale hydro-electric	39	40	795%	72	23%	199
Geothermal	35	35	-127%	31	44%	191
Biogas	116	119	137%	135	8%	201
UIOM	86	88	-325%	60	7%	82
R. En. Sales	**2 481**	**2 521**	**390%**	**3 503**	**18%**	**7 887**
Solar thermal	0	0		0		0
Photovoltaic energy	3	4	804%	8	130%	493
Energy from wind power	185	186	919%	357	43%	2 148
Wood energy	949	964	31%	993	6%	1 313
Heat pumps	0	0		0		0
Bio fuels	753	764	970%	1 505	15%	3 071
Energy from small-scale hydro-electric sources	332	335	68%	358	4%	438
Geothermal energy	97	97	31%	100	10%	158
Energy produced from biogas	29	38	259%	47	17%	103
Renewable energy produced by incineration of household waste	133	133	13%	135	4%	163
Improvements in energy efficiency	**20 825**	**21 477**	**122%**	**24 092**	**14%**	**45 976**
Residential	**8 358**	**8 640**	**51%**	**9 074**	**19%**	**21 977**
Insulation	6 902	7 180	33%	7 419	17%	16 005
Heating (condensation boilers)	712	733	120%	821	30%	3 008
Targeted electricity use	744	728	146%	834	29%	2 964
Transport	**12 468**	**12 836**	**170%**	**15 018**	**10%**	**24 000**
Train and tramway infrastructure and rolling stock	6 040	6 226	242%	7 735	6%	10 515
Specialised class A and B vehicles	6 427	6 611	102%	7 283	13%	13 485
Total	**28 568**	**29 546**	**135%**	**33 475**	**16%**	**69 698**

In millions of euros

Employment Changes

	2006	Growth rate 2006-2007	2007	aarg 2007 - 2012	2012
Renewable energy	**49 710**	**5%**	**52 298**	**18%**	**119 494**
R. En. Equipment	**33 323**	**2%**	**33 967**	**21%**	**86 586**
Solar thermal	1 928	21%	2 339	39%	12 014
Photovoltaic	1 096	95%	2 133	44%	13 123
Wind power	6 296	10%	6 915	18%	16 007
Wood powered heating equipment	16 625	-15%	14 137	11%	23 897
Heat pumps	3 451	29%	4 434	31%	16 969
Bio fuel production units	2 430	-1%	2 414	-21%	724
Small-scale hydro-electric	199	85%	368	22%	978
Geothermal	262	-14%	225	42%	1 292
Biogas	691	12%	775	11%	1 300
UIOM	346	-34%	228	4%	281
R. En. Sales	**16 386**	**12%**	**18 330**	**12%**	**32 908**
Solar thermal	117	28%	150	30%	561
Photovoltaic energy	4	107%	7	69%	102
Energy from wind power	313	55%	486	35%	2 145
Wood energy	8 785	1%	8 883	9%	13 913
Heat pumps	248	33%	331	33%	1 352
Bio fuels	2 232	65%	3 685	19%	8 709
Energy from small-scale hydro-electric sources	3 500	1%	3 534	4%	4 278
Geothermal energy	600	3%	618	10%	981
Energy produced from biogas	87	36%	118	20%	295
Renewable energy produced by incineration of household waste	500	4%	518	2%	573
Improvements in energy efficiency	**155 433**	**9%**	**169 169**	**14%**	**320 490**
Residential	**95 660**	**3%**	**98 487**	**17%**	**215 669**
Insulation	85 485	2%	87 160	15%	176 491
Heating (condensation boilers)	5 387	11%	5 974	28%	20 864
Targeted electricity use	4 788	12%	5 353	28%	18 314
Transport	**59 773**	**18%**	**70 682**	**8%**	**104 822**
Train and tramway infrastructure and rolling stock	37 695	24%	46 883	6%	61 344
specialised class A and B vehicles	22 079	8%	23 799	13%	43 478
Total	**205 143**	**8%**	**221 466**	**15%**	**439 984**

Energy Production and Sales; Energy Savings

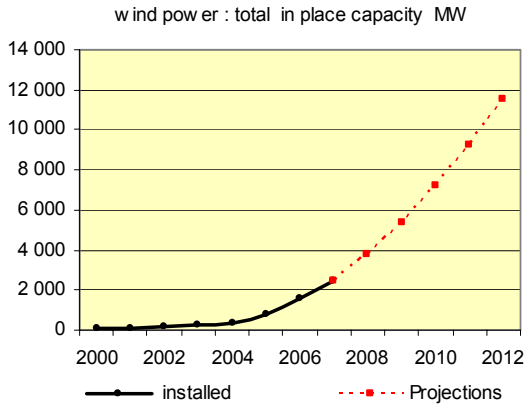
	2006	growth rate 2006-2007	2007	Aarg 2007 - 2012	2012
Renewable energy					
R. En. production (ktoe)	**11 364**	**4%**	**11 861**	**10%**	**18 881**
Solar thermal	49	22%	60	30%	225
Photovoltaic energy	3	31%	3	92%	87
Energy from wind power	188	92%	361	43%	2 176
Wood energy	8 898	-3%	8 603	4%	10 591
Heat pumps	203	33%	271	33%	1 107
Bio fuels	701	67%	1 173	19%	2 841
Energy from small-scale hydro-electric sources	517	7%	552	4%	675
Geothermal energy	247	5%	259	9%	396
Energy produced using biogas	106	13%	120	13%	222
Renewable energy from incineration of household waste	453	1%	459	4%	561
R. En. sales (ktoe)	**5 147**	**20%**	**6 185**	**13%**	**11 278**
Solar thermal	0		0		0
Photovoltaic energy	1	80%	2	117%	85
Energy from wind power	188	92%	361	43%	2 176
Wood energy	3 147	4%	3 260	7%	4 643
Heat pumps	0		0		0
Bio fuels	701	97%	1 381	16%	2 841
Energy from small-scale hydro-electric sources	517	7%	552	4%	675
Geothermal energy	197	5%	208	9%	314
Energy produced using biogas	41	49%	61	11%	102
Renewable energy from incineration of household waste	355	1%	360	4%	441
Cumulative energy savings since 2005	**926**		**1 459**		**6 422**
Residential (ktoe)	**790**		**1 236**		**5 589**
Insulation	596		912		3 621
walls	359		550		2 121
roofs	121		185		714
windows	117		177		785
Heating (condensation boilers)	134		228		1 462
Targeted electricity use	60		96		506
Transport (ktoe)	**136**		**223**		**834**
Train and tramway infrastructure and rolling stock	22		37		109
Specialised class A and B vehicles	114		186		725

2 MARKETS LINKED TO RENEWABLE ENERGY

2.1 Wind Power

Key Points

- The development of wind energy production in France began in the 2004-2005 period: the amount of power installed in 2007 (890MW) makes France the third-largest market in Europe.
- Although France's wind turbine manufacturers do not rank globally, the number of people engaged in the manufacture of components and installation of generators does provide several thousand jobs.
- The entry into the market of large scale energy producers makes the target set by the Grenelle programme (11,500MW of power installed) realistic.



Markets and employment linked to investment in wind power

	2006 Installations	Change 2006-2007	2007 Estimates	2012 Projections	2012 Target
Power installed in the year (MW)	810	+10%	888	2 200	
domestic equipment market (€ million)	1 013	+18%	1 200	2 970	
Production (€ million)	810	+22%	985	2 435	
Exports (€ million)	405	+25%	505	1 245	
Employment	6 300	+10%	6 910	16 010	

Power installed: information on power installed varies depending on the source; it either relates to wind turbines already linked up, or whose purchase has been contracted; they are subject to periodic reassessment. The information used here is that used in the official account sent to the European Wind Energy Association (EWEA)

Markets and employment linked to wind power production

	2006 Installations	Change 2006-2007	2007 Estimates	2012 Projections	2012 Target
Total end of year power (MW)	1 567	+57%	2 455	11 500	11 500
Energy production (TWh)	22	+92%	42	253	260
Value of energy sold (€M)	185	+92%	357	2 148	
Jobs connected with energy production	310	+55%	490	2 145	

Energy production: source DGEMP

Current situation in the wind power sector

With around 900 MW installed in the course of 2007, France currently sits sixth in the World and third in Europe in terms of its annual market. The total power installations in place at the end of 2007 (2,455MW, +57% compared to the end of 2006) makes France fifth in Europe and seventh in the World.

Investment, however, made little progress during 2007 (up 10% from 2006), and even fell in comparison with the previous year according to some sources, while growth of annual investment worldwide was at a level of 34%.

	2005	2006	2007
Power installed in the year	371	810	888
Cumulative power	757	1 567	2 455

In MW. Source: Wind Energy France

According to industry professionals, the main reasons for this slowdown are either administrative or linked to the current overheating of world markets for wind generators and their components.

The establishment of Wind Power Development Zones (ZDE) which reinforced dialogue and local participation in the programme did cause some delays in project implementation. According to surveys carried out by the DGEMP across a number of areas[14], permits issued also fell from 1,560 MW to 1,230 MW between 2004 and 2005 before climbing back to 1,480 MW in 2006. Requests for planning rose from 3,200 MW at the beginning of 2005 to 5,200 MW at the start of 2007. According to this survey, the average waiting period from permit request to construction is 13 months. This period remained constant on comparison with the previous report. The notification waiting period for a completed request (including the various components of impact studies) is 3 months. According to the ERDF, joining demand for the network was at 3,850 MW.

The world industry for wind turbine production is currently in a state of overheating and faces growing costs, as much due to the severe shortage of components as to the strong increase in primary materials prices. Currently, supplying delays range from 18 to 24 months.

Market estimates

Unit prices would have strongly increased during recent years. In 2004 – 2005, 1 million euros per MW was generally retained and expectations were prices reduction. A strong increase occurred in 2005 and the average price became 1 to 1.3 million euros per MW. Due to the explosion of the worldwide demand and the shortages in production capacities, le present price would be 1.2 to 1.5 million per MW

Prices and investment value

	2005	2006	2007
Unit price (million euros / MW)	1.15	1.25	1.35
Investment value (million euros)	430	1 010	1 200

Production and employment

French equipment production

Aside from the *Vergnet* group, which until recently specialised solely in medium-sized wind turbines destined for tropical regions, France does not have any windmill producers of note, while large firms in this area have appeared in Denmark, Germany and Spain.

There are, however, a growing number of French companies specialising in the manufacture and distribution of wind turbine components (generators, rotors, transformers, etc.) which have capitalised on the growth in the World market for wind turbines. In addition to *Rollix-Defontaine* (one of the world's main specialists in guide crowns and special components for windmills - whose 2006 turnover was €187 million euros and which exported 70% of its production), there are also *Alstom, Leroy Sommer* (generators), *Stromag France* - formerly *SIME* (brakes), *Aerocomposit Occitane* (a subsidiary of *Vergnet*, turnover €1.5 million), *SIAG France* (€11 million). Other firms have specialised in masts, for example *Valmont France* (modular windmill masts), as well as in their transport. Recently, *Eiffel* (a subsidiary of *Eiffage*) set up a factory manufacturing windmill masts in Fos Sur Mer, investing €10 million and creating 60 jobs.

Finally, a technology transfer project has been agreed between *Valorem* and the Canadian firm *AAER* for the construction of windmills producing a total of at least 2MW, including paddle manufacture.

Alstom has taken over control of *Ecotecnia*, a major Spanish windmill manufacture, but does not foresee the transfer of any manufacturing to France; the same is true for *Areva* which, after the industrial failure of *Jeumont* and its abortive attempt to buy *Repower*, has acquired *Multibrid*, a German company specialising in the production of offshore windmills which has just taken on the 400MW Borkum West II wind farm for €500 million. Offshore windmills should represent the principal high-tech market for wind power development.

A national industry is gradually becoming established. The embryonic nature of this industry, as well as its division over several different areas of activity makes it difficult to estimate the national level of production and exports. As far as imports are concerned, the value of wind turbine imports recorded is extremely small (around €100 million to €150 million in 2006 and 2007 for wind generators), whereas investment is above 1 billion euros.

[14] See Results of the 2007 survey about the examination of the applications for aerogenerators DGEMP DIDEME November 2007

The estimates given are based on a breakdown of the cost of investment in different components, combined with assumptions regarding national contribution, and turnover statements of the main French subsidiary of foreign manufacturers (*Nordex, Vestas France, Enercon ...*). Around 500 million € component exports have also been recorded.

Market estimates and production linked to the wind power sector

	2006	2007
Domestic market	1 010	1 200
Production for the domestic market (studies and installation)	405	480
Component exports	405	505
Total production	**810**	**985**

In millions of euros at current prices; estimates.

The number of jobs related to national production is calculated by applying the ratios [turnover / employment] for the various activities studied to the total value of production. With regard to installation, the average for construction and installation activities (formerly NAF 452T), general building work (formerly NAF 452V) and electrical installation activities (453A) were used, giving € 88 000 per employee. For technical studies, the engineering ratio (NAF 742C) was used. Finally, for exports, the ration for mechanical industries was used (formerly NES E2), giving €180 000 per employee. These ratios were changed according to the changes in average labour productivity (see the methodology section of the annex).

The result obtained was of around 6,300 individuals employed in 2006 and 6,900 in 2007.

Employment linked to investment

	2006	2007
Direct employment linked to production for the domestic market	4 050	4 410
Direct employment linked to exports	2 245	2 505
Total	**6 300**	**6 900**

Including indirect employment at the first degree (linked to intermediary consumption by the activities under review), the final employment total is 9,100 jobs in 2007 (+32% in respect to direct employment).

Energy production and employment

In 2006, energy production was estimated by the Energy Observatory at 2.2TWh. It was expected to double in 2007 to reach 4.2TWh. To value this production, the average tariff provided by the Energy Regulation Commission (ERC) was applied to the compulsory purchasing framework: €84.7/MWh in 2006. The value of production was therefore calculated as €185 million in 2006 and €357 million in 2007. This level of production resulted in a total of around €65m of compensation for public service charges (extra cost of EDF purchases).

Employment in the energy production sector was calculated by applying the ratio of 2 jobs (in management / maintenance) per unit of 10MW; the total of jobs at the end of 2007 is estimated to be 500.

Projections

The Grenelle Operational Committee for the renewable energy development plan (Comop n°10) has set out the following projections for the development of the wind power sector.

	2006	2012	Increase
End of year power installed (MW)	1 600	11 500	+9 900
land based	1 600	10 500	+8 900
sea based	-	1 000	+1 000
Electricity Production (GWh)	2 100	26 050	+23 950

Based on the power installed at the end of 2007, such an increase implies a rapid growth in the amount of power installed annually: the amount of power to be installed between 2007 and 2012 is to the value of 9,000 MW, or a yearly average of 1,800 MW, while 900 MW were installed in the course of 2007. It should be

noted that there was almost 4,000 MW waiting linking to the grid at the end of 2007 (2,900 MW at the end of 2006).

Over the recent period, a number of large energy producing companies have made strong moves into the wind power market in order to ensure their supply of renewable energy, allowing them to face the current and future constraints of the European energy sector.

- *Suez*, which strengthened its position in North America at the end of 2007 with the acquisition of *Ventus Energy Inc.,* also bought a 51.1% stake in *la Compagnie du Vent* for €321 million (148 MW of current installations and 6,500 MW in planning or development).
- *GDF* regrouped its recent acquisitions (*Maia Sonnier, Erelia, Nass & Wind Technologie* – 34 MW installed, 150 MW in permits and 1,500 MW planned) into its subsidiary, *GDF Futures Energies.*
- *Poweo* bought *Espace Eolien Developpement*, which has a potential for 400 MW of further development.
- *EDF EN* and *Theolia* continued their recent development with turnovers of €560 million and €306 million respectively

While purchase tariffs guarantee a comfortable level of profitability and stable cash flow under current conditions for wind farms placed in windy areas, it is to be considered whether the same will be true for the next round of wind farms, taking into account the increase in development costs and the lower performance of new farms placed in the less windy locations that must be set up in order to meet the targets set[15], and which represent almost half of France's wind power potential.

Comop 10 expressed concerns about the revision of purchase tariffs for sites with less than 2,000 functioning hours at full power per year, as well as those in Corsica and overseas domains.

Development projections for levels of power installed are for 11,500 MW by the 2012 deadline, in line with COMOP 10 targets.

The level of power installed during the year 2012 will be 2,200 MW which, at current prices, equates to a market value of 2.97 billion euros, with production worth 2.4 billion euros and providing 16,000 direct jobs (plus an estimated further 20,000, taking first degree indirect employment into account).

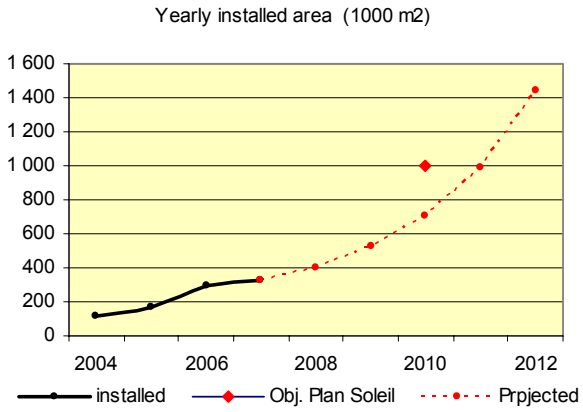
Production of electricity will reach 25.3 TWh, or around 4% of forecast consumption in 2012 (RTE's reinforced energy demand scenario). Permanent employment in wind farm management/maintenance will be around 2,150 jobs.

15 These less favorable sites represent about half of the French wind potential

2.2 Solar Thermal

Key Points

- The French market is the second in Europe. However after two years of strong growth, the solar thermal equipment market slowed significantly in 2007 (+8.4%)
- The slowdown was most pronounced in the case of individual systems (ISWH), with collective systems continuing to grow, confirming the specific nature of the French market.
- The *Plan Soleil* target of 1 million square metres installed per year until 2010 seems unattainable, but the goals set out by the Grenelle programme (645 000 new systems by 2012) should be achievable.



Markets and employment linked to the solar thermal sector

	2006 Installations	Changes 2006-2007	2007 Estimates	2012	
				Projections	Target
Number of m^2 installed in the year	298 000	+8%	323 000	1 438 000	
Market value (€ million)	345	+14%	395	1 750	
Production value (€ million)	240	+34%	330	1 800	
Direct employment	1 930	+21%	2 340	12 015	

Solar thermal energy production

	2006 Installations	Changes 2006-2007	2007 Estimates	2012	
				Projections	Target
Total power installed (MW)	812	+28%	1 040	2 200	
Employment linked to maintenance	120	+28%	150	560	
Total energy production from current installations (*ktoe*)	49	+22%	60	225	160

The *Plan Soleil*, covering the 2000-2006 period, aimed to spread the use of individual solar water-heaters (ISWH), combined solar systems (CSS: production of hot water and heating) and collective water heating (collective SWH). Supported by tax credits since 2005, this plan resulted in strong growth in the sale of equipment (+170% between 2004 and 2006).

The July 13th 2005 Act, providing the goals for energy policy forecast the installation of 200,000 solar water heaters a year between now and 2010.

Recent changes

According to the professional organisation *Enerplan*, the metropolitan market accounted for 35,000 ISHW (with a total surface area of around 150,000m2), 5,000 CSS (with a total surface of 51,000m2) and around 22,000m2 of collective SWH. According to *Observ'ER*[16], whose figures for this area are slightly lower, more than 95%of individual systems have benefited from tax credits.

According to several sources, growth in the market will have slowed in 2007, with the number of ISHWs reaching around 37,000 (+11%) and CSSs falling to 4,600[17]. Overall, excluding Overseas regions,

[16] Source: follow-up of the tax credit, first tendencies for 2007. Observ' ER for ADEME

[17] According to an assessment carried out in the Rhone-Alps region the subsidized thermal solar installations would be in retreat of 3.6% in 2007

individuals systems will be setting the pace with growth of 6% in terms of m2 installed after rates of 70% and over between 2004 and 2006.

Inversely, collective systems continued their sustained growth with growth rates over 80% in Metropolitan France. This development, which will consolidate France's position as leader in collective solar power, resulted in part from the provisions of 2005 thermal energy regulations, which made it compulsory to install 2m2 of solar panels or compensate for not doing so by fitting insulation or engaging in other energy savings.

According to *Enerplan,* in Overseas Regions the market will stabilise at the level if around 70,000m2 a year. Judging by the number of saving energy certificates emitted, however, the market will have bounced back strongly at the beginning of 2008.

Recent changes in solar panel surface areas installed

In m^2	2004	2005	2006	2007
Total	112 150	164 389	298 000	323 000
Metropolitan France	55 340	121 500	223 000	253 000
Overseas Regions	55 810	42 889	75 000	70 000

Sources: *Eur'Observ'ER* and *Enerplan*

The reduction in growth in 2007 takes place in a European market characterised by a fall of 10% in equipment sales due to the collapse of the German market (-33%) resulting from the exhausting of the funds allocated to provide financial incentives in this sector.

In total, France was the second largest market in Europe in 2007. With less than 20m^2 of panels installed per 1000 inhabitants (Germany has over 100), it also has a large potential for development.

Value of the market

According to some sources[18], unit costs will have significantly increased over recent years: +13% between 2004 and 2006. Beyond the rise in manufacturing costs, primary materials in particular (copper, etc.), there was a noticeable "tax credit effect" with certain installers making undue increases to their prices. It is, however, plausible that prices will stabilise, even fall, in response to increasing quantities resulting in growing industrialisation of equipment manufacture and increasing levels of qualification among installers.

The following unit costs were calculated (in €/m2 installed):

	2006	2007
CESI	1 250	1 325
SSC	1 000	1 060
ECS Collective	900	954

Based on these hypotheses, the domestic market would have the following value (in millions of euros):

2006	2007
345	395

There is no precise information on production and foreign trade in solar thermal equipment. National production of equipment is estimated at around 75% of the domestic market in 2006. For the following years, this percentage should increase as exports develop, taking into account the recent specialisation of *Viessmann's* Faulquemont site as the group's European solar thermal reference centre[19].

Direct employment is estimated based on the ratios of activities "manufacturing non-electric domestic equipment" (formerly NAF 297C) and "installation of thermal and air-conditioning equipment" (formerly NAF 453F), with €153k/job and €105k/job in 2006 respectively. Given the increase in the volume of products, production per employee should strongly increase over the coming years.

Direct employment in manufacturing was estimated at around a thousand jobs in 2006, with installation jobs at just fewer than 900; indirect employment (linked to intermediary consumption in manufacturing and installation) provided around a thousand jobs.

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18 See. http://www.outilssolaires.com/premier/default.htm

19 Viessmann France (850 paid in 2006) is a subsidiary company of the German group of the same name. General manufacturer of heating systems his turnover was of 266 M€ in 2006 of which nearly two thirds on the French market. He would have become the first French manufacturer of solar collectors; the production capacity was carried in 2007 to 240.000 sensors is 600.000 m^2. The production 2007 would have reached 150.000 sensors of 2,5 m^2 rough is 375.000 m^2 and 240.000 hot water storage cylinders.

On the basis of a total of 1 million m^2 installed in cities by the end of 2007 and production of 430 kWh per m^2, heat production is estimated at 37 *ktoe*. According to provisional *DGEMP* figures, production in overseas regions of France would be 23 *ktoe*, giving a total of 60*ktoe* in 2007.

Projections

The Grenelle Operational Committee's report on renewable energy (Comop no.10) set very high targets for the development of solar thermal energy, foreseeing its installation in 645,000 more homes by 2012, or installation in over 120,000 more homes on average each year and 3.5 million more homes by 2020 (400,000 a year). For solar thermal energy, the goal was to multiply the power capability installed by 3.5 times between now and 2012.

With regard to individual systems, these goals are supported by improved funding of the tax credit mechanism, but above all by reinforcement of quality standards already in place[20].

As far as collective systems are concerned (collective housing and tertiary sector), the creation of the Renewable Heating Fund will provide the different actors in the market with greater awareness of the financial support available to them.

For overseas regions of France, specific measures are proposed looking to make it compulsory for all permanent residences to use solar water-heating.

Solar thermal systems and energy saving certificates

The report on energy saving certificates highlights a significant increase in the installation of ISWHs in overseas regions of France. Between December 2007 and February 2008, the value of certificates delivered under the BAR-TH-24 (ISHW OSR) operation increased by 465 GWh, or an increase greater than the total certificates registered at the end of 2007, equivalent to 37,000m2 installed in two months.

	7 Dec 2008	8 Feb 2008	Increase	
			Value	%
Total TWh from CEEs	95	140	45	+ 47%
of which ISHW OSR	38%	59%		
or GWh	361	826	465	+ 130%
Coefficient : 12 600 kWh cumac/m^2				
Number of m^2	28 651	65 556	36 905	

Ct. *DGEMP Lettre d'information* Jan and March 2008

In new individual and collective housing, incentives will be reinforced by the terms of the coming thermal energy regulations. Progress made in construction and heating standards will attribute growing importance to saving on water heating systems. Collective housing is already set on this path insofar as it could provide a reduction in rental.

As far as the existing housing is concerned, which represents the core of potential sales, tax credits aside, the development of financing at very favourable or zero rates of interest implemented by certain regions or businesses should allow less affluent households to overcome their budgetary constraints in this area.

Projected average annual growth of 35% was calculated between 2007 and 2012, less than that resulting from the *Plan Face Sud* (1 million m^2 installed per year in 2010, the equivalent of around 45% average annual growth), but in line with Comop no.10 objectives.

In 2012, the equipment market will reach 1.7 billion euros (value installed) and direct employment will reach 12,000. Energy production will reach 225*ktoe* and maintenance jobs 560.

Production system

Until a few years ago, French producers had a relatively marginal role in the manufacture of solar panels in relation to their German (*Viessmann, BBT, BBB, ...*) or Austrian (*Green One Tec*) counterparts, and it was estimated that 75% of all solar panels sold in France came from those two countries.

[20] According to measurements on sample the energy productivity would be lower by 25% than the expected performances.

In recent years, the national production network strengthened and now holds an important place in the market, with two SMEs historically specialising in solar power: *Giordano Industries* and *Clipsol* (respective declared turnovers in 2006 annual accounts of roughly €29 million and €12 million) and large general heating equipment firms, *Viessmann* in particular.

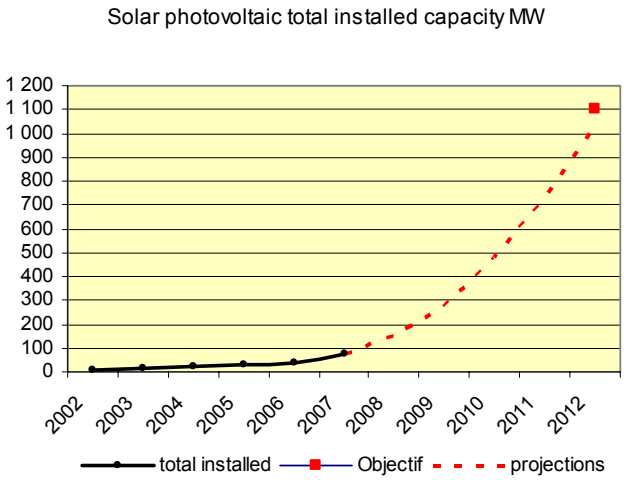
This support of the national production is based on quality standards that apply not only to equipment but also to installation services. Launched in 1999 by *ADEME*, the *Qualisol* charter was transferred to all those professional companies grouped under *Qualit'EnR* at the beginning of 2006. According to *Enerplan,* at the end of the year 2007 more than 11,500 installation service providers had signed up to the *Qualisol* charter. For equipment, *Enerplan* launched the brand *"O Solaire"* in conjunction with firms within the industry, which is managed by the certification association *Certita*.

With the creation of *INES*, France equipped itself with a federal R&D centre that will allow it to consolidate its efforts in the industrial sector. The main lines of action are reducing costs, improving performance and structural integration.

2.3 Solar Photovoltaic Energy

Key Points

- Progressively an industrial sector covering all of the different aspects of solar photovoltaic systems production is establishing itself in France, supported by a significant research and development drive and favouring structural integration in buildings.
- With installed capacities of 35 to 40 MW of power in 2007, along with numerous existing projects, the targets set by the *PPI* for electricity (+160MW by the 2010 deadline) should be greatly surpassed.
- The adoption of favourable purchase tariffs in mid-2006 should allow the sector to make the ambitious targets set for it as part of the Grenelle framework a reality.



Markets and jobs linked to solar photovoltaic equipment

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
MW installed annually	144	+160%	375	300	
Domestic market value (€ million)	115	+160%	300	2 400	
Value of Production (€ million)	192	+90%	366	2 510	
Exports (€ million)	100	+20%	120	360	
Employment in manufacturing and installation	1 100	+100%	2 100	13 100	

Solar photovoltaic energy production

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Total end of year installations (MW)	36	+105%	74	1 024	1 100
of which newly joined	9	+170%	24	992	
Energy produced (GWh)	11	+90%	21	1 010	1 100
Value of energy sold (€ million)	3	+160%	8	493	

Recent developments in the photovoltaic sector

The rise of solar photovoltaic energy is more recent than that of solar thermal energy. Before the adoption of new purchase tariffs in July 2006, this market was still a marginal one limited to remote off grid sites.

In 2007, the market will have more than doubled in comparison with 2006 levels with 35 to 40MW installed. The market is focused almost entirely on installations destined to be connected to the network.

The new purchase tariff, which in France is €300/MWh for non-integrated systems - systems placed on or fixed into the ground - and €550 for systems integrated into the building structure, reinforces France's strategy in the photovoltaic sector, which is to encourage the stream of products integrated into buildings. This direction, linked to thermal energy regulations, should allow the creation of a very specialised market, distinguishing itself from the other European markets which, until the present time, have attributed more importance to non-integrated solar power. This latter form of solar is favoured, however, by the purchase tariff in overseas regions of France (€400/MWh) which enjoy greater exposure to the sun.

The purchase tariff applies up to the 3kW mark, along with tax credits (50% of the cost of equipment), which guarantees strong profitability for installations. This could be further improved by the aid provided by a growing number of regions.

According to the early trends reported by *Observ'ER* following the impact of tax credits, individual installations in Metropolitan France will have almost doubled between 2006 and 2007, growing from 4.5 MW of power to 8.3 MW. These systems should continue their growth but only represent a decreasing fraction of the market. Collective installations (commerce, industry, governments), and "commercial" projects will experience the highest growth rates in the future.

The power production capacity installed in 2007 is estimated at 35 to 40 MW, following a total of 14.4 MW in 2006. Only part of this power, however, is already joined to the network. At the end of 2007, the total power joined to the network was 24.5MW, of which 11.5 MW was in continental France and 13 MW of which came from French Overseas Regions and Corsica. At this time, joining requests totalled 64.8MW, or almost twice annual installations. According to a recent study, 80% of power installed comes from integrated systems.

With an average price per MW installed of €8 million, the value of the market will reach €115 million in 2006 and €300 in 2007. Prices in the French market, considered high in comparison to other European markets - particularly in comparison with the German market - should fall, realigning itself with the world trend. After a period during which prices strongly increased above the world market due to the shortage of silicium, they returned to the base level due to the creation of numerous factories in response to the excess demand.

Taking exports into account, direct employment in this field (manufacture and installation of cells and panels) was estimated at the equivalent of 2,000 full time jobs in 2007. Indirect employment adds a further 500 jobs to this total. The adoption of the *QualiPV* label in November 2007 represents an important step forward in the structuring of a network of installation service providers trained in photovoltaic technology.

With a total power capability of around 20 GWh in 2007, production of electricity from photovoltaic sources is still of marginal importance in comparison with other renewable energy sources. Its total estimated value is less than €8 million.

The French photovoltaic sector

For a number of years, *Photowatt*, which produces cells from silicium crystals, was the sole actor in this sector. Almost all of this firm's products were exported (€100 million in 2006). Its current production capacity is 60MW, with plans to increase this to 135MW in 2010 (*Photovoltaic Alliance* project in conjunction with *EDF EN* and *CEA*).

In recent years, a number of firms have grown into the photovoltaic sector.

In May 2005, the ***Tenesol*** group (formerly *Total Energy*, a shared subsidiary of *EDF* and *Total*) set up a second assembly unit with 17MW capacity in Toulouse, with production beginning in December 2006. Recently, two new production lines have been planned which will take production capacity to 50MW.

On 14th March 2007, was inaugurated the *"Silicium de Provence"* in Saint Auban (Reconversion of the *Arkema* site), led by *Photon Power Technologies*. Investments totalling 245 million euros equate to 250 jobs and targeted production of 2,000-3,000 tonnes of poly-crystalline silicium by the end of 2008.

Many other firms are present in the different areas of this sector (*Tecsol, Emix, Solaire Direct, Apex BP Solar*) and are developing rapidly, particularly in the manufacture of coverings for integrated systems with the participation of firms specialising in construction products (*Lafarge* coverings*, Arcelor, Imerys* roofing...). In total, including installation services, the sector in 2007 comprises 200 to 250 firms.

Projections

The target set by the PPI (ten years investments programme for electricity production) of 7th July 2006, was for the putting in place of an additional cumulative 160MW of power in 2010 (of which around a third in the Metropolitan France) and 500MW in 2015. More recently, the Grenelle Operational Committee on the development plan for renewable energy (Comop no.10), set more ambitious targets of 1,100MW by 2012 - corresponding to around 1,000 hectares of panels - having taken into account the takeoff of the sector.

This target - which requires an annual installation of around 200MW between 2007 and 2012 - could certainly be approached if not completely achieved. The projections made by the European Photovoltaic Industry Association (EPIA) for France are effectively for 200MW installed by 2010 (a "trend-based" scenario behind all of the additional voluntary political measures in place).

Powered by large energy producers (*Suez, Poweo*), firms specialising in renewable energy (*Séchilienne Sidec, Voltalia, Solaire Direct*), or finance organisations (*Caisse des Depots*), several commercial solar

power centre projects, giving a total of 110MW coming online before 2010, are planned in the South of France.

The development of the sector is accompanied by several significant research and development efforts centred on competitive poles: *Cap Energie, Tennerdis* and *INES, CEA* and *CNRS*. With the growing involvement of major industrial and energy firms, the French photovoltaic sector seems as it may be able to recover the deficit incurred in the 1980-1990 and achieve the ambitious targets that have been set for it.

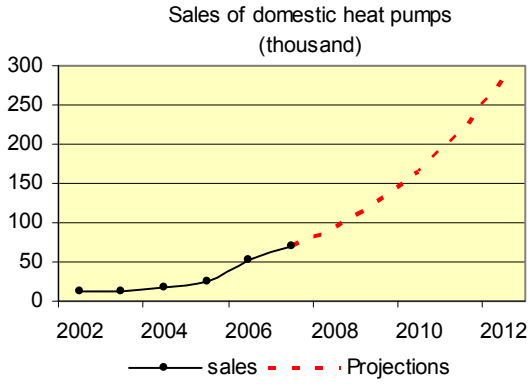
To achieve the next step, Photowatt, EDF Énergies Nouvelles and the CEA-INES joined their efforts within the PV Alliance structure. The aim is to reduce the costs for materials and components. PV Alliance will be in charge of the Lab-Fab (a pilot manufacturing unit). This 9000 m2 area unit will group together on its Bourgoin Jalieu site a laboratory and a producing capacity for solar cells prototypes using new technologies.

Within the new strategic industrial innovation programme, OSEO recently announced the financing of the Solar Nano Crystal project. This project is the R&D component of the Lab-Fab. It groups together the PV Alliance consortium with industrial partners of the photovoltaic sector like Emix, Photosil, Apollon Solar and Silpro.

2.4 Domestic Heat Pumps

Key points

- Since 2002, the rate of growth in heat pump sales in the French market has been at an average of 42% per year. The target of 100,000 annual sales could be surpassed by 2009.
- The industrial structure strengthened and benefited from standardization efforts, both in the equipment and installation services markets.
- The development of the market could be curbed by problems with training and limited household financing capacity



Market, production and employment linked to domestic heat pumps

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Number of units	53 500	+30%	69 600	283 000	
Market (€ million)	482	+24%	597	2 423	
Production (€ million)	392	+24%	485	1 970	
Direct employment	3 450	+29%	4 430	16 970	

Number of units : source AFPAC

Energy production and maintenance jobs

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Heat pumps In place end of year (1000)	216	+40%	303	1 240	1 245
Energy production (ktoe)	193	+40%	270	1 100	1 200
Employment in maintenance	250		330	1 350	

Current situation in the market for heat pumps

Following the failure of the *Perche* programme in the 1980s (sales of heat pumps exceeded 50,000 at the beginning of the 1980s) and after a long period of weakness (less than 10,000 units sold per year between 1986 and 2000), the market for domestic heat pumps has grown strongly in recent years. According to *AFPAC*, the number of heat pumps sold has increased from 25,000 in 2005 to 69,000 in 2007 (excluding air /air heat pumps) [21].

The development of the various markets in recent years is contrasting: while geothermal heat pumps (ground/ground, ground/water, water/water), mostly directed at new construction, reached a sticking point in 2007, sales of air/water pumps - two thirds of which go to existing housing - have multiplied 9 times in volume since 2004.

[21] Observ'ER's estimates (see follow-up of the tax credit), are higher for 2007, with 83.400 HP, including nearly 15.000 air/water ground/ground and ground/water HR and 58.000 air/air HP.

	2004	2005	2006	2007
Geothermal HPs	10 700	13 200	18 450	18 600
Air / Water	5 600	12 000	35 060	51 000
Total	17 300	25 200	53 510	69 600

Source: *AFPAC* 5 to 50 kW heat pumps; not including *PAC* air/air or those destined for the industrial sector, collective living spaces or the tertiary sector more powerful than 50kW [22]

Sales of air/air HPs, most often used for air conditioning - which in the end leads to an increase in consumption rather than energy production in most cases - amount to several hundred thousand per year. Only air/air HPs with a Performance Coefficient (COP[23]) greater than 3.3 and satisfying certain conditions are eligible for tax credits.

The tax credit system implemented in 2005, providing a 50% reimbursement on the price of equipment, has been a strong factor in the market's growth.

> The purchase of heat pumps with the main aim of heat production, either for integration into a new or an existing building is eligible for tax credit, when the COP is ≥ 3.3.
>
> The rate of tax credit changed from 40% to 50% on 1st January 2006 (spending taking place between 1st January 2006 and 31st December 2009). Tax credit applies to the price of equipment and materials, not including installation services. For one taxpayer and home, the value of spending eligible for tax credit cannot exceed the sum of €8,000 for a single person (€16,000 for a couple with no children).

The development of a quality industrial supply and, more recently, the establishment of standards for equipment (*NF PAC*) and quality charters for installation service providers (*QualiPAC*) have been at least as important as tax credit.

The increases in production volumes and efforts to improve standardisation have developed the industrial market supply into one which could lead to the disappearance of small-scale manufacturers. Currently, the production side is characterised by the coexistence of exclusive HP manufacturers (such as *France Geothermie* and *Thermatis Sofath*), whose turnovers have strongly increased in recent years[24], and more general firms (manufacturers of electric heating, air conditioning units and boilers: *Technibel, Viessmann, Atlantic, CIAT, MTS,* etc.). In the coming years, the critical size threshold must reach 8 to 10,000 HPs per year.

This development should result in a fall in prices, whose high level is currently one of the main obstacles to the more widespread use of heat pumps[25]. These prices are currently extremely varied, whether in terms of production (they can vary from 1 to 4 for the same technology) or for installation.

Market developments

As indicated earlier, prices within this market are highly heterogeneous. Based on information drawn from *Sofres* studies and data gathered by *OPEN*[26], the average price of an installed HP in 2006 was calculated as 9,000 euros. The breakdown of prices is as follows: equipment (factory or customs price) +/- €4200, production/distribution margins +/- €1800 and installation +/- €3,000. Prices could start falling in 2007.

22 The heat pumps intended for the production of heat for the sectors of the collective habitat, industry and the tertiary sector, represent, according to the Observatory of Energy, about 25% of the production of heat from the heat pumps. The segment of the tertiary sector is in strong progression.

23 COP (Coefficient of performance) measures the relationship between the power consumption by the HP and the energy which it produces.

24 The turnover of Thermatis Sofath passed from 7 M€ in 2004 to 26 in 2006, with an objective of 90 M€ in 2010. That of France Geothermie increased by 93% to 22,5 M€.

25 One will note that the "energy research national strategy" highlights the objective of costs reduction, in particular for the geothermal HP

26 See Sofres study for ADEME Assessment 2006 and permanent Observatory of the energy improvement of housing (OPEN) for ADEME and Club of the improvement of the habitat.

In the market for HPs solely intended for domestic heat production (excluding industry, tertiary and collective usage and air/air HPs), the turnover would be around €480 million in 2006.

	2006	2007
Equipment	225	280
Distribution and Installation	255	320
Total	480	600

In millions of euros

Production and employment

The effort to standardise the French market, which has become one of Europe's leaders, reinforces the credibility of the domestic offering and, as such, is a favourable factor in terms of exports. This could result in an increase in exports, particularly to the markets in Eastern and Southern Europe. There is no precise information available on these markets, however, and it has therefore been impossible to include exports in the study at the present time.

National production of equipment could account for 60% of the market. Distribution and installation margins have to be added.

Direct employment in manufacturing, distribution and installation is calculated on the basis of the ratios [turnover / employment] between the following activities: manufacture of industrial air-powered and refrigeration equipment (formerly *NAF 292F*), installation of heating and air-conditioning units (formerly *NAF 453F*) and wholesale trade in heating supplies (formerly *NAF 515J*).

	2006	2007
Production €m	390	485
Employment	3 500	4 300
of which equipment	735	925
of which distribution and installation	2 715	3 375

Indirect employment could provide around 1,900 jobs in 2006. With the implementation of the *QualiPAC* quality charter, the installation services market (with an estimated value of €160 million, or +/- 1,600 full time jobs) should also undergo a degree of "cleansing" with the disappearance of "tax credit chasers".

Based on total installations of 225,000 HPs (not including air/air) at the end of 2006 and an annual spending of €150 per HP, heat pump maintenance should provide the equivalent of around 250 full time jobs in 2006.

Energy production

The average values of energy saving certificates issued were used to calculate energy production for the various types of heat pump studied, taking into account the distribution of existing installations according to housing type and climatic region. Average annual energy production by a single heat pump is estimated at 10,400kWh, or 0.9 *ktoe*.

Based on the existing number of heat pumps installed (225,000 at the end of 2006), the following results are obtained:

	2006	2007
Energy production linked to annual sales	48	62
Energy production linked to existing installations	203	271

This analysis is well below the estimates published by the *DGEMP* which, for 2006, were for around 400*ktoe* of heat production from domestic heat pumps. The *DGEMP* estimate, however, does not subtract HP energy consumption from this total and includes heat pump use in collective housing areas. With these corrections, the total for energy effectively produced in the individual domestic sector is calculated as 207 *ktoe*.

Projections

The Grenelle Operational Committee for the renewable energy development plan (Comop no.10) has set an ambitious target for heat energy production from individual heat pump use: 1,200 *ktoe* from 1.245 million homes equipped, or an average of 195,000 newly-equipped homes per year in the period 2007-2012.

Although the French market is currently the most dynamic in Europe for this sector, the achievement of these goals will require a considerable effort with the major constraints being price and professional training: there is currently only one specialised higher education technical qualification for renewable energy.

The growth in the number of HPs installed will be strongly dependent on the new construction sector, which accounts for roughly half of all HP installations.

Heating regulations (RT2005), which should be reinforced by the RT2010, sets minimum performance standards to be achieved on the basis of 3 categories, particularly with regard to energy consumption.

This point is highly favourable for geothermal heat pumps, whose energy efficiency is higher than that of fossil fuel powered heat sources. This should allow geothermal pumps to make a comeback. They offer an integrated heating solution (ECS), an added benefit in comparison with other renewable energy sources (solar thermal).

There are currently 35,000 HPs (not including air/air) sold yearly in new housing, equating to an 8% penetration rate in housing declared as under construction. Taking into account developments since 2003, the penetration rate could reach one third by 2012, which corresponds to around 175,000 HPs installed in new housing.

The collective, tertiary and industrial sectors

Given the levels of power necessary, HP installations in the collective, tertiary and industrial sectors generally occur in the form of more complex geothermal solutions: horizontal or vertical geothermal power. In addition to the *Qualiforage* and *Aquapac* quality stamps, the creation of the *Renewable Heating Fund* should provide an incentive for increasing use of HPs in collective housing areas, the tertiary sector and industry.

In the existing housing market, which accounts for around half of all current installations - or around 30,000 HPs - and two thirds of all aero-thermal HPs (not including air/air), the main problem could arise from the exhaustion of tax credit: heat pumps, which are competing against wood-powered boilers and partially against solar thermal power, represent a significant investment not easily accessible to less wealthy households without specific funding. Based on current trends and on the assumption that this funding will be made available, an average annual market growth rate of 30% is expected. This will take the market for heat pumps in existing housing in 2012 to around 110,000 HPs per year (not including air/air).

According to these expectations, the market will reach 283,000 HPs in 2012, with an installed value of 2.4 billion euros. The number of jobs provided directly by this market will be around 17,000: 3,200 in manufacturing and 13,800 in installation services.

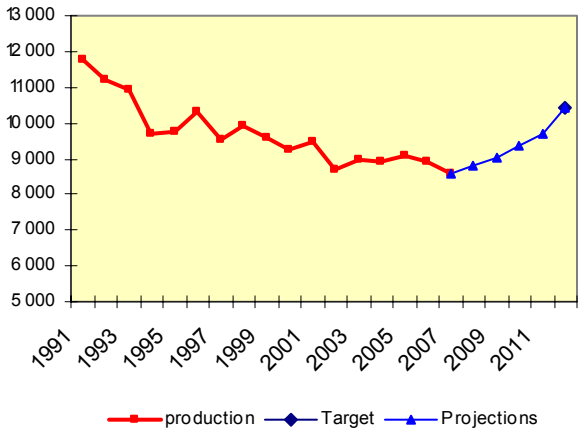
The total energy production for all installations will reach 1.1 million *toe.*

2.5 Biomass

Key points

- The 2000 - 2006 Wood Energy programme resulted into strong progresses as concerns biomass use
  - Despite the 2007 decrease, sales of wood based heating domestic appliances remain at a high level
  - As concerns the collective and tertiary sectors the first year of the new programme consolidate the growth of previous years
  - The success of the last biomass call for tenders augurs well for the progresses of fuel wood industrial use
- According to Grenelle objectives, use of biomass in collective housing, tertiary and industrial sectors should grow 1.6 million *toe* by 2012

Energy production from solid biomass (ktep)



Markets and employment linked to the use of wood biomass for energy production

	2006 Realisations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Targets
Annual sales (thousand)	530	-15%	450	685	
Power installed during the year (MW) (collective, tertiary and industrial sectors)	197	+44%	284	1 400	
Market (million €)	1 960	-49%	1 865	3 425	
Production (million €)	2 015	-5%	1 910	3 560	
Employment	16 600	-15%	14 140	23 900	

Markets and employment linked to wood combustion

	2006 Realisations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Realisations
Fuel wood production (ktoe)	8 860	-34%	8 560	10 440	10 440
of which sales (ktoe)	3 150	+ 4,0%	3 280	4 640	
Sales value (million €)	950	+ 4,7%	995	1 315	
Employment in market production	8 785	+ 1,0%	8 880	13 900	

* 2006 et 2007 : Metropolitan France DGEMP ; agricultural heat excluded

The situation in the wood energy market

With 8.9 million toe, wood accounts for 77% of all renewable energy produced in France, not including large-scale hydroelectric. Its contribution has been falling steadily since the 1990s, both in terms of absolute value and percentage.

Since 1990 wood use is on average 10 million toe, however with a decrease to 9 million toe from 1997 onwards. This trend would be the consequence of the disaffection of traditional wood heating appliances, not fully compensated by the increasing use of modern ones.

The national Wood Energy programme 2000-2006, instituted by ADEME, as an extension of the first programme begun in 1994, intended curbing this trend.

It encouraged significant development in the biomass sector:

- The goal of substituting fossil fuels by developing collective housing, tertiary sector and industrial wood based boilers was achieved, with 317 *ktoe* substituted.
- In the domestic sector, sales of heating equipment experienced a period of marked growth starting in 2003 (+27% per year between 2003 and 2005) and an increase in equipment performance (the *Flamme Verte* label covering 80% of sales).
- Although the growth in the volume of NF-labelled wood heating fuel remains limited, the structure of the wood fuel production sector has undergone noticeable development.

The equipment market linked to wood energy

The heating equipment manufacture sector is relatively developed. Two manufacturers (*Weiss France* and *Compta R*) have specialised in medium- and high-powered wood fuelled boilers. Their turnovers (each around €10 million) are both growing strongly. In the manufacture of stoves, inserts, etc., several SMEs have already been recognised as having particular specialist knowledge for a number of years, such as *Supra* (turnover €73 million), which was bought over by *EDEV EnR Reparties,* the *EDF* group's renewable energies subsidiary. *AREVA* is developing in the biomass sector through its purchase of the Brazilian firm *Koblitz*, which specialises in the engineering and management of biomass projects. Following behind them are a number of public laboratories and technical centres active in the area of wood-powered heating[27].

Based on the results of the studies ordered by ADEME[28], the value of the market for domestic wood-powered heating appliances can be estimated at 1.9 billion euros, €830 million of which is in installation services. With a positive foreign trade balance, production (manufacturing, distribution and installation margins) is slightly above the market level.

In 2006, the number of direct jobs related to the domestic appliances sector was estimated at 15,900, with 3,900 in manufacturing, 5,000 in distribution and 7,000 in installation[29].

Based on the 200MW installed in 2006, the value of the industrial, tertiary and collective housing heating markets is estimated at €80 million (+/- €0.4million / MW[30]). The direct employment provided (manufacturing and installation) would be worth 700 jobs.

Indirect employment linked to intermediary consumption for manufacturing, distribution and installation is around 5,000 jobs.

Markets linked to energy production

These are chiefly in the area of producing the fuel wood. Only jobs related to the formal "market" part of the fuel wood production were retained. This market part represent a little over a third of the total wood consumed for energy purposes. On the basis of the market prices of €310/toe for the domestic sector and €200/toe for the collective and tertiary sectors, the value of the market is estimated at 950 million euros. The corresponding number of jobs would be 8,000, with 800 added for the management and maintenance of heating units.

Recent developments and projections

Domestic sector

2006 extended the market trends observed in 2005, with 29% growth in the number of units sold as opposed to 26% in 2005. In the third quarter, however, there was a decline in sales as a result of a mild winter.

In 2007, the early market trends - based on the observation of the first three quarters[31] - point to a reduction of 15% in sales. This fall affects all areas, most particularly that for wood-powered boilers (-30%). It is possible that government incentives (tax credits), which played an important role in previous years, reach the height of their effectiveness in 2006, due in particular to the fact wood-fuelled heating systems coming into competition with other eligible forms of heating equipment, given the credit tax ceiling [32].

27 See the bio energy research national plan

28 Annual inquiry on the sales of domestic wood base appliances and Evaluation of employment in the bio combustibles industry (Algoé 2007).

29 See Evaluation of employment in the combustible die bio (April 2007)

30 Assessment of the program Wood Energy.

31 See Follow-up of the tax credit - First tendencies for 2007 Observ' ER

32 Article 200 quater of the General Tax Code

The average price of wood-powered heating units rose strongly (15% on the average annual price between 2004 and 2006), due to the dual effects of the increase of the share of high performance appliances (*Flamme Verte* label) and the spectacular rise in the cost of primary materials (steel, cast iron ...) [33].

The price of wood increased by 1 or 2% between 2005 and 2006: with a cost of around €40/MWh, it remained by far the most economical method of heating in 2007 – even before the large increases in the price of fossil fuels - whether as a source of additional heating or as the main source.

The collective and tertiary sectors

The objectives of the *Wood Energy 2000-2006* programme were surpassed with the installation of 1,042 new boilers (providing 356MW of power and an additional consumption of 107*ktoe* in the 2000-2005 period). According to the *DGEMP*, consumption of wood by the collective and tertiary sectors increased from 119*ktoe* in 1999 to 212 in 2006 and grew a further 8% between 2006 and 2007.

In 2007, new installations will correspond to 60 to 62 *ktoe* in line with the targets set in the new 2007-2010 programme (+290*ktoe* between 2007 and 2010). As was the case for the domestic sector, surveys indicate a reduction in the price of wood as fuel.

The industrial sector

The wood energy programme resulted in the installation of 381 industrial heating units between 2000 and 2005 (with a total power of 536MW and an additional consumption of 156 *ktoe*). It is noted however that, according to the Energy Observatory, energy production from biomass in industry rose from 1,242 *ktoe* to 1,295 *ktoe* between 1999 and 2005 - an increase of only 53 *ktoe*,

The increase between 2005 and 2007 was 57 *ktoe*, a value approximately corresponding to the installation of an additional 216MW as a result of the first biomass call for tender in 2003[34]..

The development of energy production should speed up with the second call for tender, launched in 2006; whereas the invitation to tender aimed for 300 MW, the proposals made exceeded 700 MW.

Intermediary goals for 2012 set by the Grenelle Operational Committee for Renewable Energy

Individual domestic heating

The Operational Committee for the renewable energy development plan (Comop no.10) predicts that the overall consumption will remain at its current level (7.4 million *toe*). This sustained level, however, will be accompanied by a significant improvement in the efficiency of heating systems thanks to the replacement of 1.87 million domestic appliances and 1.53 million first purchases between 2006 and 2012. Aid mechanisms should be re-directed towards the highest-performing equipment.

Collective, tertiary and industry

With regard to the other uses of biomass fuel, the target set is for an increase of 1.64 million *toe* in wood consumption.

The target set for industry to reach by 2012 is an increase of 700 *ktoe;* given the scarcity of wood as a resource, it is proposed that new invitations to tender be made regularly, encouraging their use for heating. The target is for 400 *ktoe* more for collective and tertiary structures, including heating networks, and 540 *ktoe* of co-generated energy.

These targets will be supported by the creation of the *Renewable Heating Fund*, intended for businesses and collective housing.

Projections

According to the 2006 survey on the sales of domestic heating units, more than 80% of them were first acquisition: 125,000 units went into new homes - or a quarter of all new builds - and 275,000 went into

33 Source Study BASIC for ADEME intermediate report (February 2008); the comparison does not take into account the cost of the equipment.

34 Estimated coefficient is 300 tep / MW.

existing housing. Their distribution between main and secondary residences is unknown, but could be over 60% if judged on the amount of equipment eligible for tax credit[35].

The number of wood-powered heating systems in main residences was estimated at 5.6 million in 2002; the figure for 2006 is not yet known but should be close to 7 million (1.9 million wood-powered domestic heating units were sold between 2001 and 2006). The rate of growth in the total number of units will be around 6% in 2007, while renewals only accounted for 87,000 sales (a little under 1.2% of the total number).

2012 sales, in line with Grenelle targets, will be around 685,000 domestic heating units sold. Wood consumption should increase very little, with improvements in efficiency compensating for the increase in the number of units; their composition will evolve in favour of biomass briquettes and wood chips.

In the tertiary and collective sectors, the 2010 targets set in the new ADEME programme (+290 *ktoe*) should be met; in total, consumption in the collective and tertiary sectors in 2012 will be around 600 *ktoe*.

The targets set for the industrial sector are very ambitious. Given the success of the second biomass invitation to tender, a 600 *ktoe* increase in consumption by 2012 has been used, with 500 *ktoe* further coming from co-generation.

Under these conditions, after the slight fall of 2007, the market for equipment will reach the value of 3.4 billion euros by 2012, with these investments providing the equivalent of 24,000 full time jobs.

The value of sales of wood as fuel will increase by 32% to 1.3 billion euros between 2007 and 2012, while merchant jobs linked to the production of wood and the management of collective heating systems in the merchant sector will grow by 57% to 13,900.

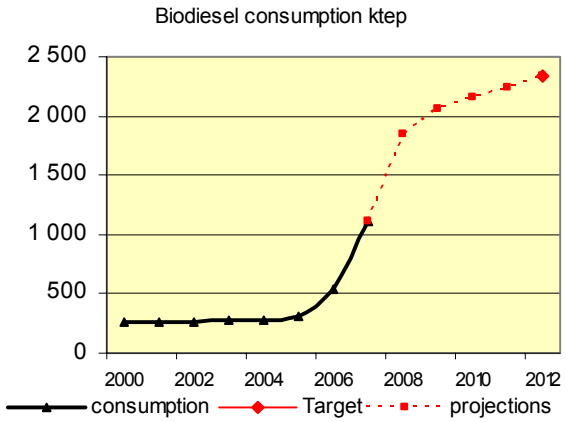
35 According to Observ' ER the percentage of eligible wood based heating appliances with the tax credit was of 57% in 2006, but only the appliances intended for the main homes are eligible.

2.6 Bio fuels

2.6.1 Bio diesel

Key Points

- In 2006, the incorporation rate set by the bio fuels development plan adopted in 2004 (1.75%) was achieved; it should be surpassed in 2007 with an incorporation rate of 3.8% with imports estimated in the energy balance at 0.3 million toe.
- The achievement of the 5.75% target in 2008 does not seem possible without resorting to imports (129,000 T over the first six months).
- This situation should better after 2008 with the entry into production of the new bio diesel production plants



Markets and jobs linked to the construction of production units

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
New capacity installed (*kt/year*)	350	+171%	600	300	
Value of investments (€ million)	68	+174%	185	70	
Employment created by investment	390	+171%	1 030	340	

The annual value of investments is calculated by dividing the cost of construction of new units (€230/t) over the 18 months preceding their activation (see table in text)

Production / consumption of bio diesel

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Bio diesel consumption (hl)	7 140	+106%	14 720	30 860	
Value (€ million)	525	+108%	1 090	2 280	
Employment in production	1 870	+63%	3 040	7 530	
Renewable energy production (*ktoe*)	553	+65%	910	2 345	

Only direct employment in bio diesel production is counted, not including agricultural jobs

Targets

The Bio fuels Plan set a target of bio diesel to be incorporated into the diesel by 5.75% by the year 2008, anticipating the demands of the 2003/30/CE directive (5.75% in 2010). Given the growing tendency in the total pool of vehicles towards the use of diesel as fuel, these targets will result in significant amounts of bio diesel being incorporated. This could require the re-orienting of French agricultural production:

Rate of incorporation and quantities of bio diesel to be incorporated

Year	2005	2006	2007	2008	2009	2010
Rate	12%	175%	35%	575%	625%	7%
Quantity (t)	420 000	628 000	1 302 000	2 155 000	2 388 000	2 725 000

Source: *UFIP* annual press conference (February 2008)

The incorporation rate for 2008 (5.75% in power value, i.e. 6.3% in volume) is higher than the rate allowed by the European directive concerning the fuel quality (5% in volume). The 04 27 2007 arrêté has fixed a maximum rate of 7% starting 01 01 2008.

Current situation and projections

After remaining relatively stable during the 2000-2004 period, consumption of bio fuels began to increase significantly in 2005 when the *TGAP* system for bio fuels was adopted.

	2000	2001	2002	2003	2004	2005	2006	2007
Consumption	308 600	310 800	308 900	322 600	324 000	368 500	631 000	1 300 000
Production					424 400	466 300	643 000	1 058 000

In tonnes; sources: consumption before 2004: ADEME; 2004-2006: France's statement to the European Union 2007; Production: *DGEMP*

In 2005, the incorporation rate was 1.04% for diesel (source: *DGEMP*) for a European target of 2%; in 2006, it reached 1.77%, still below European targets but in line with national targets. In 2007, production would have been slightly more than 1 million tonnes, while the incorporation target was met; according to the 2007 Energy Report[36], imports of bio diesel were around 0.3 million toe.

In the first 4 months of 2008, imports of bio diesel[37] from Germany, Italy and Belgium amounted to €133 million (for +/ 129,000 t, or an average price of around €90/hl). Unlike ethanol, production capacity in 2007 had been insufficient and continued to be so into the beginning of 2008. This situation should be resolved in the near future but does highlight the tension caused by the increase in sales of diesel on one hand increasing the volume of bio diesel to be incorporated and, on the other hand, the increase in food oil prices: rapeseed oil and sunflower oil passed the €1000/t mark at the beginning of 2008, as opposed to €600/t at the beginning of 2007.

The development of production capacities within the framework of the *Bio fuels Plan*

Bio fuels produced under government control in agreed production units benefit from a reduction in domestic consumption tax (*TIC,* formerly *TIPP*). Between 2006 and 2010, the development plan for these agreements was as follows:

2006	667
2007	1 343
2008	2 278
2009	2 730
2010	3 150

In millions of tonnes

In March 2006, following the European invitation to tender of November 2005, agreements involving 1.335 Mt of tax-free' bio diesel were agreed. These agreements resulted in the construction of 7 new production plants. In September 2006 (invitation to tender of July 2006), additional agreements for 900,000 t of bio diesel were reached.

On the basis of the development of production capacities (see table in annex), it was estimated that investments in the bio diesel sector were worth €70 million in 2006 and €185 million in 2007. The number of direct jobs connected with the creation of these investments was around 390 in 2006 and 1,000 in 2007.

	2006	2007	2010
Value € million	68	185	88
Jobs	354	960	440

Valuation of bio fuels

Incorporated bio diesel is sold to the end user at the same price as gasoline. It is valued at its VAT free price, less the *TIC* it has been charged (see calculation in annex). The following prices are obtained (which include distribution margins).

	2006	2007
EMHV (€/hl)	734	739

36 See Energy assessment of France for 2007 (DGEMP Observatory of energy)

37 Product 38249091 - Esters monoalkylic of fatty-acid containing at least 96,5% in volume of esters); it is only from 2008 that the customs statistics distinguish the biodiesel.

Given the volumes consumed, the (tax free) value of consumption would be the following:

	2006	2007
EMHV	525	1 090

In millions of euros

Employment in production

To calculate the number of jobs connected with bio diesel production, the *DGEMP*'s production figures were used.

Agricultural employment is shown on one side, while non-agricultural jobs are shown on the other. Further distinctions are drawn between direct non-agricultural jobs (industrial activities, transport, etc. and indirect employment - supply of agricultural inputs). The results of PWC studies were used as a starting point. The ratios used were updated for a single general productivity evolution; due to the lack of data, the specific productivity improvements made in production plants due to the increase in the power of production were not taken into account. Jobs in distribution were not taken into account (around 300 in 2006).

Ratios of jobs created by or sustained (per 1,000 tonnes of bio diesel)

Total	88
agriculture	40
Other	48
of which direct	29
Total	18

Source: various studies and publications, PWC 2004

Employment in production

	2006	2007
Total	5 659	9 219
agriculture	2 603	4 241
Other	3 056	4 978
of which direct	1 867	3 042
of which indirect	1 188	1 936

Source: own calculations

Energy produced

Production	2006	2007
Bio diesel (tonnes)	631 000	1 058 000
Energy (toe)	543 000	910 000

Conversion ratio: 1t = 0.86 toe

Projections

For bio fuels as a whole, the Operational Committee for the renewable energy development plan (Comop no.10) calculated a target of 2.8 million toe by 2012. Here, a target corresponding with the provisional volumes set by the bio fuels plan for 2010 was used: 2.35 million toe (to which a further 0.5 million toe can be added from bio ethanol).

The value of production would therefore be 2.3 billion euros, providing 7 500 direct jobs and energy production of 2.3 million toe. Indirect employment, including in agriculture, would reach 15 500.

Annex 1: Calculating the "price" of bio diesel

Per hectolitre	2006	2007
Retail Diesel price	107.7	109.5
Price without VAT	90.1	91.5
TIC	41.7	42.6
Removal of tax	25.0	25.0
Price	73.4	73.9

Source DGEMP : bio fuels taxation ; Customs : petroleum products : taxation and price structure

Annex 2: Calculating investments

In tonnes of capacity	2004	2005	2006	2007	2008	2009	2010
Existing units	373 500						
New units (DI)							
Sète		160 000		90 000			
Compiègne 2		100 000					
Montoir Saint-Nazaire			250 000				
Le Mériot			250 000				
Bordeaux Bassens					250 000		
Coudekerque					250 000		
Grand couronne 2					250 000		
Autres (hors DI)				1 300 000			

Transition to investments (hypothesis 18 month for construction ; cost: 0,23 million € /kt)

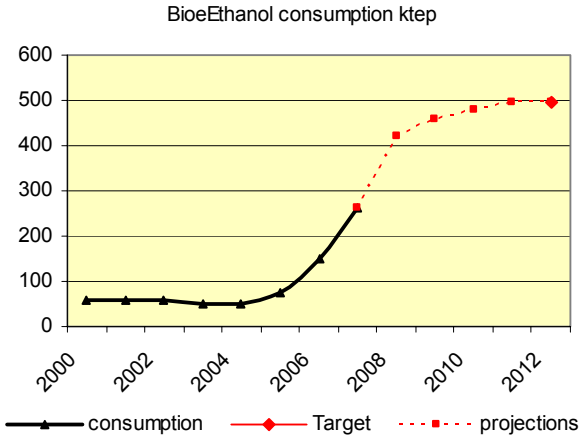
Thousands of tonnes / year	27	80	295	808	842	575	383
Investments (€ million)	6	18	68	185	193	132	88

There is no information on investments forecast for 2012, which depend on decisions that will be taken in the course of the coming years on the development of the bio diesel sector beyond 2010. By way of an example, an additional capacity of 300kt would result from an investment of €70 million.

2.6.2 Bio ethanol

Key points

- In 2004, France adopted a voluntary bio fuels development policy, setting itself higher targets for 2008 than the European Union had set for 2010.
- In 2006, the incorporation rate targeted (1.75%) was met: it should have happened in 2007 (rate of 3.5%). On the other hand, according to *UFIP*, the 2008 target (5.75%) is unachievable.
- In the context of the very slow takeoff of the E85 sector, the revision of the petrol quality directive will remove some of the obstacles to direct incorporation.



Markets and jobs linked to the construction of ethanol production plants

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
New capacity put into service (kt)	240	+67%	400	100	
Value of investments (€m)	358	-30%	250	70	
Employment in investments	2 040	-31%	1 380	380	

The annual value of investments is obtained by dividing the construction cost of new plants (€0.7m/kt) over the 18 months preceding their activation. (See the table in the text.)

Production / consumption of bio ethanol

	2006 Installations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Production / consumption ethanol (hl)	2 940	+78%	5 230	9 910	
Value (million €)	228	+82%	416	788	
Employment in production	365	75%	640	1 180	
Energy (ktoe)	148		263	500	

Only direct employment except agriculture employment

Targets

The bio fuels plan announced in September 2004, set a goal of 5.75% of ethanol incorporated into gasoline by the year 2008, 7% in 2010 and 10% in 2015, percentages expressed in amounts of renewable energy. Given the energetic power of ethanol in comparison with petrol and the forecast petrol consumption quantities, these targets result in the following quantities of ethanol being incorporated into petrol:

Incorporation rate and quantities of ethanol to be incorporated.

Year	2005	2006	2007	2008	2009	2010
Tax	12%	175%	35%	575%	625%	7%
Quantity (t)	170 000	237 000	465 000	741 000	745 000	787 000
Source: *UFIP* annual press conference (February 2008)						

These targets are in anticipation of the 5.75% rate in 2010 set at the European level by directive 2003/30/CE.

They were accompanied by a series of measures:

- An increase in the quantities that can be produced under removal of tax status.
- The adoption of the E85 programme.
- The adoption of a general tax on fuels in the 2006 Budget Law.

In a context market by conflicts of interest between fuel distributors and producers of ethanol[38], this final measure seeks to provide distributors with some incentive to incorporate bio fuels by punishing those who fail to reach the incorporation rates set. This has had the effect of strongly increasing incorporation after years of stagnation.

In order to make it easier to use ethanol, the government has taken efforts to develop the E85 programme. This sector, however, is harmed by the weakness of demand, the small number of Flex-fuel vehicles and in circulation (according to the *SNPAA*, there are a few thousand) and the concomitant weakness of the market offering: while fuel distributors were engaged to open 500 to 600 E85 sales points in 2007, the number had not exceeded 200 by the beginning of 2008[39].

It should also be noted that the Prime Minister's statement of 2nd March 2007[40] set the proportion of vehicles bought or taken on long term hire by State services as 15% in 2007 and 30% in 2008.

The ethanol sector faces several difficulties:

a) The imbalance between refinement capacities for petrol and diesel. With excess petrol refining capacities, France exports a growing proportion of its production; net exports of high-grade petrol were at 5.8Mt in 2007 for a consumption of 9.9Mt (source: *UFIP* February 2008). According to *UFIP*, petrol consumption should continue to decrease steadily and, without adjustments to France's capacities, the incorporation will only serve to increase this refining imbalance.

b) Moreover, according to the petrol industry these incorporation targets harm the European EN228 standard, which limits the incorporation rate for motor use to 5% in volume for ethanol (or 3.3% in PCI) and 15% in volume for ETBE (or +/-5.85 % for ethanol in PCI), The petrol industry also emphasises technical constraints on incorporation and distribution (the necessity of disposing of specific gasoline base) and favours incorporation in the form of ETBE.

Recent situation and projections

After having remained stable, even slightly fallen between 2000 and 2004, consumption of bio ethanol began to increase strongly in 2005.

	2000	2001	2002	2003	2004	2005	2006	2007
Ethanol in ETBE	92 549	90 513	90 470	77 197	80 183	113 867	220 000	
Pure ethanol					704	3 374	14 000	
Total ethanol	92 549	90 513	90 470	77 197	80 887	117 241	234 000	410 000

in tonnes ; sources : before 2004 ADEME; 2004—2006 French report to the European Union; 2007 DGEMP

Despite this increase, incorporation rates remained below European targeted levels until 2006. In 2005 and 2006, the rates of ethanol incorporation in petrol, expressed in energy terms (PCI), were 0.89% and 1.75% respectively for a target of 2%. In 2007, the incorporation rate will have more than doubled to reach 3.75%, conforming to the targets set by the Energy Orientation Law of 2005. The majority of this incorporation was in the form of ETBE (a mixture of isobutane and ethanol).

According to *UFIP*, the target of 5.75% for 2008 will only be reached with difficulty "due to the regulatory and technical constraints present in Europe", which could result in distributors being penalised through the *TGAP* mechanism[41].

It is generally considered[42] that ethanol will become competitive with petrol at a barrel price of around €90/barrel. The constant rise in the price of fossil fuel products, which has already surpassed €85/barrel, should assure the competitiveness of ethanol in the long term, despite the increase in primary materials in the agricultural sector.

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38 See Report on the optimization of the support instrument for bio fuels of September 2005 and Parliament's information report n° 3397

39 Recently a distribution network announced the stop of E85 distribution

40 Prime minister's circular relating to the development of the "flex-fuel" in France and to the acquisition of flexible vehicles by the services of the State

41 If the rate only reach 5% instead of 5.75% the incidence of the remaining TGAP to pay would be of 0.8 c€/l.

42 See Report on the optimization of the support instrument for bio fuels; communication of the Commission "Strategy of the EU in favor of the bio fuels" February 2006

The renewable energy directive should confirm the target of 10% incorporation of bio fuels in 2020 (France's goal is for 10% in 2015). The revision of the Petrol Quality Directive 98/70/CE provides the possibility of raising the incorporation rate of bio ethanol into petrol from 5% to 10%.

Notwithstanding the technical aspects, this group of factors should remove some of the obstacles facing the ethanol sector. Given the increase in production capacities, an incorporation rate of 7% has been calculated for 2012.

The development of production capacities within the framework of the Bio fuels Plan

In order to make them competitive in comparison with fossil fuels, bio fuels produced under government control in agreed production plants, benefit from a reduction in the domestic consumption tax (TIC, formerly TIPP). Between 2006 and 2010, the development programme for these agreements was the following:

	ETBE	Ethanol
2006	170	137
2007	225	337
2008	225	667
2009	230	870
2010	230	870

In thousands of tonnes; ETBE in ethanol equivalent

In March 2006, agreements for the tax-free production of bio fuels were reached following a European invitation to tender in November 2005. They correspond to 380,000 t of ethanol and 85,000 tonnes of ETBE ethanol. The agreements will result in the construction of three ethanol plants, while 3 existing units will see their positions consolidated. In September 2006, additional agreements for 200,000 t of ethanol were reached (July 2006 invitation to tender).

Based on the progression in production capacities (see annex), investments in the ethanol sector were estimated at €360 million in 2006 and €250 million in 2007. The number of direct jobs corresponding to this investment, calculated using the ratios of the old *NAF 742C* (engineering), *452B* (construction of various buildings) and that of the *NES E23* (mechanical equipment industries) would be around 2,040 in 2006 and 1,400 in 2007.

Investments in production plants and employment in their construction

	2006	2007
Value € million	358	250
Employment	2 040	1 380

Bio ethanol valuation

The production and distribution of ethanol-based fuels was valued by subtracting from the without VAT price of the high-grade petrol the specific domestic consumption tax for ethanol. The following prices were obtained, which include distribution costs as well as the costs incurred by the storage and the specific "gasoline base" needed for incorporation[43].

	2006	2007
Ethanol (€/hl)	77.5	79.5

Given the volumes consumed, the (tax free) value is as follows:

	2006	2007
Ethanol (€ million)	228	416

Employment in Production

Agricultural and non-agricultural employment has been distinguished. Furthermore, distinctions are made between direct non-agricultural employment (industrial process, transport, etc...) and indirect employment (supply of agricultural inputs). The results of Price Waterhouse Cooper (PWC) studies were used as a

[43] The major part of ethanol being transformed into ETBE (which includes 53% of isobutylene), this way of calculating implicitly values isobutylene at the same price as ethanol

starting point; it was impossible to take into account for the changes in the agricultural situation or the changes in productivity linked to the growth in production. For the ethanol sector, an average of the different sectors (beetroot, wheat and corn) was taken.

Ratios of employment provided or sustained (per 1000 tonnes of bio ethanol)

Total	5.7
Agriculture	3.2
Other	2.6
of which direct	1.6
Total	1.0

Source: various studies and publications by PWC 2004

Production employment

	2006	2007
Total	1 304	2 294
Agriculture	717	1 262
Other	587	1 032
of which direct	365	642
of which indirect	222	390

own calculations

Energy produced

	2006	2007
Ethanol (tonnes)	234 000	416 000
Total (*toe*)	148	263

Conversion rates: 1 t ethanol = 0.64 *toe*

Projections

For bio fuels as a whole, the operational committee for the renewable energy development plan (Comop no.10) set a target of 2.8 million *toe* by 2012. A target corresponding to the projected volumes set by the bio fuel plan for 2010 was calculated here of 0.5 million *toe* (to which a further 2.35 million toe of bio diesel still has to be added).

The value of production will therefore be around 790 million euros, providing 1,200 direct jobs and energy production of 0.5 million toe. Indirect employment, including agriculture, will provide 3,100 jobs.

Annex 1: Calculating the "price" of bio ethanol

Ethanol / ETBE	2006	2007
Fuel prices	123.7	127.6
Price of HTVA	103.4	106.7
TIC	58.9	60.2
Tax deductions	33	33
Production	77.5	79.5

Source: the taxation of bio fuels, *DGEMP;* Customs: taxation of petrol-based products and price structure.

Annex 2: Investments

	Implementation date						
	2005	2006	2007	2008	2009	2010	Total
Origny		240 000					240 000
Lillebonne 1			240 000				240 000
Llilebonne 2						250 000	250 000
Lacq (AB bioenergy)			40 000	160 000			200 000
Roquette				160 000			160 000
Bazancourt Cristal union			120 000	160 000			280 000
Soufflet				160 000			
Total		240 000	400 000	640 000		250 000	1 530 000
Annual investments (theoretical construction time: 18 months; cost: €0.7 million/kt)							
Thousands of tonnes (per year)	110	520	360	210	125	125	
Investments (€ million)	76	358	248	144	86	86	

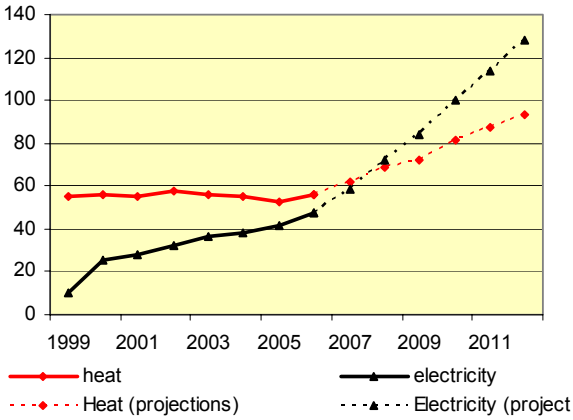
There is no information available on projected investment in 2012, which depends on decisions which will be taken over the coming years on the development of the bio diesel sector beyond 2010. By way of an example, it has been calculated that a further 100kt capacity would result from €70m investment.

2.7 Biogas

Key Points

- In 2006, biogas production contributed around 105 *ktoe* to the production of renewable energy. Of this total, discharge biogas - mainly used to produce electricity, accounts for 51%, with 30% coming from sewage.
- Markets and employment linked to biogas energy are currently limited: heat energy (53 *ktoe*) is for the most part self-consumed (for internal processes or needs in the production plant concerned). Except for the methanisation of household waste, employment is often limited to a fraction of a full time post.
- The new purchase tariffs for electricity should encourage the development of discharge biogas use as well as new streams.

Energy production from biogaz



Markets and jobs linked to investments in biogas production

	2006 Realizations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Investment value (€m)	116	16%	135	200	
Employment	690	12%	775	1300	

Energy production from biogas

	2006 Realizations	Changes 2006-2007	2007 Estimates	2012 Projections	2012 Target
Thermal (*ktoe*)	58	+7%	62	94	60
Electric (GWh)	560	+21%	677	1 490	1120
Value of sales (€m)	29	+66%	47	103	
Employment	87	+36%	118	300	

Current situation in biogas energy production

Four streams of biogas energy production exist in France: landfills of non-hazardous waste, treatment of sewage in urban STEPs, treatment of industrial by products (food industry, paper production...) and agricultural methanisation. The methanisation of municipal waste was still scarcely developed in 2006 and, unlike in Germany, so was the sector using agricultural by products.

Since 1999, production of electricity has been growing steadily, mainly due to the use of landfill biogas, while the use of biogas coming from treatment of sewage at sewage works and food farming industries to produce heat energy is stagnant at a level slightly above 50 *ktoe* (see graph).

Contribution of the various biogas sectors to the production of available energy in 2006

	Electricity		Heat		Total	
	GWh	%	ktoe	%	ktoe	%
Landfills	497	89	10	18	53	51
Waste water treatment sludge	57	10	26	46	31	30
Food industry by-products	3	1	17	30	17	17
Agricultural by-products			3	6	3	3
Total	**557**	**100%**	**56**	**100**	**104**	**100**

Source: *ITOM* 2006 and *DGEMP*

Biogas from landfills

Landfills provide 51% of all biogas energy, mostly in the form of electricity (85%).

In 2006, the 38 recorded sites engaged in energy production from biogas produced 497 GWh of electricity and 114 GWh of heat (10 ktoe). The three main operators had a portfolio of additional projects at the start of 2008 for 13 more installations, with projected production of 568 MWh of electricity in 2008 (+35%). Projected heat production was 23 ktoe.

Electrical power installed was estimated at 90 MW in 2006, and should grow by 15% in 2007 and 2008. On the basis of a unit cost of 1 to 1.5 € million/MW, corresponding solely to the energy production[44], the value of investments would be €17million to €19million per year in 2006 and 2007.

Biogas from household waste methanising plants

In 2006, three methanisation plants (Amiens, Varennes-Jarcy and Le Robert - Martinique) treated 150,000 tonnes of waste. According to the report "markets of waste related activities Situation 2006-2007, Projections 2008", in 2007 new capacities amounted to 130,000 tonnes (Lille and Calais), and the forecasts for 2008 are for 300,000 tonnes (Montpellier, Marseille), while projects under planning, whose entry into the market should take place in 2009 and 2010, would add roughly another 250,000 tonnes (Angers, Clermont-Ferrand, Romainville, Bourg en Bresse, ...). Investments in methanisation were estimated between €90million and €100million per year.

Other biogas sources

With a production level of 31 ktoe, sewage works are the second largest source of biogas in France. Currently, around 70 stations digest the waste of some 20 million people, and their number is increasing by several plants per year. This sector, however, is in a state of relative decline: with the passage of used water treatment to physicochemical treatment, the organic content of the sludge diminishes. As a result, they offer less potential for methanisation.

Following the example developed many years ago in Denmark, "territorial methanisation" projects (co-digestion of different types of waste - liquid manure mixed with other organic waste) are being looked at (Lorraine, Aveyron, Deux Sevres). Investments are in the region of €5million to €7million for a production capacity of 1 MW[45].

Other European countries, Germany in particular (almost a hundred new installations per year on average for ten years) have developed large energy producing projects using agricultural biogas. This sector is only just starting out in France. Its development should accelerate rapidly in the coming years, however, thanks to the application of new purchase tariffs. There are currently more than a hundred such projects in the pipeline, and it can be assumed that their creation will take place at the rate of roughly ten a year. Investment is estimated at 5,000 to 6,000 €/kW. Assuming an average power of 250 kW, the value of investments would be 3 million euros in 2007.

The methanisation of industrial by-products (food industry, paper production ...) accounts for around 150 installations. The majority of energy production is done on-site in the form of heat energy and, less often, electrical energy.

This group of sectors could provide an additional 2 to 3 MW of power per year and investment of €10million to €12million in 2006/2007.

Value of investments and employment linked to production

In the course of 2006 and 2007, the value of investments was estimated at €130million (landfill biogas): €15million to €20million per year; methanisation: €90million to €100million; others: €10million).

Given the breakdown of investments (50% in construction, 35% in equipment and 15% in engineering and technical studies) and considering that the engines of biogas energy production are imported, employment corresponding with investment equated to around 330 jobs in 2006 and 380 in 2007.

Value of energy sold and employment in the production of market energy

Currently, only electrical energy is sold, with the majority of the heat energy produced being consumed by the installations themselves. Taking into account the old and new tariffs, the value of electricity sold would be €25million in 2006 and €31million in 2007.

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44 By considering that the landfills are equipped, in accordance with the regulation, with biogas recovery systems

45 Source : overview of centralized biogas plants projects in France (C. Couturier Solagro)

Taking the ratio of installations treating industrial by-products (1/8th full time equivalent for small plants and 1/4 or 1/2 for large plants[46]), and on the basis of 300 installations (150 industrial, 70 STEP, 40 landfills, etc.), a little over two hundred jobs are provided by this sector of energy production, of which 90 are related to the production of market energy.

Projections on the use of biogas energy

The decree of 10th July 2006 increased purchase tariffs on electricity produced through methanisation and the use of biogas by 50%. In Metropolitan France, the new tariffs are: €90/MWh for installations below 150kW and €78/MWh for installations more powerful than 2 MW. Among other things, these tariffs place a premium on energy efficiency, encouraging cogeneration (up to €30/MWh) and reward the use of methanisation up to €20/MWh. This tariff allows the most efficient installations to achieve €140/MWh. These measures have been well received by the industry, and should strongly encourage the development of biogas as an energy source[47].

Beyond the new tariffs, one of the conditions for success in the different areas of biogas energy production is the development of networks suitable for transporting heat energy (in the case of cogeneration) or biogas itself. Another solution is the use, after treatment and compression, of biogas as a power source for municipal vehicles (see the Lille project). Among the conclusions reached by the Grenelle Renewable Energy Committee, the proposition to create the conditions under which biogas could be entered into the general gas network by 2009 is a notable one.

Looking ahead to 2012, the Renewable Energy Committee has set a target of 60 ktoe of heat energy to be produced from biogas sources. For its part, the *PPI* for electricity has set a target of 100MW of additional electrical power to come from this source by 2010.

Trends in biogas energy production in landfills and methanisation of household and other waste

Landfill biogas: the increase in capacity will continue to develop at the rate of 15 to 20MW per year. The power capacity installed will be around 220 MW in 2012, corresponding with energy production of 1,200 GWh.

Methanisation: In 2012, around 950,000 additional tonnes of waste will be methanised each year. On the basis of net production of 170 kWh per tonne of waste methanised[48], electricity production will increase by 160GWh, equivalent to +/- 23 MW. Some plants (Montpellier, Saint-Lo, Clermont Ferrand ...) are expected to function as co generators or produce biogas for use as fuel; heat production could reach 280 GWh (24 ktoe).

On-farm methanisation and collective co-digestion: Given the projects identified and the construction time required, these sectors could represent around 15 MW of additional energy in 2012. Investments in agricultural biogas are expected to reach 25 million euros in 2008/2009 and 50 million by 2012.

Sewage and industrial by-products

This sector could grow as much as 14% by 2012, equating to 6 additional ktoe.

In total, by 2012, electrical power could reach 250 MW, with heat production reaching 94 ktoe. These trends could even be surpassed if the heat energy produced is used in cogeneration to produce biogas fuel which could be injected into the gas network if it were developed sufficiently.

Energy production (excluding that consumed within the production process) would reach 1,500 GWh of electricity and 94 ktoe of thermal energy. Given the new tariffs, the value of this energy at sale (52% of the energy produced) would be around 103 million euros, mostly in the form of electricity.

Employment provided by new investments would reach a level of around 1,300 jobs and the production of merchant energy would provide a further 295.

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46 Source: Solagro's study for the Adour Garonne Water Agency

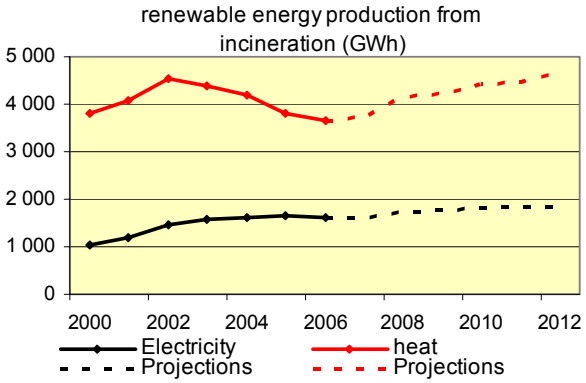
47 The CRE had given an unfavorable opinion with the new tariffs, arguing that they would result, for the industry groups concerned, in a very important profitability rate

48 The ratio could be appreciably higher if the installations functioned only on the fermentable fraction (see Kompogas quoted in the study "Which place for the methanisation of organic waste in Ile de France?" ARENA Ile de France 2003).

2.8 Energy production from waste incineration

Key Points

- Between 1995 and 2002, production of renewable energy from the incineration of waste material grew by an average of 6.6% per year.
- Since 2004, due to the effects of incinerator standardisation, there has been a reduction in the quantity of material incinerated, and consequently in the production of energy, particularly in terms of heat production.
- While the PPIs for electricity and heating have set relatively ambitious targets, trends point towards more limited development.



Markets and employment linked to the development of energy production from waste incineration

	2006 Installations	Changes 2006-2007	2007 Estimates	2012	
				Projections	Target
New capacities (tonnes/hour)	14	+614%	100	11	
Investment value for energy production (million euros)	86	- 31%	60	80	
Direct employment in investment	346	- 34%	230	280	

Source: for 2006 and 2007, study carried out by In Numeri for ADEME on the markets for activities linked to waste incineration; 2012 estimates, investment value: 25% of the value of the year's investments.

Markets and employment linked to renewable energy production from incineration of waste material

	2006 Installations	Changes 2006-2007	2007 Estimates	2012	
				Projections	Target
Waste incinerated (kt)	12 380	1%	12 485	14 070	
Heat production in ktoe	315	1%	320	402	
Production of electricity in GWh	1 600	2%	1 620	1 860	
Value of sales (€million)	133	1%	135	163	
Employment	500	4%	518	575	

Renewable portion, including cogeneration.

Incineration of household and assimilated waste

The incineration of household waste produced 1,600 GWh of electricity and 315 ktoe of heat energy from renewable sources in 2006[49]. It represents the third largest source of renewable electricity after wind power and hydroelectric power and the third largest source of heat energy after wood energy and heat pumps according to the Energy Observatory[50]. After progressing strongly until the 2002-2003 period, this source of production fell during 2004 and had fallen all the way back to its 2001 level in 2005. The quantity of material incinerated and the number of installations has not progressed any further. From 2003 onwards, installations have generally tended to focus more and more on electricity production. In 2005 and 2006, a fall in the amount of energy produced was noted, mainly due to the closure of a number of plants. These closures were brought about by standardisation of plants (the closure of the Issy-les-Moulineaux UIOM led to a 4% fall in electricity production and 10% in heat production).

Investments programming for electricity production capacity (PPI Electricity published 07 07 2007) fixed the following objectives for the development of electricity generation capacity from waste incineration in year

[49] According to the article 2 of the decree of November 8, 2007, "the renewable electrical production from a waste incineration plant is equal to 50% of the whole electrical production produced by the plant"

[50] The Observatory of energy does not deduce the power consumption by the HP.

2010: +200MW. The objectives for heat[51] were +100 ktoe. In present conditions it means a 3.5 millions tonnes increase in waste incinerated.

However during the Grenelle there was non consensus as concerns the place that incineration should take in renewable energy production. Recently the Operational Committee for the development of renewable energy (Comop n° 10) fixed a target of 470 ktoe heat production for the incineration and industrial wood waste energetic valorisation by 2012.

Purchase tariffs of electricity from incineration have been fixed by the 10 02 2001 'arrêté' (45 to 50 €/MWh + efficiency premium up to 30 €/MWh). There were not modified by the 2006 'arrêtés'. Nevertheless in order to favour the renovation of incineration plants the 12 14 2008 'arrêté' stipulates that when renovation investments exceed 750 €/kW, the incineration plant will be considered as a new one, and therefore will continue to benefit from the purchase tariffs beyond the initial 15 years period.

During summer 2006 VAT rate for the subscription to heat networks was set to 5.5%, as well as for the heat consumption for these heat networks which use more than 60% of renewable energy. These decisions should favour the energetic valorisation of waste incineration through heat networks.

Development of capacities

Starting from provisional opening of incineration plants (see report « markets of waste related activities) - situation 2006-2007 and 2008 forecast), it was estimated that the new capacities will be 235 t/h for the period 2007 – 2012, of which 200 t/h with cogeneration, 25 t/h electrical and 10 t/h thermal

Projected capacities

2006	2007	2008	2009	2010	2011	2012
14	100	19	50	11	30	25

Investments costs for the energy production part are estimated[52] as being 25% of the total investment. Hypothesis is that the corresponding production is domestic. Decomposition of investment is the following equipments 75%, construction 16% and 9% for technical studies …

Markets and employment related to the construction of incineration plants[53]

	2006	2007
Total investment million €	345	233
Energy production investment (25%)	86	58
Employment	346	210

Renovation works under the 2006 'arrêté' are not included. Employment is calculated using ratios [output per employee] of corresponding activities (former NAF291A manufacture of engines, 452B various construction works and 742C Engineering)

Production and sales of energy

During the period 2004 – 2006, the energy production decreased; this trend should invert in the future with the opening of new incineration plants and the corresponding increase in quantities of incinerated waste. Taking into account these openings, during the period 2006 – 2012, the increase in quantities should be 1.8 million tonnes. The growth in energy production would be 1.2 TWh, of which 950 GWh thermal and 250 GWh electric. Based on the present situation, sales would represent 75% of electricity and 80% of heat. Prices are 50 €/MWh for electricity and 25 €/MWh for heat[54].

Employment for market energy production is 4 to 5 employees per incineration plant. Total employment would then be 500 in 2006, 520 in 2007 and 575 in 2012.

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51 Projections of the Heat PPI were not published.

52 See: report about heating networks by H Prévot (March 2006) http://www.industrie.gouv.fr/energie/publi/pdf/rapport-prevot.pdf.

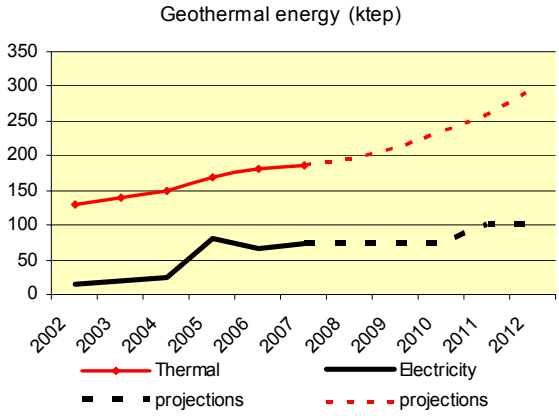
53 The annual amount of the investments does not follow the startups, but the effective realizations; see Report on the markets of waste related activities.

54 Estimated price of transfer of heat to the heating networks.

2.9 Geothermal energy

Key points

- After being remained stable, between 1999 and 2004, with approximately 190 ktoe, the energy production from medium or high temperature geothermal energy sources increased by 50 ktoe in 2005, with the start up of the power station from Ebullient 2 in Guadeloupe (+10 MW
- In spite of the success of the Soultz-sous Forêts programme, the potential of development of geothermal energy remains limited; the projects of the Guadeloupe and the Dominique would emerge only beyond 2010-2015.
- Targets fixed by Grenelle are of 115 additional ktoe heat production from geothermal energy



Markets and employment related to the development of geothermal energy

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	2012 Target
Annual capacity installed (MW)	14.7	+10%	16,2	22,2	
Total capacity installed (MW)	417	3%	430	685	
Annual Investments (€ million)	35	-13%	30	190	
Employment	260	-14%	225	1 290	

Production of geothermal energy

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	2012 Realizations
Electricity production (ktoe)	67	+10%	74	101	
Heat production (ktoe)	180	+5%	185	295	295
Sales (€ million)	97	3%	100	160	
Employment in production	600	3%	620	980	

Heat production: source ADEME : 130 ktoe corresponding to subterranean water and 50 ktoe corresponding to subsurface aquifers ; electricity production : source DGEMP for 2006

Present situation of geothermal energy in France

Low and medium temperature geothermal energy (30°C to100 °C) uses subterranean hot water of the large sedimentary basins (Aquitaine and Ile de France). Energy from hot water is distributed through heat networks for heating.

There are about 60 geothermal energy plants in France of which 30 urban heating networks and 26 various applications: fish farms, baths and swimming pools, greenhouse heating, etc.

Besides these plants there is also a specific application using heat pumps on subsurface aquifers. It allows to heat medium and large buildings of the tertiary sector. The corresponding production was about 50 ktoe in 2005. The 'soundings fields' technique whose applications are growing in foreign countries is less developed in France.

High temperature geothermal energy (> 180°C) is found in Overseas volcanic areas (geothermal plant of Bouillante in Guadeloupe). It allows producing steam and then electricity via a turbine.

With the view to sustain the targets fixed by the PPI (ten years investment planning for electricity) purchase tariffs for geothermal electricity, which was 80€/MWh, has been set to 100 €/MWh in Overseas departments and 120€/MWh in Metropolitan France by the 07 10 2006 'arrêté'. An up to 30€/kWh efficiency premium is added. The purchase tariffs reach then a level similar to the German one.

Geothermal electricity production

Only the Bouillante geothermal plant produces electricity. It started in 1985 and an additional 10 MW capacity was added in 2004. The total capacity is now 15 MW.

During the period 2000-2006 the (first phase) experimental Soultz sous Forêts deep geothermal energy programme was developed. Thanks to EU, German and French financing the second phase of the project should permit the construction of a 5 to 6 MW pilot unit. In the spring 2008 a 1.5 MW plant was put in production.

Geothermal heat production

District heating from geothermal energy exists since 1971. Main applications were realized during the period 1982 1986 after the first oil shock. At the beginning there were technical problems, namely due to the consequences of corrosion. Then economic problems conducted to the end of some plants. From 1998 ahead the production level remains stable around 130ktoe.

The installed capacity was about 430 MW at the beginning of 2006[55] Two new operations were realized in 2006, which added 15 MW, corresponding to 4 000 homes.

In 2006 the value of investments is estimated at 35 € million (+15MW with a unit cost 2.3€ million / MW). In 2007, the market would have slightly decreased, with only 11.5 MW for a value of 26 € million (30 € million with Soultz).

Starting from the value of investments, 2006 direct employment was estimated at 260. Employment related to energy production is about 600 jobs, when energy sales amount to 100 € million.

Geothermal energy projections

Electricity

Targets fixed by the ten years investment programme for electricity (PPI electricity: 07-07-2006 'arrêté') are rather ambitious: 90 MW of new capacity by 2010 and 200 MW by 2015.

However In the short – medium term, geothermal electricity potential of continental France is limited. Only one project is forecast before 2010 (Soultz-sous-Forêts industrial pilot: 6 to 10 MW). From 2015 onwards this application could develop as well as the binary cycle technology, which allows exploiting hot water resources of rather low temperature.

In Overseas Regions, the only geothermal energy potentials are located in Guadeloupe and the Dominic Island. In Guadeloupe, there are possibilities to further develop the Bouillante plant. A feasibility study is on progress in order to assess technical, environmental and economic aspects. Capacity could be 10 to 40 MW. The development of geothermal energy is also possible in the Dominic Island: produced energy would be transported through a submarine cable to Guadeloupe and Martinique. However this project should not be realized before 2010 - 2015

Heat

In relation with Grenelle a prospective scenario for the development of geothermal heat was drafted. The following new capacities objectives were fixed:

	2005	2010	2012	2015	2020
Geothermal heat on deep aquifers	135	185	195	320	500
Geothermal heat on subsurface aquifers	50	65	100	165	300
Total (excluding heat pumps	185	250	295	485	800

In ktoe

55 The figure quoted in the « Barometer of Geothermal energy » (EurObserv' ER September 2007) is of 302 MW, but does not take into account the power in geothermal energy of the aquifers surface. In a general way the figures in this note take as a starting point the last figures elaborated by ADEME for Grenelle

The extension of some urban heating networks should allow increasing production in a near future. About ten operations are foreseen by 2012 (more 30 000 homes hooked up). There is also some potential for medium applications on deep or subsurface aquifers. Size of these applications would vary from 100 kW to 1 MW. Two projects are under study in Alsace, as well as industrial and agricultural applications.

Within the scope of its 2006-2010 Programme for the development of local and renewable energy, the Ile de France Region decided to finance 40% of the costs for the extension of urban heating networks, networks hooking up and geothermal drillings. For households a capital aid (above the 50% tax credit) was created covering 50% of the drilling costs of geothermal heat pumps. Finally a call for projects related with deep geothermal application on the "Dogger", which already produce energy for 29 regional heating networks, will be launched in the near future.

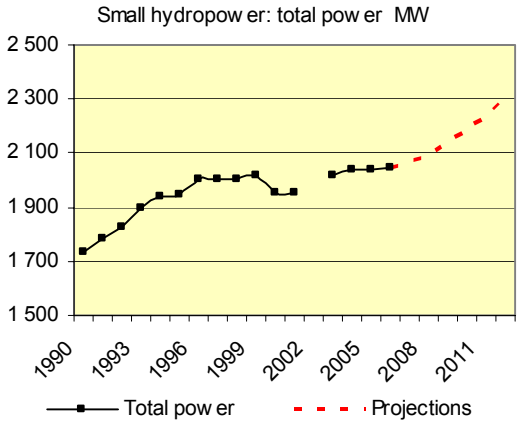
The establishment of a renewable Heat Fund was decided at Grenelle. Objective is to promote renewable heating networks, to increase the efficiency of existing networks. Another objective is to support private firms and local administrations projects giving them a financial aid that would reinforce the profitability of their projects in the field of renewable heat production, including geothermal heat.

For 2012 the geothermal capacity could be 22.2 MW for electricity production (+6 MW Soultz) and 295 ktoe for heat. The market energy would reach 300 ktoe (2.6 TWh) and a 160 € million value. Direct employment would be 980. Investments in year 2012 were estimated at 187 € million, corresponding to 1 300 jobs

2.10 Small hydropower

Key Points

- In 2006, small hydropower represented half of the electricity production of renewable origin (out great hydropower).
- In spite of a potential which remains important, so much in new projects than in restoration, the total power installed stagnated, during the recent years, due in particular to the environmental constraints imposed on the new power plants.
- In the medium term the accent must be put on the creation of an institutional, technical and lawful environment with the development of small hydropower.



Markets and employment related to investments and equipments exports

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012	
				Projections	Target
Annual Installed capacity (MW)	10	100%	20	60	
Investments (million €)	31	100%	62	191	
Production (million €)	39	84%	70	199	
Direct employment	200	88%	368	978	

Small hydro power: energy production

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012	
				Projections	Target
Total installed capacity (MW)	2 050	1%	2 070	2 300	
Electricity production (GWh)	6 010	7%	6 420	7 850	
Sales (million €)	330	8%	360	438	
Employment	3 500	1%	3 535	4 278	

2012 production is based on the assumption of normal precipitations

With 57.5 TWh, the hydraulic electricity represented, in 2006, 90% of the French production of renewable electricity. About 10% of this electricity is produced by power plants whose power is lower than 10 MW, which corresponds, conventionally, with small hydropower[56]. This one produced, in 2006, almost as much of electricity than all the other renewable energy sources. One of the stakes of small hydropower is to develop local employment and activities in regions less favourable for other activities.

Current situation of small hydropower

After having appreciably increased between 1990 and 1999 (cf. graph), the installed capacity of small hydropower plants in France stagnates since of beginning of the century; according to Observ' ER (7th assessment of renewable energies in Europe) quoting the DGEMP, “the power connected to the network was of 2.049 MW to the end of the year 2006, that is to say 10 MW more than in 2005”.

The data on the working installed capacity at the end of 2007 are not yet available, but according to the professional organisation the growth would have been very moderate, in particular due to the environmental constraints and lawful requirements. One made the assumption of an increase of 20 MW in 2007. According

[56] The data can vary according to the threshold selected to define small hydropower. Whereas conventionally this threshold is of 10 MW, the obligation of purchase applies to the installations whose power is lower than 12 MW

to France Hydro Electricity the power benefiting from the purchase obligation (threshold of 12 MW) is of 2.106 MW at the end of 2007.

According to the last data published[57] the energy production was of 5.8 TWh in 2005 and 6.0 TWh in 2006, years which saw rather low precipitations. In "normal" year the production is rather of 7 TWh. The data for 2007 are not yet available. Temporarily 6.4 TWh was retained, in accordance with the growth forecasts of the Commission of regulation of Energy (CRE) between 2006 and 2007

The prices indicated by the CRE (Regulatory commission for Energy) within the framework of the calculation of the charges of the public service of electricity, were used for the valuation of the production.

In 2006, according to the CRE, the effective purchases of EDF, within the framework of the purchase obligation, except not inter-connected zones (ZNI), were of 5.821 GWh for a value of 321 € million, that is to say unit costs of 55.1 M€/MWh; for the ZNI the purchases amounted to 60,7 GWh for a value of 3.9 M€. The average tariff is 55.2 €/MWh in 2006. The tariffs being indexed, the tariff 2007 is slightly higher than the tariff 2006; 55.8 €/MWh was retained.

The value of the production is estimated to 332 million euros in 2006

	2006	2007
Production (GWh)	6 010	6 420
Tariffs (€/MWh)	55,2	55,8
Sales (€ million)	332	358

Employment in the sector of small hydraulics is badly known. The estimates of the number of jobs vary between 2.400 (Renewable energies association) and 5.000[58]. These evaluations cumulate employment related to operation and those related to the investments. In the absence of specific information a 3.500 jobs figure was retained for the operation of the power plants[59], that is to say on average approximately two jobs (guarding, maintenance and management) per power plant.

Investments

The investments are estimated, in terms of new capacity installed, to 10 MW in 2006 and 20 MW in 2007. The Dambrine report estimates at 1.5 to 2.3 million €/MW the investment for projects of small hydropower (0.5 to 5 MW). On the basis of information available, a slightly higher cost more was adopted: 3.1 million €/MW turn-key, including the costs of connection. To these costs should be added for the new power plants that of environmental installations.

On this basis the investments for the new projects would account for 31 million € in 2006 and 62 million € in 2007, including about 50% in civil engineering, 35% in electromechanical equipment and 15% in technical studies. The investments of restoration could not be quantified.

Production statistics for water turbines are not published. Exports of water turbines of less than 10 MW declared are very weak, about 8 million € in 2006 and 2007. The imports do not reach 1 million €.

Alstom Power Hydro is the first world manufacturer of water turbines of great power. Its Grenoble-native site employs 450 people in the R & D (including of course large hydropower R&D), engineering, etc for a 150 million € turnover. Several research departments and the research laboratories also contribute to make hydropower a field of competence for France in the domain of renewable energies on a world level. This set of actors is federated around the Tennerdis pole of competitiveness

One of the axes of development is the equipment of the very small power plants: it is considered that 30.000 watermills could be equipped with systems from 10 to 20 kW. Companies THEE and MECAMIDI are well positioned on the market of very small hydraulics. In 2005, with 20 employees, first realized, about 20 projects between 10 and 500 kW for a turnover of 2.5 million € including 75% with export. In 2006 the second (20 to 25 employees) carried out 5 million € of turnover including 57% with export. More recently company MJ2 Technologies developed a turbine for very low fall which makes it possible to equip with the

57 See EurObserv'ER (7ème assessment of renewable energies in Europe),

58 See France Hydro Electricity : stakes of small hydropower

59 This employment does not include very small hydropower, i.e. pico centrals of installed power lower than 20kW.

existing waterfalls for powers of several hundred kW. Among the productive enterprises of turbines one can also quote Hydro Bouvier (Austrian group VA Tech) and ESAC (German group Voigt)

Taking into account the weakness of the imports of equipment, one considers that the whole of the investments carried out corresponds to national production. Employment related to exports is added to employment related to the domestic investment. By applying the ratios turnover by use of the corresponding sectors one obtains 180 jobs in 2006 and 335 jobs in 2007. These estimates do not include employment related to the restoration. They do not include either employment related to the R & D, or to the exports of engineering services. The whole of employment related to great hydraulics is also excluded.

Projections

According to the French Union of Electricity, the potential of development in new projects by 2015 is of 500 MW in small hydropower and 600 MW in very small hydropower. The Dambrine report for its part retains a technical potential of 750 MW additional for small hydropower by 2015

Within the framework of PPI the decree of July 7, 2006 laid down objectives 2010 and 2015 for the electric park of production. For hydropower[60] the objectives are of 500 MW additional by 2010, to which would come to be added 1 500 MW between 2010 and 2015, that is to say a total of 2000 MW additional from here to 2015, of which, in new projects, about 500 MW for small hydropower and 600 MW for very small hydraulics. More recently, for the whole of hydropower the Operational Committee of Grenelle on the development of renewable energies (Comop n°10) estimated that taking into account the environmental constraints the progression of the hydraulic production by 2012 would be of 2%

In the facts, the growth of the installed capacity remained weak in 2007: the projects consisted primarily of re-equipment of existing waterfalls. Since Grenelle the feeling of the profession is that the blocking factors resulting from a too strict application of the regulation framework are being partially raised. Therefore a light restarting is waited, without being still entered into a strong dynamics, taking into account the times of instruction and construction.

New operators enter on the market, whose some aim at combining several renewable energy sources, for example wind and hydraulic, or, in the case of the historical energy great energy producers, to benefit from “green certificates” [61].

On this basis one estimated at 250 MW the objective by 2012 for new small hydropower capacity. The total power installed would be then of 2.300 MW. Employment related to the production was calculated on the basis of 400 additional sites.

The purchase obligation constitutes the main incentive for the development of small hydropower. It was instituted since 1955 and since was regularly brought up to date in its methods and its tariffs. The last decree (March 1, 2007) modified the conditions of purchase in a direction favourable to the small installations (power lower than 3 MW), by fixing a price of 60.7 €/MWh, plus a premium ranging between 5 and 25 €/MWh for the small installations, as well as a premium ranging between 0 and 168 €/MWh in winter according to the regularity of the production.

The main obstacles with the development of the small hydropower result from the delay for translating in the Management and Master development Plans of Water (SDAGE) the constraints resulting from the Law on water and the Aquatic Environment. The current classifications of rivers penalize the new projects and the new SDAGE could result in additional constraints, according to the stakes of the basins.

In the medium term the report of the Operational Committee on the development plan of renewable energies stresses the creation of favourable conditions, on the plans institutional: simplification of the administrative procedures, dialogue between actors, and technical: R & D programme, certification, standardized specifications…

60 Including tidal energy, except pumping.

61 The SHEM (subsidiary of Electrabel - Suez) announced the start up in 2008 a new power station of 4 MW.

3 IMPROVEMENT OF ENERGY EFFICIENCY IN THE RESIDENTIAL SECTOR

In 2006, the residential and tertiary sector in France accounted for 43.6% of total final energy consumption, equivalent to 70.6 million toe, 48 million of which was attributed to the housing sector. In 2006[62] the growth was 1.1% in relation to 2005, higher than the average between 2000 and 2005 (0.8%).

In 2005, the consumption of final energy by 31.4 million homes was 516 TWh. The total homes park represents an area of about 2.66 billion m^2; the average annual consumption in primary energy is 240 kWh/m^2/year (164 kWh/m^2/year in final energy[63]).

In principal residential homes only, the annual consumption (excluding wood) for heating and hot water amounted to 329.1 TWh, while cooking represented 29 TWh and specific electricity consumption (lighting, refrigeration, appliances, etc.) 66.6 TWh.

Given the replacement rate in housing (about 1% per year), progress in improving energy consumption in new residence will not be enough to attain the “4 factor” and implement by 2050 the "3 times 20" objectives of the European Union (20% reduction in emissions of greenhouse gases compared to 1990, 20% energy saving compared to the trend scenario of the European Commission of 2005 and 20% of renewable energy in final energy consumption). In the short and medium term, energy savings will depend in the renovation of existing housing.

The goal of Grenelle is to reduce by 12% in 2012 energy consumption in old homes, and by 38% in 2020. For the whole housing sector this would represent a reduction of about 60 TWh of final energy consumption by 2012.

The first group of markets studied in this report is that of services related to improving energy efficiency of existing housing, through insulation of walls, roofs and replacement of windows. The second group relates to improving energy efficiency of heating equipment, electrical equipment and lighting. Due to lack of data, markets related to the improvement of energy in the tertiary sector and in new homes have been excluded.

Over the past ten years, according to investigations conducted by the Sofres for ADEME, around 2.7 million homes each year undergo energy efficiency works. In 2006, this number is reported to have increased by 6.7% compared to 2005, recovering the level reached in 1999.

After remaining relatively stable between 1996 and 2004 (1.7% annual average), the average expenditure per intervention has increased sharply in the past two years, from 2100 € in 2004 to 2 860 € in 2006 (+35 %). This increase is largely due the increased costs in heating equipment which has on average almost doubled, while the average cost of the work on the buildings, which accounts for two thirds of the work, increased by only around 2 to 3% per year, a rate smaller than the rise in prices of maintenance repair.

	2004	2005	2006
Total expenditure (in million of euros taxes included)	7.9	9.2	11.6
Works on buildings	5.5	6.2	6.5
Insulation works (walls, roof, etc.)	*0.9*	*0.9*	*1.2*
Replacement of windows	*4.2*	*3.9*	*4.8*
Other works	*0.4*	*1.5*	*0.5*
Improvements on heating	2.4	3.0	5.2
Percentage of households with improvements	11.0%	11.1%	11.7%
Average expenditure per household (euros)	2 738	3 206	3 810

In billion of euros; source : ADEME

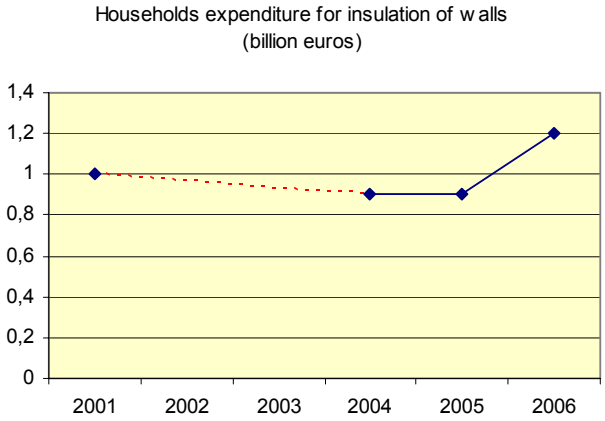
62 Source: energy assessment 2006 of France DGEMP Observatory of energy; final consumption corrected foe the climate.

63 Source: Pelletier report February 2008.

3.1 Walls and roofs insulation

Key points

- The amount of insulation works entrusted by households to firms amounted to 1.1 billion euros in 2006.
- Markets of insulation materials, mineral wool and expanded polystyrene, was 810 million euros.
- Marked by a rapid growth in 2006, these markets are expected to consolidate in 2007 and beyond.
- Overall in 2012, the insulation of walls would make about 35% of energy savings targets in existing homes.



3.1.1 Wall insulation works in existing housing

Markets and jobs related to the insulation of existing housing: opaque walls[64]

	2006	Evolution	2007	2012	
	Realizations	2006-2007	Estimates	Projections	Target
Value of works (million €)	1 100	9%	1 200	2 630	
Value of insulation materials (million €)	810	9%	890	1 945	
of which lad by households themselves	*550*	*9%*	*600*	*1 310*	
Employment related to works	9 660	4%	10 040	20 940	
Employment related to materials	7 150	4%	7 390	14 990	

Source: OPEN 2006, 2007 and 2012 estimates, only material installed by households are included in the evaluation of markets, insulation material installed by companies are included in the value of project

Energy savings

	2006	Evolution	2007	2012	
	Realizations	2006-2007	Estimates	Projections	Realizations
Savings related to annual works (ktoe)	180	5%	190	420	
Savings related to cumulated works since 2005 (ktoe)	360	+53%	550	2 120	

Insulating works of opaque walls (walls, floor and ceiling) carried out in existing homes, in the course of renovation - apart from routine maintenance - entrusted to companies in 2006, accounted for an amount of 1.1 billion euros HT, with an average expenditure of € 3100 per household. They covered about 350 000 homes, 1.1% of existing housing. Insulation work carried out by households themselves (installation of insulating materials), for the most part, concerned 450 000 dwellings, amounting to 550 million € according to the Permanent Observatory of Homes Energy Improvement (OPEN).

In general this work appears to have been conducted without any serious prior study on energy. Furthermore, two thirds of the work conducted bear only one aspect: wall, floor or ceiling (attic).

According to data made available by the Sofres, all modes of implementation combined, the number of insulation works increased between 2004 and 2006 at a steady pace (between 5 and 7% per year), while the average expenditure per intervention grows at an average 4% per year, identical to the evolution of the price index of home maintenance works (IPEA): 4.2% annual average in 2006.

64 Insulation of the opaque walls designates works of interior insulation of the walls, the ceilings and the floors. For its first year the OPEN observatory did not collect data about the external insulation, which according to some analyses, would constitute the most effective insulation technique.

Insulation work is carried out by companies in the former NAF 453C, which includes about 2 500 companies, of which 1 100 are limited liability or personal firms. They provided employment to 13 800 people and achieved 1.67 billion euros in sales in 2005.

Output per employee, in full-time equivalent is 114 000 euros. The number of jobs directly involved in carrying out insulation works of existing homes would be 9 700 in 2006. Indirect employment - other than employment related to production of insulating material discussed below – is estimated at 2 300.

The market for insulation materials for opaque walls

316 million m^2 of Insulation materials (mineral wool, cellular plastic and other insulating material) were marketed in 2006 excluding fibber cement and plasterboards. Of this total approximately 36% (115 million m^2) was used for housing renovation, equally installed by companies and households themselves. Insulation mineral wool occupies the first position at 54.5%.

The total value of the 115 million m^2, at factory output prices and / or customs is evaluated at 430 million €. The distribution margin can be estimated at 380 million euros. Foreign trade of insulation material shows very small deficit.

The insulating materials manufacturing industry is highly concentrated. The main insulation materials are mineral wool (glass wool and slag wool) and expanded polystyrene (PSE). The main producers and processors of PSE in France are BASF, Nova Innovene and Polimeri Europa for the production, whereas Knauf, Lafarge, Saint Gobain specialise in processing products. Knauf and Saint Gobain are also among the major manufacturers of mineral wool insulation materials.

Based on turnover / employee ratios of the corresponding activities, the manufacture of 430 million € of insulation material used by businesses and households represents about 1 700 jobs; the wholesale and retail distribution sector employing roughly 5 500 people.

For the assessment of the market, the only values retained are those of insulation material used by households, the value of materials employed by enterprises is supposed to be already reflected in the insulation works value. On the contrary, all jobs related to manufacturing of material are taken into account.

In total, the overall markets and jobs evaluated are as follows:

Jobs and markets linked to insulation of existing homes

	Markets	Jobs
Insulation works	1 100	9 660
Materials		7 150
of which materials lais by households themselves	550	
of which exports (estimates)	90	
of which material used by enterprises (reminder)	*(230)*	
Total	1 740	16 810

Amounts in millions of euros to the nearest ten million euros; jobs are rounded to the nearest ten.

Energy stakes

Apart from Energy Saving Certificates statistics, which provide only a partial view, there is no direct data on energy savings related to insulation of existing homes.

It is assumed that the 56 million m^2 of insulation materials used by businesses (the only ones eligible for energy saving certificates) have thermal performance equal to the lowest categories eligible for tax credit before 1 January 2008, which represents 38 kWh / m^2 of annual energy savings[65]. The annual energy savings resulting from these insulation works is estimated at 2.12 TWh (182 ktoe) in 2006. Savings resulting from cumulated works in 2005 and 2006 would be 360 ktoe.

65 The amounts of energy savings are expressed in kWh cumac per m^2. They depend on the type of work (insulation of the walls, the ceiling, the roofs, etc), of the distribution of the residences by climatic area and of heating systems. An average value was calculated using the distribution of works according to the data of Sofres. As indicated, the average amount is applied only to m^2 posed by firms and craftsmen. This careful assumption was retained owing to the fact that the effective characteristics of insulation materials posed are not known.

Evolution 2006-2007 and 2012 projections

Results of 2007 surveys as concerns the insulation works of walls of existing homes are not yet available. According to the quarterly economic report of the Club de l'Habitat, growth in volume of maintenance works in housing was 2% in 2007, while the price index for maintenance and improvement works (IPEA) increased by 4.4%.

The professionals' general opinion indicates pursuit of growth in maintenance and improvement activity in housing, which should benefit from strong demand for household energy savings, following the increase in energy consumption bills and tax incentives.

We also observe that according to indices of industrial production, production of insulation material has raised quite sharply in volume in 2007, from 7% and 18% for fibber glass and PSE sheets respectively, a 10 % weighted average, which would mean substantial progress of insulation.

The May 3rd 2007 'arrêté' relative to thermal and energy performance of existing buildings was enforced on the 1st of November 2007. This 'arrêté' is the first thermal regulation of existing buildings. It imposes a minimal performance for most products and systems implemented as part of renovation. It should result in improved quality of materials and installation.

Certificates of Energy Savings related to insulation

At the end of February 2008, the certificates of energy saving (EEC) bearing on the insulation of roofs and attics accounted for 980 GWh cumac and those bearing on the insulation of the walls 406 GWh, i.e. respectively 50,5 GWh and 21,0 GWh in annual terms of savings. That would correspond to less than 2 million declared m^2 of certified insulating materials ACERMI (Association for the certification of insulating materials) set up by professionals. The growth compared to December 2007 is of 47% for the insulation of the roofs and the attics and of 42% for the insulation of the walls.

The general assumption of volume growth in insulation work is 5%, slightly above trends in recent years (3%) as well as a slight deceleration in prices increase (3.8%). The amount of market related works and materials for insulation of walls would be 1.2 and 0.9 billion euros respectively. Given assumptions about productivity trends (+2.6% in the production of material and 1.0% in 2005 in housing construction) the total number of jobs would be 17 420. Energy savings associated with insulation works carried out in 2007 would be 190 ktoe, whereas measures implemented between 2005 and 2007 would sum to 550 ktoe.

2012 projections

Since 2000 the percentage of households undertaking energy savings improvements in a year evolves between 11% and 12%, while the percentage of households with prospects to do so is more variable and unrelated with actual accomplishments of the next year.

In 2006 the main energy prices related to housing had increased by around 19% for gas and 10% for fuel and heat, electricity prices remaining stable. This increase encouraged households to increase their energy management in 2007. Gas tariffs, which had remained stable in 2007, began to increase in 2008 (up 10% since the beginning of the year). Fuel tariffs, which had decreased by 10% in the first half of 2007, increased by over 38% in the last twelve months alone. This could be a strong incentive to accelerate activity in household insulation.

Under the Grenelle project, the 12% target of reducing energy consumption in old housing was retained. It has been translated into an ambitious renovation programme, which focuses on substantial renovations of 400 000 homes and an increase in the total renovation expenditure, close to 8.5 billion euros, as concerns energy consumption reduction in homes.

Several measures favourable to the insulation of houses have been put forth, in particular the extension of the tax credit for insulation of walls labour costs and the implementation of an "eco-loan zero-rate" for renovation works including some insulation of opaque walls.

The framework used to describe markets is not directly transposable in terms of the "Grenelle" program[66]. Efforts were made to formulate hypotheses which result in a similar increase in the volume of activity. As concerns specifically housing insulation, in the years between 2007 and 2012 a 17% per year increase in the

66 Grenelle's calculations are made on the basis of overall costs of the restorations (for example 300 €/m^2 for a heavy restoration). Therefore it is rather difficult to express Grenelle's figures into the categories of interventions used in this report.

work volume is assumed. This rate provides an indication of the acceleration needed compared to previous years.

Under these conditions, markets for works and insulation materials, in 2007 prices, would be 2.6 and 1.9 billion euros respectively in 2012, the total employment would reach 35 800 and annual energy savings 420 ktoe, while savings accumulated since 2005 are predicated to attain 2 120 ktoe (24.7 TWh).

3.1.2 Roof Insulation in existing housing

Besides slates, the total market for roofing material is estimated by OPEN at 1 433 M € in 2006, including 128 M € for roof screen (49.2 million m^2). About 45% of roof screen (21 million m^2) was used by firms for existing housing renovation, 45% in the new homes or as part of enlargement works. By integrating the distribution margins the value of insulation screens used in roofing for renovation totals 114 million €. Corresponding direct employment in manufacture is 445 jobs.

The total number of work related to maintenance and improvement of roofs is 4 080 million €. In the 580 000 improvement interventions reported only 163 000, 28.3% involved insulation. Their value is estimated at 1 340 million €. Insulating during roof renovation had added costs compared to renovations not including insulation estimated at 24%. The value of insulating roof in existing homes would then be 260 million €[67].

The total number of jobs related to the renovation of roofs, with insulation, are 15730; indirect employment is **3** 000. Of the 15 600 direct jobs**,** those corresponding to insulation alone are estimated at 3 050.

Applying to the 21 million m^2 of insulation screens in roofs used by professionals, as part of renovation work, the average value of the certificate of energy saving BAR-IN-01 (insulation of attic or roof) with screen of an insulation coefficient R comprised between 2.5 m^2K/W and 5 m^2K/W (34 kWh/m^2 in annual savings), the energy savings are 714 GWh (61 ktoe) linked to insulation carried out in 2006, while economy accumulated since 2005 would add up to 121 ktoe.

Assumptions regarding developments in 2007 and the 2012 outlook, for progress related to markets that provide roof insulation services are the same as those made regarding opaque walls.

Markets and employment related to insulation of existing homes: roofs

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	Target
Total cost of works (million €)	1 340	9%	1 461	3 370	
Of which insulation materials (million €)	*114*	*9%*	*125*	*275*	
Employment	15 620	4%	16 235	33 090	

Source : OPEN 2006 ; 2007 and 2012 targets

Energy stakes

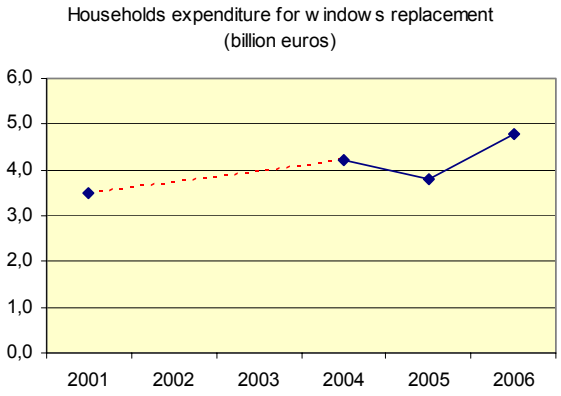
	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	Target
Energy savings related annual works (ktoe)	61	5%	64	140	
Energy savings related to works since 2005 (ktoe)	121	53%	185	710	

67 I.e. 24% of 1192 € (value without insulation).

3.2 Replacement of openings

Key points

- In 2006 replacement of openings was the second household spending in the quest for reduction of energy consumption. According to different sources it represented between 4 billion and 6 billion €.
- On this amount only 52% of works has resulted in an energy efficient solution with equal or superior performance to TH8 standard.
- May 2007 decree requires that all window replacements meet the energy performance of the TH8 standard. This should result in strong growth of the markets and jobs growth related to improving energy efficiency



Markets and employment linked to replacement of openings

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	2012 Target
Number of homes (in thousand)	760	2%	775	1 570	
Market value of works (million €)	3 820	6%	4 060	8 650	
of which supplies (million €)	*2 260*	*6%*	*2 400*	*5 105*	
Total employment	53 060	1%	53 500	107 500	

Energy stakes

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections	2012 Realizations
Energy savings related to annual works (ktoe)	59	2%	61	129	
Energy savings related to works since 2005 (ktoe)	117	+52%	177	785	

Energy efficiency improvement: openings[68] of existing housing

Works

According to the Permanent Observatory of Homes Energy Improvement (OPEN) approximately 1.4 million homes have had renovations performed on windows, doors, shutters, etc. under a renovation project in 2006. The total cost of these improvements is estimated at 5.9 billion €, i.e. an average cost of 4 200 € per home, comparable in magnitude to that given by the Sofres survey on energy management improvements. As a result, intervention on openings represent the second most important expenditure in energy related improvements, the first being energy consumption reduction in heating related interventions.

54% of works on windows has resulted in the establishment of an energy efficient solution (thermal performance superior or equal to TH8, which corresponds to an Uw coefficient[69] inferior to 2 W/m^2 °K). Although *a priori*, any intervention on apertures results in reduced energy consumption, for the present market assessment only those energy efficient solutions were retained.

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68 The interventions of energy improvement on the openings relate to the whole of the windows, doors, glazed doors, shutters, etc Taking into account the availability of the data only windows are taken into accounts in this report

69 Uw: coefficient of thermal surface transmission of the window; it takes account of the performances of joinery and the glazing, as well as connection between the glazing and joinery

The costs of replacement with a TH ≥ 8[70] window would be 70% higher to that of a window TH < 8 type. The market for associated works is estimated at 3.8 billion € (65% of the total market) for 760 000 interventions, i.e. an average cost of 5 000 €. Of this amount supplies would account for 2.2 billion Euros (see below).

On the basis of the ratio [added value / employee] of the old NAF 45.4C (Wood and plastic joinery), which installs around 84% of windows (see below), the number of jobs corresponding to energy efficient solutions is 39 300. Indirect employment (except in windows manufacturing – see below) is estimated at 8 000 jobs.

The extra costs to improve energy efficiency, calculated as the difference between the average cost of TH ≥ 8 solutions and the cost of lower solutions, is estimated at 1.4 billion €, of which about 1.2 billion corresponding to windows themselves.

According to the results of the latest Sofres survey, after a drastic increase between 2004 and 2005, the number of works related to replacement of openings decreased in 2006, down to its 2004 level, while average costs of works on windows or doors progressed at an annual average rare of 8%. This progress, superior to that of the index price of maintenance and improvement works could stand as an evidence of the higher part of effective solutions as a result of the tax credit incentive put in place in 2005.

Supplies: doors and windows

In 2006, the number of windows and doors installed by enterprises or by artisans in the context of maintenance and improvement of homes was in all 4.7 million, for an average price unit amount of 425 €. The average number of windows for a typical building project is 4 to 4.5. PVC and wood doors and windows represented 94%.

Distribution of windows and French windows installed in the context of maintenance and improvement of existing homes

PVC	3 773 300
Wood	613 300
Metal	294 000
Total	4 681 200

Source OPEN

According to information from the ANAH[71] evaluation guide, one can estimate the supply costs for the 760 000 effective replacement (TH ≥ 8) at 53% of the costs of the works. The costs of the windows would then be 2 billion €. On this amount, the extra costs in comparison with TH <8 windows would be 1.2 billion

On the basis of the ratio [turnover / employee] of former NAF 203Z (manufacture of carpentry and wooden joinery) and 252E (manufacture of plastic components for construction), the number of window manufacturing jobs involved in 760 000 renovations is 12 200. The indirectly related jobs to manufacturing of windows is estimated at 6 500.

Insulating double glazing

Due to data availability limitation, only insulating double glazing is taken into account amongst the various components of windows.

In 2006, sales of insulating double glazing amounted to 16.2 million m^2 which corresponds to a value ex factory of 517 million €, i.e. 32 €/m^2. The surface area of windows replacement described above is estimated at 6.5 million m^2. According to ANAH, the extra cost of double glazed glass as compared to simple glazed ones is of about 44%. The value of double glazed glass would then be 245 million €, i.e. an extra cost of 62 million € compared to a normal glazing.

The average turnover per employee in the 261C sector (transformation of flat glass) was 158 k€ in 2006. Productivity went up 0.7% on average per year between 2004 and 2006. Direct employment would then total 1 500.

Whereas in 2006, the production increased 5.8% as compared to 2005, it remains almost stable (+0.4%) in 2007. Due to high energy costs prices went up: by 10% compared to 2006[72], when they had remained relatively stable in 2006 (+2.5% in relation to 2005). Exports of NC 70080081 products (double glazed

70 This difference being essentially due to the supplies and the change of materials.

71 See ANAH Evaluation guides for rehabilitation work - Apartments and houses, sheets L1.2.2, L1.2.3

72 Producers price index - French production sold on the French market, in industry - Nomenclature CPF - Flat Glass transformed for building 000854596).

windows) amount to 3.3 million € in 2007, and 2.8 in 2006, while imports went up from 18.6 million € to 22.3 millions €.

Energy stakes

Improvements accounted for concern windows with effectiveness superior or equal to TH8, with an Uw coefficient ($W/m^2.K$) less than 2. The energy savings are calculated using the average amount of the energy saving certificate BAR-EN-04, corresponding to improvements on windows with a surface transmission coefficient Uw inferior to 2 $W/m^{2^\circ}K$. The average amount of the certificate is 106 $kWh/m^2/year$[73].

The surface area corresponding to the works retained amounts to 6.5 million m^2. Reduction of energy consumption reflecting measures taken in 2006 is 689 GWh. The total savings related to works undertaken since 2005 is 1357 GWh (117 ktoe).

2007 estimates and projections

2007 estimates

2007 has been a year with relatively sustained growth in the maintenance and renovations of homes: +3.3% in volume according to SESP, when the 'Club d'amelioration de l'habitat' gave a slightly less figure of 2%. In the joinery, the CAPEB survey on the housing construction sector indicates a 2% progress of activity in the third quarter of 2007, future prospects being a 10% rise in demand. In this activity, prices increase remained quite high (+4.2%).

On this basis the 2007 rise in the volume of activity was estimates at 2%

Windows and energy savings certificates

During the period January-February 2008, energy saving certificates delivered under windows and French windows with insulating glazing increased by 497 GWh cumac, that is to say an increase of 75% compared to the total of the issued certificates at the end of 2007 (665 GWh). By applying the average coefficient indicated above, this amount of certificates corresponds to about 200.000 m^2 per month.

Projections

The decree drawn up on 3rd May 2007 stipulates that when windows are replaced, the new ones must have a minimal energy efficiency which corresponds to Ug = 2 W/m^2K[74] (windows with reinforced insulation).

The enforcement of this decree, from 1st November 2007 should ensure that all renovations on openings comply with the category of effective insulation performance (equal or superior to TH8).

The creation at the end of 2007 of the UFME (Professional Union of exterior joinery manufacturers) would be a favourable context. In facts, this Union aims to draw up quality standard for the installation of exterior joinery and to follow their application in works, its other objective being formation, in order to fill the existing lack of competent workers.

The assumption retained is a 3% annual growth for interventions, and a generalisation of energy efficient solutions, which globally mean, together with the progresses of other types of energy efficient interventions in the housing, an increase of works in line the Grenelle program. As for interventions in openings, growth would be 16% per year.

2012 markets for the replacement of windows would be the following:

	Markets (million €)	Employment
Activity	8 650	80 310
Windows	4 550	23 945
Double glazing	555	3 220
Total	13 755	107 475

73 The amount of the certificate depends on fuel and the climatic zone; the average coefficient is calculated by taking the Sofres sharing out work.

74 Surface coefficient of thermal transmission of the glazing.

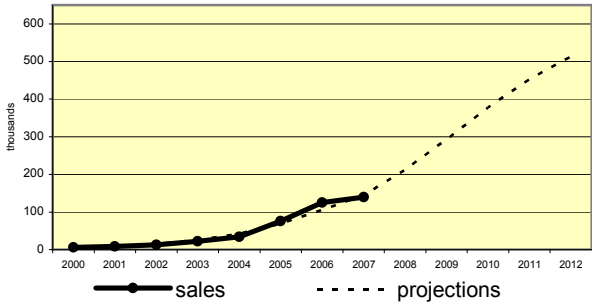
Given the assumption of a generalization of energy efficient solutions as from 2008, energy savings resulting from 2012 works would be 1.5 TWh. Savings related to replacements during the 2005 - 2012 period would be 9,1 TWh (767 ktoe).

3.3 Condensing boilers

Key points

- In a context characterised by the fall in sales of gas and oil -fired boilers, low temperature boilers are now the best-selling products on the market, with 60 per cent market share.
- Thanks to tax credit, the share of condensing boilers is rising regularly, reaching 22% of sales in 2007 (compared to 4.6% in 2004). However this share remains lower than that in The Netherlands or Germany.

Sales of condensing domestic boilers



Markets and employment related to condensing boilers

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trends	2012 Target
Sales (number of units	125 000	+12%	140 000	515 000	
% of the boilers market	17,4%		22,2%	81.4%	
Value (million €)	715	+15%	820	3 000	
Direct employment	5 390	+11%	5 975	20 865	

Energy savings related to condensing domestic boilers

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trends	2012 Realizations
Savings due to annual sales (ktoe)	83	+12%	94	343	
Savings due to sales since 2005 (ktoe)	134	+70%	228	1 462	

Heating and sanitary hot water represent by far the biggest consumption of final energy in the residential sector: in main homes alone they used 329.1 TWh in 2005 (heating 279.2 and hot water 49.9), nor including fuel wood (78 TWh for all homes). That is a total of more than 80% of all household energy consumption.

While electric heating is the most widespread means of heating in new homes (a 70% share according to the DGEMP[75]), natural gas remains the principal energy source used for home's main heating (41% of households), followed by electricity (31% of households) and oil (20%)[76].

Heating systems using renewable energy (solar, heat pump, biomass) are dealt with in the sections on renewable energy. The present sheet only deals with gas and oil heaters. Improvement in energy efficiency related to electric heating is not included, due to the lack of data.

Boiler sales

Performing oil and gas boilers have been put on the market for several years, taking a growing share of the market. With sales of oil and gas boilers declining, "standard" boilers now represent only 13% of sales. Low temperature boilers have become the main products (67% of 2006 sales), and may be considered the "standard" products. The market and employment evaluations will then be restricted to condensing boilers.

75 See DGEMP France 2006 Energy Assessment

76 TNS Sofres 2006 Assessment of Energy control

	2004	2005	2006	2007
Oil and gas boilers	753 000	740 000	690 000	610 000
of which condensing boilers	34 500	76 000	125 000	140 000
of which low temperature boilers	n. d.	n. d.	465 000	380 000
Of which standard boilers	n. d.	220 000	100 000	80 000

Source GFCC

Improvements in heating systems

According to Sofres, 1.2 million households carried out improvements to their heating, hot water and ventilation systems in 2006 to the value of 5.2 billion €. 512,000 of these works involved the installation of a boiler for the first time to a value of 2.3 billion €. The average cost of boilers installation is 4,600 €, a considerable rise on preceding years (an average annual rate of 26% up over the 2004 - 2006 period).

According to OPEN, 863,000 households carried out renovations to their main heating system, for a value of 3.9 billion € (an average of 4,400 € per household. 416,000 of those households had work done on electric heating systems (including heat pumps) and 447,000 had work done on oil, gas or wood-fired boilers.

OPEN calculates the turnover of the heating equipment industry in the housing sector (both new-build and existing) to be 2.8 billion €. Oil or gas-fired boilers represent 1,140 million euros; solar water-heaters, heat pumps, insulated homes and stoves 650 million € and other systems (electric heating, radiators, etc) 985 million €.

Market value

According to OPEN's survey, the average price (ex factory / customs) of an oil or gas-fired boiler is 1,700 euros before tax. In 2006 the total market value of boilers (excluding wood-fired) was 1.04 billion €. A condensing boiler is 30-40% more expensive than a standard boiler, i.e. about 2,200 euros compared to 1,600 euros. Prices rose 3% in 2007[77]. In ex factory/customs prices the condensing boiler market was worth 275 million euros in 2006 and 317 million euros in 2007.

The average cost of an installed boiler (including distributors' and installers' costs but not the cost of associated equipment such as radiators, taps and thermostats) is about 4,400 euros before tax.

	Unit price (€)	%
Equipments (ex factory or customs prices)	1 700	39%
Distribution margins	1 300	29%
Installation	1 400	32%
Total	4 400	100 %

Including distribution and installation costs, the condensing boiler market was estimated to be worth 715 million euros in 2006 and 225 million in 2007.

Production and employment

According to industrial statistics, invoices for central heating boilers came to 778 million euros in 2006, 94 million euros of which were for wall-fitted condensing boilers. French production of condensing boilers would represent 40% of the market, at 110 million euros, in 2006. Foreign trade in boilers showed a deficit of 55 million euros in 2006. There was an improvement in 2007, with a reduction of the deficit to 25 million euros[78].

Based on the ratio [output / employee] of the "manufacturing of radiator and boiler for central heating" industry (previously NAF 282D), there are an estimated 630 jobs directly concerned with manufacturing.

There are 4,750 jobs in distribution and installation. The first rank indirect employment is estimated to total 1,190 jobs.

77 Source : Insee producer's price index (boilers and radiators)

78 Source: Customs products 84031010 and 84031090.

Energy stakes

Average amount of energy savings certificates for condensing boilers is 7,700 kWh/ year.

As for the 125 000 condensing boilers sold during the year 2006, the energy savings would be 970 GWh (83 ktoe). For the year 2007, the savings would be 1087 GWh (94 ktoe).

Energy savings certificates

Amongst energy saving certificates, there are two operations concerning domestic boilers:

- Condensing domestic boiler (BAR-TH-06). Annual energy savings: 7,700 kWh
- Low temperature domestic boiler (BAR-TH-08). Annual energy savings: 3,400 kWh

According to the DGEMP information letter, boilers amount to 50% of total energy savings certificates issued.

	end 2007	February 2008	Change two months
Total of energy savings certificates issued (TWh)	**9,5**	**14,0**	**4,5**
of which condensing boilers (%)	26%	21%	0,5
Condensing boilers (TWh)	2,4	2,9	0,5
Corresponding number of units (94 000 kWh / unit)	25 939	30 788	4 850
of which low temperature boilers (%)	21%	16%	0,3
Low temperature boilers (TWh)	2,0	2,2	0,3
Corresponding number of units (41 000 kWh / unit)	47 475	54 001	6 526

The energy savings certificates provide the conventional savings related to the installation of a condensing or low temperature boiler. These savings vary according to the climatic zone, the type and the size of housing and the use (heating alone or heating plus sanitary hot water); one retained the OPEN and Sofres distributions to calculate the average amount, by making the assumption that they concern 100 m^2 houses and that half of the boiler was intended for heating and half for the heating and hot water.

2012 projections

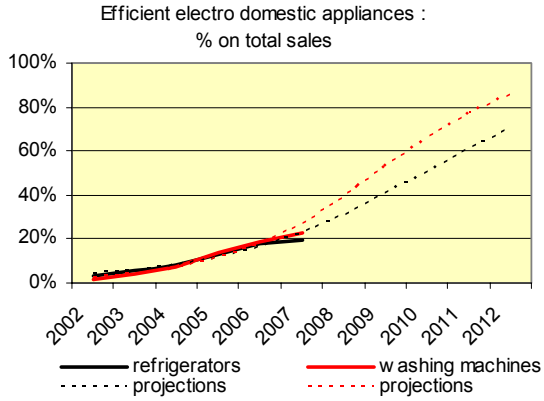
According to a projection using a logistic adjustment over the 2000 – 2007 period, the share of condensing boilers[79] in to the market would reach 80% by 2012. Sales would go up to 513 000 units. All things being equal and according to the evolution of productivity, direct jobs in the production sector would reach 2,135. Employment in distribution and production could increase to 19 700 while first rank indirect jobs would reach 6200. Energy savings related to accumulated sales since 2005 would be 17 TWh (1.5 million toe).

[79] Logistic adjustment of the penetration rate gauged over the period 2000 - 2007.

3.4 Energy efficient electro domestic appliances

Key points

- The refrigerators and freezers consume 32% of the specific electricity of the residential sector that is to say more or less 22 TWh per annum and the washing machines and dryer 21% (14 TWh).
- After having progressed rapidly since 2002, the penetration rate of the refrigerators and the washing machines of A+ class seems to slow down in 2007
- The installation of a bonus malus system following the example that which was set up for the private cars would likely support a recovery.



Market of energy efficient electro domestic appliances

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend
Sales (thousand of unite)	855	+14%	975	3 610
Domestic market (million €)	465	+14%	530	1 960
Domestic production (1)	436	+14%	500	1 855
Direct employment	4 790	+12%	5 355	18 315

Class A+ refrigerators and washing machines; (1) including distribution margins

Energy stakes

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend
Energy savings related to annual sales (ktoe)	34	+8%	37	135
Energy savings related to sales since 2005 (ktoe)	58	+64%	95	600

Specific electricity consumption and energy labelling

In 2006 the final consumption of electricity of the residential sector was of 148 TWh, including 46% (that is to say 68 TWh) for specific electricity[80], which continues to progress at a rather rapid pace (+ 3.4% on annual average between 2000 and 2006). According to ADEME[81], on this total 32% are consumed by the refrigerators and freezers (+ 22 TWh) and 21% (14 TWh) by the washing machines and dryers

The energy label, appeared in 1994 on the initiative of the European commission, informs about consumption of the various models of electro domestic appliances. It is compulsory for the refrigerators, freezers, refrigerators and combined freezers, washing machine, dryers, drying washing machine and dishwasher and also for the electric furnaces, the air-conditioners, etc. The industry required as it be extended to the vacuum cleaners. However the European commission answered that the standard for measuring the consumption of energy of these products should be elaborates before engaging the consultations on this topic with the Member States.

80 See consumption of electricity of the residential and tertiary sector by use in DGEMP electricity in France in 2006: an statistical analysis - April 2007

81 Practical Guide for electrical equipment March 2008

Within the framework of the Directive on the eco-design, the Commission launched in 2005 a call for tender for 14 studies of products, some bearing on electro domestic appliances, which must lead to regulations whose first should be adopted during 2008 and be based on energy labelling in order to reduce the environmental impacts of the products.

Present situation

The manufacturers of electro domestic households appliances made significant efforts to reduce energy consumptions - and the other environmental impacts - with more than 10 billion € of R&D in 10 years (change of the compressors, of the fluids, improvement of the thermo isolation of the appliances ,…).

Currently as concerns cold appliances, 90% of the market products are classified under class A, and it was decided, following agreements with the professionals, to create 2 new higher classes A+ and A++, which were validated by the Directive 2003/66/CE.

Compared to the class A the energy improvement is of 25% for A+ and 40% for A++. However, the extra cost related to the selling price of A++ is dissuasive; and for this reason, A++ products are no more sold in France.

For the washing machines, manufacturers decided through a voluntary agreement to create an A+ class, but it does not have basic legal.

Within the framework of the energy saving certificates created by the law of July 13, 2005 fixing the orientations of the energy policy, there exist two approved operations related to the electric household appliances.

- Cold domestic appliances of the A+ class: refrigerator (combined apparatus), the annual economy is of 66 kWh; freezer, the annual saving is of 50 kWh.
- Washing domestic machines of the A+ class: the annual saving is of 15.4 kWh.

Today nearly 22% of the turnover of the sales of refrigerators is realized with apparatuses of class A+ and A++, against only 3% in 2002. In the freezers, the performance of A+ and A++ are still better: it reaches 39% of the sales in value. In the washing machines the percentage reaches 23% of the sold units.

As regards energy labelling energy of the dryers, the Community authorities put the threshold very high: the best produced appliance could only be classified in the C class. This situation lasted ten years, before a manufacturer decides for his top-of-the-range appliances to make a technological jump (thermodynamic system). This recourse to the heat pump made it possible to classify these apparatuses in A class, but the selling price doubled. Today, the manufacturers aim, without having recourse to this technological change, to manage to reach the class B for their appliances, by modifying in-depth the design of the products (thermo isolation, aerodynamics…).

% of class A+ appliances (value of sales)

	2002	2003	2004	2005	2006	2007
Refrigerators	3%	-	9,7%	15,5%	20,5%	21,8%
Freezers						33,0%
Washing machines	2%		10,4%	18,3%	24,0%	28,2%

Source GIFAM / GfK

Market

The study of the market is limited to the refrigerators and the washing machines of class A+; it was not possible to collect data as concerns the freezers and the dryers

Turn over: refrigerators and washing machines

	2006	2007
Refrigerators	219	234
Washing machines	246	294
Total	465	528

Million of euros; source GIFAM

Taking into account the price differences between the equipment of A+ class and those of the lower classes (approximately 70 € for the refrigerators and 140 € for the washing machines), the ‘additional” expenditure related to the purchase of A+ equipment is estimated at 35 million € for the refrigerators and 75 million € for the washing machines. For the freezers the order of magnitude is 20 million €.

Extra cost for class A+ electro domestic appliances

	2006	2007
Refrigerators	31	35
Freezers	n.a.	21
Washing machines	64	75
Total		131

Million of euros ; own calculation from GIFAM data

Production and employment

There is no more manufacture of domestic cold appliances in France. There exists on the other hand a manufacture of washing machine and dryer: FAGOR Brandt has manufacturing plants in La Roche-sur-Yon (550 paid) and Lyon; Whirlpool manufactures dryers in Amiens (550 paid) and Electrolux washing machines in Revin (700 paid, 150 million € of turnover and 700.000 washing machines produced in 2005).

In the absence of statistical data on the national production of washing machine, one can estimate it starting from the interior market and the foreign trade. The interior market at the acquisition prices net of tax is of 1024 million euros, for an average unit value of 445 euros. On the basis of average costs of the imports and exports, the value at 'ex factory/customs' prices is estimated at 452 million.

Production of washing machines estimates (2006)

	Value (million €)	Number	Unit price (€/unit)
Imports	444	2 267 000	196
Exports	223	1 041 000	214
Domestic market	452	2 302 000	196
Production	231	1 076 000	215

Source : own calculations on the basis of GIFAM and Customs data; ex factory / customs prices

The assumption is made that the nationally produced washing machines are rather top-of-the-range and that the share of A+ washing machines in the national production is of 70%. Under these assumptions, taking into account the price difference, the order of magnitude of the production of A+ washing machine would be 175 million euros at the prices 'ex factory' and the number of direct jobs in full time equivalent related to the manufacture (old NAF 297A) 1050. The indirect 'first rank' employment (related to the intermediate consumptions of the production units) is estimated at 650. The direct employment related to the distribution is 3.700 and the indirect employment 790.

Only a weak share of these markets and this employment can be regarded as directly related to energy efficiency; the markets satisfy first a demand for equipment able to produce cold, to wash the linen, independently of the possible concern of the households as regards energy saving. In particular employment related to the distribution of electro domestic household appliances can be regarded as independent of energy efficiency. As concerns the manufacturing employment, one can consider that they are related to the energy performances, the rise in range allowing the maintenance of manufacture in France.

Energy stakes

Conventionally, the energy saving was estimated by multiplying the number of units by the value of the annual savings according to the certificates of energy savings. One obtains following energy savings.

	2006	2007
Refrigerator	28,0	29,3
Washing machines	6,4	7,8
Total	34,3	37,2

GWh

Projections

Until now, France did not install any system of financial incentive to encourage the consumers to acquire energy efficient products. Such systems exist in other countries, for example in the Netherlands, where the government refunded 50€ for the purchase of a class A refrigerator and 150 € for a class A+ product, which caused a complete transformation of the market. Other countries entered this way, often at the regional level (Lombardy in Italy, Spain…)

It has be indicated that the growth of the penetration rate of the class A+ appliances tends to slow down, and this rate is lower in 2007 than it could be expected within the framework of a model of progression of the logistic type (see graph).

The project to create a system of bonus malus, currently being studied as a regulatory application of Grenelle, should accelerate the progression of the appliances the most energy efficient appliances. The assumption was made that this system will be adopted during 2008 on the level of the European Union, as a result of the implementation of the Eco-design Directive. This would accelerate the penetration of the energy efficient appliances.

By 2012, in the absence of any prohibition of the lower classes, that would result in percentages of sale of the A+ class appliances (or their equivalent in the event of reform of the system of labelling), of 70% for the refrigerators and 85% for the washing machines. Broadly the appliances of the A+ class would represent in by 2012 about one third of the park.

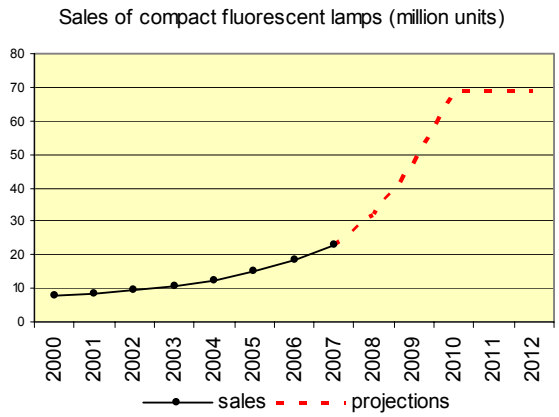
Without taking into account the new progresses which could be accomplished, the annual saving cumulated on the whole of the park would be then 600 GWh.

All things being equal, the market of the A+ appliances (refrigerators and washing machine) would reach 2 billion euros and the direct employment in manufacturing would be, in the absence of delocalization, 3750.

3.5 Compact fluorescent lamps

Key points

- With 90% of the energy dissipated in the form of heat, the lighting of the residences by incandescent lamps represents a considerable source of wasting of energy.
- It was calculated that the replacement of the incandescent lamps by compact fluorescent amps would make it possible to save 5.3 TWh per annum, that is to say 8% of the specific electricity consumed by the main homes.
- Taking into account the absence of national production, the impact on the activity and employment are negligible.



Market for compact fluorescent lamps

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend
Annual sales (million of units)	18,7	23%	23,0	69
Domestic market (million euros)	166	11%	184	552
Output (distribution margins)	111	11%	123	370
Employment	p.m.	-	p.m.	p.m.

Energy stakes

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend
Energy savings related to annual sales (GWh)	319	+27%	378	1 020
Energy savings accumulated since 2005 (GWh)	638	+50%	1 016	5 282

Energy savings are calculated on the basis of 18 kWh per lamp, except for 2005 sales (20 kWh) and replacement sales

Compact fluorescent lamps in France

The Enertech study for the ADEME and EDF[82] estimated at 5,3 TWh per annum the layer of energy saving related to the replacement of the incandescent lamps by compact fluorescent lamps (CFL) in the residential sector, that is to say approximately 8% of the consumption of specific electricity of the main homes.

The number of compact fluorescent lamps (CFL) sold each year has increased regularly for several years (see graph). According to the figures of the Syndicat de l'Eclairage (the professional organism for lighting), on the 213 million lamps sold each year for the domestic market, 185 million is "traditional" incandescent lamps, 4 million are halogen lamps[83], 1 million the LED replacement lamps and 23 million the compact fluorescent lamps.

According to the Sofres survey, the percentage of housing having at least one compact fluorescent lamp was of 63% in 2006. The rate of average equipment remains rather low: according to the Enertech study, these lamps represented into 2003 only about 9% of the sources of light of a home (2.3 CFL on a total of 24.8 sources of light by home). Taking into account the 45 million LFC sold since this date, the median number of CFL per home should now approach four.

82 Lighting in 100 residences: present situation and evaluation of energy saving potential in residential (EDF Enertech ADEME 2004)

83 Lamps with reflectors and very low tension excepted

During last years the diffusion of the CFL was supported by the widening of the range: form, size and type of the bases, aesthetics. The CFL are also more powerful in terms of lifespan and capacity of lighting, speed of rise in power, spectrum of colour, etc

The sales in 2007 were of 23 million units (+ 23% compared to 2006). The price of the lamps is extremely variable according to the various parameters: the average costs retained for 2007 are of 8 € HT, in fall of 10% compared to 2006. The market would be about 184 million euros.

There is no national production of CFL, and European production capacities are still insufficient. At the end of 2006 beginning 2007, several shortages were noted on the market. The production concentrates gradually in the countries of Asia where the three large producers (Osram - group Siemens, Philips and General Electric) established production units.

In order to fight against exports of certain producers Asian (China, Pakistan, Filipino etc) carried out according to it at dumping prices, the European Union set up a tax going up to 66% of the price, in order to bring back this price to the European conditions of production. In 2007, the average costs with the importation went from 1.3 € for the imports coming from China to 2.2 € for the imports coming from Poland.

Although the unit margins on the CFL are higher than the margins on the incandescent lamps, one did not retain employment in the distribution, the quantities being weaker.

Energy stakes

In the Energy Saving Certificates (operation BAR EQ-01), the annual energy saving related to the acquisition of a class A compact fluorescent lamp was estimated at 34.7 kWh on the basis of operation a 800 hours per annum (replacement of an incandescent lamp of 80 W by a CFL of 18 W), while that of a lamp of class B was estimated at 15kWh.

Within the framework of a study preliminary to the installation of a possible bonus malus on the lamps a lower value was retained; energy saving is estimated at 24 kWh/year for the lamps of class A[84]. In the facts one estimates that only half of the sold CFL are of class A.

To evaluate energy saving related to the annual sales, one retained an energy saving of 18 kWh per lamp[85]. Energy saving related to the annual sales is estimated at 319 GWh (27 ktoe) in 2006 and 378 GWh (33 ktoe) in 2007.

Other types of lamps and other measurements related to lighting

In the field of lighting, the control of energy consumption takes other forms that the replacement of the incandescent lamps by the compact fluorescent lamps.

Electroluminescent diodes (ELD): in spite of the recent progress their apparent brightness is still insufficient (about 40 lumen/W) to enable them to compete with the domestic CFL (50 to 60 lumen/W). It is probable that it will be necessary to wait several years of technical and industrial development so that electronic lighting is competitive as concerns economic and environmental aspects. According to the Syndicat de l'éclairage the sales of ELD replacement lamps could however reach 9 million units in 2010.

In the residential sector many devices allow to carry out energy saving on the lighting of the common parts: detector of presence, automatic cutting of standby lighting. Finally the control of the energy demand extended to public lighting; whereas lighting accounts for on average 18% of the energy consumption of the communes, the potential of savings was estimated at 30% of the annual total consumption of 5.5 TWh [1].

1See Acts of the meetings of public lighting (ADEME Area of the Countries of the Loire) March 2005annuelle of 5.5 TWh

Projections

The directive "eco-design" (2005/32/CE) adopted in 2005 by the European Union aiming at increasing the energy efficiency of the domestic appliances envisages the implementation of measures relating to groups of products. The lighting products in the residential and tertiary sectors are included among the priority groups

84 Taking into account of an average lamp of 48 W during 500 hours.

85 Except for the sales corresponding to the replacement of the LFC arrived at the end of the lifetime.

of products. In March 2007 the Summit of the Heads of State and Government required of the Commission to present proposals by 2009 on the incandescent lamps and the other forms of lighting for the households.

Rather than a pure and simple prohibition, these proposals would consist in “introducing criteria of energy efficiency such as they would make impossible the access to the market of these lamps”.

Taking into account its impossibility to ensure the sufficient level of production immediately, the industry supported at the European level the progressive replacement according to the classes of power, taking the form for example of the prohibition of the incandescent lamps of 100 Watts in 2009, etc…

Lamps low consumption within the framework of the Certificates of energy saving

Between December 2007 and the end February 2008 the amount of the Energy savings certificates issued under the compact fluorescent lamps class A category passed from 200 GWh to 392 GWh. The progression in two months accounts for 96% of the total reached at the end of 2007. In annual rhythm the first two months of 2008 correspond to the sales of 5 million CFL of class A. In addition to this acceleration the assessment also highlights that only a small part of the sales results in the emission of certificates. The number of issued certificates at the end of December 2007 did not represent indeed that 0.9 million CFL of class A, that is to say less than 10% of the sales of the only year 2007.

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	December 2007	February 2008	Increase (two months)
total of certificates (TWh)	9.5	14.0	+ 4.5 (+ 47%)
of which FCL of A class (GWh)	199.5	392.0	+ 192.5 (+ 96%)
Number (thousands)	867	1 704	+ 837

The prospects retained, until 2010, projections established by the Syndicat de l’éclairage, which fall under the scenario of the European industry of progressive replacement. After 2010 one considered that the sales remained constant. These prospects result in sales of 69 million lamps CFL in 2012, including the replacement of the CFL arriving at the end of the lifetime. At the prices of 2007, the market would reach 550 million euros. Energy saving related to the annual sales, except replacement, would be of 1.0 TWh and the economies cumulated over the period 2005 - 2012 of 5.3 TWh, i.e. the estimate of the potential of energy saving.

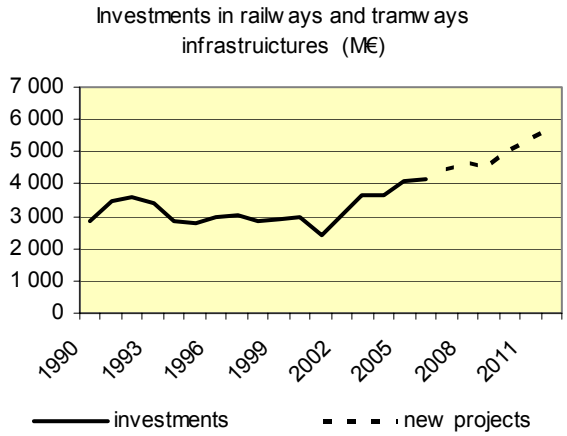
One can however wonder about the opportunity of accounting for this market since the energy efficient solution became the standard solution.

4 IMPROVEMENT OF ENERGY EFFICIENCY IN TRANSPORT

4.1 Railway transports and trams

Key Points

- The bill Grenelle 1 stressed the development of the railways transport and own site urban public transport (TCU) in order to reduce the CO_2 emissions of 20% by 2020.
- The currently identified projects, which remain short of the Grenelle's objectives, result alone in an increase of 65% of infrastructure realization works between 2006 and 2012.
- Direct employment related to the realization of these infrastructures and the manufacture of rolling stock should exceed the 55.000 in 2012.



Realization of infrastructures and equipments manufacturing

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections
Total domestic market for infrastructures (million €)	3 390	+31%	4 450	5 730
of which railways (million €)	2 320	+37%	3 180	4 330
of which tramway (million €)	1 070	+19%	1 270	1 400
Domestic market equipments (million €)	2 024	+25%	2 520	3 250
Exports (million €)	625	+22%	765	1 535
Direct employment realization of infrastructures	28 170	+23%	34 840	43 460
Direct employment manufacture of equipments	9 030	+20%	10 880	12 970

2006 and 2007 million euros at current prices ; 2012 million euros 2007 prices

Energy stakes and employment in new trams lines

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Projections
Energy savings related to annual investment (ktoe)	11	+34%	15	18
Energy savings related to total investment since 2005 (ktoe)	22	+67%	37	109
Employment in new trams lines	497	+134%	1 161	4 912

In the field of transport, the bill Grenelle 1 fixed as objective to reduce by 20% the level of the CO_2 emissions by 2020 in order to bring back them to the level which they had reached in 1990.

The development of the public transport is considered a priority: as regards infrastructures, the sustainable transport policy should give the priority to public transport in the urban areas and the railway investments compared to the development of road or airport projects. The networking of the territory by the lines at high speed (LGV) will be continued (the realization of 2000 km new LGV will be launched by 2020). The local administrations will increase own site public transport from 330 km to 1800 km.

For goods transport the priority is granted to the railway, river and harbour investments, with the development of the massive traffics of railway freight, combined transport, rail motorways and sea motorways. In a first phase, three rail motorways will be launched: the Alpine rail motorway prolonged to the region of Lyon, the rail motorways between Perpignan and Luxembourg and the Atlantique rail motorway between the Basque Region, the Paris Region and the North of France.

The results of an analysis of the projects, currently identified, of transport infrastructures by railway, including urban public transport (trams) are presented below.

The projects of transport by inland waterway or channels are not included; the only project of Northern Seine - Europe channel has an estimated cost of 4 billion euros in 2010 prices.

Infrastructures for urban collective transport: trams, tram train, subway

The total amount of the 40 projects of trams and subways currently identified and programmed, whose realization extends on whole or part of the period 2006 - 2012, is of 11.1 billion euros, including 2.2 billion for the rolling stock. The total amount of the projects in Ile de France Region is 3.3 billion for 100 kilometres and that of the projects in provincial towns 9.3 billion for 350 km.

	2006	2007	2008	2009	2010	2011	2012	total
Infrastructures	1 070	1 270	1 400	1 200	1 259	1 331	1 408	8 938
Rolling stock	260	315	344	293	307	325	344	2 188
Total	1 330	1 585	1 743	1 494	1 566	1 656	1 752	11 126

In million euros, 2006 et 2007 at current prices ; 2012 at 2007 prices

Mileage corresponding to the 17 projects whose estimated frequentation is available, is of 153 km (that is to say an average of 9 kilometres per project), for an annual number of passengers of 208 million. By retaining a 5 kilometres per passenger, one obtains approximately 1 billion passengers * kilometres, and extrapolated with the whole of the projects about 3 billion passengers * kilometres. Adopting the conventional ratios of consumption of energy per passenger * kilometres[86], it results in an economy for all the projects of 150.000 toe, including about 109 ktoe related to the openings over the period 2005 - 2012.

Railway network

Over the 2006 – 2012 period the value of the works of infrastructures related to the 55 railway projects (new lines) identified is of 24 billion euros (except equipment).

The mileage of the 12 projects for which information is available is of 1.015 km, at a cost of 18.1 billion euros (either 18 million € / kilometre), including 12.1 over the period. For lack of information sufficiently detailed on the projects it was not possible to calculate corresponding energy saving.

Direct employment related to the realization were calculated on the basis of average coefficient output / employee of the activities corresponding to the old NAF 451A (earthwork), 451B (earthworks in great mass), 452C (construction of works of art) and 452N (construction of railways).

Investments in infrastructures (trains and trams) and direct employment related to the realization

	2006	2007	2012
Railways Infrastructures excluding tramways	2 320	3 180	4 330
Tramways Infrastructures	1 070	1 270	1 400
Total	3 390	4 450	5 730
Employment	28 170	34 840	43 460

In million euros, 2006 et 2007 at current prices ; 2012 at 2007 prices

Direct employment related to the exploitation of the tram lines brought into service, are estimated at 2.300 per billion travellers * kilometres. The number of direct jobs created would be about 500 per annum, for a total of 4.900 jobs over the period.

The manufacture of equipment

According to the Federation of railway industries (FIF) in 2006 out of a production of rolling stock of 2.2 billion euros, the sales of material for traction and travellers' coaches reached 1.57 billion euros on the domestic market, due to the juxtaposition of a dynamic LGV market, a more vigorous market for regional trains and of a resumption of the investments in the materials for freight traction. In spite of a light withdrawal in 2006, urban public transports remain a key market for the railway industry (55 trams for the RATP and six provincial towns). Exports were of 627 million euros.

Prospects for 2007 are characterized by an exceptional order book (10 billion euros). According to the index of turnover of Insee, the increase of the manufacture of rolling stock turnover would have been of 26% in 2007 compared to 2006. The production by employee is estimated in 2006 (Sessi data) at 243 k€.

86 Consumption data from a study ADEME Deloitte 2007, that is to say 5.9 ktoe for a billion traveler * kilometers carried out in the tram and 56 ktoe for a billion traveler * kilometers carried out in the particular vehicle.

Recently railway industry gained important foreign contracts; the assumption was made that the deliveries on the domestic market would follow the progression of the infrastructures and that exports would continue their growth estimated in volume at 15% per annum beyond 2007.

	2006	2007	2012
Rolling stock manufacture	2 200	2 770	4 110
of which exports	630	765	1 530
of which domestic market	1 570	2 006	2 580
Imports	454	515	665
Domestic market	2 020	2 520	3 245
Employment	9 030	10 880	12 970

Million euros Source FIF for manufacturing and exports in 2006; Insee for growth rates; Eurostat for imports.

Rail motorways and combined transport

In 2005, combined transport made it possible to avoid the circulation of 959.000 heavy trucks including 77% for rail road combined transport, 17% for the rail motorways, 5% for the maritime coastal traffic and 1% for river road combined transport.

In March 2007 was inaugurated the line Perpignan Luxembourg. The service is ensured by the company Lorry Rail, subsidiary of the Deposit and Consignment Office (CDC), and of which are shareholders the SNCF, Vinci Concessions, the CFL, and Modalohr.

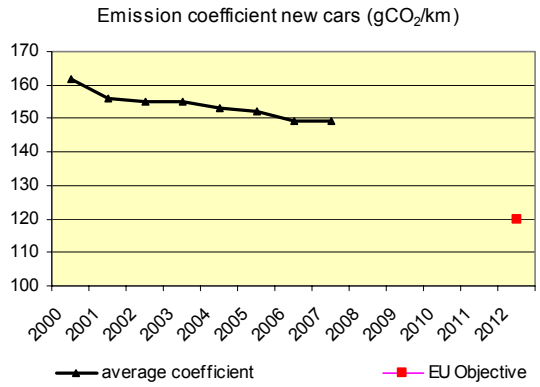
This rail motorway of 1060 kilometres has the following characteristics:

- 30.000 trailers transported per year (round trip)
- the objective by 2012-2014 is to multiply by ten the number of round trips to be able to transport 300.000 trailers per annum;
- 10% of circulation of heavy lorries in less on the roads, from Perpignan to Luxembourg
- ˜36 million € were invested by the State
- ˜20 million € were invested by Lorry Rail (+ 6 million € of subsidies)
- ˜14 hours and a half of journey time against 17 to 22 hours by the road
- ˜approximately 10% of economy in comparison with the road average tariffs
- ˜80% of saving in CO_2 compared to the road way

4.2 Private cars

Key points

- In 2006, for the first time, the average rate of emission of the new vehicles sold in France passed under the bar of the 150gCO_2/km.
- This downward movement stopped in 2007, but the setting-up, at the end of the year, of the system of bonus-malus which favours the low emissions cars should start it again.
- The sales of "clean vehicles" decrease in 2007, in spite of the rise of the hybrid vehicles, because of fall of the sales of vehicles gasoline – LPG
- The sales of flexible vehicles (E85) start to be significant in 2007, but are still hampered by the low number of stations distributing E85



Classes A & B private cars and clean vehicles markets

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend	2012 Target
Yearly sales of classes A & B private cars (number)	356 380	+12%	399 260	740 000	
LPG, hybrid, electric vehicles (number)	11 040	- 3,8%	10 620		
Domestic market A & B (million €)	4 900	+ 15%	5 644	10 450	
Exports class B (million €) (1)	1 530	+7%	1 640	3 040	
Production class B (million€ (1))	5 480	+ 8%	5 890	10 900	
Direct employment (inc. distribution)	22 080	+8%	23 800	43 480	

2006 & 2007 Sales : source : ADEME « Private cars in France » (1) estimates

Energy savings related to sales of new classes A & B private cars

	2006 Realizations	Evolution 2006-2007	2007 Estimates	2012 Trend	2012 Realizations
Savings related to yearly sales	63	+12%	71	134	
Savings related to sales since 2005	114	+63%	186	725	

In ktoe (thousands of tonnes of oil equivalent)

Policies and instruments

Since May 10, 2006, the new label energy CO_2 came into effect in France; it must be affixed on all the new particular cars for sale. It classifies the vehicles in 7 classes.

The class A has corresponds to a less than 100 gCO_2/km emission coefficient; the number of vehicles of class sold in France is on average over the three last years of a few hundreds per annum. The class B corresponds to an emission coefficient ranging between 100 and 120 gCO_2/km; it was sold in 2007 about 400.000 particular vehicles of class B, that is to say 20% of the registrations of private cars.

In 1998 the European manufacturers (ACEA) signed with the European commission a voluntary agreement for the reduction of the average emission coefficient of the new vehicles sold in Europe to 140 gCO_2/km in 2008 and 120 gCO_2/km in 2012.

The European commission adopted on December 19, 2007 a proposal for a Regulation which aims at limiting to 120 grCO_2/km the average emission coefficient of the new vehicles in 2012, according to the following methods: 130 gCO_2/km by the means of technological improvements on the engines and a

reduction of 10 additional grams by the means of other improvements and by an increased use of the bio fuels

These objectives should be modulated by the mass of the vehicles and the manufacturers who would not respect by the objectives would be financially penalized.

In France (decrees of December 26 and 26, 2007 and 'arrêté' of December 26, 2007), following Grenelle, the bonus – malus system was founded, which financially encourages (bonus) the purchasers of private cars to privilege low CO_2 emissions cars and penalizes (malus) the purchasers of the high CO_2 emissions vehicles. The system is supposed to be financially balanced the bonuses being financed by the maluses.

The amounts of the bonus and the malus are founded on the number of grams of CO_2 emitted per kilometre by the new vehicles: the bonus with the purchase for the new cars emitting less than 130 gCO_2/km lies between 200 and 1.000 euros, even 5.000 euros for the vehicles emitting less than 60 gCO_2/km. The malus with the purchase for the new vehicles emitting more than 160 gCO_2/km lies between 200 and 2.600 euros and increases according to the CO_2 emissions per kilometre. Finally a "super bonus" is paid to the people who decommission a vehicle of more than 15 years at the time of the purchase of an eligible vehicle to the bonus. An intermediate zone is exonerated from bonus and malus and relates to the vehicles to which the emissions would be close to the average of the current emissions, that is to say the 44 to 45% of sold cars which emit between 130 and 160 gCO_2/km.

Conceived so that the receipts of the maluses strictly balance the expenditure related to the incentives for the purchase of "clean" cars or ecological renewal of the existing cars fleet, the mechanism should not to result in any additional global charges on the households or the companies.

The system will be gradually hardened by lowering of the thresholds of eligibility to the bonus and of release of the malus, according to a rhythm making it possible to the manufacturers to adapt their production equipment, 5gCO2/km in every two years

One of the immediate effects of the system was to increase during the last months of the year 2007 (before the coming into effect of the malus) the sales of the most polluting vehicles. Since the beginning of 2008 there was on the contrary a strong progression of the sales of the "small" vehicles, eligible with the bonus. Taking into account these evolutions, the system is for the moment financially unbalanced.

Recent evolution in France

For the first time in 2006 the average emissions coefficient of the new vehicles had been less than 150gCO_2/km (149 gr.), against 160 gr. for the whole of the European Union.

In spite of progress of the dieselization (favourable to the reduction of the CO_2 emissions) and of the percentage of the sales of vehicles of classes A and B, this rate almost stagnated in 2007 for the whole of the vehicles (- 0.5 gr. i.e. a fall of -0.3%). Evolutions diverge according to the motorization; whereas the rate continued to drop for the petrol vehicles, from 155 gr. to 153 gr., it slightly increased for the diesel vehicles, in particular for the vehicles of the classes C and +. The phenomenon mentioned above, of the more important purchases of the most polluting vehicles at the end of 2007, can partly explain this evolution.

The share of the vehicles of classes A and B continues to progress, from 18.1% to 19.7%, but less strongly than during the year 2006 during which it had passed from 14.6 to 18.1%.

Market

On the basis of the sales of classes A and B new vehicles and of average prices, the market was estimated at 4.9 billion euros in 2006 and 5.6 billion euros in 2007. The share of the French manufacturers in the sales of the vehicles of class B[87] dropped by 78 to 72% between 2006 and 2007.

Although there is no automatic linkage between the nationality of the manufacturer and the place of manufacture, this percentage was retained to calculate the domestic production and employment.

By integrating an estimate of exports, the production would be of 5.5 billion euros and the direct employment related to manufacture and the distribution of the vehicles of classes A and B would be 23.000. The indirect employment of first rank is estimated at 20.000 supplementary jobs.

It was not possible to estimate the "extra cost" due to energy efficiency; in facts it was not possible to relate the price and the energy performance, except few specific cases.

87 There is no French manufacturer of vehicles of class A

« Clean » cars sales: hybrid, LPG, etc. (1)

	2005	2006	2007
Electric	6	14	6
GNV	0	243	475
ES/LPG	3 986	4 371	2 980
Hybrid	2 581	6 412	7 159
Total	**6 573**	**11 040**	**10 620**
Flexible		-	4 250

Since 2005, in spite of the various incentive measures implemented, the “clean” sales of vehicles progress only moderately. They represent less than 0.5% of the registrations. The only category which increases significantly is those of the hybrid vehicles, the electric vehicles having almost disappeared.

Whereas the flexible sales of vehicles (allowing using Ethanol 85) were null in 2006, the incentives created by the complementary Budget Law of December 30, 2006 in favour of the flex fuel vehicles seem to have borne their fruits. The sales would have amounted to 4.250 in 2007 (data of the SNPAA). At the beginning of 2008, the sales reached 300 per month. Several factors however contribute to limit this progression: because of their over consumption these vehicles are penalized by the bonus malus system; in addition the number of petrol stations distributing E85 remains much lower than the 500 announced for the end 2007, when the programme was launched. The circular of March 2, 2007, which obliged the public administrations to buy 15% of flexible vehicles in 2007 and 30% as from 2008 seem to have had little impact.

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(1) Here “clean vehicles” correspond to electric vehicles, vehicles functioning with the GNV, the hybrid vehicles and the Essence/GPL vehicles

Energy savings

Saving energy related to the sales of the vehicles of the classes A and B are calculated by multiplying the annual sales by the differential of consumption between these vehicles and the vehicles of the other classes, taking into account average mileages[88].

2006	Sales (thousand)	Difference in average emissions (gCO_2/km)	mileage	emissions (tonnes of CO_2)	Consumption in toe
Petrol	60 332	50,9	9 546	29 289	8 787
Diesel	296 049	38,0	16 174	181 977	54 593

conversion 1 t CO_2 = 0.38 m3 of fuel = 0,3 toe

2007	Sales (thousand)	Difference in average emissions (gCO_2/km)	mileage	emissions (tonnes of CO_2)	Consumption in toe
Petrol	58 498	48,7	9 122	25 967	7 790
Diesel	340 760	39,0	15 917	211 518	63 456

Same calculation is made on the whole of the park, approximated by the cumulative sales of classes A and B vehicles since 2005.

Cumulated savings reach 114 ktoe in 2006 and 186 ktoe in 2007. This is a very small economy, when compared with the 22 million toe consumed by the private cars. It will be noted that the calculation relates only to the sale of 400.000 vehicles per year whereas the total park is of 30.5 million vehicles.

Projections

The market share of the vehicles of classes A and B in 2012 was estimated by logistic adjustment on the basis of share for the years 2002 - 2007. The resulting market share in 2012 would be 37%. On this basis

88 In 2007, the average emissions of the particular vehicles of classes A and B are of 109,7 grCO_2/km for the vehicles with gasoline and of 117,4 gr. CO_2/km for the vehicles diesel. They are respectively of 158,4 and 156,4 for the vehicles of classes C and +; average mileages are those indicated in the booklet “the private cars in France” (ADEME).

and keeping constant the other parameters (total number of sold vehicles, share of the imports and exports); the values of the market, the production and employment for 2012 were calculated[89].

	2007	aarg	2012
Classes A et B cars market (million €) (1)	5 640	13%	10 450
Production of class B cars (million €)	5 900	13%	10 900
Direct employment	23 800	13%	43 480

(1) including estimated exports

In 2012, in the absence of any evolution of the other parameters (average emission coefficient per category, rate of dieselization) and with identical average mileage, energy savings related to the sales of classes A and B private cars would reach 725 ktoe for the whole park of classes A and B sold between 2005 and 2012.

89 Employment evolves at the same rate as the production. This parallelism results from the assumptions made as concerns the evolution of the productivity of the distribution; the productivity of the automobile retail business would have dropped by 0.12% on annual average from 2000 to 2006.

Methodology

Domestic market is obtained adding expenditure of resident units (households, enterprises and public administrations) in products (goods and services) related to renewable energy and improvement of energy efficiency (cf. list below).

Valuation is at purchaser's price without taxes on products. It means that in the case of goods (equipments and materials) distribution margins are included. In general they are separated. The same occurs with equipments' installation services (enterprises' investments and households' durable goods).

Products selected

Equipments for the production of renewable energy

- Equipments and installations for the production of wind power energy
- Equipments and installations for the production of solar photovoltaic energy
- Solar Water Heating systems (CESI, SCS, ECS col)
- Domestic heat pumps (except air – air systems)
- Wood heating domestic equipments (closed stoves, inserts, boilers and cookers)
- Wood based boilers for collective housing, industrial and tertiary sectors
- Equipments and installations for the production of geothermal energy (except heat pumps)
- Equipments and installations for the production of hydraulic energy (power < 10 MW
- Equipments and installations for the production of energy from organic matter fermentation (biogas)
- Equipments and installations for the production of renewable energy from the combustion of waste
- Equipments and installations for the production of bio fuels

Market renewable energy

Materials and equipments related to the improvement of energy efficiency

Residential sector

- Insulation materials,
- Windows with TH coefficient ≥ 8
- Insulating glazing with multiple walls
- ~ Interior insulation and roof insulation
- ~ Installation of windows with TH coefficient ≤ 8
- ~ Condensation boilers
- ~ Products electric household appliances of class A+ (refrigerators and washing machine)
- Low consumption lamps

Transport sector

- Classes A & B private cars
- Infrastructures and locomotives and rolling stock for railways and tramways

Products under consideration are in general complete systems, corresponding to a final use (final consumption or gross fixed capital formation). In some cases, when their market was judged of specific interest some intermediary products (components for wind mills, insulation materials and windows) where retained.

Domestic market, production and employment

Valuation of domestic market

a) Sales and installation of renewable energy equipments are followed by professional organisations (France wind power, AFPAC (heat pumps); Enerplan (solar thermal and photovoltaic), France hydro (small hydraulic) or are known through surveys and studies (sales of wood heating equipment, biogas...). Construction of units for bio fuels production was estimated on the basis of announcements made by firms and public administration. Estimates for geothermal is based on ADEME's information.

For some equipments (wood heating, heat pumps and solar thermal), data come from the following of taxes credits, made by Observ'ER. ERDF data give some information as concerns on grid equipments.

Estimates of installed capacities are generally expressed in physical units (MW, area …). They are then transformed in monetary value using unit prices coming from professional organisations, experts, etc. Prices used are purchaser's prices, including distribution margins.

For most markets the various components of the « installed price » are identified: equipment (basic price or custom price[90]), distribution margins, installation costs, including engineering and studies.

b) Energy sales

Quantities of renewable energy's sales are known from the following sources:

- DGEMP (General Directorate for Energy and raw materials) for the production of most renewable energy
- CRE (Commission for Electricity Regulation) for the purchases of renewable energy under the « purchase obligation » system.
- ADEME for the sales of energy from waste incineration and landfills' biogas

Other quantities (wood sales, small hydroelectricity, bio fuels …) are estimated from various sources. Those quantities are valued using unit prices from CRE, surveys on wood prices and available data on heat prices. Value of bio fuels is derived from the retail prices less taxes.

c) Improvement of dwellings' energy efficiency

The market is estimated on the basis of results of surveys made by SOFRES for ADEME and BIIS for OPEN (the permanent observatory of habitat improvement). Markets for materials (insulation material and windows) and works are both estimated. Other equipments contributing to energy efficiency (electro domestic, lamp, and efficient fuel heating systems) are based on professional organizations' data (GIFAM, GFCC and Lighting Union).

d) Improvement of transports' energy efficiency

Rail transports infrastructures, including for tramways were estimated through the recollection of existing projects. Manufacture of rail transport equipment's data comes from the FIF (federation of rail transport equipment manufacturers). Numbers of classes A &B private cars are given by the ADEME's publication « private cars in France ». Those numbers are multiplied by estimated prices in order to obtain the market.

Production

Goode and services the acquisition of which enters the domestic market are either produced domestically or imported. When they are imported the distribution margins and installation services are considered domestic production.

When they are domestically produced, the corresponding activity may export a part of its output. These exports are not accounted for in the domestic market.

For the various products there is an identity: « domestic market + exports = imports + domestic production ». More precisely in the case of equipments:

Output (producers' prices)
+ Imports (custom prices)
+ Distribution's margins
+ Installation services
=
Expenditure (purchaser's price except taxes on products – domestic market
+ Exports (custom prices)

Such an approach allows theoretically determining the domestic output corresponding to the domestic market and exports. However, whereas sales of equipments on the domestic market are generally well known, it is not the case for output and foreign trade. In most cases those equipments are not identified in economic classifications and therefore output and foreign trade data are only partial.

Estimates of output and foreign trade result from the analysis of existing data: production and customs statistics, firms' information or surveys.

Employment

[90] Corresponding to the "basic price" to which the production is measured in the national accounts and industrial production surveys

In this report, jobs are only « direct » jobs corresponding to the production activities, the output of which consists in the goods and services listed above. It means that “upstream” jobs are excluded; for example agricultural jobs are not accounted for in the bio fuels production. As far as possible they are measured as “full time equivalent” jobs.

Starting from the output, the calculation of employees is made using ratios. Production of equipments generally corresponds to a given NAF position; when it appears to be impossible to identity a NAF class, one uses the level immediately above. For the installation and distribution services one uses the construction and distribution NAF corresponding to the respective equipment. Finally for engendering services the NAF 742C is used.

The ratio is defined as [output/employee]. When possible output and not turn over was used and the ratio is calculated in “full time equivalent”. However employment and output data do not always allow to be sure that employment is in full time equivalent. Ratios are the following:

- Manufacture industry (Sessi) : output by number of employees
- Construction (Sesp) : output, excluding sub contracting by total number of wage and non wage workers (in full time equivalent)
- Distribution (Insee) : distribution margin by occupied person in full time equivalent
- Services (Insee) : turn over by occupied person (wage and non wage worker)

As concerns renewable energy production the employment is calculated only for market output. Finally jobs corresponding to non market and informal market fuel wood are excluded.

Ratios **used for the various markets**

	NAF rev. 1 / NES	M€ / employee
Renewable energy		
Wind power		
Equipments	FE2 Manufacture of mechanical equipments	0,180
	452V / FH1 General masonry works	
installation	453A / FH1 Electrical wiring works	0,088
	452T / FH1 Lifting works	
Engineering	742C / FN2 Engineering, technical studies	0,168
Solar photovoltaic		
Equipments	321C / FF6 Manufacture of active electronic components	0,222
Installation	453A / FH1 Electrical wiring works	0,097
Engineering	742C / FN2 Engineering, technical studies	0,168
Heat pumps		
Equipments	292F/ FE2 Manufacture of industrial ventilation and refrigerating equipments	0,184
Installation	453F / FH1 Installations of thermal and air conditioning equipments	0,105
Distribution	515J / FJ2 Wholesale trade of heating and plumbing materials	0,081
Geothermal		
Equipments	FE2 Manufacture of mechanical equipments	0,180
Construction	FH1 Construction	0,094
Solar thermal		
Equipments	297C / FC4 Manufacture of domestic non electric appliances	0,153
Installation	453F / FH1 Installations of thermal and air conditioning equipments	0,105
Small hydraulic		
Equipments	291A / FE2 Manufacture of engines and turbines	0,324
Civil works	452C / FH2 Civil engineering works	0,132
Engineering	742C / FN2 Engineering, technical studies	0,168
Waste incineration		
Equipments	291A / FE2 Manufacture of engines and turbines	0,324
installation	452B / FH1 Other buildings construction	0,137
Engineering	742C / FN2 Engineering, technical studies	0,168
Biogas		
Equipments	282C / FE2 Manufactures of tanks, reservoirs, metallic	0,126
installation	452B / FH1 Other buildings construction	0,137
Engineering	742C / FN2 Engineering, technical studies	0,168
Bio fuels		
Equipments	E23 / FE2 Manufacture of mechanical equipments	0,200
installation	452C / FH2 Civil engineering works	0,132
Engineering	742C / FN2 Engineering, technical studies	0,168

(1) For wood heating appliances results of the Algoé Blézar study were used

…/…

Ratios (following)

Renewable energy production	Employment related to energy production
Wind power	2 fte for 10 MW
Photovoltaic	Maintenance: 1 to 2 fte for 5 MW
Solar thermal	Maintenance: 0,5 fte for 1000 domestic installations
Heat pumps	Maintenance: 1 fte for 000 domestic installations
Fuel wood	Cf. Algoé study
Waste incineration	4,5 fte for one installation
Biogas	0,3 fte for each landfill ; 15 fte for each methanisation unit
Geothermal	10 fte for each installation
Small hydraulic	1,5 fte for each installation
Bio fuels	bio diesel : 2,9 fte by 1000 t ; bio ethanol 1,6 fte

IEE dwellings

Wall and roof insulation		
Insulation works	453C / FH1 Insulation works	0,114
Insulation materials	268C / FF1 Manufacture of non metallic mineral products 252A / FF4 Manufacture of plastic plates … 261G / FF1 Fibber glass manufacture	0,236
Material trade	515F / FJ2 Wholesale trade building materials	0,278
	524P / FJ3 Retail trade do-it-yourself materials	0,061
Roof insulation	452J / FH1 Roof construction 452L / FH1 Carpentry works	0,091
	Manufacture of insulation materials (cf. insulation materials)	0,236
	Distribution of materials (cf. insulation materials)	

Windows …		
Installation of windows	454C / FH1 Wood and plastic joinery 454D / FH1 Metallic joinery	0,097
Manufacture of windows	203Z / FF3 Manufacture of builder's carpentry and joinery 252E / FF4 Manufacture of builder's plastic components	0,164
Insulating glazing	261C / FF1 Shaping and processing of flat glass	0,151

Condensing boilers		
Equipments	282D / FE2 manufacture of central heating radiators and boilers	0,174
distribution	515J / FJ2 Wholesale trade of plumbing and heating materials	0,081
installation	453F/FH1 Installation of thermal and air conditioning equipments	0,105

Electric domestic appliances		
Equipments	297A / FC4 Manufacture of electric domestic appliances	0,169
Distribution	514F/ FJ2 Wholesale trade of electric domestic appliances	0,191
	524L / FJ3 Retail trade of electric domestic appliances	0,051

Ratios (end)

IEE transportation

infrastructures	***FH2***	
	451A Other earth works	0,128
	451B Large earth works	
	452C Civil engineering works	
	452N Construction of railways	

Rolling stock	352Z / FE1 Manufacture of railway and tramway locomotives and rolling stock	0,243

Private cars		
Manufacture	341Z / ED Manufacture of muter vehicles	0,473
Distribution	501Z / FJ1 Trade of motor vehicles	0,050

Changes in productivity

Changes in productivity during the 2006 - 2012 period were calculated using 2000 -2006 trends (national accounts data)

	Changes in the ratio output / employees (2000 – 2006)	Average rate of change
FC4	Domestic appliances manufacture	3,6%
ED	Manufacture of motor vehicles	0,8%
EE	Manufacture of investment goods	3,3%
FE1	Manufacture of other transport equipment	4,5%
FE2	Manufacture of mechanic investment goods	3,5%
FE3	Manufacture of electrical and electronic instruments	1,9%
EF	Manufacture of intermediary products	2,3%
FF1	Manufacture of minerals products	3,3%
FF2	Manufacture of textile	3,3%
FF3	Manufacture of wood and paper products	1,7%
FF4	Manufacture of chemicals, rubber and plastics products	1,3%
FF5	Manufacture and transformation of metals	1,6%
FF6	Manufacture of electric and electronic components	4,2%
FH1	Construction	0,5%
FH2	Civil works	0,8%
FJ1	Trade and repair of motor vehicles	-0,1%
FJ2	Wholesale trade	0,8%
FJ3	Retail trade and repair	1,3%
FN2	Studies and assistance	2,0%

Link with domains are indicated in the previous table

Indirect employment

In some parts this publication contains estimates of indirect employment, limited to “first range” upstream employment. There is neither overall calculation of « total indirect » employment, nor macroeconomics effects of energy savings on demand.

For each activity the intermediate consumption corresponding to the output is calculated and distributed between classes of products using the input output table. Employment corresponding to these intermediate consumptions is then calculated using ratios.

Example: solar thermal (NAF rev1 297C, NES FC4)

			Output/ employee	Direct employment
Output 2006 (M€)		**161,3**	0,153	**1 055**
Intermediate consumption ratio 67%	**IC**	**107,5**		

Intermediate consumption distribution (NES FC4)			Output/ employee	Indirect employment
Distribution margin	3,4%	**5,6**	99,2	57
Imported products	13,0%	**21,5**	so	
Taxes	2,1%	**3,6**	so	
Domestic products				
GA GB	0,1%	**0,1**	124,7	1
GC 11 -32	0,2%	**0,3**	221,3	1
GC 41 –GE	9,7%	**16,0**	252,1	63
GF	16,4%	**27,1**	220,2	123
GG GH	1,6%	**2,6**	142,9	18
GJ -	18,6%	**30,7**	98,3	313
Total IC	65,0%	**107,5**		**576**
		Indirect / direct		**55%**

Results: ratio of indirect / direct employment (%)

2007	NAF rev. 1 / NES	indirect employment	
		%	Number 2007
Equipments and installations for the production of renewable energy		**36%**	**12 149**
Wind power		***34%***	***2 400***
Components	FE2 Manufacture of mechanical equipments goods	**60%**	1 366
installation	452V General masonry works	**18%**	708
	453A Electrical wiring works		
	452T Lifting works		
Engineering	742C Engineering, technical studies	**42%**	326
Photovoltaic		***35%***	***711***
Equipments	321C Manufacture of active electronic components	**40%**	517
Installation	453A Electrical wiring works	**18%**	120
Engineering	742C Engineering, technical studies	**42%**	74
Wood heating appliances		***32%***	***4 524***
Heat pumps		***35%***	***1 478***
Equipments	292F Manufacture of industrial ventilation and refrigerating equipments	**46%**	568
installation	453F Installations of thermal and air conditioning equipments	**31%**	727
distribution	515J Wholesale trade of heating and plumbing materials	**25%**	183
Geothermal		***38%***	***84***
Equipments	FE2 Manufacture of mechanical equipments goods	**60%**	50
Construction	H01 Construction	**24%**	34

Solar thermal		***43%***	***1 036***
Equipments	297C Manufacture of domestic non electric appliances	**55%**	745
installation	453F Installations of thermal and air conditioning equipments	**31%**	292
Small hydraulic		***53%***	***176***
Equipments	291A Manufacture of engines and turbines	**50%**	40
Civil Works	452C Civil engineering works	**58%**	110
Engineering	742C Engineering, technical studies	**42%**	25
Waste incineration		***67%***	***148***
Equipments	291A Manufacture of engines and turbines	**74%**	101
installation	452B Other buildings construction	**67%**	32
Engineering	742C Engineering, technical studies	**42%**	14
Biogas		***57%***	***354***
Equipments	282C Manufactures of tanks, reservoirs, metallic	**47%**	77
installation	452B Other buildings construction	**67%**	232
Engineering	742C Engineering, technical studies	**42%**	45
Bio fuels		***55%***	***1 238***
Equipments	E23 Manufacture of mechanical equipments	**60%**	702
installation	452C Civil engineering works	**58%**	304
Engineering	742C Engineering, technical studies	**42%**	232
Renewable energy production (bio fuels: agricultural employment …)		**212%**	**7 807**
IEE Dwellings		**29%**	**25 339**
Wall and roof insulation		***24%***	***7 169***
Walls insulation works	453C Insulation works	**25%**	2 368
Materials	268C Manufacture of non metallic mineral products	**77%**	1 133
	252A Manufacture of plastic plates …		
	261G Fibber glass manufacture		
Materials distribution	515F Wholesale trade building materials	**16%**	314
	524P Retail trade do-it-yourself materials		
Roof insulation works	452J Roof construction	19%	3 121
	452L Carpentry works		
	Manufacture of insulation materials (cf. insulation materials)	**77%**	201
	Distribution of materials (cf. insulation materials)	**16%**	32
Windows …		***30%***	***14 581***
Installation	45.4C Wood and plastic joinery	**23%**	8 037
	45.4D Metallic joinery		
Manufacture of windows	203Z Manufacture of builder's carpentry and joinery	**57%**	6 544
	252E Manufacture of builder's plastic components		
Condensing boilers		**32%**	**2 221**
Equipments	282D Manufacture of central heating radiators and boilers	**56%**	899
Distribution	515J Wholesale trade of plumbing and heating materials	**25%**	726
Installation	453F Installation of heating and air conditioning appliances	**24%**	596
Electric domestic appliances		**38%**	**1 368**
Equipments	297A Manufacture of electric domestic appliances	**66%**	756
Distribution	514F Wholesale of electric domestic appliances	**25%**	612
	524L Retail trade of electric domestic appliances		

IEE transports		**66%**	**44 108**
Infrastructures	451A Other earth works 451B Large earth works 452C Civil engineering works 452N Construction of railways	**35%**	12 229
Equipments	352Z manufacture of railway and tramway locomotives and rolling stock	**82%**	12 356
Private cars			
Equipments	341Z Manufacture of motor vehicles	**163%**	17 650
Distribution	501Z trade of motor vehicles	**23%**	1 873
Total		**41%**	**89 403**

Extra cost and related employment

As far as improvement of energy efficiency is concerned the « energy efficient » products (equipments and works) substitute in most case « standard - less efficient » products that offer the same service, except as concerns energy efficiency. For example the purpose of a condensing boiler or a solar water heater is primarily heating, as for standard boiler or electric water heater.

The only difference is that generally there is an extra cost. This « extra cost » notion is important in order to assess, from the consumer's point of view[91] the « rate of return » of the equipment in relation with the energy savings. It also explains the « taxes credit » incentives.

Extra cost provides an alternative valuation of the markets. However we need a standard reference product and with time passing the efficient product may become the standard product (e.g. compact fluorescent lamps).

The report made some attempts in this direction. Table below gives for each market the standard product and an estimate of the extra cost for the efficient product[92].

Improvement of energy efficiency in the residential sector.

- Wall insulation works: extra-cost does not apply. The purpose of insulation work is always to improve energy efficiency.
- Roof insulation: generally roof insulation is made in parallel with roof refection. Extra-cost (insulation) estimate in relation with the cost of roof refection is 19%.
- Windows: extra-cost corresponds to the difference between standard windows (defined by their TH coefficient < 8) and energy efficient windows (TH ≥ 8); estimate of the extra cost is 36% of the cost of works.
- Heating: the standard product is the « standard » boiler; extra cost is 38%.
- Electro domestic appliances: the market is defined as appliances belonging to energy efficiency class A+; extra-cost estimate in relation with appliances belonging to inferior classes is 26%.
- Compact fluorescent lamps in relation to incandescent lamp.

	Extra cost %	**Amount**
IEE Residential sector	**43%**	**4 479**
Wall and roof insulation	***74%***	***2 454***
Wall insulation; materials and works	100%	1 199
Roof insulation works	**19%**	283
Roof insulation materials	100%	125

91 Without taking into account the social benefit related to the reduction of the emissions of CO_2, to the reduction of petroleum products imports, etc.

92 In the case of energy efficiency in the residential sector, the over costs are estimated starting from the results of OPEN and study ICE ARENA Ile de France (diagnosis and perspectives of the activities and employment in the sectors of energy efficiency and the ENR in Ile de France). The percentage of over cost is defined as: (cost of the performing - cost of the basic solution) / cost of the performing solution.

Windows	***36%***	**1 513**
Windows installation	5%	190
Manufacture of windows	59%	1 257
Insulation glazing	25%	66
Condensing boilers	**38%**	237
Domestic electric appliances	**26%**	129
Compact fluorescent lamps	**88%**	**145**

Domestic renewable energy equipments

For heat pumps extra cost estimate, in relation to a fuel or gas boiler is 50% (9000 € vs. 4500 €). For solar water heater extra cost in relation to electric water heater is 80% (4000 € vs. 800 €). For wood heating appliances comparisons are difficult, these appliances being generally a complement to a principal heating. Comparison is made with an electric radiator. A 2/3 extra cost is retained (1500 € vs. 500 €).

	Extra cost %	**Amount**
Renewable energy domestic heating	**63%**	**1 768**
Wood heating appliances	66%	1 260
Heat pumps	50%	243
Solar water heater	80%	265

No extra cost is applied for the equipments intended to produce market renewable energy. In the case of bio fuels extra cost is given by their partial detaxation (estimate is 540 millions euros for the year 2007). In the case of electricity from renewable sources estimate is based on the « compensation for the charges of the electricity public service – CSPE"- (estimate is 100 millions euros for the year 2007).

Improvement of energy efficiency in the transportation sector

Extra cost was not applied.

In the case of private cars pertaining to classes A and B there is no estimate of the extra cost; energy efficiency results mainly from the fact that their motor power is smaller.

In the case of railways and tramways transportation as far as they are market activities there is no extra cost for the investments. Extra cost would only apply to the transport services; these are not valued in this report.

A « supplementary » production corresponds to the extra cost, depending upon the imports and exports of equipments. In the case of exports, it was considered that exports should not be valued by the extra cost but by the total value.

The estimate of the « supplementary » production, corresponding to extra cost is the following:

IEE residential sector: extra cost (domestic market): 4 478 M€; corresponding supplementary production:

Distribution	766
Installation	1 769
Manufacture	2 032
Total	4 567

Domestic renewable energy heating appliances; extra cost (domestic market): 1 768 M€; corresponding supplementary production:

Distribution	420
Installation	669
Manufacture	716
Total	1 805

One may calculate the employment related to the supplementary production. The calculation uses the same ratios than for direct employment, where production is restricted to the supplementary production.

When for the relevant domains only « supplementary jobs » are taken into account, the employment result is the following

IEE residential sector	26 920
Domestic renewable energy heating appliances	11 195
Other renewable energy	12 672
IEE transport sector	49 830
Renewable energy sales	18 330
Total	**118 948**

However this estimate should not be taken as real "supplementary" jobs related to renewable energy and energy efficiency improvement. As a consequence of the incremental expenditure in these domains demand is lower in other domains; for example budgetary resources allocated to support these markets are not available for other activities. Conversely the benefits of energy savings are not taken into account.

Projections

Grenelle's documents have fixed objectives for the year 2020, with an intermediate step in 2012. These objectives describe the installed power for the production of renewable energy, decrease of energy consumption, development of collective transports, etc. For each market the projections are based on these objectives. These projections are not forecasting. They constitute a benchmarking in order to determine whether in following years markets are in line with objectives.

As concerns renewable energy the 2012 projections strictly follow Grenelle's objectives, either for power capacity or produced energy. The pathway between 2007 and 2012 takes into account the programmes and projects which have already been identified (new ADEME's wood – energy programme, last competitive bidding in the biomass domain, bio fuels projects, etc. …)

As concerns energy efficiency improvement in the residential sector, projections are based on the Grenelle's programming for existing habitat. During the 2007 – 2012 period the increase in the value of insulation works and heating efficiency is estimated in 8,6 billions euros (constant 2007 prices), which means a 17% per year growth rate. These objectives are expressed according to the OPEN typology of works. A first hypothesis is the generalisation of energy efficient windows. The second one is the 19% per year trend of growth of insulation works, which could correspond to the progresses of outdoor insulation and heavy rehabilitation. Percentage of energy efficient appliances within households' purchases follows a logistic model, established on 2000 -2006 trends.

% of energy efficient equipments

	2007	2012	Reference period
Condensing boilers	8%	80%	2003-2007
Private cars : classes A & B	20%	37%	2002-2007
Refrigerators A+	19%	70%	2002-2007
Washing machines A+	23%	85%	2002-2007

Projections of railways and tramways infrastructures were established on the basis of identified projects: 40 projects for tramways and 55 projects for railways, the realization of which tales place during the 2006 – 2012 period. Sales of rolling stock follow the infrastructures projects.

Prices, productivity and employment analysis

For the calculation of employment during the year 2007 one takes into account the changes in labour productivity. Furthermore it is necessary to introduce changes in prices, so that changes in prices do not result in changes in employment.

The results of analysis of markets' changes between volume and price, as well as the consequences on employment are presented below for the main domains. In first analysis changes in employment are deemed to result from the difference between changes in volume and change in labour productivity.

	2 006	2 007	change
Market at current prices M€	28 600	33 500	17,2%
Imports M€	2 800	3 800	33,3%
Output at current prices M€	25 800	29 700	15,4%
Prices change	1,000	1,033	3,3%
Output at 2006 prices M€	25 800	28 800	11,8%
Output / employee (M€ by fte)	0,126	0,130	3,5%
Employment	205 100	221 500	8,0%

Equipments for renewable energy production

	2 006	2 007	change
Market at current prices M€	5 300	5 900	11,8%
Imports M€	900	1 100	16,9%
Output at current prices M€	4 300	4 800	10,7%
Prices change	1,000	1,048	4,8%
Output at 2006 prices M€	4 300	4 600	5,5%
Output / employee (M€ by fte)	0,130	0,135	3,5%
Employment	33 300	34 000	1,9%

Market renewable energy

	2 006	2 007	changes
Market at current prices M€	2 500	3 500	41,2%
Imports M€	0	200	
Output at current prices M€	2 500	3 300	32,1%
Prices change	1,000	1,016	1,6%
Output at 2006 prices M€	2 500	3 200	30,0%
Output / employee (M€ by fte)	0,151	0,176	16,2%
Employment	16 400	18 300	11,9%

Improvement of energy efficiency dwellings

	2 006	2 007	changes
Market at current prices M€	8 400	9 100	8,6%
Imports M€	490	540	10,5%
Output at current prices M€	7 900	8 500	8,4%
Prices change	1,000	1,034	3,4%
Output at 2006 prices M€	7 900	8 300	4,8%
Output / employee (M€ by fte)	0,082	0,084	1,8%
Employment	95 700	98 500	3,0%

Improvement of energy efficiency transport

	2 006	2 007	changes
Market at current prices M€	12 500	15 000	20%
Imports M€	1 400	1 900	36%
Output at current prices M€	11 100	13 100	19%
Prices change	1,000	1,030	3%
Output at 2006 prices M€	11 100	12 700	15%
Output / employee (M€ by fte)	0,187	0,183	-2%
Employment	59 300	69 500	18%

Changes in output / employee ratio include effects of the changes in the repartition of the various products in the overall aggregates

For example in the IEE for the transport domain there is a 2% decrease of the average labour productivity, whereas labour productivity increases for each activity. Explanation is that the growth of the manufacture of cars, the labour productivity of which is higher than in other activities, is lower than the growth of these other activities.

Conversely for the renewable energy production, the two activities the labour productivity of which is the highest (wind power and bio fuels) are those that experiment the highest growth. Therefore the average labour productivity for this group increases strongly.

When it was not possible to collect data about prices changes, national accounts data for the respective industries were retained. In some cases prices changes include a “quality effect”, due to the improvement of

equipments (e.g. increasing percentage of « Flamme verte » label within wood heating domestic appliances). As far as possible these effects were eliminated.

Energy savings calculation

Amounts of energy savings for « standard energy efficiency improvement operations » are available (see DGEMP: http://www.industrie.gouv.fr/energie/developp/econo/f1e_eco.htm « energy savings certificates ».

The method used consists in multiplying these standards amounts by the quantities of operations expressed in the convenient physical unit.

These amounts vary according to several parameters: climatic zone, surface area and type of accommodation (flat, house), type of heating, etc.). In order to rigorously the energy savings it would be necessary to have the detailed distribution of the operations according to these parameters.

Such a detailed description does not exist and for the calculation of energy savings average amounts were used[93]. These average amounts were determined for each operation on the basis of the general distribution of accommodations given by the SOFRES surveys (distribution by climatic zone, type of accommodation, etc.)

Example: windows substitution. The distribution is the following:

	Heating energy		
Climatic zone	Electricity	Fuel	Total
H1	24%	36%	60%
H2	12%	17%	29%
H3	4%	7%	11%
Total	40%	60%	100%

These percentages are applied to the respective amounts of the certificates in order to obtain the average amount for the operation “windows substitution”.

Amount of certificates (kWh cumac by m^2

	Heating energy	
Climatic zone	Electricity	Fuel
H1	1 700	2 700
H2	1 400	2 200
H3	900	1 500

The average amount expressed in « kWh cumac” is 2064 kWh / m^2. This amount corresponds to energy savings during the whole life of the windows, including an actualisation rate. Corresponding annual energy savings are calculated (106 kWh/m^2/year) and multiplied by the number of m^2.

NB In some cases SOFRES’ data do not allow to distribute the operations according to the parameters of the « energy saving certificates ». In these an equal distribution hypothesis is made. When the surface area of accommodation is a parameter, an average surface area is retained (category 80 -130 m^2; 4 to 5 rooms).

For class A+ domestic electric appliances the amounts of the certificate is directly used. For compact fluorescent lamps the amount used is slightly lower than the amount of the standard operation BAR–EQ-01 in order to tale into account the average lamp power (see the respective sheet).

For private cars energy savings were calculated starting from the consumption difference between classes A & B vehicles and other vehicles. For year 2007, average emissions of classes A & B cars are 109.7 grCO_2/km for gasoline cars and 117.4 gr. CO_2/km for diesel cars. They respectively amount to 158,4 and 156.4 for the classes C & + cars; average mileages are those given by the ADEME’s leaflet “private cars in France”

For tramways, the energy savings are obtained multiplying the difference in energy consumption between tramways and private cars (cf. the ADEME Deloitte 2007 study), that is to say 5,9 ktoe for a billion passenger –kilometres by tramway and 56 ktoe for a billion passenger – kilometres by private car.

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93 The annual saving is calculated using the reverse of the present value calculation, taking into account the lifespan and of the actualization rate (4%).

GLOSSARY

Aerogenerator

An aerogenerator is a complete system able to convert wind (mechanical) energy to electric energy. The most common aerogenerators are made with a horizontal axis. They are composed of a mast, of a rotor (composed of two or three blades) and of a spatial engine. To describe an ensemble of aerogenerators, it is generally used the term “wind farm”.

Agricultural biomass

Bio combustibles from agricultural biomass are all the energy products coming from this biomass (heat, electricity…). They may be classified in two sub-categories: combustibles based on triticale cultures: barley, hemp, kenaf, miscanthus… combustible based on co-products: oilseeds or cereal straw.

Alcoholic ether – (bio) ETBE Ethanol

Alcohols are bio fuels used in variable proportions mixes with lead free petrol (ethanol, methanol) either as additives (less than 5% of the mixture), or as components (≥ 5% of mixture) or as total fuel (100%). Their ethers are used in variable proportions in lead free petrol (ETBE) or diesel (DME). The ethanol, alcohol used in their composition is obtained by fermentation of starch cultures (wheat, corn, potatoes…), saccharinous cultures (beets, sugar cane…)… by hydrolysis and fermentation of lignocelluloses compounds (grass, wood, etc.). The ETBE is obtained by a reaction between ethanol and isobutene. Methanol is obtained starting from gas of synthesis after a stage of lignocelluloses gasification of biomass. Finally, the DME is made by dehydration of methanol.

ANAH – National Agency for Improvement of Housing

BBC – Low consumption buildings

These are buildings with a very high energy performance level and foreshadowing the average future constructions with an energy performance index of about 50kWh/m^2, placing them in Class A as energy efficiency classes of the energy performance diagnosis (DPE). A specific label characterises new construction reaching this performance.

Bio combustibles

Bio combustibles are all solid combustibles from vegetal origin allowing production of energy (electricity and heat). One separates agricultural bio combustibles and forest bio combustibles.

Bio fuels

Bio fuels use any solid matter, liquid or gas of vegetable or animal origin for purpose of transport. The liquid or gas forms are obtained from solids ones by extraction (for example oil or grease) or by the transformation of biomass (for example thermo conversion). There exist two types of bio fuels produced starting from the agricultural or forest biomass, or their co products: oils and their esters, alcohols and their ethers.

Biogas

Gas which results from a process of biological degradation of organic matter in the absence of oxygen. It is produced in the waste landfills or in methanisation plants. To prevent increasing the green house effect and the creation of smell pollutions, it is often burned using a flam. It can also be used as an energy substitute for fossil energy.

Briquette

A bio combustible obtained by the same procedure as the pellets but of larger dimension: .diameter from 20 to 100 mm – length from 30 to 300 mm.

Business investment

In this note, the acquisition by firms of equipment for the production of renewable energy destined for sale or auto-consumption, the realization of railway infrastructures (excluding tramways financed by local administrations) and the acquisition of railway material (including tramways.

CAH – Club for the improvement of Housing

Association which now includes about 30 members, representing the housing renovation network: public organisms, professional federations, building enterprises, foremen, building materials distributors and manufacturers, providers of energy, banking establishments.

CEE: Energy savings certificates

The principle of energy savings certificates is based on an obligation to realise energy savings imposed by Public authorities for a given period to energy providers (electricity, gas, heat, refrigeration and domestic fuel) such as EDF, Gaz de France, heating networks such as CPCU. As a compensation of investments made by consumers thanks to their actions, providers of energy receive certificates on the basis of forfeits in kWh calculated according to the kind of action.

CESI – Individual Solar Water Heater

A CESI is an appliance for domestic use, made in a factory, which converts directly solar rays to heat only for the production of sanitary hot water. The thermal conversion is accomplished by one or several solar captors with liquid circulation.

Closed hearth

Independent wood based heating appliance equipped with at least one glazed pane, intended for a new chimney and for which a lagging is selected (stone, wood…) In addition there can be a system for the distribution of hot air. The glazed pane can be hinged upwards.

Coefficient Ug

The coefficient Ug characterizes the insulation efficiency of glazing; the lower the coefficient is, the better the thermal efficiency is.

Combined Solar System (CSS)

An installation using sun radiation for heating and sanitary hot water

COMOP Operational Committee (of Grenelle)

Compensation for Cost of the Public Service of Electricity

The made obligation at EDF and the local operators of distribution to buy the electricity of renewable origin to the prices fixed by the Public authorities generally results, in an over cost compared to the market price of electricity. This over cost is the object, jointly with the costs due to the other obligations of the public service of electricity, of a compensation calculated every year by the Commission of Regulation of the energy and paid for by the consumers

CRE: Commission for Energy markets Regulation

Cumac

"KWh cumac" is the unit of energy saving accounted for in kWh of final energy, cumulated over the lifespan of action and actualised to present time. The actualization's rate, fixed at 4%, is at the same time financial (because the CEE has an economic value) and technique (improvement of the reference in time, therefore progressive depreciation of the saving).

DGEMP

General direction of energy and primary material

Direct employment

Herein it means employment obtained by dividing of value of the production by the ratio of production/employment (in full time equivalent) of the activity described (an activity producing goods and services contributing to the markets studied here).

Domestic market

The sum of final domestic uses: expenditure by households for goods and services acquisition, formation of capital by corporations or local administrations. The market is evaluated without including the TVA or other taxes on products

ECS: sanitary hot water

EMHV – Ester Methyl of Vegetable Oil (cf. Ester Oil)

Energetic Performance of a Building

The quantity of energy actually consumed or so estimated to meet the various needs linked to the standard utilisation of the building. This may include, among others, heating, hot water, air conditioning, ventilation.

Energy efficiency

Energy yield of a process or machinery with respect to its supply of energy. For a household appliance, for example, a good energy efficiency would be defined as a lower consummation than the energy supplied.

Energy Intensity

The relationship between energy consumption and GDP; it represents the quantity of energy needed to produce a unit of GDP. The purpose is to diminish the energy intensity which would correspond to an increase in energy efficiency.

ENR – Renewable energy

Energy produced by various natural procedures (solar radiation, wind, wood, waterfalls, etc.). Contrary to fossil energy, the EnR are inexhaustible and emit no – or less - green house gases.

Ester Oil (EMHV)

Plant oils and their esters (EMHV) are bio fuels used in variable proportions in the diesel, either as additives (less than 5% of the mixture), or as components (≥ 5% of the mixture), or entirely (100%). Plant oils come from oleaginous cultures. The esters which are similar are obtained by etherification of oils with an alcohol (methanol). In this report: bio diesel

ETBE cf. Ether Alcohol

Extra cost

Surveys concerning households' expenditure for the improvement of their dwelling show that many of that expenditure may have an objective, a motivation which is not linked to the improvement of energy efficiency. For example: the replacement of the heating system at the end of its life, the repair of the roof or the purchase of a refrigerator does not necessarily reflect an

improvement of energy efficiency. When an action translates into the improvement of energy efficiency, one calls extra costs (or over cost) the additional expenditure, if any, relative to an action of similar characteristics, offering the same service and/or the same utility for the buyer but not improving the energy performance: acquisition of a refrigerator of a class lower than A+, repair of the roof without insulation, acquisition of a new, but "normal" heating system.

Factor 4

The objective is to divide by 4 the gas emissions between today and 2050 based on the figures in 1990 for the industrialized countries in order to limit climate change to less than 2 °C

Flam

It is a high chimney-like Installation which insures the permanent combustion of landfills biogas, when landfills are not developed for energy production, in order to limit the emissions of green house gases into the atmosphere and the propagation of unpleasant odours.

Forest biomass

Bio combustibles originating from forest biomass encompass all the energy production resulting from this biomass valorisation (production of heat, of electricity). They can be separated into three sub-groups: combustibles based on cultures specifically designed to produce energy: coppice with short or very short rotation of willows, eucalypti or poplars… combustible from by-products: granulated, combustible sawdust… combustibles from remanent: plates, logs

Fuel wood

Logs of various sizes used for house heating and less often for heating small administrations (schools, old people residences…)

Full time equivalent employment

The total number of hours of work divided by the yearly average of hours worked for full time employees in the domestic economy

Geothermal Energy

Energy extracted from hot water or hot water vapour found in certain zones

Grenelle

Grenelle de l'environnement is the name of the process that brings together the Public Administration and the representatives of the civil society, in order to define the roadmap towards sustainable development.

GWh

Abbreviation for giga watt hour (giga = 10^9)

Heating network

An installation comprising a heating system providing heat though heat transport canalisations to various customers, of whom at least one is the not the owner of the heating system.

High Energy Performance 2005 and Very High Energy Performance 2005 (HPE 2005 and THPE 2005)

Put into place by ordinance on May 8 2007, these labels are attributed by certification bodies to construction projects whose conventional consumption of energy is lower by 10% (HPE) and of 20% (THPE) to the guiding value required by the RT 2005

Household expenditure

In this report, households expenditure for the acquisition of domestic heating systems based on renewable sources (solar, thermal, wood-based and heating pumps), for the improvement of energy efficiency in houses (insulation, replacement of windows, acquisition of condensing boilers and other high-grade energy equipment as well as vehicles of class A and B.

Hybrid car

Car equipped with a double energy system (for example: the classic fuel and electricity may be used, simultaneously or not, to assure the energy for the motorisation of the car)

Indirect employment of the first rank

This note considers indirect employment of the first rank as employment linked to intermediary consumption produced nationally, of the activities which produce goods and services contributing to the markets studied here (cf. methodology). Indirect employment of the first rank is weaker than the total indirect employment obtained by inverting the input output matrix

Insert

An insert is a closed hearth which settles obligatorily in an existing open chimney. An addition of a hot air system can also be added.

Investment by local administrations

In this note, investment by local administrations is limited to investment in railway infrastructures for tramways.

Labels of energy efficiency Classes

The labels of energy efficiency classes are used to indicate the energetic consumption of an apparatus. They are compulsory on all household appliances. Classes go from the letter A (appliance very energy saver) to the letter G. Since a short while, this label is also applied to private cars. Compulsory label notice exists in France since 1995.

Low consumption lamps

Electric light bulbs whose energy is produced by a gas discharge producing the same lighting as a normal bulb while consuming 4 times less electricity. (Fluo compact lamps)

Markets

In this note markets concern the domestic market (utilisation by resident units, for their consumption or formation of capital) plus exports

Methanisation

The transformation of organic matter by anaerobic fermentation (without oxygen) and digestion. Methanisation leads to production:

- of biogas, primarily made of methane
- of a digestat usable raw or after treatment as compost. Methanisation concerns more particularly the organic waste rich in water and with high fermentation power: fermentable fraction of households waste, sludge from waste water treatment plants, grease and sewage matter.

Mtoe – Millions of tonnes of equivalent petrol

MWh

Abbreviation of mega watt hour (mega = 10^6).1 MWh = 0.086 toe except for geothermal energy (1 MWh = 0.86 toe)

Opaque Walls

In descriptions of the insulation work, opaque walls designate walls, ceilings, attics, floors, as opposed to openings. Insulation of roofs from the exterior is not included.

PAC – heat pump

A device or installation which draws out from the air, water or the ground, low temperature heat to provide it to a building. There are several types, which draw heat either from the air (aerothermal pumps), or from the ground or the water of the ground water (geothermal pumps).

Passive buildings (BEPAS)

A “passive building” is designed so as to minimise thermal loss and uses utilise in optimal fashion the energy supplied by the sun.

Pellets

Bio combustibles manufactured by compaction of the sawdust, and possibly of the chips or other by-products of the industry of wood. Cut: diameter of 6 mm, length of 15 mm.

Photovoltaic cells

A photovoltaic cell is a basic photovoltaic device which generates electricity, when it is exposed to the solar radiation. The use of the terminology solar cell or photo pile is not encouraged.

Photovoltaic energy

Renewable energy using the radiation of the sun to produce electricity

Photovoltaic modules

The smallest assemblage of photovoltaic cells completely interconnected and protected from the environment. (Avoid saying solar module or solar panel to avoid confusion with thermal solar)

Photovoltaic panels

A group of modules attached together, pre-assembled and interconnected, intended to be incorporated in a field and/or a sub-field

Photovoltaic system

A group of components and sub-systems used to convert solar radiation into electric energy

Plan Climat

A programme of actions by the French government established in 2004 and revised in 2006, with the aim of reducing green house gas emissions in order to respect or go beyond the French objective defined by the Kyoto Protocol to stabilise such emissions to the 1990 level during the period 2008-2012

Plaquettes

Fragments or slices of wood resulting from the wood industry, the exploitation of forests, coppices, obtained from direct cutting by the knives of a shredder.

Poly-Cristallin Silicium (pc-Si)

A material used for the fabrication of photovoltaic cells, of a width between 10µm and 30µm laid on a separate substratum with a size of grains from 1 µm to 1 mm (term often used, falsely, to designate multi-cristallin).

Positive energy building (BEPOS)

Building whose design is such as it produces more energy than it consumes. These buildings, very strongly isolated from a thermal point of view and provided with the most sparing equipments, function without heating system or without heating systems using fossil fuels. They produce energy, generally by means of photovoltaic equipment connected to the electrical grid, in quantity higher than their needs.

Primary Energy

Primary energy is the energy total final consumption plus the energy consumption necessary to the production of final energy. It makes it possible to measure the national rate of energy independence and also to add between them consumptions of different energies. It represents 275.3 Mtoe in 2006. For fuels, and by convention, one considers the same value in primary energy and final energy. For electricity, 1 kWh in final energy is equivalent to 2.58 kWh in primary energy.

Reference Price for Electricity

The law of February 10, 2000 lays out that the costs avoided by EDF through the purchase of renewable energy in metropolitan France are valued by reference to the price of electricity in the market. For each quarter, the CRE takes as its reference for the calculation of the avoided cost the price for a term contract of the French energy market, Powernext. Quarterly price corresponds to the average for the three previous months.

Residential Housing

Residential housing (individual homes, collective housing, etc.)

RT2005 – Thermal regulation 2005

The thermal regulation relative to new buildings was published in May 24, 2006 and is applicable as of September 1, 2006. It reinforces the principles of RT 2000 with requirements higher to about 15% and improves the measures concerning renewable energy. The requirements of the energetic regulations applicable to new construction will be reinforced at intervals of 5 years as anticipated in the Climate Plan and in conformity with the European Directive for Energetic Performance in Buildings (DEPEB). In 2020, successive reinforcements will led to a reduction of 40%¨relative to the requirements of 2000.

Sesp Formally the Service of Studies, Statistics and Prospective of the Minister of Transport and Civil works

In the framework of a new organisation of its administration, the MEEDDAT decided to bring together those services dealing with the functions of statistical observation and information. The SESP, the Ifen and the Observatoire de l'Energie now constitute the Service of observation and statistics (SOeS)

Sessi (Service of industrial studies and statistics)

The Sessi is the statistical service, of national scope, attached to the Director General of Enterprises of the Ministry of Economy, Industry and Employment

SOeS

Attached to the General Commissariat for Sustainable Development, the SOeS, since July 10, 2008, is responsible for the statistics in the domains of environment, energy, construction, housing and transport

Solar Thermal

Solar thermal allows the production of heat (at low, medium or high temperature). The most frequent applications are those concerning building, such as the production of sanitary hot water. The conversion of sun radiation to heat is achieved thanks to a thermal solar collector.

Solar thermal collector

Generally made of a glazed rigid chest, containing a black plate and metal tubes (absorber) receiving the solar radiation and heating a liquid coolant (antifreeze). Some of these, conceived to be assembled on building site are provided in spare parts. When they are integrated or incorporated in roof, the collectors also provide a function of cover of the building.

Standard Solution

In this note, the solution that does not offer an improvement of energy efficiency or an improvement inferior to the solution retained. The standard solutions are susceptible to evolve with time, in particular due to new regulations

Tertiary buildings

Buildings used for tertiary sector activities (commerce, offices, teaching, health, cafes/hotels/restaurants, etc.

TH

Double-glazed glass, carpentry, windows and their finishing receive certificates according, in particular for their thermal performances:.

The class of thermal insulation is indicated by: Th 4 to Th10

Class	Coefficient Uw* ($Wm^2K°$)
Th4	3.2 ≥ Uw >2.9
Th5	2.9 ≥ Uw >2.5
Th6	2.5 ≥ Uw >2.2
Th7	2.2 ≥ Uw >2.0
Th8	2.0 ≥ Uw >1.8
Th9	1.8 ≥ Uw >1.6
Th10	1.6 ≥ Uw

* Uw is the coefficient of surface thermal transmission of the window; it takes into account the performances of the joinery and glazing (as well as connection between the glazing and joinery)

The Green Flame

All domestic wood based heating appliances which respect the French and/or European standards (EN 13 229. EN 13 240, EN 12815, NF 35376), benefit from an energy efficiency superior to or equal to 65 %. The label “Green Flame” is attributed to appliances having a production above or equal to 65% but also excellent performance with regard to the environment.

THPE 2005 and HPE 2005 – Very high energy performance 2005 and high energy performance 2005

Put into effect par the bill of May 8, 2007, they are attributed by the organisms responsible for giving the certificates to construction projects whose conventional consumption of energy is lower than 10% (HPE) and 20% (THPE) than the value legally ascribed by RT 2005

Thermal insulation

All measures implemented in a building to reduce the exchange of heat with the exterior

TOE – Ton of oil equivalent

Toe is a conventional unit which permits the realisation of energy balance sheet for multi-energy systems with petrol as the equivalent reference. By definition, the value is 41.868 Giga joule (GJ) corresponding to the calorific value of a ton of crude oil.

TWh – Tera Watt Hour

Abbreviation of tera watt hour (tera = 10^{12})

Ug (see: coefficient Ug

UIOM – Incineration plant for households’ waste

Plants able to produce of electricity and/or provide heat to a heating network

Uw (see TH)

Wood-Energy

Wood used as combustible to heat various buildings. In 2006, this represented 3.3% of national primary energy, i.e. 9.3Mtep.

Wood Energy Program

The Wood Energy Programme, put into place by ADEME in 2000 with the support of the Ministries in charge