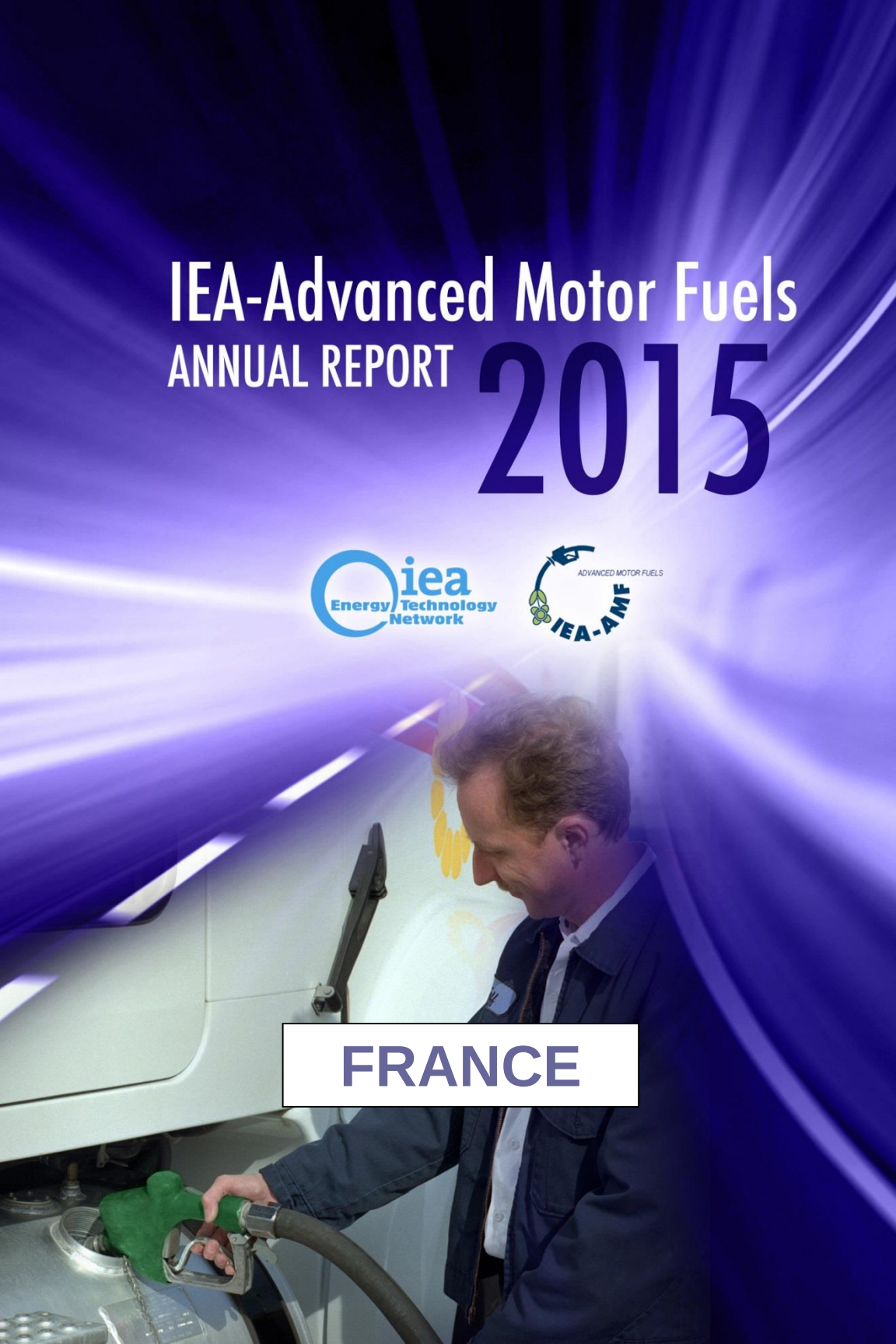
IEA-Advanced Motor Fuels
ANNUAL REPORT 2015



FRANCE

France
Introduction

French fuel consumption for use in road transportation increased continuously up to the very beginning of the past decade as a result of the increasing number of vehicles and road traffic. After a period of stabilization, a slight decline could be observed starting in 2011. The economic situation, the improvement in engine efficiency and the consequent reduction in unitary consumption, and the dieselization of the fleet explain this slight decline. In 2015, fuel consumption in road transportation registered a 0.9% increase (excluding biofuels). Oil products (gasoline, diesel, LPG fuel) are still predominant while biofuels reached 6% of the mix in 2014. The share of diesel in fuel consumption increased continuously between 1970 and 2014, rising from 28% to 83% (81.2% in 2015 according to UFIP). The SP95-E10, marketed since 2009 and which could contain up to 10% ethanol, represented in 2014 more than 30% of the sales of premium fuels (unleaded 95 and 98, and SP95-E10).

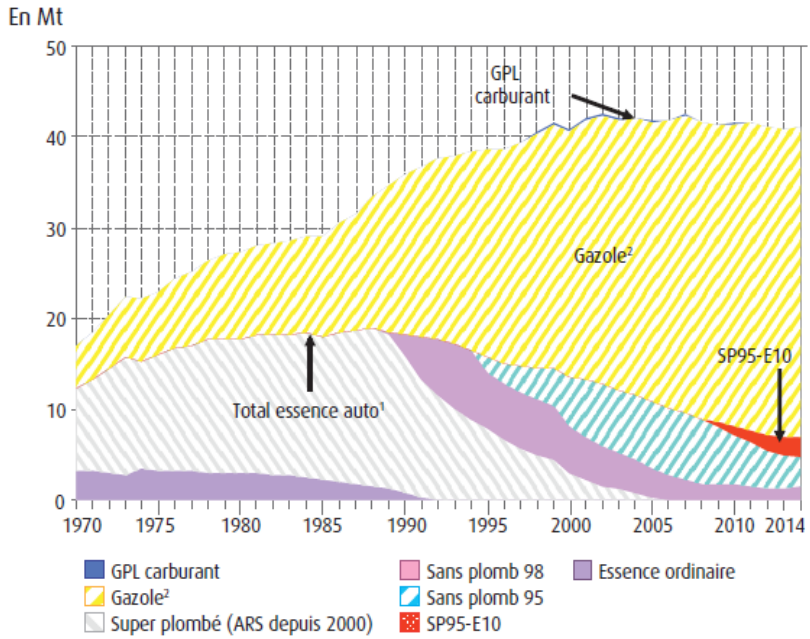


Fig. 1 Evolution of fuels sales for road transportation (including biofuels)

1 Gasoline, unleaded, unleaded 98, unleaded 95, SP95-E10, including biofuels

2 Including biofuels
(Source: Chiffres clés de l'énergie – Edition 2015, February 2016, Commissariat Général au Développement Durable)

In 2014, biofuels consumption for use in road transportation amounted to 2,955 Ktoe. Biodiesel represents about 86% of this volume, compared to 14% for bioethanol. Between 2013 and 2014, biofuels consumption increased by about 268 Ktoe, i.e. +10% (biodiesel consumption rose 10.8%, compared to 5.2% for bioethanol).

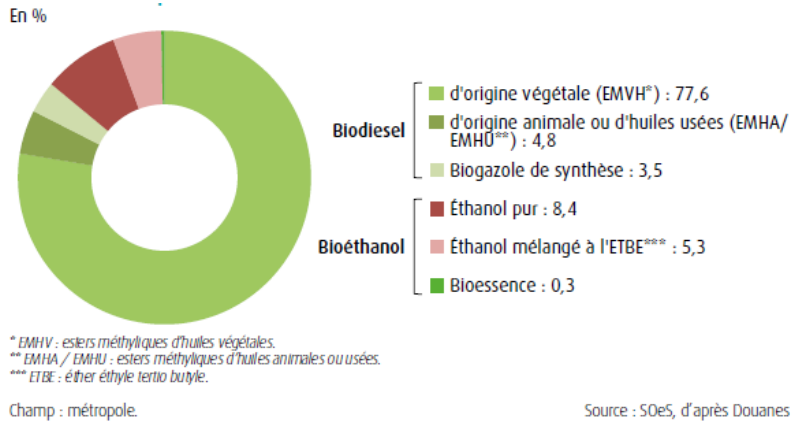


Fig.2 Biofuels consumption in France in 2014: 2,955 Ktoe
(Source: Chiffres clés des énergies renouvelables – décembre 2015, Commissariat Général au Développement Durable)

The economic crisis has been affecting new vehicle registrations continuously since 2009. Almost all kinds of vehicles are impacted, and more particularly the heavy and light commercial vehicles. Registrations of small gasoline vehicles are progressing while those of diesel cars are declining. The share of electric and hybrid cars has increased significantly since 2012 as a result of the environmental bonus. It is around 3% in 2014 while it was less than 1% in 2011.

Policies and Legislation

Incentives to Promote Use of Renewable Energy in Transport

Under the National Action Plan for Renewable Energy,[1] following the Grenelle de l'Environnement, a number of incentives were introduced to promote the use of energy from renewable resources in the transport sector.

Incentives to Use Biofuel Blends

- On April 1, 2009, the launch of new SP95-E10 in the gasoline sector corresponded to an incorporation rate of 10% ethanol in gasoline (between 7% and 8% ethanol composition, effectively). This product has been approved for sale in petrol stations since 2009. It aims to replace the SP95 (5% bioethanol) in accordance with European directives. In 2015, the SP95-10 accounted for a 45% share of the gasoline volume sold — a 13% increase compared to 2014 (32%). Since 2012, sales of SP95-E10 have exceeded those of SP98.

  France is the European country which has the largest number of petrol stations distributing SP95-E10 (available in around 57% of the total distributing network). In 2015, more than 90% of the French fleet was compatible with SP95-E10, as well as almost all petrol vehicles registered since 2000.

- Fuels with high levels of biofuel were authorized for use, including E85 in the gasoline sector and B30 in diesel fuel production. On the first quarter of 2015, superethanol E85, which contains 65–85% bioethanol, registered a 7% growth in sales over those in the first quarter of 2014. As of October 2015, E85 has been sold in more than 700 petrol stations. To encourage the development of E85, it is subsidized and accordingly benefits from reduced pump prices (€ 0.73/L in September 2015). The E85 price savings, compared to SP95, reached 20 to 40 cents/L (over-consumption effect is included).
  Since 2013, many manufacturers have suspended marketing flex-fuel vehicles. As a consequence of the tightening of European standards, few models are now available for sale. In 2015, Volkswagen added a flexfuel motor on 3 models. In 2012, the number of sales of flex-fuel vehicles had reached 7,341. They accounted for no more than 129 vehicle registrations in 2015, or 0.01% of all new vehicle sales.

[1] Directive 2009/28/EC of April 23, 2009, requires Member States to have a "National Action Plan for Renewable Energy" that sets out objectives in terms of a "renewable energy mix" in 2020 and annual trajectories by energy type (i.e., biomass, hydro, wind, solar).

With regard to B30 (gasoil that is not authorized for sale to the public), the Senate adopted two amendments in November 2014 that aim to apply a taxation scheme to B30 that is adapted to its low environmental impact, as is done for superethanol E85.

Fiscal Incentive Schemes

- A tax exemption is being granted to biofuels. It complies with European Directive 2003/96/EC on the taxation of energy, which allows Member States to have a special tax for biofuels to ensure their development and promotion.
- A general tax on polluting activities (Taxe Générale sur les Activités Polluantes, or TGAP) was levied to enable France to reach national objectives with regard to using biofuels. TGAP is an additional levy that must be paid by the operators and distributors (refiners, supermarkets, and independent dealers) that sell fuel containing a lower proportion of biofuels than the proportions represented by national goals. This rate increased from 1.75% in 2006 to 6.25% in 2009. The objective since 2010 of incorporating biofuels fixed at 7% was almost reached in 2013 (6.8%). The 2014 Finance Act established an incorporation target of 7.7% biodiesel in diesel. A decree in December 2014 authorized the incorporation of 8% fatty acid methyl ester (FAME) in diesel. For gasoline, the rate is maintained at 7%. To promote the second-generation biofuels industry, TGAP is double-counted. This incentive was designed to encourage the development of the production of biofuels that would not compete with farming for the production of food. Since 2014, the amount of biofuels that benefitted from this advantage was limited to 0.35% for incorporation in diesel and 0.25% for incorporation in gasoline. These limits were introduced to limit biofuel production from imported waste, which was observed in 2011.

- The domestic tax on consumption (Taxe Intérieure sur la Consommation, or TIC) aims to reduce the extra cost of manufacturing biofuels over the cost of manufacturing fossil fuels. This is a partial tax exemption for biodiesel and bioethanol and a total exemption for pure vegetable oil used as fuel for agriculture and fishing industries. After a gradual decrease, the tax exemption rates were stabilized from 2011 to 2013. The 2014 Finance Act ("Loi de Finances") proposes a further reduction of the tax exemption for 2014 and 2015 until its abolition in 2016. The biodiesel sector benefitted from a € 3/hL reduction in 2015, compared to € 4.5/hL in 2014. The bioethanol sector tax exemption was € 7/hL in 2015, compared to € 8.25/hL in 2014. Taxation applied to superethanol E85 was maintained at a rate of € 17.29/hL from 2011 to

2014. The energy product consumption tax (Taxe Intérieure de Consommation sur les Produits Énergétiques, or TICPE) was decreased to € 12.62/hL in 2015. This device was stopped in December 2015.

The Climate Energy Contribution (CEC) came into force on April 1, 2014. It introduced a carbon component within the TICPE that was progressive and proportionate to CO_2 emissions from energy products under the TICPE, according to the value for a ton of CO_2 being fixed at € 7 in 2014, € 14.5 in 2015, and € 22 in 2016.

Measures to Encourage Fleet Renewal

The bonus-malus system that applied to the purchase of a new vehicle and which had been amended in November 2013 evolved again on January 1, 2015, for the bonus calculation scale, whereas the malus calculation scale established on January 1, 2014, remained unchanged for 2015. The bonus amount was revised downward, with the maximum CO_2 release being set at 60 g/km (it had been set at 90 g/km previously). The maximum bonus of € 6,300 introduced in 2013 has remained the same. The € 150 bonus for the purchase of thermal vehicles (from 61 to 90 g CO_2/km) was removed.
For a vehicle emitting more than 130 g CO_2/km, the ecological malus generates an increase in the purchase price of € 150 up to € 8,000. The objective of the bonus-malus system is to start the ecological transition by using measures that encourage individuals to acquire low-emission vehicles and consequently renew the old automotive fleet. The bonus-malus system from 2008 to 2015 (hybrid electric vehicles – HEVs- and electric vehicles –Evs- excluded), is shown in Figure 3. Figure 4 shows the bonus-malus for HEVs and EVs.

Emissions de CO2 en g/km	2008 2009	2010	2011	Du 1/1/2012 au 31/07/2012	Du 1/8/2012 au 31/12/12	Au 1/01/2013	Du 01/01/2014 Au 31/12/2014	Du 01/01/2015 Au 31/12/2015	Emissions de CO2 en g/km
0-20	-5000	-5000	-5000	-5000	-7000	-7000	-6300	-6300	0-20
20-50					-5000	-5000	-4000	-4000	20-50
51-60				-3500	-4500	-4500			51-60
61-90	-1000	-1000	-800	-400	-550	-550	-150	0	61-90
91-95			-400	-100	-200	-200	0		91-95
96-100		-500							96-100
101-105	-700			0	0	0			101-105
106-110									106-110
111-115		-100							111-115
116-120									116-120
121-125	-200								121-125
126-130		0							126-130
131-135	0						150	150	131-135
136-140		0				100	250	250	136-140
141-145				200	200	300	500	500	141-145
146-150						400	900	900	146-150
151-155			200	500	500	1000	1600	1600	151-155
156-160		200							156-160
161-165	200			750	750	1500	2200	2200	161-165
166-175	750	750	750						166-175
176-180						2000	3000	3000	176-180
181-185				1300	1300	2600	3600	3600	181-185
186-190						3000	4000	4000	186-190
191-195			1600	2300	2300	5000	6500	6500	191-195
196-200		1600							196-200
201-230	1600			3600	3600	6000	8000	8000	201-230
231-240			2600						231-240
241-245		2600							241-245
246-250									246-250
250-...	2600								250-...

Fig. 3 Bonus-Malus System from 2008 to 2015 (excluding HEVs and EVs)

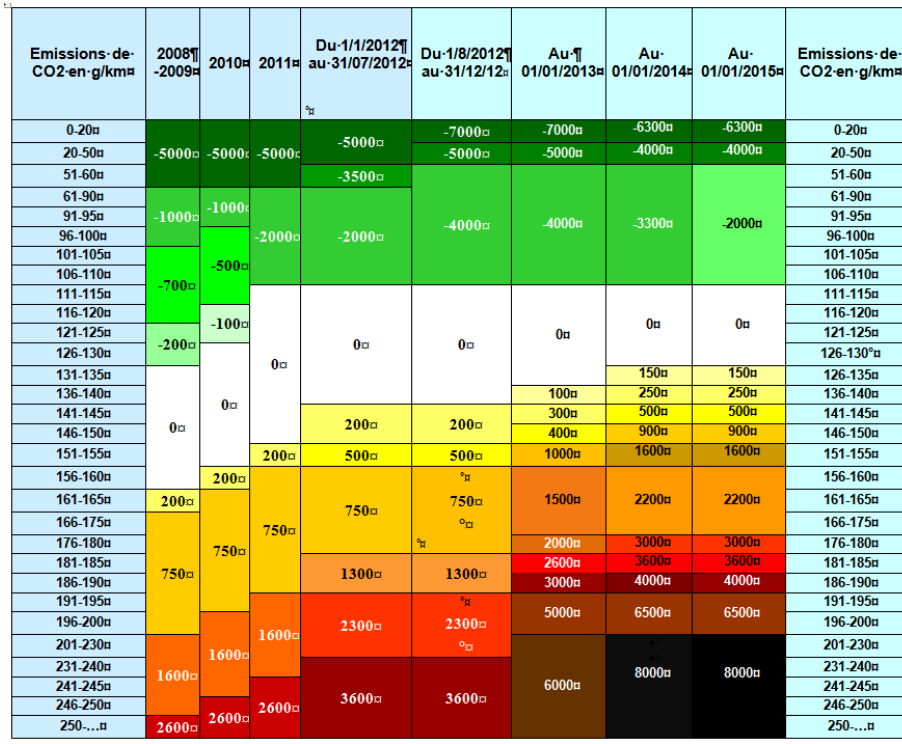


Fig. 4 Bonus-Malus System from 2008 to 2015 for HEVs and EVs

The Bonus-Malus system was revised again downward on January 1, 2016. The hybrid vehicles will be the most impacted category. The aid for the purchase of a hybrid vehicle will decrease from € 2,000 in 2015 to 750 € in 2016. As for the plug-in vehicles the decrease is more important, the aid applied decreasing to € 1,000 (€ 4,000 in 2015).

Environmental Bonus for Hybrid Vehicles (HEVs)

The aid applies only to hybrid vehicles with CO_2 emissions below 110 g/km. The Hybrid vehicles segment was very much impacted by the new device in 2015. The amount of aid being allocated was 5% only (8.25% in 2014) of the vehicle price, with the minimum amount being € 1,000 (€ 1,650 in 2014) and the maximum being € 2,000 (€ 3,300 in 2014). The aid applied for the purchase of a HEVs will decrease to € 750 on January 1, 2016 (see Table 1).

Table 1 Environmental Bonuses for HEVs

CO_2 Emissions (g/km)	Bonus in 2013	Bonus in 2014	Bonus in 2015	Bonus in 2016	Comments	Examples of Vehicles
Less than 110	€ 2,000–4,000	€ 1,650–3,300	€ 1,000–2,000	€ 750	Maximum financial aid of 5% of the acquisition cost plus the cost of the battery if it is rented.	Toyota Yaris HSD, Peugeot 3008 Hybrid4

With regard to plug-in HEVs (PHEVs), the bonus is capped at 20% of the purchase cost, plus the cost of the battery if it is rented. The aid applied is € 4,000 as a maximum for a vehicle emitting less than 60 g CO_2/km. The bonus applied on January 1, 2016, will decrease to € 1,000.

Support for Electric Vehicles (EVs)

Electric vehicles are eligible for the highest environmental bonus levels. The bonus granted for purchasing an EV that emits less than 20 g CO_2/km fell from € 7,000 in 2013 to € 6,300 in 2014 and 2015 and will be the same for 2016. The aid applied may not exceed 27% of the purchase price, including all taxes plus the cost of the battery if the vehicle is rented.

Table 2 Environmental Bonuses for EVs

CO_2 Emissions (g/km)	Bonus in 2013	Bonus in 2014	Bonus in 2015	Bonus in 2016	Comments	Examples of vehicles
Less than 20	€ 7,000	€ 6,300	€ 6,300	€ 6,300	Bonus is capped at 27% of the purchase price, plus the cost of the battery if it is rented.	Renault ZOE, Nissan LEAF

The Super Bonus

Initially introduced in October 2014 as part of the Law on "Transition Energétique", the superbonus was revised on April 1, 2015. This cumulative premium, together with the automotive bonus device, could add up to:

1. € 500 for the purchase of a vehicle that meets the Euro 6,
2. € 2,500 for a PHEV, and
3. € 3,700 for EVs.

This super bonus will be set for the purchase of one out of those three types of vehicles and the scrapping of a diesel vehicle in service before January 1st 2001. For the purchase of an EV, the device will, under certain conditions, allow the amount to reach € 10,000.

Bonus-Malus Budget

Since its introduction in 2008, the bonus-malus automotive device, was originally designed to be in balance: revenues issued from the malus system were to balance expenses associated with the bonus system. However, this device had been showing a deficit from 2008 to 2013. It is subject to adjustment annually in order to account for technological developments and ensure that the budget is balanced. In 2014, the bonus-malus device recorded a surplus of € 141 million.

In 2015, the amount of aid for the purchase of a clean vehicle was € 242.15 million, of which € 214.5 million in bonuses and €28 million in conversion premiums.

The share of vehicles with bonus accordingly fell from 8.8% in 2014 to 3.2% in 2015. The share of cars subject to malus decreased from 17.4% in 2014 to 13.6% in 2015. The neutral zone gained 9.4 points to 83.2%.

In 2016, the government plans an increase in loans of approximately 10% or €236 million for the bonus and €30 million for the conversion premiums.

Research and Development (R&D) in the Transportation Sector

Public support for innovation and R&D deployed within competing clusters (i.e., associations or partnerships) results in:

- Financial support via the single interdepartmental fund (Fond Unique Interministériel, or FUI), which involves the participation of various partners, such as the National Research Agency ("Agence Nationale de la Recherche"-[ANR] through a Carnot device[2]), OSEO now incorporated in « La Banque publique d'investissement ou Bpifrance », or Caisse des Dépôts, in project financing; and
- Tax exemptions for companies with a cluster involved in an R&D project financed by the government.

[2] The Association Institut Carnot is a network of 34 Carnot institutes. It is a research network dedicated to fostering enterprise innovation. A major national multidisciplinary research task is to build economic development through technologies and innovation: Founded in 2006, the Carnot label was designed to develop partnership-based research, meaning that research efforts are conducted by public laboratories in partnership with socioeconomic players, primarily enterprises (from subject matter experts to large corporations), to serve the partners' needs.

NRA R&D Projects

The NRA, established in 2005, is responsible for implementing financing projects designed to boost the research sector, France's competitiveness, and the visibility of France's research abroad. The NRA is mobilized to focus its research efforts on economic and societal priorities at the highest level of the State and to consult with other stakeholders in the research results and develop European and international collaborations. Now the action of the NRA revolves around nine major societal challenges identified in the Strategic Research Agenda that are consistent with the European Strategic Agenda. Two of the challenges are related to transport issues: (1) clean, safe, and efficient energy and (2) sustainable mobility and urban systems.

None of the NRA projects launched in 2015 relates to thematics on biofuels, transport or energy.

Projects launched in 2014 on these thematics (see more details in IEA-Advanced Motor Fuels Annual Report 2014) and which will be developed over the next 3 to 4 years include the following:

- **CATAPILS**. This 3-year project deals with the catalytic conversion of lignin into biofuels and simple aromatic compounds by an innovative hybrid system composed of metallic nanoparticles stabilized by polymerized ionic liquids (PILs).
- **Cellutanol**: This 3-year project aims to build, within four years, an *Escheria coli* strain that will directly convert crystalline cellulose into butanol at a high yield and will be able to be used to produce third-generation biofuel with a better octane rating than that of ethanol.
- **DIGAS**: This 4 and a half-year project aims to develop a heterogeneous catalytic process for the direct synthesis of dimethyl ether (DME) from sustainable sources to use in several energy applications. The DIGAS project focuses on the direct, one-step synthesis of DME from biomass-derived syngas in two reactions.
- **GreenAlgOhol**: The goals of this 4-year project are to develop efficient biomass production schemes and optimized enzymatic hydrolysis of seaweed glucans to produce algal glucose.

- **And four projects (**FOREWER, HYSTOR, APPIBio, ECN -European Combustion Network- France) **on Modeling, Forecasting, and Risk Evaluations.**
  Under NRA umbrella, the "Instituts pour la Transition Energétique (ITE)" (previously "Institut d'Excellence en matière d'énergies décarbonées (IEED)), interdisciplinary platforms in the field of low-carbon energy, bring together the expertise of industry and public research. Among these, PIVERT and VeDeCoM projects can be mentioned (see more details in IEA-Advanced Motor Fuels Annual Report 2014).

  The central role of competitiveness clusters ("Pôles de Compétitivité") — such as Mov'eo (automotive cars) and LUTB (heavy trucks) — in the field of transportation should also be emphasized, since they represent an important tool in supporting that sector.

  In the last call (closed in July 2015) only one project in the field of alternative fuel for transport has been preselected waiting only for final budget and contract negotiations:

DirectSynBioFuel	Design des nanocomposites métal-zéolithe hiérarchisés pour la synthèse directe des carburants à partir de biosyngas

ADEME programmes

ADEME, the French energy public agency, also hosts R&D programs and is the operator of some investment for the future plan ("Investissements d'Avenir" or PIA), such as these:

- **Bioresources, Industries, and Performance (BIP) Program.** Projects must be enrolled under at least one of the two topics detailed in the text of the "call for projects":
  1. Biorefineries: (1) plant chemistry, (2) bio-based products for chemicals and materials, and (3) biofuels
  2. Renewable and clean energy from biomass

- **Road Vehicle of the Future Program (inside PIA).** With 1.04 billion euros, the program "Vehicle and transport of the future" PIA promotes the development of innovative technologies for mobility: electric vehicles and charging infrastructure, thermal and hybrid engines,

reduction of heavy vehicles, mobility and logistics, rail, efficient ships ...Projects cover (1) technology and (2) systems and mobility). Possible levers include alternative energy and auxiliary functions (including safety, comfort, and energy management).

http://www.gouvernement.fr/sites/default/files/contenu/piecejointe/2015/03/aap_vhicule_routier_2015.pdf

Some examples in the areas of advanced biofuels and the development of EVs and PHEVs are discussed here.

1. ADEME Advanced Biofuels Programs

In France, the challenges to developing biofuels industrial sectors are considerable and include (1) reducing GHG emissions in the transport sector, (2) limiting the country's energy dependence, and (3) creating new economic activities.

Projects that aim to remove a number of scientific and technical bottlenecks in the advanced biofuels sector are summarized here (see more details in IEA-Advanced Motor Fuels Annual Report 2014).

- **Futurol.** The Futurol project aims to develop and commercialize a complete solution for producing cellulosic ethanol, from the field to the finished product. Thanks to its pilot plant (180 m^3/yr) and the involvement of its partners, the project has made breakthroughs in terms of the three key elements: pretreatment, enzymes, and yeasts. In 2015, the project passed a new key milestone in its development, the first R&D steps and the pilot plant validating the viability of the process under economic and environmental plans. A demonstration unit capable of producing 3,500 m^3 per year is under construction on Tereos site in Bucy-Le-Long for production launch in 2016.

- **BioTfueL.** The 180-million BioTfueL project aims to develop and bring to the market a chain of processes for producing second-generation biodiesel and bio-kerosene by using a thermochemical process. It is led by a group of six partners: Avril, Axens, CEA, IFP Energies Nouvelles (IFPEN), Thyssenkrupp Industrial Solutions, and Total. The demonstration phase work has started and two preindustrial units are currently being built: one to pre-process the raw biomass material on the Avril site in Venette (Picardy), and one to produce liquid biofuel on Total's refinery site in Dunkirk (Flanders establishment). Planned

biomass processing capacity is 3 tons per hour. Tests are due to start in 2017.

- **Gaya.** This €57 million project involves BioSNG (synthetic natural gas made of renewable resources) production by a thermochemical process (bio-methane fuel produced by gasification followed by a methanation step). This project brings together 11 public research organizations and private partners. The R&D programme amounts to €17 million out of which a third is financed by ADEME. Engie (fomer GDF SUEZ Group) will coordinate the project. The R&D GAYA platform is due to start operation by the end of 2016.

- **Syndiese.** The aim of this project is to build a preindustrial demonstrator for producing second-generation biofuels that has a capacity of 10 metric tons per hour (t/h). As a result of their R&D programs, Air Liquide and CEA are working together to develop a concept for transforming biomass into synthesis gas (BtS tyechnology).

2. ADEME and other EV and PHEV Programs

The electrification of vehicles has great potential for reducing fuel consumption, limiting the impact of vehicles on the environment, and diversifying energy sources. Many projects aim to eliminate existing technical barriers to this goal.

In order to promote electric mobility, the government is encouraging local authority projects to install electric charging terminals through the "Investments for the Future" (PIA) programme :

- **BienVEnu Project** is an innovative Smart City project to encourage deployment of electric vehicles (EV) in collective housing launched by project coordinator ERDF and seven partners, including CentraleSupélec, G2Mobility, MOPeasy, Nexans, Park'N'Plug, Tetragora, and Trialog. Supported by ADEME under the PIA program and by the Ile de France Region, BienVEnu aims to meet these challenges through a simple "all-inclusive" offering, designed to meet the needs of collective housing managers and residents in the Smart City.

  Based in the Ile de France region, the three-year project has a €10 million budget (with €4 million supported by PIA). Charging facilities

will be deployed in three "pilot" buildings during the first year, then seven more during the second year, both in private and socially owned collective housing. Initially, about 10 charging stations will be installed in each building. The project is designed around "charging clusters".

These provide an open-ended system that groups several charging stations together and can easily be expanded. This solution also limits the impact on both the local electricity distribution grid and the building's power load, thus providing a cost reduction opportunity for the community.

In order to increase the potential for developing the electric vehicle market in Europe, the "Mobilité Hydrogène France" consortium gathered twenty partners (Air Liquide, Alphéa Hydrogène, AREVA, CEA, CETH2, EDF, GDF SUEZ, GRTgaz, IFPEN, INEVA-CNRT, Intelligent Energy, ITM Power, Linde, Michelin, McPhy Energy, Pôle Véhicule du Futur, PHyRENEES, Solvay, Symbio FCell, Tenerrdis, WH2) to produce scenarios for the development of hydrogen-energy infrastructures across the nation. The HyWay project's filling stations represent the initial building blocks of a future national network :

- **HyWay project** aims to put on the road a fleet of 50 electric cars with a fuel cell range extender, and the construction of two hydrogen filling stations in Lyon and Grenoble. HyWay project is backed by the French governement, through DREAL and ADEME, and by the Rhone-Alpes region (co-financing €1.4 million) with the help of Tennerdis local cluster focused on energy transition. It also aligns with European Regional Development Fund (ERDF) objectives. The partners of the project are Air Liquide, CNR, GEG, McPhy Energy, PUS (COFELY Services), STEF and Symbio FCell.

Others projects continue until 2016:

- **HYDIVU**. This €90-million project will focus on an innovative solution for diesel hybrid powertrain, light utility vehicles (i.e., family vans and Trafic and Master ranges – ranges are van category). Renault has partnered with Valeo and Continental, leading suppliers to the automotive industry, and with IFP Énergies nouvelles and LMS to support this project.

- **ESSENCYELE**. The aim of this project is to combine a high-efficiency gasoline engine with a mild hybrid low-voltage powertrain. The goal is to reduce the consumption of fuel by 25%, while using affordable technologies, based on:

- A mild hybrid gasoline powertrain that takes advantage of all the synergies offered by the combined motorization;
- A high-efficiency, downsized engine that implements affordable technologies;
- Hybridization at low cost with an operating voltage of 48 V and with zero-emissions vehicle (ZEV) capability; and
- A technological breakthrough in the electrical energy storage system due to the use of ultra capacitors.
-

The program, supported partly by ADEME (total budget is €79 million), involves the following partners: Valeo GKN, Hutchinson, PSA Peugeot Citroën, EFS, CORIA, IFP Énergies nouvelles, Ecole Centrale de Lille, ENS Cachan, INP Toulouse, UTC Compiègne, University of Valenciennes.

Air Transportation

In the field of air transportation, R&D (particularly research focusing on alternative powertrains, combustion, and low-carbon fuels) is conducted in cooperation with European partners. Examples of projects in the aviation sector include the undergoing **CORAC and CORE Jet Fuel projects** (see more details in IEA-Advanced Motor Fuels Annual Report 2014).

The DGAC ("Direction Générale de l'Aviation Civile") is associated with the "Lab'line for the future" initiative which was launched in 2014 by Air France. Since October 2014, a biofuel-powered Airbus A321 has been undertaking weekly flights between Toulouse and Paris-Orly. The biofuel used is farnesane. Produced by Total-Amyris, this biofuel comes from the fermentation of sugar cane. It does not compete with the food industry and meets the sustainability requirements recognised by the Commission. The DGAC backed experiment should enable a study on the operational and socio-economic impacts of the regular operation of flights using biofuels. First studies have shown that the use of farnesane could reduce greenhouse gas emissions by up to 80% compared to fossil fuel-based kerosene.

After the end of the project CAER (Alternative Fuels for Aeronautics), a new project MOCASSIN should begin in 2016 and will aim to develop modelling the behaviour of conventional and alternative aviation fuel in order to have complementary models of experimental results.

Implementation: Use of Advanced Motor Fuels

Outlook

By adopting the Law on Energy Transition (LTE), France is strongly mobilized in acting against climate change. It sets up the conditions for a gradual, balanced change, based on the development of a diversified energy mix responding to environmental constraints. Among the goals, the LTE aims at a 15% consumption of advanced biofuels in transportation by 2030: 15% PCI of renewable energies, -30% of fossil energies.

Various studies have tried to put into perspective this goal of the LTE. Among these, the "Biofuels" working group from the NFI (Nouvelle France Industrielle) "New Resources" Solution which is composed of organizations and companies representing the biofuel industry, the refining sector and car manufacturers as well as representatives from the State (ministries and funding agency). Led by Mr. P. Barthélemy, Deputy General Director with IFP Energies nouvelles, the working group has developed a scenario for the energy mix by 2030 supporting the development of advanced biofuels and meeting the objectives of the Law (15% PCI of renewable energies, -30% of fossil energies). Besides reaching these targets with 14.3% of biofuels and 0.7% of biogas and renewable electricity, the scenario foresees a 3.5 rebalancing diesel/gasoline ratio in France and the deployment of industrial units, including lignocellulosic biofuels production, necessary for its realization. The results of this scenario have been proposed for the elaboration of the Multi-Year Program of Energy, in particular for setting the objectives of the progressive incorporation of advanced biofuels.

The LTE also promotes several measures to lay the foundations for a sustainable mobility and levers of actions to develop the most environmentally friendly vehicles. These include:

• the obligation to purchase by the state and its public institutions, local authorities and their associations, national companies, car rental companies and taxi operators, environmentally friendly vehicles upon renewal of their fleet;

• the introduction of the possibility to define terms of “parking and traffic preferred” (including in areas with restricted circulation);

• the introduction of a development strategy and infrastructure deployment fuel alternative refueling (natural gas, biogas, ...).

The main objective of these measures is to reduce the local pollution generated by transport activities and emissions of greenhouse gases, via increasing low vehicles emissions.

Additional References

Chiffres clés de l'énergie Chiffres clés des énergies renouvelables – December 2015, Commissariat Général au Développement Durable

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