



Intelligent Energy  Europe



Energy Efficiency trends, Policies & Measures in FRANCE (1990-2007)

**Monitoring of Energy Efficiency in EU 27,
Norway and Croatia (ODYSSEE-MURE)**

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1 Executive Summary

- Over the period 1990-2007, the final energy consumption has grown up by 13% or 0.7%/year. Only the final energy consumption of industry has decreased (-4%) since 1990. Agriculture and services have considerably increased their final consumption by respectively 32% and 33%. The transport and household consumption have also increased (21% and 8% respectively), but since 2000, the trend for these two sectors, is almost stable which is remarkable for transport.
- The final energy intensity (final consumption per unit of GDP) (with climatic correction) has decreased by 18.5% or 1.2%/year since 1990. Since 2006, we are on track with the target of the French energy law (-2%/year until 2015). All sectors contributed to reach this target. In 2007, services intensity decreased the most with -5.3%. Industry and households intensities have been close to 2%. The transport intensity has slightly decreased of 0.7%.
- In 2007, the overall index of energy efficiency (ODEX) reached 84 in France, which means a 16% efficiency improvement since 1990; all sectors participated in a different way to this efficiency progress: 17% improvement in industry, 21% for households and 12% in transport. However, in 2007, ODEX has improved by 1% compared with 2006 indicating energy savings during this 2007 year. This recent achievement is in line with the indicative target of the ESD.
- Direct CO₂ emissions related to energy have increased by 6% since 1990 in France. Emissions increased the most in the transport sector (16.5%) then in households (12.1%) and services (7.5%). Only agriculture and industry sectors have succeeded in reducing their CO₂ emissions (respectively -15% and -9.5% since 1990).
- France must continue its efforts to reach the national and European commitments in force. A lot of efforts will be necessary to reach the target "3 X 20" and reach a decrease of 20% of the energy consumption and a decrease of 20% of CO₂ emissions.

- The most important event in 2007 was the Environment Round Table so called “Grenelle de l’environnement” which aims to define a national plan creating a new impetus for the environment. This democratic process has drawn up different action plans of concrete quantifiable measures. Four programmes have been decided, the energy efficiency and carbon program, the mobility and transportation programme, the modernising buildings and cities programme, and the urban planning and national/regional governance programme.

- The fifth thermal building code for new buildings in households is in force since September 2006: it should bring on average energy savings of 15%, compared to the previous standards of 2000. For the existing dwellings, the tax credit scheme has been reinforced in 2005. An energy performance assessment for buildings is effective since November 2006. A newly implemented important and innovative measure has been launched in July 2006, the “Energy savings or white certificates scheme”. It sets a target of 54 TWh cumulated savings.

- Since 2007, lot of innovative measures have been implemented such as the bonus malus for new cars, sustainable building training scheme, a sustainable development account, a green loan at zero percent rate,.

2 The Background to Energy Efficiency

2.1 Overall economic context

Stabilisation of the economic growth in 2007.

In 2007 the economic growth measured by the GDP was 2.3% stable compared with 2006 and 1.7% in 2005.

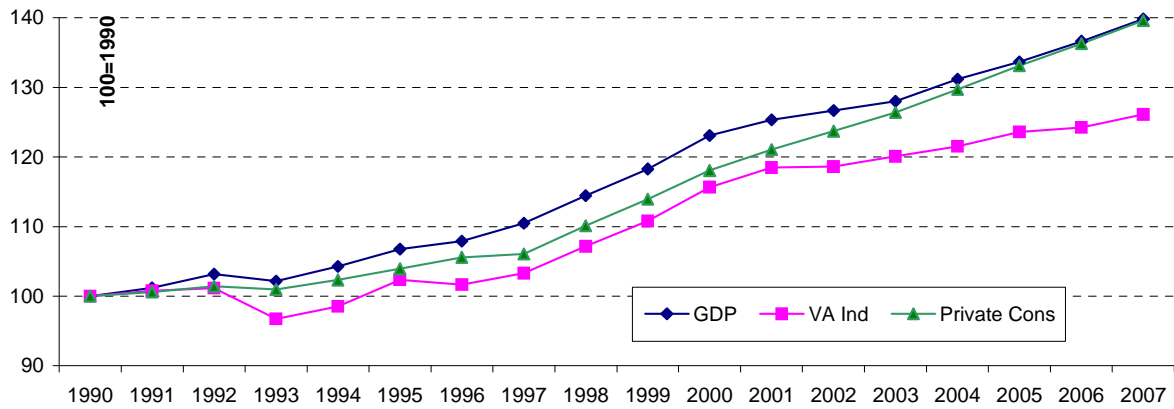
In 2007, the households' expenditures (measured by the private consumption) have a rate close to the GDP economic growth (2.4% for the private consumption compared to 2.3% for the GDP) whereas the annual growth rate of industrial activity (as measured by the value added at constant price) is lesser than the GDP (1.5%) (**Table 1 and Figure 1**).

Since 1990, the average economic growth has been 2%/year. Between 1990 and 1996, the average growth rate was lower with the recession in 1993. On the contrary, between, 1996 and 2001, the growth was high (about 3%). Since 2001, the growth rate was 1.8%.

Table 1: Economic and industrial annual growth rate in France.

%/year	1990-2007	1990-1996	1996-2001	2001-2007	2006-2007
GDP	2,0%	1,3%	3,0%	1,8%	2,3%
Industry	1,4%	0,3%	3,1%	1,1%	1,5%
Private consumption	2,0%	0,9%	2,8%	2,4%	2,4%

Figure 1: Macro-economic developments in France: 1990-2007



2.2 Energy consumption trends: by fuel and by sector

Decrease of energy consumption in 2007 excepted for transportation

Over the whole period 1990-2007, the final energy consumption has grown up by 0.7% per year (at normal climate) (**Table 2**). All sectors increased their consumption except the industry. Since 1990, the final consumption has increased by about 20 Mtoe and reached 159 Mtoe.

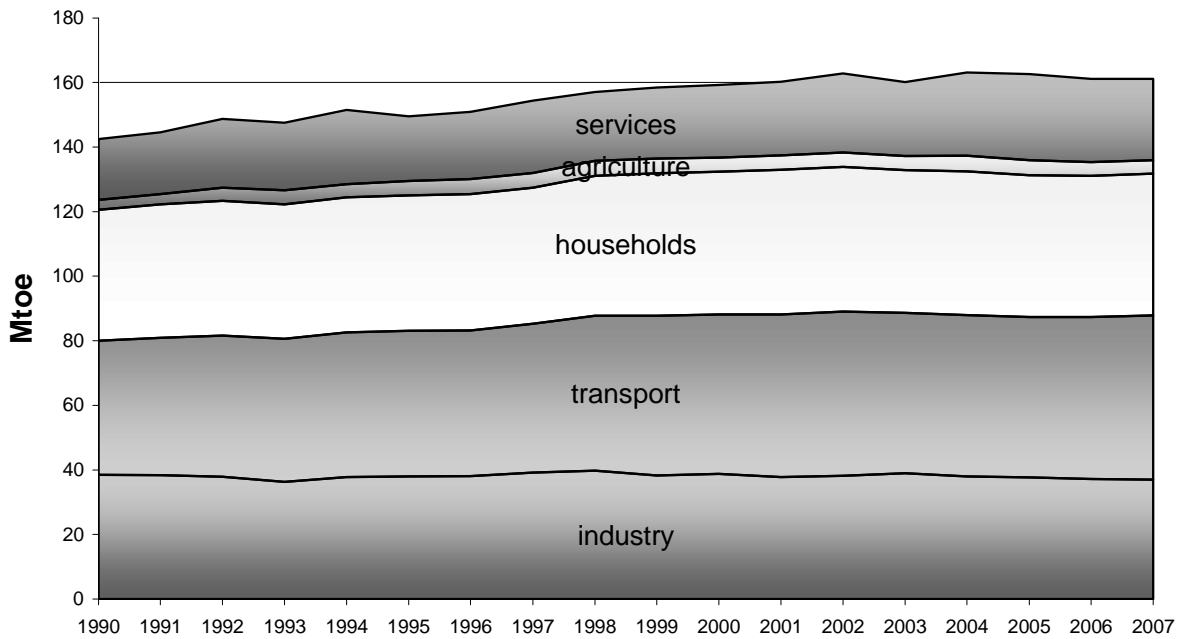
The growth in the final energy consumption was the most dynamic for transport, 1.6% however the consumption since 2001 has been almost stable which is a remarkable achievement, because of the massive installation of speed limits controls since 2001, the oil price rise in the recent years and the penetration of fuel efficient vehicles.

Table 2: Evolution of the final consumption by sector

	1990-2007	1990-1996	1996-2001	2001-2007	2006-2007
Industry	-0,2%	-0,2%	-0,1%	-0,3%	-0,8%
Transport	1,2%	1,4%	2,2%	0,2%	1,6%
households	0,5%	0,7%	1,2%	-0,3%	0,6%
Agriculture	1,6%	6,3%	-0,3%	-1,3%	-2,8%
Services	1,7%	1,8%	1,8%	1,5%	-2,6%
Total	0,7%	1,0%	1,2%	0,1%	-0,01%

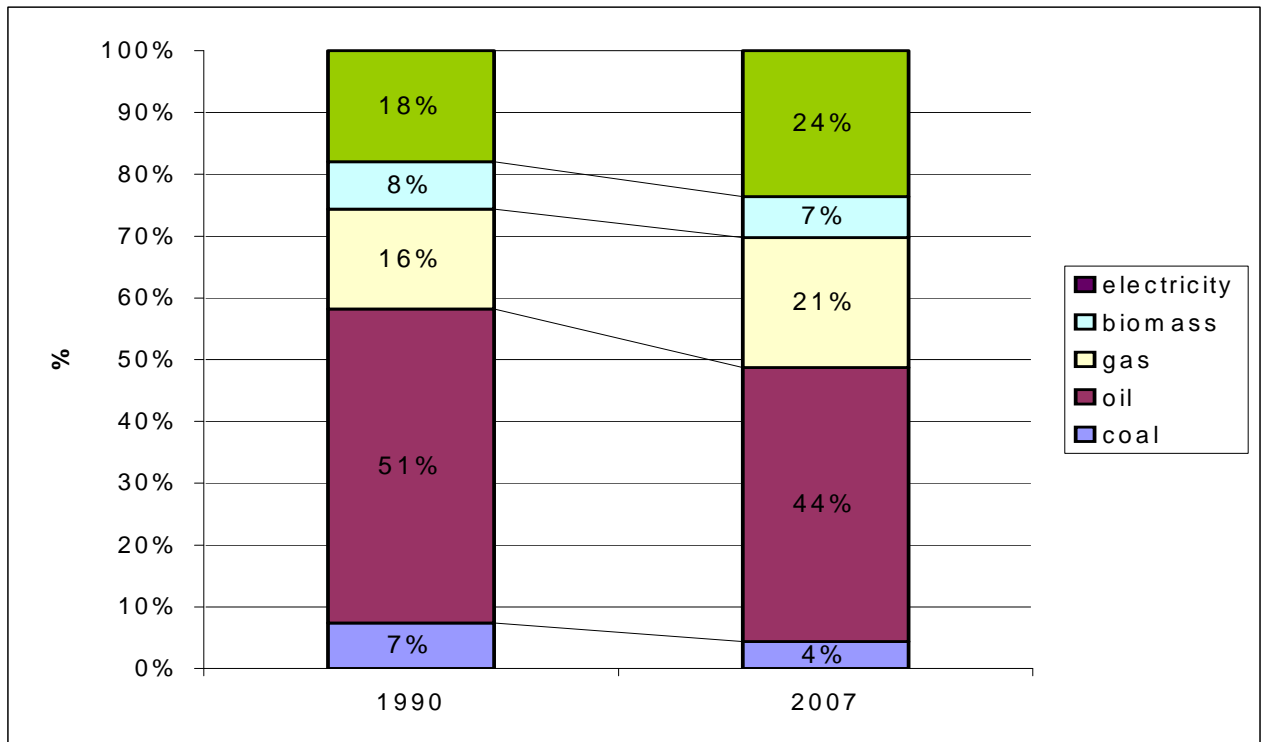
With respect to the breakdown of the final energy consumption by sector (non energy uses excluded), the most important feature is the increasing role of transport, from 29% in 1990 to 32% in 2007 and the decreasing contribution of industry from 27% in 1990 to 23% in 2007. Services grow up from 13% to 16%. Households and agriculture remain quite stable over the period (27% and 3% respectively) (**Figure 2**).

Figure 2 : Final energy consumption by sector in France



The market share of electricity in the final energy consumption is continuing its progression, from 19% in 1990 to 24% in 2007 (**Figure 3**). The share of natural gas is also steadily progressing (from 16% in 1990 to 21% in 2007). Coal continues its recession with 4% of the final consumption in 2007 against 7% in 1990. The share of oil decreases slightly from 51% to 44% in 2007. Biomass (mainly wood) remains stable around 7%.

Figure 3: Final energy consumption by energy



2.3 The policy background to energy efficiency

ADEME is the national agency in charge of implementing RUE, RES and environmental policies. It operates within a 4 years agreement with the government (2007-2010). Implementing France's national policy on the rational use of energy is one of ADEME's key missions.

An energy law has been adopted in 2005 including several measures and targets related to energy efficiency

A National Programme against Climate Changes (PNLCC) has been adopted in January 2000 and reinforced in 2004 and 2006 with the Climate Plan.

France's Environment Round Table so called "Grenelle de l'Environnement" was organised in 2007 in order to define the key points of government policy on ecological and sustainable development issues for the coming five years.

The energy law of 2005 (n° 2005-781)

The objectives and the main orientations of the energy law of 2005 in the field of energy efficiency and climate changes are the following:

- To encourage energy efficiency through voluntarist actions with the objective to reduce the energy intensity by 2% per year until 2015
- to preserve the environment, with the objective to divide by 4 greenhouses emissions in 2050.
- to guarantee the security of supply, competitive prices of energy in particular face to the variations of oil prices
- to diversify energy sources, by promoting renewable energy

The energy law included the implementation of a system of mandatory energy savings imposed to energy companies, with a market of “white certificates”, like in Italy

The Energy Law was completed in July 2004 by a Climate Plan, which reinforced the previous National Programmes against Climate Change of 2004 and 2006.

The Climate Plan

The Climate Plan proposes additional measures to comply with the French commitments according to the Kyoto Protocol, which is to have in 2010 the same level of greenhouses gases emissions as in 1990 (144 MteC (Mt Carbon equivalent) or 565 MteCO₂ (Mt CO₂ equivalent)). Without these additional measures, GHG emissions would grow up by 10% compared to 1990.

Through these new measures, the Energy Plan identified a potential of emissions reduction of 16.3 MteCO₂ in transport (14 measures, for a budget of 41 M€), 11.7 MtCO₂ in buildings (5 measures, for a budget of 8 M€), 10.8 MteCO₂ in industry (9 measures), 16.8 MteCO₂ in the energy sector (12 measures), 5.9 MteCO₂ for agriculture and waste.

In total, the annual reduction of greenhouse gases would be 72.3 MtCO₂ in 2010 compared to the reference scenario.

In the transport sector, the main sources of energy savings will come from an increased use of biofuels (7 MteCO₂ savings in 2010) and from progress in the efficiency of vehicles, in particular with vehicles with less than 140 gCO₂/km (3 MteCO₂ savings).

Concerning biofuels, the European Directive (2003/30/CE – 8 May 2003) gives an objective of 5.75% of liquid fuels from biomass in 2010 (against 1% for France in 2006).

In buildings, the main measure concerns new thermal regulations for newly built buildings (7.3 MteCO₂ of savings for households, 3 MteCO₂ of savings in public and private services).

In industry, the main measure concerns the creation, at the EU level, of the “market of quotas allowance” for CO₂ and N₂O later (savings of 3.2 MteCO₂ and 4.6 MteCO₂ respectively).

In the energy sector, the main reductions of greenhouses gas should be due to the increase use of renewable in the electricity production (savings of 5 MteCO₂ for the production of electricity from renewable). The share of electricity from renewable should be 21% in 2010, through an increased diffusion of wind and biomass.

The long-term objectives, as included in the energy law, are to divide by 4 the greenhouses gases emissions in 2050.

The Environment Round Table: « le Grenelle de l'environnement »¹

On 21st May 2007, the President of the Republic launched an original approach, “The Environment Round Table”: It brought together for the first time the State, the regional authorities and civil society representatives in order to define a roadmap for ecology and sustainable development. Its aim, in particular, is to draw up an action plan of concrete, quantifiable measures with as much agreement as possible from the participants. The objectives proposed in this round table are mid term and long term (2020, 2050). This plan, the measures of which will be assessed beforehand and afterwards, will be a starting point for mobilising French society to develop in a sustainable manner.

The objectives arising from Workgroup 1 "Combating climate change and controlling energy" are:

- Make an ambitious and determined contribution to the European "3x20 by 2020" objective
- Include France in the "factor 4" group – fourfold reduction of our emissions by 2050

¹ In 2009, the round table 1 was adopted and the round table 2 is under discussion to the Senate. <http://www.legrenelle-environnement.fr/>

- "+20 Mtoe by 2020": increase our renewable energy production by 20 Mtoe by 2020 and reach, or even exceed, a 20% proportion of renewable energy in energy end-use
- Energy savings and reduction of greenhouse gas emissions: opening of sector-specific projects and introduction of immediate operational and/or structural measures;
 - Construction: reduce energy consumption by approximately 20% in service-sector construction and 12% in residential construction within 5 years, and by more than a third by 2020
 - Transportation/mobility: lower greenhouse gas emissions by 20% in the next 12 years

Selected detailed measures:

Building:

- Thermal renovation of public buildings within the next 5 years.
- Building new energy-efficient housing from 2010, widespread use of Green Buildings by 2012, and passive or positive-energy buildings from 2020.
- Building office space, buildings and public facilities that comply with low-consumption or positive energy standards from 2010.
- Ban on incandescent light bulbs and single glazing from 2010.
- Financial incentives for thermal renovation of privately-owned buildings.
- Carbon balance and energy-efficient assessments of all organisations of more than 50 people.

Energy efficiency and carbon:

- Study of the introduction of a climate-energy tax.
- Plan for very energy-efficient low-input farming
- Carbon balance assessments of administrative departments and a 20% improvement in their energy efficiency.

Urban planning and national/regional governance:

- Widespread implementation of national/regional climate-energy plans by the end of 2012 in built-up and urban communities, complying with the objective of a 20% reduction in greenhouse gas emissions by 2020.

Transport:

- Priority given to public transport: construction of more than 1 500 km of bus lanes, tramways and cycle lanes.
- Rail: construction of 2 000 km of high-speed lines by 2020.
- Increasing the share of rail freight to 25% by 2012.
- Upgrading the conventional rail network.
- Developing rolling motorways.
- Developing sea motorways and inland waterways transport.
- Huge reduction of air transport emissions.
- New private vehicles: introduction of eco-tags.
- Developing clean vehicles.
- Eco-tax based on mileage for trucks using the non-concessionary road network.

3 Overall Assessment of Energy Efficiency Trends

To clean energy efficiency indicators from the influence of climatic variations, all the indicators are calculated with climatic corrections. An indicator with climatic corrections represents the theoretical value of that indicator corresponding to a normal winter.

Over the period, climatic variations have played an important role. Since 1990, winters were about 10% warmer than normal winters (see Figure 4 the trends in degree-days).

In 2007, the winter was particularly warm.

3.1 Overall trends in energy intensity

Two indicators are generally used to characterise the relationship between energy use and economic growth: the primary energy intensity (i.e. the ratio primary energy consumption over GDP), and the final energy intensity (ratio final consumption over GDP²).

Between 1990 and 2007, the primary intensity decreased slower than the final intensity (Figure 4): -0.9%/year on average compared to -1.2% /year.

In the recent years (2001-2007) it was also true, the final energy intensity reduction was the strongest and reached -1.6%/year.

In 2007, the final energy intensity decreased by 2% compared with 2006 which is a remarkable result. Surprising enough is the stronger decrease of the primary intensity in 2007 which is more important than the final intensity.

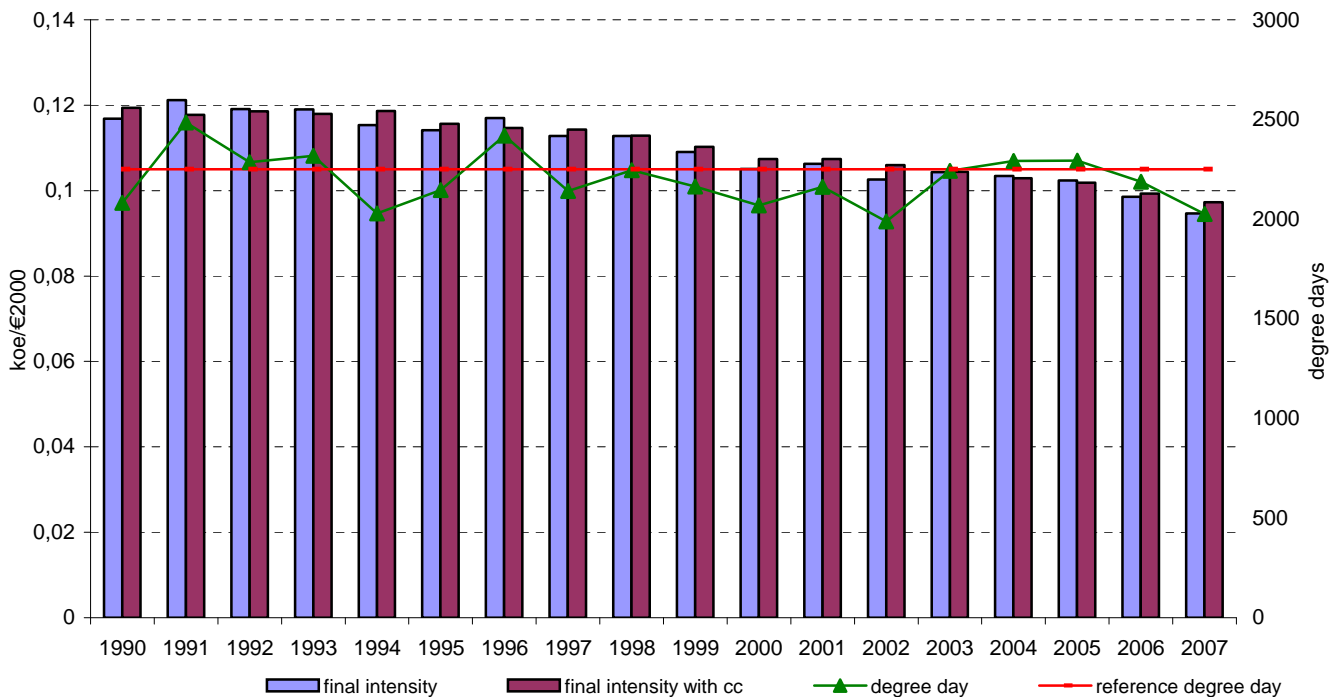
Figure 4: Variations in primary and final energy intensities (normal climate)

	1990-2007	1990-1996	1996-2001	2001-2007	2006-2007
Primary	-0,9%	0,5%	-1,5%	-1,5%	-2,4%
Final	-1,2%	-0,7%	-1,3%	-1,6%	-2,0%

Figure 5 shows the impact of climatic corrections on the final energy intensity.

² Excluding energy uses

Figure 5: Final energy intensity actual, with climate corrections and degree days

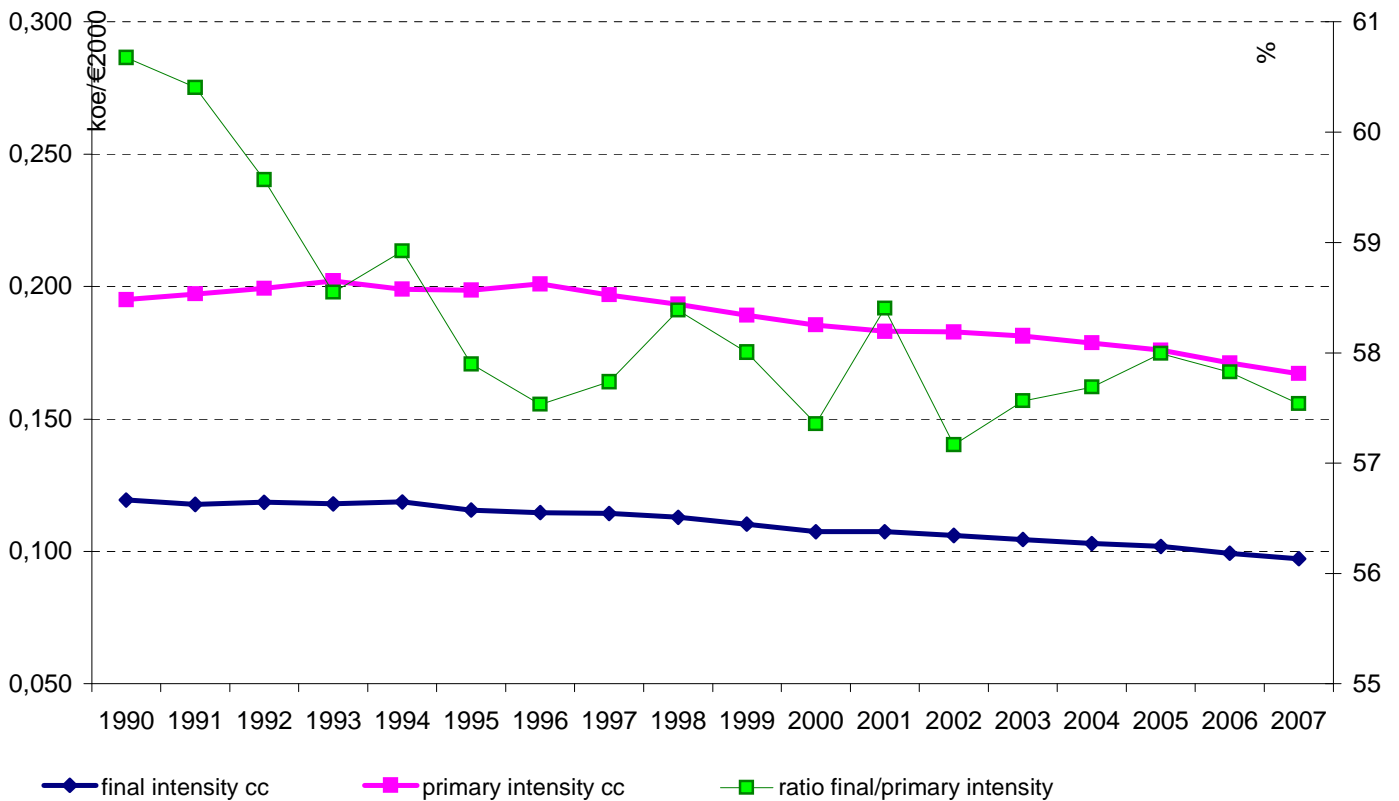


The different variations between primary and final intensities are captured by the ratio final to primary intensity (Figure 6). This ratio has regularly decreased from 61% in 1990 to 58% in 2007. This means that an increasing share of the primary energy consumption is not going to final consumers: it is consumed in energy transformations, mainly in the electricity production.

The main reason for these different trends is the rapid penetration of electricity, from 18% of the final consumption for energy uses in 1990 to 24% in 2007, which had two consequences on these intensities.

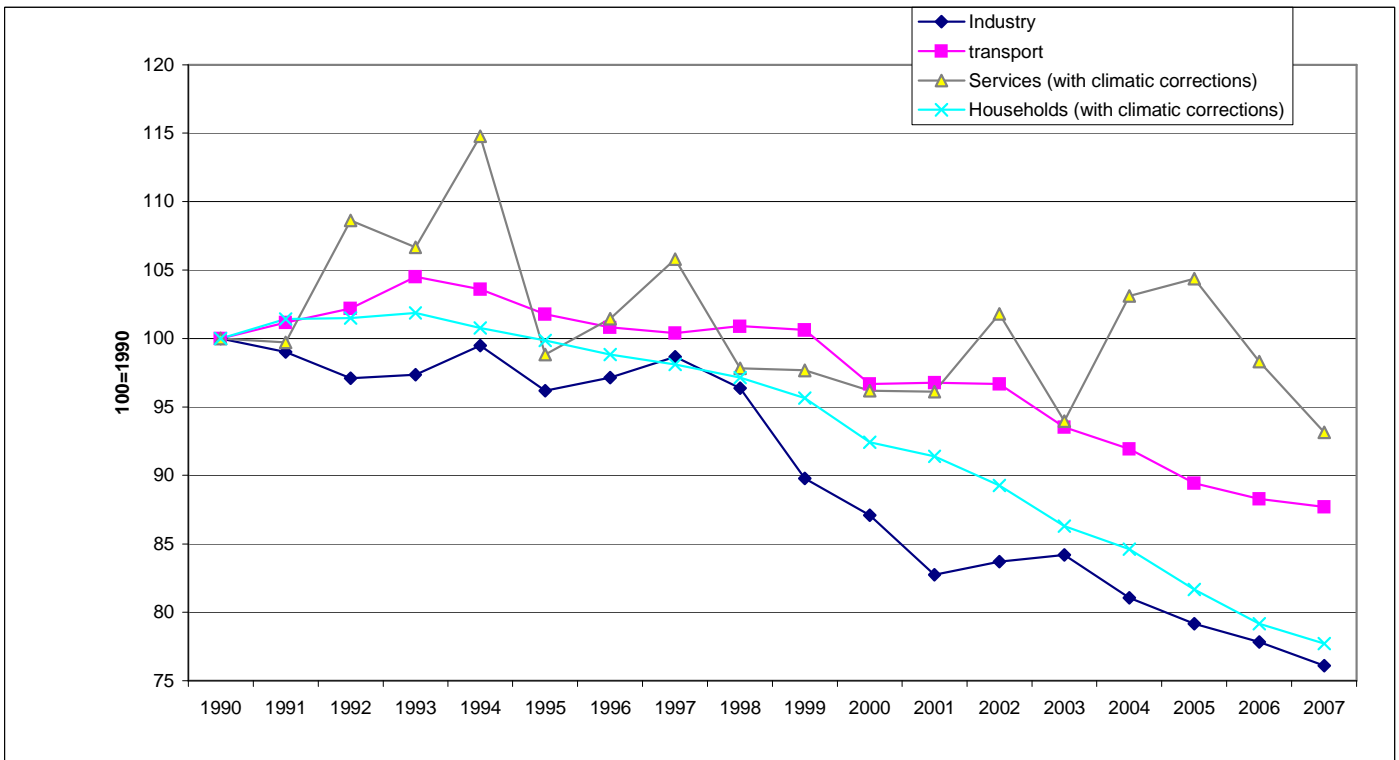
- Lower the final energy demand growth, as the substitution of electricity with fossil fuels generate energy savings at the level of final consumers (electricity is converted into toe assuming a 100% end-use efficiency);
- Increased losses in the transformation sector because an increased electricity production, all things being equal, that is dominantly produced from nuclear with a low efficiency (33%).

Figure 6 : Primary and final energy intensities 1990-2007 (normal climate)



In details, the energy intensity for all sectors decreased since 1990 with a heterogeneous way. Energy intensity of industry (ie. ratio final energy consumption over value added of the sector) decreased by 24% since 1990. Energy intensity of household (ie ratio final energy consumption with climatic correction over private consumption of household at 1995 price) has decreased in the same proportion (22% since 1990). For transport, the energy intensity slightly decreased by 12% since 1990. Over the period 1990-2007, these three energy intensity trends are steadily decreased contrary to the energy intensity of services. The trend of energy intensity for services (ie ratio final energy consumption with climatic correction over value added of the sector) is very irregular. We can although observe a little decrease of 7% since 1990.

Figure 7 : Energy intensity trends by sector since 1990

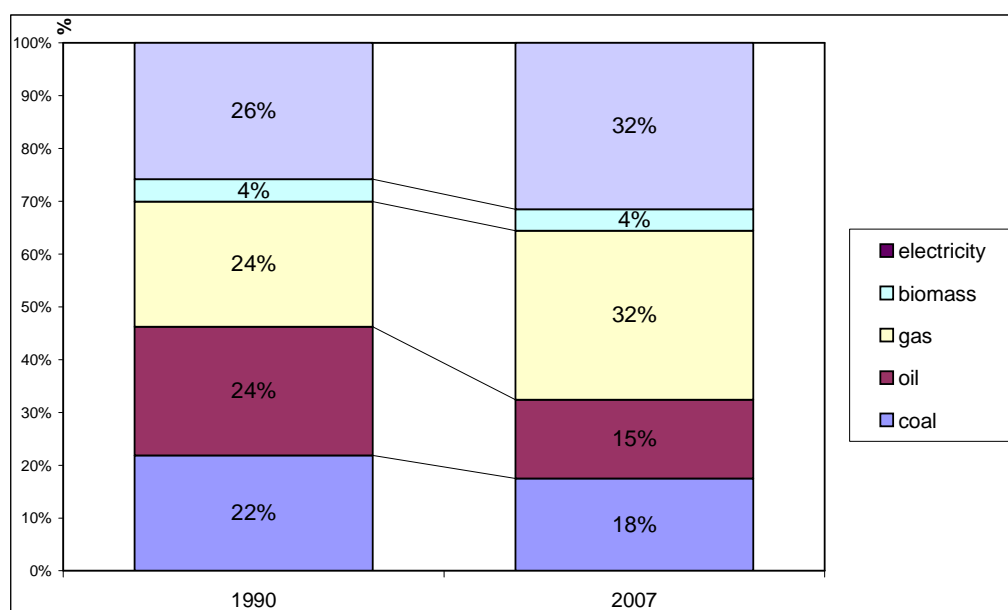


3.2 Industry

3.2.1 Energy productivity trend

Since 1990, the consumption of coal and oil decrease regularly. Gas and electricity increase in the same time to reach 32% of the total consumption (**Figure 8**).

Figure 8: Distribution of energy consumption by fuel type since 1990.



Although the value added growth of industry (euro 2000) improved by 26% since 1990, the final consumption has slightly decreased by 4% since 1990 (38.5 Mtoe against 37 in 2007). Consequently, the energy intensity has decreased by 24% since 1990 with an annual average growth rate of 1.6%/year.

In 2007, the energy intensity has decreased by 2%. However the energy intensity varied drastically according to the branches (**see below Figure 9 and Figure 10**).

Three branches improved their energy intensity, chemicals, non metallic minerals, textiles and leathers (**Figure 9**).

Energy Efficiency Policies and Measures in France in 2007

Figure 9 : Energy intensity of chemicals, non metallic minerals and textiles and leathers

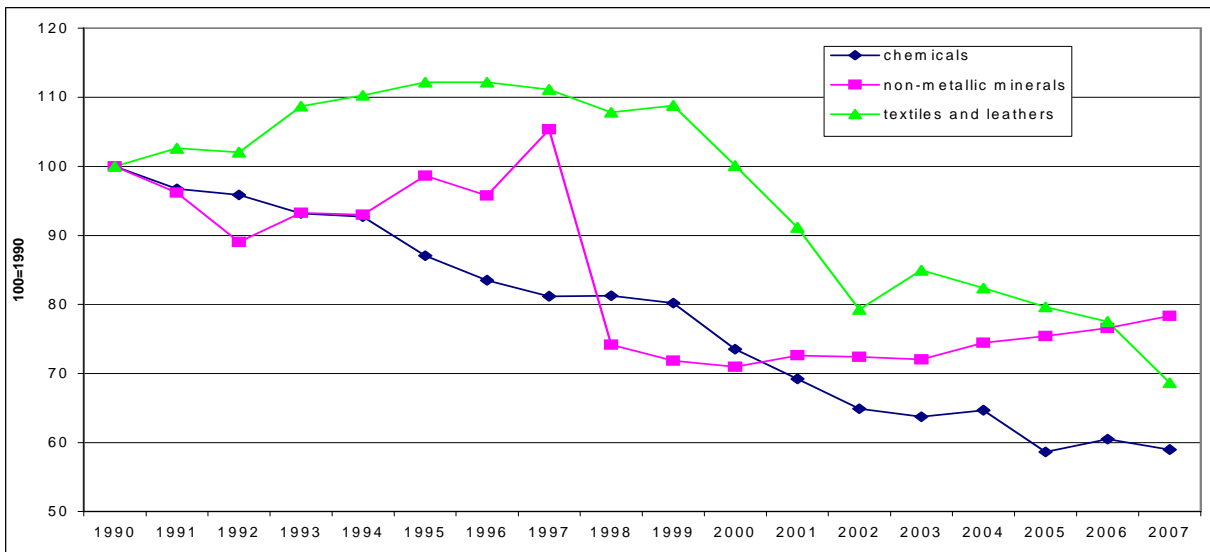
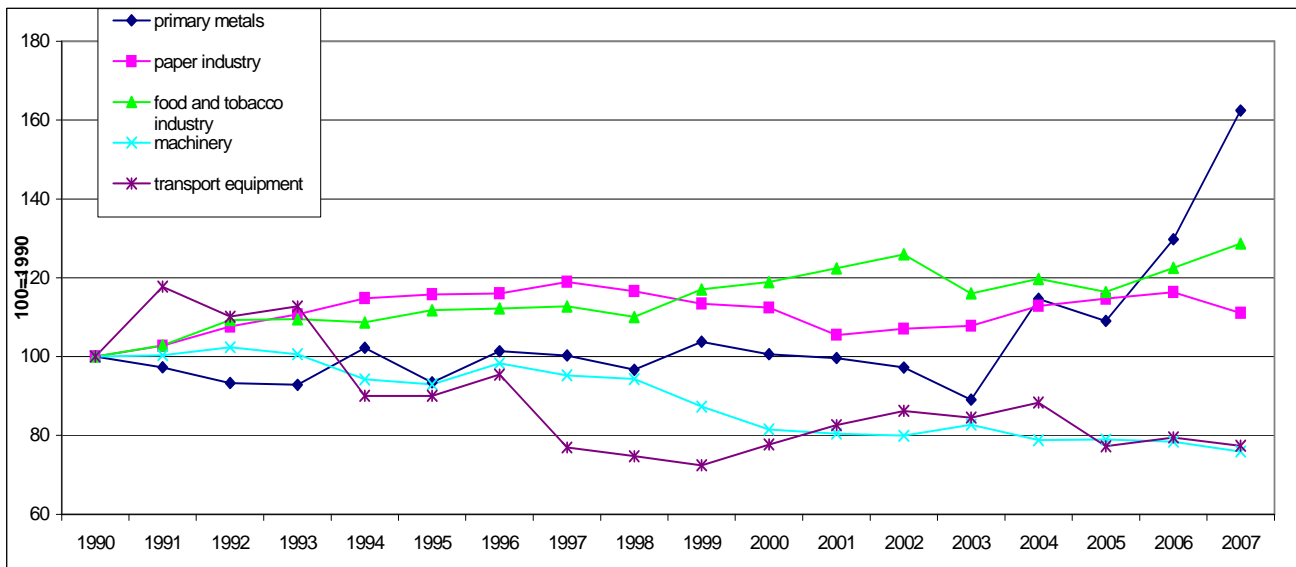


Figure 10: Branches of industry with a positive energy intensity between 1990 and 2007



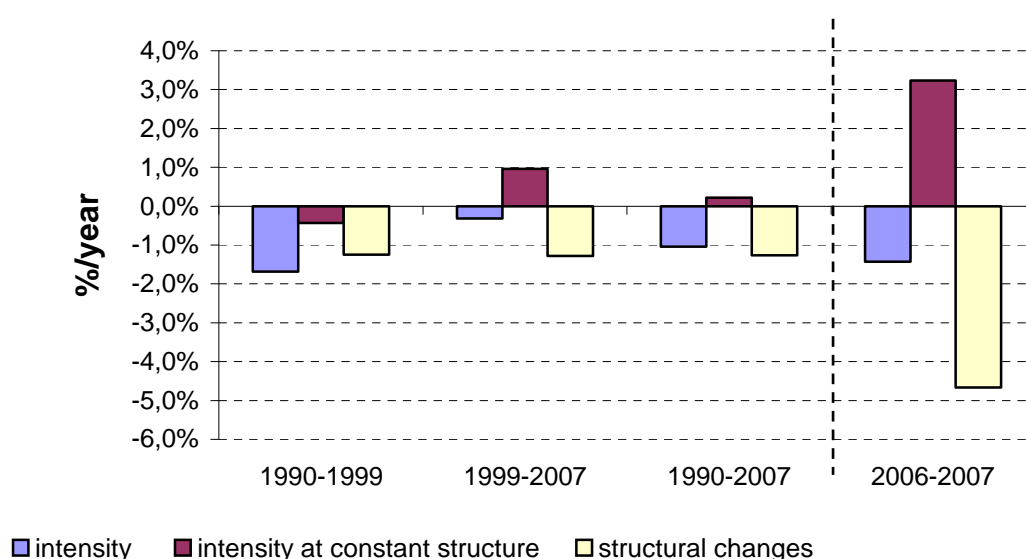
Only one branch had an energy intensity which has increased strongly since 1990, the primary metals with a rise of 62%. Paper industry and food and tobacco industries intensities have grown up slower with 11% and 29% respectively. The energy intensity of machinery and transport equipment has decreased by 24% and 22% respectively since 1990.

We can observe there are no particular rules between the intensive branches and not intensive branches as regarded to their trends.

Structural changes were fully responsible of the energy productivity decrease since 1990.

The energy intensity in manufacturing industry has decreased by 1%/year since 1990 and by 0.3%/year since 1999. This trend is explained by two factors: a decrease in the energy intensity at the level of each sub-sector (branches) and structural changes, i.e. changes in the share of each branch in the total value added. Without structural changes the energy intensity would have deteriorated (**Figure 11**).

Figure 11: Energy intensity in manufacturing and structural changes



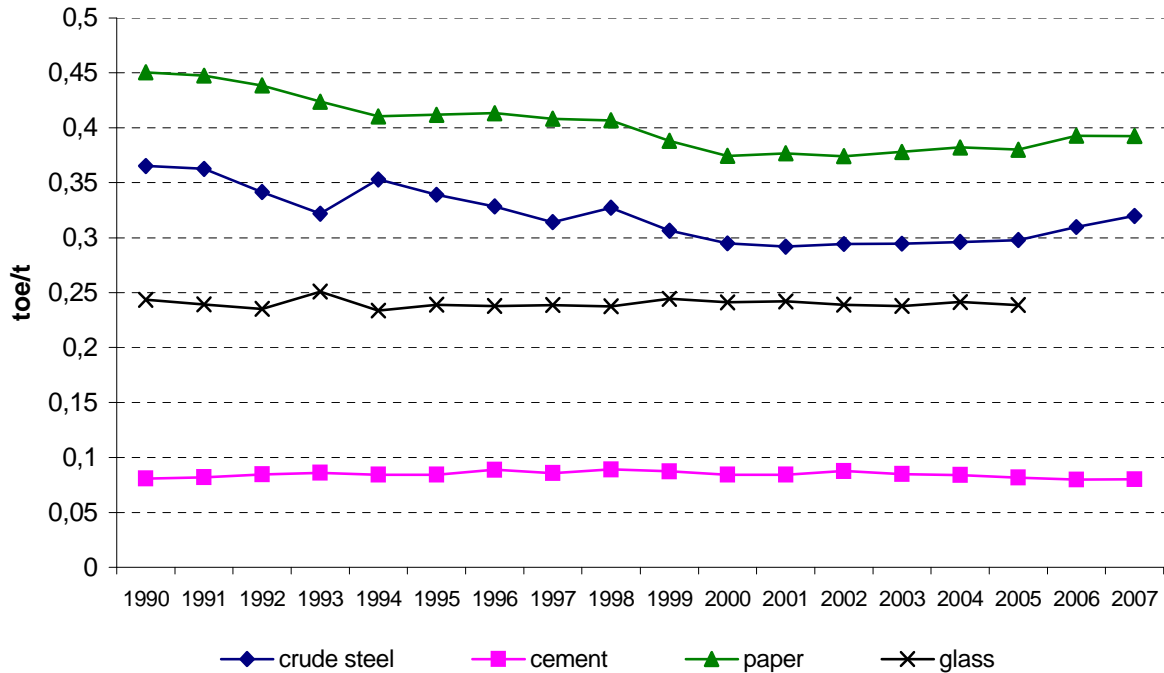
In 2007, the structural effect towards less energy intensive industries has been very massive (4%) and has mainly contributed to the slight improvement of energy intensity. In other words, corrected from this structural effect, the energy productivity of the industry has deteriorated in 2007 compared with 2006.

3.2.2 Energy efficiency trend

The unit consumption (toe/t) of most energy intensive products decreased or remained stable over the period, -0.8% for crude steel and paper and 0.1% for cement and glass

industry. In the recent year, there was a slight increase of unit consumption for crude steel (**Figure 12**).

Figure 12: Unit consumption trends of energy intensive products



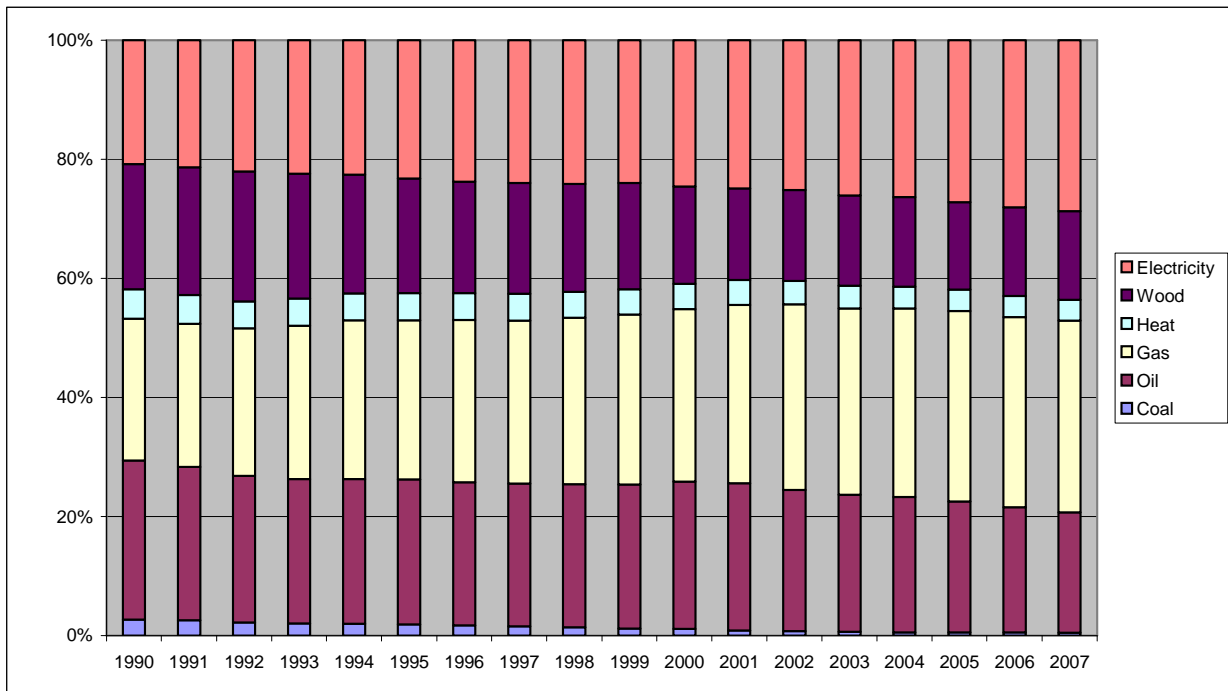
3.3 Households

3.3.1 Consumption trend

The final energy consumption with climatic corrections has increased by 8% between 1990 and 2007 (40.5 Mtoe to 44Mtoe). This rise wasn't steady over the period. Between 1990 and 2001, the final consumption has increased by 11% and between 2001 and 2007 this consumption has decreased by 2%. In 2007, the final energy consumption growth rate is quite stable (+0.5%).

Since 1990, the trend of the different energies market share is continued. In 2007, the two dominant energies are gas and electricity with their respective shares of 32% and electricity 29% (against 24% and 21% in 1990). Wood and oil decreased by 5% during the same period. The consumption of coal was insignificant (**Figure 13**).

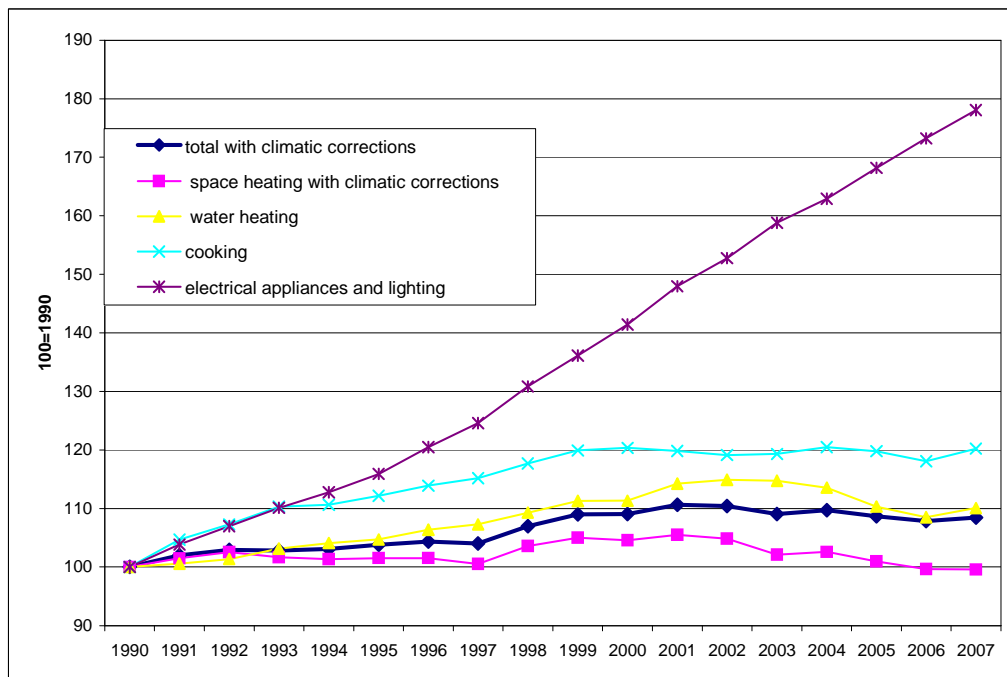
Figure 13 : Breakdown of the different energies in the consumption of dwellings



Except for space heating the most dominant end uses, all the final consumptions by end-use have increased. The strongest rate of growth was for electricity consumption of electrical appliances and lighting (+80%) (**Figure 14**).

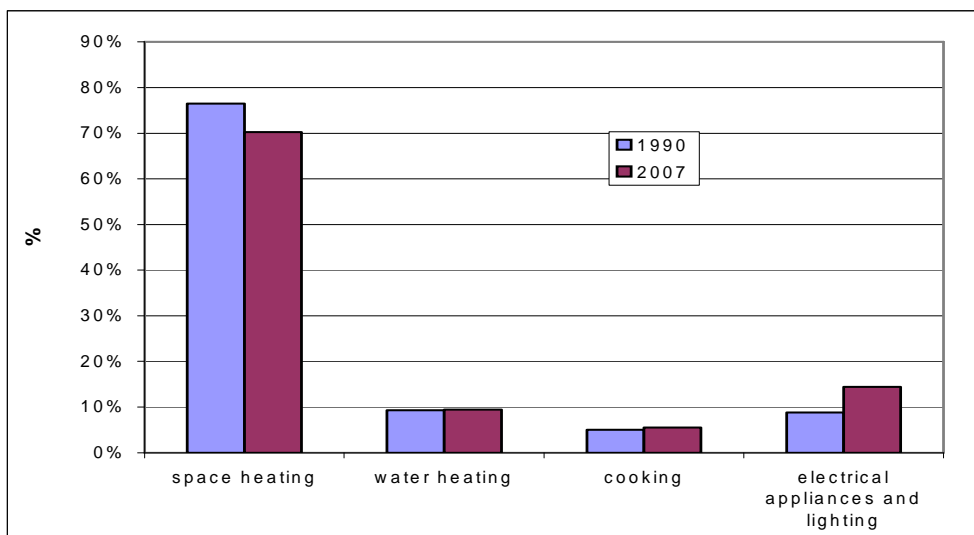
In 2007, no particular evolution can be observed except for electricity appliance as in the past.

Figure 14: Evolution of the final consumption of household by end-use



In the meantime, the share of the energy consumption by end-uses showed a drop for space heating 70% in 2007 against 77% in 1990. Oppositely the trend of the electrical appliances is increasing by 5% (Figure 15).

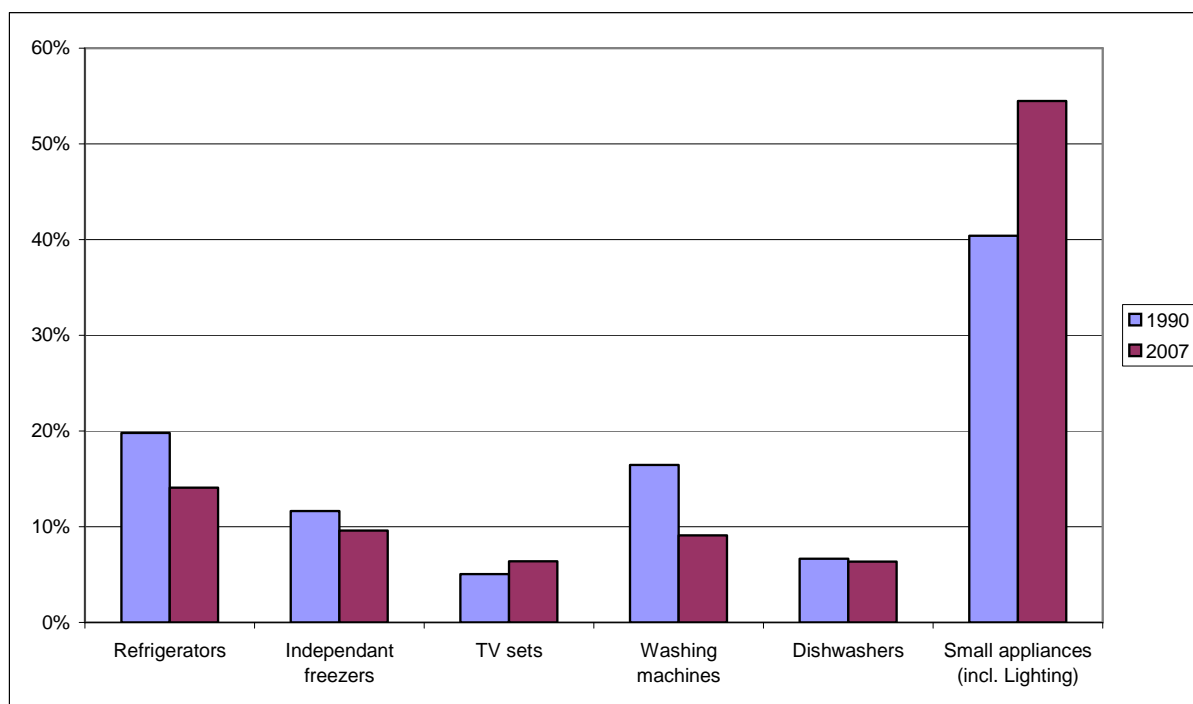
Figure 15: Share of the consumption by end-use



Since 1990, the consumption of electrical appliances and lighting has increased by 78% (3.6 Mtoe in 1990 and 6.4 Mtoe in 2007) corresponding to a market change of 9% to 14%. In details, the shares of the consumption of refrigerators, washing machines

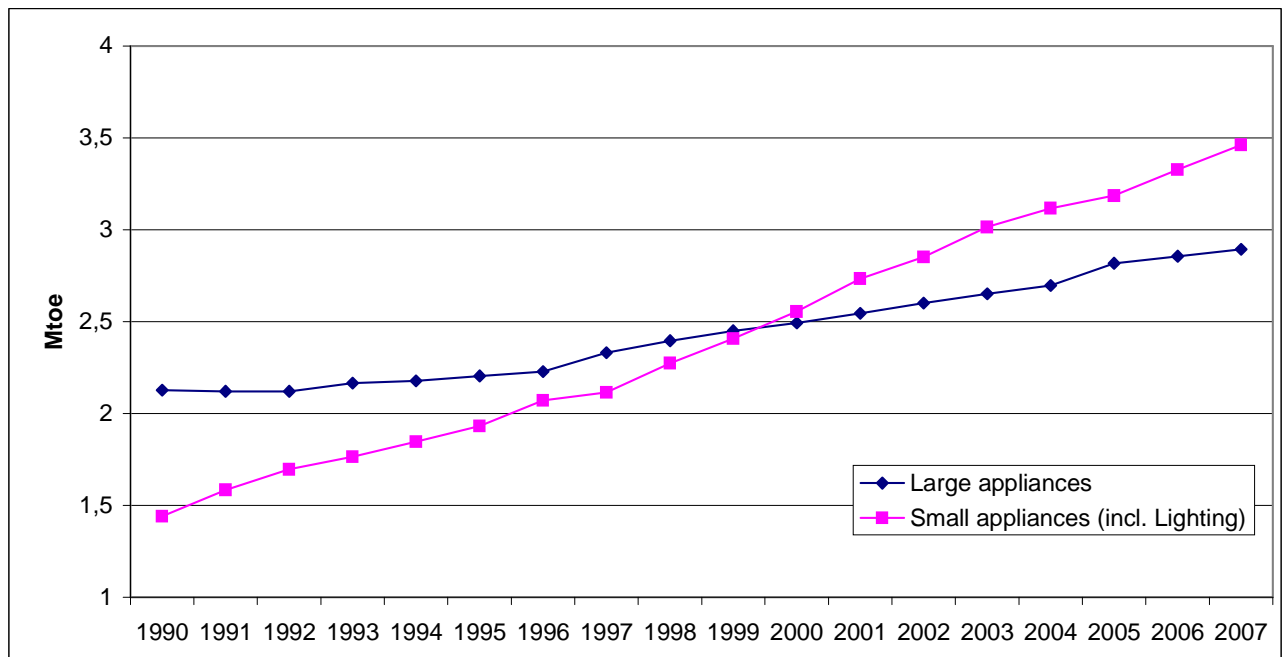
and dishwashers have decreased whereas the shares of TV sets, and small appliances (incl. lighting) have grown up (**Figure 16**).

Figure 16 : Share of consumption of appliances



We certainly observe a saturation of energy consumption for large appliances due to the impact of labelling of large electrical appliances implemented from 1994. Since 1999, the consumption of small appliances was higher than the consumption of large appliances (**Figure 17**).

Figure 17 : Consumption of large and small appliances since 1990.



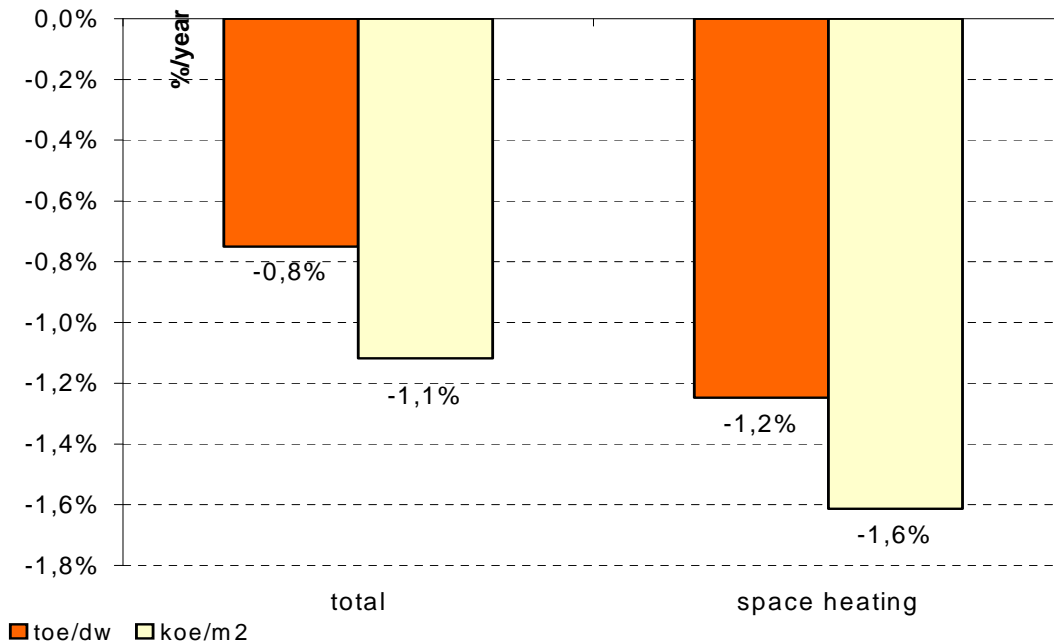
3.3.2 Energy efficiency trend

The increasing size of dwellings tends to offset the energy efficiency progress

The unit energy consumption of households related the square meter of floor area (toe per m²) is decreasing more rapidly than the energy consumption per dwelling (toe/dwelling), because of the growing size of dwellings (from 86 m² in 1990 to 91 m² in 2007). This is especially true for space heating.

The unit energy consumption per m² for space heating decreased by 1.6%/year, compared to 1.2%/year for the energy consumption per dwelling (**Figure 18**). The increase in the average size of dwellings has offset 25% of the energy efficiency improvement (measured in terms of a decrease of the energy consumption per m²).

Figure 18: Unit consumption trend in total and for space heating

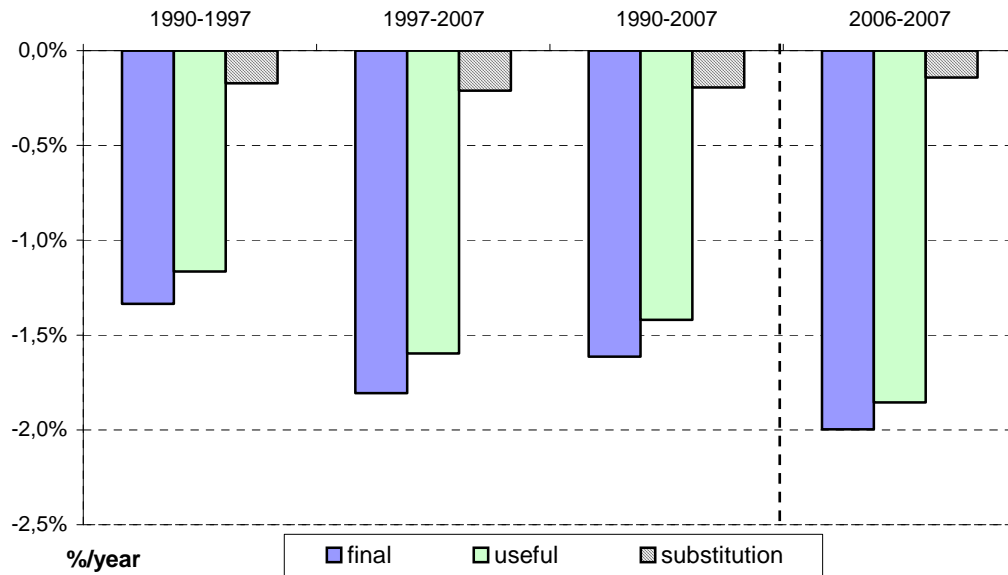


Energy substitutions contribute to decrease the unit consumption for space heating by 0.2%/year or 13% since 1990

The impact of inter-fuel substitutions can be assessed by comparing the unit consumption per dwelling expressed in terms of useful and final energy.

Over the period 1990-2007, the final energy consumption for space heating per m² decreased by 1.6%/year, whereas the decrease is less important in useful energy: 1.4%/year (**Figure 19**). In other words, energy substitutions explained 13% of the energy efficiency improvement for space heating as they contributed to decrease the heating consumption per m² by 0.2%/year. This substitution is due to penetration of gas.

Figure 19 : Impact of energy substitutions on heating consumption per m² for households

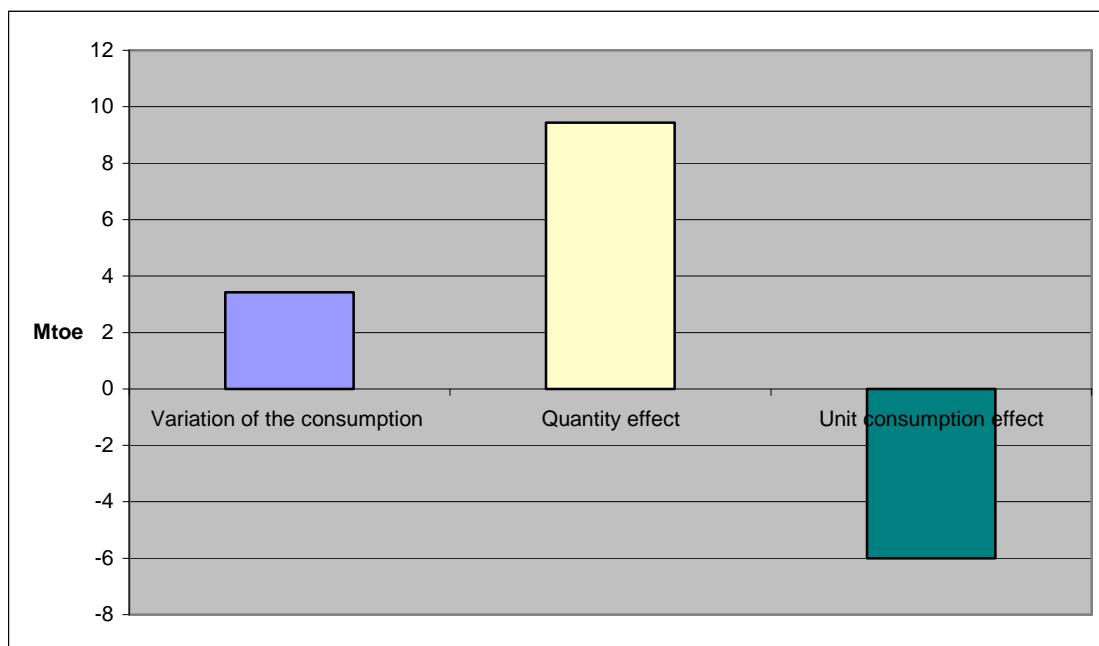


3.3.3 Energy savings

Due to energy efficiency, 6 Mtoe has been saved since 1990.

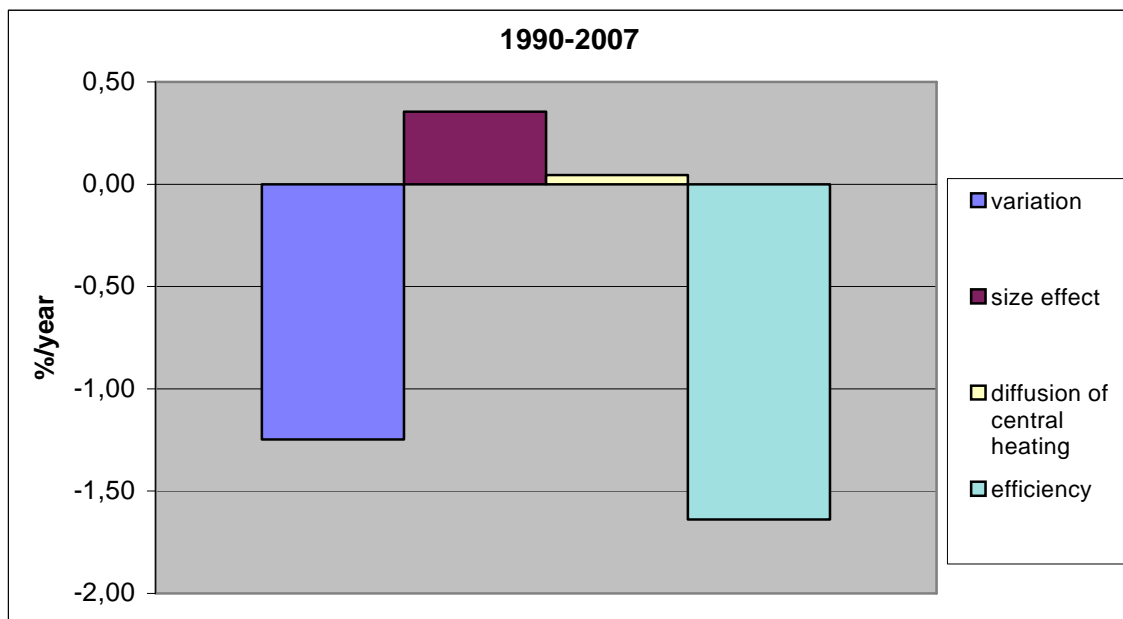
Since 1990, the final energy consumption increase by about 0.5%/year to reach 43.9Mtoe in 2007. The savings due to the decrease of unit consumption were offset by the rise of stock of dwellings (+23% between 1990 and 2007). The unit consumption per dwelling with climate corrections has nevertheless fallen by 12% between 1990 and 2007 (respectively 1.87 toe/dw and 1.64 toe/dw) and has generated 6 Mtoe of energy savings.

Figure 20 : Effects of stock and unit consumption changes on the energy consumption between 1990 and 2007



At a glance, the unit energy consumption effect can be explained by three other factors (**Figure 21**). Without the energy efficiency, the unit consumption would have increased by 0.4%/year between 1990 and 2007 due to respectively the diffusion of central heating (0.04%/year) and the increase of size dwellings (0.35%/year).

Figure 21: Explanatory factors of the unit energy consumption variation



3.4 Services

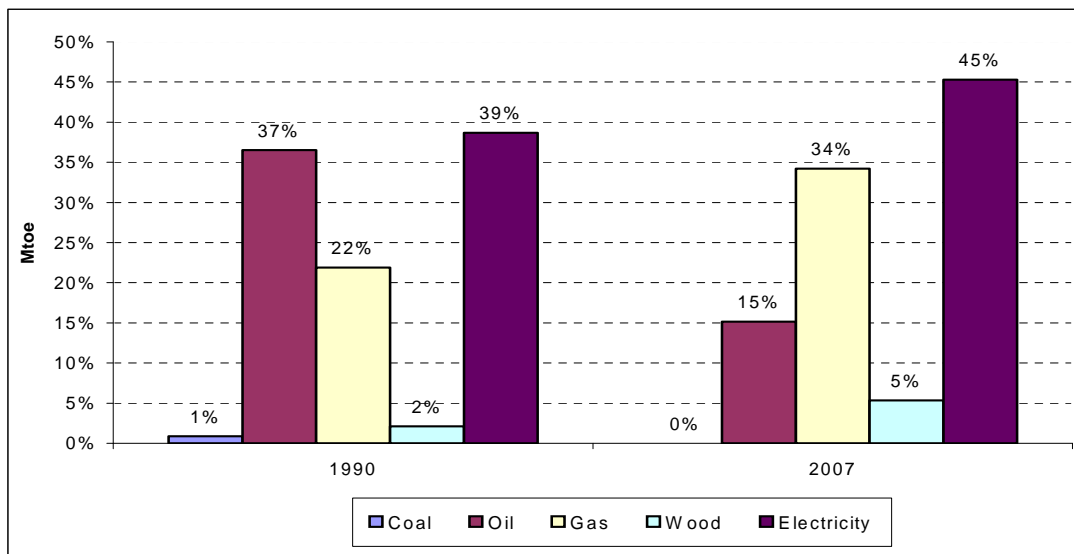
3.4.1 Energy consumption trends

The final consumption has increased by 2%/year since 1990 or 33% in total (18.8 Mtoe with climatic correction in 1990 against 25 Mtoe in 2007).

In 2007, final consumption with climatic correction decreased by 2.6%.

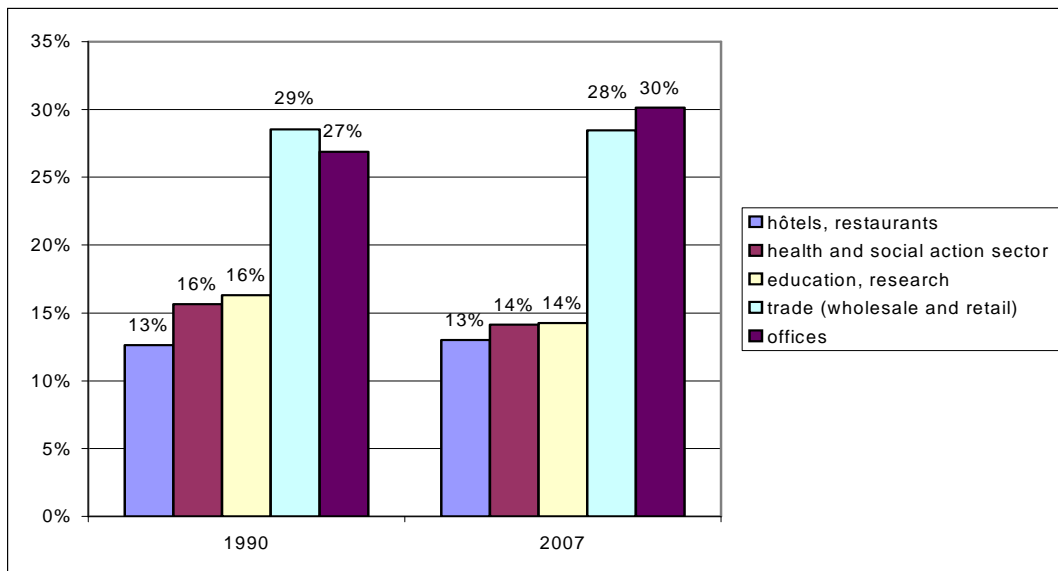
Since 1990, the fuel mix in the services has really changed. In 2007, electricity and gas were the main sources of energy corresponding to respectively 45% and 34% of the market shares. The consumption of oil has considerably decreased reaching 22%. Wood rose slowly and coal has become insignificant (**Figure 22**).

Figure 22 : Energy by type in service sector



All sub-sectors have increased their consumption: about 0.7%/year for education, research and for health and social action sector, about 1.5% for trade and for hotels, restaurants, and 2.1% for offices. The breakdown of the energy consumption has almost not changed since 1990 (**Figure 23**).

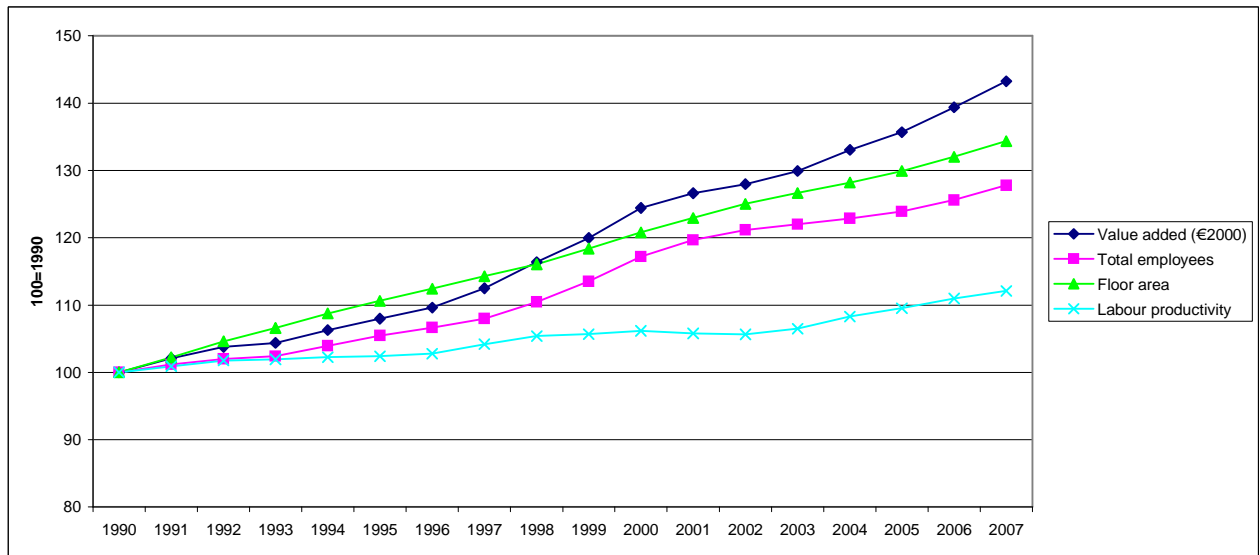
Figure 23 : Breakdown of the energy consumption by sub-sector



The services sector experienced a strong growth of activity. Since 1990, the value added has increased by 43%, the employment has grown up by 28%, the surface of building has risen by 34% and the labour productivity (value added divided by the em-

ployees) has increased by 12% (**Figure 24**). In 2007, the rising trend for these four indicators of activity has continued.

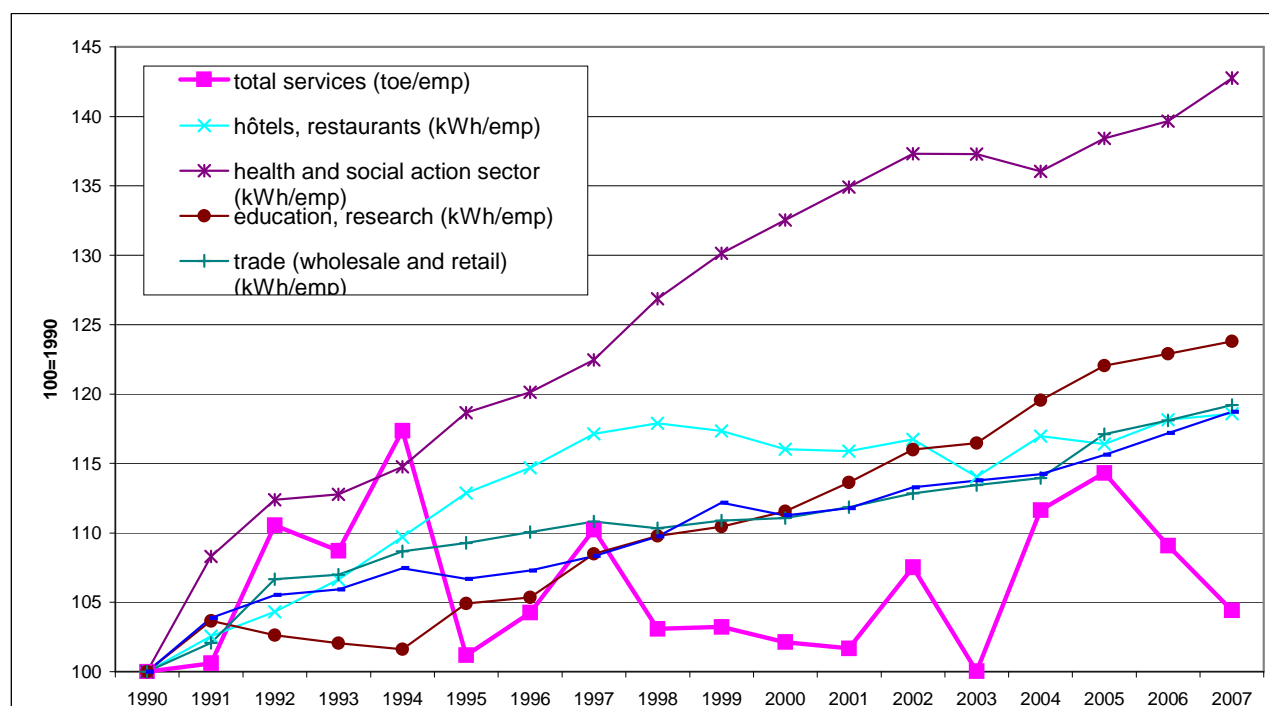
Figure 24 : The main indicators of activity in the services



3.4.2 Energy efficiency trends

All unit consumptions by branch have increased. The branch with the largest increases was health and social action (43%) (**Figure 25**). The unit consumption of the other branches has risen by about 20%. Unit consumption per employee was very irregular since 1990 and has grown up on average by 0.3%/year.

Figure 25 : Evolution of the unit consumption since 1990



3.5 Transport

Overall context

Between 1990 and 2007, total energy consumption in the transport sector grew by about 23% (from 48 to 51 Mtoe). The consumption has steadily grown up during the 90's; since 2001, this consumption is almost stable (about 50 Mtoe). In 2007, the consumption is almost stable.

Since 1993 the total energy intensity (energy demand in relation to the GDP in constant prices) decreased regularly by 0.8 %/year. This decoupling is even reinforced since 2003 with a decrease of the intensity by 1.9%/year from 2002 to 2007. In 2007, energy intensity decrease by 0.7%.

3.5.1 Energy consumption trend

Road transport represents 83% of the consumption in 2007 (87% in 1990) (**Table 3**). Air transport amounts 15%, against 10% in 1990. The consumption of rail transport is rather stable. The share of inland navigation is negligible.

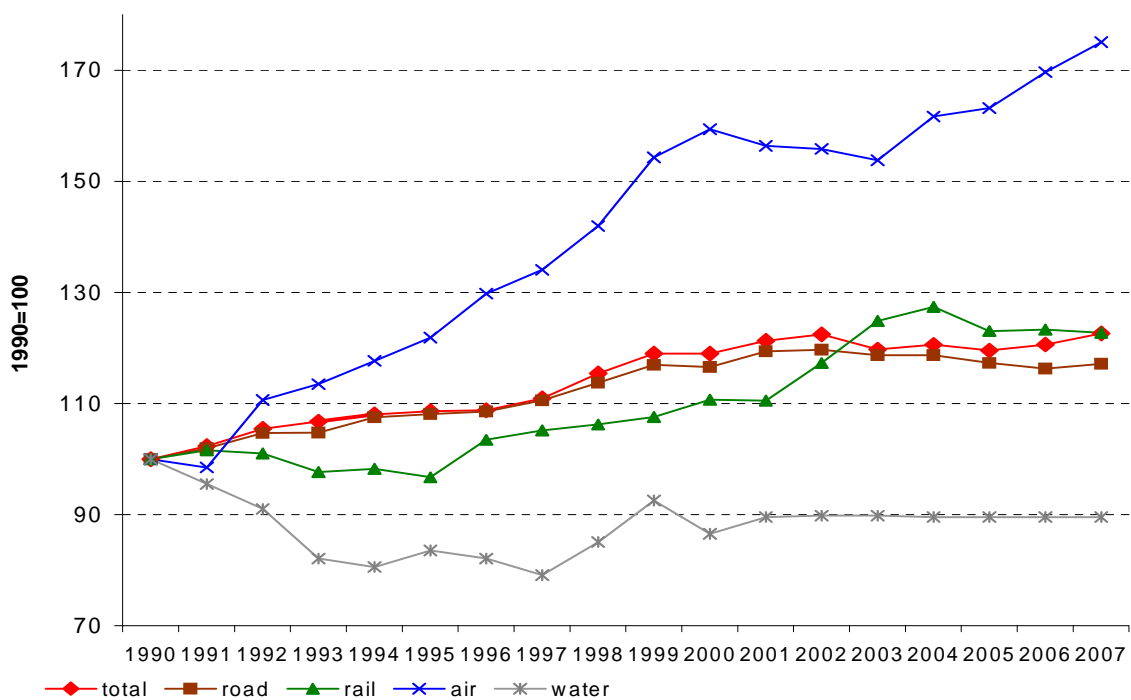
Table 3 : Transport energy consumption by mode

	1990	2007
road	87%	83%
rail	3%	3%
air	10%	15%
water	0%	0%

The overall consumption of the transport sector grew by 20% from 1990 to 2000 and is quite stable since 2000.

Road transport consumption increased by 20% since 1990, but remained stable since 2000 (**Figure 26**). This new trend is mainly the result of the sharp increase in oil price in 2000 and the result of the enforcement of speed limits via radar speed traps. Penetration of fuel efficient vehicles has also played an important role. Air transport consumption increased by almost 75% since 1990. This trend was irregular: rapid growth until 2000, decrease from 2001 to 2003 and increase in 2007.

Figure 26 : Evolution of the transport consumption by mode (1990-2007).



3.5.2 Energy efficiency

Transport activities become less energy intensive since 1993, except since 2000 for goods transport

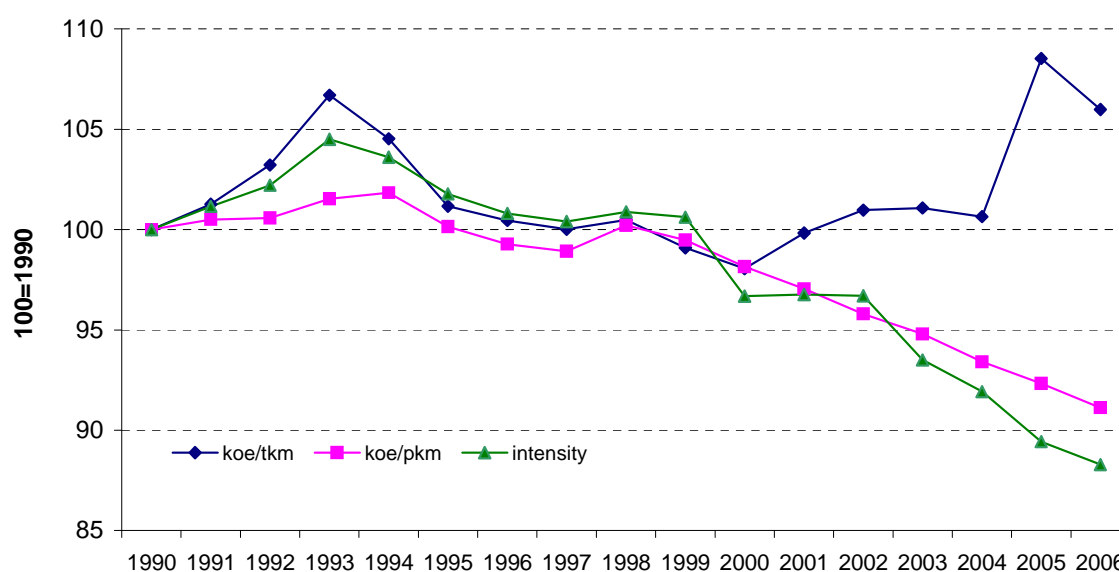
The unit consumption per tonne-km has been decreasing between 1993 and 2000 (-1.2%/year). Since 2000, this unit consumption tends however to increase (0.7%/year). At a glance, the unit consumption for rail transport has increased (2.2%), whereas unit consumption for road transport of goods has remained stable (-0.3%/year).

The unit consumption per passenger-km is decreasing since 1994 (-0.9%/year), mainly due to a reduction of the unit energy consumption of cars per passenger-km (-1%/year). The unit consumption of domestic air transport grew regularly by 2%/year from 1994 to 2007.

Between 1990 and 2006, the unit consumptions of domestic air transport and rail have increased respectively by 1.4%/year and 1.6%/year.

Since 2000, the unit consumption per tkm tends to increase contrary to the unit consumption per pkm, which continues decreasing (**Figure 27**).

Figure 27 : Energy intensity, unit consumption per passenger-km and tonne-km in transport



3.5.3 Road transport activity

The share of different types of vehicle in the energy consumption has slightly changed. The car consumption share has decreased by 4% since 1990 representing now 57%, whereas the share of light vehicles has increased by 5%. The share of trucks was stable (22%) and the one of bus and motorbikes were still insignificant (**Table 4**).

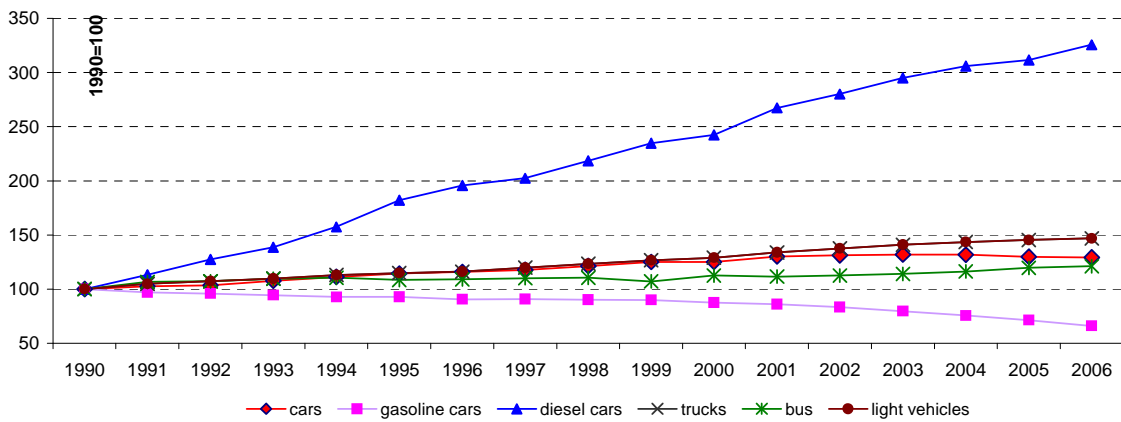
Table 4: Trend of road consumption by vehicle

	1990	2007
cars	61%	57%
motorbikes	1%	1%
bus	2%	2%
light vehicles	14%	19%
trucks	22%	22%

The increasing trend of energy consumption in road transport is mainly driven by cars traffic, measured in vehicle kilometres. Since 2003, this car traffic has stopped increasing (**Figure 28**). The traffic of diesel cars increases considerably whereas the traffic of gasoline cars decreases in the same time. For light vehicles and trucks, there is a constant progression of the traffic.

In 2007, the car yearly mileage was similar to the level of 1990. Over the period, the stock of car has grown up by 1.6%/year. However, the situation varies drastically between fuel type since the stock of diesel car has increased by 9%/year since 1990 and it decreased for the stock of gasoline car by 1.6%/year.

Figure 28 : Evolution of the traffic of road vehicles (in vehicle kilometre)

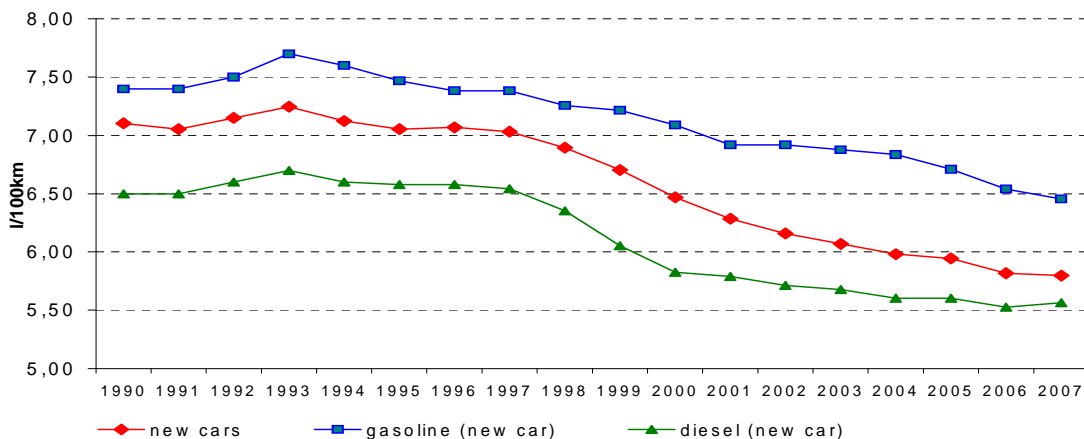


The share of diesel vehicles in new cars continuously increases, 74% in 2007, against 71% in 2006 and 69% in 2005. Diesel vehicles are now the most important component of the car stock and are responsible of 64% of the distance travelled.

3.5.4 Energy efficiency

Continuing technological improvement since 1997 particularly visible for gasoline in the recent years.

Figure 29 : Evolution of tested specific consumption of new cars.



Due to lack of statistic, it's difficult to separate in the trend the impact of sales structure changes towards more powerful cars and the impact of the technological improvement.

However in total, the specific consumption of car sales on the French market has decreased by 17% since 1990. For new car, the specific consumption has decreased by 18% (**Figure 29**).

The evolution of the overall performance of the car stock results of three causes: recent decrease in gasoline car, stabilization for new diesel car and substitution towards diesel car. Translated in term of gCO₂/km, the performance of the French market sales is slightly above the EU voluntary agreement commitment (ACEA) (149 gCO₂/km). For the French car alone, PSA has reached the objective of the agreement (140gCO₂/km) since 2006 and Renault has a rate near the agreement (143gCO₂/km).

A decrease in the distance travelled per car since 1999 has reinforced the effect of more efficient vehicles.

Since 1999, the average consumption per car (toe/car) decreased rapidly, by 2%/year. This trend is explained by a reduction in the average distance travelled by car of around 1000 km and in the specific consumption of cars, from 7.5 to 6.8 l/100km (-1.2%/year). Since 1990, unit consumption of car has decreased by 1% due to the improvement in specific consumption and to the increase of the distance (**Table 5**). The reduction is mainly observed for gasoline cars stock with a decrease of the specific consumption from 8.3 to 7.6 l/100 km, whereas for diesel cars the reduction was more modest, from 6.7 to 6.4 l/100 km.

Table 5: Evolution of the unit consumption and specific consumption of the car stock since 1990

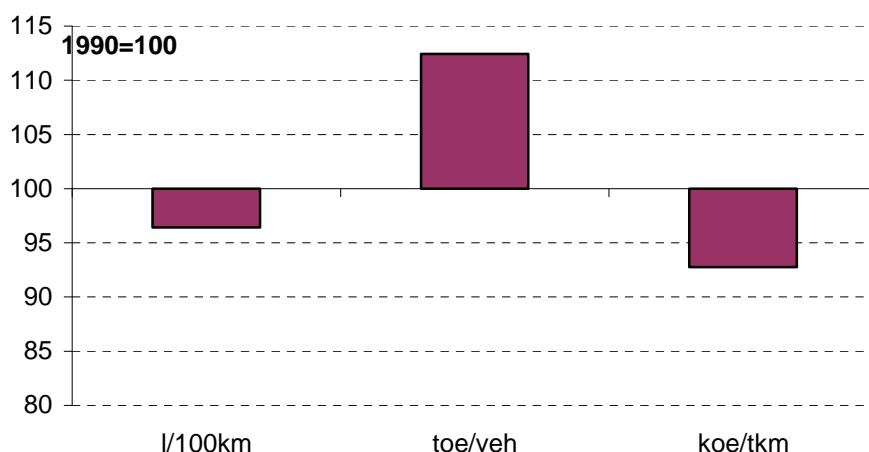
%/year	1990-2007	1990-1999	1999-2007	2006-2007
Unit consumption (toe/car)	-1,0%	-0,2%	-2,0%	-0,7%
On road specific consumption (liters/100 km)	-1,1%	-1,0%	-1,2%	-0,5%
Influence of mileage	0,1%	0,8%	-0,8%	-0,2%

An increasing use of trucks

The specific consumption of trucks (in l/ 100km) remained stable over the whole period, as opposed to the unit consumption per vehicle (in toe/vehicle), which has increased by 0.7%/year since 1990 (**Figure 30**). These two trends reflect an increasing utilisation of trucks, measured in km/ vehicle (+1%/year since 1990).

On the other side, the overall energy efficiency of the transport of goods by road improved, as the unit consumption of goods vehicles per ton kilometre has decreased by 0.4%/year since 1990.

Figure 30: Unit consumption and specific consumption of trucks between 1990 and 2007



3.6 Assessment of energy efficiency/savings through ODEX: total and by sector

France has achieved a 16% energy efficiency improvement since 1990 (1%/year)

Overall trends

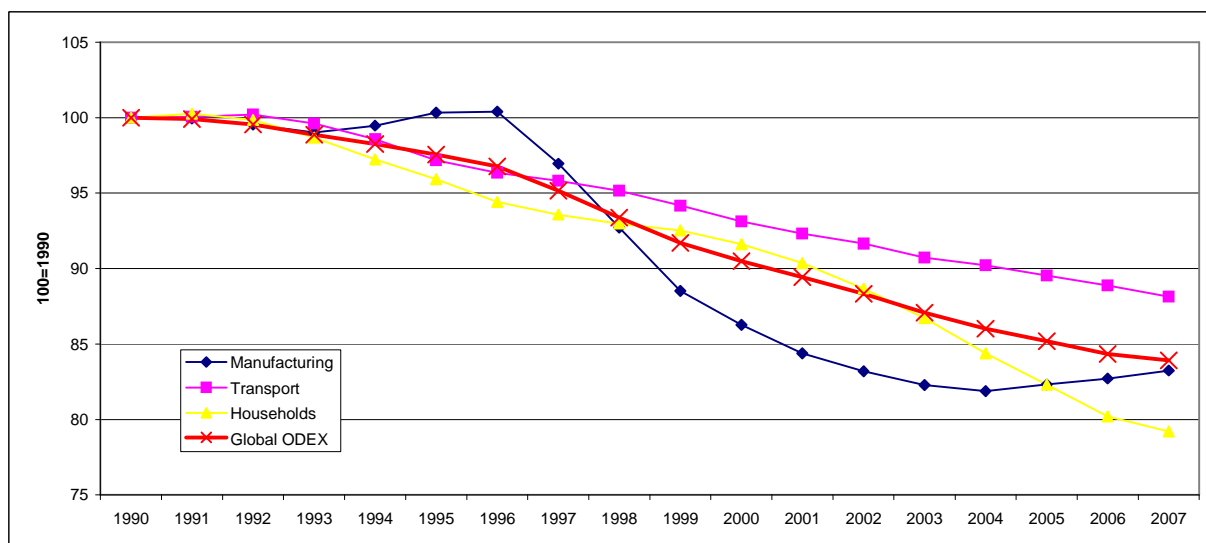
The final energy intensity is often used to describe energy efficiency trends for final consumers. But in fact the evolution of the final energy intensity can be caused by many factors which are not related to energy efficiency, such as structural changes in the economy, changes in lifestyles (e.g. more dwellings, bigger cars). These factors have to be separated to have a better overview of the real energy efficiency gains.

An aggregate energy efficiency indicators (ODEX) has been developed in Odyssee. It is based on 21 end-uses. It provides an overall perspective of energy efficiency trends by sector and combines the trends of indicators by end-use or sub-sector. It represents a better proxy to evaluate energy efficiency trends at an aggregate level (e.g. overall

economy, industry, households, transport, services) than energy intensities, as it is cleaned from structural changes and from other factors not related to energy efficiency.

In 2007, overall ODEX reached 84 in France, which means a 16% efficiency improvement since 1990; all sectors participated in a different ways to the efficiency progress: 17% improvement in industry, 21% for households and 12% in transport (**Figure 31**). In 2007, ODEX has improved by 1% compared with 2006 indicating energy savings during this 2007 year. This recent achievement is in line with the indicative target of the ESD.

Figure 31 : Energy efficiency index by sector

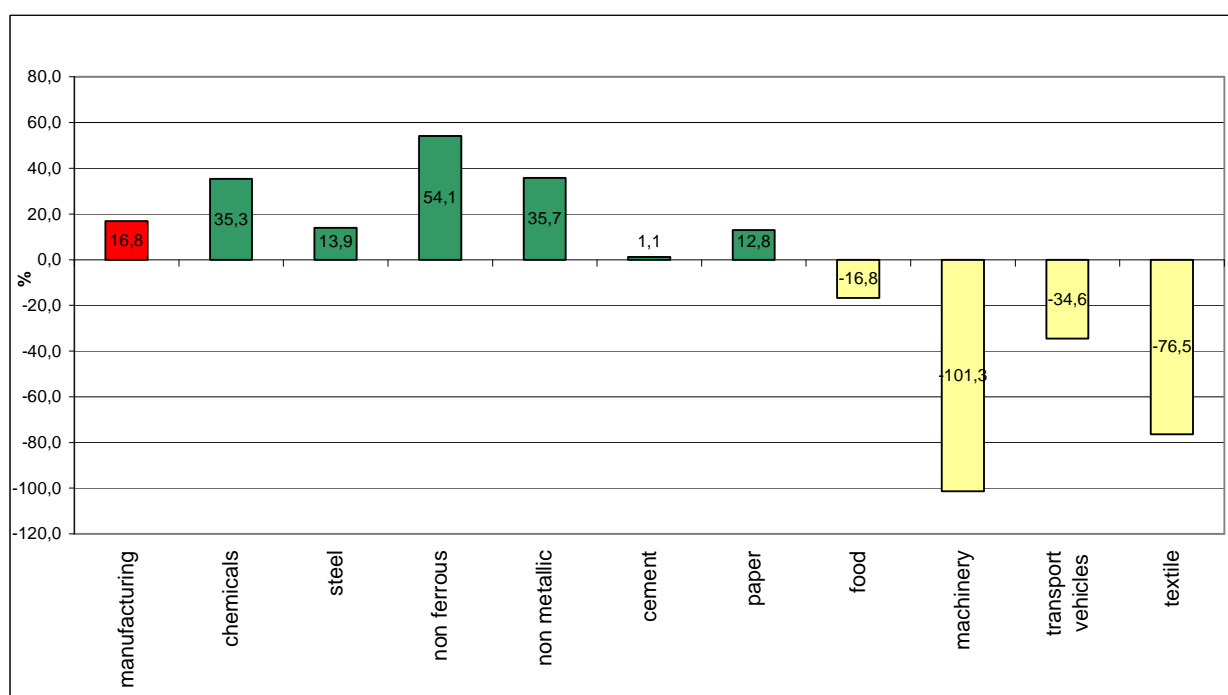


Industry

Overall energy efficiency improvements of 17 %since 1990

For industry, the energy efficiency index (ODEX) is calculated at the level of 10 branches (in terms of energy used per production index or per ton). Between 1990 and 2007, energy efficiency improved by 17% in industry as a whole. The main improvements are registered in the chemicals, non ferrous and non metallic industries: 35%, 54% and 36% respectively (**Figure 32**). On the other hand, other branches, such as transport vehicles, textile and especially machinery, had poor performances.

Figure 32 : Energy efficiency gain in Industry since 1990.



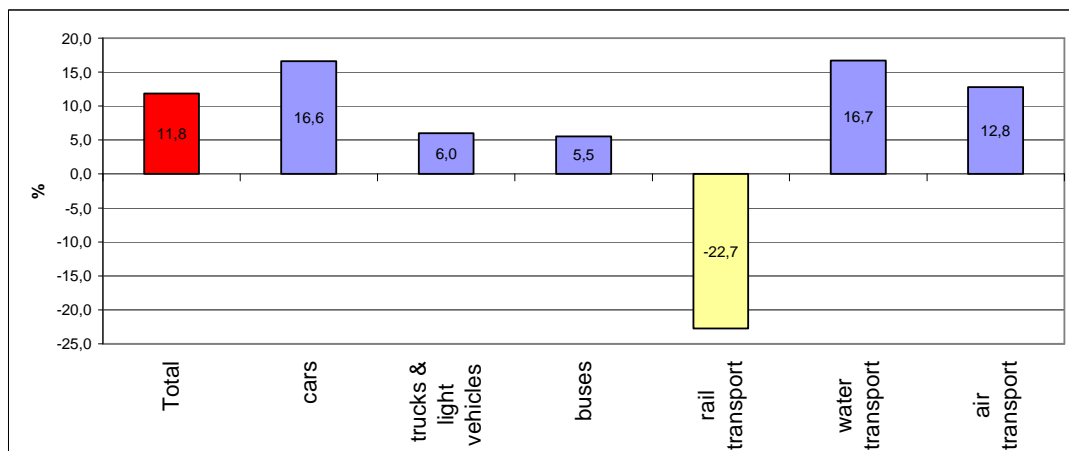
Transport

Energy efficiency improved by about 12% in transport since 1990

For transport, the energy efficiency index (ODEX) is calculated at the level of 7 modes or vehicles types (cars, trucks & light vehicles, buses, motorbikes, rail, water and air transport) and aggregated. Energy efficiency improved by 12% in the transport sector between 1990 and 2007; most of the progress achieved came from cars (16.6% improvements), water transport (16.7%) and air transport (13%) (**Figure 33**). Trucks and light vehicles registered modest gains in energy efficiency (6%) as buses (5.5%). The energy efficiency for rail and motorcycles was negative (respectively -103% and -23%).

For cars, the efficiency progress is due to the decrease of the specific consumption (-1.1%/year). For trucks and light vehicles, the unit consumption per ton-km, which is the indicator used to assess energy efficiency, decreased, as the specific consumption of these vehicles (in litres/100 km) which has felt over the period (-0.2%/year).

Figure 33: Energy efficiency gain in transport since 1990



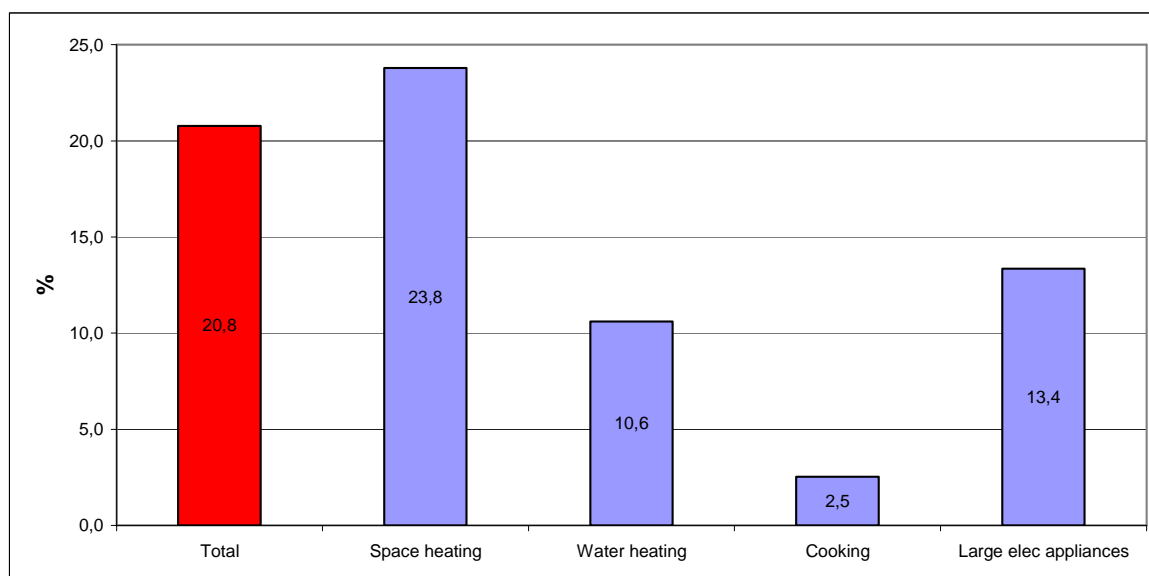
Households

Energy efficiency improvements of 21% since 1990

For households, the energy efficiency index (ODEX) is calculated at the level of 4 end uses: space heating, water heating, cooking and large electrical appliances, according to 5 appliances (refrigerators, freezers, washing machines, dishwashers and TV).

The energy efficiency in the households sector has improved by 21% over the period 1990-2007. The improvement is mainly due to space heating and electrical appliances, with an increase of about 24% and 13% of their energy efficiency respectively (**Figure 34**).

Figure 34 : Energy efficiency gains for households since 1990



3.7 CO₂-emissions trends

In ODYSSEE, two types of emissions are considered: direct emissions and total emissions.

Direct CO₂ emissions correspond to emissions generated at level of the consumers by the combustion of oil, gas and coal. They correspond to the definition used in the official inventories in national communications to UNFCCC or EEA.

Total CO₂ emissions, includes in addition to the direct emissions the indirect emissions generated at the level of power plants by the production of electricity consumed in each of the end-use sectors; Total emission show the responsibility of each end-use sector in the total emissions of the country.

Direct CO₂ emissions

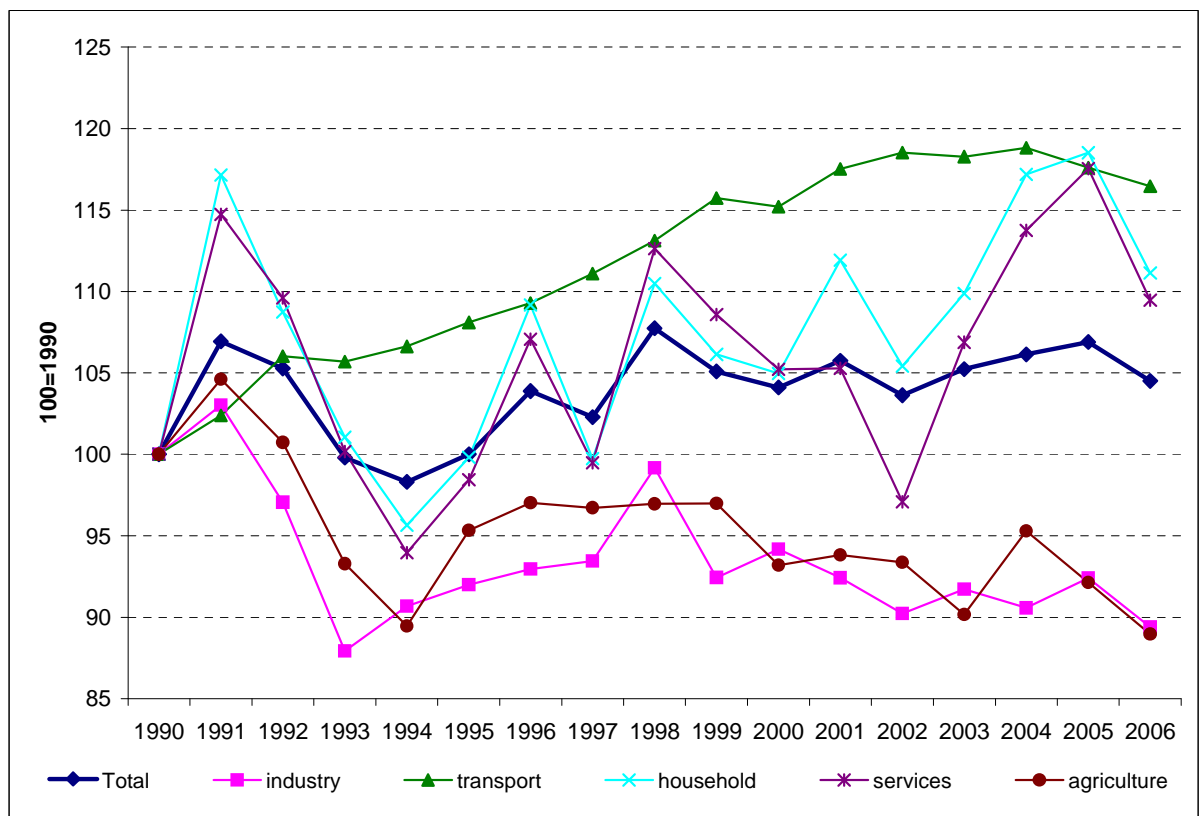
Direct CO₂ emissions have increased by 6% since 1990 in France (317 Mt CO₂ in 2006) Emissions increased the most in the transport sector (16.5%) then households 12.1% and services 7.5%. Only agriculture sectors and industry have succeeded in reducing their CO₂ emissions (respectively -15% and -9.5% since 1990).

Total CO₂ emissions

Change in total CO₂ emissions, including indirect emissions, have a similar trend by sector than direct emissions due to the stability of the electricity generation mix. Since 1990, the total CO₂ emissions (final consumers with electricity) has increased by 6% (358 Mt CO₂.in 2006). The reduction is even slightly higher than for direct emissions (-11% for industry and agriculture, 11% for households, 9.5% for services, 16.5% for transport since 1990) (

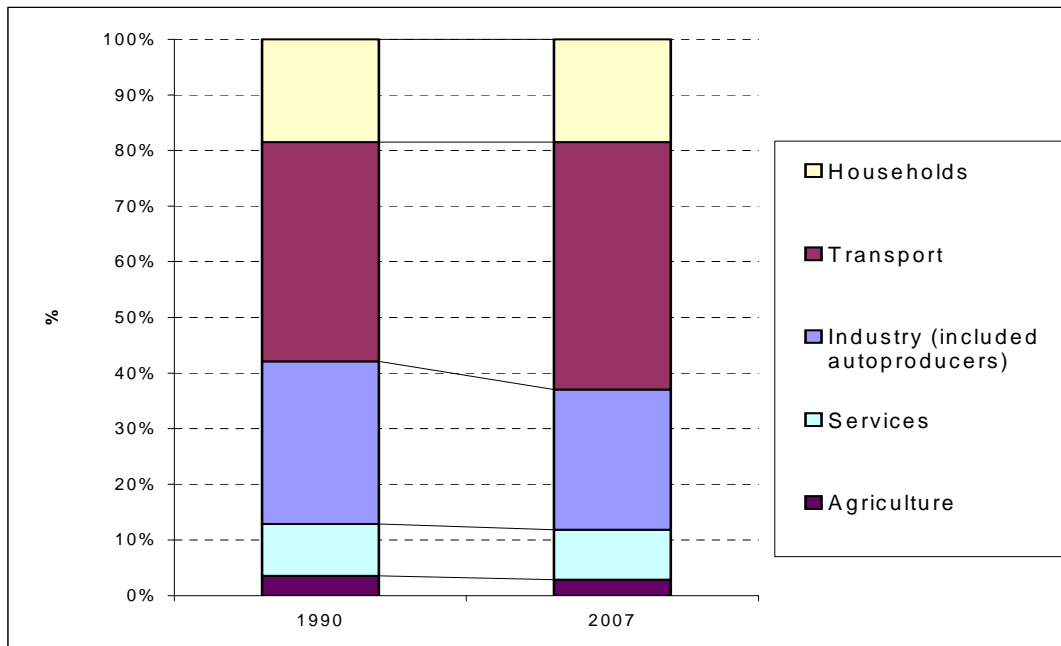
Figure 35).

Figure 35 : Trend of total CO₂ emissions by sector



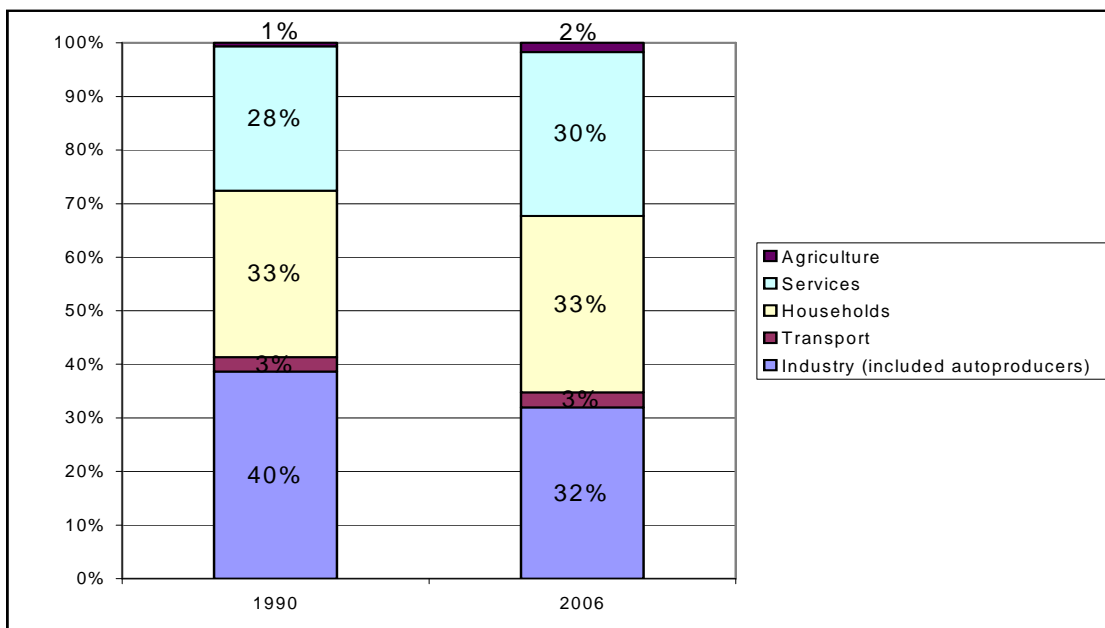
Between 1990 and 2007, the share of transport sector in the total of CO₂ emissions has increased by 4%. The share of industry has decreased by 4%. The share of households, services and agriculture has remained stable in the over period (respectively 19%, 9% and 3%) (Figure 36).

Figure 36: Evolution of the share of the different sectors in the total of CO₂ emissions between 1990 and 2007



Since 1990, the difference between total CO₂ emissions and direct CO₂ emissions fluctuated considerably. In 2006 this difference is about 41 Mt CO₂. The glance is represented in the **Figure 37**.

Figure 37 : Difference between total CO₂ emissions and direct CO₂ emissions by sector



4 Energy efficiency measures

4.1 Recent Energy Efficiency Measures

The description of the energy efficiency policies and measures in France is extracted from the MURE database (www.mure2.com). This database provides comprehensive and detailed information on the energy efficiency measures in Europe by sector (industry, transport, households and tertiary). An overview of all the French measures is included in **Annex 2**.

Residential Sector

A **fifth thermal building code** has been introduced in France in July 2005, both for households and services and has been in force since September 2006. This new thermal building code should bring on average energy savings of 15%, compared to RT 2000 standards that entered into force in 2001, which already was 15% more efficient than the previous regulation of 1989 for dwellings (40% for service sector buildings).

For the existing stock, **the tax credit** scheme has been reinforced in 2005 and concerns a selection of eligible equipment (equipment using renewable, low temperature boilers condensing boilers, heating regulation equipment, thermal insulation products). For solar water heaters and other equipment using renewable, the tax credit increased from 15% before 2005, to 40% in 2005 and 50% in 2006. For other equipment, the tax credit was increased from 15-25% in 2005 to 25-40% in 2006.

The energy performance assessment (DPE in French) is an energy performance evaluation of a household or a building. Realized by professionals, the DPE identifies the estimated consumption of energy of the residences and the buildings. It is necessary since November 1st 2006 for the sales of residential and tertiary buildings (except for very particular cases admitted by the European directive). It is necessary since July 1st, 2007, for buildings offered for lease. The decree n°2006-1147 specifies that it must be provided to the completion of the building sites of constructions (the whole buildings or parts of building) whose permit building was deposited from July 1st, 2007. Since January 2nd 2008, the DPE will have to be posted in the public buildings (decree n°2006-363 of March 19, 2007) of an overall surface clear higher than 1.000 m².

The French sector organizations (FFB, CAPEB, FNSCOP) and a few obliged actors (so far mainly EDF), under the control of the French Ministry for Environment and Sustainable Development and Planning (MEDAD) and of the French Agency for Environment and Energy Management (ADEME), have designed a **sustainable building training scheme** during 2007 that begun to work on Jan. 2008. This programme is managed by the ATEE NGO (www.clubc2e.org). It is built on a common referential that encompasses 3 modules:

- 1- General knowledge about building and climate change, and buildings as energetic systems;
- 2- Conceptual and software tools to make a global energetic refurbishing offer;
- 3- Nine specialized modules about how to properly use actual efficient solutions in refurbishing buildings (insulation, solar hot water...)

The training organisms that are purveying modules 1 and 2 were selected through public offering in 2007; those for module 3 are being selected.

50 000 workers of the building industry should have been trained through this programme by mid-2009.

Since January 1st, 2007 the CODEVI (saving plan allowing banks to invest in industrial development) is replaced by **the sustainable development account** ("livret développement durable"). The sustainable development account allows henceforth to collect a supplementary savings and to allocate these savings to loans to the private individuals for works of energy performance improvement of the building. The beneficiaries of the loans are not inevitably the savers. The ceiling of the sustainable development account was raised from 4 600 € to 6 000 € (approximately 30 % of the CODEVI already reached the previous ceiling).

Jean-Louis Borloo, Minister of environment signed on February 26, 2009 with banks, building and real estate professionals, and ADEME, an agreement detailing the practical implementation of the green loan.

The **green loan** is intended to finance renovation works and energy performance improvement in all the main homes. The beneficiaries, without any condition of resources, are, occupying owners or non occupying owners. The buildings concerned must be completed before January 1, 1990 and a household can only have one green loan.

The green loan has a zero interest rate with the amortization period between 36 months and 120 months.

Transport Sector

For passengers transport, there are measures to organise mobility plan for employees in some companies (about 250 agreements signed in 2006) and for schools (about 1500 mobility plans for schools in 2008) see evaluation in 4.4.2.

For the transport of goods, the main area is the support to rail/road-combined transport. In addition, several audits of company fleet have been performed.

Two new measures have been recently implemented: the compulsory energy and CO₂ car labelling scheme and an additional taxation for powerful cars (above 200g CO₂/km).

The Environment Round Table highlighted the advantages of an ecological tax (**'bonus malus' for new cars**) on the most polluting new vehicles, the revenue of which would finance the withdrawal of the oldest vehicles, which are, on average, more polluting. It involves rewarding the purchase of an environmentally responsible car and funding this incentive by penalising those who buy vehicles with the highest CO₂ emissions. Moreover, if the acquisition of the clean vehicle is accompanied by the scrapping of an old vehicle over 10 years old, there is a scrapping bonus of €1000. This incentive system would not mean any additional general taxation of households or companies (see ex post evaluation in chapter 4.3).

Industrial Sector

The most challenging operation in industry was the implementation of the CO₂ National allocation plan that set a quota amounting to 150 Mt CO₂.

Between 2000 and 2006, ADEME has implemented about 5400 audits, (light audits, detailed audits, in depth feasibility studies). These audits resulted in more than 90 ktoe/year of energy savings (15 kteCO₂/year).

To accelerate the penetration of new technologies or process into the market, more than 250 demonstration or pilot projects have been launched from 2000 to 2007.

Tertiary Sector

The recent energy efficiency measures are described in details in the residential sector above (thermal building code, energy performance assessment, and sustainable building training scheme).

Cross-cutting measures

A newly implemented important and innovative measure has been launched in July 2006, the “Energy savings or white certificates scheme”. It sets a target of 54 TWh cumulated savings. This measure is described below in section 4.3.

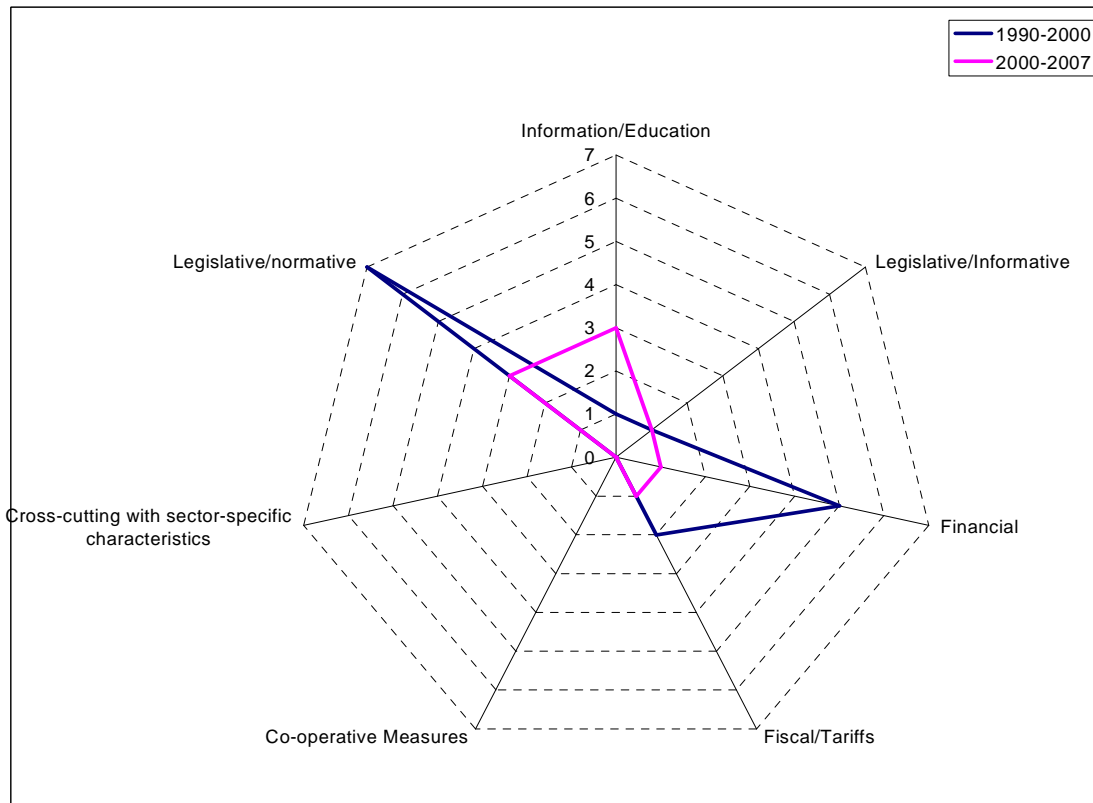
4.2 Patterns and Dynamics of Energy Efficiency Measures

Diagrams in the form of a spider graph can be used to illustrate the patterns of energy policies and measures, ie the main measure type in a sector.

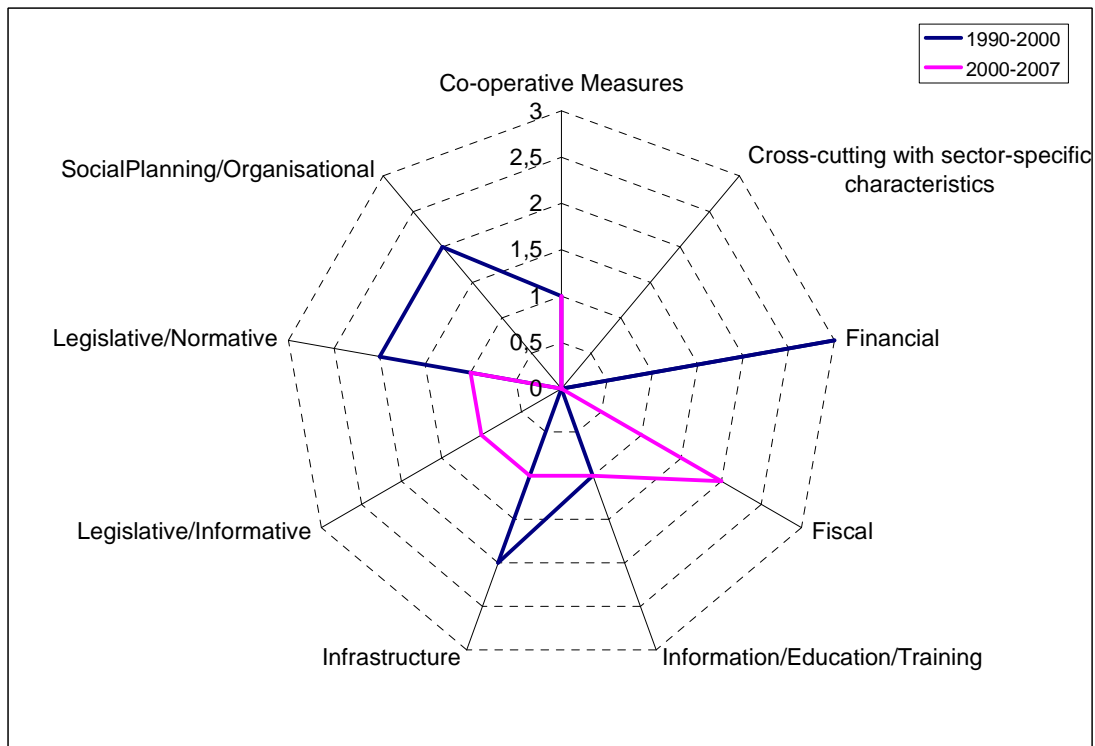
Residential Sector

64% of the measures has been implemented before 2000, essentially normative (buildings code), financial and fiscal /tariffs measures.

The main measures implemented since 2000, are information/education type and legislative/normative type as energy performance audits.



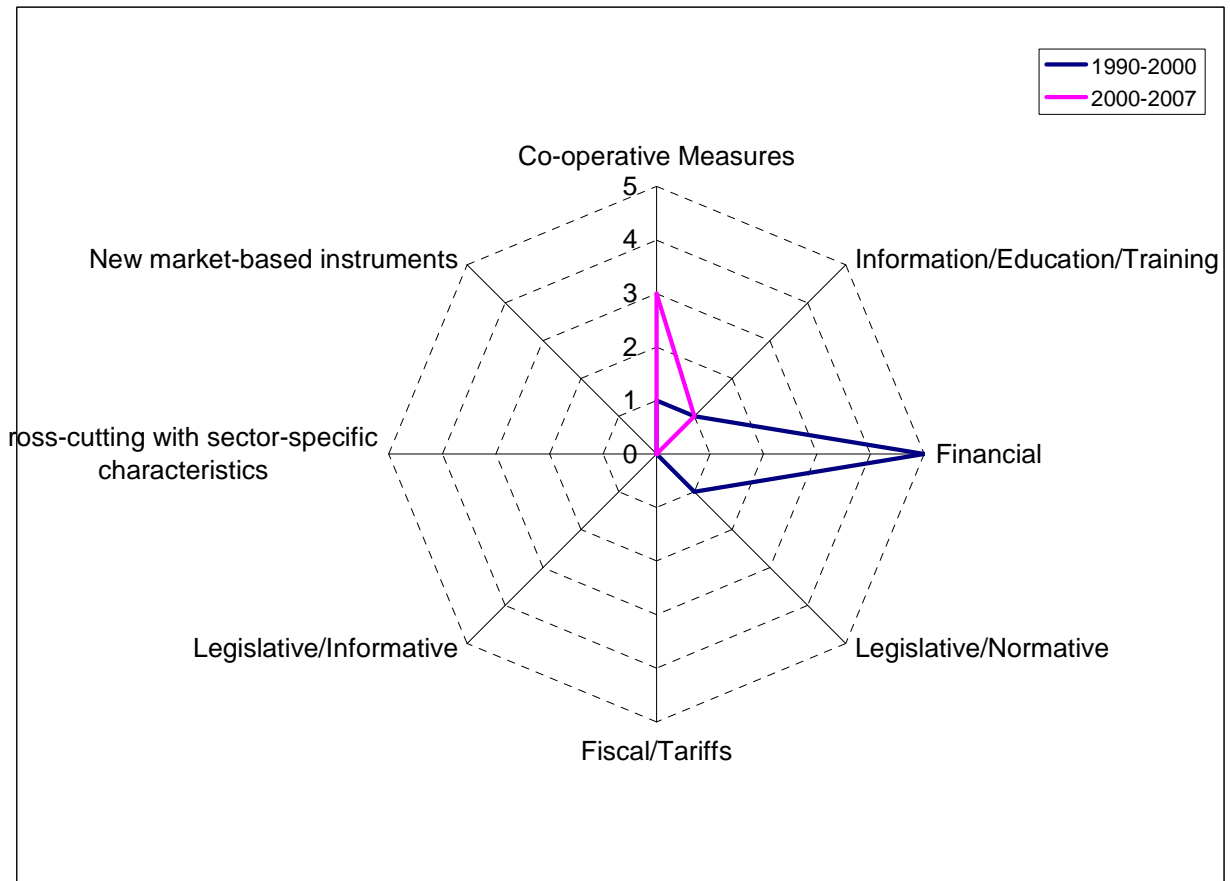
Transport Sector



Between 1990 and 2000, the majority of type of measures were social planning/organisational, financial, infrastructure and normative. Since 2000, fiscal measures were dominant. There is also a diversity of type of measures that have been implemented excepted financial and social/organisational type.

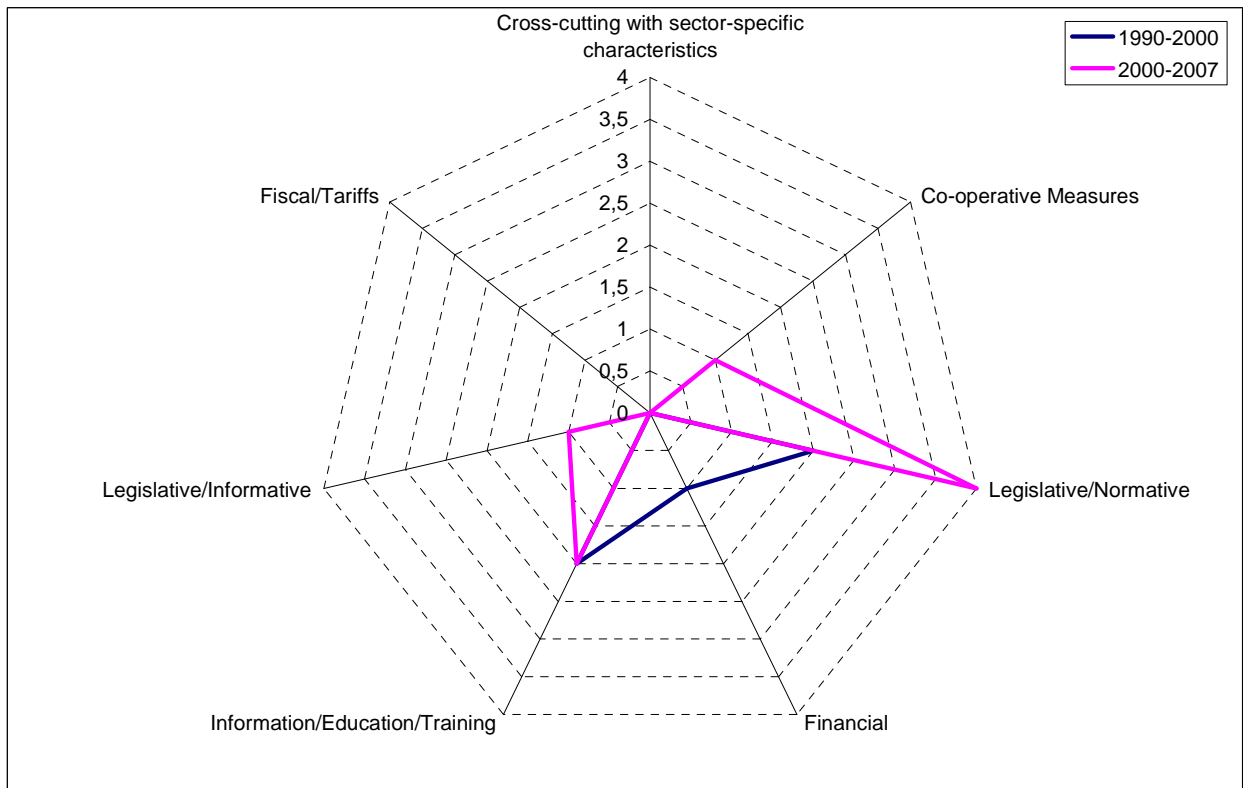
Since 1990, all type of measures has been implemented excepted cross cutting with sector specific characteristics.

Industrial Sector



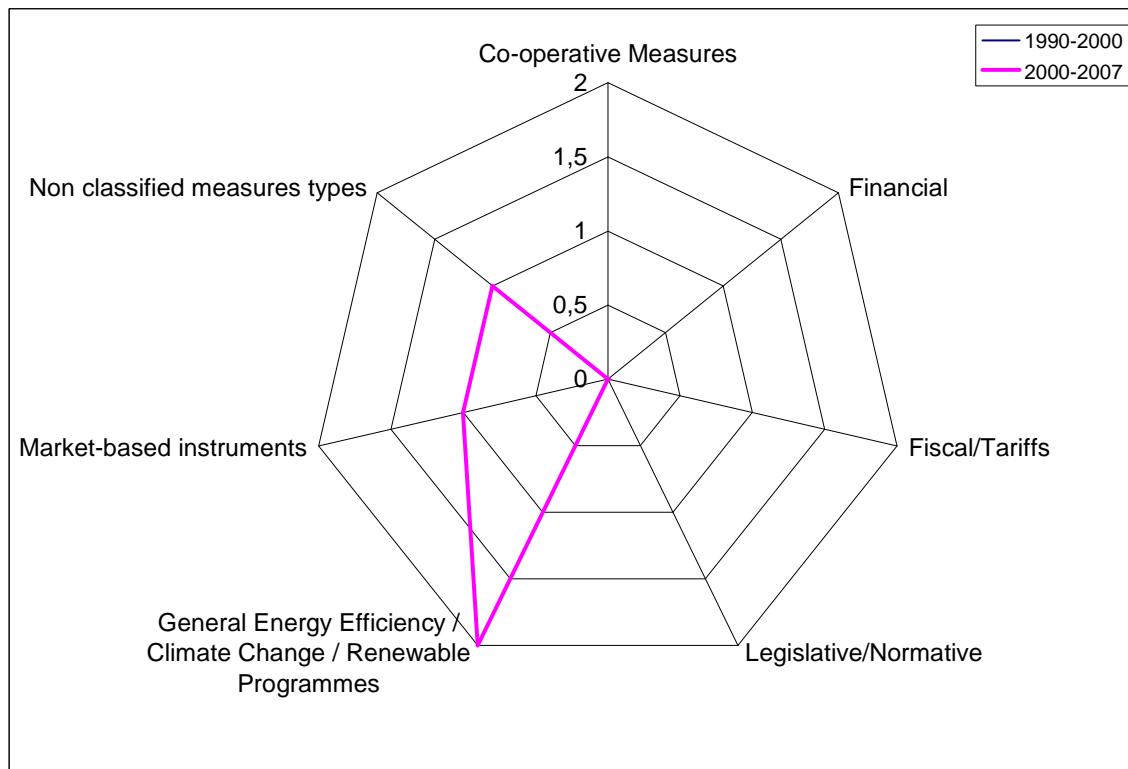
Before 2000, the measures were essentially financial. After 2000, co-operatives measures, such as voluntary agreements, were majority with information/education/training measures. We can notice that there are only four types of measures implemented in the industrial sector since 1990. However, the emission quota system is the major tool in that sector. No particular important policy is specifically targeted towards the SMEs.

Tertiary Sector



Before 2000, the main measure types were information/education/training, normative, and also financial. Since 2000, normative measures are dominant. Two new measure types were taken, co-operative and informative measures.

Cross-cutting measures



Before 2000, none measure were been implemented. Since 2000, two types of measures were taken: market based instruments as energy savings certificates, general energy efficiency as building programme or mobility programme of the environment round table. The other type of measure is an information campaign (non classified measures types).

4.3 Innovative Energy Efficiency Measures

Energy savings certificates (ESC)

The law n° 2005-781 adopted the 13th of July 2005 introduces a new instrument in France in the framework of the energy demand management policy: the energy savings or white certificates. The need was acknowledged to apply this action to existing basins (household and tertiary sectors), characterised by generally widespread - but energy intensive on the whole - user classes. This background brought about opportunities to set up a national policy based on energy efficiency Certificates, with a complementary role to other existing instruments, such as regulations under way, tax credit

etc, and which could be based on encouraging the market parties towards mobilisation of their demand/supply, with no involvement of subsidies.

The mandatory targets involve for the first three years 54 TWh in final energy cumulated and actualised with a 4% discount rate over the life of the energy efficiency actions (depending on the considered measure). The saving actions must be performed in the three years period: 1st of July 2006 to the 30th of June 2009. Within this period, there are no annual deadlines to be respected, and the targets will be verified only at the end of June 2009.

The overall target will be shared among the different energy sources covered, then among obliged actors: depending on their market share. The decree from the 26th of September 2006 has decided the following repartition among the energy suppliers (obliged actors):

- Electricity : 31 TWh ;
- Natural gas : 14 TWh ;
- Fuel : 6,8 TWh ;
- LPG : 1,5 TWh ;
- Cooling and heating: 0,7 TWh.

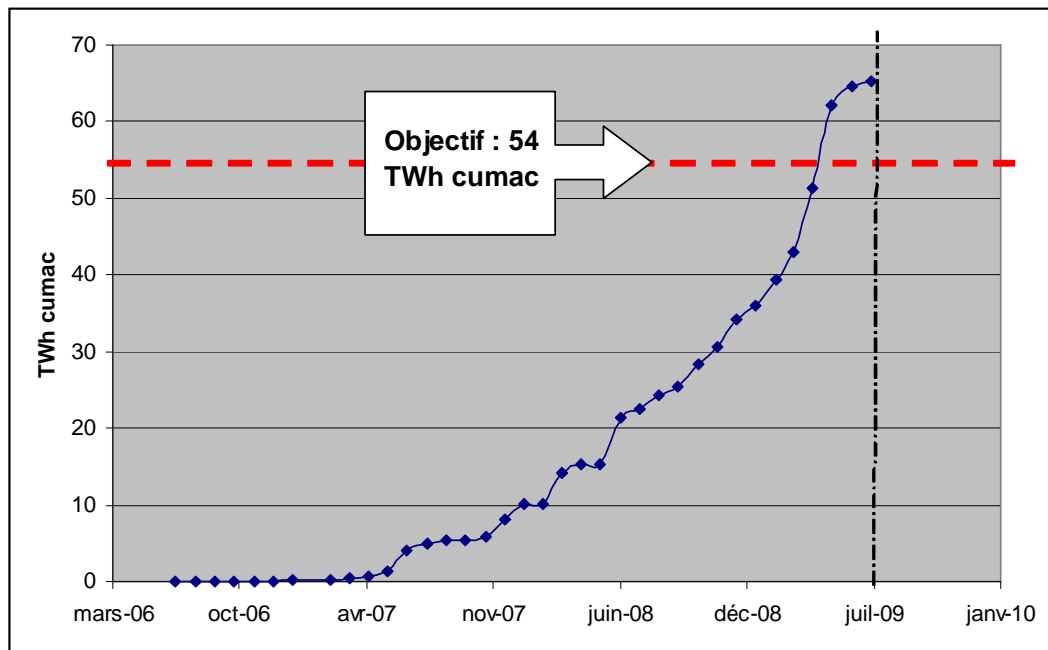
At all, 2 500 firms are obliged by the order from the 26th of September 2006 to realise energy savings.

As a rule, the total energy savings targets are shared among suppliers with annual sales beyond a fixed threshold. This threshold depends on the kind of energy supplied: in case of suppliers of electricity, natural gas, LPG and heating or cooling, the threshold is 0.4 TWh in the year in case of domestic fuel suppliers, there is no threshold: the obligation occurs "from the first litre", according to a specific request of the professional organisation.

The attribution of the energy savings certificates is represented in the **Figure 38**.

Within the context of the Environment Round Table, energy savings certificates are an important tool in meeting targets in the residential and service sectors at the least cost, namely to reduce energy consumption by approximately 20% in service-sector buildings and 12% in residential buildings within 5 years, and by more than a third by 2020. The operational committees (COM-OPs) in question look into how far a target substantially increased in the second period, starting in July 2009, could contribute to the objectives of the Environment Round Table.

Figure 38: Energy savings certificates attribution between 2006 and 2009)



Source ADEME

The bonus malus

In 2008 the French government set up a "bonus malus" system for car sales: a premium (bonus) is paid to the purchasers of vehicles that emit less than 130 gCO₂/km³. The amount declines in line with emissions of CO₂/km. A vehicle that emits less than 100 gCO₂/km receives a bonus of € 1,000. Buyers of cars that emit between 120 and 130 gCO₂ receive € 200 euros. On the other hand, a tax on sale (penalty) is levied on cars that emit more than 160 gCO₂/km. The amount increases in line with emissions of CO₂ and varies between € 200 for vehicles that emit less than 165 gCO₂, and € 2,600 for class G vehicles that emit more than 250 gCO₂/km

The bonus is equivalent to 8% of the price of a class A vehicle and almost 5% of the price of a class B vehicle. The penalty is equivalent to more than 5% of the average price of a class G vehicle

This measure, coupled with a sharp rise in oil prices, had a significant effect on the change in market shares of the various energy classes during the first half of 2008. The market share of class B vehicles increased from less than 20% to 33%. Sales of class G vehicles fell by half

³ The emissions are measured with official standard criterions which have been negotiated between the ADEME and the representatives of the cars constructors. The emissions induced by air conditioning are taken into account.

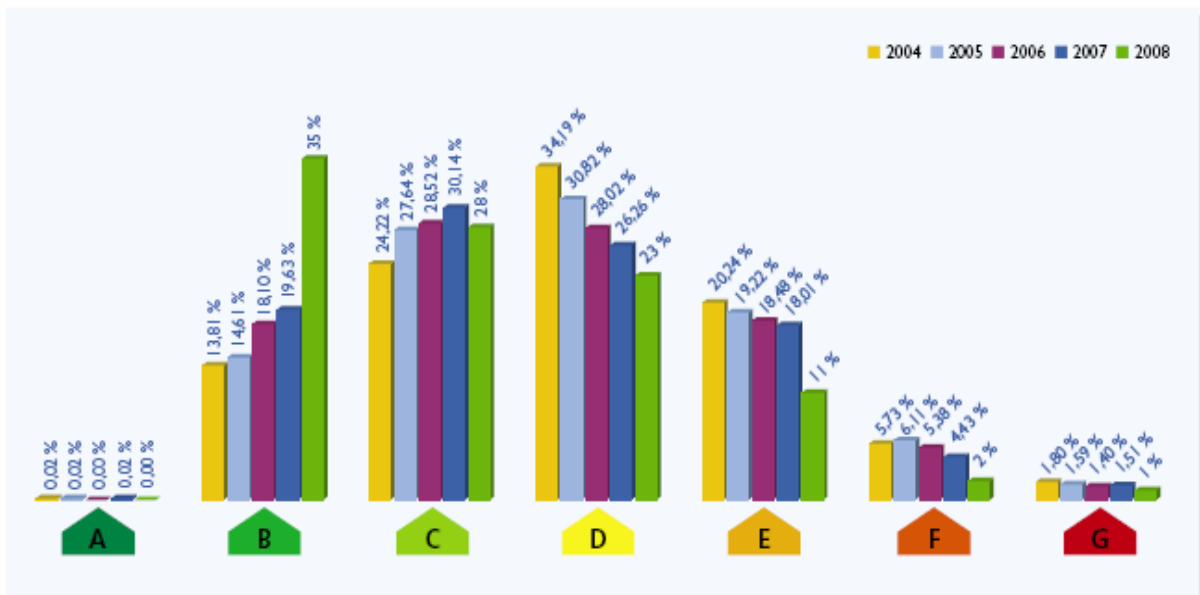
Thanks to the bonus malus, the CO2 emissions of new cars have decreased by 6% from 148gCO2/Km to 139gCO2/km. It has had a positive effect on the French automobile market, with sales of new vehicles rising by +3.5% in France between January and September 2008 (**Figure 39**).

Sales by French manufacturers increased by +5.5% over the same period, which may have improved their net revenues by almost +euros 1.2 billion, in a difficult international context. Indeed, new registrations fell by -4.5% in Europe over the same period.

This measure has therefore had positive economic and ecological effects, for a modest cost to the taxpayer, costing euro 168 millions of public money in the first half of 2008. This deficit should be reduced with future modifications to the malus rates.

Given such a success, the French government is thinking to implement this bonus malus system to new equipments, especially motorcycles and vans.

Figure 39 : Breakdown of the car market by class between 2004 and 2008



Source ADEME

Tax credit for energy efficiency materials and renewable energies

At the beginning of the year 2005 the government has reinforced the system of tax credit in favour of energy efficiency materials and equipment using renewable energies. For solar energies this measure has replaced previous subsidies.

The logic of the tax credit is as follows: the rate of the tax credit is applied to the purchase price of equipment and materials. If the person has benefited from another aid (ANAH, regional council ...) the calculus is made with the price of the equipment/materials less aids perceived. The cost of the installation is not taken into account. Everybody benefits from tax credit even without paying revenue tax.

The measure targets the most efficient equipment and renewable energies. The objective is to promote the products with the best energy performances and to improve the quality of the equipment proposed in the market.

For the main dwellings built since more than two years the rate is now:

- 15% for the individual and collective low temperature boilers
- 25% for condensation boilers and thermal insulation products and heating regulation equipment
- 50 % versus 40% for wood boilers

For new or old dwellings the rate is between 15% to 40% for the equipment using renewable energies (solar and wood) and some heat pumps used to produce heat.

The reinforcement of the rate of tax credit since 2006 (50 % instead of 40 %) should consolidate this growth.

The implementation of the tax credit in favour of energy savings and renewable energies in 2005 revitalized the market of equipments saving the energy or using the renewable energies in the private individual environment. For the investments realized by the private individuals in 2006, the market of these equipments and their installation is estimated between €/year 3 and 4 billions

However, as regards the heat insulation, the existing device is unbalanced and almost exclusively dedicated to windows to the detriment of the insulation of the opaque walls. The ratio efficiency / cost of this last one is nevertheless much better than that of the glazed walls.

As a consequence, it was necessary to redesign the scheme in order to make it more effective, with a strategy in two times:

- In the short run, the requirements of performance has been raised to avoid free-rider effect and to assure the most effective possible use of the public means. It is thus suggested raising the wanted requirements, in particular for the double glazing which represent half of the credit charges of tax for the State, but also for heaters in the wood and the hot air pumps. It would also be advisable to increase the grant in favour of the insulation of the opaque walls, for which the current incentive is insufficient. A decree could be very quickly prepared (or merged with that above). These two measures would allow to lower the credit charges of tax of 180 M€ while doubling its efficiency in term of tons of avoided CO₂.

- In the medium term (1 - 2 the years), a modification of the device towards a system rest basing on the performance reached by the works of renovation (and either as today on a logic of means by a list of equipments), by means of the diagnosis of energy performance, recently introduced, would allow France to be equipped with a real device of very legible financing allowing it to aim at the objective Factor 4 in the residential sector.

4.4 Energy efficiency measure evaluations

4.4.1 Semi-quantitative Impact Estimates of Energy Efficiency Measures

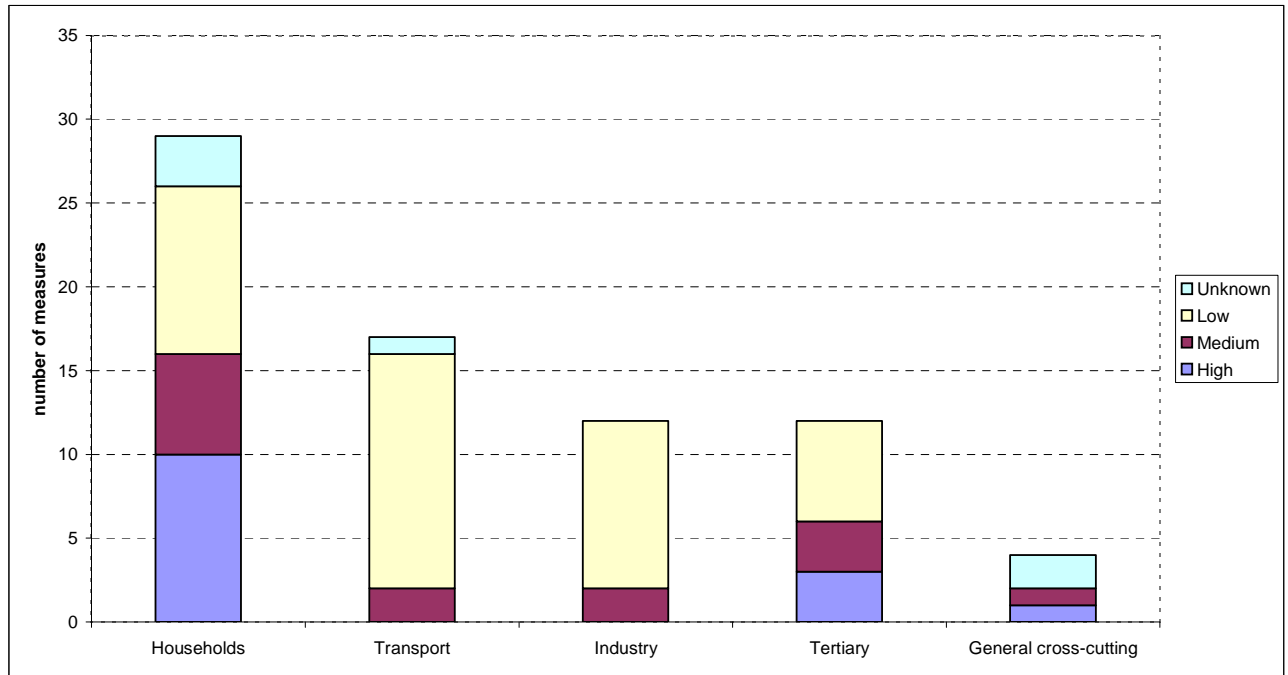
In the measure descriptions, which are included in the MURE database, information related to the impact evaluation of a measure is included. If a quantitative evaluation is available, the methods used and the results of the evaluation are provided, including as far as possible the impacts in terms of energy savings and CO₂ savings.

If no quantitative evaluation is available, or in addition to the quantitative evaluation, a qualitative expert judgement is reported, too, namely an assessment of the measure's impact (high/medium/low) in terms of energy and CO₂ savings⁴. The last column in the

⁴ The categories (low, medium, high) are linked to the aggregate electricity or final energy consumption of the respective sector (households, transport, industry or tertiary). The following limits are defined for the three impact levels: low impact: <0.1%; medium impact: 0.1-<0.5%; high impact: ≥0.5%. If a quantitative evaluation is available, the qualitative impact can easily be calculated by applying this definition to the quantitative figures. For measures with no quantitative evaluation, the qualitative evaluation is a very rough expert judgement.

overview tables in Annex 2 shows the respective semi-quantitative impact assessment for all French measures in the MURE database. In **Figure 40** the number of measures in each qualitative impact evaluation category is summarized.

Figure 40: Semi-quantitative impact evaluations by sector



74 measures are described in the MURE database for France of which 40 have been qualified in terms of quantitative impact.

Fourteen measures are described with a high semi quantitative impact and five types of measures are represented (generally on the building), building codes, energy performance audits, tax credit, national campaign, and local information centre.

Fourteen measures are described with a medium semi quantitative impact. These measures are represented in all sectors.

Forty measures are with a low semi quantitative impact. This type of measures is majority.

Six measures are proposed without evaluation of a semi quantitative impact (unknown).

4.4.2 Lessons from Quantitative Energy Efficiency Measure Evaluations

To illustrate this topic, we have selected two case studies which have been deeply evaluated through an exhaustive ex-post methodology: the mobility plan for companies and the local energy information centres (EIE).

Evaluation of mobility plans for companies and schools

A mobility management plan (MP) consists in a package of measures put in place by an organisation to encourage and support more sustainable travel patterns among staff, pupils, students, clients and other visitors.

ADEME provides a methodological assistance (creation of a methodological guide...) and grants:

- 50% of the cost of study mobility plans for companies (up to a maximum cost of €75 000)
- for the implementation (if the operation is exemplary) ADEME finances 20% (30% for the first operations) with up to a maximum cost of €300 000 net.
- for specialized installation (MP for schools)

These 2 evaluations had four specific objectives:

- Make an exhaustive inventory and categorize the steps
- Evaluate the environmental impact
- Know the potential development
- Evaluate the national policy and the role of ADEME: make operational recommendations

An exhaustive inventory with local authorities, companies, schools has been realized with a questionnaire to all silent partners to collect quantitative information (e.g. area, type of companies, numbers of employees, alternative modes of transport chosen...) An in depth-evaluation was realized on 17 MP for companies and 25 MP for schools

Results for companies:

Quantitative results:

- In 2005, 257 MP for companies (today, more than 3,500 MP for companies)
- A low and very variable environmental impact depends on the MP (between 0 and 315 t/CO₂/year)
- The 2 main steps are bicycling (22%) and reduction of public transport cost (21%) (eg. season ticket)

Qualitative results:

- The MP is a complex project: implementation requires competences in project management.
- Beyond financial aid the added-value of ADEME is for methodological assistance
- For 66%, the need for an MP is to solve accessibility problems
- For silent partner and staff, the primary impact is economical, and social

Results for schools:

Quantitative results:

- In 2008, 1,348 MP for schools
- Difficulty to evaluate the environmental impact
- According to the hypothesis taken, a trip saved between 0.26 to 0.65teqCO₂.
- By extrapolation, 1,348 steps saved between 21 to 52 teqCO₂/year.
- 89% of all steps are in primary schools
- 69% are pedestrian steps

Qualitative results:

- The 3 main reasons for a MP for schools are:
 - Problems of parking
 - Feeling of insecurity
 - Urban mandatory plan
- For a MP to be successful, young participation is essential
 - 1,348 MP represent 2% of national schools, so an important development potential (98%) is possible.

In conclusion, due to the complexity of the project, the inputs must be numerous. The coherence with other policies is very important (existence of public transport, infrastructure...etc). It was very difficult to evaluate the efficiency (cost and impact too different) and the result is not significant. The effectiveness is limited for energy efficiency or greenhouse gases reduction. There are lot of real expected and unexpected effects. To evaluate these kind of measures better, the initial displacements must be known and silent partners must fill a reporting data tool.

It's difficult to have an impacted evaluation, because the steps are too different (and an average isn't very significant). The calculated impact (with these type of evaluations) is low

For ADEME, the main objective of these measures is to save energy and to reduce greenhouse gases. In fact the objectives for the silent partners are economical, organisational, social, however not environmental

Evaluation of local energy information centres (EIE)

To increase the awareness of households and assist them in their investment decisions in energy efficiency, ADEME has decided in 2000 to create local energy information centres (Espaces Info Energie, EIE). In 2007, there were 200 EIE with 350 advisors. Between, 2004 and 2007, these local centres have informed more than 4.3 millions of people (of which 84% from households, 9% from organizations, 4% from buildings professionals).

An evaluation has been carried out for ADEME in January 2004 to evaluate the role of the local centres for advices on investments. The study aims to identify the demand, and focuses more precisely on private households (sample of 503 contacts). Between 2006 and 2009, 10 regions have been carried out (on a total of 26) an evaluation based on the same method to evaluate theirs local's centres. The aggregation of these ten evaluations showed the below results.

The satisfaction rate is high (80 %) but becomes weaker than in 2003. In return a rate of dissatisfaction has almost doubled: 20 % against 11 % in 2003. The explanation is a saturation of the network (thus a longer waiting time) and more and more technical and precise demands.

After consulting the information centres, 56% of the households (against 26 % in 2003) have invested with an average expenditure of 8500 €/action. The investment concerns mainly the heavy improvement of the energy performance.

In 2008, the economical impact for the EIE is estimated at euros 400 millions or an economical average by EIE of euros 1.8 millions.

The reduction of CO₂ emissions is around 2.7 tCO₂ per household that made investments (based on about 2004 investments analysed). The evaluation has estimated that EIE is responsible of the investment with a rate of 56%. In total, in 2008, the environmental impact is estimated at 138 kt eq CO₂.

These bottom up evaluations show that for a recent measure as EIE, results changed a lot (between, the first evaluation in 2004 and the others evaluations in 2005-2008). Indeed, the network of the EIE have grown a lot since it creation in 2001. The context also change (oil price, the round table of environment...). So it's important to carry out steadily evaluation in order to have more updated results.

5 National Developments under the EU Energy Efficiency Directive and the 20% Energy Efficiency Target of the EU

The National Energy Efficiency Action Plan is essentially based on the environment round table realised in 2007.

The four programmes which have been proposed are described below:

The "Energy efficiency and carbon" programme

- Programme to promote renewable energy > hydraulic, wind, biomass, geothermal, photovoltaic cells and solar energy.
- Consumption of 30% to 50% renewable energy in the French overseas departments and territories by 2020.
- Research into second-generation biofuels.
- R&D programme for geological capture and storage of CO₂.
- Plan for very energy-efficient low-input farming.
- Carbon balance assessments of administrative departments and a 20% improvement in their energy efficiency.
- Inclusion of environmental clauses in the public procurement code.
- Study of the introduction of a climate-energy tax.

The "Modernising buildings and cities" programme

- Building new energy-efficient housing from 2010, widespread use of Green Buildings by 2012, and passive or positive-energy buildings from 2020.
- Building office space, buildings and public facilities that comply with low-consumption or positive energy standards from 2010.
- Ban on incandescent light bulbs and single glazing from 2010.
- Thermal renovation of public buildings within the next 5 years.
- Financial incentives for thermal renovation of privately-owned buildings.
- Carbon balance and energy-efficient assessments of all organisations of more than 50 people.

The "Urban planning and national/regional governance" programme

- Revitalising city centres in decline.
- Developing "eco-quarters".

Energy Efficiency Policies and Measures in France in 2007

- Widespread implementation of national/regional climate-energy plans by the end of 2012 in built-up and urban communities, complying with the objective of a 20% reduction in greenhouse gas emissions by 2020.
- Fighting urban sprawl and the destruction of the countryside.
- Environmental impact study for new urban development zones, integrating transport and the use of agricultural and natural land, with a view to protection.

The "Mobility and transportation" programme

- Priority given to public transport: construction of more than 1 500 km of bus lanes, tramways and cycle lanes.
- Rail: construction of 2 000 km of high-speed lines by 2020.
- Increasing the share of rail freight to 25% by 2012.
- Upgrading the conventional rail network.
- Developing rolling motorways.
- Developing sea motorways and inland waterways transport.
- Huge reduction of air transport emissions.
- 50% reduction of noise related to air transport by 2020.
- New private vehicles: introduction of eco-tags.
- Developing clean vehicles.
- Eco-tax based on mileage for trucks using the non-concessionary road network.

Annex 1

Energy Efficiency Measure Summary

Provide summary tables of all the measures implemented in your country (mainly on going measures, classified by sector) (can be downloaded from the MURE web site)

Energy Efficiency Policies and Measures in France in 2007

Household

Measure Code	Title	Status	Type	Starting Year	Ending Year	Semi-quantitative Impact
FRA1	High environmental quality of buildings	Ongoing	Information/Education	1990		Low
FRA2	Labels on electrical households appliances	Ongoing	Legislative/Informative	1995		Medium
FRA3	Minimum efficiency standards for hot water boilers	Ongoing	Legislative/Normative	1994		Low
FRA4	Demonstration projects in buildings	Ongoing	Financial	1980		Low
FRA5	VAT Reduction on energy efficiency investments	Ongoing	Fiscal/Tariffs	1999		High
FRA6	Subsidies for dwellings retrofitting : OPAH and PALULOS	Ongoing	Financial	1978		Medium
FRA7	Tax credit for works on energy efficiency	Completed	Fiscal/Tariffs	1990	2004	Medium
FRA8	Building insulation standard of 1974	Completed	Legislative/Normative	1974	1982	High
FRA9	Building insulation standard of 1982	Completed	Legislative/Normative	1982	1989	High

Energy Efficiency Policies and Measures in France in 2007

FRA10	Subsidies for wood equipment	Completed	Financial	1999	2006	Low
FRA11	Subsidies for solar equipment	Completed	Financial	2000	2005	Low
FRA12	Limit to the internal temperature of houses or dwellings (19°C)	Ongoing	Legislative/Normative	1974		Low
FRA13	Audits subsidies in buildings	Ongoing	Financial	1980		Medium
FRA14	Minimum efficiency standards for refrigerators and freezers	Completed	Legislative/Normative	1999	2007	Medium
FRA15	Building insulation standard of 2001	Completed	Legislative/Normative	2001	2005	High
FRA16	Local energy information centres	Ongoing	Information/Education	2001		High
FRA18	Building insulation standard of 1989	Completed	Legislative/Normative	1989	2001	High
FRA22	Information and advertising campaign "Faisons vite ça chauffe"	Completed	Information/Education	2004	2006	High
FRA23	Tax credit for energy efficiency materials and renewable energies	Ongoing	Fiscal/Tariffs	2005		High
FRA28	Training for sustainable building	Proposed (advanced)	Unknown			Medium
FRA31	Loan has zero rate	Proposed (advanced)	Financial			Unknown
FRA32	Loan lean to savings account of sustainable development	Proposed (advanced)	Financial			Unknown

Energy Efficiency Policies and Measures in France in 2007

FRA33	Building codes RT 2005	Ongoing	Legislative/Normative	2006		High
FRA34	Energy performance audits	Ongoing	Legislative/Informative	2006		High
FRA35	High performance label dwellings	Ongoing	Information/Education	2007		Low
FRA37	CO2-credits for "household" projects	Ongoing	Financial	2007		Low
FRA38	Periodic mandatory inspection of boilers	Ongoing	Legislative/Normative	1998		Low
FRA39	Periodic mandatory inspection of Heating/Ventilation/AC (HVAC)	Ongoing	Legislative/Normative	2002		Low
FRA40	"Modernising buildings and cities" programme	Ongoing	Unknown	2008		Unknown

Transport

Measure Code	Title	Status	Type	Starting Year	Ending Year	Semiquantitative Impact
FRA1	Development of infrastructure for combined transport : road/rail, road/river, short sea shipping	Ongoing	Infrastructure	1990		Low
FRA2	Vehicle maintenance, technical control	Ongoing	Legislative/Normative	1985		Low
FRA3	Grants for energy savings in transport companies	Completed	Co-operative Measures	2000	2004	Low
FRA4	Mandatory urban transport plan	Ongoing	Infrastructure	2000		Low
FRA5	Mobility plans for companies	Ongoing	SocialPlanning/Organisational	2000		Low
FRA8	Subsidies for cars replacement	Completed	Financial	1994	1996	Low

Energy Efficiency Policies and Measures in France in 2007

FRA9	Speed limit control	Ongoing	Legislative/Normative	1974		Medium
FRA11	Grants for rail/road combined transport equipment	Ongoing	Infrastructure	2003		Low
FRA13	Grants for LPG and CNG vehicles	Ongoing	Financial	2000		Low
FRA14	Grants for electric vehicles	Ongoing	Financial	1999		Low
FRA15	Development of biofuels	Ongoing	Legislative/Normative	2005		Medium
FRA16	Car labelling in CO2 emissions	Ongoing	Legislative/Informative	2006		Low
FRA17	Free bike rental system	Ongoing	Information/Education/Training	2005		Low
FRA19	Ecological bonus	Ongoing	Fiscal	2007		Low
FRA20	Mobility management for school	Ongoing	Information/Education/Training, SocialPlanning/Organisational	1999		Low
FRA21	FRA21 Registration surcharge for cars	Ongoing	Fiscal	2006		Unknown
FRA22	Voluntary agreement	Ongoing	Co-operative Measures	2008		Low

Industry

Measure Code	Title	Status	Type	Starting Year	Ending Year	Semi-quantitative Impact
FRA1	Voluntary agreement (AERES)	Ongoing	Co-operative Measures	2002		Medium
FRA2	Negotiated agreement with the Ministry of Environment	Completed	Co-operative Measures	1996	2002	Low
FRA3	FIDEME: fund for investment in environment and rational use of energy	Ongoing	Financial	2000		Low
FRA4	FOGIME: Guarantee fund for energy conservation	Ongoing	Financial	2000		Low
FRA5	Efficiency standards for boilers	Ongoing	Legislative/Normative	1994		Medium
FRA7	Energy audits subsidies in industry	Ongoing	Financial	1999		Low
FRA8	Motor Challenge Programme	Ongoing	Co-operative Measures, Information/Education/Training	2002		Low

Energy Efficiency Policies and Measures in France in 2007

FRA9	Sofergie: funds for energy efficiency investments	Ongoing	Financial	1980		Low
FRA10	Information, technical assistance	Ongoing	Information/Education/Training	1983		Low
FRA11	Negotiated agreements between ADEME and professional federations	Ongoing	Co-operative Measures	2003		Low
FRA12	Grants for technological demonstration projects and exemplary operation in industry	Ongoing	Financial	1975		Low
FRA14	support the promotion of radiant energies	Ongoing	Financial			Low

Tertiary

Measure Code	Title	Status	Type	Starting Year	Ending Year	Semi-quantitative Impact
FRA1	Grants for energy audits in buildings	Ongoing	Financial	2000		Medium
FRA2	Energy efficiency of residential and tertiary buildings - Program OPATB	Ongoing	Co-operative Measures, Financial, Information/Education/Training	2003		Medium
FRA3	Building standard of 2001 (RT2000)	Completed	Legislative/Normative	2001	2005	High
FRA4	High environmental quality of buildings	Ongoing	Information/Education/Training	1990		Low
FRA5	Minimum efficiency standards for fluorescent lamp ballasts	Ongoing	Legislative/Normative	2001		Medium
FRA6	Public information, local information centres	Ongoing	Information/Education/Training	2000		Low
FRA7	Building codes RT 2005	Ongoing	Legislative/Normative	2006		High

Energy Efficiency Policies and Measures in France in 2007

FRA8	Energy performance audits	Ongoing	Legislative/Informative	2006		High
FRA9	Minimum efficiency standards for boilers	Ongoing	Legislative/Normative	1992		Low
FRA10	Periodic mandatory inspection of boilers	Ongoing	Legislative/Normative	1998		Low
FRA11	Periodic mandatory inspection of Heating/Ventilation/AC (HVAC)	Ongoing	Legislative/Normative	2002		Low
FRA12	High energy performance label	Ongoing	Information/Education/Training	2007		Low

General Cross-cutting

Measure Code	Title	Status	Type	Starting Year	Ending Year	Semiquantitative Impact
FRA4	"Mobility and transportation" programme	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2008		Unknown

Energy Efficiency Policies and Measures in France in 2007

FRA3	"Modernising buildings and cities" programme	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2008		Unknown
FRA1	Energy efficiency certificates	Ongoing	Market-based Instruments	2006		Medium
FRA2	Information and advertising campaign: why wait? (pourquoi attendre)	Ongoing	Non-classified Measure Types	2008		High

Annex 2

Country Profile



Energy Efficiency Profile : France

September 2009

Energy Efficiency Trends

Overview

The energy efficiency of final consumers improved by 17% (or 1.1%/year) in France between 1990 and 2007. This is close to the EU average. All the sectors participated to this improvement.

Industry

Energy efficiency improved by about 19% since 1990. Above-average improvements in energy efficiency could be observed in the steel, non ferrous and chemical industries. On the other hand, some branches have poor performance such as food, machinery and textile industries.

The intensity of manufacturing has decreased by 1.7%/year since 1990; these progress were mainly registered during the period 1993-2001, where structural changes explain one third of the energy productivity increase.

Households

Less energy is required every year per dwelling for space heating; this is mainly explained by the increasing share of more efficient new dwellings in the total stock of dwellings, and the substitution to electricity.

According to that, energy efficiency improved by 21% between 1990 and 2007 in the households sector, due to progress realized for space heating (25% improvements) and for large electrical appliance (13%). Most of the progress have been realized until 1997 and after 2001.

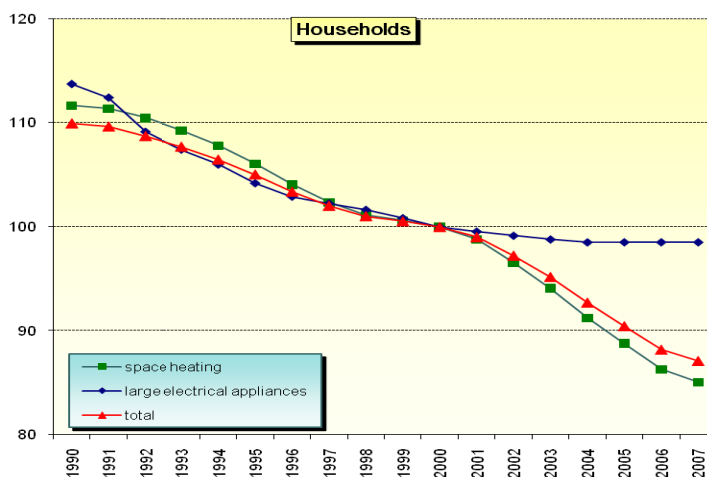
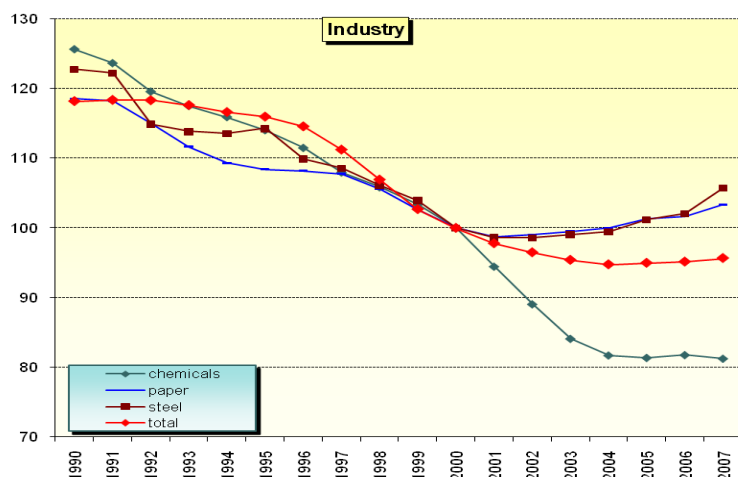
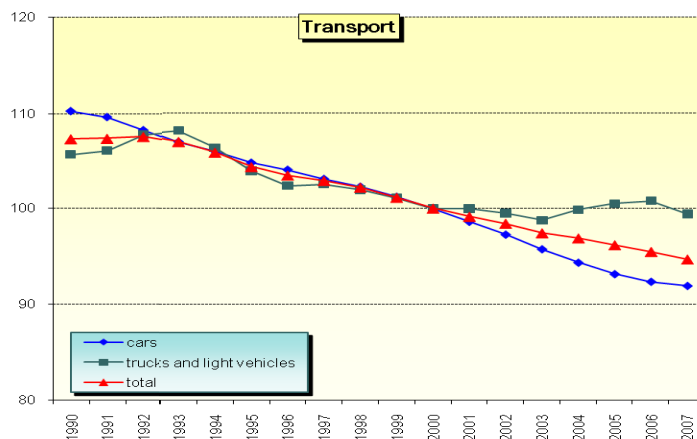
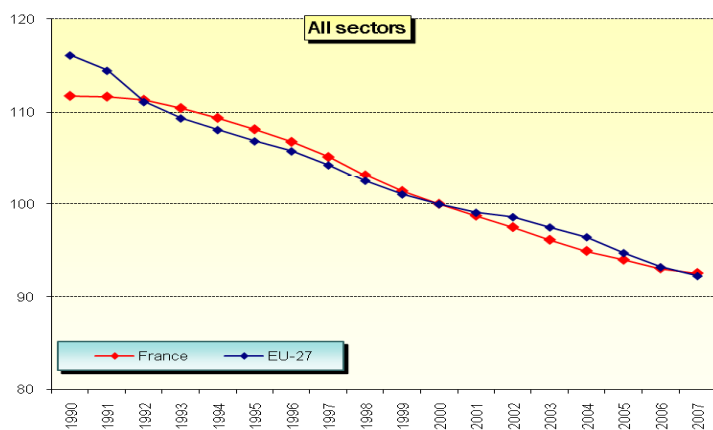
Transport

The transport sector has experienced regular energy efficiency improvements (around 12% since 1990). The progress was the most significant for cars (17%); for trucks and light vehicles, it is around 7%.

The specific consumption of cars in litres/100km is regularly decreasing since 1990 (-1.1%/year), with improvements for new cars, even if part of this gain is offset by a shift to larger cars.

Since 1993, almost all traffic indicators tend to show a slow down of the energy demand growth of transport compared to the economic activity, except for rail.

Energy efficiency index , base 100=2000



Energy Efficiency Policy Measures

Institutions and programmes

ADEME is the national, agency in charge of implementing RUE, RES and environmental policies. It operates within a 4 years agreement with the government (2007-2010).

In terms of CO₂, the adoption of the National Programme against Climate Changes (PNLCC) in January 2000, has been reinforced in 2004 and 2006. These programs are part of the 2005 energy law.

Industry

The most challenging operation in industry was the implementation of the CO₂ National allocation plan amounting to 150 MtCO₂. In 2006, ADEME has implemented 511 audits. Since 2000, 4233 energy audits have been carried out. These audits resulted in 90 ktoe/year of energy savings (88 ktCO₂/year).

To accelerate the penetration of new technologies or process into the market, 248 demonstration or pilot projects have been launched from 2000 to 2006.

Households, Services

The thermal building code was reinforced as of July 2005 for both households and the service sectors. This should bring on average energy savings of 15%, compared to 2000 standards. For the existing stock, the tax credit scheme, which was very successful, has been reinforced in 2005 and can reach 50%. In 2006, 6456 buildings have been audited for a total of 49 000 buildings since 2000. This measure is completed by demonstration projects and by OPATB program (energy efficiency of residential and tertiary building). The total subsidies dedicated to these measures reached 19 M Euros in 2006.

The implementation of local energy information centres has been reinforced: 187 centres, 340 advisers. These councils resulted in 317ktoe/year and 592ktCO₂/year between 2004 and 2006.

Three newly implemented important and innovative measures have been launched in 2006 and 2007: a compulsory energy

efficiency label scheme for building (November 2006); the innovative "White certificate scheme" accounting for 54 TWh cumulated savings" (since July 2006) and a CO₂ oriented financial/banking product for household with an expected leverage of 1 billion euro (starting January 2007).

Since 2006-2007, the energy performance audit of the household or a building was a legal obligation for the sale, for the hiring and for construction.

Transport

There is a large subsidies scheme towards clean fuels technologies (electric vehicles, LPG fuelled vehicle and clean buses). For passengers transport, there are measures to organise mobility plan for employees in some companies (7 agreements signed). For the transport of goods, the main area is the support to rail/road-combined transport. In addition, several audits of company fleet have been performed. However two new measures have been recently implemented the compulsory energy and CO₂, car labelling scheme and an ecological bonus since the first January 2008. In six month, the average of CO₂ emissions of the new cars decreased by 149 to 140gCO₂/km.

Energy prices and taxes

There is no environment or CO₂ tax in France. However in all consuming sectors, the energy prices at the consumer level have raised again.

Budgets

The budget of ADEME allocated for energy efficiency and renewable has increased by a factor 6 from 1998 to 2003, reaching 90 M Euros. This budget again has continued to grow and represents more than 100 M Euros in 2005.

Between 2000 and 2006, 125 M Euros were allocated to transport, 200 M Euros for energy efficiency and 429 M Euros for renewable energy.

Selected Energy Efficiency Measures

Sectors	Title of Measure	Since	Evaluation impacts
Households	Building insulation standards of 2005 : RT 2005	2005	15% of energy savings compared to 2000
Households	Tax credit for energy efficiency works and RES	1978	1 billion Euro in 2005, up to 50% aid
Households	Energy performance audits	2006	
Households, tertiary	Audits subsidies in buildings	1980	1.94 tCo ₂ saved per audited building
Transport	Grants for electric and natural gas vehicles	1985	CO ₂ savings : 13 tCo ₂ for electric vehicles; 63 ktCo ₂ for LPG vehicles
Transport	Car labelling	2006	
Transport	Ecological Bonus	2008	In six month, the average of CO ₂ emissions of the new cars decreased by 149 to 140gCO ₂ /km.
Industry	Quota Allocation plan	2002	
Industry	Energy audits and subsidies	1999	16.5 tCo ₂ saved per company
Tertiary	"High environmental quality" in buildings (HQE)	2001	
All	White certificate scheme	2006	Excluding energy intensive industries, 54 TWh cumulated
All	Local energy information centres	1990	187 centres; 1000 000 contacts between 2004 and 2006; 317 ktoe/year and 592 ktCO ₂ /year

