



## National report on the French Energy regime

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Knowledge for business

## **Introduction**

French energy policy over the past decades has been characterised by a centralised, nation-based approach with strong government involvement. Nonetheless, the context in which French energy policy historically operated has changed dramatically in recent years, driven by two main forces: the introduction of competition into the electricity and natural gas sectors, and the growing internationalisation of the energy sector in Europe as it moves towards a single market. France has now largely transposed the European Union directive its internal market: business market (small & large) is open since 2004 and mass market (residential customers) opened in July 2007.

France has very limited energy reserves with, consequently, a strong energy dependence (gas, oil), excepted for electricity production. Nuclear energy is the major source of electricity production.

The Mix Production for electricity is:

- nuclear 85%, based on the capacity of 58 production units,
- renewable energies including hydro 14%,
- oil and gas 1%.

Currently, 98% of French renewable energy comes from hydropower and biomass. The objective fixed is to reach 21% of renewable electricity by 2010. (Directive renewable electricity - 27/9/2001), with a diversification of sources (wind power and solar power for instance). French State implemented several mechanisms to regulate the market. T

he CRE (Commission of Regulation of Energy), an independent and specialized authority created in 2000, is charged to insure a correct competition on the French energy market.

The electricity transport is an autonomous entity since 2000 (RTE : Réseau de Transport Elecrique –Electric transport network), with a specific regulator. Grid access is transparent and has non-discriminatory rules for third parties, enforced by the CRE. The cost of transport and investments (TURP) is explicit in the tariffs.

## **Energy use and sourcing in France**

Final energy use in France was 162 Mtoe (Million tons oil equivalent) in 2006.

Housing sector is the main user, followed by transport and non-steel industry. In 2007, housing (domestic and tertiary) used 71 M toe, and transports 52 Mtoe out of a total of 161 Mtoe for final use. During the 1973-2007 period, the share of industry (including steel) strongly decreased (36% to 23%), the Residential-Tertiary sector remained stable (42% to 44%), while the transportation sector increased from 20% to 32%.

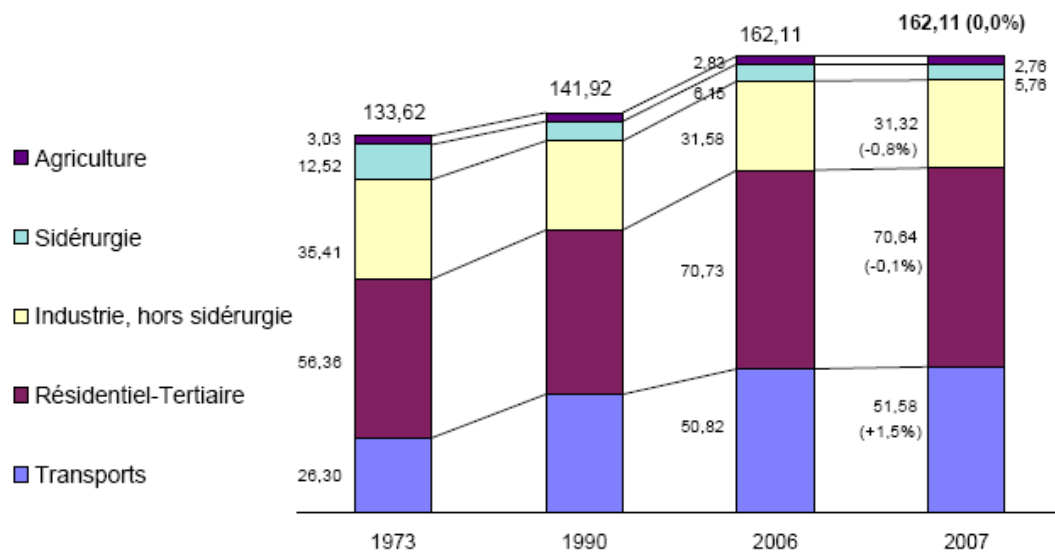


Fig. 1: Energy use by sectors in France (from top to bottom: agriculture, steel, other industries than steel, housing, transports) (source: Ministère de l'Industrie, 2008).

In 2007, the primary production of all renewable energy (electricity and thermal) amounts to 18 Mtoe, or 13.2% of the domestic production of energy. The hydraulic represents 28%, wood-energy 51%, renewable & municipal waste 6.5% on an equal footing with biofuels. The other channels totaled the remaining 8%. (Sources : Observatoire de l'Énergie, ADEME, CEREN, Observ'ER.)

The share of renewable electricity, using methodology defined by European Directive of 27 September 2001 and resumed by Eurostat, amounted to 13.0% in 2007 in continental (mainland) France. If the hydraulic replaces the concept of producible (average production park potential hydropower) to actual data, this unit is then to 14.5% in 2007.

Source: Observatoire de l'énergie, from EdF

Total availabilities of energy, feeding final and intermediary use, are as follows :

	Coal	Oil, crude	Oil, refined	Natural Gas	Electricity	renewable & waste	total
Total availabilities	12,6	82,6	7,5	38,3	115,6	14,1	270,7

Fig. 2. Total availabilities of energy in France in Mtoe, 2007 (source: Ministère de l'Industrie, 2008)

This table reflects the national choice, made in the 1970's, of using nuclear power as the major electricity source. This choice is explained by the absence of fossil energy resources in France. As a result, the situation of energy resources of France is as follows:

- Coal extraction ceased in April 2004
- 13 oil refineries with a total capacity distillation of 97 Million tons

- 58 nuclear power plants on 21 sites, or 63.3 GW:
- 0.01% of global fossil reserves at 01-01-2008:
- 14.11 million tons of crude oil
- 0.163 million tons of petroleum products extracted from natural gas
- 6.3 billion m<sup>3</sup> sellable gas.

And the sourcing of electricity by primary energy is as follows (fig. 3):

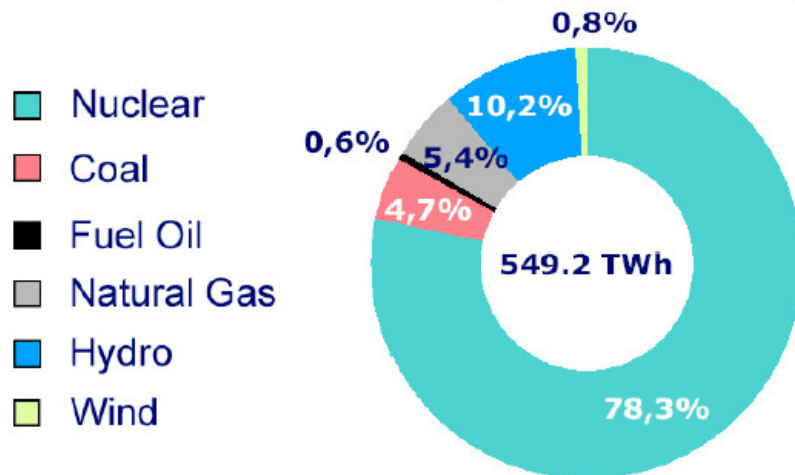


Fig. 3 : Electricity generation in France in 2005

The evolution since the 1970's is visible on the next chart showing the primary sources of energy used in France: it reflects the impact of nuclear electricity in substitution with oil.

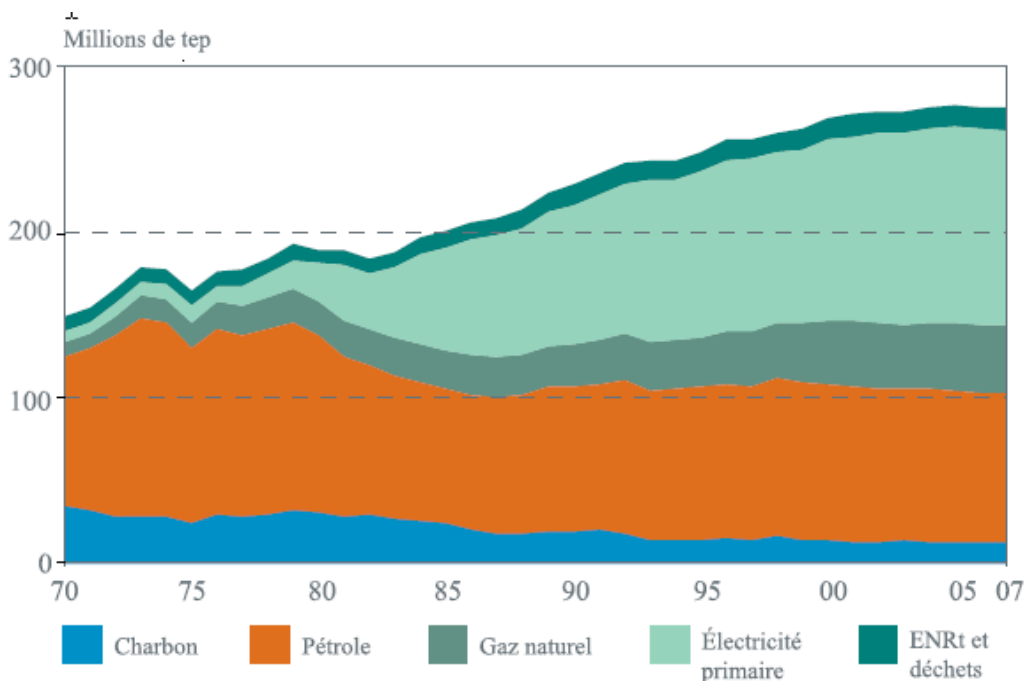


Fig. 4: Evolution of French consumption of energy by source from 1970 to 2008 (source: Ministère de l'Industrie, 2008). From bottom to top: coal, oil, natural gas, primary electricity, renewable energies.

A result of this peculiar choice of generation is that the carbon value of electricity is very low compared to any other country. This fact has a lot of implications on the energy policies: in France, switching to electricity (e.g. for transportation, or using heat pumps for heating) means lower carbon, which is not the case to the same extent when electricity generation is based on oil or coal. Therefore, the cost of carbon may have a greater impact here.

Nuclear sourcing is rather well accepted. Every year, the French are asked “The choice of nuclear energy to produce three-quarters of electricity in France has, in your opinion, rather benefits or rather disadvantages?”. The results on the acceptability are rather stable since 1994. The last major change was, in 1998, that many “don’t know” transformed into “disadvantages”. In 2008: “advantages” are 51%, disadvantages : 31%, don’t know : 10%. (source : Crédoc, Observatoire de l’énergie). The figures in 1998 were respectively 48%, 33%, 20%.

### Electricity

France is the second market in size Europe.

Consumption : 448 TWh (2007) with a growth of 1 to 2% per year

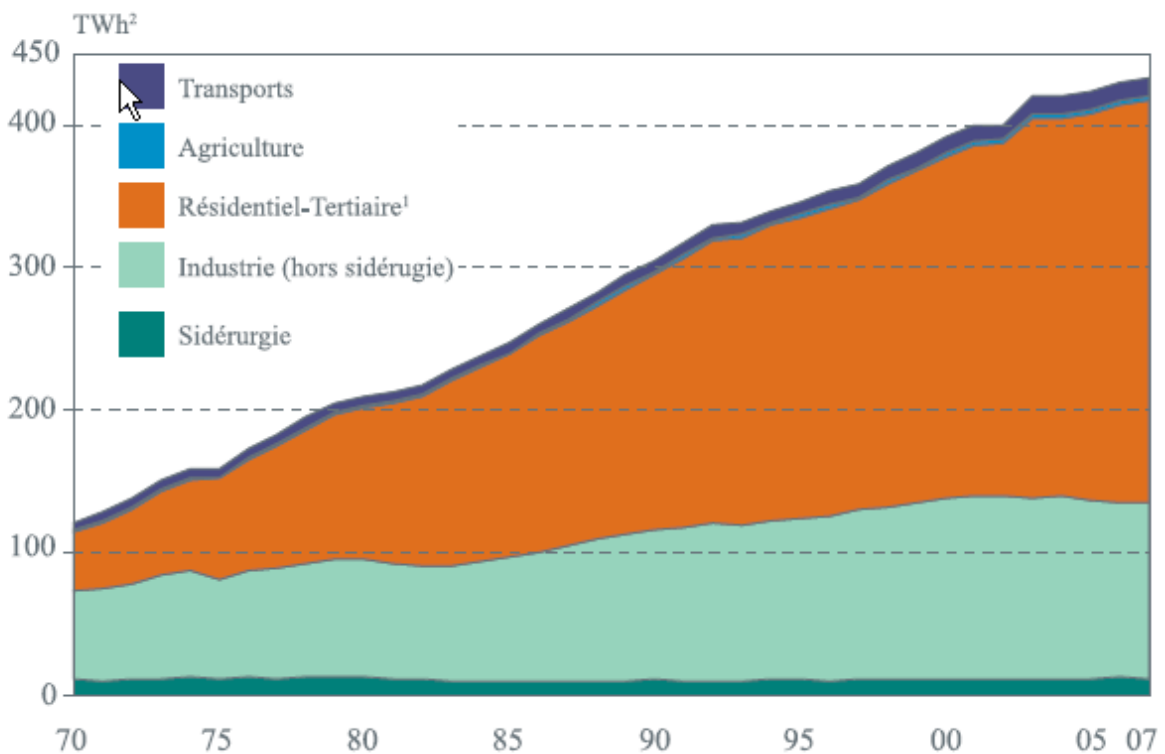


Fig. 5 Final consumption of electricity per sector from 1970 to 2007. (source : Ministère de l'Industrie)

Total nuclear waste since 1969 is about 1 million m<sup>3</sup> equivalent of conditioned material (65% came from electricity nuclear generation). Out of these 10% are high activity or long-life. The overall annual volume has decreased thanks to good practice and better technology, and is currently around 17 000 m<sup>3</sup> per year of conditioned material.

### ***Electricity market:***

Electricity markets prices are negotiated at Powernext, the French power exchange to trade hourly spot (since 2001) or futures electricity products (since 2004). There is also trading of EU CO2 allowances, and an OTC market to trade spot and forward electricity products (month, quarter, year), and platts quotations since 2001. Generation capacity auctions (Virtual Power Plants) exist since 2002. A balancing mechanism is in operation since 2003 and now available to cross-border adjustments (from UK, Germany, Spain, Switzerland).

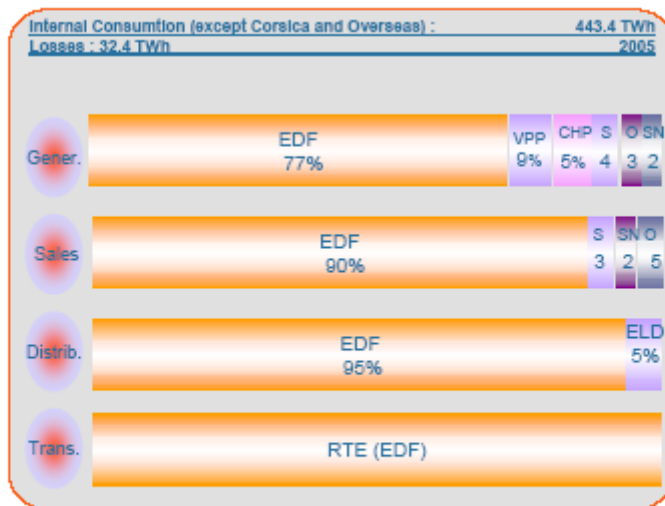
Interconnections : 2006 saw the end of priority access for historical contracts and market-based allocation of transmission capacities (explicit auctions, market coupling with Belgium & Netherlands).

EDF, the major operator, undertook the commitment to auction 6000MW virtual power plant capacity when the company entered into the capital of ENBW in 2001

The market has considerable transparency. RTE publishes the following, on French aggregated level:

- Power plant data since 2006 :
- realised production (hourly)
- Short-term (next 7 days, updated daily) – at peak load
- medium term (11 weeks, updated weekly)
- long-term (36 month, updated monthly)
- Hydraulic data : stocks
- Demand data : half hourly load
- Interruptibility data : historical use
- Inter-connexion data : price and capacity (tendered and allocated)
- Balancing data : balancing offers and balancing charge

The shares of main actors in the 4 markets (generation, sales, distribution, transport) are pictured on fig. 6



S : SUEZ ; SN : SNET (now Eon) ; O : Others ; ELD : Local Distributors

Sources : EDF, RTE

*Fig. 6. Shares of operators in the French electricity market. (from top to bottom : generation, sales, distribution, transport)*

France is a net exporter of electricity (Fig. 7)

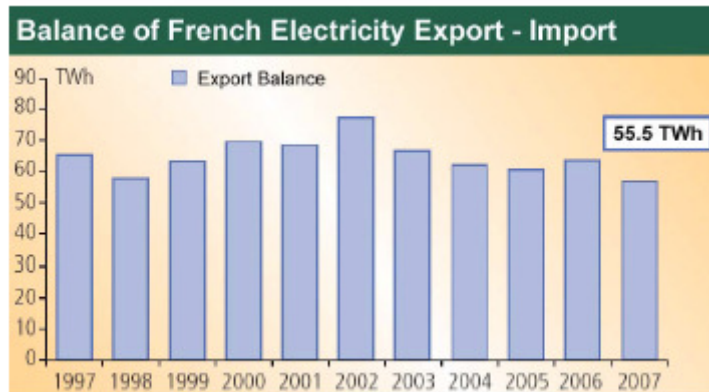


Fig. 7 : Balance of electricity commerce for France 1997-2007

The main countries of export are the following (figures : 2007)

- UK : export 6 TWh
- Belgium : export 10.2 TWh
- Germany : import 8.2 TWh
- Switzerland : export 21.7 TWh
- Italy : export 20.4 TWh
- Spain : export 5.4 TWh

Although the market is open, there have been relatively few consumer switches from the main operator, due to competitive prices resulting from the large nuclear base production which has little sensitivity to oil price raises, and good image of the company. This number grows slowly. At mid 2008, 220 000 consumers had switched.

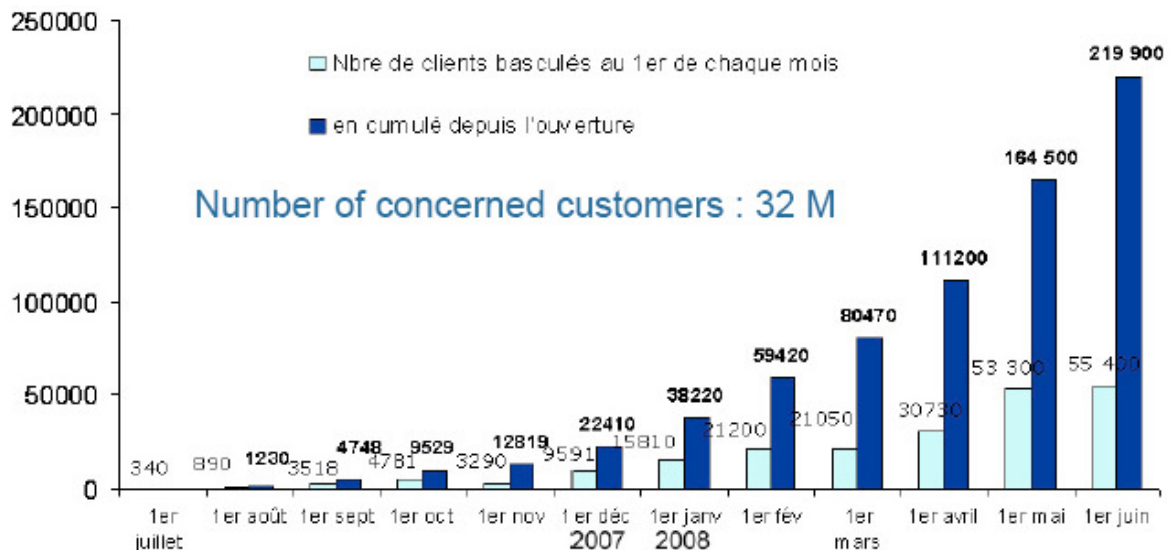


Fig. 8: Number of customers switching from the historical electricity supplier in France

The (regulated) low tariffs limit competition (Fig. 8).

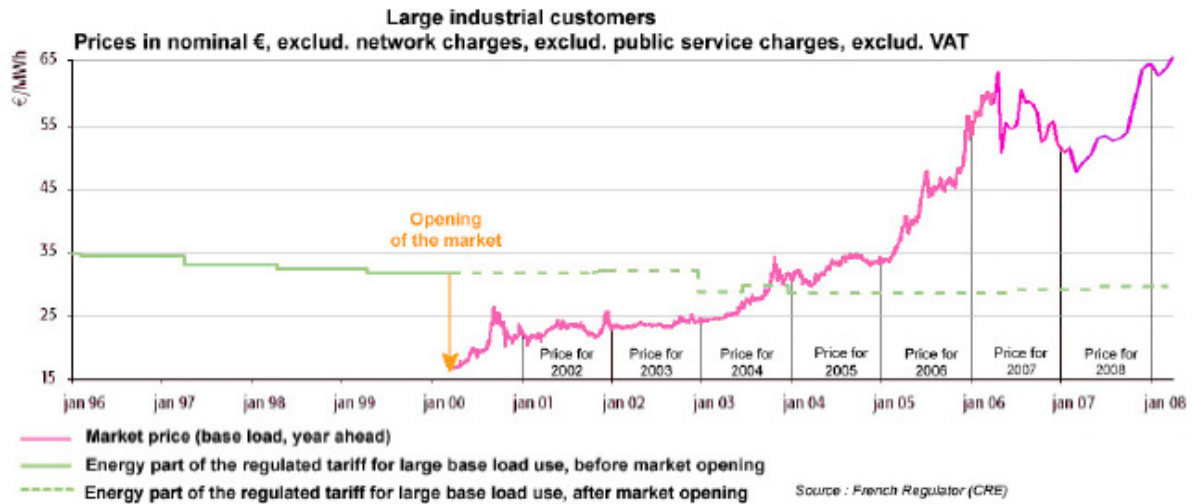


Figure 9: Evolution of electricity prices for large customers in France.

### Heating:

The total final energy for heating households has grown slightly, despite the significant developments in heating equipment: about 35 Mtoe in 2002, slightly more than 20% of final consumption Corrected energy climate, against 33.8 Mtoe in 1973, 30.8 Mtoe in 1985 and 33.3 Mtoe in 1990.

If the level of energy consumption varied little over time, its share of final consumption (climate corrected) fell 25% in the 70s, 23% in the 90's and decreased a bit faster in the last 10 years, probably because of the progress of isolation and performance of boilers.

The average consumption per capita has fallen sharply: 0.58 toe in 2002 against 0.65 toe in 1973, representing a total decrease of 10%. The decline in average consumption is even more visible when reported to the number of main residences: 1.41 toe in 2002 against 1.65 toe in 1973 (-28%).

Indeed, the number of main residences (or number of households) is growing very fast (43%): 17.3 million in 1973, 19.7 million in 1982 and 24.8 million in 2002, faster than the total population ( 14%): 51.9 million in 1973, 56.4 million in 1985 and 59.5 million in 2002. In addition to the decrease in the average number of people in the same principal residence, 3.0 in 1973, 2.7 in 1985 and 2.4 in 2002, housing conditions have changed rapidly: 13.9 million homes (56, 6%) in 2002 against 10.6 million (53%) in 1982 and 8.8 million (51.2%) in 1973.

In addition, the type of primary energy heating has radically changed:

- coal has almost disappeared,
- the share of electricity has increased nine fold,
- the share of gas by 5 (making today the main energy for heating)
- fuel consumption was divided by 2,
- wood almost maintained

Two current emerging trends may change the market : heat pumps, and solar. But they are still marginal, even if growth is strong.

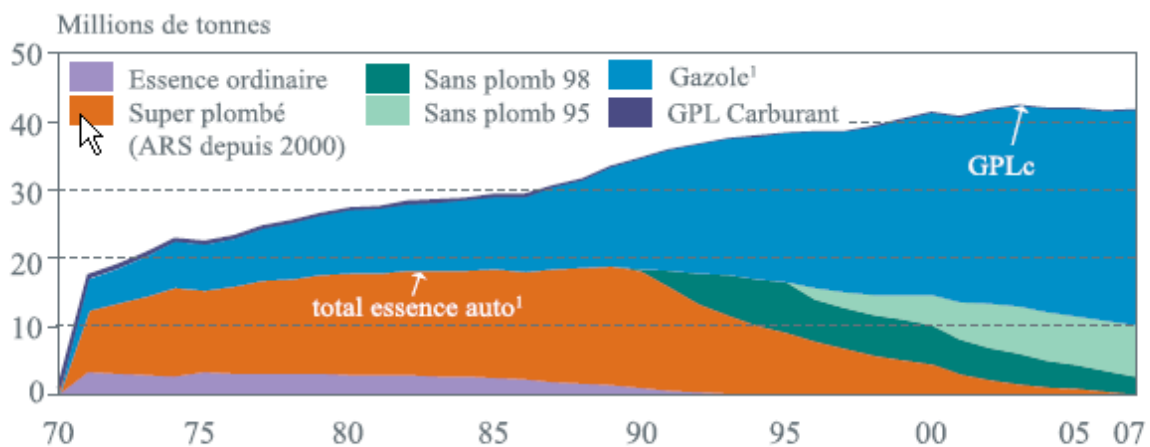
## Gas :

France is 4th market in Europe

Final demand 2007 is 540 TWh with a growth: of+ 2% per year.

In 2007, gas accounts for 22% of the final energy consumption, 33% of the demand of industry (including steel) and 32% of the Residential - Tertiary. The Gas in the latter has a smaller share than in most other European countries. Indeed, the development of Residential-Tertiary gas market faced competition from electric heating, but also problem of the low profitability of the networks, due to a relatively low population density. But it is growing particularly fast (2.1% in annual average since 1995, against 0.9% for all energies).

## Transportation fuels:



1 : Biocarburants inclus.

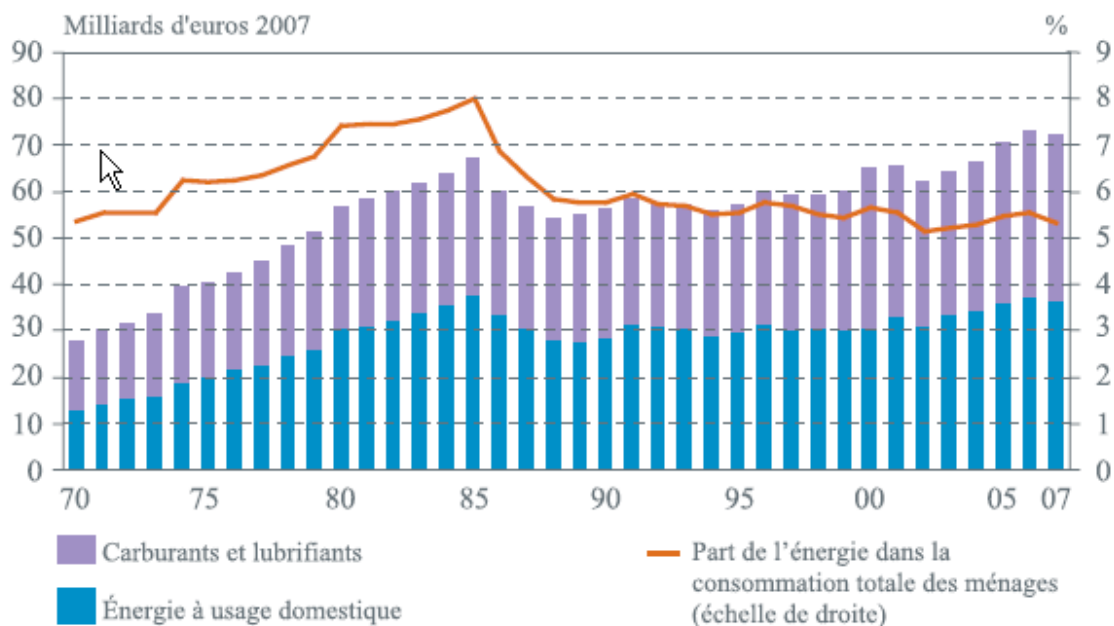
Source : Observatoire de l'Énergie d'après CPDP.

Fig. 10: Evolution of transportation fuels in France (Source: Ministère de l'Industrie)

France has a large, and growing, share of diesel vehicles, mainly due to the lower price of this fuel.

unit	1975	1979	1985	1990	2000	2005	2006	2007
Gasoline cars	8,5	8	6,9	6,8	7	6,7	6,5	6,4
Diesel cars	8,6	7,8	6	5,9	5,8	5,6	5,6	5,6
New registration plates total	8,6	8	6,7	6,5	6,4	5,9	5,9	5,8

Fig. 11: Mean CO<sub>2</sub> emission per car dropped from 176g/km in 1995 to 149g/km in 2007 (all new private cars, whatever fuel) (source: ADEME).



Sources : Observatoire de l'Énergie et INSEE.

Fig. 12 Market volume of transportation fuels (histograms, left scale); and budget share (orange curve, right scale) of energy in household budget in France, from 1970 to 2007.

## CO<sub>2</sub> emissions

CO<sub>2</sub> emissions in France tend to decrease in the long period, mainly due to energy generation which uses little fossil fuels, and a decrease of manufacturing industry. But transports are an increasing source of CO<sub>2</sub>.

Millions de tonnes de CO <sub>2</sub>	1970	1980	1990	1995	2000	2005	2006	2007(e)
Transformation énergie	113	147	69	60	66	69	65	66
Industrie manufacturière	163	143	110	102	100	100	97	96
Résidentiel/tertiaire	113	112	83	87	87	95	92	85
Agriculture/sylviculture hors UTCF <sup>2</sup>	7,6	9,4	9,4	8,9	8,6	8,1	8,1	8,0
Transport routier	52	85	109	117	125	126	126	125
Autres transports <sup>3</sup>	8,4	8,1	7,6	7,9	8,4	8,2	8,1	8,2
<b>TOTAL hors UTCF<sup>2</sup></b>	<b>457</b>	<b>504</b>	<b>388</b>	<b>382</b>	<b>395</b>	<b>407</b>	<b>396</b>	<b>387</b>
Hors total <sup>***</sup>	15	17	16	18	24	24	25	27

e : estimation.

1 : Bilan secteur net hors émissions CO<sub>2</sub> des énergies renouvelables, en particulier issues de la biomasse.

2 : Utilisation des Terres, leur Changement et la Forêt.

3 : Selon définitions de la CCNUCC, les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non anthropiques.

Source : CITEPA/CORALIE format SECTEN.

## References:

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