The Seventh national communication of France

United Nations Framework Convention on Climate Change

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RÉPUBLIQUE FRANÇAISE

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE

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Analytical summary

A. COUNTRY-SPECIFIC CONDITIONS

A.1 A country mobilised to meet the climate challenge

France's commitment in the area of climate change mitigation policies and measures began at the beginning of the 1990s on the occasion of the Rio conference and the signing of the United Nations Framework Convention on Climate Change. France's climate policy has developed and strengthened in line with the progress in international negotiations and in the development of specialised knowledge on this subject and was established in an integrated manner in the National Climate Change Programme adopted in 2000. The national mitigation policy was subsequently based on the regular publication of Climate Plans in 2004, 2006, 2009, 2011 and 2013.

With regard to adaptation to climate change, the first national adaptation strategy was published in 2006. France then adopted the National Climate Change Adaptation Plan (PNACC) in 2011 covering the period from 2011 to 2015. A consultation process is underway for the preparation of the 2nd National Adaptation Plan to be published at the end of 2017.

Further impetus was given to France's climate policy by the Energy Transition for Green Growth Act of 17 August 2015. This law confirmed the target to reduce French emissions by 75% by 2050 compared to 1990 (which was set in 2005 in the Energy Programme Act establishing France's energy policy priorities and renewed in the 2009 Grenelle Act). It introduced an intermediate reduction target of 40% by 2030 and set in place new measures to cover the different areas of energy transition. Another major area of progress under this law was the establishment of a climate-related governance principle around a National Low-Carbon Strategy (SNBC) subject to enhanced Parliamentary and civil society oversight.

In July 2017 the Government published a new Climate Plan to accelerate energy and climate transition and the implementation of the Paris Agreement. This Plan sets ambitious priorities, in particular, to achieve carbon neutrality towards the middle of the century, the elimination of "thermal sieves" within 10 years with 4 billion euros earmarked for energy retrofit, discontinuing the sale of vehicles emitting greenhouse gas in 2040, shutting down the last coal-fired power stations by 2022, gradually phasing out hydrocarbon production in France by 2040, a faster increase in the price of carbon and redoubling of efforts in publicly funded energy transition research.

These priorities are included in the process of revising the National Low Carbon Strategy which began in 2017 for publication at the end of 2018.

A.2 Recent developments

In terms of territorial organisation, on 25 November 2014 the National Assembly adopted the new map on second reading, reducing the number of regions in mainland France from 21 to 12[1]. In 2014, Mayotte became an outlying European territory, thus falling within the scope of the Kyoto Protocol for the purposes of greenhouse gas emissions accounting.

On 1 January 2017, the population of France was 67 million, including 64.9 million in mainland France. France's GDP has been increasing since the 2008 crisis. The French economy is mainly a service economy. In GDP classification in terms of purchasing power parity, France is the 9th economic power in the world. In 2014, France was in 26th place in terms of GDP per head of population in terms of purchasing power parity[2], slightly higher than the EU average, which is in 28th place.

The transport sector is the primary consumer of petroleum products, accounting for almost three quarters of final energy consumption, which exerts a strong impact on greenhouse gas emissions. Alternative means of road transport only account for a small proportion of transport emissions. Progress is being made in the use of renewable energy in transport: the share of renewable energy in gross final energy consumption in the transport sector must reach 10% by 2020. This share was 7.7% in 2014.

Consumption corrected for climate variations in the residential and service sector has been decreasing steadily since the beginning of the 1970s. The share of total final energy consumption decreased from 38% in 1973 to 25% in 1990, then to 16% in 2015. Price rises and aid schemes have encouraged the development of higher-performance facilities or lower-carbon energy consumers such as electricity, gas or renewable energy. As from 2015, natural gas consumption has generated almost 61% of the CO_2 emissions linked to these types of use.

Following a period of steady growth from 1990 to 2008, the slump in 2009 and recovery from 2010 followed by stabilisation from 2010 to 2012, national primary energy production increased slightly again

[1] This new map sets out regional links: Alsace, Champagne-Ardenne-Lorraine, Aquitaine, Limousin-Poitou-Charentes, Auvergne-Rhône-Alpes, Bourgogne-Franche Comté, Languedoc-Roussillon-Midi-Pyrénées, Nord-Pas-de-Calais-Picardie and Basse-Normandie-Haute-Normandie. Six regions remain unchanged: Bretagne, Centre, Île-de-France, Pays de la Loire, Provence-Alpes-Côte d'Azur.
[2] http://donnees.banquemondiale.org/indicateur

between 2013 and 2015 (+ 0.4% for the latter year). The power capacity of renewable energy sources is gradually increasing, whereas the proportion of nuclear energy is still dominant.

In addition to resulting in a major slump in the refining sector, the 2008 crisis led to a substantial reduction in manufacturing output, capital goods and transport equipment, while activities in the agri-food sector remained stable. The overall situation of the manufacturing industry is gradually improving.

Agriculture differs from other sectors in that most of its greenhouse gas emissions are not related to energy combustion. The main sources of emissions in France are methane emitted by farm animals (enteric fermentation) and N20, linked to the nitrogen cycle. France is still a major livestock farming country in the European Union. In particular, France still has the highest number of bovine livestock, with 19.4 million head of cattle in 2015.

The dynamics of French forest sinks are primarily affected by the forestry transition that has been in progress in mainland France for more than a century, with an increase in the forested area and in the volume of timber per hectare. The forest sink, taking into account managed forest sequestration minus extracted amounts, accounted for 56 Mt of CO_2 in 2015.

There has been an underlying downward trend in municipal landfill since 2000. At the same time, the share of recycled waste increased from 13% in 2000 to 22% in 2015. This reflects the effects of policies to introduce metal, glass and paper/cardboard waste streams during this period. As for the level of material and organic recycling of municipal waste, this has now reached 40%.

B. INFORMATION ON THE GREENHOUSE GAS INVENTORY INCLUDING INFORMATION ON THE NATIONAL INVENTORY SYSTEM AND THE NATIONAL REGISTRY

B.1 Trends

In 2015, French greenhouse gas emissions within the scope of the Convention were estimated at 457.1 million tonnes of CO_2 e excluding LULUCF. Following a period of relatively stable emissions in the 1990s, there has been a substantial reduction since 2005. Energy use is the main source of greenhouse gas emissions in France, accounting for 72% of emissions in 2015. As for emissions from energy combustion, most emissions are generated by the transport sector (41%), while energy industries account for 25% of emissions.

Between 1990 and 2015, France's greenhouse gas emissions (within the scope of the Kyoto protocol) excluding LULUCF fell by 16.4% in comparison to 1990, in a context where the population increased by 14.6%. French per capita emissions over the same scope decreased from 9.4 t CO_2e to 6.9 t CO_2e between 1990 and 2015, i.e. a reduction of almost 30%; CO_2 emissions decreased by 9.8% between 1990 and 2015. Between 1990 and 2015 N_2O and CH_4 emissions excluding LULUCF decreased by 36.5% and 15.0% respectively as a result of measures such as landfill methane recovery, reducing the amount of inputs into agricultural land and introducing industrial mitigation processes.

B.1.1 Analysis by business sector

The transport sector is the primary greenhouse gas emitter in France. In 2015 it accounted for 29.7% of national emissions, i.e.135.6 Mt of CO_2e, with a substantial increase between 1990 and 2003 (+ 17.2%), followed by a 6.8% reduction since 2004. Considerable progress with biofuels from 2005 has significantly limited these road transport sector emissions, which in 2015 accounted for 93.7% of transport sector emissions.

In 2015 agricultural greenhouse gas emissions accounted for 90.7 Mt of CO_2e (excluding carbon sinks), i.e. 19.8 % of French emissions. Agriculture differs from other sectors in that most of its greenhouse gas emissions are not related to energy combustion. The main sources of emissions are CH_4 emitted by livestock (enteric fermentation) and N_2O, linked to the nitrogen cycle. Since 1990, the steady reduction in agricultural greenhouse gas emissions is due to a reduction in nitrogen fertilisation, a decline in cattle numbers and a drop in energy consumption.

In 2015, the residential service sector accounted for 18.9% of national emissions, i.e. 86.5 Mt CO_2e, representing a slight reduction of 2.5% from 1990[3]. Since 1990, regulations regarding the thermal insulation of new buildings have stabilised emissions from the residential and service sector, offsetting the rise in emissions caused by an increase in housing. In terms of the energy mix, fuel oil has fallen sharply in favour of gas and electricity and the use of coal continues to decline.

In 2015 the energy industry sector accounted for 46.5 Mt of CO_2e, i.e. only 10.2% of French emissions. These have decreased by 40.3% from 1990. Emissions in this sector mainly result from electricity generation and urban heating, which account for 67.5%, a substantial reduction by 36.8% since 1990.

Production of one tonne of steel in France emits on average 1.2 t of CO_2; about 0.62 t CO_2 is emitted for one tonne of cement and 0.65 t CO_2 for one tonne of glass.

In comparison with 1990, emissions from industry (including industrial processes) have decreased substantially in France (- 45.5%) due to the shift of the French economy towards the service sector, linked to a loss of production sites and the economic crisis of 2008-2009. Most emissions reductions are nevertheless due to improvements in processes and in energy and carbon efficiency. The chemistry sector has thus seen emissions fall by 75.3% in France between 1990 and 2015, due in particular to a drastic reduction in N_2O emissions related to the production of adipic and nitric acids.

B.2 The national system

In accordance with Article 5.1 of the Kyoto Protocol, France has created a national inventory system known as SNIEBA (National system for air emissions inventories and audits) established by an inter-ministerial decree dated 24 August 2011[4]. The Caisse des Dépôts was selected to administer the national registry and to develop information systems to operate it and ensure security.

[3] Emissions from the service sector dropped by 12.1% between 1990 and 2015
[4] https://www.legifrance.gouv.fr/eli/arrete/2011/8/24/DEVR1124328A/jo

C. POLICIES AND MEASURES

The National Low Carbon Strategy (SNBC) adopted in 2015 is the framework within which France meets its European and international commitments. For the purposes of overall consistency, it includes long-term priorities and sectoral recommendations. Meeting greenhouse gas emissions reduction targets (in particular the target of a 75% reduction from 1990) is organised on the basis of carbon budgets set in the National Low Carbon Strategy. Carbon budgets are greenhouse gas emissions caps that must not be exceeded at national level over five-year periods. The system for regularly revising the National Low Carbon Strategy and monitoring its implementation allows France to assess its position in relation to its targets and to introduce the adjustments required to sectoral and territorial policies if the situation is found to diverge from the reference trajectory.

At regional and local level, municipalities take action on the basis of territorial planning instruments developed in accordance with the national priorities established in the National Low Carbon Strategy: Regional Planning, Sustainable Development and Territorial Equality Schemes (SRADDET) at regional level and Territorial Climate-Air-Energy Plans (PCAET) for inter-municipality groupings of more than 20,000 inhabitants.

The following section sets out an overview of the policies and measures which France has introduced to reduce its emissions. The purpose of these measures is to operate the different mitigation factors in all sectors: transport, residential-services, energy, industry, waste, agriculture and forestry. The national measures complement the European measures applied by France as a European Union member state.

C.1 Transport

The purpose of the policies and measures implemented in this sector is mainly to improve the energy efficiency of new road transport vehicles by encouraging purchasers to acquire the highest-performing vehicles (by providing information, incentives and disincentives) and imposing emissions standards on vehicle manufacturers (with European regulations setting a target for manufacturers of 95g CO_2/km in 2020); to encourage the development of low-emission vehicles (particularly through an incentive to purchase rechargeable electric and hybrid vehicles and providing support for the development of recharging infrastructures); to encourage the development of biofuels and other alternative fuels (by means of fiscal measures); and to support the modal shift (by improving the available alternative non-road transport and infrastructure services and through measures to encourage the use of bicycles). With regard to freight, the players involved are encouraged to work on emissions reduction targets.

C.2 Residential/services sector

The purpose of the measures implemented to reduce emissions from the residential/services sector is mainly to improve the thermal performance of building shells, to encourage the use of high-performance heating equipment and of the lowest-carbon sources of energy and to improve the energy efficiency of other types of equipment (lighting, cooking, domestic hot water, specific electricity consumption). These factors are set out for both new and existing buildings.

For new buildings, the 2012 thermal regulations standardise low-consumption buildings as from 2013. Trials of the E+C- label initiated at the end of 2016 prepare the way for future environmental regulations for new buildings which will standardise positive energy buildings and the deployment of buildings with a low carbon footprint throughout their life cycle.

Improving the energy performance of existing buildings requires numerous and diverse measures: regulating the performance of retrofit works, certifying high-performance retrofit works, financing their implementation (tax credit, zero-interest or reduced-interest loans, subsidies for low-income households, third party finance, etc.), training of professionals, awareness raising among householders to encourage them to carry out retrofit work or to encourage environmentally friendly use (schemes to provide information on the energy performance of buildings and existing aid schemes for retrofit, individualised heating bills in apartment buildings) and an obligation to install heat insulation when carrying out major building renovation works.

C.3 Industry

France's policy in terms of reducing greenhouse gas emissions in the industrial sector is mainly based on capping the emissions of the most polluting production plants via the European emissions trading scheme and ETS, improving energy efficiency and recovering waste heat (with an obligation to carry out a cost benefit analysis for new plants that generate waste heat in order to assess the opportunity to recover this heat in a heating or refrigerating network).

C.4 Energy

Alongside sectoral policies to control energy consumption (particularly in the residential-services and transport sectors), a number of cross-cutting measures contribute to limiting energy demand and developing renewable energy sources. In particular this involves the following actions:

- the carbon component in energy taxation in proportion to the CO_2 content of fossil products encourages energy efficiency and the development of low-carbon solutions in transport and "residential/services" sector;
- energy saving certificates are based on an obligation imposed on the main energy suppliers (electricity, gas and domestic heating oil suppliers, etc.) to make energy savings. These suppliers are encouraged to actively promote energy efficiency among energy consumers;
- large companies have an obligation to carry out an energy audit every four years;
- the heat fund supports the production of heat energy from renewable sources in the service, industry and collective housing sectors;
- renewable energy support schemes (electricity and biogas): calls for tender, a purchase obligation for small plants and a remuneration supplement for high-capacity plants. These systems are calibrated to achieve the quantitative renewable energy targets set in the multi-year energy programme.
- emissions capping for electricity and heat generating plants and refineries via the European emissions trading scheme;
- The ETS system.

C.5 Agriculture and forestry

The purpose of policies and measures in agriculture is to improve control over nitrogen fertilisation, prevent surplus organic nitrogen, reduce livestock effluent emissions, develop agricultural renewable energy sources (particularly methane production), improve the energy performance of farms and maintain and increase carbon stocks on land and in soils. In particular, a set of cross-cutting plans contributes to this: the farm competitiveness and adaptation plan, the plant protein plan, a number of schemes to allocate aid under the Common Agricultural Policy, the biogas energy and nitrogen independence plan and the agroforestry development plan.

With regard to forestry, the purpose of the measures in place is to encourage carbon sequestration in the forest ecosystem through improved forest management and to develop the use of biosourced products (simultaneously storing carbon and replacing high energy consumption materials or those for which energy can be recovered).

C.6 Waste treatment

Emissions reduction from the waste sector is based on preventing waste (prohibiting single-use plastic bags, preventing food waste, penalising planned obsolescence), establishing extended producer responsibility, measures to encourage sorting to increase the amount of recovered waste (an obligation to sort paper, cardboard, plastic, metal, wood and glass from business activities, an obligation to sort organic waste from major manufacturers and subsequently from households by 2025, extending sorting procedures, etc.) and tax measures to limit landfill disposal and waste incineration (the waste component of the general tax on polluting activities). The waste prevention and management policy is financially supported by the waste fund (financed by revenue from the waste component) and by calls for “Zero Waste Territories, Zero Wastage” projects that provide support for municipalities.

C.7 Cross-cutting policies and measures

Obligations have been imposed on companies with regard to taking their greenhouse gas emissions into account. These obligations affect all sectors and all greenhouse gases.

Large companies (and municipalities with more than 50,000 inhabitants, State services and public institutions) must carry out regular greenhouse gas emissions measurement and reporting and establish action plans to reduce the emissions. In addition, large companies must include information in their non-financial reports on their significant greenhouse gas emissions due to their activities, particularly through the use of the goods and services they produce. As for institutional investors, they must publish information regarding their contribution to climate change targets and the financial risks involved in energy and environmental transition.

C.8 Cross-cutting policies and measures in relation to fluorinated gases

European regulation No. 517/2014 (referred to as “F-Gas II”) establishes a set of provisions to limit fluorinated gas emissions from refrigeration and air conditioning equipment used in buildings, industry and refrigerated transport. In particular it establishes a mechanism to gradually reduce the amounts of hydrofluorocarbons placed on the market and to impose sectoral prohibitions on the marketing of products and equipment containing fluorinated greenhouse gases exceeding a certain global warming potential.

D. PROJECTING GREENHOUSE GAS EMISSIONS AND QUANTIFYING THE IMPACT OF POLICIES AND MEASURES

D.1 Results of projections: updating the scenario with existing measures

Between April 2016 and February 2017 France carried out a scenario-based projection exercise for the period until 2035. A "with existing measures" or WEM scenario taking into account all policies and measures adopted and implemented before 1 July 2016 was developed. This scenario updates the 2014 WEM scenario, including all policies and measures adopted and implemented between 1 July 2014 and 1 July 2016. In particular this scenario includes measures adopted under the energy transition act of August 2015.

D.2 Presentation of the results

Within the scope of the Convention, emissions in the WEM scenario diminish to 434 Mt CO_2e in 2020, i.e. a 21% reduction from 1990 and 403 Mt CO_2e in 2030, i.e. a 27% reduction from 1990.

Within the scope of the Kyoto protocol, emissions in the WEM scenario fall to 426 Mt CO_2e in 2020, i.e. a 22% reduction from 1990 and a 23% reduction from 2005 and 392 Mt CO_2e in 2030, i.e. a 28% reduction from 1990. With LULUCF, emissions diminish by 28% between 1990 and 2020 and by 35% between 1990 and 2030.

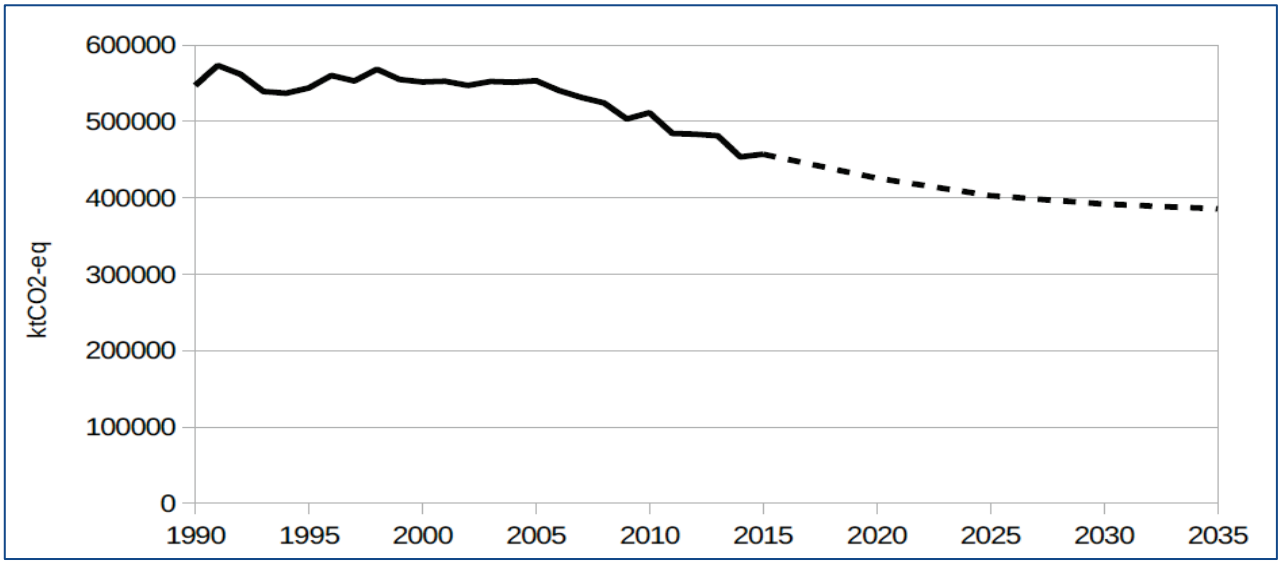


Figure 1.1: Projections in kt CO_2 e, excluding LULUCF, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

D.2.1 Reaching the 2020 targets under the Kyoto protocol

With non-ETS emissions forecast to show a 21% reduction by 2020 compared to 2005, existing policies and measures should enable France to reach its target by 2020.

D.2.2 Reaching the objectives set by France for 2030

Under the Paris Agreement, the EU has undertaken to reduce its greenhouse gas emissions by 40% from now by 2030. In the same way as for 2020, this reduction effort will be allocated between ETS and non-ETS sectors and shared between member States. These texts are currently being adapted. France's

reduction target for non-ETS sectors is -37% from 2005. In addition, France has set itself a national reduction target for all its emissions of 40% by 2030 compared to 1990.

Projected emissions in 2030 amount to 392 Mt CO_2, i.e. a 29% reduction from 1990. Projected emissions from the sectors covered by the ETS are down 31% from their 2005 level, while projected emissions from non-ETS sectors are 28% lower than their 2005 level.

By 2030, the existing measures taken into account in the WEM scenario will significantly reduce emissions. Additional efforts must be implemented beyond the measures already adopted. The July 2017 climate plan will enhance reduction efforts. The purpose of regularly revising the national low carbon strategy is to make the adjustments required to reach the targets.

E. IMPACTS, VULNERABILITY AND ADAPTATION

E.1 Climate change impacts

As on a global scale, average annual temperatures in mainland France show a clear warming trend since 1900. This warming has progressed at a variable rate, with a particularly marked increase since the 1980s. The year 2016 was once again a hot year that exceeded the average annual reference (1981-2010), but it was not exceptional for mainland France and ranks in 10th place, far behind 2014 (+1.2°C), 2011 (+1.1°C) and 2015 (+1.0°C).

The consequences of changing climatic conditions are being felt in many areas. Glaciers in the French Alps have experienced a loss in surface mass balance and glaciers in the Pyrenees show the same trend. Despite fluctuating accumulation and ablation values, the balance has been negative every year since the 2001-2002 cycle. On average, between 2001 and 2013 the glaciers studied in mainland France have lost the equivalent of 18.8 metres of water, i.e. a 21-metre loss in ice thickness.

E.2 Predicted climate change impacts

Although France has been relatively spared up to now, the situation could deteriorate substantially from 2060.

The main characteristics expected, in line with the changes already in progress, are as follows:

- a higher temperature increase than the global average of 2°C, particularly in areas further away from the coast, with heat waves becoming increasingly frequent and severe and extending beyond traditional summer periods;
- more intense rainfall, even in areas where the annual amount of precipitation decreases, increasing the risk of rising water levels flooding. At the same time, droughts will become more frequent and severe, with the dry weather water flows of rivers diminishing sharply, increased pressure on water resources needed for ecosystems and human activities and an increased risk of forest fires;
- rising sea levels that will continue to accelerate and increase the risk of submersion;
- the major climate change trends are better known today in the overseas territories, with the exception of very small islands: climate projections are between +1.4° and +3°C for the end of the 21st century;
- uncertain change in the frequency and severity of storms, except in tropical overseas regions where hurricanes are expected to become more severe;

- finally, the geographical distribution of the bioclimatic zones of tree species will change faster than their natural adaptation capacity allows.

E.3 Adaptation

The National Climate Change Adaptation Plan was adopted in July 2011. At regional and local level, adaptation policies are set out in Regional Climate, Air and Energy Plans and in Climate, Energy and Territory Plans, which must also have an adaptation component.

The adaptation of French territory to climate change is a major issue that should now be considered as an essential addition to the mitigation actions already undertaken. Before the end of 2017 the Government will publish a new National Climate Change Adaptation Plan, which will be implemented during the five-year term. Its aim will be to better protect the French population against extreme weather events and also to build resilience to climate change in the main sectors of the economy (agriculture, industry and tourism).

F. FINANCIAL RESOURCES AND TECHNOLOGY TRANSFER

Between 2013 and 2016 France increased public finance for climate change mitigation and adaptation in developing countries by 48.5% through bilateral and multilateral sources. In 2016, the total volume of finance provided by France amounted to over 3.3 billion euros (USD 3.7 billion) as opposed to 2.2 billion euros in 2013 (USD 3 billion). In addition, France provides technical cooperation and supports capacity building in developing countries through numerous channels described in this report.

F.1 Public Development Assistance - Bilateral Cooperation

In 2016, “joint climate benefit” finance authorisations of the French Development Agency (AFD) Group amounted to 3.06 billion euros in finance (i.e. USD 3.38 billion) as opposed to 2.6 billion euros in 2015. Finance granted by the Group in 2016 for mitigation purposes increased substantially (+31.5% from 2015), reaching almost €2.2 billion (excluding combined mitigation/adaptation projects). Adaptation finance amounted to €334.5 million in 2016, accounting for 11% of the “climate” activities of the French Development Agency (excluding combined mitigation/adaptation projects). The share of adaptation within cross-cutting projects is estimated to represent 166,4 M euros, which would bring the overall rate of adaptation finance of AFD to 16.4% of its total commitments in 2016.

In order to ensure that the finance provided meets the climate change mitigation and adaptation needs of recipient countries, local agencies of the French Development Agency identify the projects and needs of recipient countries jointly with the partners and project developers provided by these countries.

F.2 Public Development Assistance - Multilateral Cooperation

With a contribution of 9.5 billion dollars in 2016, France is the fifth-largest donor in the world by volume among OECD countries in terms of public assistance for multilateral development[5] and is in third place among G7 countries in terms of contribution related to gross national income. France is one of the main contributors to financial institutions and multilateral funds dedicated to the climate.

A substantial part of France’s action is dedicated to its participation in development banks and multilateral development funds such as the International Development Association (IDA), the World Bank concession-al financing facility, the African Development Fund (ADF), the African Development Bank

[5] Source: http://www2.compareyourcountry.org/oda?cr=oecd&lg=fr

concessional financing facility, the Asian Development Fund (AsDF), the Special Inter-American Development Bank Fund and the International Fund for Agricultural Development (IFAD). In 2016, the amount of “climate” disbursements made to these institutions is estimated to be €103 million.

The Green Climate Fund aims to become the main multilateral fund dedicated to finance for mitigation and adaptation towards resilient low-carbon economies in developing countries. Its initial capital amounts to USD 10.3 billion. France contributes 1 billion dollars to the Green Climate Fund, representing the fourth largest amount contributed and the fifth largest in grant equivalents.

France contributes €57 million specifically to finance climate change action). France makes the fifth largest contribution in terms of value to this fund. All Global Environmental Facility (GEF) climate finance corresponds to climate change mitigation projects.

F.3 Technological Cooperation

There have been major developments in technology since the sixth national communication. Low-carbon industries have developed and been deployed on a large scale in the renewable energy and energy efficiency sector. An increasing number of countries wish to implement these technologies both in the North and in the South, as it is estimated that more than 164 countries have set a renewable energy production target[6], one half of which are developing countries.

On a bilateral level, technical cooperation is provided in works particularly with Africa, but also countries such as Brazil, Indonesia and China. In particular this involves strategic cooperation in the area of renewable energy and energy efficiency.

In this phase of public policy implementation, the private sector and decentralised cooperation play a particularly important role as operational stakeholders developing the capacity required on the ground to set up low-carbon projects and contribute to this technology transfer.

On a multilateral level, France’s technical cooperation takes place through major international energy partnerships such as the International Energy Agency (IEA) and particularly in the IEA’s international platform on low-carbon technologies established in October 2010, the Clean Energy Ministerial (CEM) and the International Partnership for Energy Efficiency Cooperation (IPEEC).

[6] REN 21, 2015

G. RESEARCH AND OBSERVATION

G.1 Research

On an international scale, French teams are closely involved in the work of the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

As well as supporting these platforms of experts, the Ministry in charge of research supports major international programmes such as Future Earth, launched in 2015 and which integrates three large international programmes (DIVERSITAS, the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme (IHDP)) in partnership with the World Climate Research Programme (WCRP).

On a European scale, the ministry in charge of research fully supports the 10 Joint Programming Initiatives [7] (JPI). Each joint programming initiative develops joint activities for the purposes of coordinating European research. The Ministry in charge of research also supports Article 185-type initiatives such as the PRIMA initiative currently being introduced in the Mediterranean.

Adopted under the Higher Education and Research Act of 22 July 2013, a National Research Strategy (NRS), including a multi-year programme of resources, has been developed under the coordination of the ministry in charge of research in consultation with civil society. Societal challenges of the NRS. Alongside the France Europe 2020 strategic research and innovation agenda, the NRS establishes the major French research priorities based on ten major challenges, the first being sustainable resource management and climate change adaptation.

Publicly funded climate research in France takes place in higher education establishments represented in the AllEnvi alliance by means of the Conference of University Presidents (CUP, with members including the directors of universities, National Polytechnic Institutes, higher teacher training colleges and large establishments) and in 12 research bodies which dedicate a variable proportion of their activities to this area.

There are several climate modelling centres in France which have led to the development of two major climate models, one developed by the Institut Pierre-Simon-Laplace (IPSL) and the other by Météo-France.

Two national organisations (IRD and Cirad) under the joint supervision of the ministry responsible for research and the Ministry of Foreign Affairs, conduct research and development activities with and for countries in the Southern Hemisphere.

- • The role of the Development Research Institute is to contribute to developing research capacity among partners in the Southern Hemisphere. Its research strategy is developed in more than 90 countries in the form of centres or temporary missions. The aim of the DRI is to better understand the processes at the origin of climate variability and improve predictive capabilities in tropical environments and to refine climate change scenarios on decade- and century-long time-scales.
- Together with countries in the Southern Hemisphere, the Agricultural Research Centre for International Development (CIRAD) meets international challenges related to agriculture for development. Its activities concern the life sciences, social sciences and engineering sciences applied to agriculture, food and rural areas. Cirad works with its partners in countries in the

[7] These include FACCE: agriculture, food safety and climate change, CLIMATE: coordinated development of climate knowledge for the benefit of Europe, WATER: water-related challenges in a changing world and OCEANS: healthy and productive seas and oceans)

Southern Hemisphere to generate and pass on new knowledge to support agricultural development and contribute to the debate on major global agricultural issues. CIRAD has established 6 priority areas for research: ecological intensification, energy biomass, nutrition, animal health and emerging diseases, public policies, and rural areas. It is involved in cooperation activities with more than 90 countries in Africa, the Indian Ocean, Asia and South America.

G.2 Systematic observation

France takes part in the Global Climate Observing System (GCOS), a combined observation system comprising four areas of observation with specific networks: the atmosphere, the ocean, terrestrial networks (glaciers and carbon flows) and the space domain. This climate observation programme is managed under the auspices of the World Meteorological Organisation (WMO), the International Council for Science (ICSU), the Intergovernmental Oceanographic Commission (IOC) and the United Nations Environment Programme (UNEP). The purpose of the GCOS National Communication is to check that the French system can monitor the climate (spatial resolution, temporal frequency, functional status) and complies with the specific aspects linked to the Climate Convention (Rio, 1992) and the Kyoto Protocol (1997).

Climate research in France is based on observation services approved by the National Institute of Astrophysical Sciences (CNRS-INSU) and managed locally by Astrophysical Science Observatories (OSU). These services are the basic building bricks of the national research infrastructure, included in a national road map (established in 2008 and updated in 2012 and 2016). Over approximately the last 10 years, the structure of the national infrastructure landscape bears witness to France's approach to ensure the sustainability of existing observation systems, required in particular for climate research in line with European and international research infrastructures. Météo-France, as a national meteorology and climatology service working for the safety of people and property in meteorological terms on behalf of the State, also has the role of being at the cutting edge of research and the latest scientific advances in climate observation, forecasting and modelling.

Among the numerous examples of observation programmes in which France takes an active part, one could mention IAGOS (In-service Aircraft for Global Observing System approved as a landmark by the European Strategy Forum on Research Infrastructures (ESFRI)). IAGOS is a European research infrastructure which aims to establish, operate and exploit a long-term global network to observe the composition of the atmosphere. IAGOS, which was initiated by the Jülich research centre (Germany), CNRS (France), Météo-France (France) and Airbus, produces data for the scientific community and public operators. These data are used by international scientific networks, international weather forecasting centres, air quality forecasting centres, the Atmosphere Department of the Copernicus programme and, more broadly, by the realm of the Global Earth Observation System of Systems (GEOSS).

H. EDUCATION, TRAINING AND RAISING PUBLIC AWARENESS

H.1 Raising public awareness, the state of public opinion, public participation and access to data

Following the same trend from the polls reported in France's 6th National Communication to the United Nations Framework Convention on Climate Change, the more recent results confirm the existence of a strong relationship between awareness among the French population, current affairs and international climate negotiations. This substantial increase in awareness was encouraged by two major events in 2015: the organisation of COP21 in France which resulted in the Paris Climate Agreement and the debates on the Energy Transition for Green Growth Act. These two major events rallied the media and public opinion in France for several months, which explains the record levels of awareness. Information campaigns organised by France between 2014 and 2017 on the importance of combating climate change were directly or indirectly motivated by this context.

This high level of awareness was reflected in the expectations of the French electorate in respect of candidates for the 2017 presidential elections. At the end of 2016, 73% of French people wanted the elected candidate to comply with the commitments made at COP21; 83% of French people wanted the new government to implement the entire Energy Transition for Green Growth Act. At the end of 2016, 77% of French people wanted the government to treat the development of renewable energies as a priority. Despite the high level of awareness of environmental issues among its population, France has encountered the same difficulties in carrying through measures and policies that call for substantial changes in behaviour.

Public participation in the development of national mitigation and adaptation policies has always been a major concern for France, given the complexity and societal challenges involved in these topics. This topic was also the subject of a public and stakeholder consultation conducted by the Ministry of the Environment in November 2015, which brought together more than 200 representatives of several sectors of French society to establish a Public Participation Charter.

France's action in the area of public participation and access to information on climate change received a fresh impetus in April 2014 when it joined the Open Government Partnership, which today brings together 75 countries and hundreds of civil society organisations working around the world for transparency in public action, for its co-construction with citizens and for democratic innovation. As a member of the Open Government Partnership, France must develop a National Action Plan every two years in an open and participatory manner.

In its first Action Plan rolled out between 2015 and 2017, France allocated an important place to sustainable development and combating climate change, with three commitments in this area: involving civil society in the COP21 conference and promoting transparency in the agenda and negotiations, providing data and models related to climate and sustainable development and undertaking new cooperation with civil society to develop innovative solutions to meet the challenges of the climate and of sustainable development.

H.2 Education-Training

National education and French higher education are an essential factor in implementing the energy and ecological transition of society as a whole, through a comprehensive approach to sustainable development. In French schools, environmental and sustainable development education (the EEDD policy) has been on the syllabus since 2004. In primary schools, science, humanist culture and geography curricula have included sustainable development concepts since 2008. In middle schools, climate and energy concepts have been included since 2009.

Chapitre II

National circumstances

A. INSTITUTIONS

A.1 France, a member of the European Union, is a decentralised Republic

France is a constitutional republic, "indivisible, secular, democratic and social" (Article I of the Constitution of 4 October 1958), with a parliamentary system.

The President of the Republic is elected for 5 years by direct universal suffrage. He appoints the Prime Minister and the members of the Government, based on a proposal from the Prime Minister. The President of the Republic chairs the Council of Ministers and enacts laws. The President is also the head of the armed forces. The Prime Minister directs the government, which determines and leads the politics of the Nation. The Prime Minister is responsible to both Houses of Parliament: The National Assembly, whose 577 deputies are elected by direct universal suffrage for 5 years, and the Senate, which has 348 senators elected by indirect universal suffrage for 6 years.

The constitutional amendment of 28 March 2003 enshrined the fact that the organisation of the Republic is decentralised in article 1 of the Constitution[8]. On 25 November 2014, the National Assembly adopted, at second reading, the new 12-region map, which in particular includes the merger of the Poitou-

[8] http://www2.assemblee-nationale.fr/decouvrir-l-assemblee/role-et-pouvoirs-de-l-assemblee-nationale/les-institutions-francaises-generalites/l-organisation-territoriale-de-la-france

Charentes, Limousin and Aquitaine regions, as well as that of Nord-Pas-de-Calais and Picardy. This new map reduces the number of regions in mainland France from 21 to 12[9].

A.1.1 Special-status communities and overseas communities

Some communities in mainland France and overseas enjoy a special status.

In mainland France, Paris, Lyon and Marseilles have a special status: these cities are divided into 'arrondissements', which elect district councils and mayors.

The overseas departments and regions of Guadeloupe, Martinique, French Guiana, Reunion and Mayotte, under article 73 of the Constitution, are subject to a legislative assimilation regime. They exercise the ordinary jurisdiction of the departments and regions, but they are also involved in international negotiations and have greater powers of proposal. In 2011, Mayotte became the fifth overseas department, with the status of a single community exercising the powers devolved to the overseas departments and regions. In 2014, Mayotte became a European outermost region, thus entering the scope of the Kyoto Protocol for calculating greenhouse gas emissions. In 2016, Martinique and French Guiana also became single communities.

On the other hand, the overseas communities (Saint Barthélemy, Saint Martin, Saint Pierre-et-Miquelon, the Wallis and Futuna Islands and French Polynesia) and New Caledonia are subject to a legislative specialty rule, governed respectively by Articles 74 and77 of the Constitution: an organic law defines the status of each community and lists the laws that apply to it. Local assemblies may draft regulations within the scope of the law, excluding sovereign matters.

The inhabitants of overseas territorial communities are European citizens. Guadeloupe, Martinique, French Guiana, Réunion, Saint-Martin and Mayotte (since 1 January 2014 for the latter) have the status of outermost regions (ORs) of the European Union.

France's emissions scope for the United Nations Framework Convention on Climate Change includes all the overseas communities, in addition to the mainland area. However, only those that have the status of outermost regions (ORs) of the European Union are taken into account for the scope of emissions under the Kyoto Protocol.

B. DEMOGRAPHICS[10]

As of 1 January 2016, France's population reached 66.7 million inhabitants, including 2.1 million in the overseas departments (DOM). The territorial reform, which came into effect on 1 January 2016, re-organised the mainland territory into 13 regions instead of 22 as previously. Although the differences in size of the regions have decreased, the population remains unevenly distributed over the territory: three out of ten French people live in one of the two most populated regions (Île-de-France and Auvergne-Rhône-Alpes) but these regions represent only 13% of the territory.

The average population density in France[11], including the overseas departments, is 105 inhabitants per square kilometer. The density of mainland France is 118 inhabitants per square kilometer. The population is particularly concentrated in the densely populated or medium density areas: together they hold nearly

[9] This new map sets out regional links: Alsace, Champagne-Ardenne and Lorraine, Aquitaine, Limousin and Poitou-Charentes, Auvergne and Rhône-Alpes, Bourgogne and Franche Comté, Languedoc-Roussillon and Midi-Pyrénées, Nord-Pas-de-Calais and Picardie, Basse-Normandie and Haute-Normandie, 6 regions remain unchanged: Brittany, Centre, Île-de-France, Pays de la Loire, Provence-Alpes-Côte d'Azur.
[10] https://www.insee.fr/fr/statistiques/2496228
[11] https://www.insee.fr/fr/statistiques/1906658?sommaire=1906743

two thirds of the French population. Île-de-France remains by far the most densely populated area with 1,011 inhabitants/km2, which is nearly 10 times higher than the average French density.

On 1 January 2017, the population of France was 67.0 million, including 64.9 million in mainland France. In 2016, as in 2015, the population grew by 265,000 people, an increase of 0.4%. As in previous years, this increase is mainly due to the natural balance, +198,000 people in 2016. Net migration is estimated at 67,000. The population continues to grow at a constant rate, but more moderately than before (excluding Mayotte). Indeed, population growth was around +0.5% between 2009 and 2014 and around +0.7% in the first half of the 2000s.

In 2016, the natural balance was 7,000 fewer than in 2015 and thus the lowest since 1976 (+182,000). It decreased significantly in 2015, due to the higher number of deaths that year and, to a lesser extent, a decline in births. In 2016, the decrease in the natural balance, which was more moderate than in 2015, was due to the decrease in the number of births.

If recent demographic trends continue, France will have74.1 million inhabitants in 2050 and 76.5 million in 2070 according to the forecasts of the French National Institute of Statistics and Economic Studies (that is,10.7 million more people than in 2013, the date of the last census). According to this central scenario of the 2013-2070 population projections, the population increase would mainly be of people aged 65 or over (+10.4 million). The natural balance would be the main driver of growth at the beginning of the period. Then, around 2050, population growth would be driven more by net migration. At the end of the projection period, the natural balance would increase again and reach the level of net migration.

The birth rate was 1.78 children per woman in 1990. Between 2008 and 2012 it was at more than 2 (2.01 in 2012). In 2015, it amounted to 1.92.

The number of households is increasing faster than the population, given the decreasing trend in the average number of persons per household (see figure below). This household growth has a direct influence on the need for housing and on energy consumption due to housing and transport.

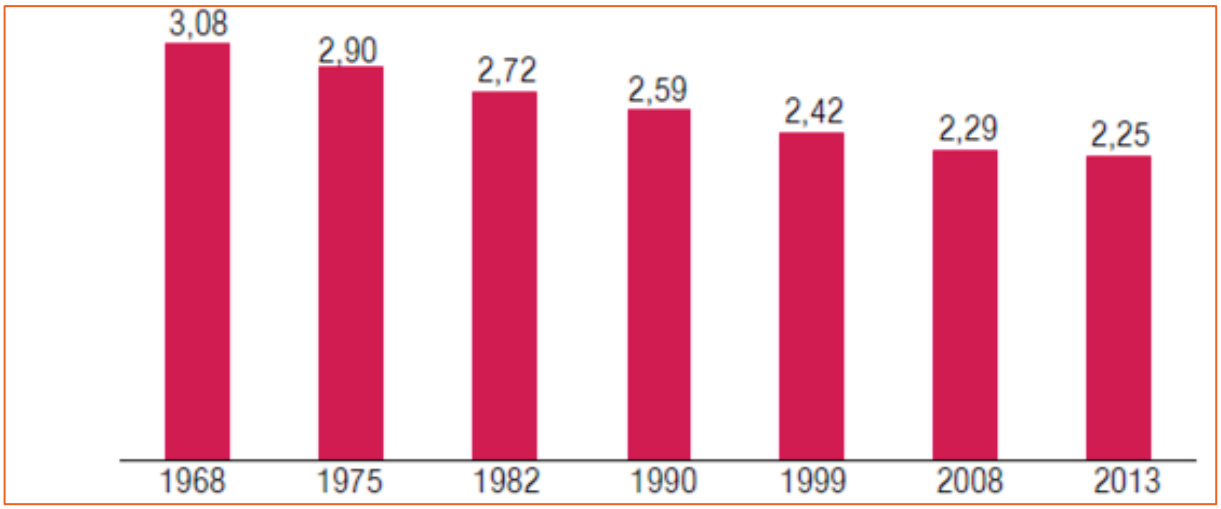


Figure 1.1: Evolution of household size – Source: INSEE

C. GEOGRAPHY

The surface area of mainland France (550,000 km2) is the largest of the European Union countries (around 13% of the EU area). Located between the Atlantic and the Mediterranean, between latitudes 41°N and 51°N, France has around 3,200 km of coastline. France is a country of average elevation, and plains and hills occupy two thirds of the territory. However, it has two mountain barriers, one in the east and the other in the south: The Alps and the Pyrenees. Mont Blanc (4,810 m), the highest point in France, is located in the Alps, on the border with Italy. The Massif Central, in the centre of the country, plays a role in dispersing water to the four major basins: The Seine to the north, the Loire to the northwest, the Rhone to the east and the Garonne to the southwest.

Nearly 60% of the mainland surface area is used for agriculture (33 million hectares), 34% is forests and natural or semi-natural environments (19 million hectares), while just under 6% corresponds to urbanised land (3 million hectares)[12].

The figure below on land use corresponds to the data available in the context of the CORINE Land Cover geographical database produced as part of the European programme for coordinating environmental information.

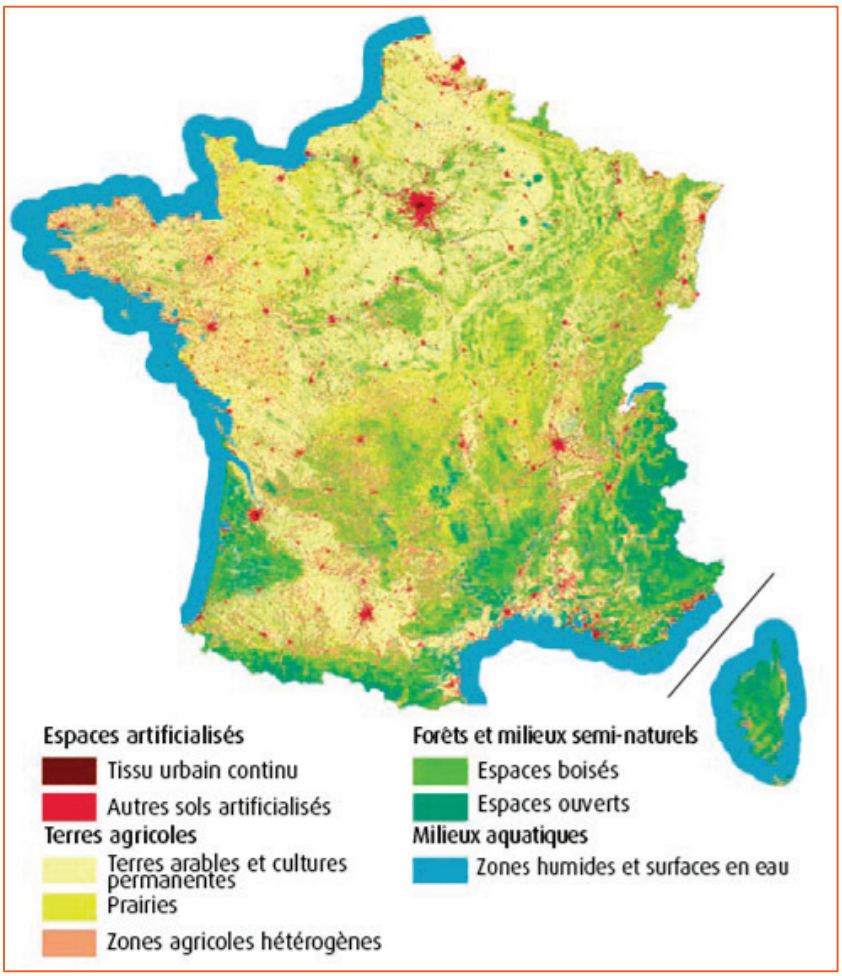


Figure 1.2: Land cover in 2012
Source: UE- SOeS, CORINE Land Cover

[12] http://www.statistiques.developpement-durable.gouv.fr/publications/p/2361/1328/loccupation-sols-france-progression-plus-moderee.html

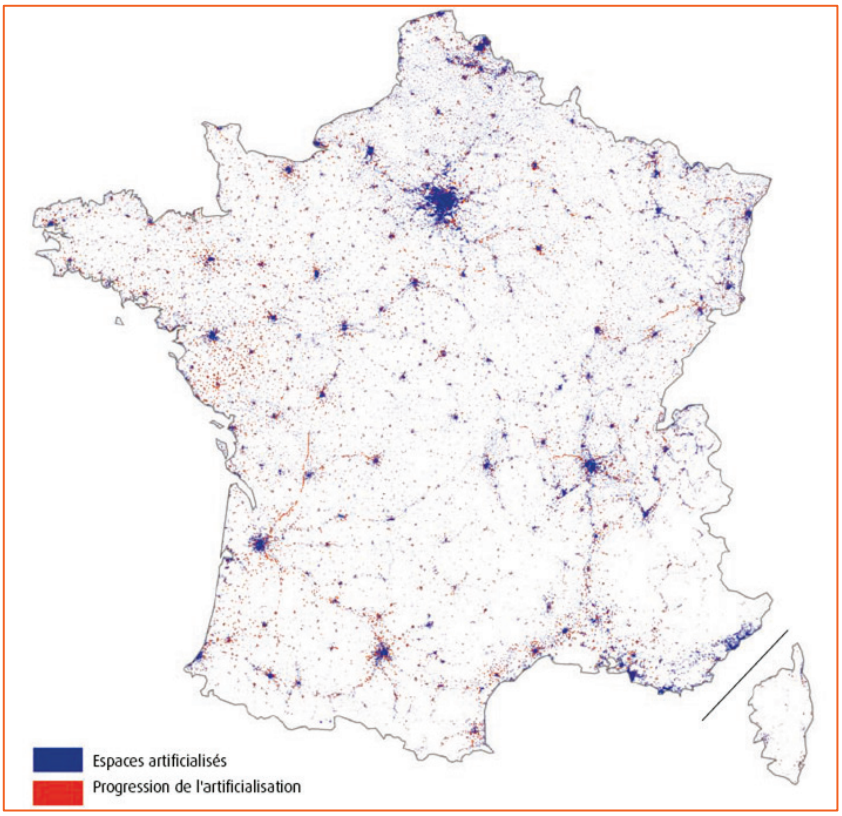


Figure 1.3: Progression of urbanisation between 2006 and 2012
Source: UE-SDES

In terms of the use of space, we can note a continuation of urbanisation during the recent period. The figure below illustrates the progression of urbanisation between 2006 and 2012 (see figure below). This urbanisation is concentrated around urban centres of regional importance in particular.

D. CLIMAT

On a global scale, mainland France enjoys a so-called temperate climate. It has rainfall distributed throughout the year and relatively mild temperatures. These characteristics are due to France's mid-latitude location and the dominance of winds from the Atlantic.

However, the regions experience climates that vary according to their latitude, altitude and their proximity or not to the sea, which is reinforced by their position in relation to the three major mountain ranges (Pyrenees, Massif Central, Alps).

At first glance, there are five main types of climates in mainland France: oceanic, altered oceanic, semi-continental, mountainous, Mediterranean.

The climates of the French overseas territories are more mixed. Most of the overseas territories are located in tropical or equatorial areas (such as the Caribbean, South America, the Indian Ocean and Polynesia). The others come from harsh cold climates (Saint Pierre-et-Miquelon), and even extreme climates (French Southern and Antarctic Lands, with a record at Dumont d'Urville of -37.5°C in 1990).

Finally, the French overseas territories in the tropics are exposed to natural hazards such as hurricanes and tropical storms (Oli and Tomas in 2010, Evan in 2012 and Hurricane Irma in September 2017).

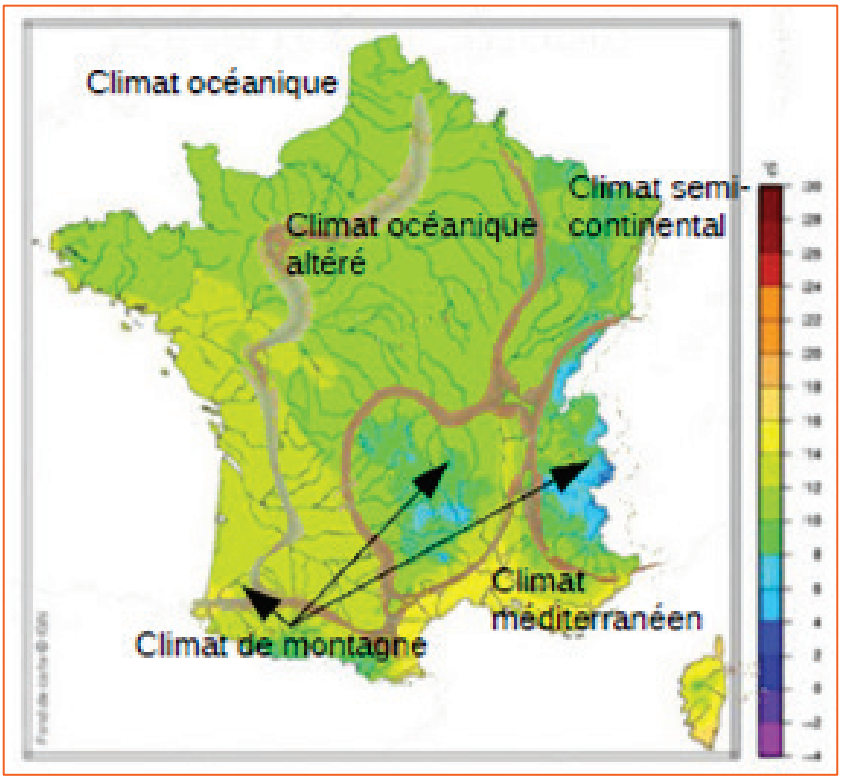


Figure 1.4: Climate typology of France
Source: UE, Météo-France

The shaded areas are transition areas.
The colours correspond to the average annual temperatures.

Climate records from 2013 to 2016

In 2013, the average annual temperature was not exceptional as it was near to normal[13] throughout France. However, the month of May was very cold and the months of July and October were particularly hot, with a heat wave throughout France from 15 to 27 July 2013. Aggregated over the whole country, the amount of rainwater collected was more than 10% greater than the average[14] amount.

In 2014, temperatures remained very high throughout the autumn. The year 2014 was the hottest year on average for mainland France (+1.2°C compared to the average). In 2014 and throughout the season, there was a wide difference in rainfall across the regions. Rainfall was scarce in the South-West, from the Pays de la Loire to Nord-Pas-de-Calais, on the Vosges mountains, in the northern Alps and in Corsica. The deficit exceeded 40% from Calvados to the Nord region.

In 2015, the average temperature in France was above normal for most of the year, except in February, September and October. The year was marked by two heatwaves in July and an exceptionally mild end to the year. On average in France and over the year, the average temperature exceeded the norm by 1°C, placing 2015 in third place in the hottest years since 1900, after 2014 and 2011 (+1.1°C). Rainfall has been decreasing in most of the country, particularly north of Aquitaine in the North-East and in Aude, Hérault and Lozère with a deficit exceeding 20%. The end of the year was marked by the driest December

[13] Reference average 1981-2010
[14] Reference average 1991-2014

recorded in the 1959-2015 period. On average in France and in 2015, rainfall was below normal by more than 15%.

In 2016, temperatures were higher than normal throughout most of the country, sometimes by more than 1°C in the Southwest and in places along the Northern borders. There was a deficit in rainfall on the West coast as well as in the regions alongside the North and North-Eastern borders with the exception of the extreme North of the country, which had more rainfall along the Channel. On average throughout France, there was a rainfall deficit of nearly 15%.

The evolution of the annual average temperature in mainland France is shown in the figure below as a deviation from the 1961-1990 average. It presents the same characteristics on a national and global scale: the warming of average temperatures is very clear. Until the mid-1980s, the difference was mostly negative: the average annual temperature was mostly lower than average for the 1961-1990 period. From the end of the 1980s, average annual temperatures increase rapidly and the difference is systematically positive. As on a global scale, the evolution of average annual temperatures in mainland France shows a net warming since 1900. This warming has been at a variable rate, with a particularly marked increase since the 1980s. The year 2016 was once again a hot year that exceeded the reference period's annual average (1981-2010), but it was not exceptional throughout mainland France and ranks 10th, far behind 2014 (+1.2°C), 2011 (+1.1°C) and 2015 (+1.0°C).

Over the 2010-2015 period, the climatic severity index, used in energy consumption calculations to remove the effect of climate, was highest in 2010 (with 1.168, thus characterising a very cold year) and particularly low in 2014 (0.816 thus characterising a very hot year). In 2011, the climatic severity index was 0.837. These very significant differences have had a meaningful impact on national greenhouse gas emissions given the resultant variations in energy consumption.

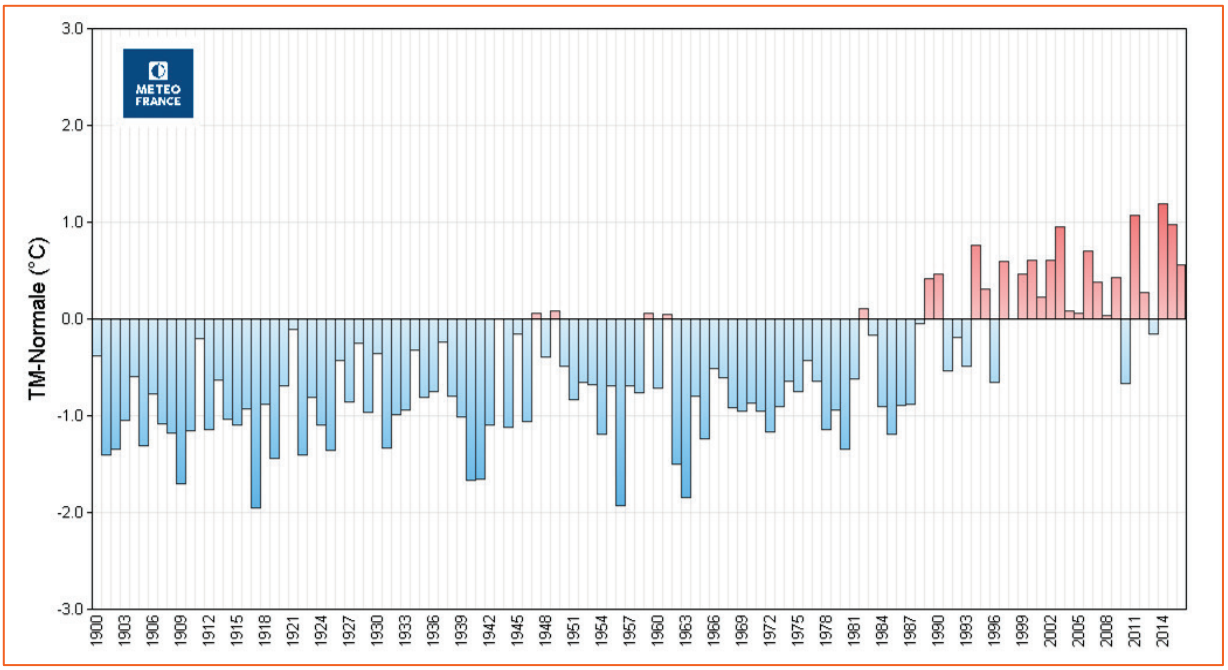


Figure 1.5: Difference from the annual reference average
Source: UE, Météo-France

E. ECONOMY[15, 16]

In 2014, France was in 26th place in the world for GDP per capita in terms of purchasing power parity[17], slightly higher than the EU average, which is in 28th. In the classification by GDP in terms of purchasing power parity, France is the 9th economic power in the world. France's GDP has been increasing since the 2008 crisis. In 2016, it was 2 228.9 billion euros (in current euros), up 1.2% compared to 2015 in constant euros, after an increase of 1.1% in 2015 and 0.9% in 2014.

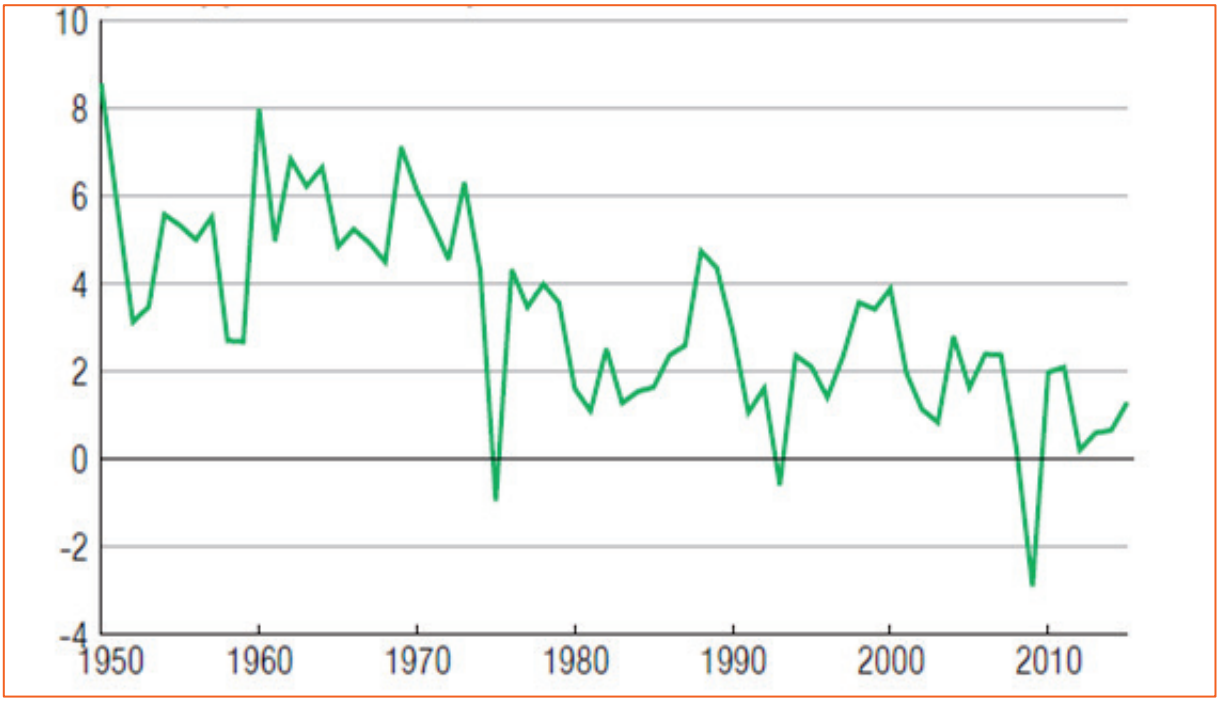


Figure 1.6: Changes in GDP from 1950 to 2015 – Source: INSEE National Accounts, 2010 base

The French economy is mainly a service economy. In 2006, exports accounted for 26% of the gross domestic product(GDP) and imports 27%[18]. In 2015, the tertiary sector accounted for 76.7% of the labour force, while the primary sector (such as agriculture, fishing) accounted for only 2.8%, and the secondary sector (mainly industry) 20.5%. The trade balance (goods and services) became loss-making in 2004, and this deficit increased until 2011 before declining slightly but remaining high in 2015[19].

Despite the slight slowdown in global demand for France, exports of goods and services accelerated sharply in 2015: + 6.1% in volume, after + 3.3%, which reflects gains in market share. In 2015, the foreign trade balance of goods and services improved in value by €12.5 billion, while remaining largely in deficit: - €30.0 billion, after - €42.5 billion. This is the lowest deficit since 2010 (-€ 27.6 billion). In terms of value, exports grew faster (+5.7%) than imports (+3.5%) in 2015. Indeed, the price of imports fell much more sharply than that of exports, due in particular to the fall in the price of oil: the price of Brent crude fell by

[15] https://www.insee.fr/fr/statistiques/2587886 French economy tables 2017
[16] https://fr.wikipedia.org/wiki/%C3%89conomie_de_la_France for the structure illustrating the French economy and for some sources and figures cited.
[17] http://donnees.banquemondiale.org/indicateur
[18] https://www.banque-france.fr/fileadmin/user_upload/banque_de_france/Economie_et_Statistiques/base_de_donnees/chiffres-cles-zone-euro/zoneeuro.pdf
[19] Source INSEE

more than a third in 2015. The graph below illustrates these trends since 2011, putting them in historical perspective compared to 1990, the year in which France's greenhouse gas reporting began.

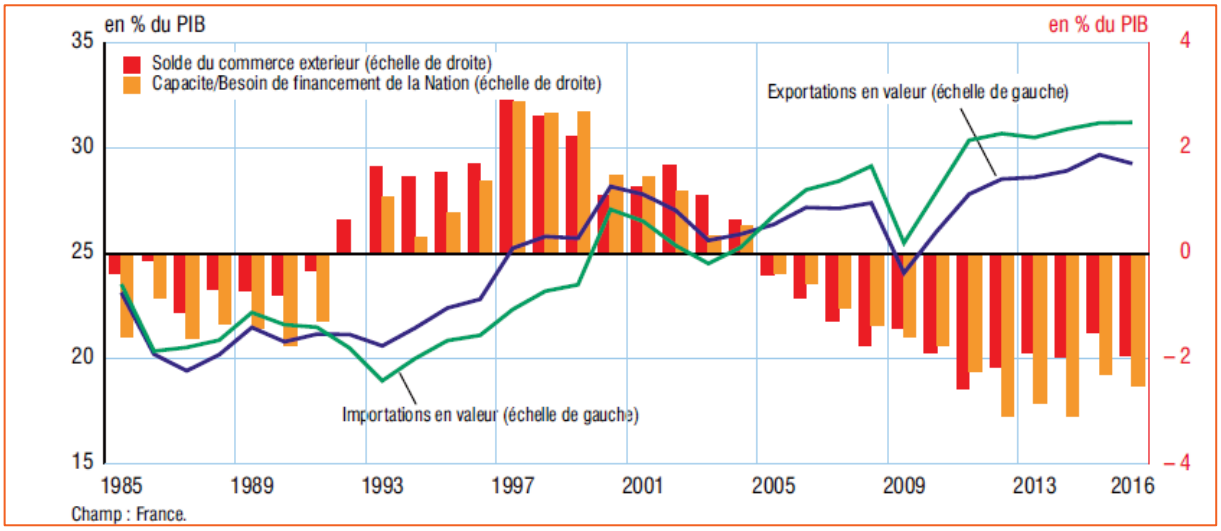


Figure 1.7: Changes in external balance from 1985 to 2016 – Source: INSEE National Accounts, 2010 base

E.1 Transport

The transport sector is the primary petroleum products consumer, with almost three quarters of final energy consumption of petroleum products, which exerts a strong impact on greenhouse gas emissions. After reaching a plateau of more than 48 Mtoe between 2001 and 2007, the consumption of petroleum products in the transport sector has slightly decreased since the 2008 crisis and stagnated at around 45 Mtoe. It rose to 45.4 Mtoe in 2015, up 1% from 2014. The high rate of dieselisation of the car fleet and the better energy performance of engines favoured the downward trend in consumption until 2012[20]. In 2015, diesel sales increased modestly (+0.8 %). Sales of unleaded 95-E10, continued to increase significantly (+5.9%). Consumption is rising again in air transport (+4.8%).

Alternative modes of transport to that by road only account for a small proportion of transport. The share of alternative modes of transport to road transport has declined significantly for freight transport since 1990 (23.2%) and even since 2000 (19%). In 2015, alternative modes of transport to road transport accounted for only 12.9% of land transport of goods (excluding pipelines). In connection with the revival of rail freight transport, this share improved in 2015.

Compared to its level from 2011 to 2013 (19.7%), the share of public passenger transport is declining, at 19.1% in 2015. The resumption of private cars in road traffic, related to the low price of fuel, explains this decline, despite the continuous growth of public passenger transport.

Since 2007, the number of kilometers of public transit in the provinces (segregated-lane public transport - TCSP) increased from 1,104 km to 1,854 km in 2014. It is nearing the target of 2,200 km set for 2020.

[20] Since 2013/2014, the trend has been a slight increase.

E.1.1 Freight transport

As shown in the two figures below, from1990, domestic freight transport increased sharply until the economic crisis of 2008, led by road traffic. In 2015, with 334.6 billion tonne-kilometers, domestic inland freight transport decreased compared to 2014 (-1.6%). The decline in road transport activity carried out by heavy goods vehicles under the French flag involves all major types of goods. In 2015, with 281.4 billion tonne-kilometers, inland road freight transport decreased by 2.5%, due to the 5.7% decline in shipping under the French flag, while shipping under a foreign flag rose 3.0%. This transport is mainly carried out by trucks weighing more than 3.5 tonnes.

en milliards de tonnes-kilomètres

	1990	2000	2015 (p)	15/14 en %
Transport routier	**197,0**	**277,4**	**281,4**	**– 2,5**
Pavillon français	159,0	203,6	172,2	– 5,7
National	137,7	181,8	164,7	– 5,4
International	20,0	21,2	7,5	– 11,3
Transit	1,3	0,5	0,1	0,0
Pavillon étranger	38,0	73,8	109,2	3,0
Cabotage	0,0	2,2	7,9	2,6
International	17,2	33,1	56,7	3,0
Transit	20,8	38,4	44,6	3,0
Transport ferroviaire	**52,2**	**57,7**	**34,3**	**5,1**
National	31,5	29,9	21,4	6,1
International	15,0	18,5	9,5	3,2
Transit	5,7	9,3	3,3	4,0
Transport fluvial[1]	**7,2**	**7,3**	**7,5**	**– 3,7**
National	4,3	4,1	4,6	– 4,3
International	2,9	3,1	2,9	– 2,9
Oléoducs	**19,6**	**21,7**	**11,4**	**3,5**
Total	**276,0**	**364,0**	**334,6**	**– 1,6**
National	193,1	239,8	210,0	– 3,6
International	55,1	76,0	76,5	1,2
Transit	27,8	48,3	48,1	3,1

1. Hors trafic rhénan et mosellan.

Figure 1.8: Domestic freight transport by mode of transport in 1990, 2000 and 2015– Source: SOeS

Rail transport decreased continuously over the 1990-2015 period. This decrease continued until 2010. Since2010, the rail freight situation has stabilised. In 2015, the share of road transport in all modes of transport (including transit and excluding oil pipelines), which stood at 87.1%, decreased in favour of rail transport, whose share reached 10.6%. Rail freight activity amounted to 34.3 billion tonne-kilometers in 2015, driven by the resumption of national transport (+6.1%).

Waterway transport, which declined between 1990 and 1997, then gradually made a comeback until 2005. Waterway transportation of goods amounted to 7.5 billion tonne-kilometers in 2015. It fell for the second year in a row (-3.7% after -2.0% in 2014). Activity is declining due in part to a reduced demand for mineral fuels and building materials. Pipeline transport has been declining steadily since 1990. Coasting trade, international trade and transit increased between 2000 and 2015.

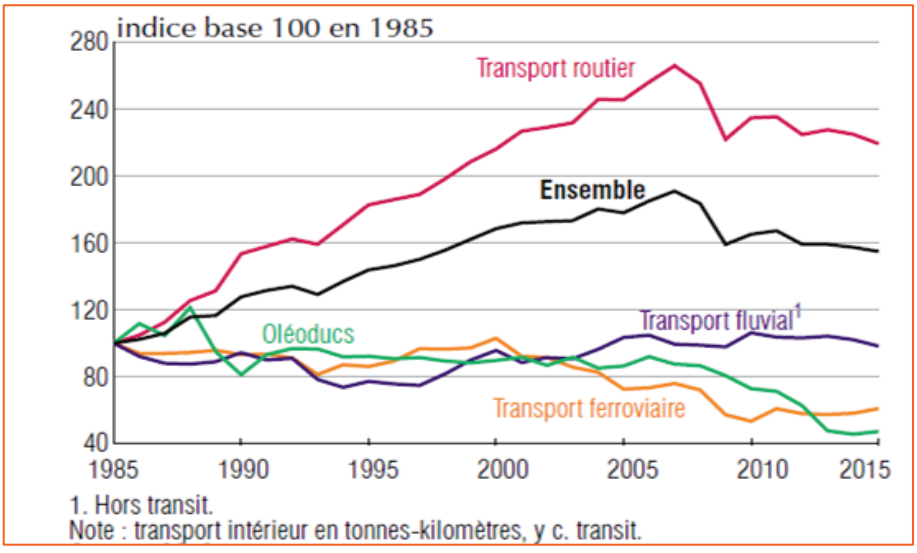


Figure 1.9: Domestic land transport of goods by mode of transport from 1985 to 2015
Source: SOeS

E.1.2 Passenger transport

From 1990, the total volume of domestic passenger transport increased steadily for all modes until 2005, with the exception of rail and air transport, which fell between 1990 and 1995 and then increased. The volume of passenger cars increased steadily, while buses, coaches and trams stagnated. The volume of air transport rose sharply between 1990 and 2000, and then contracted heavily until 2005. The figure below illustrates these changes.

Between 2005 and 2013, the total volume of domestic passenger transport stagnated. The volume of rail transport continued to grow rapidly. The volume of buses, coaches and trams rose sharply. At the same time, the volume of private passenger cars stagnated. The volume of air transport increased significantly between 2010 and 2015.

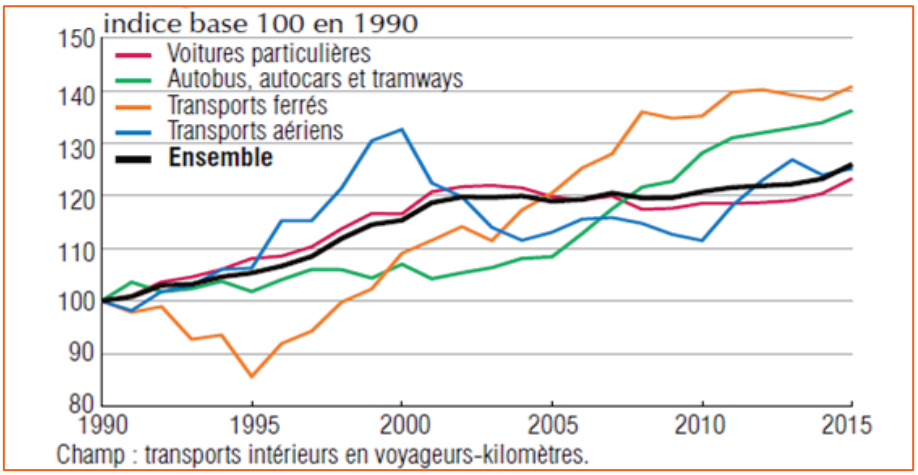


Figure 1.10: Changes in the modes of public transport since 1990
Source: SOeS

In 2015, domestic passenger transport activity grew significantly (+2.1%, after +0.8% in 2014), at a rate well above its annual average since 2010.

The two figures below illustrate the change in the types of engines used, in private passenger cars on the left, and in light commercial vehicles on the right. An increase in the amount of diesel engines has been confirmed since the sixth national communication. This trend has recently started to reverse with a rebalancing seen from 2015.

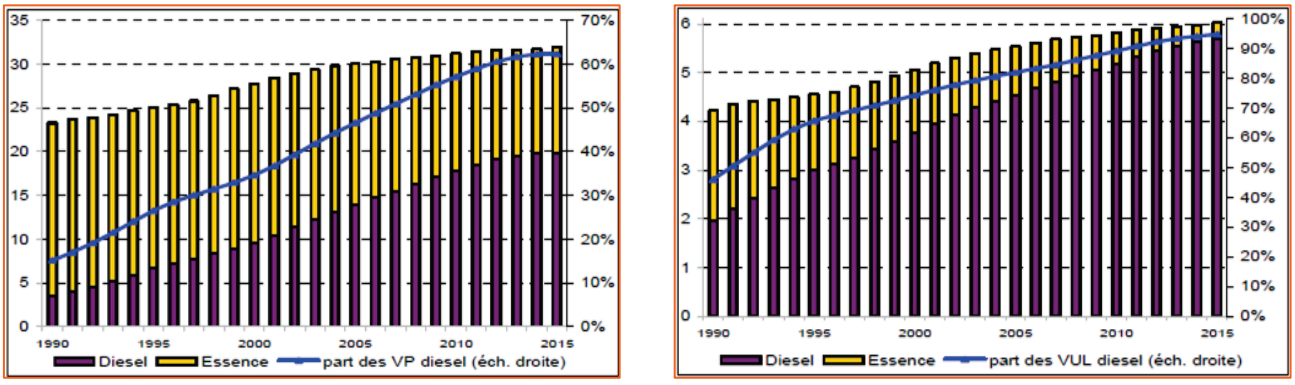


Figure 1.10: French vehicle fleet from 1990 to 2015, in millions of units: on the left, for private passenger cars; on the right for light commercial vehicles - Source: CCFA

The strong growth in domestic passenger transport is mainly due to the increase in private passenger car traffic, which is growing faster than in 2014. The number of passenger-kilometers travelled in private passenger cars and two-wheeled motor vehicles increased by 2.4% between 2014 and 2015, which is a much higher rate than its trend since 2010. As regards public transport, it is once again seeing growth. All modes of public transport are increasing to some degree: rail transport, air transport and road transport. The share of domestic passenger modes of transport has not changed much since2011. The share of the road transport was stable at 87% in 2015.

Since the sixth national communication, public transport has grown on average. In billions of passenger-kilometers, public transport grew by + 2.1% in 2015 compared to 2014, for example.

From 2000 to 2014, the maritime traffic of passengers on ferries[21] dropped, with a 10% decrease in the number of passengers in the ports studied. This is mainly due to the shift of some of the trans-Channel maritime traffic to Eurotunnel. At the same time, the number of cruise passengers has increased significantly. With these two opposite trajectories, maritime passenger traffic has been almost stable since 2000.

The use of renewable energy in transport is increasing

Directive 2009/28/EC on the promotion of the use of renewable energies introduced two binding national targets, one of which concerns transport: for France, the share of renewable energies in the transport sector's final gross energy consumption must reach 10% by 2020. This share was 7.7% in 2014.

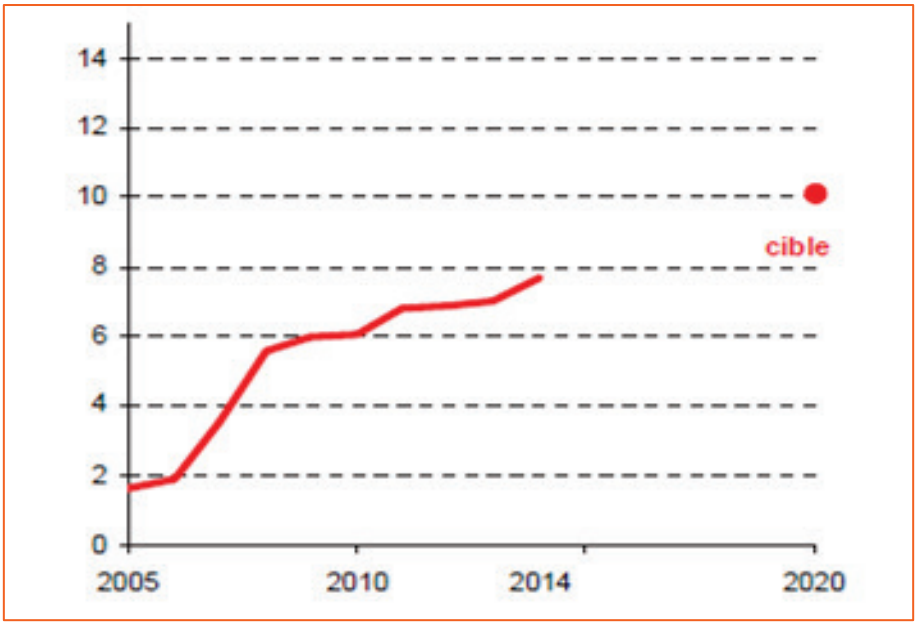


Figure 1.11: Share in % of renewable energy consumption in the transport sector's total energy consumption – Source : SOeS

[21] http://www.onml.fr/onml_f/fiche_aretenir.php?id_fiche=117&auth=NOK

E.2 Property/ Residential / Tertiary

Consumption corrected for climate variations in residential and commercial properties increased until the beginning of the 2000s, but has now been decreasing slightly. The share of total consumption changed from 41.5% in 1973 to 40.5% in 1990, then to 44.9% in 2015[22].

In particular, the consumption of heating oil for heating has been decreasing for over thirty years. Since 1990, natural gas has replaced coal and oil for heating buildings, hot water and cooking. Price rises and aid schemes have led to domestic fuel boilers being replaced by installations that are more energy-efficient or consume other types of energy, such as electricity, gas, or renewable energies. Fuel oil is being used less and less in heat networks for district heating, in particular for the benefit of renewable energies. Finally, the use of butane and propane has been decreasing sharply for several years.

As from 2015, natural gas consumption has generated almost 61% of the CO_2 emissions linked to these types of use.

E.2.1 Residential[23]

Over the last thirty years, the housing stock has been growing at a rate of around 1% per year (see table below). As of 1 January 2016, the number of dwellings stands at 35.4 million in France excluding Mayotte.

	1986		2016		Average annual change (in %)
	Number of dwellings (in thousands)	Distribution (in %)	Number of dwellings (in thousands	Distribution (in %)	
All dwellings, including:	**25,453**	**100.0**	**35,425**	**100.0**	**1.1**
Main residences	20,962	82.3	29,173	82.3	1.1
Secondary residences and occasional dwellings	2,566	10.1	3,318	9.4	0.9
Vacant dwellings	1,925	7.6	2,934	8.3	1.4

Field: France, excluding Mayotte

Table 1.1: Distribution of the housing stock by category – Source: SDES Transport accounts

The number of collective dwellings is increasing faster than that of individual dwellings due to recent developments in new construction. Before 2008, more individual dwellings were completed per year than collective dwellings. Since 2013, the opposite is true: individual housing accounted for 56% of dwellings in 2016. Individual dwellings make up the majority of main residences as well as second homes and occasional dwellings.

[22] http://www.statistiques.developpement-durable.gouv.fr/fileadmin/documents/Produits_editoriaux/Publications/Datalab/2016/datalab-bilan-energetique-de-la-france-pour-2015-novembre2016.pdf
[23] https://www.insee.fr/fr/statistiques/2533533#Figure1

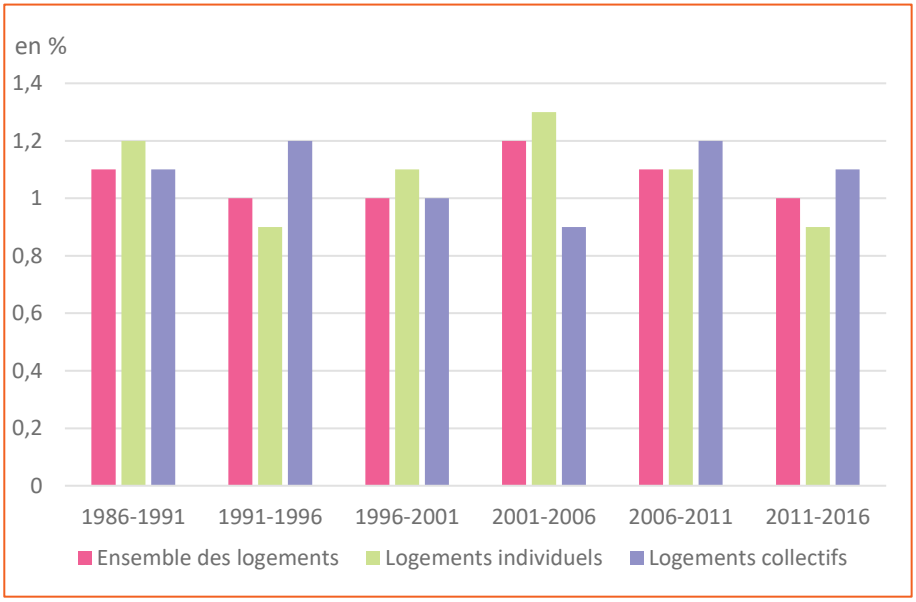


Figure 1.12: Changes in the number of dwellings by type of housing since 1986 – Source: SDES Housing accounts

The share of rural dwellings has declined over the last thirty years (51% in 1986 compared to 43% in 2016), while that of small urban units has increased (from 39% to 32%) with urbanisation. In 2016, in mainland France, 16% of the main residences were in the Paris conurbation and 22% in rural areas. Secondary residences or occasional dwellings are much more often located in a rural area or in a small urban unit (fewer than 100,000 inhabitants) in four out of five cases, compared to only half of main residences.

The table below examines the distribution of housing between individual and collective according to the type of conurbation.

	In thousands			
	All dwellings	**Main residences**	**Secondary residences and occasional dwellings**	**Vacant dwellings**
All dwellings	**34,537**	**28,430**	**3,281**	**2,825**
Individual	19,325	16,088	1,883	1,354
Collective	15,212	12,343	1,399	1,471
Rural communities	8,341	6,227	1,405	709
Individual	7,473	5,768	1,093	613
Collective	867	460	312	96
Conurbations of fewer than 100,000 inhabitants	11,114	8,834	1,264	1,016
Individual	6,956	5,798	664	493
Collective	4,158	3,035	600	523
Conurbations of more than 100,000 inhabitants	10,038	8,793	443	801
Individual	3,827	3,512	112	202
Collective	6,211	5,281	331	599
Paris conurbation	5,045	4,576	169	299
Individual	1,069	1,009	13	46
Collective	3,976	3,567	156	253

Table 1.2: Distribution of housing between individual and collective according to the type of conurbation
Source: SDES Housing accounts

E.3 Energy

Following the period of steady growth from 1990 to 2008, the decline in 2009 and the recovery from 2010, then the stabilisation from 2010 to 2012, national primary energy production increased slightly again between 2013 and 2015 (+0.4 % for the latter year) to establish a new record, at nearly 140Mtoe. Nuclear production increased slightly between 2011 and 2015.

The graph below illustrates these long-term trends. Renewable energy sources are gradually increasing in power, while the nuclear energy share still predominates.

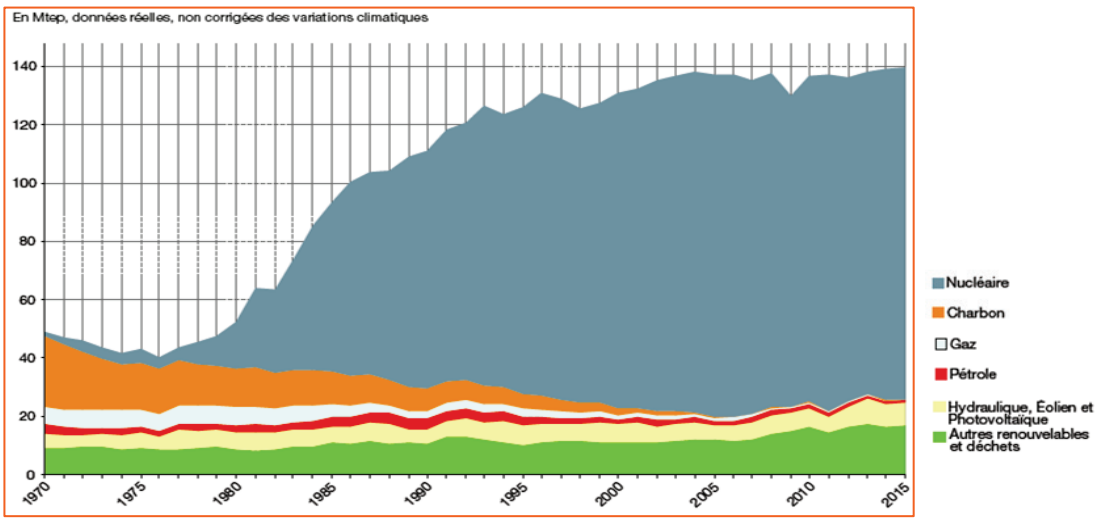


Figure 1.13: Primary energy production from 1970 to 2015
Source: SOeS

Actual primary energy consumption rose until 2005, then it went down slightly. In 2009 it experienced a setback. It has been almost stable since. It rebounded slightly by 1.6% in 2015 to 253.4 million tonnes of oil equivalent (toe), after falling 3.8% in 2014. This rebound is mainly the result of lower temperatures compared to 2014, which was an exceptionally mild year. In data corrected for climatic variations, primary consumption increased slightly, returning to a level close to that of 2013, at 256.7 Mtoe. Final energy consumption corrected for climate variations, which has been declining continuously for three years, remained stable in 2015 at 149.2 Mtoe.

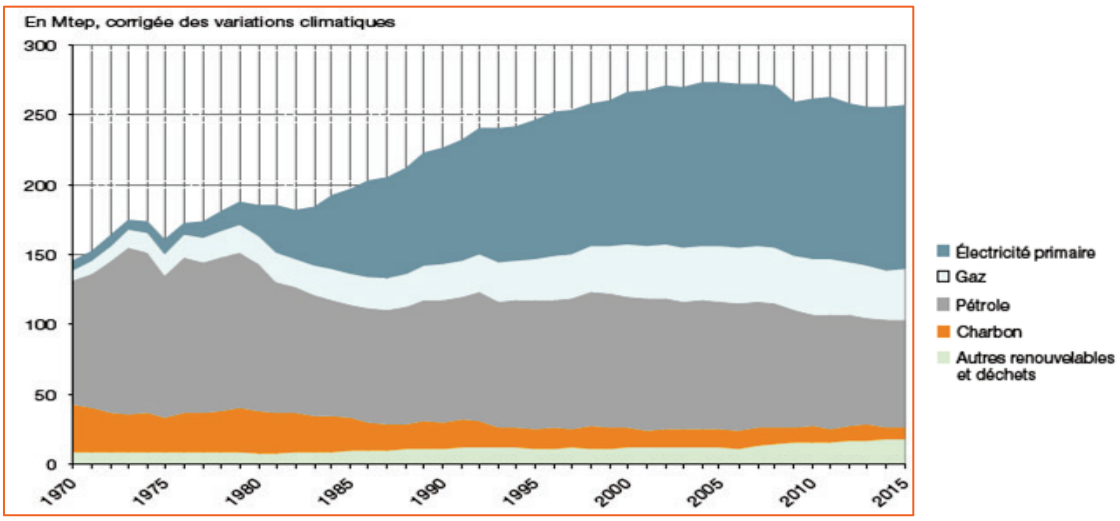
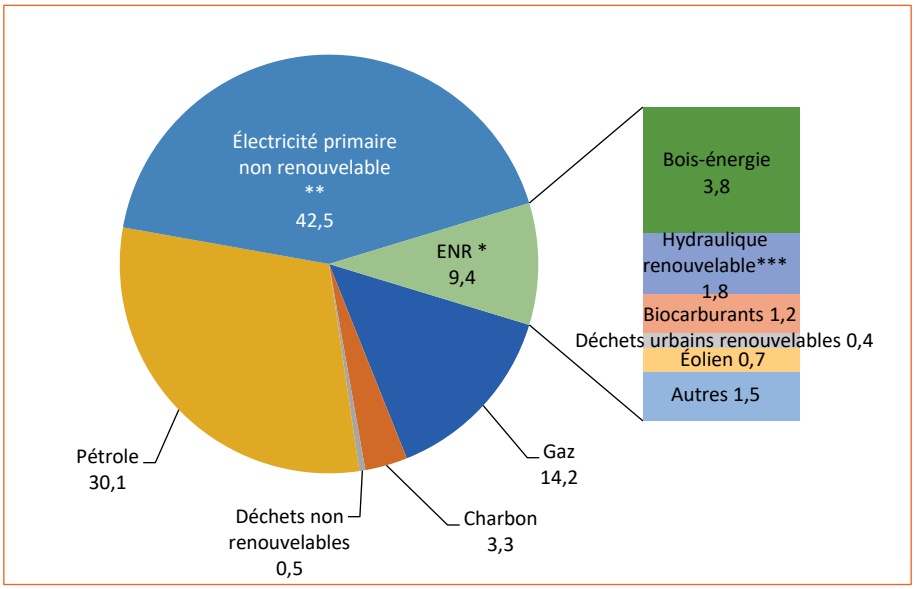


Figure 1.14: Changes in primary energy consumption by form of energy
Source: SOeS

In 2015, the primary energy mix consisted of 42.5% non-renewable nuclear primary electricity and 9.4% renewable energies. Oil still occupies nearly a third (30.1%) and gas 14.2%, while the coal share is very low (3.3%), as shown in the figure below.



** EnR : énergie renouvelable.*
*** Production nucléaire, déduction faite du solde exportateur d'électricité, et production hydraulique issue des pompages réalisés par l'intermédiaire de stations de transfert d'énergie par pompage (Step).*
**** Hydraulique hors pompage.*

Figure 1.15: Primary energy mix - Source: SDES chiffres clés de l'énergie

Renewable energies include biomass, incinerated non-renewable waste, renewable primary heat, and energy from the hydraulic (non-pumping), tidal, wind and photovoltaic sectors. Primary production of renewable energy reached 23.0 Mtoe in 2015.

The graph below illustrates the progress of renewable energies since the first reports on greenhouse gases: in 2007, we see these energies taking off.

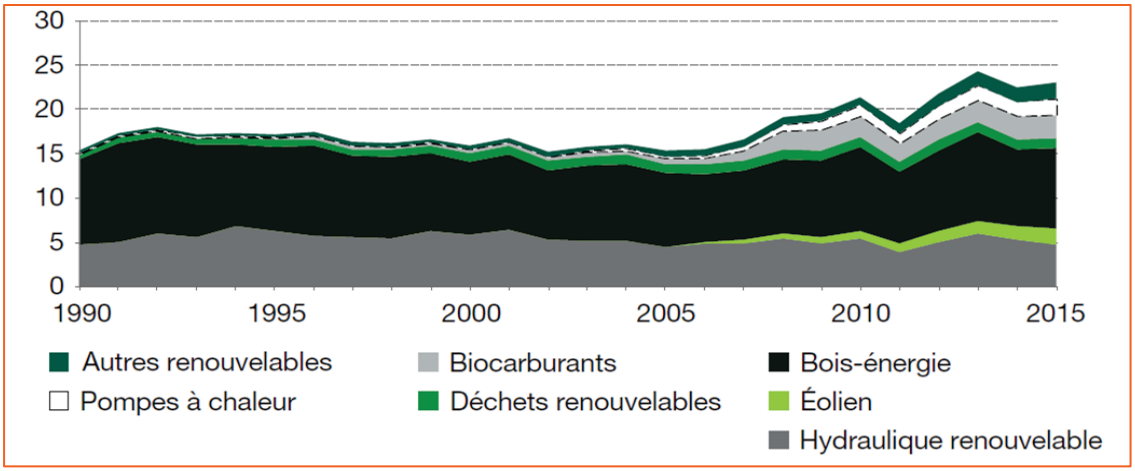
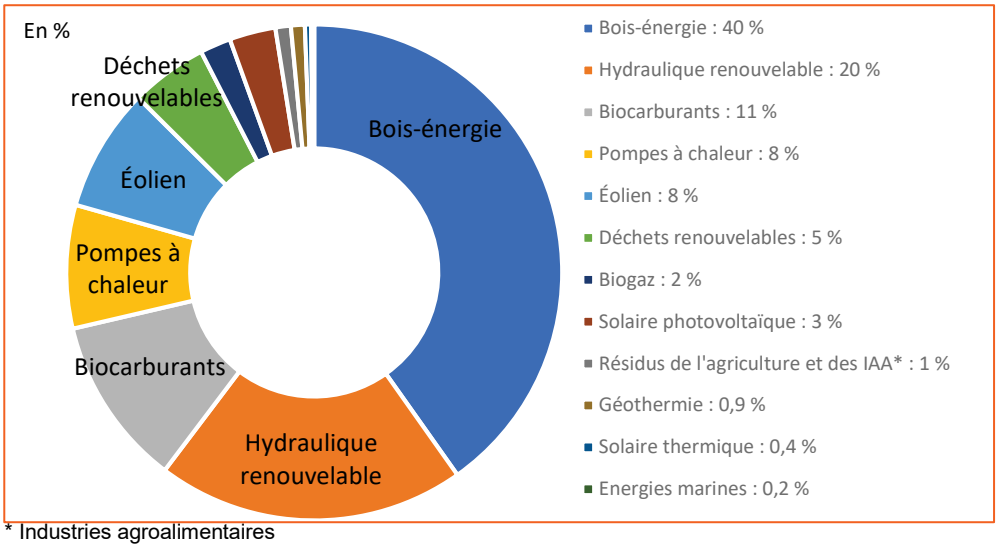


Figure 1.16 [24] : Progression of the primary progression of renewable energies by sector (mainland France) in Mtoe - Source: SDES[24]

[24] http://www.statistiques.developpement-durable.gouv.fr/fileadmin/documents/Produits_editoriaux/Publications/Datalab/2017/Datalab-8-CC-des-energies-renouvelables-edition-2016-fevrier2017.pdf

In 2015, approximately 60% of the primary production of renewable energy came from biomass: 40% for wood energy, 11% for biofuels, 5% for renewable urban waste, 2% for biogas and 1% for residues from agriculture and agri-food industries.

Primary renewable electricity, combining renewable hydropower, marine, wind and photovoltaic energy, represented one-third of the primary production of renewable energies in 2015. Primary heat of aerothermal, geothermal or solar origin, represents 9% of the primary production of renewable energies.



* Industries agroalimentaires

Figure 1.17: Share of each sector in the primary production of renewable energies in 2015
Source: Source SDES - Bilan énergétique de la France 2015

As shown in the table below, there has been a particularly strong increase in renewable energies in the final consumption since 2005: +47.6% between 2005 and 2015. This increase is particularly strong for solar photovoltaic energy (330 X growth), wind energy (18X growth), biofuels (5X growth), solar, thermal and biogas (3X growth), biomass and waste (+11.0%).

par filière — en milliers de tep

	2005	2015
Hydraulique renouvelable normalisé	5 686	5 259
Éolien normalisé	96	1 718
Solaire photovoltaïque	2	666
Énergie marine	41	42
Géothermie électrique et thermique	115	128
Solaire thermique	49	159
Pompe à chaleur	203	1 986
Biomasse et déchets	8 506	9 446
Biogaz	90	305
Biocarburant	591	2 996
Consommation finale brute d'EnR[1]	**15 379**	**22 705**

1. Énergie renouvelable.

Tableau 1.3: Gross final consumption of renewable energy by sector in 2005 and - Source: SDES

E.4 Industry

Despite deindustrialisation as a result of the globalisation of industrial production over the last 30 years, the manufacturing industry held up well between 2000 and 2008, with the exception of the refining sector which showed a steady decline.

In addition to resulting in a sharp reduction in the refining sector, the 2008 crisis led to a substantial reduction in manufacturing output, capital goods and transport equipment, while activities in the agri-food sector remained stable.

Over the 2011-2015 period, this resilience in the agri-food industry was confirmed, while transportation equipment increased dramatically. Manufacturing output and capital goods have recovered some of the lost ground, without yet returning to 2008 levels. In general, the situation is gradually improving. In 2015, industrial production in volume recovered significantly (+1.7%, after -0.3% the previous year). However, it remains 8.5% lower than its highest level reached in 2007. The different components of demand are contributing to this improvement, in particular, household spending on manufactured goods returned in 2015 to the pre-crisis growth rate for the first time since 2008. In addition, business investment in manufactured goods and especially exports of manufactured goods accelerated at the end of the period. The graph below describes the evolution of manufacturing output by branch by volume.

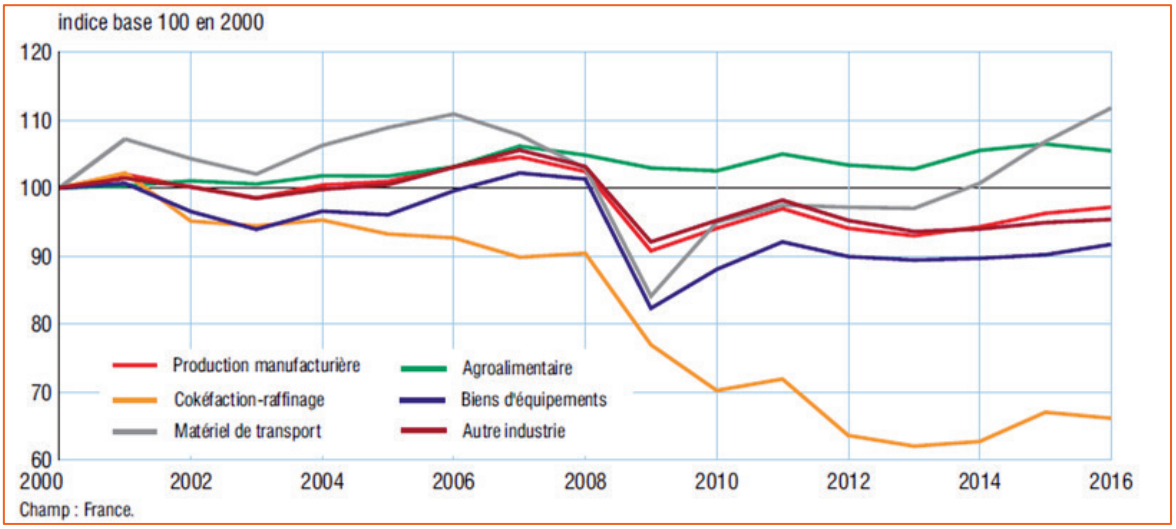


Figure 1.18: Evolution of manufacturing output since 2000
Source: INSEE National Accounts, 2010 base

The graph below shows the production levels of the main aggregates of the industry and their evolution between2014 and 2015.

	Production en valeur en milliards d'euros	Évolution 15/14 en volume en %				
		Production	Valeur ajoutée	Exportations[1]	Importations[1]	Dépense de consommation des ménages
Extr., énerg., eau, gestn déch. & dépol.	149,4	1,9	1,5	– 9,3	6,7	2,2
dont : prdn & distr. élec. gaz vap. & air cond.	*108,1*	*2,9*	*2,2*	*– 1,6*	*28,5*	*3,0*
gestion eau, déchets & dépollution	*35,9*	*– 1,1*	*– 0,2*	*– 12,6*	*11,3*	*– 0,2*
Fabric. denrées alimentaires, boissons et prdts à base de tabac	158,4	0,9	2,2	3,3	4,1	1,5
Cokéfaction et raffinage	40,8	5,0	7,0	20,1	2,6	1,2
Fab. éq. élec., électr., inf. & machines	80,6	1,3	1,0	5,0	8,1	4,8
dont fab. prod. informat., électroniq. & opt.	*23,5*	*6,4*	*5,8*	*7,7*	*12,4*	*6,4*
Fabrication de matériels de transport	116,2	3,5	10,2	10,7	12,0	4,3
Fabrication d'autres produits industriels	343,7	1,2	1,8	5,4	5,1	1,7
dont : fab. textiles, ind. hab., cuir & chauss.	*16,2*	*0,9*	*2,8*	*8,0*	*4,0*	*1,0*
industrie chimique	*65,7*	*1,5*	*– 0,5*	*4,6*	*5,6*	*0,4*
industrie pharmaceutique	*26,3*	*9,1*	*13,0*	*6,5*	*8,2*	*5,7*
métallurgie & fab. ps mét. sauf machines	*79,6*	*– 0,8*	*– 0,6*	*3,7*	*3,8*	*0,3*
Total de l'industrie	**889,1**	**1,7**	**2,4**	**6,5**	**6,7**	**2,1**

1. Exportations valorisées FAB (franco à bord) et importations valorisées CAF (coûts de l'assurance et du fret inclus) par produit.
Source : Insee, comptes nationaux - base 2010.

Table 1.4: Main aggregates of the industry in 2015 – Source: TEF 2017

The improvement in the situation of the manufacturing industry is not reflected in France, however, by job creation in all sectors. Between the sixth and seventh national communication, the decline in employment persists in the refining sector, whose decline has been confirmed as indicated above, and in the manufacture of equipment and materials, whose situation has, however, improved. On the other hand, employment is growing in the extractive industries, energy, water, waste management, depollution, as well as in the manufacture of foodstuffs and beverages.

	Évolution en moyenne annuelle en %			Effectifs en 2015 en milliers d'EQTP
	2013	2014	2015	
Industries extractives, énergie, eau, gestion déchets et dépollution	1,2	0,4	0,7	306,4
Fabrication de denrées alimentaires, de boissons et de produits à base de tabac	0,1	0,6	0,1	599,4
Cokéfaction et raffinage	– 2,1	– 1,0	– 1,3	8,3
Fabric. équipmnts. élec., électroniq., informatiq. ; fab. machines	– 2,3	– 2,1	– 2,4	300,7
Fabrication de matériels de transport	– 0,9	– 2,0	– 2,3	187,9
Fabrication d'autres produits industriels	– 1,5	– 1,1	– 1,4	1 462,1

Lecture : en 2015, l'emploi des branches cokéfaction-raffinage recule de 1,3 % par rapport à 2014, pour s'établir à 8 265 personnes en équivalent-temps plein.
Source : Insee, comptes nationaux - base 2010.

Table 1.5: Domestic employment by branches of industry in 2013, 2014 and 2015 – Source: TEF 2017

E.5 Agriculture and forestry

Since 1990, the number of farms has almost halved in the tail end of the massive rural exodus that characterised France between 1950 and 1970. Large farms which were still in a small minority in 1990, now make up more than a third, which reflects the groupings carried out in this sector. This is shown in the figure below.

In parallel with this concentration of farms, the permanent assets of the sector decreased from 966,300 in 2010 to 908,100 in 2014, that is, a decrease of 6.0%.

Permanent crops and forage crops declined between 2010 and 2015, as have shares in the total of surfaces by3.4% and 49.1%, confirming the trends observed since 1980 and beyond, since the beginning of the rural exodus:

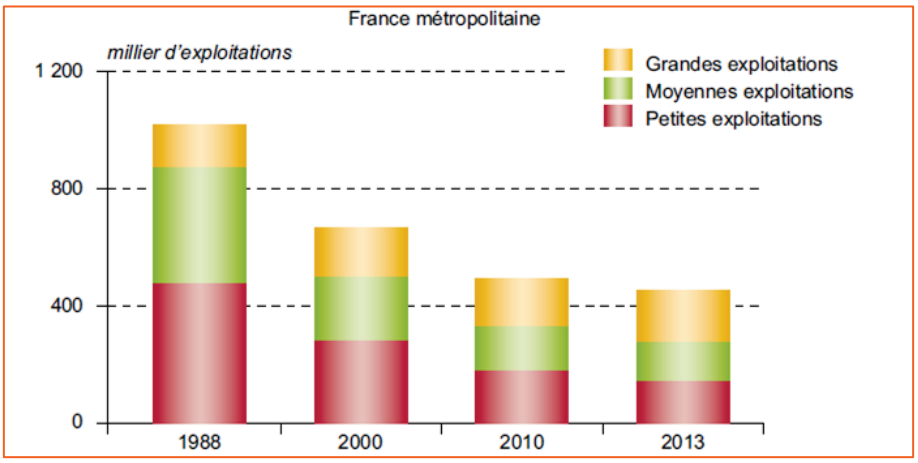


Figure 1.19: Nomber of farms by economic size
Source: AGRESTE

France métropolitaine	**1950**	**1980**	**2000**	**2010**	**2015**
			(millier d'hectares et %)		
Grandes cultures	11 812	11 620	13 459	13 136	13 169
(%)	*34,3*	*36,6*	*45,2*	*45,4*	*45,9*
Cultures fourragères	19 511	18 194	14 691	14 339	14 089
(%)	*56,7*	*57,3*	*49,3*	*49,6*	*49,1*
Cultures permanentes	2 050	1 422	1 141	1 011	989
(%)	*6*	*4,5*	*3,8*	*3,5*	*3,4*
Autres[1]	1 035	508	517	440	455
(%)	*3*	*1,6*	*1,7*	*1,5*	*1,6*
Total superficie agricole utilisée	**34 408**	**31 744**	**29 807**	**28 926**	**28 703**
(%)	***100,0***	***100,0***	***100,0***	***100,0***	***100,0***

(1) légumes frais et secs, fleurs et plantes ornementales, semences et plants divers, jardins et vergers familiaux des exploitants et des non exploitants.

Table 1.6: Forage crops and permanent crops between 1950 and 2015

France nevertheless remains a major livestock farming country in the European Union. In particular, France still has the most bovine livestock, with 19.4 million head of cattle in 2015. That same year, the pig livestock was 13.3 million animals, the sheep herd 7.1 million animals and the goat herd 1.2 million animals.

Agriculture differs from other sectors in that most of its greenhouse gas emissions are not related to energy combustion. The main sources of emissions in France are methane emitted by farm animals (enteric fermentation) and N20, linked to the nitrogen cycle.

The **dynamics of French forest** sinks are primarily marked by the **forestry** transition that has been in progress in mainland France for more than a century, with an increase in the forested area and in the volume of timber per hectare. This fundamental phenomenon, which has a long-term impact, finds its origin in the industrial revolution of the 19th century. Over the course of the 20th century, this led, on the one hand, to agricultural abandonment and a return of agricultural land to forest, and on the other hand, to a rural decline which, combined with the emergence of the use of fossil fuels, has caused a continuous decline in the exploitation of coppice trees intended for heating. Land clearing is otherwise limited,

resulting in a forest whose area increases with the rate of agricultural abandonment, whose density and age vary widely by region. Moreover, the increase in time between revolutions and rotations that follows the progressive abandonment of the coppice and coppice-with-standards treatment methods leads to an increase in the average diameter of the trees in the French forest and therefore an increase in the volume of wood per hectare. Increases in area and volume, however, are due to two different non-synchronous processes that are not always spatially correlated.

The expansion of the forests over the national territory is currently taking place mainly in the form of natural increases, but it has also benefited from major afforestation campaigns, such as that undertaken by the French National Forest Fund (FFN) between 1947 and the end of the 1990s and which contributed to one million hectares of softwood being planted (spruce, Douglas fir, laricio pine). Over the period from 1990 to 2010, the forest area increased by two million hectares, due to the afforestation of shrublands.

The French mainland forest covers one third of the territory at 16.5 Mha. It is a very diverse forest compared to its European neighbors: 138 species have a significant presence, of which 25 are locally dominant. Two thirds of the forest surface is hardwood (oak, beech). Three quarters of the French mainland forest is privately owned (10% belongs to the State and 15% to the local authorities). Three and a half million French people own forests, but 380, 000 own three quarters of the private forest, and 50,000 account for three quarters of the commercialisation of timber from privately-owned forests. Many forests are difficult to access for topographical reasons (mountain terrain) or as a result of the lack of access infrastructure. Finally, these different features contribute to the fact that about half of the natural increase of the forest is harvested each year, leading to a phenomenon of capitalisation. French forests are growing both in terms of area and volume per hectare.

The French forest and wood products industry represents around 440,000 direct and indirect jobs, and 60 billion euros in turnover. The forest and wood products industry remains a sector that weighs heavily on the deficit of the French trade balance, with a deficit that fluctuates between 5 and 6 billion euros annually. The main loss-making sectors are, in descending order, furniture, paper/ cardboard, pulp and sawnwood, while raw wood is slightly in surplus. Hardwoods represent two thirds of the growing stock, but half of the harvest and only 17% of sawnwood, because of the lack of markets for these species (solid wood furniture) and the economic difficulties of the primary processing companies. Softwood species, which are easier to process, and whose supply has been standardised under the impetus of competitive industries in Northern Europe, have more promising markets, particularly in construction.

The forests of Guadeloupe, French Guiana, Martinique, Mayotte, Reunion and Saint-Pierre and Miquelon represent 8.3 million hectares, or more than a third of the French forests, 97%of which is found in French Guiana. From the mangrove-lined coasts of the West Indies and Mayotte, to the immense primary forests of French Guiana, through the Reunion mountain forests and the boreal forests of Saint Pierre and Miquelon, the forests in the overseas territories are very diverse and offer exceptional biodiversity. France is one of the only developed countries to have tropical forests and thus bears special responsibility for exemplary protection and sustainable management.

Logging remains small-scale but allows economic activity to be maintained, mainly by supplying local processing sectors to the domestic market (third largest economic sector in French Guiana). In French Guiana, the National Forests Office (ONF) is developing this natural area in a sustainable manner, to protect its resources, while promoting the development of forest production and eco-tourism. There is a high demand for wood, especially for construction, in this department with high population growth. In the French West Indies, Mayotte and Reunion, forest management is focused on the protection of the environment, restoration of degraded land and public access. Timber harvesting remains low, but the wood sector is a significant economic activity (it provides several thousand jobs).

The public forest of the overseas departments is sustainably managed by the ONF. Private forests in the overseas territories are very poorly managed, yet they account for more than half of the forests in the French West Indies and 40% of the forests in Mayotte. The wood industry relies almost exclusively on wood produced by the ONF or imported, with private forests producing around 2,000 m^3/year. The structure of private property in the overseas departments is quite comparable to that of mainland forests and there are more than 600 owners with more than 25ha.

E.6 Waste

Between 2000 and 2014, environmental protection expenditure increased by 3.5% on average annually, while the growth of the gross domestic product (GDP) in value was 2.6% over this period, reaching 47.6 billion euros (€ bn) in 2014. The weight of these expenses remains modest: 1.4% of GDP. Waste management and wastewater treatment continue to be the main items in this total: 36% and 27% respectively in 2014.

There has been an underlying downward trend in the use of municipal landfills since 2000. At the same time, the share of recycled waste increased from 13% in 2000 to 22% in 2015. This reflects the effects of policies to introduce metal, glass and paper/cardboard waste streams during this period. For its part, the material and organic recycling rate of municipal waste has now reached 40%. France is still exporting an increasing amount of secondary raw materials for production: over 75% from 1999 to 2014.

The graph below illustrates these trends.

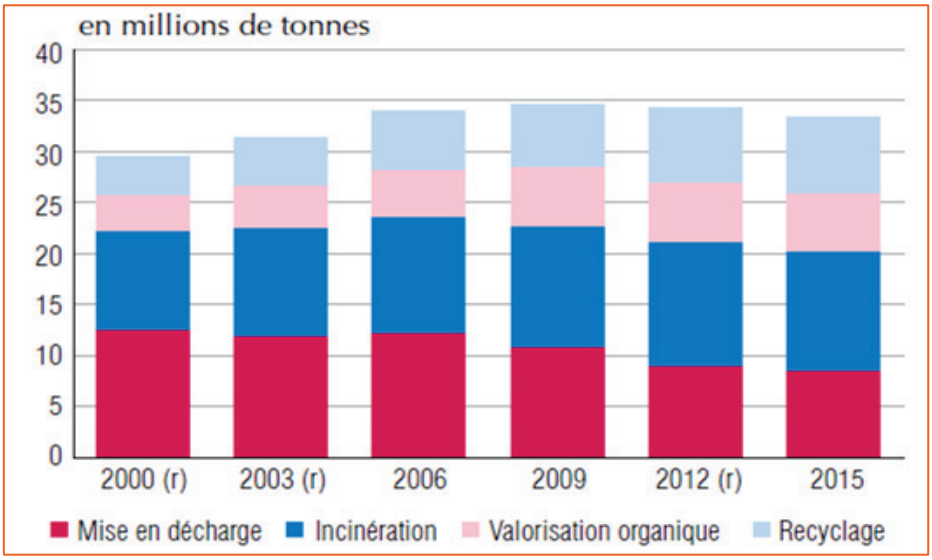


Figure 1.19: What happens to household and similar waste by mode of treatment between 2000 and 2015 - Source: Ademe-SOeS

Nearly 324 million tonnes of waste was produced in France in 2014, 71% of which came from the construction sector and 9% from households. The municipal waste collected in 2015 (excluding excavated material and rubble) represents 34.2 million tonnes, half of which was collected through selective collection.

Restraint in using resources is one of the four challenges of the 2015-2020 National Ecological Transition Strategy for Sustainable Development (SNTEDD) which was adopted in 2015. To meet this challenge, it invites citizens to engage in the circular and low-carbon economy by setting up a more resource-efficient industrial policy, by limiting the production of waste and recycling it, by relying more on renewable energies and by preserving both quantitatively and qualitatively the continental bodies of water.

Chapter III

Information on the greenhouse gas inventory including information on the national inventory system and the national registry

A. CHANGE IN FRENCH GREENHOUSE GAS EMISSIONS

The scope of France's emissions for the United Nations Framework Convention on Climate Change includes, in addition to mainland France (and Corsica), the following territories: French Guiana, Guadeloupe, Martinique, Réunion, Mayotte, Saint Martin, which are within the scope of the Kyoto protocol, but also entities 'outside of the Kyoto protocol': New Caledonia, French Polynesia, Wallis and Futuna, Saint-Barthélemy and Saint Pierre and Miquelon. In fact, in addition to mainland France, only the outermost regions of the European Union are taken into consideration for the scope of emissions as part of the Kyoto protocol.

It has been decided that the data presented here will, as far as possible, focus on the scope of the Kyoto protocol. The figures used were those submitted to the United Nations Framework Convention for Climate Change Secretariat on the 15 April 2017, covering the period from 1990 to 2015. Following a review of the inventory in September 2017, corrections will be made, which will have an impact on the emissions figures provided in this national statement, as well as in France's third biennial report.

In 2015, French greenhouse gas emissions within the scope of the Convention were estimated at 457.1 million tonnes CO_2 equivalent excluding LULUCF. Emissions peaked in 1991. Following a period of relative stability in emissions in the 1990s, there has been a strong reduction from 2005. Between 2014 and 2015 emissions increased. The causes are, in addition to a higher climate severity index, the low price of fuel and the lack of availability of some nuclear power plants following maintenance work. This lack of availability has led to an increased use of fossil fuels (petrol, gas, coal).

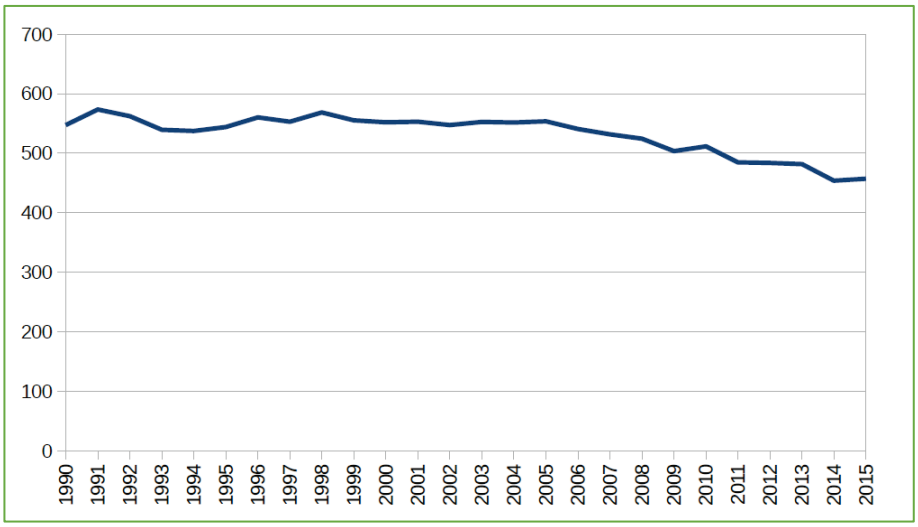


Figure 3.1: Evolution of total GHG emissions between 1990 and 2015 for France in million tonnes of CO_2 equivalent. Source: UNFCCC inventory, within the scope of the Kyoto protocol, CITEPA/MTES, UNFCCC submission 2017

Energy use is the main source of greenhouse gas emission in France accounting for 72% of emissions in 2015. As for emissions resulting from energy combustion, the sector which produces the most emissions is the transport sector (41%), whilst the energy industries account for 25% of emissions.

Between 1990 and 2015, France's greenhouse gas emissions (within the scope of the Kyoto protocol) excluding LULUCF fell by 16.4% in comparison to 1990, in a context where the population increased by 14.6%. French per capita emissions for the same scope fell from 9.4 t CO_2 eq to 6.9 t CO_2 eq between 1990 and 2015, a reduction of almost 30%.

Emissions intensity per unit of GDP fell by 43% between 1990 and 2015.

GREENHOUSE GAS SOURCEAND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	SF_6	Unspecified mix of HFCs and PFCs	NF_3	Total
	CO_2 equivalent (kt)								
Total (net emissions)(1)	297 500,68	60 015,52	43 467,25	19 263,86	540,18	520,70	NO,NA	10,63	421 318,82
1. Energy	310 205,22	2 910,24	3 745,38						316 860,83
A. Fuel combustion (sectoral approach)	307 245,10	1 708,94	3 730,71						312 684,75
1. Energy industries	41 799,00	28,43	260,25						42 087,68
2. Manufacturing industries and construction	50 034,93	106,48	364,03						50 505,44
3. Transport	130 731,02	164,67	1 606,43						132 502,13
4. Other sectors	84 680,15	1 409,35	1 500,00						87 589,50
5. Other	NO	NO	NO						NO
B. Fugitive emissions from fuels	2 960,12	1 201,30	14,66						4 176,08
1. Solid fuels	NO,NA	14,98	NO,NA						14,98
2. Oil and natural gas	2 960,12	1 186,32	14,66						4 161,10
C. CO_2 transport and storage	NO,IE								NO,IE
2. Industrial processes and product use	2 2851,09	49,77	1 282,71	19 263,86	540,18	520,70	NO,NA	10,63	44 518,95
A. Mineral industry	10 624,61								10 624,61
B. Chemical industry	6 534,42	48,54	1 147,76	208,85	2,42	NO,NA	NO,NA	NO,NA	7 941,98
C. Metal industry	4 024,03	1,01	NA	NO,NA	62,15	37,64	NO,NA	NA	4 124,82
D. Non-energy products from fuels and solvent use	1 667,98	0,23	2,63						1 670,84
E. Electronic Industry				6,42	78,58	4,51	NO,NA	10,63	100,15
F. Product uses as ODS substitutes				19048,07					19 048,07
G. Other product manufacture and use	NA	NA	132,32	0,52	397,03	478,55	NA	NA	1 008,43
H. Other	0,05	NA	NA						0,05
3. Agriculture	2 005,60	40 929,68	35 437,66						78 372,94
A. Enteric fermentation		34 580,16							34 580,16
B. Manure management		6 219,19	1 858,70						8 077,88
C. Rice cultivation		81,37							81,37
D. Agricultural soils		NO	33 563,84						33 563,84
E. Prescribed burning of savannas		NO	NO						NO
F. Field burning of agricultural residues		48,96	15,13						64,09
G. Liming	862,72								862,72
H. Urea application	1 142,88								1 142,88
I. Other carbon-containing fertilizers	NO								NO
J. Other	NO	NO	NO						NO
4. Land use, land-use change and forestry(1)	-39 087,21	1 110,35	2 167,10						-35 809,76
A. Forest land	-54 130,06	592,23	310,00						-53 227,83
B. Crop land	16 016,41	116,43	1 794,67						17 927,52
C. Grassland	-10 747,84	113,39	58,51						-10 575,94
D. Wetlands	498,29	9,16	0,75						508,20
E. Settlements	10 944,00	58,41	3,17						11 005,58
F. Other land	0,16	NO	NO,NE						0,16
G. Harvested wood products	-1 747,11								-1 747,11
H. Other	78,93	220,73	NA						299,66
5. Waste	1 525,99	15 015,48	834,40						17 375,86
A. Solid waste disposal	NA	12 553,33							12 553,33
B. Biological treatment of solid waste		242,18	331,03						573,20
C. Incineration and open burning of waste	1 525,99	27,90	46,83						1 600,71
D. Waste water treatment and discharge		2 192,07	456,55						2 648,61
E. Other	NO	NO	NO						NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:(2)									
International bunkers	22 948,65	14,84	210,90						23 174,39
Aviation	17 308,42	2,11	167,57						17 478,10
Navigation	5 640,23	12,72	43,33						5 696,29
Multilateral operations	1,35	NE	NE						1,35
CO_2 emissions from biomass	58 381,78								58 381,78
CO_2 captured	NO,NE								NO,NE
Long-term storage of C in waste disposal sites									
Indirect N_2O			NO,NE						
Indirect CO_2(3)	NO,IE,NA								
Total CO_2 equivalent emissions without land use, land-use change and forestry									457 128,58
Total CO_2 equivalent emissions with land use, land-use change and forestry									421 318,82
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry									NA
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry									NA

(1) For carbon dioxide (CO_2) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).
(2) See footnote 7 to table Summary 1.A.
(3) In accordance with the UNFCCC Annex I inventory reporting guidelines, for Parties that decide to report indirect CO_2, the national totals shall be provided with and without indirect CO_2.

Figure 3.2: Emissions excluding LULUCF in million tonnes of CO_2 equivalent - Source: UNFCCC inventory April 2017, within the scope of the Kyoto protocol

B. SUMMARY OF ITEMS ON THE INVENTORY OF GREENHOUSE GAS EMISSIONS IN FRANCE, SCOPE OF THE KYOTO PROTOCOL

In 2015, CO_2 emissions excluding LULUCF were[25] 336.6 Mt of CO_2 eq, which represents 73.6% of French greenhouse gas emissions, amounting to 457.1 Mt of CO_2 eq (cf. graph below). Methane emissions excluding LULUCF were 58.9 Mt of CO_2 eq and represent 12.9% of French emissions. N_2O emissions excluding LULUCF amounted to 41.3 Mt of CO_2 eq and represent 9.0% of French greenhouse gas emissions. Fluorinated gas emissions (PFCs, HFCs and SF6) amounted to 20.3 Mt CO_2 eq and represent 4.4% of France's total greenhouse gas emissions.

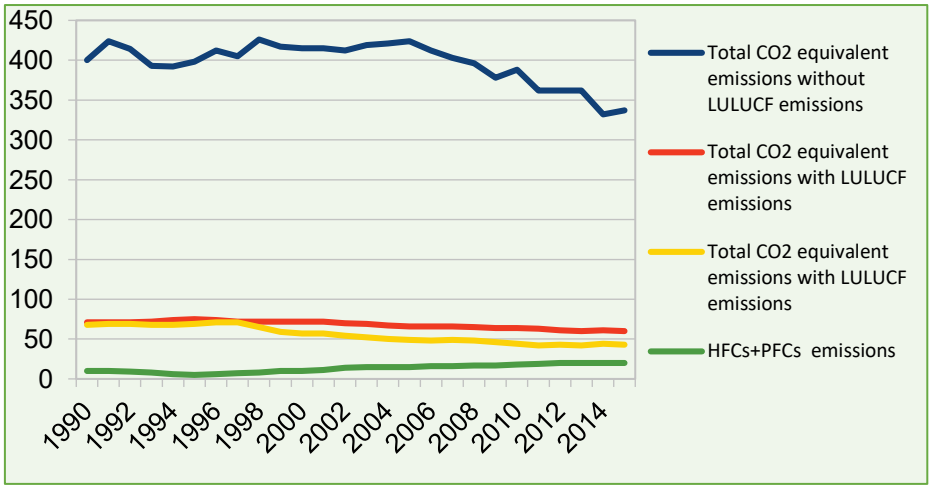


Figure 3.3: CO_2, CH_4, N_2O, HFC and PFC emissions since 1990 in million tonnes of CO_2 equivalent - Source: CITEPA/MTES inventory submission 2017, within the scope of the Kyoto protocol, PNLCCC format

CO_2 emissions have decreased by 15.8% between 1990 and 2015. From 1990 to 2007, CO_2 emissions remained stable then decreased sharply in 2008 with the financial crisis. This reduction continued after 2008, heralding a new phase of decline linked to the policies and measures put in place.

N_2O and CH_4 emissions excluding LULUCF decreased between 1990 and 2015, by 37.5% and 15.4% respectively. These reductions are explained in particular by the establishment of policies and procedures such as recovering methane from landfill sites, reducing the amount of inputs used on agricultural soils and introducing procedures to reduce emissions in industry.

Fluorinated gas emissions increased by 71.8% between 1990 and 2015 despite the implementation of European directives (European regulations N°2037/2000 and N°842/2006, and directive 2006/40/EC), supplemented, in 2011, by the decree 2011-396 which sets out regulatory provisions for use excluding refrigeration and air-conditioning. Since 2014 a plateau has been observed, which seems to reflect the effects of the F-Gas[26] regulation.

The sectors chosen to present the analyses of the emissions inventory per sector are those defined by France in the context of the PNLCC (French national programme to combat climate change) format, within the scope of the Kyoto Protocol[27] (CITEPA, SECTEN inventory/outputs 'climate plan' format, 2017).

[25] Emissions per sector within the scope of the Kyoto protocol
[26] In 2007, the F-Gas regulation affected operators with the coming into force of ADC certification and operator's qualifications to handle these fluids. The second version of the F-Gas regulation, which came into force on the 1st January 2015, has set the course to be followed until 2030.
[27] See table annexed

This format is based on the Common Reporting Format (CRF), in which emissions are grouped by sector, in comparison to the international CRF format. For example, emissions related to the use of fluorinated gas are distributed within each consumer sector (transport, residential, etc,) and not grouped together in a single category (in particular, CRF 2F). Results tables for greenhouse gas emissions in CRF format for the two scopes (Kyoto and Convention) can be found annexed.

B.1 Distribution of carbon dioxide (CO_2) emissions per sector

In 2015, CO_2 emissions excluding LULUCF were[28] 336.6 Mt of CO_2 eq, which represents 73.6% of French greenhouse gas emissions, amounting to 457.1 Mt of CO_2 eq.

The transport sector is the biggest emitter of CO_2, with a share equal to 38% of CO_2 emissions. The second and third largest emitters of CO_2 are the residential/tertiary sector with a share of 22% and manufacturing industry with a share of 21%. These proportions have changed very little since the 6th national communication.

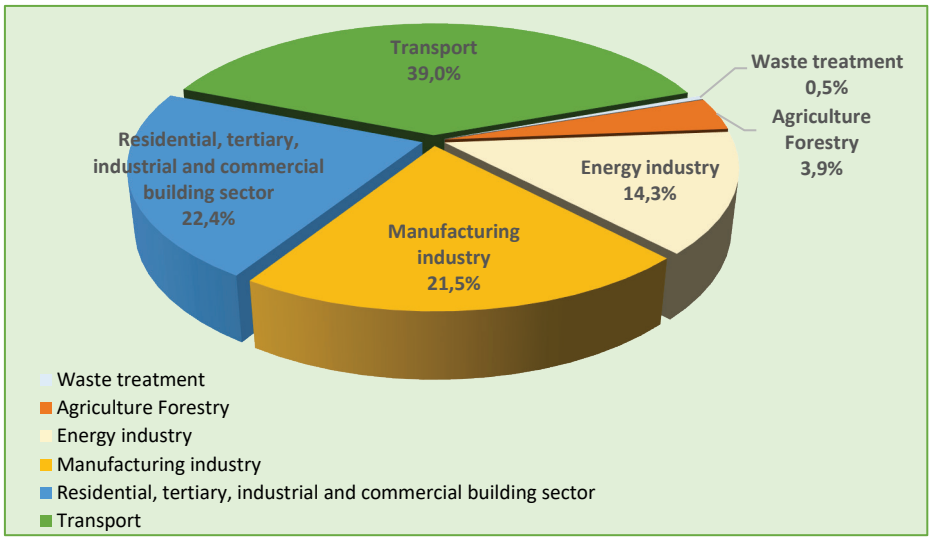


Figure 3.4: CO_2 emissions in 2015 - Source: CITEPA/MTES inventory, submission 2017, within the scope of the Kyoto Protocol, PNLCC format

B.2 Distribution of methane (CH_4) emissions per sector

In 2015, methane emissions excluding LULUCF were 58.9 Mt of CO_2 eq and represent 12.9% of French greenhouse gas emissions.

70% of methane is emitted by the agricultural sector. This primarily comes from enteric fermentation and animal waste management. The sector responsible for the second largest amount of methane emissions is waste treatment (anaerobic fermentation). Between 2011 and 2015, the agricultural sector's share of emissions has remained stable, with a slight decrease of 0.1%. Over the same period, emissions from the waste sector fell by 14.0%.

[28] Emissions per sector within the scope of the Kyoto protocol

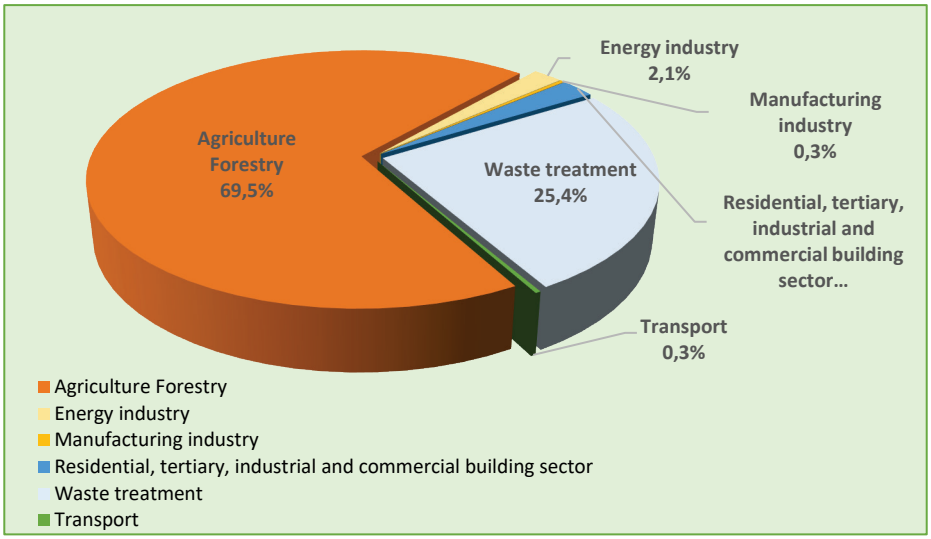


Figure 3.5: CH_4 emissions in 2015 - Source: CITEPA/MTES inventory, submission 2017, within the scope of the Kyoto Protocol, PNLCC format

B.3 Distribution of nitrous oxide (N2O) emissions per sector

In 2015, N_2O emissions excluding LULUCF within the scope of the Kyoto Protocol amounted to 41.3 Mt CO_2 eq and represented 9.0% of French greenhouse gas emissions.

The sector which emitted the most N_2O was agriculture with a share of 88% of the total amount of French emissions. The emissions are mainly related to manure spreading (81.3%) and animal waste (5.1%). Between 2011 and 2015, agriculture's share of emissions increased by 2.7%. However, in comparison to 1990 emissions have fallen by 9.0%. Over this same period, the share of manufacturing industry remained small (3.6% instead of 3.8%).

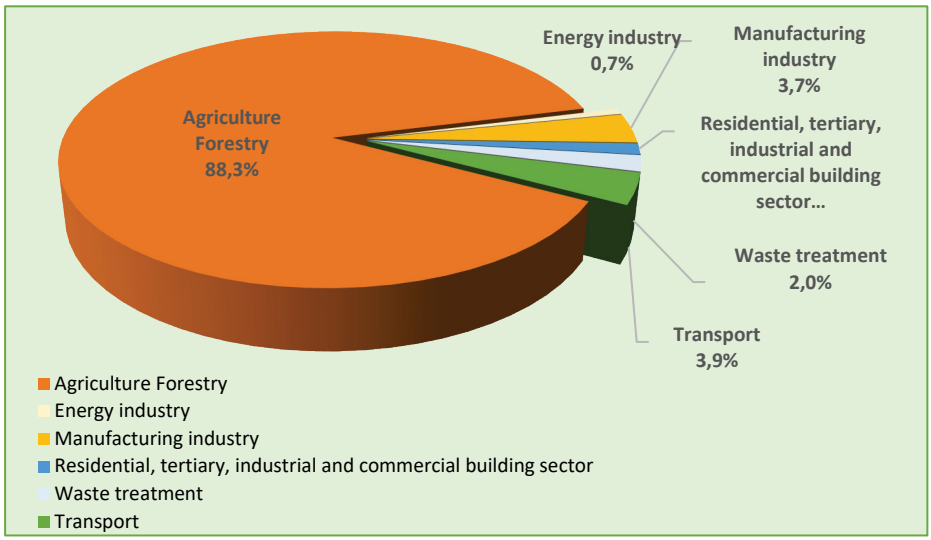


Figure 3.6: N_2O emissions in 2015 - Source: CITEPA/MTES inventory, submission 2017, within the scope of the Kyoto Protocol, PNLCC format C

B.4 Distribution of emissions per sector: fluorinated gases (PFCs, HFCs, SF_6 and NF_3)

In 2015, fluorinated gas emissions (PFCs, HFCs, SF_6 and NF_3) within the scope of the Kyoto Protocol accounted for 20.3 Mt CO_2 eq and represented 4.4% of France's total greenhouse gas emissions, a slight increase in comparison to 2011 (when they represented 4.1% of all emissions). They have almost doubled in proportion compared to 1990 (2.1%).

In 2015, fluorinated gas emissions mainly came from:

- the residential/tertiary sector (air-conditioning and commercial and domestic refrigeration systems): 53.4% of emissions (in comparison to 50.5% in 2011)
- the transport-air conditioning sector: 13.3 % (in comparison to 15.0% in 2011)
- the manufacturing sector: 30.9% (in comparison to 31.9% in 2011). Emissions from manufacturing industry are mainly related to the production of magnesium and the manufacture of high-voltage circuit breakers.

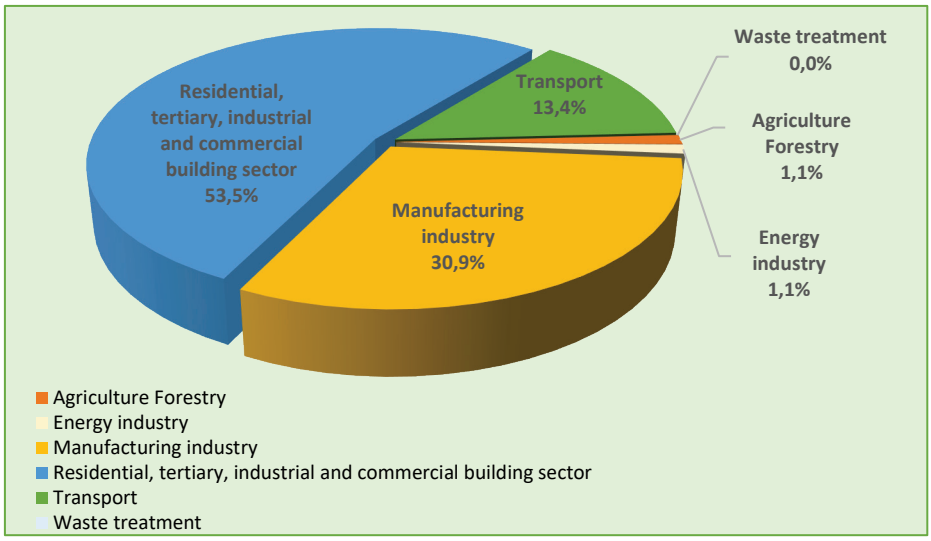


Figure 3.7: Fluorinated gas emissions in 2015 - Source: CITEPA/MTES inventory, submission 2017, within the scope of the Kyoto Protocol, PNLCC format

B.5 Analysis of total greenhouse gas emissions per activity sector[29]

B.5.1 The transport sector (CRF 1A3 and 2F in part for fluorinated gases)

In France, the transport sector is the biggest emitter of greenhouse gas. In 2015, it represented 29.7% of national emissions, i.e.135.6 Mt of CO_2 eq, with a significant increase between 1990 and 2001 (+17.2%), then a fall of 6.8% since 2004 (cf. figure below).

[29] Main source: SECTEN inventory April 2017, within the scope of the Kyoto Protocol - PNLCC outputs

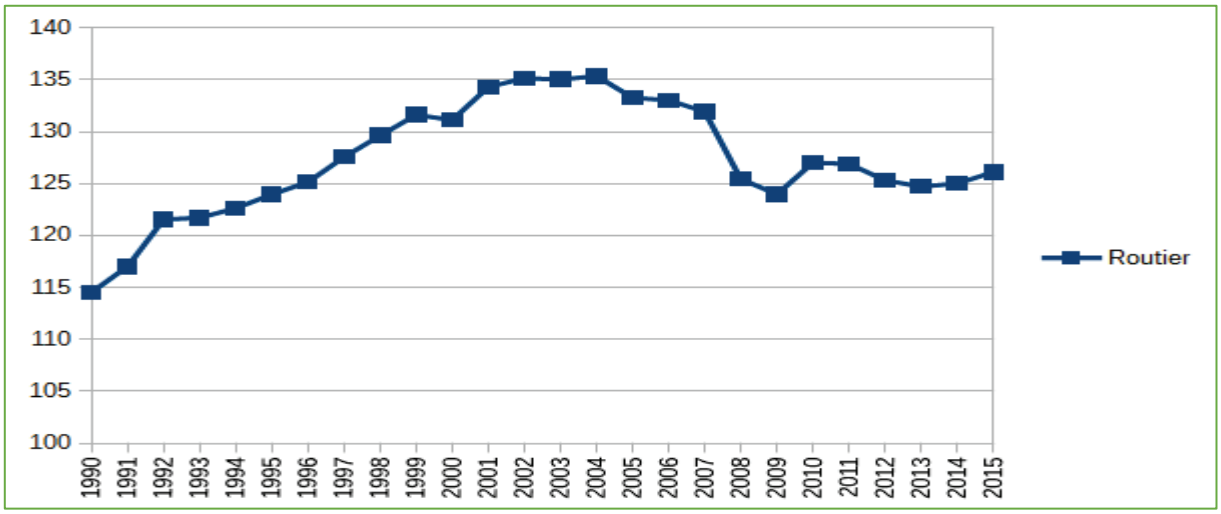


Figure 3.8: Emissions from the road transport sector since 1990 - Source: Within the scope of the Kyoto Protocol - PNLCC format

This change is due to an increase in road traffic which has not been offset by the development of biofuels or a reduction in unitary emissions from new vehicles. From 2005, considerable advances in biofuels have made it possible to significantly limit emissions from road transport.

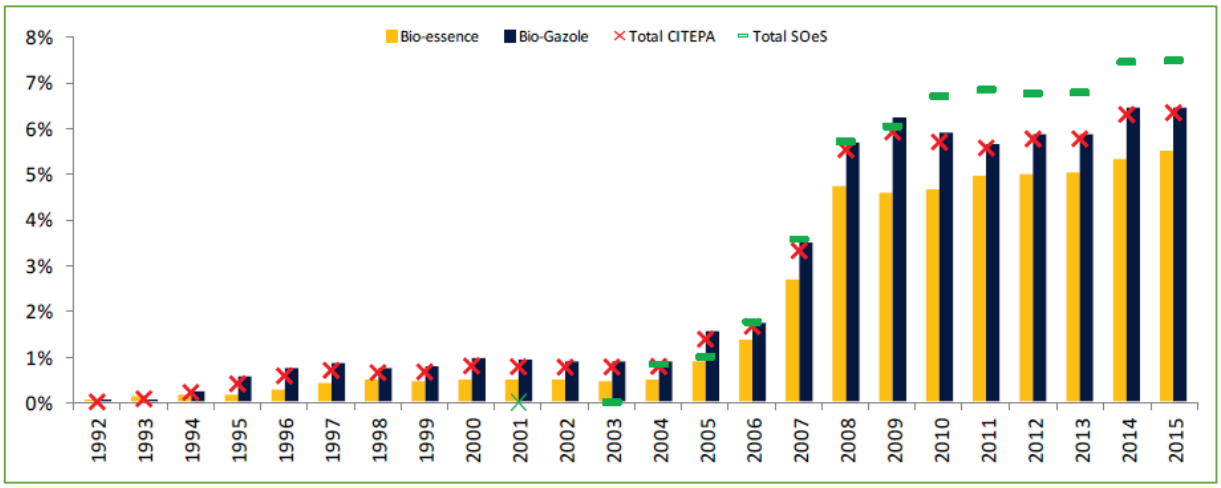


Figure 3.9: Incorporation rate of agrofuels in mainland France - Source: CITEPA, OMINEA publication February 2017

In 2015, emissions from road transport represented 93.7% of emissions in the transport sector. Passenger cars emit more than half of CO_2 transport emissions. Heavy goods vehicles represent a fifth of emissions although they only account for one twentieth of road traffic. Utility vehicles represent about a fifth of the total emissions for the sector (cf. graph below for the distribution of emissions by mode of transport and vehicle type).

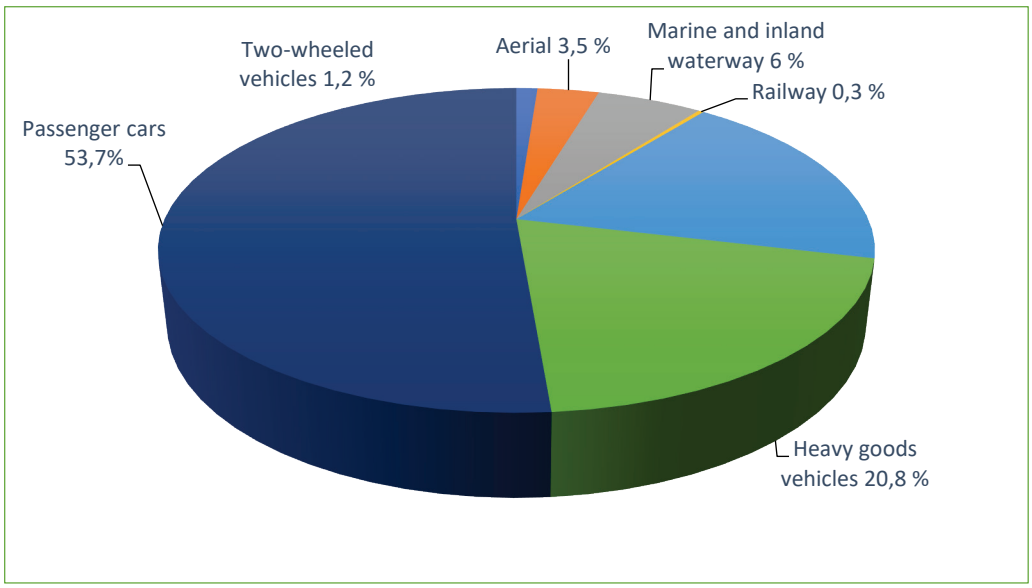


Figure 3.10: Distribution of GHG emissions by mode of transportation in France, overseas departments included (%) - Source: CITEPA 2017

In terms of traffic, alternatives to road transport in 2015 only represented 12.9% of land freight transport (excluding oil pipelines); this share has fallen sharply since 1990 (23.2%) and even since 2000 (19%). In connection with the revival of rail freight transport, this share improved in 2015.

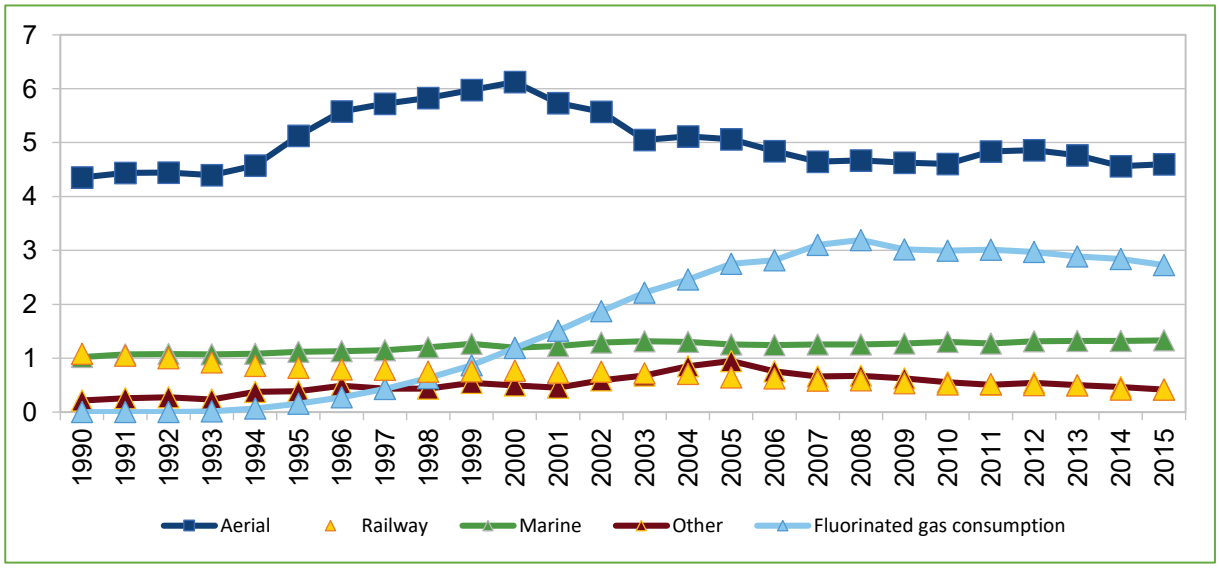


Figure 3.11: Emissions from other sectors than road transport since 1990 in Mt CO_2 eq - Source: Within the scope of the Kyoto Protocol - PNLCC format

In the inventories, only GHG emissions from domestic (and overseas departments) air transport are taken into account, regardless of the airline. Greenhouse gas emissions from international air transport are nonetheless calculated, from the consumption of fuel sold on French territory. Unitary emissions for domestic flights, which are shorter and where the take-off and landing stages, which give off the most emissions, are close together, are higher than those for overseas or international flights. Unitary emissions for air transport have fallen continuously since 1990 (-40.2% per passenger-km in total since

1990). They have fallen less sharply for domestic flights, which have fallen from 176.2 grams of CO_2 per passenger-km in 1990 to 136.8 g in 2015 (-22.3% since 1990), whilst unitary emissions for overseas flights have fallen from 94.0 g to 71.7 g (-23.7% since 1990) and those for international flights have fallen by 192.1 g to 104.2 g (-43.4%).

B.5.2 The residential/tertiary sector (CRF 1A4a and 1A4b, CRF 2 in part)

In 2015, the residential/tertiary sector represented 18.9% of national emissions, i.e. 86.5 Mt CO_2 eq, a slight decrease of 2.5% in comparison to 1990. Since 1990, the policies and measures put in place, and in particular regulations regarding the thermal insulation of new buildings, have made it possible for emissions from the tertiary sector to stabilise, by offsetting a rise in emissions related to an increase in housing. Housing increased by 5.4% between 1st January 1990 and 1st January 2016. One example of such a measure is the tax credit for energy transition (CITE), which concerns expenditure on energy saving work in the primary residence.

Emissions in the residential/tertiary sector have fallen by 2.5% between 1990 and 2015[30]. Fluorinated gas consumption, which was very low in 1990 (0.1 Mt CO_2 eq), reached 10.9 Mt CO_2 eq in 2015. These shares have decreased thanks to policies implemented in the construction industry, including measures to help improve the energy efficiency of existing buildings. In terms of the mix of energy, fuel oil has fallen sharply in favour of gas and electricity, and the use of coal continues to decline.

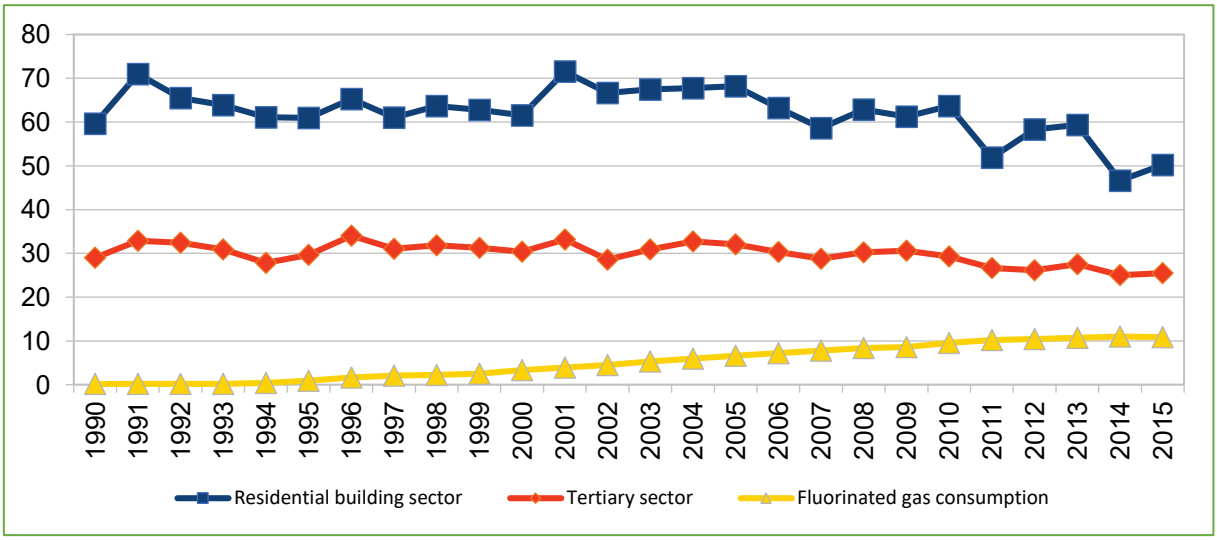


Figure 3.12: Emissions from the residential/tertiary sector since 1990 in Mt CO_2 eq - Source: Within the scope of the Kyoto Protocol - PNLCC format

B.5.3 The manufacturing sector (CRF 1A2, CRF 2 in part)

In the EU and France, greenhouse gas emissions from the manufacturing industry mainly come from sectors producing CO_2-intensive commodities such as metallurgy, chemistry or the manufacturing of non-metallic minerals (cements, lime, glass, etc.). Thus, in France, producing one tonne of steel emits on average about 1.2 t of CO_2, one tonne of cement about 0.62 t of CO_2 and one tonne of glass 0.65 t of CO_2.

In comparison to 1990, emissions from industry (including industrial processes) have sharply fallen in France (-45.5%). This reduction can be seen in all major sectors of industry. While the 2008-2009 economic crisis may have played a part, the reduction in emissions is mainly due to improvements in

[30] For the tertiary sector, this is a decrease of 12.1% between 1990 and 2015

processes and energy and carbon efficiency. Thus, the chemistry sector has seen emissions fall by 75.3% in France between 1990 and 2015, in particular due to a drastic reduction in N_2O emissions related to the production of adipic and nitric acids.

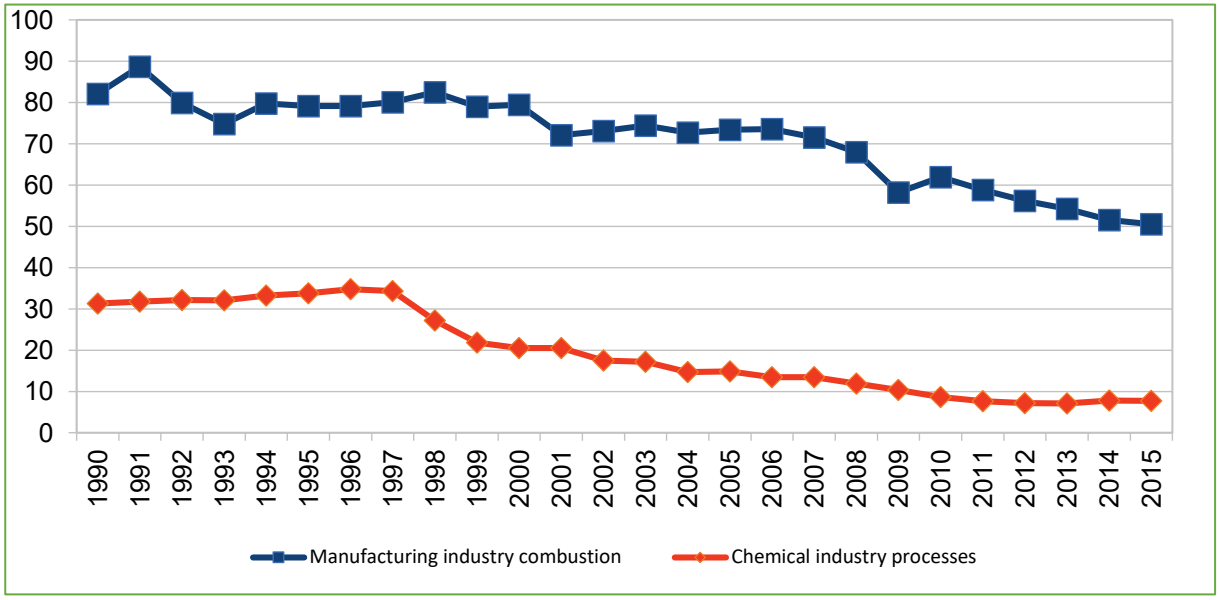


Figure 3.13: Emissions in manufacturing industry since 1990 in Mt CO_2 eq: first part - Source: Within the scope of the Kyoto Protocol - PNLCC format

As the following figure shows, emissions from other industrial processes have also fallen by significant amounts because of technical improvements to processes, resulting in fewer and fewer emissions. Therefore, emissions from mineral product and metal production processes have decreased by 35.2% and 54.6% respectively since 1990. It should be noted that fluorinated gas consumption emitted 5.2 times more in 2015 than in 1990, but it has stabilised since 2012.

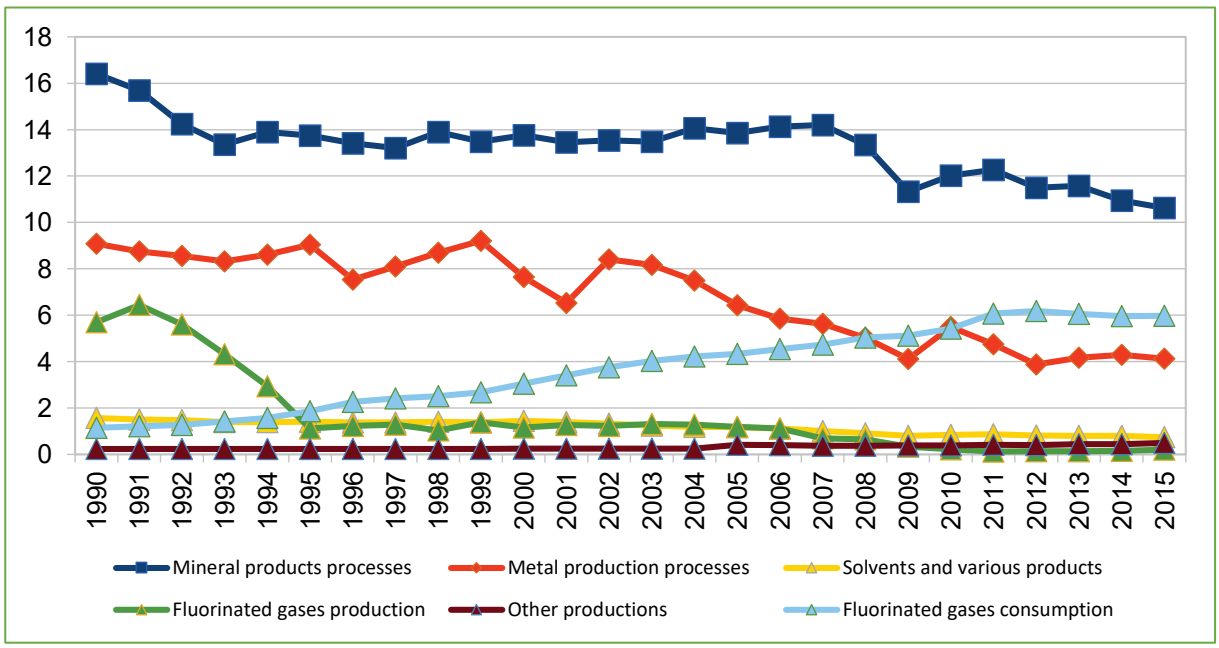


Figure 3.14: Emissions from manufacturing industry since 1990 in Mt CO_2 eq: second part - Source: Within the scope of the Kyoto Protocol - PNLCC format

B.5.4 The energy industries sector (CRF 1A1 and 1B, CRF 2 in part)

The energy industries sector represented, in 2015, 46.5 Mt CO_2 eq, i.e.10.2% of French emissions. This is a decrease of 40.3% in comparison to 1990. Emissions in this sector mainly result from electricity production and urban heating, which represents 67.5%, a significant reduction of 36.8% since 1990. The share from refining, from emissions from solid fuels such as coal, and fugitive emissions from fuels is low in comparison, and has been steadily declining since 2009. In 2015, refining represented 16.4% of emissions in this sector, compared with 15.4% in 1990, a fairly stable proportion.

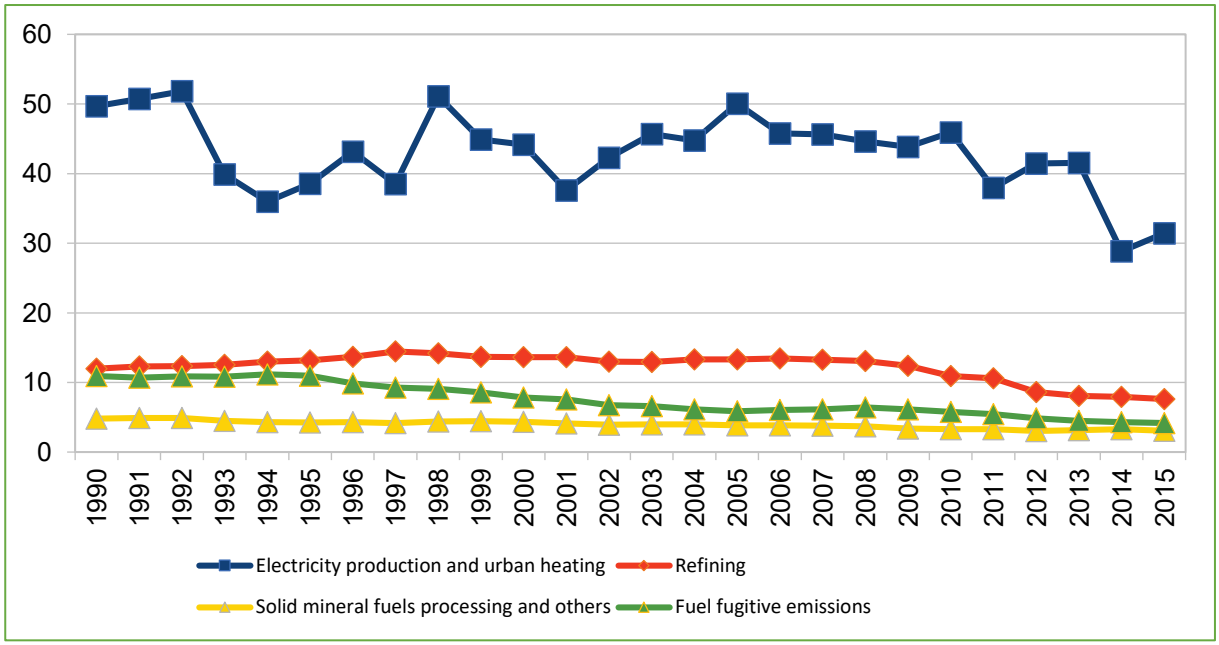


Figure 3.15: Emissions from the energy industries sector since 1990 in Mt CO_2 eq - Source: Within the scope of the Kyoto Protocol - PNLCC format

B.5.5 The agricultural sector (CRF 1A4c and 3)

Agriculture and forestry are a form of land use whereby human activity can lead either to the emission or the absorption of greenhouse gases.

In 2015, greenhouse gas emissions of agricultural origin represented 90,7 Mt CO_2 eq (excluding carbon sinks), i.e. 19.8% of French emissions. These were mainly due to the activities (crops, livestock) of about 450,000 farms in 2010.

Agriculture differs from other sectors in that the majority of its greenhouse gas emissions are not related to energy combustion. The main sources of emissions are CH_4 emitted by farm animals (enteric fermentation) and N_2O, linked to the nitrogen cycle.

Since 1990, the steady reduction in greenhouse gas emissions of agricultural origin is due to a reduction in nitrogen fertilisation, a decline in cattle numbers, and a drop-in energy consumption. Between 1990 and 2015, the reduction in emissions from the agricultural sector reached 4.4 % in accordance with the scope of the Kyoto Protocol. However, it is worth noting that nitrogen fertilisation, which directly affects N_2O emissions from agricultural soil, varies from one year to the next according to costs and meteorological conditions, despite a downward trend driven by policies and measures to reduce nitrogen emissions in the agricultural sector.

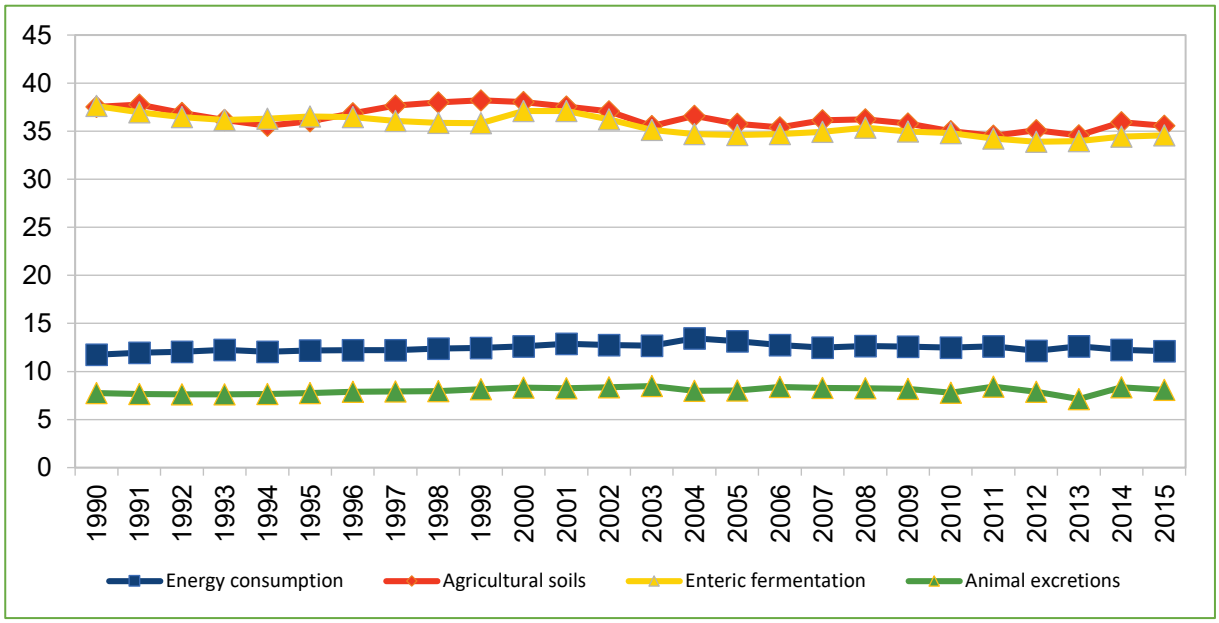


Figure 3.16: Emissions from industries in the agricultural sector since 1990 in Mt CO_2 eq - Source: Within the scope of the Kyoto Protocol - PNLCC format

B.5.6 Land-use, land-use change and forestry sector (CRF 4)

Forests contribute to tackling climate change because of their potential to capture and store atmospheric carbon, On average, forests store 75 tonnes of carbon per hectare in trees (aerial and subterranean biomass). Forests (forest growth, forest harvest and land-use change) represent a very significant source of carbon dioxide sinks (-53.2 Mt CO_2 eq in 2015 according to the Kyoto format, 2015 greenhouse gas inventory), a significant increase since 1990 with however, a turning point from 2013 (forest sinks reached a peak of 61, 4 Mt CO_2 in 2015). The increase in carbon sequestration in managed forests in mainland France is mainly a result of the relatively low exploitation of forest resources, about half of the natural growth as well as the relatively young age of the forest.

Total emissions related to land use, land-use change and forestry (LULUCF) are negative in both the EU and France (-35.8 Mt CO_2 eq for France in 2015). This means that the LULUCF sector sequesters more greenhouse gas than it emits. This is mainly due to forest growth, although land urbanisation contributes to increasing emissions.

B.5.7 The waste treatment industries sector (CRF 5)

Emissions related to management of waste accounted for 17.3 Mt CO_2 eq in 2015, i.e. 3.8% of France's total greenhouse gas emissions. They have fallen by 3.0% since 1990. In 2015 emissions from landfills accounted for 72.3% of these emissions. These emissions have decreased in Europe since the mid-1990s and in France since the early 2000s, after peaking in 2002. However, it is worth noting the increasing amount of equipment required for storage facilities in systems used to recover biogas produced during the anaerobic fermentation process.

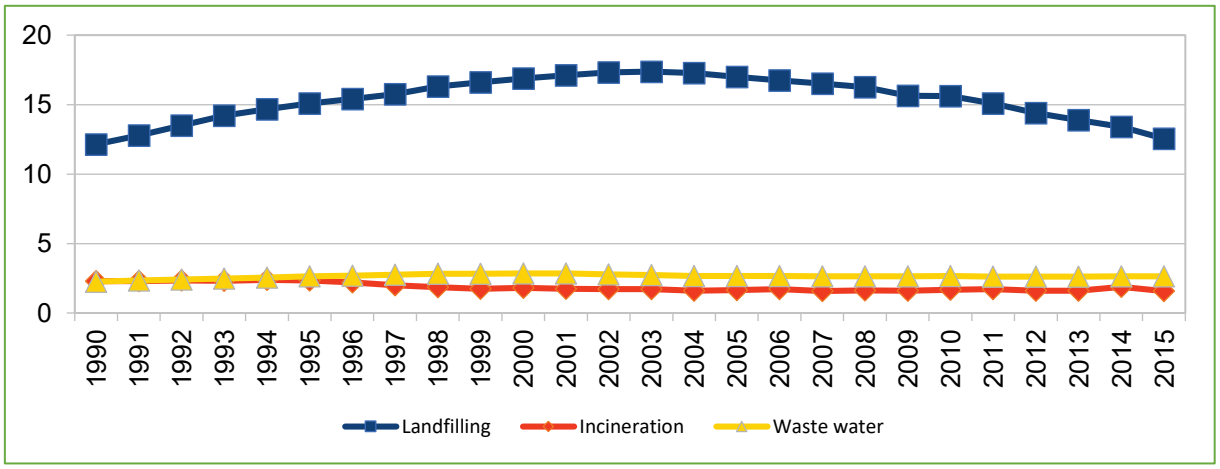


Figure 3.17: Emissions from the waste treatment industries since 1990 in Mt CO_2 eq - Source: Within the scope of the Kyoto Protocol - PNLCC format

C. NATIONAL INVENTORY SYSTEM (ARTICLE 5.1 OF THE KYOTO PROTOCOL)[31]

C.1 Name and details of the person in charge of the national inventory system appointed by the Party

In accordance with Article 5.1 of the Kyoto Protocol, France has created a national inventory system: SNIEBA (National system for air emissions inventories and audits), defined by an interministerial decree dated 24 August 2011[32].

The Ministry for Ecological and Inclusive Transition (MTES) is responsible for its operation. Mrs. Pascale Vizy of the General Directorate for Energy and Climate (DGEC), within the MTES, is responsible for the French national inventory of greenhouse gas emissions pascale.vizy@developpement-durable.gouv.fr.

C.2 Allocation of roles and responsibilities within the national inventory system

The MTES, together with the other ministries concerned, is responsible for coordinating the operation of SNIEBA (National system for air emissions inventories and audits, defined by an interministerial decree dated 24 August 2011) and in particular, institutional, legal and procedural provisions. In this way, it defines and divides the responsibilities allocated to the various bodies involved.

[31] Le rapport national d'inventaire de la France « NIR 2017 » comporte de nombreuses informations complémentaires : http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php
[32] https://www.legifrance.gouv.fr/eli/arrete/2011/8/24/DEVR1124328A/jo

These are divided as follows:

- Project management for compiling inventories and coordination of the whole system is carried out by the MTES.
- Other departments and public organisations contribute to the emissions inventory by providing data and statistics which are used to compile the inventory. They are listed in the SNIEBA decree.
- The MTES has entrusted CITEPA (Interprofessional Technical Centre for Studies on Air Pollution) with drawing up emissions inventories in relation to the methods used and preparation for their future development, gathering and processing data, archiving, producing reports and material in various media, quality control and quality management. CITEPA assists the MTES with the coordination of the entire national inventory system for emissions of pollutants and greenhouse gases into the atmosphere. In this respect, it should be emphasised that it is essential to ensure coordination between emissions inventories and registries of emitters, such as E-PRTR and the registry for greenhouse gas emissions quotas under the EU ETS (European Union's Emissions Trading Scheme), not to mention other aspects (guides published by the MTES, annual declaration system for pollutant waste, etc.) for which it is important to ensure information is consistent.
- The MTES provides CITEPA with all the information it has under existing regulations, such as annual declarations for pollutant waste from Classified Facilities, as well as the results of various studies undertaken to increase knowledge of emissions, which were initiated by its departments and other public bodies such as INERIS (National Institute for the Industrial Environment and Risks).
- The MTES manages the Emissions Inventory Consultation and Information Group (GCIIE), whose purpose is:
    1. to express an opinion on the results of estimates produced from the inventories,
    2. to express an opinion on changes made to methodologies used in estimates,
    3. to express an opinion on plans to improve inventories for future dates,
    4. to make recommendations regarding any subject which is directly or indirectly related to emissions inventories in order to ensure consistency and the smooth implementation of actions, foster their synergy, etc.
    5. to recommend improvements to emissions estimates as part of research programmes.
- The GCIIE is made up of representatives from:
    1. the Ministry for Ecological and Inclusive Transition (MTES), in particular from the Directorate-General for Energy and Climate (DGEC), the Directorate-General for Risk Prevention (DGPR), the Directorate-General for Planning, Housing and Nature (DGALN), the Directorate-General for Infrastructure Transport and the Sea (DGITM), the Directorate-General for Civil Aviation (DGAC) and from statistical departments within the MTES including the Data and Statistical Studies Department (SDES),
    2. the Ministry for Agriculture and Agri-food (MAA), including the Department of Statistics and Foresight Analysis (SSP) and the Directorate-General of Economic Performance (DGPE),
    3. the Ministry for Economy and Finance, including the Directorate-General of INSEE (the French National Institute of Statistics and Economic Studies) and the Directorate-General of the Treasury,
    4. the Environment and Energy Management Agency (ADEME)
    5. the National Institute for the Industrial Environment and Risks (INERIS).

The distribution of emissions inventories is organised by the MTES.

The DGEC sends the GHG emissions inventory to the United Nations Framework Convention on Climate Change (UNFCCC).

At the request of the MTES, CITEPA is responsible for distributing all the inventories that it compiles, and in particular for free public access to the corresponding reports online athttp://www.citepa.org/fr/le-citepa/publications/rapports-d-inventaires.

The MTES implements provisions which ensure procedures are put in place for determining methods used for estimates, gathering and processing of data, archiving, quality control and quality management, the national and international distribution of inventories as well as provisions regarding monitoring performance.

The abundance of requirements leading to air emissions inventories being drawn up, often focusing on substances and similar sources, justifies, in the interests of consistency, quality and efficiency, retaining the principle of one single inventory system for the various national emissions inventories regarding atmospheric pollutants and greenhouse gases. This strategy meets the recommendations of international authorities including the European Commission and the United Nations. The French organisation complies with the principles of the guiding framework for national systems as specified in paragraph 1 of article 5 of the Kyoto Protocol (decision CMP.1 annexed to decision 20/CP.7 of the UNFCCC).

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ANNEXE II

LISTE INDICATIVE DES STATISTIQUES ET DONNEES EMANANT D'ORGANISME PUBLICS OU AYANT UNE MISSION DE SERVICE PUBLIC UTILISEES POUR LES INVENTAIRES D'EMISSION

SECTEUR	TYPE DE DONNEES	ORGANISME EMETTEUR des données
Energie	Bilan de l'énergie Consommation d'energie en France Consommation en ventilation des produits petroliers a usage non energétique Consommations d'énergie dans l'industrie Consommations d'energie dans le residentiel et le tertiaire Consommation d'énergies renouvelables dans l'industrie et le residentiel/tertiaire Bilan de pétrochimie	Ministère chargé de l'Industrie
	Déclarations annuelles des rejets polluants de certaines installations classées	Ministère chargé de l'écologie
	Consommations d'énergie dans les industries agricoles et alimentaires (IAA)	Ministère chargé de l'agriculture et de la pêche
	Comptes des transports de la nation Statistiques du transport maritime Statistique du transport aérien	Ministère chargé des transports
Procédés industriels Utilisation de solvants et autres produits	Déclarations annuelles des rejets polluants de certaines installations classées	Ministère chargé de l'écologie
	Production des IAA. Enquêtes de branches	Ministère chargé de l'agriculture et de la pêche
	Statistiques industrielles	INSEE
	Inventaire de fluides frigorigènes	ADEME
	Décalrations annuelles des rejets polluants de certaines installations classées	Ministère chargé de l'écologie
	Production , imports et exports, consommation de peinture /encre/colle.	INSEE et ministère chargé du commerce exterieur
Agriculture	Statistiques agricoles Caractérisation des modes d'elevage (mode de gestions des déjéctions, bâtiments).caractérisation des pratiques culturales Facteurs d'émission	Ministère chargé de l'agriculture et de la pêche INRA
UTCF (utilisation des terres, changement d'affectation des terres et foresterie)	Statistiques forestières. Utilisation du territoire Recolte de bois et production de sciages	Ministère chargé de l'agriculture et de la pêche
	Accroissement et stocks forestiers en métropole	IFN
	Température et rayonnement solaire global	Réseau Rer/ Ecofor / ONF
Déchets	Inventaire des installations de traitement des déchets ménagers et assimilés Statistiques déchets de soins a risques Statistique déchets industriels	ADEME et ministère en charge de l'écologie
	Déclarations des rejets polluants surveillance dioxines/métaux lourds des usines d'incinération	Ministère chargé de l'écologie
Tous secteurs	Tout ou partie des éléments ci-dessus selon les secteurs, pour les inventaires teritoriaux	Voir ci-dessus, AASOA, CITEPA, services des collectivités.

Figure 3.18: List of statistics and data. Source: Official Journal

C.3 Procedure for gathering data, choosing emissions factors and calculating emissions

Emissions inventories are carried out in compliance with recommendations from the UNFCCC (FCCC/SBSTA/2006/9 guidelines) and based on CORINAIR methodology.

In accordance with article 10, paragraphs a) and f) of the Kyoto Protocol, France has undertaken various programmes in order to improve emissions factors or activity data regarding the national emission inventory. These various programmes are monitored by the Emissions Inventory Consultation and Information Group (GCIIE) as part of SNIEBA (Decree dated 24th August 2011 regarding the national system for air emissions inventories and audits). The main programmes to improve the national inventory, over recent years, are shown below.

C.3.1 Energy/industry sectors

- An integrated system for making declarations to the national emissions registry (GEREP) has been implemented since 2005, making it possible to meet various requirements in terms of the emissions registry (EU ETS, E-PRTR) and requirements regarding various different emissions inventories. This programme has made it possible to improve national inventories by increasing the number of industrial sites taken into account individually and to improve consistency between the national GHG inventory and data in the EU ETS registry.
- Exchange programme with the SOeS (the Ministry of Ecology's Statistics and Observation Department) to refine certain points regarding energy consumption when using the national energy audit in the national emissions inventory.
- Work on the completeness of the national inventory (e.g. emissions related to industrial processes of ferro-alloy production).
- Work on improving fluorinated gas emissions inventories in certain sectors in collaboration with industrial federations, the Ecole des Mines in Paris and the Ministry for Ecology.
- Work on improving emissions factors in the steel sector with the federation and annual GEREP declarations.

C.3.2 Transport sectors

- Working group as part of the CCTN (Commission for National Transport Accounts) for monitoring and ensuring the suitability of national transport statistics (traffic and consumption data) for national emissions inventories.
- Programme to implement the European COPERT IV methodology (with its various successive versions) in France (FE improvements in the road transport sector for N_2O, CH_4, NOx, etc.).
- Directorate-General for Civil Aviation (DGAC) working group on aircraft emissions evaluations, making it possible to periodically improve emissions calculations for aviation (e.g. refinement of aircraft engine distribution, taking APUs into account, etc.).
- Bottom-up work in 2010 for updating the distribution of fuel consumption between national and international maritime transport.

C.3.3 Agriculture sector

- Since 2010, a working group specifically for agriculture (with INRA, technical institutions, the Ministry for Agriculture, etc.) has met regularly as part of the GCIIE to monitor and help improve methodologies for the agricultural sector.
- For the last three years, data from building surveys has been used to refine livestock farming emissions.
- Finally, the 'MONDFERENT' ('Methane emissions for cattle in France', INRA) project has made it possible to refine emissions calculations for enteric fermentation and the management of cattle excrement for the national inventory. This project was followed by 'MONDFERENT 2', a project dedicated to the excrement of small ruminants and sheep.
- Lastly, following the Agricultural Census in 2010, the statistical series from 1990 to 2011 on areas and annual productions has been updated in the March 2013 edition of the national inventory.

C.3.4 LULUCF sector

- Contributions from the French LULUCF working group as part of the GCIIE. These are seen in the taking into account on a regional basis of growth parameters, samples and stocks in soils, through improvements in monitoring land in mainland France and overseas departments, and greater knowledge of carbon stocks in overseas departments.
- Since the March 2012 inventory, updated statistical data on forest growth and mortality has been taken into account, in particular following a revision of the collection system and field forest data by the National Forest Inventory which has merged with the IGN (the French National Institute for Geographical and Forest Information).
- Since the March 2012 inventory, additional statistical data has been included to estimate forest harvesting: a 'direct' measure of forest exploitation. Thanks to this new information, it has been possible to limit the effect of calculation hypotheses for the GHG inventory (volume of wood energy, origin of wood energy, etc.)
- Since the March 2012 inventory, a stock value has been taken into account for developed areas and wetlands, which was not the case for previous inventories. This modification has made it possible to take into consideration carbon flows from soil reservoirs, including on developed land, which has had a significant impact in terms of emissions.
- March 2013 inventory, review of the CO_2 emission factor for scums from sugar factories used to enrich agricultural soils with lime.

C.3.5 Waste sector

- Regular collaborations with the ADEME and FNADE (the French Federation of Waste Management and Environmental Services) to improve emissions factors and activity data for the waste sector.
- With the March 2013 edition of the national GHG inventory and following a survey conducted by the ISDND, the collection of generated biogas and its combustion in flares or waste-repurposing facilities are taken into account when calculating CH_4 emissions for landfill sites.
- Improvements in emissions estimates related to the incineration of industrial waste, in terms of identifying sites (use of GEREP declarations), particularly concerning in situ incineration. Identification of the impact of the use of alternative fuels.

Extent and temporary resolution, frequency: Under the UNFCCC, inventories are compiled on the basis of a calendar year.

C.4 Results from the analysis of key categories (see France's NIR 2017 for further information)

In accordance with the recommendations of the IPCC, an analysis of key categories is carried out in this section. Generally, it is carried out based on contributions in CO_2 equivalents from different sources, at a more detailed sectoral level than the default one, for the seven direct greenhouse gases. Following the recommendations of the IPCC, this analysis is carried out by fuel type for combustion plants.

Two different Tier 1-type analyses are proposed:

- the first excluding LULUCF[33] making it possible to evaluate contributions from different sources in terms of commitment such as those of the Kyoto Protocol,
- the second including LULUCF to meet the recommendations of the UNFCCC.

For the year 2015:

- excluding LULUCF/Analysis Tier 1

  19 main sources account for more than 80% of the total, whilst the top 31 sources account for 90% of the total, and 44 sources make up all of the key categories related to 95% of all emissions excluding LULUCF. CO_2 from road transport alone accounts for more than a quarter of total emissions excluding LULUCF. CH_4 from enteric fermentation in livestock contributes up to 7.6%; followed by CO_2 from natural gas combustion in the residential sector with 7.1% of total emissions in CO_2 equivalent. By adding to this the N_2O from direct agricultural soils emissions (6.0%) as well as the HFCs used in refrigeration and air-conditioning (3.6%), these five entities account for more than half of all greenhouse gas emissions in France in 2015 excluding LULUCF.

- • Key categories including LULUCF

  This is the same analysis as before but including the LULUCF sector as an absolute value (in the overall assessment, the LULUCF category is an entry which significantly contributes to emissions levels and their change over time). Consequently, the analysis focuses on the total excluding LULUCF to which the absolute value of LULUCF entries (absorptions or emissions) is added in CO_2 equivalent.

Taking into consideration the importance of LULUCF emissions, eight sub-categories are considered in relation to the analysis of key categories for emission levels excluding LULUCF in 2015 (seven in 1990). The 4A1 category relating to 'forests remaining forests', characterised in particular by forest growth and harvest, takes second place in key emission level categories with 8.5% in 2015. Road transport still takes first place but its contribution has lowered to 22.1% in 2015, compared with 27.1% excluding LULUCF. The seven other categories which feature are sinks and/or sources of CO_2 or sources of N_2O as the case may be and account for 9.6% of French emissions including LULUCF in 2015 (9.0% in 1990).

Detailed results are available in the appendix.

C.5 Description of the reverse projection process for methodological changes to previous inventories: see the 2017 NIR and appendix 10

Each year, a certain amount of revisions are made to the results of inventories. There are two kinds of revisions, firstly, methodological, and secondly, statistical. These modifications meet both the requirements of the United Nations and a continual improvement process which makes it possible to reduce any uncertainty and ensure greater reliability in the data.

The main reasons for annual revisions are:

[33] LULUCF: Land Use, Land-Use Change and Forestry

- retroactive statistical updates;
- statistical breaks: when a statistic stops being disseminated; an alternative method is developed;

Consecutive methodological improvements:

- to decisions taken by the Emissions Inventory Consultation and Information Group managed by the Ministry for Ecology,
- to remarks made during official reviews of France's inventory by the United Nations and the European Commission,
- to the availability of new information;
- to correct errors and anomalies
- to take into account a new source of emissions.

After each submission of the inventory, the continuous improvement programme is revised by dealing with the key categories as a priority.

Any modifications made are retroactively applied to the whole historic series of emissions since 1990, the year used as a reference for inventories under the UNFCCC.

C.5.1 Repercussions of modifications on the change in emissions

In order to assess the effect of methodological changes to the inventory, each year, the body in charge of the inventory compares the results obtained three years previously with the methodology of the previous year and that of the current year.

The modifications of methods between the 2011 submission and 2010 submission show a difference of -7.1% in the change observed in GHG emissions between 1990 and 2010. Discrepancies for this period, by gas and/or by sector show that the new methodology resulted in a reduction in CH4 emissions (-16%) linked to the implementation of new methodology on landfill sites, an increase in SF6 emissions (+18%) and a fall in HFC emissions (-10%).

C.6 Description of the quality assurance and quality control procedure

C.6.1 Quality management

The national emissions inventory system was established by integrating the usual criteria applicable to **Quality Management Systems** (QMS). CITEPA, which is responsible for carrying out national emissions inventories at a technical level, has set up such a system based on the **ISO 9001** reference document. This provision was confirmed in 2004 by a certificate awarded by the AFAQ, which was renewed in 2007, 2010 and 2013, as well as by annual follow-up audits. Carrying out national emissions inventories is covered by QMS by means of several specific procedures (see the Quality Manual - internal, not public, document)

in this context, several processes related to quality control and quality assurance for inventories are included in the various processes and procedures implemented, corresponding to the different stages and actions related to the following points:

- General tasks including reviewing, managing resources, planning, overseeing and being involved in external work related to emissions inventories.
- The choice, implementation and development of methodologies as well as the selection of information sources and data collection. The process for choosing methods is clearly defined in particular regarding reference frameworks and in terms of the relevance and permanence expected from data sources. These choices are generally made in consultation with stakeholders and experts

in the relevant fields. Methodological changes are subject to evaluation by the Emissions Inventory Consultation and Information Group (GCIIE).

- Development of calculation procedures including models used to calculate emissions, databases, reporting.
- Pursuit of a greater degree of transparency and traceability.
- Implementation and recording of checks related to important stages and risks involved in compiling the inventory, by means of multiple internal checks, on both input data and calculations, databases, reports, data archiving, monitoring of modifications (error corrections or improvements) and non-compliance. Several tools to support these checks have been developed.
- Validation and approval of inventory results, following the recommendations made by the Emissions Inventory Consultation and Information Group (GCIIE).
- Validation and approval of reports and other information materials by the ministry in charge of the environment.
- Systematic archiving of items needed to ensure the required traceability.
- Dissemination of information and corresponding products.
- Permanent improvement to the quality of estimates by developing procedures to avoid potential systematic errors, reduce any associated uncertainties, cover substances and sources of emissions more completely, etc., aimed at meeting quality objectives. An action plan is created and regularly updated. It includes any required and potential improvements taking into account the recommendations made by the GCIIE.

C.6.2 Quality objectives

The overall objective of the quality control and quality assurance programme focuses on carrying out national emissions and sinks inventories, in accordance with the requirements defined in the various national and international frameworks covered by SNIEBA. These requirements focus on the definition, implementation and application of procedures and methods aimed at meeting traceability, exhaustiveness, consistency, comparability and timeliness criteria required particularly for international and European authorities in accordance with the commitments made by France.

In particular, this overall objective can be broken down into sub-elements:

- Preparing reports (including national inventory reports for certain protocols and European directives) according to content and format criteria that may be required (in particular analyses of trends, uncertainties, quality control and quality assurance, national inventory system, methods used, etc.).
- Supplying basic sectoral data required in defined reporting formats (CRF, NFR, GIC, etc.) and in particular: additional explanations, use of defined rating codes, modifications introduced during the last financial year, retrospective adjustments, specific data (in particular for LULUCF in accordance with articles 3.3 and 3.4 of the Kyoto Protocol), etc.
- Developing suitable procedures for selecting methods and reference documents, gathering, processing and validating data as well as archiving and protecting it
- Determining any quantitative uncertainties regarding estimates
- Searching for and eliminating inconsistencies
- Developing quality assurance procedures

Contributing to the continuous improvement of inventories by:

- Researching and implementing more relevant and precise methods and/or data,

- Making recommendations to various bodies involved in the national emissions inventories system, and possibly to other bodies including international ones,
- Participating in international work on topics related to national emissions and sink inventories,
- Cooperating with other countries on these same aspects,
- Complying with EU and international communication deadlines for emissions inventories,
- Seeking greater efficiency in work carried out (relevance, accuracy, implementation of methods vs. means, etc.) aimed at meeting requirements for determining emissions and sinks.

C.6.3 Quality control

Quality control is integrated into the different steps in processes and procedures developed by the organisations involved in the national system with regard to the elements they are responsible for in order to meet their set objectives. CITEPA, the organisation in charge of the technical coordination and compilation of inventories is responsible for monitoring quality control and making recommendations aimed at improving, supplementing, and developing the necessary procedures and processes. These procedures can be automatic or manual, take the form of a check-list, tests of plausibility, consistency and exhaustiveness, trend analyses, simulations, etc. They occur in several stages involved in producing the inventory. More specifically, some are specified below:

Incoming data

- Monitoring data collection (necessary processes, actual publication, relaunch, etc.),
- Actual receipt (delivery, capture online, data effectively presented to CITEPA)
- Conformity of the content in terms of quantity (complete flow) and quality (any observations regarding sampling, change of scope, methodology that may lead to a statistical break, etc.).
- Recording and archiving raw data before processing.

Data handling:

It is mainly carried out by means of calculations spreadsheets, one for each category of emission sources (SNIEBA has more than one hundred).

Thus, the calculations spreadsheet for each sector contains its own internal controls. These include internal tests intended to check calculations (e.g. verifying subtotals, showing trends at the most specific level of activity) and ensure consistency between the values calculated and the values exported to the national databases system. In the same way, documentation of the sources and the hypotheses is subject to particular care to ensure traceability.

Internal control and validation of results:

Before being exported to these databases, several additional control steps are performed. The calculation spreadsheet for each sector is submitted by its author for checking using a tool specially developed for this purpose by CITEPA, called VESUVE[34]. This tool makes it possible to not only check for consistency between emission factors, activities and emissions, but also provides a graphical display of activity trends, emission factors and emissions for all pollutants for the previous edition and the current inventory. The changes observed between the two editions are systematically analysed and commented on by the author of the calculations spreadsheet.

The calculations spreadsheet for each sector is then, as a minimum, checked by a third party and by a second, from higher up in the hierarchy, in the case of methodological changes. The check carried out focuses on, among other things, the consistency and transparency of the method, the referencing of the

[34] VESUVE: Verification and monitoring of inventory sheets

data used, the processing of any potential non-compliances or planned improvements (cf. RISQ application in paragraph 4 below) and the recording of checks carried out using VESUVE.

In particular, it concerns the extent to which information is representative (definition, field, relevance, accuracy, etc.), the relevance and conformity of methods, and the suitability of processing tools and communication formats.

An additional control step is added during the compilation of descriptive methodological elements during which a new review of the changes in methods and emission factors is made (justifying changes, explaining methods, referencing sources, etc.). In addition, the final compilation of the inventory report makes it possible to carry out a general check on the results.

Given the considerable quantity of data collected and processed in the various fields concerned, the relevant documentation for each of the organisations involved should be examined. In particular, it is worth noting the procedures related to quality management processes put in place by CITEPA for this purpose (CITEPA is ISO 9001 certified) for compiling emission inventories.

With regard to the compilation of inventories, almost all the general measures (tier 1) described in the IPCC's Good Practices are implemented. The measures specific to certain categories of sources (tier 2) are implemented on a case by case basis mainly in the 'industry', 'transport' and agriculture sectors and, to a lesser extent, other sectors. In particular, accessing and using data related to individual sources or very fine subsets of sources leads to the application of specific procedures. In particular, the QMS endeavours to:

- Ensure the availability of the documentation used for emissions inventories,
- Classify and archive all data and information taken into account for each inventory,
- Maintain the potential confidentiality of some data.

C.6.4 Quality assurance

This is assured by means of several provisions aimed at submitting inventories to reviews and gathering comments and evaluations from those in the public sector who generally have appropriate expertise. More specifically, the following actions, some of which are included in the inventory system and therefore, in the QMS, are effective:

Comments from members of the Emissions Inventory Consultation and Information Group (GCIIE) who also have their own data for cross-checking methodological elements.

- Assessments carried out by local authorities (DREAL) with regard to individual activity and/or pollutant emission data declared annually which involves more than 10,000 facilities, all of which report to the ETS. Note that, in this last framework, the second level of verification cannot be completed if the first level of verification is inconclusive.
- Quality assurance implemented by statistical bodies responsible for producing certain data as part of agreements obtained by the Civil Service (energy report, production, etc.) Therefore, this quality assurance is integrated ahead of the inventory itself.
- Reviews instigated by the Secretariat for the United Nations Framework Convention on Climate Change, with regard both to inspecting submitted documents and to carrying out in-depth reviews in the country concerned such as, for example, those of January 2002, May 2007, September 2010 and September 2016 in the case of France. These reviews lead to reports which enable improvements to be made. Although these reviews do not correspond to the quality assurance actions organised by the country, the nature and results of these reviews are entirely similar to those that would be produced by third-party reviews organised as part of the country's quality assurance process. Many improvements introduced in greenhouse gas inventories come from these international reviews.

- Reviews carried out in different frameworks (UNFCCC, UNECE/LRTAP, EC/Community mechanism for monitoring greenhouse gas emissions, etc.) are effectively analyses by experts who each participate, within other frameworks, in the quality assurance process for emissions inventories. As a minimum, these analyses focus on common factors such as the activities of certain sources (e g. energy), but also various other aspects (organisation, uncertainties, etc.) owing to common reporting elements and strong similarities between financial years.
- Occasional assessments carried out by various individuals with access to inventory reports available to the public or further to comments made by third parties.
- Bilateral and multilateral discussions and actions conducted with foreign organisations and experts responsible for compiling national inventories. Comprehensive and in-depth reviews carried out by third parties face a twofold problem in terms of the availability of the skills and resources required. In this registry, bilateral operations between experts from two countries limited to certain sectors and/or pollutants, are methods that combine interest with a greater ease of implementation. Such an operation was carried out in July 2008 between French and British experts for the agricultural sector and late 2013/early 2014 between French and German experts for fluorinated gas emissions.

The information collected feeds into a tool designed to record and monitor corrections of any non-conformances identified and planned improvements, called RISQ[35]. This tool is systematically consulted by all the authors of calculations spreadsheets and reports when they are updated and any planned actions that are carried out are recorded and checked by their inspector.

This information helps to improve future editions of inventories according to the impact of the change regarding, on the one hand, the difference generated in estimates and, on the other hand, the resources and time needed for data to become available and/or to implement alternative methods.

C.7 Description of the official validation procedure for the inventory

In accordance with the responsibilities previously described, the GCIIE validates methodological changes in the submission of the national inventory report for the year n+2, in October of the year n+1. The results of the inventory are then validated in December of the following year.

D. NATIONAL REGISTRY

The Caisse des Dépôts is a public group, a long-term investor serving the public interest and the economic development of the country. The Caisse des Dépôts was appointed by decree No.2004-1412 to manage the national registry and develop information systems designed to use the registry, and to ensure their security.

Since the migration to the European Union registry on 20 June 2012, it is the responsibility of the European Commission to supply, maintain and secure the national registry information system in accordance with the commitments of European Member States as Parties to the Kyoto protocol (KP registry) and as participants in the European Union Emissions Trading System for greenhouse gases (EU-ETS Registry) managed by the European Commission.

In 2016 modifications were made to the registries in a coordinated way at European level. A summary of the changes made, which are applicable in particular to France's national registry, is provided in the 2017 NIR and in the following table:

[35] RISQ: Quality System Integrated Network

Section	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	No change. The National Administrator is Mr. Yves ANDRE. + 33 1 58 50 11 87 yves.andre@caissedesdepots.fr
15/CMP.1 annex II.E paragraph 32.(b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	New tables were added to the CSEUR database for the implementation of the CP2 SEF functionality. Versions of the CSEUR released after 6.7.3 (the production version at the time of the last Chapter 14 submission) introduced other minor changes in the structure of the database. These changes were limited and only affected EU ETS functionality. No change was required to the database and application backup plan or to the disaster recovery plan. The database model, including the new tables, is provided in Annex A. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Changes introduced since version 6.7.3 of the national registry are listed in Annex B. Each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and were successfully carried out prior to the relevant major release of the version to Production (see Annex B). Annex H testing was completed in January 2017 and the test report will be provided at a later date. No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(f) Change regarding security	The mandatory use of hard tokens for authentication and signature was introduced for registry administrators.
15/CMP.1 annex II.E paragraph 32.(g) Change to list of publicly available information	No change to the list of publicly available information occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	No change of the registry internet address occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	Changes introduced since version 6.7.3 of the national registry are listed in Annex B. Both regression testing and tests on the new functionality were successfully carried out prior to release of the version to Production. The site acceptance test was carried out by quality assurance consultants on behalf of and assisted by the European Commission; the report is attached as Annex B. Annex H testing was carried out in January 2017 and the test report will be provided at a later date.

Table 3.1: Summary of changes made – Source: NIR 2017

Chapter IV

Policies and Measures

A. DRAWING UP POLICIES AND MEASURES

A.1 Institutional foundations

A.1.1 At Government level

The Ministry for Ecological and Inclusive Transition (MTES) aims to address the environmental and climate issues being faced in the twenty-first century. The coordination and leadership of domestic policy for tackling climate change falls under the remit of the Department of Climate and Energy Efficiency (SCEE) within the Directorate General for Energy and Climate (DGEC). The Greenhouse Effect Department (DLCES) is part of this body.

With regard to climate change adaptation policy, the mission of the French National Observatory on the Effects of Global Warming (ONERC), created on 21 February 2001 by an initiative of the French parliament, is to collect and disseminate information on global warming and extreme climate phenomena. The Observatory is attached to the Directorate General for Energy and Climate.

Other ministries also make essential contributions to the implementation of national climate policy, in particular the Ministry of Agriculture and Food, the Ministry of Economy, the Ministry of Higher Education and Research, and the Ministry of Regional Cohesion.

Public institutions are also involved in the implementation of public climate policies. In particular, the French Environment and Energy Management Agency (Agence de l'Environnement et de la Maîtrise de l'Energie, or ADEME) provides expertise and advice to companies, local authorities, public authorities and the general public, and participates in the funding of projects. The French National Housing Agency (Agence National de l'Habitat, or ANAH) supports and finances energy retrofits for low-income housing. The French Development Agency (Agence Française de Développement, or AFD) works on the implementation of France's Climate financing program in developing countries.

A.1.2 At local authority level

Local authorities act alongside the national government as public contracting authorities, playing an important role in the fight against global warming through their assets, their direct activities, and more generally, by animating the country's fundamental economic and social fabric. They also steer regional and urban transport policies. They also have a hand in organising and supporting the renovation of buildings within their jurisdiction. Through their urban and land-use planning policies, they are involved in organising the distribution of activities and accommodation units. Through their economic and land planning policies, they contribute to the enhancement of their area's energy potential.

Climate action from local authorities is structured around territorial planning instruments: Regional Planning, Sustainable Development and Territorial Equality Schemes (SRADDET), and Territorial Climate-Air-Energy Plans (PCAET) for inter-municipality groupings of more than 20,000 inhabitants.

The SRADDETs, introduced by the NOTRe[36] law in 2016, will assimilate several existing schemes, including the current Regional Climate, Air and Energy Schemes (SRCAE), Regional Waste Prevention and Management Plans and Regional Transport/Intermodality Schemes. They serve as an all-encompassing program for planning, mobility, energy and the fight against climate change, to be developed by the Regions in cooperation with local authorities by mid-2019. The SRADDETs are intended to set the strategic orientations and medium and long-term objectives for regional territories, particularly in terms of climate change mitigation and adaptation, the fight against atmospheric pollution, energy consumption management, and the development of renewable energy sources and energy recovery, in accordance with our national objectives.

Inter-municipality groupings of more than 20,000 inhabitants must develop PCAETs as of 2017. Until the end of 2016, only the municipalities of more than 50,000 inhabitants were required to develop a Territorial Climate-Energy Plan (PCET). The PCAET is a regional operational tool that defines strategic and operational objectives in order to mitigate climate change and adapt to its effects, develop renewable energy sources and optimize energy consumption in accordance with national and regional guidelines. It includes a diagnostic report, a strategy and targets (in precise figures), an action programme, and measures for monitoring and evaluation.

A.2 The foundations of the climate policy

Following the first oil crisis in 1973, France became aware of the need to moderate the growth of its energy consumption, and to limit its dependence upon oil imports. In its wake, households and companies were made much more aware of the need for energy savings. At the same time, the electronuclear programme was rolled out; its large-scale deployment led to the transition from an electricity production mix with 85% of energy sourced from coal and oil to an energy mix in which thermal energy represents only about 10% of overall production.

[36] New territorial organisation of the French Republic

France's commitments regarding climate change mitigation policies and measures began in the early 1990s with the Rio Summit and the signing of the United Nations Framework Convention on Climate Change. France's climate policy has evolved and solidified over the course of international negotiations and the development of specialist expertise on the subject, and was defined through an integrated policy: The National Climate Change Program, adopted in 2000. The national mitigation policy was subsequently based on the regular publication of Climate Plans in 2004, 2006, 2009, 2011 and 2013.

With regard to adaptation to climate change, the first national adaptation strategy was published in 2006. France then adopted the National Climate Change Adaptation Plan (PNACC)[37] in 2011, covering the period from 2011 to 2015. A consultation process is underway for the preparation of the 2nd National Adaptation Plan, to be published at the end of 2017.

Further impetus was given to France's climate policy by the **Energy Transition for Green Growth Act** of 17 August 2015. This law confirmed the target to reduce French emissions by 75% by 2050 compared to 1990 levels (which was set in 2005 in the Energy Program Act establishing France's energy policy priorities, and renewed in the 2009 Grenelle Act). It introduced an intermediate reduction target of 40% by 2030 and set in place new measures to cover the various areas of energy transition.

Another major area of progress under this law was the establishment of a climate-related governance principle around a National Low-Carbon Strategy (SNBC) subject to enhanced Parliamentary and civil society oversight. The National Low-Carbon Strategy was adopted by decree on 18 November 2015 and is the result of a collaborative effort involving all stakeholders concerned (ministries, public institutions, professional organisations, research institutes, and representatives from civil society). It orchestrates the implementation of the transition towards a low-carbon economy, and will be updated every 4-5 years. For the purposes of overall consistency, it includes long-term guidelines and sector-specific recommendations (energy and non-energy sectors). It defines the emissions reduction trajectory, broken down by sector on an indicative basis, leading to the achievement of Factor 4 by 2050 (-75% reduction of greenhouse gas emissions compared to 1990 levels). The various State-run plans and programs influencing the trajectory, including the next regional schemes (SRADDET) and Territorial Climate-Air-Energy Plans (PCAET), must take this target into account.

Meeting greenhouse gas emissions reduction targets is based around "**carbon budgets**" set out in the National Low Carbon Strategy. Carbon budgets are greenhouse gas emissions caps that must not be exceeded at national level over five-year periods. The first three carbon budgets were published at the same time as the National Low Carbon Strategy, and cover the periods 2015-2018[38], 2019-2023 and 2024-2028 (Decree No. 2015-1491 of 18 November 2015[39]).

The first three carbon budgets are as follows:

Period	Carbon budget
2015-2018	442 Mt CO_2eq
2019-2023	399 Mt CO_2eq
2024-2028	358 Mt CO_2eq

[37] https://www.ecologique-solidaire.gouv.fr/sites/default/files/ONERC_PNACC_1_complet.pdf
[38] Exceptionally, the first carbon budget covered a 4-year period to align with the timeline for a French presidential mandate.
[39] http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031493783

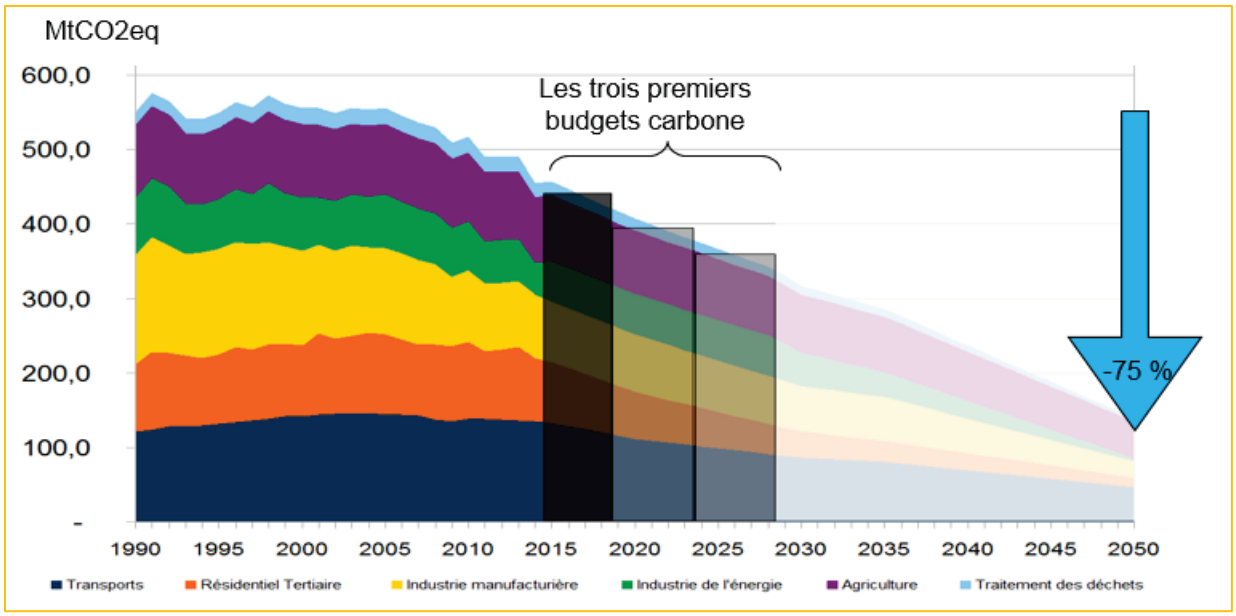

Figure 4.1: Illustration of how carbon budgets function, broken down by sector on an indicative basis
Source: SNBC

The SNBC is consistent with decision 1/COP16 of the Cancun Agreements, which prompted, in 2010, each developed country Party to the UNFCCC to adopt a low-carbon development strategy (or low-carbon strategy) that must present and evaluate the orientations and measures contributing to the achievement of long-term national objectives for mitigating climate change, in accordance with the provisions of Article 4, paragraph 19 of the Paris Agreement.

In July 2017 the Government published a new **Climate Plan** to accelerate energy and climate transition and the implementation of the Paris Agreement. This Plan sets ambitious priorities, which in particular include the aim of achieving carbon neutrality towards the middle of the century, the elimination of "thermal inefficient buildings" within 10 years (with €4 billion earmarked for energy retrofitting), discontinuing the sale of vehicles emitting greenhouse gases in 2040, shutting down the last coal-fired power stations by 2022, gradually phasing out hydrocarbon production in France by 2040, a faster increase in the price of carbon, an expansion of pricing mechanisms for carbon and other greenhouse gases, in particular HFCs, and redoubling of efforts in terms of publicly-funded energy transition research.

These orientations will be integrated into the **SNBC review** process which was initiated in 2017 for a publication at the end of 2018, after an examination of the results achieved during the period covered by the 1st carbon budget. In addition to adjusting the orientations, this review will enable the 4th carbon budget (for the 2029-2033 period) to be set. It must also allow us to take into account certain developments already observed (in particular the latest technological developments), and must include the issue of adaptation to climate change in its strategy, extend projections until 2050, and identify driving forces to be mobilized in order to achieve carbon neutrality by the second half of the twenty-first century.

Further revisions of the SNBC will occur every 5 years, following an examination of the results achieved during the period covered by the carbon budget having just expired. This will provide an opportunity to adjust the trajectory and define a new carbon budget, integrating new possibilities to raise ambitions and bolster the goals agreed upon during the COP21 in December 2015, which are enshrined in the Paris Agreement.

A.3 Monitoring and evaluation of climate policy

Several mechanisms are in place to monitor and evaluate climate policy in France.

Each year, the Government reports to Parliament to provide an update on:

- the State's public expenditure on climate policy (via a cross-cutting policy document entitled "Lutte contre le changement climatique"[40]);
- the financing of the energy transition ("Rapport sur le financement de la transition énergétique"[41]), quantifying and analysing public financial resources and evaluating the private financial resources being used to finance the energy transition, and whether these resources are sufficient in terms of the overall financial amounts required in order to reach objectives and match the pace of transition set by the law. In particular, this report targets energy demand management actions and measures to promote renewable energy, as well as the impact of energy consumption on the evolution of greenhouse gas emissions, and more generally on the environment.

With regard to the National Low Carbon Strategy, the Greenhouse Gas Department has established a process to regularly monitor the strategy's implementation, reporting to the stakeholders involved in its development and also feeding into the iterative process of reviewing the strategy every 5 years. A set of almost 150 indicators has been established, against which the policies and measures envisaged in the strategy will be characterized, monitored and managed. In this way, the strategy will make it possible to achieve the targets set by providing all necessary means for parties to position themselves, and pointing out any necessary adjustments to sectoral and territorial policies (where deviations from the reference trajectory are observed). These monitoring indicators are reviewed and analysed annually with the involvement of the Expert Committee on Energy Transition[42]. They are presented on a biennial basis to those stakeholders involved in the development of the strategy, who are thereby able to participate in the monitoring process. At the outcome of these biennial reviews, the results of the indicator monitoring process are published.

Finally, as part of the country's European reporting obligations as defined in the "MMR" regulation[43], every two years France submits information regarding the measures adopted, implemented or being planned to reduce its GHG emissions to the European Commission. It must also assess their impact (on GHG emissions and, whenever possible, on costs) and describe their prospects for reducing emissions in the medium term, in particular via the compilation of a forecasting scenario that accounts for measures already implemented. This information is made available to the public[44].

The evaluations of the policies and mitigation measures published under the "MMR" regulation are performed by the DLCES. All hypotheses, calculation methods and evaluation results in terms of greenhouse gas reduction and costs are detailed in the following report, available in both French and in English: "France 2017 Report in accordance with Article 13.1 of Regulation No. 525/2013"[45].

[40] This document is available via the following link: https://www.performance-publique.budget.gouv.fr/actualites/2016/publication-dpt-lutte-contre-changement-climatique-annexe-plf-2017#.We74Pri2VOg
[41] This document is available via the following link: https://www.performance-publique.budget.gouv.fr/sites/performance_publique/files/farandole/ressources/2017/pap/pdf/jaunes/Jaune2017_transition_energetique.pdf
[42] This committee was formed to give an opinion on carbon budget projects and the low-carbon strategy. It is made up of a maximum of ten members, appointed based upon their expertise.
[43] Regulation No. 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gases and for reporting other information relevant to climate change and repealing Decision No. 280/2004/EC.
[44] The report submitted by France to the European Commission on policies and measures and projections made in 2017 is available at the following link: http://cdr.eionet.europa.eu/fr/eu/mmr/art04-13-14_lcds_pams_projections/.
[45] The French version of this report is available at the following link: http://cdr.eionet.europa.eu/fr/eu/mmr/art04-13-14_lcds_pams_projections/pams/envwm_t7a/Rapport_2017_France_MMR_article_13.pdf/manage_document.
The English version is available at the following link: http://cdr.eionet.europa.eu/fr/eu/mmr/art04-13-14_lcds_pams_projections/pams/envwsc9fq/Report_2017_France_MMR_article_13_EN.pdf/manage_document

A.4 Implementation of European policies

France's national policy fits into the wider framework of European climate policy. European climate policy is set out by the EU energy-climate packages for 2020 and 2030.

Regarding 2020, the energy-climate package 2020 provides an integrated approach to energy and climate issues. It is based on three major targets for 2020: a 20% reduction of the European Union's GHG emissions compared to 1990 levels, a 20% reduction in the European energy consumption compared to trend growth, and for renewable energy to make up 20% of all energy consumed.

The greenhouse gas reduction target is divided into two sub-targets:

- the European Union Emissions Trading System (EU ETS) sets a uniform and integrated emissions cap at an EU-wide level, applying to emissions from carbon-based energy production and from industry. Emissions from the airline sector have been included since 2012, as have N_2O and perfluorocarbon (PFC) emissions from the chemical and aluminium sectors since 2013. Since 2005, the EU ETS has imposed a cap on emissions from more than 11,000 industrial facilities responsible for almost 50 % of the CO_2 emissions of the European Union; i.e. about 2 billion tonnes of CO_2. Each year, these installations must possess enough allowances to cover their level of verified emissions from the previous year. The allocation of allowances under the EU ETS will decrease by 21% between 2005 and 2020.
- along with the EU ETS, the Member States have shared efforts to reduce diffuse emissions by 10% between 2005 and 2020 (in sectors such as transport, construction, agriculture, waste, small industrial installations, etc.). Within this framework, France has committed to a 14% reduction target between 2005 and 2020 in its emissions from activities not covered by the EU ETS.

Regarding 2030, the European Council reached an agreement in October 2014 concerning the constituent elements of the EU's 2030 energy and climate framework:

- a binding target to achieve at least a 40% reduction in domestic greenhouse gas emissions compared to 1990 levels. This binding target was communicated to the UNFCCC as a 'planned contribution determined at national level of the EU.' It is based on a 43% reduction of emissions covered by the EU ETS in 2030 compared to 2005 levels, and on a 30% reduction of emissions from non-EU ETS sectors compared to 2005 levels;
- a binding target of at least 27% renewable energy usage by 2030;
- an indicative energy efficiency target of at least 27% for 2030 (reduction of primary energy consumption compared to the trend-based scenario for 2030). A review is planned for 2020 to increase this target further if necessary.

The implementation of a set of European provisions contributes to the achievement of these European targets, in particular:

- the 43% emission reduction target by 2030 set by the EU ETS should be reflected in a 2.2% annual cap reduction as of 2021, instead of 1.74% currently. The negotiations should be finalised before 2018;
- the second climate sub-target of -30% for the non-EU ETS sectors is to be divided among Member States. France should receive a target of -37% for 2030 compared to 2005 levels. These negotiations should also be finalised before 2018;
- France's LULUCF obligations are currently those set by Europe (Decision 529/2013). They involve the communication of accounting information for forestry (afforestation, reforestation, deforestation, managed forests) in order to limit or reduce emissions and to maintain or improve carbon absorption for the 2013-2020 accounting period;

- the Directive on the promotion of the use of energy from renewable sources (Directive 2009/28/EC) which sets a 20% target for the share of energy from renewable resources in the European Union's total energy consumption in 2020, including 23% for France;
- the 2012 Directive on energy efficiency (Directive 2012/27/EU) which supplements the 2006 Directive on energy services. This document establishes a common framework of measures for the promotion of energy efficiency in the Union, in order to ensure the achievement of the objective to increase energy efficiency by 20% by 2020. As such, France is required to submit updates of its national action plan concerning energy efficiency to meet the indicative target of 9% energy savings by 2016 and 20% by 2020;
- the regulations on CO_2 emissions from vehicles (Regulation no. 443/2009 amended by Regulation No. 333/2014) which aim to reduce average specific emissions from new passenger cars;
- the implementation of the directive on ecodesign (Directive 2009/125/EC) which sets ecodesign requirements for energy-related products (bulbs, electric appliances, etc.);
- the regulation on fluorinated greenhouse gas emissions ("F-gas II" Regulation No. 517-2014 repealing "F-gas" Regulation No. 842/2006) which introduces, in particular, a mechanism to gradually reduce the quantities of hydrofluorocarbons (HFCs) that can be placed on the market.

B. POLICIES AND MEASURES AND THEIR EFFECTS

B.1 Transport

In 2015, the transport sector contributed to 29.7% of France's greenhouse gas emissions. The challenges are particularly significant for the road sector, which alone accounts for 93.0% of transport sector emissions. CO_2 is the main greenhouse gas emitted by the transport sector (96.7 %), followed by fluorinated gases (2.0 %).

B.1.1 Measures to reduce CO_2 emissions from the transport sector

The measures implemented to reduce CO_2 emissions from the transport sector are mainly aimed at improving the energy efficiency of new road transport vehicles, encouraging the development of low-emission vehicles, promoting the development of biofuels and other alternative fuels, and supporting modal shift.

Improving the energy efficiency of new road transport vehicles

The energy efficiency of private passenger cars has improved a great deal in recent years as a result of several major measures:

- the **energy/CO_2 label** indicating the fuel consumption and CO_2 emissions of new vehicles, which has been mandatory in sales outlets since 2006. This label is designed to raise vehicle purchasers' awareness about their energy consumption and emissions;
- the **bonus-malus** scheme, in place since 2008, aims to reward buyers of new cars emitting the smallest volume of CO_2 by awarding them a financial bonus, and to penalise those who opt for the most polluting models - hence the bonus of some buyers being financed by the penalty ("malus") of others. The amounts and thresholds involved are reviewed periodically to maintain the incentive effect of the scheme. Since 1 January 2017, the penalty has applied to vehicles whose emissions rating is greater than 126 gCO_2/km, and equates to an increase on the purchasing price ranging from €50 to €10,000. The greater the vehicle's CO_2 emissions, the greater the purchasing penalty;
- at European level, **Regulation No. 443/2009** requires automobile manufacturers to gradually reduce average CO_2 emissions of new passenger cars to 130 gCO_2/km; this applied to 65% of the

total stock of new cars sold in 2012, rising to 74% in 2013, 80% in 2014, and 100% in 2015. This regulation also introduces a sanction mechanism when emission limits are exceeded. In order to send a signal to the industry for subsequent production cycles, it also set a target of 95 gCO_2/km for 2020. **Regulation No. 333/2014** confirmed this target and set conditions for its achievement by manufacturers.

These various measures are inter-connected. On the one hand, EU regulations No. 443/2009 and No. 333/2014 are designed to influence the choice of vehicles available to consumers by setting gradual performance objectives for new cars. On the other hand, the energy/CO_2 label and the bonus-malus system both influence demand for certain vehicles by encouraging consumers to choose the least polluting models. Average emissions per new passenger car in France decreased from 149 gCO_2/km in 2007 to 110 gCO_2/km in 2016 (cf. Figure 4.2).

For light utility vehicles, **European Regulation No. 510/2011** requires manufacturers to gradually reduce average emissions of new vehicles to 175 gCO_2/km between 2014 and 2017. An average emissions level of 147 gCO_2/km was set for 2020. Average emissions per new light utility vehicle in France decreased from 170.5 gCO2/km in 2010 to 146.0 gCO_2/km in 2016 (cf. Figure 4.2).

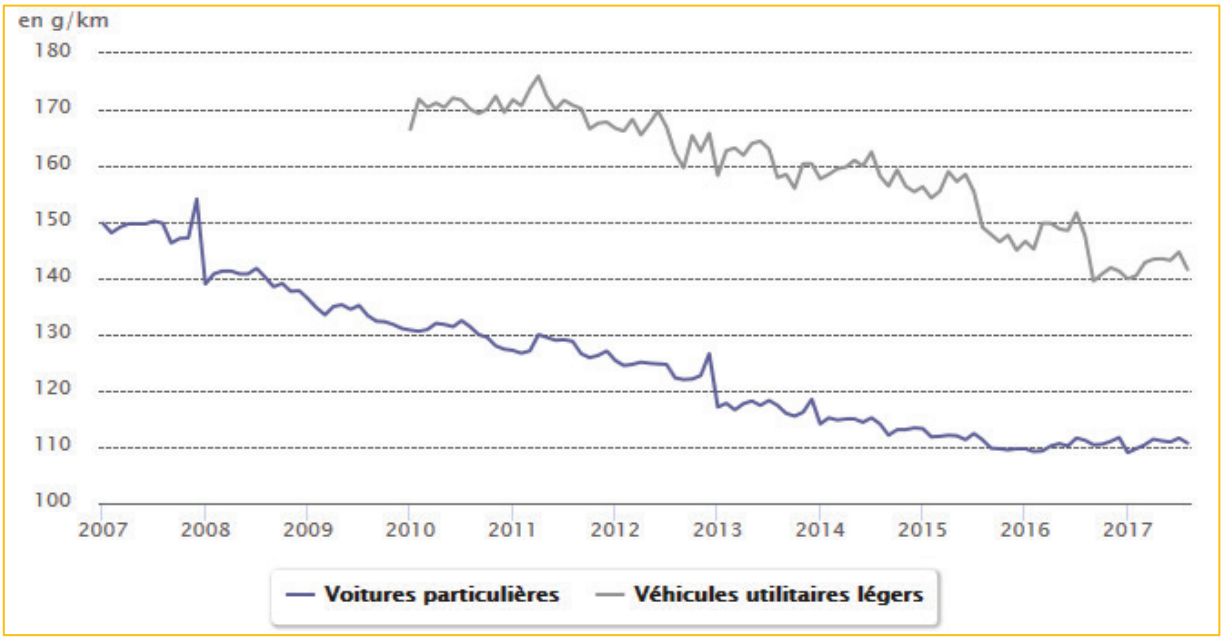

Figure 4.2: Average CO_2 emissions per new passenger car and per new light utility vehicle in France - Source: SDES, RSVERO

Development of low-emissions vehicles

Several measures have been put in place to promote the development of rechargeable electric and hybrid passenger cars. These measures aim, on the one hand, to encourage the acquisition of these vehicles, and on the other hand to promote the deployment of charging infrastructures.

The following measures have been put in place to encourage the acquisition of electric and plug-in hybrid vehicles:

- within the bonus-malus scheme, introduced in 2008, the bonus scale was revised on 1 January 2015. Subsidies are now reserved for new vehicles emitting less than 60 gCO_2/km, which under current market circumstances refers to a plug-in hybrid vehicle or an electric vehicle, as these are

the only vehicles capable of operating at such low emissions levels. As of 1st January 2017, the bonus for electric vehicles amounts to €6000 (up to a limit of 27 % of the acquisition cost), and €1000 for plug-in hybrid vehicles. If the purchase is accompanied by the scrapping of an old diesel vehicle put into service before 1st January 2006, a conversion bonus can be cumulated with the emissions bonus. Financial aid can therefore be up to €10,000 for electric vehicles (with a conversion bonus of €4 000) and €2 500 for plug-in hybrid vehicles (with a conversion bonus of €2 500).

Furthermore, since 2017, a new bonus is offered for two or three-wheeled vehicles and electric quadricycles with an engine power of up to 3 kW. To be eligible, these vehicles must not use a lead battery and the amount of financial aid provided may reach €1,000 depending on the vehicle's characteristics;

- **equipment targets in terms of low-emission vehicles are set for fleets of vehicles managed by the State, its public bodies and local authorities, and for vehicle rental companies, and operators of taxis and chauffeured cars** (French: *voitures de transport avec chauffeur*, or VTCs). When replacing their vehicle stock, the State and public sector organisations must include at least 50% low-emissions vehicles (i.e. rechargeable electric or hybrid vehicles in practice). For local authorities, the percentage must be at least 20%. Furthermore, rental companies and operators of taxis and VTCs are obliged to acquire a 10% share of low emissions vehicles when replacing their vehicle stock, and must reach this target by 2020.

A range of measures aims to promote the deployment of charging infrastructures around the country:

- all **construction** of certain types of building with a car park (residential, tertiary, industrial, hosting a public service, constituting a commercial complex, cinemas) must fit a section of the car parks with pre-equipment to facilitate the subsequent installation of charging facilities for rechargeable electric or hybrid vehicles;
- the installation of charging stations may benefit from various forms of **financial aid**, depending on the infrastructure type and the project owner involved. For private individuals, the installation of charging stations for cars is eligible for the energy transition tax credit (CITE) for up to 30% of the expenses incurred. The Investments for the Future Program (Programme d'Investissement pour l'Avenir, or PIA) has participated in the financing of installation projects for over 20,000 charging points, providing €61m for the local authorities carrying out the installations. A new edition of the PIA was put in place in October 2016 to promote the deployment of charging facilities in activity centres and residential areas. Since February 2016, the ADVENIR program has encouraged the installation of private charging stations in the car parks of shops, companies and collective residences, via financial aid;
- in addition, the **IRVE decree** on recharging infrastructures (12 January 2017) aims to standardize in a single text all measures relating to recharging infrastructures for electric vehicles, and includes various regulatory measures issued via Directive 2014/94/EU. It sets out several points: minimum requirements for the configuration of normal and quick recharging points; provisions for energy management; provisions for the exploitation of recharging infrastructures; communication of data on the characteristics and availability of recharging infrastructures; provisions for access to infrastructures and recharging payments; provisions for the qualification of installers and the maintenance of recharging infrastructures.

These various measures have already enabled a gradual increase in the sales of rechargeable electric and hybrid passenger cars in France. Over the course of 2016, almost 22,000 electric passenger cars and 7,500 plug-in hybrid passenger cars were registered, i.e. a 26% and 32% increase respectively compared to 2015 levels, although the market share of these types of vehicle remains low (1.5% of new vehicle registrations in 2016).

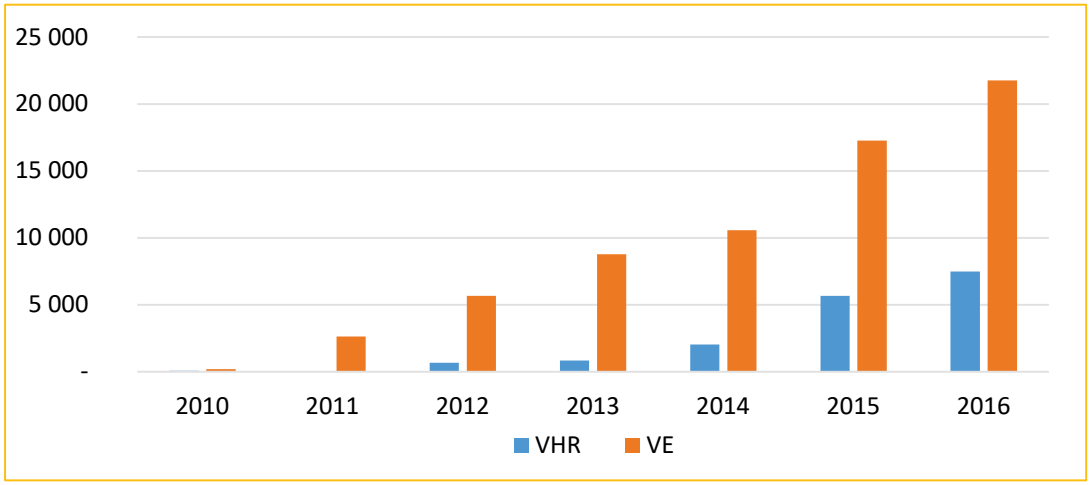

Figure 4.3: Registrations of electric vehicles and plug-in hybrid vehicles since 2010 in France - Source: SDES, RSVERO

With regard to heavy goods vehicles, since 2016 there has been a **support scheme for investment in natural gas vehicles**. Companies can deduct from their taxable income a sum equal to 40% of the original value of goods allocated to their business, acquired between 1 January 2016 and 31 December 2017, which fall under the class of vehicles weighing more than 3.5 tonnes and running exclusively on natural gas and biomethane fuel.

Natural gas-based transport was also encouraged in 2016 by the launch of a **call for project bids** for a future investment programme intended to support the emergence of solutions that combine the purchase of heavy goods NGVs and the creation of points of supply.

Finally, there is an obligation for vehicles used for public urban transport managed by the State and by local authorities (buses and coaches) to include at least 50% low-emission vehicles when replacing their vehicle stock as of January 2020, and then to acquire only low-emissions vehicles as of 1 January 2025. The criteria that define low emissions vehicles (electrical, hybrid, biogas or biofuels that are very largely renewable) are set according to vehicle use, the areas in which they will travel and the local capacities for supply of a given energy source.

Developing biofuels and other alternative fuels

Biofuel development is driven by **incorporation targets** (7.7% target for the diesel and 7% for the petrol in 2014, reapplied for 2015 and 2016) and incentive **tax measures** with an additional tax rate for the General Tax on Polluting Activities (TGAP) penalising operators when they release for consumption a proportion of biofuels that is lower than the incorporation target. Biofuels must also comply with sustainability criteria. These measures will make it possible to comply with the European target of 10% renewable energy in the transport sector by 2020 (Directive 2009/28/EC). The Energy Transition for Green Growth Act of 17 August 2015 set a 15% target for the share of renewable energy in the transport sector's final fuel consumption in 2030.

When used as vehicle fuel, natural gas for vehicles (NGV) is **taxed at a very low rate** compared to other fuels. At the same time, the gaseous biofuel sectors are also being developed. A target of 0.7 TWh of bioNGV was set for 2018 and 2 TWh in 2023, so that bioNGV will represent 20% of NGV consumption in 2023.

Supporting modal shift

Supporting the modal shift towards transport modes that emit the least amount of CO_2 consists, in particular, of improving the availability of alternative transport services and infrastructures to road use, whether involving urban and interurban passenger transport or freight transport.

Since 2008, the State has supported exclusive-lane public transport (French: *transport collectif en site propre*, or TCSP) projects carried out by transport authorities, co-funding these initiatives within the framework of **calls for projects**. A TCSP is a public passenger transport system with a dedicated traffic lane or space which may only be used by public transport vehicles, generally benefiting from priority right-of-way at traffic lights and using modes of transport ranging from buses and tramways to metros. Three calls for projects launched in 2008, 2011 and 2013 have thus made it possible to co-fund the development of 1900 km of additional TCSPs in provincial conurbations, including 43 km of metro, 455 km of tramways and 1400 km of bus rapid transit systems.

In Ile-de-France, the **Grand Paris des transports** project launched in 2013 is aimed at improving public transport services available to passengers in terms of information and network exploitation, refurbishing and developing existing networks, building a new automatic metro network and developing a direct connection to the Paris-Roissy airport. In the long run, it is anticipated that 90% of the Ile-de-France population will have access to a station within 2 km. This new network will greatly improve journeys from one side of the city to the other, and will also help relieve pressure on the existing network. The objective is for all lines to gradually go into operation between 2019 and 2030.

The national high-speed rail transport networks are well-developed, and investments in this area have been especially high in recent years, in particular with the launch of four new **high-speed lines**: Tours-Bordeaux, Brittany Pays-de-la-Loire, the East European high-speed line, and the bypass Nîmes-Montpellier (mixed passenger and freight line to free up the Nîmes-Montpellier axis), i.e. 757 km of additional new high-speed lines put into service between 2015 and 2020.

Furthermore, incentivising measures to encourage cycling have also been implemented:

- **the bicycle mileage allowance** is an incentive mechanism designed to encourage employees to cycle to and from their place of work. The employer can bear all or part of the expenses incurred by the employees for their trips by bicycle or electric bicycle between their residence and work place, in the form of a bicycle mileage allowance. The amount of the allowance is set at €0.25 per km and capped at €200 per year. The introduction of the bicycle mileage allowance within companies is optional, and remains the decision of the individual employer;
- the companies providing their employees with a fleet of bicycles for their home-workplace commute may also benefit from a **tax reduction**;
- in 2015, a new national **regulation** was introduced aiming to improve the sharing of roadways and increase cyclist safety in urban areas;
- measures have been taken to **facilitate the parking of bicycles**, with the obligation to create secure parking spaces for bicycles during the construction of residential or office buildings, or when work is carried out on car parks, and the issue of secure bicycle parking must now be included as a point of discussion in the general assemblies of co-owned buildings;
- in February 2017, **financial assistance was put in place for the purchase of new electric bicycles** that do not use a lead battery. The amount of the aid package is set at 20% of the acquisition cost, without exceeding €200.

For freight, the Government encourages the use of rail, waterway or maritime modes of transport for the main link of the logistical chain, reserving road transport for the final leg of the journey (combined transport) within the framework of a **financial support scheme**. The current aid scheme has been implemented for the 2013-2017 period. The beneficiaries are combined transport service operators, or the freight forwarders. It involves paying a flat-rate amount per intermodal transport unit (ITU, including containers, swap bodies, semi-trailers, trailers) transhipped in a land or port terminal located in mainland France and integrated into a transport chain including a pre- and post-road transportation to the end points of the main loop. The aim is to enable combined transport operators to establish a competitive pricing scheme in order to promote the development of this type of transport system.

Another action area for the policy to support modal shift consists of improving the information available to transport service users via the **transport services' GHG information** scheme. Services providers for freight, passenger transport or removal services must provide mandatory information on the quantities of greenhouse gases induced by their services.

Multi-faceted Measures

Freight and passenger road transport professionals are involved in voluntary commitments through the **"Objectif CO_2" programme**. This programme consists of two complementary approaches: a Progress Charter and a Certification Label to highlight results achieved. Operational tools and support are also offered to evaluate, manage and reduce GHG and atmospheric pollutant emissions. For signatory companies, the Charter of Commitments consists of implementing a progress and continuous improvement strategy, by setting a reduction target and a concrete and personalized action plan over a three-year period. In particular, the companies must implement at least one action in each of the four areas defined in the strategy, namely: vehicles (for example, by limiting vehicle speed to 80-85 km/h or increasing the pace of fleet modernization), fuel (for example, by using alternative fuels or improving the monitoring of consumption and activity data), drivers (for example, through eco-driving training or bonus incentives), flow organisation (for example, by using combined transport modes or optimizing freight flow and loading processes). The label is awarded to those companies that have achieved a high level of performance throughout their entire fleet.

Since 2008, almost 1500 companies have joined the programme, representing more than 160,000 vehicles (LDVs, lorries, buses and coaches), i.e. approximately 20% of the French fleet, for an estimated annual gain of 400,000 tonnes of GHG.

B.1.2 Policies and measures focusing on CO_2 emissions from international transport

Air transport

The European Union has adopted the Directive 2008/101/EC of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the EU ETS: the scheme has been active since 2012 for all flights arriving at or departing from the European Union (a temporary suspension was granted from 24 April 2013 for international flights). The emissions cap given to the airline sector is set based on the average annual emissions of 2004-2005-2006: 97% of these emissions in 2012, and 95% the following years.

Maritime transport

In 2015, the European Union adopted Regulation 2015/757 which establishes a monitoring, reporting and verification system (MRV system) for CO_2 emissions from ships. As of 1st January 2018, maritime companies will have to monitor and report, on an annual basis, emissions from their ships for all intra-Union journeys and all journeys to the Union (between the last non-Union port and the first port of call located within the Union), all the journeys between a port within the Union and the first port of call outside the Union, as well as the CO_2 emissions produced in Union ports.

These rules apply without distinction to all ships, whatever flag they fly. Public access to emissions-related data will contribute to removal of the commercial barriers that prevent the adoption of many negative-cost measures that would reduce greenhouse gas emissions from maritime transport.

B.1.3 Measures to reduce fluorinated gas (HFC) emissions from the transport sector

The **European Directive 2006/40/EC** of 17 May 2006 and the measures taken to transpose the measure into French law (Decree of 21 December 2007 on the reception of motor vehicles with regard to air conditioning systems) prohibit the use of fluorinated gases whose GWP is greater than 150 in the air conditioning systems of motor vehicles, and also outline measures to limit leakage. Since 1 January 2011, the air conditioning systems of all new types of vehicles must work with a refrigerant fluid whose GWP is lower than 150. Since 1 January 2017, this prohibition applies to all new vehicles. In practice, this entails replacement of the refrigerant gas R-134a (GWP of 430) with the gas R-123yf (GWP of 4), leading to very substantial gains.

Table 4.1: Summary of policies and measures in the transport sector

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2eq.$)[c]				
						2015	2020	2025	2030	2035
Energy/CO_2 label of new cars for sale*	Encouraging the purchase of passenger cars that emit the least amount of CO_2 by raising buyer awareness	CO_2	Information	Implementation	MTES	1 111[d]	2 412	4 353	5 409	6 130
'Bonus-malus' scheme for car purchases*	Encouraging the purchase of passenger cars that emit the least amount of CO_2	CO_2	Tax, economic	Implementation	MTES					
European regulations on CO_2 from new passenger cars (443/2009 and 333/2014)*	Requiring car manufacturers to lower average emissions for new private passenger vehicles to 95gCO_2/km by 2020.	CO_2	Regulatory	Implementation	MTES					
European Regulation on CO_2 levels of new light-utility vehicles (510/2011)*	Requiring vehicle manufacturers to lower average emissions for new light-utility vehicles to 175 gCO_2/km by 2017 and 147 gCO_2/km by 2020.	CO_2	Regulatory	Implementation	MTES	69[e]	231	418	521	539
Equipment targets in terms of low emissions vehicles for vehicle fleets managed by the State, its public bodies, local authorities, rental companies, taxis, chauffeured cars*	Encouraging the acquisition of low emissions vehicles	CO_2	Regulatory	Implementation	MTES	85[f]	780	1 840	3 400	5 650
Requirement to fit sections of car parks in new buildings with pre-equipment for recharging facilities for electric vehicles*	Fostering the deployment of recharging facilities for electric vehicles	CO_2	Regulatory	Implementation	MTES, MCT					
Financial assistance for the installation of recharging stations for electric vehicles*	Fostering the deployment of recharging facilities for electric vehicles	CO_2	Economic	Implementation	MTES, ADEME					
Consolidated regulatory framework for recharging facilities*	Fostering the deployment of recharging facilities for electric vehicles	CO_2	Regulatory	Implementation	MTES					
Tax arrangement to support investing in NGV for heavy goods vehicles*	Fostering the purchase of heavy goods vehicles running on NGV	CO_2	Tax	Implementation	MTES	na	na	na	na	na
Call for projects intended to support natural gas vehicle transport*	Fostering the purchase of heavy goods NGVs and promoting the deployment of supply facilities.	CO_2	Economic	Implementation	ADEME	na	na	na	na	na
Equipment targets for low-emissions vehicles when renewing the fleet of vehicles used for public urban transport and managed by the State and by local authorities*	Fostering the development of low emissions buses and coaches	CO_2	Regulatory	Implementation	MTES, local authorities	na	na	na	na	na
Taxation in favour of biofuels*	Developing biofuel incorporation	CO_2	Tax	Implementation	MTES	na	na	na	na	na
NGV-friendly taxation*	Encouraging the development of natural gas vehicles	CO_2	Tax	Implementation	MTES	na	na	na	na	na
Call for projects for the development of exclusive-lane public transport*	Supporting the modal shift to public transport for urban passenger transport	CO_2	Economic, other (planning of transport infrastructures)	Implementation	MTES, local councils and transport authorities	186[g]	242	246	252	258

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2eq.$)[c]				
						2015	2020	2025	2030	2035
"Grand Paris des transports" project*	Supporting the modal shift to public transport for urban passenger transport	CO_2	Other (planning of transport infrastructures)	Implementation	Société du Grand Paris	na	na	na	na	na
Development of high-speed railway lines*	Supporting the modal shift to rail transport for interurban passenger travel	CO_2	Other (planning of transport infrastructures)	Implementation	MTES	0[h]	452	441	434	425
Measures to encourage cycling (bicycle mileage payments, tax reductions, regulations for road sharing and cyclist safety, bicycle parking, bicycle bonus) *	Supporting the modal shift to cycling	CO_2	Economic, regulatory	Implementation	MTES	na	na	na	na	na
Financial support scheme for combined transport*	Supporting the modal shift to rail, waterway or maritime transport for the main link of the freight transport chain (combined transport)	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Mandatory GHG information for transport services*	Supporting modal shift for both passenger transport and freight transport by promoting transport services with the lowest emissions	CO_2	Information, regulation	Implementation	MTES	na	na	na	na	na
"Objectif CO_2" programme*	Improving energy efficiency and encouraging the use of alternative fuels for passenger and freight road transport - targeting the vehicle, fuel type, the driver and flow management	CO_2	Voluntary agreement, information (Certification label)	Implementation	MTES, ADEME	400[i]	400	400	400	400
European emissions trading scheme	Capping emissions from air transport	CO_2	Economic	Implementation	MTES	na	na	na	na	na
European system for the monitoring, reporting and declaration of CO_2 emissions from ships	Setting up an MRV system for maritime transport	CO_2	Information, other (MRV)	Implementation	MTES	na	na	na	na	na
European Directive on the air conditioning systems of motor vehicles (2006/40) *	Lowering the GWP of fluorinated gases used in air conditioning systems of motor vehicles, and limiting leakage	HFC	Regulatory	Implementation	MTES	171[j]	937	2 322	2 828	2 177

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry of the Ecological and Inclusive Transition; ADEME: Environment and Energy Management Agency
c na: assessment not available
d Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 46-52)
e Source: France 2015 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 21-23)
f Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 38-45)
g Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 58-64)
h Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 53-57)
i Source: http://www.objectif CO_2.fr/index/programme
j Source: France 2015 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 26-27)

B.2 Residential/services sector

This sector represented 18.9% of national emissions in 2015. The residential sector accounted for 58.0% of the emissions from this sector, the tertiary (services) sector for 29.4%, and fluorinated gas consumption in buildings contributed up to 12.6%. CO_2 was the main greenhouse gas emitted by the residential/tertiary sector (85.1%), followed by fluorinated gases (12.6%).

B.2.1 Measures to reduce CO_2 emissions from the residential/services sector

The purpose of the measures implemented to reduce CO_2 emissions from the residential/services sector is mainly to improve the thermal performance of building shells, to encourage the use of high-performance heating equipment and of the lowest-carbon energy sources, and to improve the energy efficiency of other types of equipment (lighting, cooking, domestic hot water, specific electricity consumption). These measures are applied to both new and existing buildings.

For new builds

The energy performance of new buildings has been included in construction regulations since the first oil crisis in 1973. The thermal regulations applying to new buildings have since been gradually reinforced. All new buildings whose construction permits were filed after 1st January 2013 are subject to the **2012 Thermal Regulation** (RT 2012). These buildings must have an overall energy consumption below 50 kWhep/m²/year on average. This obligation has been applied in advance since 28 October 2011 for office buildings, schools for primary and secondary education, and early childhood centres. The requirement of 50 kWhep/m²/year on average concerns consumption of heating, cooling, lighting, domestic hot water and auxiliary items (pumps and fans). In addition, this threshold is adjusted based on the geographic location, altitude, building use, average size of residences and the greenhouse gas emissions of the energies used. Regarding this last point, only buildings using wood-fired heating systems and low-CO_2 district heating networks may benefit from an adjustment of the primary energy consumption threshold - the maximum adjustment possible being set at 30%.

The **trial phase for "Positive Energy Buildings & Carbon Reduction (E+C-)" certification label** for the construction of exemplary buildings was launched at the end of 2016. This trial phase will pave the way for future environmental regulations for new buildings, which will standardize positive energy buildings and the deployment of buildings with a low carbon footprint throughout their life cycle, from design to demolition. This label establishes an innovative environmental standard for new buildings, bringing together requirements for both energy and greenhouse gas emissions in the building. Thanks to this double "energy" and "carbon" criterion, the project owner is able to choose the appropriate combination based on the specific characteristics of the local area, building typology and costs induced. The trial phase aims to field-test the balance between environmental ambitions, the management of construction costs, and the ability of companies and equipment manufacturers to fulfil these ambitions. In this way, France is committing its building sector to move towards the construction of positive energy and low-carbon buildings.

To encourage property developers to construct exemplary buildings in terms of energy efficiency and environmental features, the Energy Transition for Green Growth Act of 17 August 2015 offers the possibility of obtaining a **'constructability bonus'** (bonus plot ratio) for this type of building. The relevant town planning authority may allow plot ratios to be exceeded by a maximum of 30% for new buildings which are energy-positive or which display exemplary energy or environmental features. This arrangement will improve the economic balance of these construction operations, allowing for extra costs associated with achieving this exemplary status to be partly absorbed.

Furthermore, since 2008, for all new buildings whose surface area exceeds 1000 m^2, a technical and economic **feasibility study** of the building's various energy supply solutions must be carried out. This measure is designed to foster the use of renewable energy and high-efficiency systems. The field of application for this measure was extended in 2014 to all new buildings of more than 50 m^2 (with the exception of individual houses or outbuildings and extensions of existing buildings).

Finally, the Energy Transition for Green Growth Act of August 2015 provides that new public buildings (constructed on behalf of the State, including its public bodies and local authorities) must set exemplary environmental and energy standards, and where possible shall be energy-positive with a high level of environmental performance. This obligation came into force in 2017.

Renovations to existing builds

Improving the performance of existing buildings is essential to the reduction of greenhouse gas emissions. A wide range of instruments have been mobilised to achieve this goal, aimed at regulating the performance of retrofits, certifying and financing efficient retrofits, training professionals, improving information, removing obstacles to the renovation decision, etc.

For existing buildings, the **Thermal Regulation** (RT) aims at ensuring a significant improvement in the energy performance of an existing building when undertaking its renovation. The applicable measures are the "global RT" and the "RT by building feature", and differ according to the scale of the work being carried out. For major renovations of buildings with a total area over 1000 m^2, the overall RT sets an overall energy performance target for renovated buildings, except for those built before 1948. For buildings of less than 1000 m^2 or for buildings of over 1000 m^2 undergoing light renovation, the RT by building feature defines a minimum performance level for replaced or installed elements: in particular it applies to insulation (opaque and glass walls), heating, hot water production, cooling and ventilation equipment. The requirements of the RT by building feature were reinforced in 2017 (for coming into effect of new provisions on 1st January 2018).

The **"high energy performance"** certification for building renovations supports and enhances the efforts of building contractors eager to carry out high-performance (i.e. highly energy-efficient) renovation projects. The label indicates that the building meets superior standards for energy efficiency and summer temperature management.

Finally, since 1st January 2008, any building of over 1 000 m^2 undergoing major renovation must, like any new building, be the subject of an energy supply **feasibility study**, to encourage the building owner to use a renewable source of energy or a high-performance system.

To foster energy renovation, financial aid is available for private individuals and for social landlords. Private individuals can benefit from the eco-loan at a zero percent interest rate, and from the energy transition tax credit. Social landlords can obtain the social housing eco-loan.

The **energy transition tax credit** (CITE) makes it possible to deduct 30% of expenditure on certain energy performance improvement works from one's income tax. The objective of this scheme is to encourage individuals to carry out energy upgrade work on their homes while supporting the most efficient emerging technologies in terms of energy consumption reduction, thereby spurring markets towards higher performance standards. This scheme, in place since 2005, was simplified and reinforced by the Finance Act 2015. To ensure the measure remains effective, and to continue to promote the use of efficient equipment and materials by private individuals, eligibility requirements are regularly revised.

The **zero-interest eco-loan** (French: éco-PTZ) enables recipients to benefit from a zero-interest loan of up to €30,000 to finance a range of energy renovation projects. It applies to property owner-residents or landlords. The performance criteria for building work eligible for the CITE and the éco-PTZ are identical, thus increasing accessibility and synergies between the two measures.

Since 2015, the main aid packages (éco-PTZ and CITE) have been subject to an **'eco-conditionality' requirement**: in order to benefit, individuals must use companies recognized as environmentally-minded (French: *"Reconnues Garantes de l'Environnement"*, or RGE). Indeed, the environmental competency of the contracting company employed to carry out the various aspects of the building refurbishments is an essential aspect of construction quality. In addition, the training of building professionals is supported via the **FEEBat training initiative** (training in energy savings for companies and artisans in the building sector) which benefits from financing under the energy savings certificate scheme. This initiative allows professionals to benefit from energy savings training from approved providers under favourable financial conditions, available throughout the country. The FEEBat initiative will be reinforced over the coming period of the energy savings certificate scheme, and in accordance with the implementation of "eco-conditions" for incentive schemes: training objectives have been revised, rising to 25,000 trainees per year, with new training providers integrated into the scheme in order to increase capacity.

In addition to the CITE and the éco-PTZ, the French **National Housing Agency (ANAH) aid scheme** helps property owner-residents or landlords living under a certain wealth threshold to carry out living space improvement renovations. The "Habiter mieux" (Live better) programme run by ANAH allocates an additional aid package for low-income owner-residents carrying out renovations that will enable energy gains of at least 25%. It also includes a specific support measure providing project management assistance to property owners.

The **social housing eco-loan** (French: éco-PLS) is a reduced-interest rate loan - the rate varies based on project duration and the amount varies based on the energy savings achieved through the work funded by the loan. It is available in particular to low-rent housing organisations, semi-public companies, and municipalities owning or managing social housing, in the context of the thermal renovation of energy-inefficient residences. The éco-PLS finances energy saving work that will enable a dwelling to move from a primary energy consumption level of over 230 kWh/m^2/year to a consumption level below 150 kWh/m^2/year.

Besides financial aid, schemes have been set up to facilitate the financing of energy renovation work:

- a full legal framework has been established covering **third-party financing**. Third-party financing is an energy upgrade offer that includes the funding of the operation and post-construction monitoring, in such a way that the owner has no outlay to fund since the future energy savings will gradually repay all or part of the investment.
- a **guarantee fund for energy upgrades** was created by the Energy Transition for Green Growth Act of August 2015, to facilitate the funding of building work to improve the energy performance of existing dwellings. It enables banking institutions to benefit from a guarantee when awarding loans to owners of existing dwellings with modest resources in order to finance energy upgrade work.

Furthermore, a **reduced VAT** (value added tax) **rate of 5.5%** applies to work to improve the energy performance of dwellings, thereby limiting costs involved.

Measures have been implemented to foster the provision of information to users on the energy performance of the buildings they occupy, and on existing renovation aid schemes:

- **-energy performance diagnostics** (French: DPE) indicate a building's energy efficiency ratings, assessed on the basis of energy consumption and greenhouse gas emissions. The assessment also includes recommendations that will allow the buyer, property owner, landlord or renter to understand the most effective measures to save energy. Since 2006, a DPE must be established on the occasion of the sale of any building or section of a building, whatever its use (residential or tertiary). Since 2007, a DPE must be established for the rental of a dwelling or a building mainly used as a residence.

- -condominiums built before 2000 comprising 50 lots or more and equipped with a collective heating or cooling installation were obliged to conduct a mandatory **energy audit** before 1st January 2017. This audit includes, for each building in the condominium, an estimation of the building's annual energy consumption for heating, cooling, domestic hot water production, lighting and ventilation. The audit must include proposals for building work intended to improve the building's energy performance;
- the **"renovation info services" network**, composed of more than 450 renovation info service points (French: PRIS) located all over the country, offers a free and independent consultancy service to private individuals carrying out energy renovations on their building. The PRIS advisors provide information on the work to be carried out, help individuals understand how to benefit from aid schemes, and steer them towards qualified RGEs (building firms recognized as being environmentally-friendly) to carry out the work;
- since 2012, an **environmental annex** (known as the 'green annex') must accompany the contract for recently concluded or renewed leases for business premises used for offices or shops with floor space exceeding 2 000 m2. Since July 2013, this annex has been mandatory for all existing leases. The environmental annex must include a description of the energy characteristics of the building's equipment and systems, their actual water and energy consumption and the quantity of waste generated by the building.

Furthermore, various schemes aim to remove some of the barriers to building renovation decisions or other virtuous practices being carried out:

- the asymmetry between owner-landlords, who bear the cost of the works, and tenants, who benefit from the energy savings induced, is reduced via the possibility of **sharing cost savings between owners and tenants**. Following the completion of the energy saving renovations, an owner can request a monthly financial contribution from their tenant equal to half of the energy savings achieved for that month. This contribution is noted via a new indication on the tenant's official rent receipt, remaining valid for a period of 15 years. However, this participation is only possible if the landlord completes a range of efficiency operations including at least two actions, or action enabling a minimum performance level to be reached, and if they have consulted their tenant beforehand.
- in a collectively heated building, bills are usually broken down according to ownership share or in proportion to the surface area of the apartment, even if the heating consumption differs from one dwelling to another. **Individualised heating costs** involves making the occupant pay for their actual heat consumption. This gives the occupant more information on their heating use and encourages them to control their consumption. The Energy Transition for Green Growth Act of August 2015 sets out **a nationwide roll-out** of this scheme, which had hitherto been mandatory only for energy-inefficient residential buildings. The obligation to individualize heating costs is thus extended to all residential buildings, and to the tertiary sector, except where this is technically impossible or it has become necessary to change a building's entire heating installation.

Finally, another recent measure introduced by the Energy Transition for Green Growth Act of August 2015 concerns the **requirement for thermal insulation refurbishments to be included in all major building renovations**, including renovations to the building's façade, roof repairs, and any conversion of garages, lofts or other undeveloped spaces into living quarters. The measure ensures that each instance of major building work is treated as an opportunity for a contractor to carry out (at a reduced cost) energy-efficient refurbishments and therefore lower the building's energy requirements. The energy-efficiency refurbishment requirements apply to all contracting agreements entered into as of 1 January 2017 for buildings intended for use as residences, offices, commercial spaces, educational centres and hotels. The insulation installed must result in a level of thermal performance that complies with the thermal regulation for each building feature. In addition, insulation operations may benefit from financial aid packages (energy transition tax credits, zero-interest eco-loans, energy savings certificates).

For the public services sector, a particular effort is being made to **reduce the energy consumption of the State's housing stock**. Several types of actions are being implemented: renovations to building exteriors and facilities, actions related to facilities and occupant management, reduction in amounts of space used by civil service departments. The objective is to achieve a 40% reduction in energy consumption in buildings owned by the State and its public bodies between 2012 and 2020.

Increasing the energy efficiency of other types of equipment

The European Framework Directive 2009/125/EC establishes a framework for setting eco-design requirements applicable to energy-related products. Twenty-five implementing regulations of the framework directive have been adopted to date, covering a range of products, and in particular the following regulations which affect the residential/services sector's energy consumption (specific electricity consumption, cooking, lighting and heating);

- horizontal regulations which apply in a systematic manner to all types of equipment, such as "stand-by and off" modes;
- regulations on so-called "white" products: refrigeration equipment, washing machines, dishwashers, laundry dryers; kitchen equipment such as ovens, extractor hoods and hobs; vacuum cleaners;
- regulations on electronic products: TV sets, computers and servers, decoders and external power supplies;
- regulations on air conditioning and heating systems: boilers (all fuels), water heaters, mixed heating, heat pumps and cogeneration, independent appliances; air conditioners and fans;
- regulations on lighting: domestic lighting.

Energy labelling (under Directive 2010/30/EU) completes the scheme by encouraging consumers to buy the least wasteful products. The range of products subject to this obligation is gradually being broadened.

B.2.2 Measures to reduce HFC emissions from building

Fluorinated gas emissions in the building sector come from cooling equipment (domestic cooling for the residential sector and commercial cooling for the services sector), air conditioning systems and heat pumps. **European regulation No. 517/2014 (referred to as "F-Gas II")** establishes a set of provisions to limit fluorinated gas emissions from refrigeration and air conditioning equipment used in buildings, as well as in other sectors (industry and refrigerated transport) (cf. detailed description of the F-Gas II Regulation in Section B. 8. *Cross-cutting policies and measures*).

Table 4.2: Summary of policies and measures in the residential/services sector

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2eq.$)[c]				
						2015	2020	2025	2030	2035
Thermal Regulation 2012*	Improving the energy efficiency of new buildings, and encouraging the use of renewable energies.	CO_2	Regulations	Implementation	MTES, MCT	1 075[d]	3,624	6,290	9,001	11,713
Trial phase for the "Positive Energy and Carbon Reduction Buildings (E+C-)"* certification label	Improving the energy efficiency of new buildings, decreasing their carbon footprint and encouraging the use of renewable energies.	CO_2	Regulations, information (labelling), and other measures (trial phases)	Implementation	MTES, MCT	na	na	na	na	na
Bonus Plot Ratio*	Improving the energy efficiency of new buildings, and encouraging the use of renewable energies.	CO_2	Economic	Implementation	MTES, MCT	na	na	na	na	na
Energy supply feasibility study for new buildings*	Fostering the use of renewable energy and more efficient systems in new buildings	CO_2	Regulation, information	Implementation	MTES, MCT	na	na	na	na	na
Exemplary new public buildings*	Improving the energy efficiency of new buildings, and encouraging the use of renewable energies.	CO_2	Regulations	Implementation	MTES, MCT	na	na	na	na	na
Thermal Regulation*	Increasing the energy performance of existing buildings during renovation work	CO_2	Regulations	Implementation	MTES, MCT	na	na	na	na	na
High Energy Performance (HPE) certification label for building renovations	Encouraging high-performance renovations of existing buildings	CO_2	Information (label)	Implementation	MTES, MCT	na	na	na	na	na
Energy supply feasibility study for existing buildings*	Fostering the use of renewable energy and more efficient systems in existing buildings	CO_2	Regulation, information	Implementation	MTES, MCT	na	na	na	na	na
Zero-interest eco-loan*	Incentives for energy upgrades to existing buildings	CO_2	Economic	Implementation	MTES, MCT	7 200[e]	7200	7200	7 100	7 100
Energy transition tax credit*	Incentives for energy upgrades to existing buildings	CO_2	Tax	Implementation	MTES, MCT					
Eco-conditionality*	Improving the quality of renovations by certifying the competency of professionals	CO_2	Economic, other (certification)	Implementation	MTES, MCT	na	na	na	na	na
Training in energy savings for companies and artisans in the building sector (FEEBat initiative)*	Improving the quality of renovations by improving the training of building sector professionals	CO_2	Education (training)	Implementation	MTES, MCT	na	na	na	na	na
ANAH financial aid, "Habiter mieux" (Live better) programme	Incentives for energy upgrading of existing buildings, reducing energy poverty	CO_2	Economic	Implementation	ANAH	na	na	na	na	na
Eco-loans for Social Housing*	Incentives for energy upgrading of existing buildings (social housing)	CO_2	Economic	Implementation	MTES, MCT	na	na	na	na	na
Third-party Financing*	Incentives for energy upgrades to existing buildings	CO_2	Economic	Implementation	MTES, MCT	na	na	na	na	na
Guarantee Fund for Energy Upgrading*	Incentives for energy upgrades to existing buildings	CO_2	Economic	Implementation	MTES, MCT	na	na	na	na	na

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2eq.$)[c]				
						2015	2020	2025	2030	2035
Reduced VAT rate of 5.5% for renovation work to improve the energy quality of buildings*	Incentives for energy upgrades to existing buildings	CO_2	Tax	Implementation	MTES, MCT	na	na	na	na	na
Energy Performance Diagnostics*	Improving information on the energy performance of existing buildings	CO_2	Information, regulation	Implementation	MTES, MCT	na	na	na	na	na
Mandatory energy audit for condominiums*	Incentives for energy upgrades to existing buildings	CO_2	Regulation, information	Implementation	MTES, MCT	na	na	na	na	na
"Renovation info services" network*	Encouraging the renovation of existing buildings by improving the information provided to individuals on energy upgrading of their dwelling	CO_2	Information	Implementation	MTES, MCT	na	na	na	na	na
Environmental annex included in lease contract for commercial and office premises*	Improving information on the energy performance of existing services sector buildings	CO_2	Information	Implementation	MTES, MCT	na	na	na	na	na
Sharing cost savings between owner and tenant*	Incentives for energy upgrading of rented accommodation	CO_2	Economic	Implementation	MTES, MCT	na	na	na	na	na
Nationwide adoption of individualized heating costs*	Encouraging the control of energy consumption in existing buildings	CO_2	Regulation, information, economic	Implementation	MTES, MCT	na	na	na	na	na
Obligation to install thermal insulation when undertaking major building refurbishment work*	Increasing the number of energy upgrades in existing buildings	CO_2	Regulations	Implementation	MTES, MCT	0[f]	663	1,480	2,287	3,087
Measures to reduce energy consumption of the State's housing stock*	Reducing the energy consumption of the public services sector	CO_2	Planning	Implementation	MTES	na	na	na	na	na
Ecodesign Directive*	Increasing the energy efficiency of appliances	CO_2	Regulations	Implementation	MTES	na	na	na	na	na
Energy labelling*	Steering demand towards the most energy-efficient appliances	CO_2	Information	Implementation	MTES	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry for Ecological and Inclusive Transition; MCT: Ministry for Territorial Cohesion; ANAH: Agence nationale de l'habitat/ National housing agency
c na: assessment not available
d Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 65-68)
e Source: France 2015 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 27-32)
f Source: France 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 69-78)

B.3 The manufacturing industry

The manufacturing industry contributed to 17.6% of France's greenhouse gas emissions in 2015. Emissions from the manufacturing industry mainly come from sectors producing CO_2-intensive commodities such as metallurgy, chemicals or the manufacturing of non-metallic minerals (cements, lime, glass, etc.). CO_2 is the main greenhouse gas emitted by the manufacturing industry (90.1%), followed by fluorinated gases (7.8%) and N_2O (1.9%).

B.3.1 Measures to reduce CO_2 emissions from industry

The **European emissions trading system** plays a structuring role by capping emissions from industrial facilities (cf. description in Section A. 4. Implementation of European policies). In addition, several incentive schemes to improve energy efficiency have been established:

- The **"Green loan"** scheme is dedicated to financing investments that put in place industrial manufacturing processes and tools which are more energy-efficient, less polluting, or create more eco-efficient products. It is aimed at small and medium-sized enterprises (SMEs) and middle-market companies (*entreprises de taille intermédiaire* - ETIs) in all industrial sectors. Since the program's renewal at the beginning of 2015, €164 million of green loans have been attributed to industrial SMEs and ETIs to support them in their ecological and energy transition projects. In order to accelerate the distribution of the green loan, the cap was raised from €3 to 5 million in 2017, and eligibility has been extended to business activities such as industrial services, data centres, and cold chain logistics;
- The ADEME's **"Decision-making aid"** mechanism subsidises the completion of studies looking at energy efficiency in industry, including energy diagnostics (where these have not been made mandatory by regulations), as well as the setting up of energy management systems.
- The **DEREFEI Program**, set up by the ADEME in collaboration with various professional stakeholders (professional fields, consultancy services, etc.), has established a training scheme entitled 'Becoming a specialist in industrial energy efficiency' (*Devenir Référent Énergie en Industrie*) It provides the energy user with tools and methods that aim to improve the company's energy performance, by setting up technical and organizational solutions that are simple and quickly profitable;
- Since 1 January 2015, pursuant to Article 14 of Directive 2012/27/EU on energy efficiency, industrial facilities generating unused waste heat must carry out a **cost-benefit analysis** if they are either a new facility or carrying out major refurbishments. This analysis makes it possible for an industrialist to evaluate the potential profitability of the unused waste heat through a connection to a heating or cooling network, and is accompanied by the implementation of solutions that are deemed cost-effective. The main industrial sectors concerned by the measure are chemicals, glass production, cement, plaster, and paper-cardboard, metal transformation and agribusiness;
- Since 2016, companies that are heavy consumers of electricity can benefit from a **reduction on the tariff for the use of public electricity networks** (TURPE). In return, they must implement an **energy performance policy** (implement an energy management system according to the ISO 50001 standard, reach a performance target monitored by means of indicators subject to certification within 5 years, and develop an energy performance plan to reach this target).

B.3.2 Measures to reduce fluorinated gas emissions from industry

European Regulation No. 517/2014 (referred to as "F-Gas II") establishes a set of provisions to limit fluorinated gas emissions from cooling and air conditioning equipment, in particular industrial cooling (cf. detailed description of the regulation in Section B.8).

Moreover, since 2013, perfluorocarbon (PFC) emissions from aluminium production are subject to the European emissions trading system.

B.3.3 Measures to reduce N_2O emissions from industry

Since 2013, N_2O emissions from the chemicals sector are subject to the European emissions trading system.

Table 4.3: Summary of policies and measures in the manufacturing industry sector

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2eq.$)[c]				
						2015	2020	2025	2030	2035
European emissions trading scheme*	Capping emissions from industrial installations	CO_2, PFC, N_2O	Economic	Implementation	MTES	na	na	na	na	na
Green loans*	Encouraging more efficient manufacturing processes and equipment, or which or create eco-efficient products	CO_2	Economic	Implementation	Bpifrance	na	na	na	na	na
Decision-making aids*	Improving industrial energy efficiency by subsidizing energy efficiency studies	CO_2	Economic, information	Implementation	ADEME	na	na	na	na	na
"Becoming a Specialist in Industrial Energy Efficiency" program*	Improving energy efficiency in industry by training energy users	CO_2	Education & Training	Implementation	ADEME	na	na	na	na	na
Mandatory cost-benefit analysis of waste heat recovery*	Making energy savings by recovering waste heat from production processes	CO_2	Regulatory, information, economic	Implementation	MTES	na	na	na	na	na
Preferential pricing of electricity supply for power-intensive sites implementing an energy performance policy*	Increasing energy efficiency at power-intensive sites	CO_2	Economic	Implementation	MTES	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry of the Ecological and Inclusive Transition; ADEME: Environment and Energy Management Agency
c na: assessment not available

B.4 Energy

In this section, a distinction is made between energy production and energy consumption. In the sub-section on energy consumption (B.4.2), we have chosen to report on policies and measures that have a 'cross-cutting' impact on energy consumption (i.e. those which affect several sectors). The policies and measures which impact energy consumption in a single sector are reported in the sections focusing on individual sectors.

B.4.1 Energy production

Energy production accounted for 10.2% of national emissions in 2015. Electricity production and urban heating represented 67.6% of the emissions in this sector, while 16.4% came from refinement operations. CO_2 is the dominant greenhouse gas (96.3%), followed by methane (2.6%) from fugitive fuel emissions.

Measures to reduce CO_2 emissions from energy production

The reduction of CO_2 emissions from the energy production sector involves the capping of emissions from electricity and heating production facilities and refineries via the **European emissions trading scheme** (cf. description in Section A.4 Implementation of European policies) and through supporting renewable energy.

The Energy Transition for Green Growth Act of August 2015 sets ambitious objectives in terms of renewable energy development, in particular:

- increasing the share of renewable energy to 23% of final gross energy consumption in 2020 and to 32% of gross consumption in 2030:
- achieving 40% of electricity production from renewable sources in 2030;
- achieving 38% of final heating consumption from renewable sources in 2030;
- achieving 10% of gas consumption from renewable sources in 2030;
- multiply by five the amount of renewable and recovered heating and cooling delivered by heating and cooling networks by 2030.

To achieve these objectives, the Government has introduced a new planning instrument called multiannual energy plan (French: PPE) which sets quantitative goals for each renewable source over a period of 10 years (except for the initial period, which covers 2016-2023). The PPE will be reviewed every 5 years, apart from the first revision which will take place in 2018.

Targets have thus been set for each renewable source for 2018 and 2023. The incentive mechanisms put in place are specific to each source and must be the subject of periodical adjustments to account for technical and economic developments. They are guided by the principle of ensuring the minimum profitability required for the deployment of these technologies.

To achieve its targets regarding renewable energy production, the Government uses two main types of mechanisms: open-access schemes and tendering procedures.

The **open-access** mechanism confers the right to benefit from support for any eligible installation. This mechanism is adapted for mature sectors for which production costs are relatively known and stable, and for which there are many potential development sites with limited conflicts of use. Two open-access support mechanisms can be identified, depending on the size of the facility: the purchasing obligation and the additional compensation scheme.

The purchasing obligation has only been applied to small facilities since 2016. Any kilowatt-hour injected onto the public network is purchased by an obligated buyer at a feed-in tariff exceeding the average market price level, set in advance and enabling the costs of its installation to be covered while ensuring normal project profitability.

The additional compensation scheme, introduced in 2016, applies to high capacity installations (installed capacity exceeding 500 kW). Open-access additional compensation is a bonus paid to a renewable energy producer as a supplement to the market sale of the electricity that it has generated. This bonus is proportional to the energy generated and calculated as the difference between a reference tariff and a reference market price. It must provide the producer with sufficient remuneration to cover the costs of its installation while ensuring normal project profitability.

In **tendering procedures**, support is only allocated to parties awarded with contracts under these procedures (e.g. calls for tender). These systems are suitable for renewable energy sectors that have one of the following characteristics: need for supervision due to the risk of usage conflicts (e.g. in the case of high-capacity biomass); lack of suitable areas (e.g. offshore wind power); highly asymmetric cost information; technological demonstration and industrial development issues. Tendering procedures improve competitiveness in renewable energy development by placing projects in competition with one another, and are suitable tools for controlling renewable energy development trajectories in accordance with the targets set by the PPE (multi-year energy programme). When the capacity targets set by the PPE have not been attained, the minister in charge of energy has the option of initiating tendering procedures to develop new production capacities. Winning projects can benefit both from a feed-in tariff and from an additional compensation scheme, depending on the installed capacity of the projects and the procedure's bill of specifications.

Support is provided for renewable energy in the gas sector via the following mechanisms:

- open-access schemes: any biogas producer wishing to inject its product into the natural gas transport and distribution networks is eligible for an open-access purchasing obligation, provided that this has no adverse effect on the proper operation of the networks. In this system, the injected biogas is purchased by a natural gas supplier at a pre-set feed-in tariff covering the biogas production plant investment and operating costs, while ensuring normal project profitability. The purchasing obligation is contracted for a period of 15 years.
- calls for tender: when the capacity for producing biogas for injection into the gas network fails to meet the targets calculated in the multiannual energy plan, the Minister in charge of energy may issue a call for tenders.

In addition, producers who request them may benefit from **guarantees of origin** for electricity generation from renewable energy sources and high-efficiency co-generation, or for injected biogas. These guarantees of origin can be used on the markets, and constitute an additional source of income for producers.

Since 1 January 2015, in accordance with Article 14 of Directive 2012/27/EU on energy efficiency, energy production installations in heating or air-conditioning networks with a total thermal capacity exceeding 20 MW must carry out a **cost-benefit analysis** for new installations and in cases of substantial refurbishment. This analysis identifies potential waste heat suppliers located near the network and enables implementation of a solution considered to be profitable.

B.4.2 Policies and measures with a cross-cutting impact on energy consumption

Several structural policies and measures have been introduced to limit energy consumption, encourage energy efficiency and reduce the carbon intensity of the energy mix in several energy consuming sectors. These measures affect carbon dioxide.

The **energy savings certificate** scheme in operation since 2006 is based on an obligation to achieve energy savings imposed by the public authorities on energy vendors (electricity, gas, LPG, heating and air conditioning systems, domestic fuel and automotive fuels). A multi-year target is established and allocated among the obligated parties according to their sales volume. At the end of the period, the

obligated parties must prove that they have met their obligations by holding a number of energy savings certificates equivalent to these obligations. To obtain certificates, obligated parties have a choice of action to implement (carrying out energy saving actions themselves, encouraging consumers to reduce energy consumption, purchasing certificates from other stakeholders on the market, etc.), business sectors (residential, services, industrial, agricultural or transport) and types of clients (households, companies, public bodies, etc.). The first three-year period of the scheme took place between mid-2006 and mid-2009, with a total obligation set at 54 TWh cumac[46]. The second period, which extended from 1 January 2011 to 31 December 2014, included a target of 460 TWh cumac. The scheme entered into its 3rd period on 1 January 2015 for a duration of 3 years. The overall obligation imposed on energy vendors amounts to 700 TWh cumac over the 2015-2017 period. In accordance with the Energy Transition for Green Growth Act (LTECV) of 17 August 2015, a new obligation to benefit households experiencing fuel poverty has been in place since 1 January 2016, with a target of 150 TWh cumac by the end of 2017. A 4th obligation period is planned from 2018 to 2020, with a target set at 1600 TWh cumac, including 400 TWh cumac to benefit households experiencing energy poverty.

In 2014, a share in proportion to CO_2 emissions from energy products was introduced in the domestic consumption charges on energy products (TICPE). The **"carbon component"** has been fluctuating as follows: €7/tCO_2 in 2014, €14.5/tCO_2 in 2015, €22/tCO_2 in 2016 and €56/tCO_2 in 2020. Under the Energy Transition for Green Growth Act, a target of €100/tCO_2 was set for 2030. In accordance with the target set by the July 2017 climate plan, the budget proposal for 2018 provides for an **accelerated carbon component trajectory**, with a level fixed at €86.2/t CO_2 in 2022.

With the transposition of EU Directive 2012/27 on energy efficiency, companies employing more than 250 employees or having an annual turnover in excess of €50 million and a balance sheet total in excess of €43 million must conduct an **energy audit** every 4 years. The energy audit, carried out by an internal or external auditor, consists of a methodical analysis of a site's energy flows and consumption and must enable companies to identify energy saving actions at all levels (buildings, production processes, transport, etc.).

The **heat fund** provides financial support to project for producing heat from renewable energy: biomass (forestry, agricultural, biogas, etc.), geothermal energy (direct use or through heat pumps), thermal solar energy and recovered energy as well as the development of heat networks using these forms of energy. The sectors involved are group housing, services, agriculture and industry. The heat fund makes renewable heat competitive with heat produced from conventional forms of energy by guaranteeing a price for heat from renewable sources approximately 5% lower than that obtained from conventional sources. The heat fund was endowed with a total budget of €1.7 billion for the 2009-2016 period.

[46] Energy savings certificates are expressed in kWh cumac of final energy, i.e. in kWh saved during the lifetime of the energy saving operations and discounted at a rate of 4%.

Table 4.4: Summary of energy policies and measures

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
European emissions trading scheme*	Capping emissions from electric power generating plants, heat production plants and refineries	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Multiannual energy plan*	Developing renewable energy by setting quantitative targets	CO_2	Planning	Implementation	MTES	na	na	na	na	na
Open-window schemes*	Developing renewable energy sources for electricity by means of open-window financial support (feed-in tariff for small -sized installations, additional compensation scheme for large installations)	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Tendering procedures*	Developing renewable energy sources for electricity by means of financial support allocated on conclusion of a tendering procedure	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Open-window biogas purchasing obligation*	Developing biogas by means of open-window financial support (feed-in tariff)	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Calls for tender for biogas*	Developing biogas by means of financial support allocated after calls for tender	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Guarantees of origin for renewable electricity and biogas production*	Developing renewable energy sources for electricity and biogas	CO_2	Economic	Implementation	MTES	na	na	na	na	na
Obligatory cost-benefit analysis of waste heat recovery*	Making energy savings by recovering waste heat from production processes	CO_2	Regulatory, information, economic	Implementation	MTES	na	na	na	na	na
Energy savings certificates*	Energy savings across different sectors	CO_2	Regulations	Implementation	MTES	6190[d]	16,303	18,830	18,290	16,066
Carbon component in energy taxation*	Reducing demand for fossil fuel energy	CO_2	Taxation	Implementation	MTES	1130[e]	6140	7750	9100	8650
Accelerating the raising of the 'carbon component' in tax rates	Reducing demand for fossil fuel energy	CO_2	Taxation	Planned	MTES	na	na	na	na	na
Heat fund*	Increasing the use of renewable energy for heat production	CO_2	Economic	Implementation	ADEME	3359[f]	6361	7634	7634	7275
Energy audits*	Improving information of companies on their energy consumption, and encouraging them to introduce actions to reduce it	CO_2	Regulation, information	Implementation	MTES	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry of the Ecological and Inclusive Transition; ADEME: Environment and Energy Management Agency
c na: assessment not available
d Source: France's 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 9-19)
e Source: France's 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 20-27)
f Source: France's 2017 Report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 28-37)

B.5 Agriculture

Agriculture accounted for 19.8% of emissions in France in 2015. Emissions from agricultural soils account for 39.2% of emissions from the sector, followed by emissions from enteric fermentation (38.1%), energy consumption (13.4%) and animal manure (8.9%). CH_4 emissions (from enteric fermentation and animal manure) and N_2O emissions (mainly from agricultural soils) are predominant, accounting for 45.1% and 40.2% respectively of agricultural emissions. CO_2 accounts for 14.4% of emissions from this sector and mainly originates from energy consumption.

In general, the Law on the future of agriculture, food and forestry (LAAAF), enacted on 13 October 2014, establishes the need to give the population access to foodstuffs produced in conditions contributing to climate change mitigation and adaptation as one of the primary purposes of the country's agriculture and food policy.

B.5.1 Reducing CH4 emissions from livestock effluent management

Agricultural biogas production reduces methane emissions by processing livestock effluent. France has introduced measures to support the development of agricultural biogas production:

- the **farm competitiveness and adaptation plan** offers financial support for the acquisition of methane digesters;
- the **feed-in tariff** for electricity generated by methane digesters was re-valued in 2016 for small and medium-sized installations (less than 500 kWe) and a **call for tenders** was set up for larger installations in the form of a "biogas" category included in the calls for tender for the production of electricity from biomass;
- the **"biogas energy for nitrogen self-sufficiency" (EMAA) plan**, which came into effect in 2013, has the primary goal of simplifying the administrative procedures for developing biogas projects, and improving support for project developers and efforts to structure the sector.

Agricultural biogas production is currently a developing industry, and has increased from 90 implemented projects listed in France at the end of 2012 to 281 agricultural installations and 38 regional installations operating as of 1 January 2017.

The **farm competitiveness and adaptation plan** also provides support for investments to promote slurry pit covers and effluent management.

B.5.2 Measures to reduce agricultural N_2O emissions

Reducing nitrous oxide (N_2O) emissions through improved control of nitrogen fertilization and preventing surplus organic nitrogen is a priority for the agricultural sector, despite the fact that fertilizer deliveries have been falling in France for the last 20 years (at an average rate of 0.5% per year, i.e. more than 10% in total) along with the addition of organic animal fertilizers to the soil (-9 %).

The application of **Nitrates Action Programs** is obligatory in vulnerable areas. Their purpose is to ensure balance in nitrogen fertilisation and proper control of nitrogen fertilisers, including livestock farming effluent. These programs reduce the amounts of nitrogen fertilisers applied, optimise the recovery of livestock farming effluent and reduce losses linked to applying nitrogen fertiliser by improving application practices. Intermediate nitrogen fixing crops must be introduced throughout land plots in vulnerable areas on which the duration of the inter-crop period exceeds 5 months.

The Biogas Energy for Nitrogen Self-Sufficiency plan is compatible with an agricultural approach based on balanced fertilisation and an overall reduction in the use of agricultural inputs. This plan includes a set of instruments to improve nitrogen management, particularly calls for projects, promoting and disseminating knowledge and simplifying administrative regulations.

The **Ambition bio 2017** ('Organic ambition') programme limits N_2O emissions by aiming to develop organic production. This programme is based on six main pillars: developing production, sectoral structuring, developing consumption, increasing research, supervising the programme and disseminating results; training agriculture and food industry operators; and adapting the regulations.

The purpose of the **plant protein plan** is to enhance the development of pulses and forage legumes. This plan is based around three main areas of focus: development of plant-based protein production and strengthening the self-sufficiency of French livestock farming via the use of regulatory tools and financial incentives available via the Common Agricultural Policy; pursuing research and technical support efforts coordinated with producers; and strengthening governance by encouraging dialogue between professions.

The **seed and sustainable agriculture plan** contributes to limiting N_2O emissions by supporting the selection of low-nitrogen plant cultivars and improving resources in terms of leguminous seed varieties.

The **farm competitiveness and adaptation plan** offers investment assistance to reduce the use of mineral fertilizers and to develop leguminous crops.

In addition, various **Common Agricultural Policy assistance schemes** contribute to the implementation of farming practices to reduce nitrogen inputs, in particular:

- decoupling agricultural assistance to optimize crop practices;
- conditions imposed on assistance programs (maintaining land in a good agricultural and environmental condition (buffer zones), particularly in compliance with Nitrates Action Programme measures);
- support for organic agriculture, with a declared target of 20% of agricultural land devoted to organic produce by 2020.

Lastly, a **call for projects entitled "Agr'Air"** (2017-2022) was initiated at the beginning of 2017. The purpose of this call for projects is to support pilot projects aiming to disseminate technologies and practices in the agricultural sector that contribute to reducing ammonia and/or fine particle emissions. An additional benefit of these projects is to reduce greenhouse gas emissions by improving the management and recovery of nitrogen contained in livestock effluent, fertilizers and animal feed. Selected projects must promote a collective approach and implement reproducible and sustainable action.

B.5.3 Reducing CO_2 emissions by controlling energy consumption and developing renewable energy sources in the agricultural sector

As mentioned above, agricultural methanisation produces biogas. This biogas can be used as a source of renewable energy under a number of different forms:

- via simple heat production, which can be consumed near the production site;
- via combined production of electricity and heat (co-generation) by means of a combustion engine;
- via injection into natural gas networks following a purification phase (here, biogas is upgraded into biomethane);
- via conversion to fuel in the form of compressed natural gas (CNG).

The **farm competitiveness and adaptation plan** mentioned above also provides subsidies for additional action to reduce energy consumption and to develop renewable energy sources.

A **tariff reconstruction** system for connecting renewable energy production facilities to gas and electricity networks was introduced at the beginning of 2017. Under this system, up to 40% of these costs will be covered by network operators. This will considerably reduce connection costs for agricultural facilities that are often far from the networks and will therefore make it easier to deploy renewable energy. The specific procedures for applying this measure are to be promulgated in the near future.

B.5.4 Measures affecting the different factors for reducing agricultural emissions

Agri-environment climate measures (AECMs) provide financial support for farms involved in the development of practices that combine economic and environmental performance, and for maintaining these practices where they are falling into demise. For the period from 2014 to 2020, priority is placed on the following agri-environment climate measures:

- agri-environment climate measures which respond to a systemic approach, consistent with proposing an overall commitment for an entire farm, rather than involving only particular plots of land affected by a single environmental issue;
- maintaining practices for extensive grassland systems/limiting intensification and returning organic matter to the soil;
- maintaining and changing polyculture and livestock farming practices / limiting inputs; - changing field crop practices / limiting inputs;
- reducing or even eliminating the use of fertilizers;
- introducing leguminous crops in irrigated systems (particularly in maize monoculture systems);
- maintaining topographical features such as hedges, copses, shelterbelts, etc.

The **Agro-Ecological Project** encourages innovation and engagement in the transition towards all aspects of new, higher-performance production systems (in economic, environmental and social terms), while also promoting research, training and agro-ecological communication initiatives.

The aim of the **Training for Alternative Production plan** is to mobilize agricultural training to support the transition to new, more sustainable production systems. Reference materials used in educating future farmers have been revised to include the progress made in the agro-ecological project, especially regarding climate issues.

Table 4.5: Summary of policies and measures in the agricultural sector

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
Nitrates action programs*	Improved control of nitrogen fertilization	N_2O	Regulations	Implementation	MAA	na	na	na	na	na
'Organic ambition' program*	Encouraging the development of organic agriculture without the use of mineral nitrogen fertilizers	N_2O	Economic, information, education, research, planning	Implementation	MAA	na	na	na	na	na
Plant-based Proteins Plan*	Encouraging the development of leguminous crops that require less nitrogen fertilizers	N_2O	Economic, regulatory, research, information, planning	Implementation	MAA	na	na	na	na	na
Seed Planning and Sustainable Agriculture*	Supporting the selection of low-nitrogen plant cultivars and improving leguminous seed resources that use less nitrogen fertilizer	N_2O	Economic, information, research	Implementation	MAA	na	na	na	na	na
Common Agricultural Policy assistance schemes*	Encouraging agricultural practices that reduce nitrogen inputs	N_2O	Economic	Implementation	MAA	na	na	na	na	na
"Agr'Air" call for projects	Supporting pilot projects aiming to disseminate technologies and practices in the agricultural sector that contribute to reducing ammonia and/or fine particle emissions.	N_2O	Economic, information	Implementation	MAA	na	na	na	na	na
Biogas Energy for Nitrogen Autonomy Plan*	Improved nitrogen management, development of agricultural biogas in which livestock farming effluent is processed and renewable biogas is produced.	N_2O, CH_4, CO_2	Economic, regulatory, information, planning	Implementation	MAA	534[d]	1384	2234	3084	3934
Feed-in tariff for electricity produced by small and medium-sized biogas installations, call for tenders for larger installations*	Development of agricultural biogas to process livestock farming effluent and produce renewable biogas.	CH_4, CO_2	Economic	Implementation	MTES					
Farm Competitiveness and Adaptation Plan*	Investment support to encourage the following for livestock farming: covering slurry pits, effluent management; for arable farming: reducing the use of mineral-based fertilisers; for energy issues: supporting the acquisition of energy saving or renewable energy generating equipment (such as methane digesters); for agro-ecology: investments to support the development of leguminous crop cultivation and animal feed self-sufficiency	N_2O, CH_4, CO_2	Economic, information	Implementation	MAA					

Name[a]	Objective and/or Activity Affected	Green-house Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
Tariff reconstruction system	Supporting the production of renewable energy in rural areas by reducing the costs of connecting renewable energy production plants to gas or electricity networks	CO_2	Economic	Adopted	MTES	na	na	na	na	na
Agri-Environment and Climate Measures	Encouraging the development of agricultural practices that combine economic and environmental performance	N_2O, CH_4	Economic	Implemented	MAA	na	na	na	na	na
Agro-ecological Project	Encouraging a transition to new production systems with high economic, environmental and social performance	N_2O, CH_4, CO_2	Information, research, education	Implemented	MAA	na	na	na	na	na
"Learning to produce differently" plan*	Deployment of agricultural training to support a transition to new, more sustainable production systems	N_2O, CH_4, CO_2	Education	Implemented	MAA	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MAA: Ministry of Agriculture and Food; MTES: Ministry for Ecological and Inclusive Transition
c na: assessment not available
d Source: France 2017 report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 88-94)

B.6 Land Use, Land Use Change and Forestry (LULUCF)

In comparison with other sectors, the land use, land use change and forestry (LULUCF) sector is a net carbon sink: in 2015, overall absorption from the sector was -35.8 $MtCO_2e$, corresponding to 7.8% of national emissions outside the LULUCF sector. Forests alone represent a carbon sink of -53.2 $MtCO_2e$ (i.e. 11.6% of emissions).

The main effect of the measures set out in this section is to reduce CO_2 emissions or to contribute to carbon storage through CO_2 absorption. In general, the Law on the future of agriculture, food and forestry (LAAAF) described in section B.5 is now the reference text for guiding climate action in the forest and timber sector. In particular, Article 67 recognizes the overall benefit of "CO_2 sequestration by woodlands and forests and carbon storage in woodlands and forests, timber and products manufactured from timber, thus contributing to action against climate change". Other land categories, in particular cultivated land and grasslands, are also subject to several LAAAF agriculture provisions (see section B.5).

B.6.1 Provisions encouraging carbon storage in soils and biomass

The Common Agricultural Policy (CAP) includes various measures encouraging carbon storage in soils and biomass:

- **the natural handicap compensation** (NHC) scheme, by contributing extensively to maintaining extensive grassland areas, is a major factor in keeping and storing carbon in soils on cultivated land and grassland;
- it is conditional upon several **good agricultural and environmental conditions** (GAEC) and imposes several **statutory management requirements** (SMR) to encourage the return of organic matter to the soil, grasslands or environments that are favourable to diversity and hence better adapted, to the maximum extent possible;
- **support schemes interlinked with the first pillar**, aiming to provide support for leguminous crop production, may contribute to the storage of organic matter and maintaining soil fertility. The three greening components foster organic matter inputs, grasslands or woodland cover, which are beneficial for carbon storage and diversity, and represent a source of improved adaptation;
- under the second pillar, the **technical assistance section of the national risk management and technical assistance programme** (PNGRAT) is brought into play to improve knowledge of soils (regional soil repositories) and several measures under **regional rural development programs** (PDRR) combine to improve the carbon content of agricultural soils.

Improving the carbon content of agricultural soils also involves investment under certain schemes within the **farm competitiveness and adaptation plan** (PCAE) to counteract erosion and optimise organic fertilisation, which results in increased returns of organic matter to soils, more planting of perennial crops and increased plant cover on agricultural soils.

Measures to encourage agroforestry are also major factors in encouraging carbon storage, both in the soil and in plant biomass. The **agro-forestry development plan** initiated in 2016 involves five courses of action: i) enhancing knowledge, agro-forestry monitoring and research initiatives; ii) improving the regulatory and legal framework and increasing financial support; iii) developing training and consultancy, promoting agro-forestry and developing the use of its products; iv) increasing the economic returns from agro-forestry products and developing them on a local and regional level; and v) promoting European and international approaches.

Climate action on agricultural soils also involves **agri-environmental climate measures** (AECM). One of these, conversion to direct covered seeding (SOL_01), is now applied to agricultural soils for the explicit purpose of reducing tillage, introducing cover and diversifying crop rotations. Several types of operation

and agri-environmental climate measures referred to as “systems” were already combining to increase or keep organic matter in soils by maintaining and extensively managing grasslands and range lands, trees and hedges, leguminous crops and noteworthy environments or maintaining meadow orchards.

Organic agriculture also deserves a mention due to its almost exclusive use of organic fertilisers by means of practices that usually involve crop diversification and intermediate plant cover, and due to its enhanced use of grass in livestock farming and/or its increased trend towards agroforestry.

In certain cases (when biodiversity protection involves increased plant cover or plant cover around water abstraction points), the **Natura 2000 network and the framework water directive** lead to an increase in organic matter in soils and increased carbon stocks in plant biomass.

In addition, implementing **biofuel sustainability** criteria avoids the production of raw materials intended for biofuel production on some carbon-rich soils and in some biodiversity-rich areas in the European Union or in countries exporting to the European Union.

B.6.2 Forest carbon storage

French forests currently make a positive net overall contribution to climate change mitigation, with emissions (particularly originating from dead wood oxidation and forestry extraction operations) remaining lower than sequestration. The forest sink, taking into account managed forest sequestration minus forestry extraction, represented 56 Mt of CO_2 in 2015.

Among the different policies and measures that can be mentioned for contributing to the forest carbon sink, the three main measures are:

- the **forest investment tax incentive scheme** (DEFI) encouraging forest owners to adopt a sustainable management approach to their forests, including joining producers’ organisations by means of a higher tax credit rate, has been extended until 31 December 2017. The purpose is to improve forest management, leading to multiple benefits, in particular reducing the over-capitalisation of some forests, improved resistance to wind-throw and also the increased use of timber;
- establishment of the **forestry and insurance investment account** (CIFA) encouraging forest owners to take out insurance against wind-throw and to save money to finance preventive works and, if applicable, to clear and re-stock damaged forest stands. The purpose is to improve resistance to climate change and hence maintain forest sequestration.
- the **forest firefighting scheme** is established every year to protect forest populations and forest stands. Combating forest fires begins via the preventative mobilization of firefighting resources and accurate assessment of the fire risk on a daily basis.

In addition, a number of cross-cutting schemes aim both to improve forest management and increase the use of timber:

- The **National Forest and Timber Programme** (PNFB) under the LAAAF, approved by the Government Order of 8 February 2017, sets the national forestry policy priorities for the 2016-2026 decade. In particular, one of its objectives is to optimize forestry factors in order to adapt French forests to climate change, and contribute to mitigation by taking the complete carbon balance of the forestry and timber sector into consideration (carbon storage in above-ground and below-ground living biomass, dead biomass, forest soils and timber products and using wood to replace fossil fuel energy or competing materials). In particular, it sets the objective of an additional 12 Mm^3 of commercial timber use by 2026 compared to 2015 levels. **Regional forest and timber programs** (PRFB) are a regional application of the national forest and timber program, and are currently being developed by regional authorities. Regional forest and timber programs will be based on the structure of the multi-year regional forest development plans;

- the **timber sector strategic contract** was signed at the end of 2014 by the ministers in charge of forestry, the economy and industry, housing, environment and energy, by the chairman of the Association of French Regions and by the 28 professional organisations involved upstream and downstream in the sector. The activities carried out under this contract both by public authorities and professional organisations involve the management instruments required by the sector, financing and support for companies, development of employment and skills, technical and commercial innovation, ensuring secure supplies for the entire value chain and the contribution of the sector to the country's energy transition. In addition, companies in the timber sector benefit from a **"sawmill finance fund"** managed by Bpifrance, as well as from **timber sector equity loans** to finance the industrial modernisation of sawmills and forestry companies producing timber.

B.6.3 Developing timber as a material

Timber produced and used sustainably requires little energy for its production and stores carbon temporarily: in France it already stores about 2 $MtCO_2e$ annually and the development of these forms of use could increase this storage capacity. In addition, it can replace materials that generate greenhouse gases when manufactured (such as concrete, steel and aluminium for example).

Several schemes have been devised to encourage the development of timber as a material, particularly in the building industry. The **"bio-sourced buildings" label**, in operation since 2013, ensures improved visibility of new buildings that make the effort to make significant use of materials of plant and animal origin (timber, hemp, straw, wool, feathers, etc.). **The timber I and II plans (the timber III plan** was launched on 28 September 2017) contributed to removing the technical and regulatory obstacles to the use of timber in medium and high-rise buildings. The purpose of the **new French industry "High-rise timber buildings" plan** is to demonstrate the feasibility of high-rise timber construction in a highly specific manner through the construction of buildings, and subsequently to promote widespread use of the most suitable technical solutions. Finally, the **energy-positive building and carbon reduction (E+C-) label** (see section B.2) takes into account all emissions from a new building throughout its life cycle (including material manufacturing), which promotes the use of bio-sourced products.

In addition, **support for the Xylofutur and Fibres-Energivie clusters** encourages the development of timber products by facilitating the development of differentiated products that meet market requirements and by fostering competitiveness, performance and re-positioning timber sector companies in different areas.

B.6.4 Energy biomass development

Wood for energy can be harvested as a co-product of timber, in line with the hierarchy of uses. Using by-products from timber harvesting, sawmills and certain types of wood waste as a heat source can be financially and environmentally beneficial. More generally, the development of biomass recovery for energy reduces greenhouse gas emissions in different business sectors when it replaces energy from fossil fuels. A choice has been made to report energy biomass development measures in this section on forestry (rather than in the energy section), as these measures complement measures designed to ensure sustainable forest management. Public policy on forestry and timber aims to take upstream and downstream forestry activities into account in a complementary manner.

The **national biomass deployment strategy** (SNMB) and **regional biomass deployment schemes** (SRMB) were established under the Energy Transition for Green Growth act of August 2015. The SNMB sets priorities, recommendations and actions regarding biomass production and recovery lines for use in energy production, with the aim of increasing biomass production and deployment while also monitoring its use and contribution to climate change reduction. Regional biomass deployment schemes adapt the national biomass deployment strategy to regional circumstances.

With regard to heat production, the **heat fund** managed by ADEME since 2009 (see section B. 4.2) supports numerous biomass heating projects. Between 2009 and 2015, 723 biomass plants were supported with a total of €640 million in assistance, providing annual heat production of 1.4 Mtep. Moreover, two calls for expression of interest entitled **DYNAMIC wood** were initiated by ADEME in 2015 and 2016 to support innovative operational action, using additional wood to facilitate supplies to biomass heating systems financed under the heat fund and to improve forest stands.

Electricity generation from solid biomass is supported by **calls for tender** (see section B.4.1).

In addition, tax credit schemes for the energy transition (see section B.2), energy-saving certificates (see section B.4.2) and zero-interest eco-loans (see section B.2) support the development of wood use for energy among private individuals.

Table 4.6: Summary of policies and measures in the land use, forestry and timber sector

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
Common Agricultural Policy measures promoting carbon storage*	Carbon storage in soils and biomass	CO_2	Economic, information	Implementation	MAA	na	na	na	na	na
Farm Competitiveness and Adaptation Plan*	Carbon storage in soils and biomass	CO_2	Economic	Implementation	MAA	na	na	na	na	na
Agro-forestry Development Plan*	Carbon storage in soils and biomass	CO_2	Research, regulations, economic and education	Implementation	MAA	na	na	na	na	na
Agri-Environmental and Climate Measures (AECM)*	Carbon storage in soils	CO_2	Economic	Implementation	MAA	na	na	na	na	na
Tax incentive scheme for forestry investments*	Improving forest management	CO_2	Tax	Implementation	MAA, Ministry of Finance	na	na	na	na	na
Forestry and Insurance Investment Account*	Improving the resistance of forests to climate change and maintaining forest sequestration.	CO_2	Economic	Implementation	MAA, Ministry of Finance	na	na	na	na	na
Multi-year regional forestry development plans*	Improving forest management and fostering the use of timber	CO_2	Planning	Implementation	MAA	na	na	na	na	na
National Forest and Timber Program and regional Forest and Timber Programs	Improving forest management and fostering the use of timber	CO_2	Planning	Adopted	MAA	na	na	na	na	na
Timber sector strategic contract*	Supporting the timber sector upstream and downstream	CO_2	Economic, planning, economic, information, voluntary commitment	Implementation	MAA	na	na	na	na	na
Sawmill finance fund, timber sector equity loans*	Supporting the timber sector	CO_2	Economic	Implementation	Bpifrance	na	na	na	na	na
Support schemes for timber use in the construction industry*	Fostering the use of timber in the construction industry	CO_2	Information, regulation	Implementation	MTES, MCT	na	na	na	na	na
Xylofutur and Fibres-Energivie competitiveness clusters*	Fostering the development of timber products	CO_2	Economic	Implementation	MAA	na	na	na	na	na
National Biomass Deployment Strategy (SNMB) and Regional Biomass Deployment Schemes	Fostering biomass production and deployment	CO_2	Planning	Planned	MAA	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MAA: Ministry of Agriculture and Food; MTES: Ministry for Ecological and Inclusive Transition; MCT: Ministry for Territorial Cohesion
c na: assessment not available

B.7 Waste treatment

In 2015 this sector accounted for 3.8% of French greenhouse gas emissions. Landfill accounted for 72.4% of waste treatment emissions; wastewater treatment accounted for 15.3% and incineration generated 9.1%. Methane from landfills and wastewater treatment is the main greenhouse gas emitted by this sector (86.4% of emissions), followed by CO_2 from waste incineration (8.8%) and N_2O from wastewater treatment (4.8%).

B.7.1 Measures to reduce CH4 and CO_2 emissions from the waste sector

Preventing waste production is set as a waste management priority in the Environment Code. Preventing waste production not only avoids the environmental impacts related to waste treatment, it also avoids environmental impacts from the upstream phases of the product life-cycle: natural resource extraction, production of goods, services, distribution and usage. Several recent measures have been introduced to reduce waste production:

- **single-use plastic bags have been banned** since 1 January 2016;
- **counteracting food waste** has been set as a national priority with the objective of reducing losses and waste by half by 2025. The following measures have been taken: major food retailers now have an obligation to offer agreements to authorised charitable organisations to donate unsold food products. Retailers are prohibited from deliberately making unsold food products unfit for consumption. The State, public bodies and local authorities are obliged to set up a system to combat food waste in the canteens and catering services they manage.
- in the energy transition and green growth act of 17 August 2015, planned obsolescence is defined as “all techniques through which a marketer deliberately aims to reduce the life cycle of a product in order to increase its rate of replacement.” The law recognizes **planned obsolescence as an offense**, punishable by two years of imprisonment and a fine of €300,000; the amount of the fine may be extended to 5% of the retailer’s average annual turnover.

After waste prevention, the waste treatment hierarchy in French law (in accordance with European waste directive 2008/98/EC) is as follows: re-use, recycling and other forms of recovery of the material, energy recovery and disposal (incineration without energy recovery and landfill).

Extended producer responsibility (EPR) sectors are schemes to organize waste prevention and management for certain types of products. These schemes are based on the principle of extended producer responsibility, according to which producers, i.e. the parties responsible for marketing certain products, are made responsible for financing or organising the management of waste arising from these products at the end of their life. France currently has 15 sectors which are subject to this principle, which was introduced gradually between 1992 and 2016. This kind of scheme allows producers to include waste management costs in the price of the product, and encourages product eco-design to reduce waste.

Immediately after waste reduction and prevention procedures, sorting waste at the source is a highly important step in routing the waste to an appropriate processing sector, and increasing the amounts of recovered waste. The energy transition for green growth act contains provisions related to waste sorting:

- since 1 July 2016 there has been an **obligation to sort waste** (paper, cardboard, plastic, metals, wood, and glass) **produced by the economic activities** of companies and administrative bodies, for the purposes of material and energy recovery;
- **universal sorting of household organic waste at source** by 2025: each French national will have a kitchen waste sorting solution for waste recovery purposes. The bio-waste sorting obligation has already applied to major organic waste producers since 2010;

- deployment of **price incentives for the collection of household and similar waste**, i.e. introducing a variable component into the household waste collection charge to reward 'good sorters' (target: 15 million inhabitants covered by 2020, 25 million by 2025 compared to 5 million in 2015);
- **extending the system for sorting household packaging** to all plastic packaging by 2022, including plastic film and trays (to date, only plastic bottles and jars had to be sorted);
- **gradual standardization of sorting procedures and bin colouring** by 2025: this will make it easier to identify the appropriate container or bin anywhere in France;
- introduction of a **building and public works industry network of business waste collection points** as of 1 January 2017, imposing a responsibility on building materials distributors to take back pre-sorted waste from their clients.

To avoid waste disposal, a tax incentive was introduced a few years ago. The **waste component of the general tax on polluting activities** (TGAP) is payable by all landfill (storage facility) operators or incinerator (waste heat treatment facility) operators subject to authorisation. The charge becomes payable when the facility operator receives the waste. The TGAP waste charge rate has gradually increased since 2009, in order to financially undercut these processing methods so as to limit their use and encourage the prevention of waste production and the development of recycling, in accordance with the hierarchy of waste treatment methods. The 2016 amended finance act established a trajectory until 2025 for the charges applicable to storage of non-hazardous waste (increasing from €40/t in €2017 to €48/t in 2025). In addition, the TGAP non-hazardous waste charge is modulated according to environmental and energy landfill and incinerator criteria, in order to encourage the operation of facilities with a higher level of environmental and recovery performance.

In addition, financial schemes have been introduced to support the waste prevention and management policy:

- one of the aims of the **ADEME waste fund** is to support all operations that contribute to implementing the waste policy and the circular economy. The waste fund is financed from receipts from the TGAP waste charge. The amount of this fund (€193 million in 2016) enables ADEME to offer support for most operations contributing to this policy, according to procedures that depend on the nature of the operations (studies, coordination, awareness raising, investments, etc.) and their objective (waste prevention, recycling, recovery, etc.). In 2016, priority actions involved: the sorting of biowaste at source by households and companies, preventing waste production from economic activities, waste sorting and incentive-based pricing of the public waste management service.
- the **"Zero waste, zero wastage by local authorities" call for projects**, initiated by the Ministry of the Environment and implemented by ADEME, aims to identify and support local authorities committed to preventing, reusing and recycling their waste. Local authorities are invited to implement a local programme for preventing domestic and similar waste, including measures for reducing the amounts of waste produced (for example combating food wastage in institutional and corporate catering services, public awareness campaigns, trialling information campaigns for the re-use of certain packages or products, repair shops), improving waste collection and sorting (e.g. improved organic waste sorting at source and setting up separate collection of organic waste and/or nearby composting, deploying incentive-based pricing for domestic waste removal), supporting companies in setting up business waste sorting, and a public procurement policy for the circular economy. A total of 153 local authorities have been designated to receive funding over the course of two successive calls for projects (58 local authorities at the end of 2014 and 95 local authorities at the end of 2015). These local authorities represent a total of 33.7 million inhabitants.

Table 4.7: Summary of policies and measures in the waste treatment sector

Name[a]	Objective and/or Activity Affected	Green-house Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
Ban on single-use plastic bags*	Preventing Waste	CO_2, CH_4	Regulations	Implementation	MTES	na	na	na	na	na
Preventing food waste*	Preventing Waste	CO_2, CH_4	Regulations	Implementation	MTES	na	na	na	na	na
Penalizing planned obsolescence*	Preventing Waste	CO_2, CH_4	Regulations	Implementation	MTES	na	na	na	na	na
Sectors with extended producer responsibility*	Waste prevention and management (recycling)	CO_2, CH_4	Regulations, economic	Implementation	MTES	na	na	na	na	na
Requirement to sort waste from the economic activities of companies and administrative bodies*	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Implementation	MTES	0[d]	1800	3600	4000	4200
Obligation on major producers to sort organic waste*	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Implementation	MTES	na	na	na	na	na
Universal sorting of household organic waste by 2025	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Adopted	MTES	na	na	na	na	na
Price incentives for the collection of household waste	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Economic	Adopted	MTES	na	na	na	na	na
Extending the system for sorting household packaging to all plastic packaging by 2022	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Adopted	MTES	na	na	na	na	na
Gradual standardization of sorting procedures and bin colouring by 2025	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Adopted	MTES	na	na	na	na	na
Establishing a building and public works industry network of professional waste collection points*	Encouraging sorting to increase the quantities of recovered waste	CO_2, CH_4	Regulations	Implementation	MTES	na	na	na	na	na
Waste component of the general tax on polluting activities*	Limiting waste disposal, encouraging waste prevention and recycling, improving the performance of landfill sites and incinerators	CO_2, CH_4	Tax	Implementation	MTES	na	na	na	na	na
Waste fund*	Supporting waste prevention, recycling and recovery	CO_2, CH_4	Economic	Implementation	ADEME	na	na	na	na	na
"Zero waste, zero wastage local authorities" calls for projects*	Fostering local authority initiatives to encourage waste prevention, re-use and recycling	CO_2, CH_4	Economic	Implementation	MTES, ADEME, local authorities	na	na	na	na	na

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry of the Ecological and Inclusive Transition; ADEME: Environment and Energy Management Agency
c na: assessment not available
d Source: France's 2017 report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 95-101)

B.8 Cross-cutting policies and measures

B.8.1 Policies and measures affecting all sectors

Policies and measures affecting all sectors ('cross-cutting') are those which apply to both companies and local authorities. They also affect all greenhouse gases.

Compiling a greenhouse gas emissions report and an action plan to reduce them has been obligatory since 2012 for companies with over 500 employees, local authorities with over 50,000 inhabitants, public bodies employing over 250 staff and government departments. The report and action plan must be compiled every three years for local authorities and public bodies, and every four years for companies. A greenhouse gas emissions report provides a detailed account of the emissions produced by an organisation (public or private). These reports are produced to identify and implement the measures required to reduce emissions. Regulations require direct and indirect energy-related (scopes 1 and 2) emissions to be calculated, and encourage calculation of other indirect emissions (scope 3). Methodological guidelines for producing the report are available to organisations free of charge. In addition, an Internet platform for publishing reports was set up in 2015 to facilitate the publication and dissemination of this information among the public.

The requirements of companies to meet social, environmental and corporate responsibility criteria have been increased by the Energy Transition for Green Growth act of August 2015 with regard to **climate change reporting obligations**. As of the financial year ending on 31 December 2016, large companies must include information in their non-financial reports on their significant sources of greenhouse gas emissions due to their activities, particularly through the use of the goods and services they produce. The concept of significant sources of emissions was chosen to make companies take stock of the impacts of their activities on climate change, irrespective of whether the emissions are direct or indirect, particularly those generated by the use of the goods and services the company produces. This obligation therefore extends beyond the regulation regarding greenhouse gas emission reports.

The same law also supplemented the regulatory system with regard to information provided by portfolio management companies about the environmental, social and governance (ESG) criteria applied in their investment policies. As of the financial year ending on 31 December 2016, **institutional investors must therefore publish information on their contribution to climate change targets and the financial risks associated with the energy and ecological transition**.

The climate activities of local authorities are structured around local and regional planning instruments: **Regional Planning, Sustainable Development and Inter-Regional Equality Schemes** (SRADDET) on a regional level and **Territorial Climate-Air-Energy Plans** (PCAET) for inter-municipality groupings of more than 20,000 inhabitants (see section A.1. Institutional foundations).

Finally, in 2015 the Ministry of the Environment supported efforts by local authorities in their energy and ecological transition through the **"Positive energy for green growth" call for projects**. The local authorities selected received €500,000 in subsidies to support their energy transition initiatives (reducing energy consumption, clean transport development, renewable energy development, preventing and reducing waste, public awareness raising, etc.)

B.8.2 Cross-cutting policies and measures regarding fluorinated gases

European regulation N° 517/2014 (referred to as "F-Gas II") establishes a set of provisions to limit fluorinated gas emissions from refrigeration and air conditioning equipment used in buildings, industry and refrigerated transport. In effect since 1 January 2015, this law supersedes regulation N° 842/2006 (referred to as "F-Gas"). The regulation is based on the following measures:

- strengthening legal requirements for equipment containment (air tightness checks, repair obligations), certification for persons handling HFCs and an obligation to recover hazardous gases during maintenance and dismantling of equipment;
- implementation of a mechanism to gradually reduce the quantities of HFCs placed on the market from 2015 to 2030 via a quota system. In 2030, the total quantity of HFCs placed on the market in CO_2 equivalent terms must equal 21% of the average levels observed between 2009 and 2012;
- sector-wide bans on the sale of products and equipment containing fluorinated gases above a certain GWP level;
- a ban on the maintenance of refrigeration units using new fluids with a GWP (Global Warming Potential) rating of more than 2500 as of 1 January 2020.

Table 4.8: Summary of cross-cutting policies and measures

Name[a]	Objective and/or Activity Affected	Greenhouse Gases Affected	Instrument	Status	Responsible entity[b]	Estimated emissions reductions for a given year ($ktCO_2éq.$)[c]				
						2015	2020	2025	2030	2035
Greenhouse gas emissions report and action plan for emissions reductions for companies, local authorities, government departments and public bodies*	Improving information from companies on their greenhouse gas emissions and encouraging them to introduce actions to reduce them	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Regulation, information	Implemented	MTES, ADEME	na	na	na	na	na
Obligatory climate change reporting by large companies*	Improving information from companies on their direct and indirect greenhouse gas emissions and encouraging them to introduce actions to reduce them	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Regulation, information	Implemented	Ministry for the Economy, MTES	na	na	na	na	na
Obligatory climate change reporting for investors*	Improving information from investors on the carbon footprint of their investments and encouraging them to reduce the carbon intensity of their portfolio	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Regulation, information	Implemented	Ministry for the Economy, MTES	na	na	na	na	na
Regional Planning, Sustainable Development and Inter-Regional Equality Schemes*	Setting strategic priorities and medium and long-term objectives in the region, particularly in terms of climate change mitigation, managing energy consumption and developing renewable energy sources	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Planning	Implemented	MTES, Regions	na	na	na	na	na
Territorial Climate-Air-Energy Plans*	Improving information from regional authorities and municipalities about their greenhouse gas emissions, establishing a strategy and calculated objectives; an emissions reduction action programme; and a monitoring and evaluation system	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Information, planning	Implemented	Local authorities	na	na	na	na	na
Calls for projects: "Energy-Positive Regions for Green Growth"*	Encouraging municipalities to introduce actions to reduce their emissions, to manage their energy consumption and to develop renewable energy sources	CO_2; CH_4; N_2O; HFC; PFC; SF_6; NF_3	Economic	Implemented	MTES, local authorities	na	na	na	na	na
European Regulation N° 517/2014 (F-Gas II)*	Limiting fluorinated gas emissions from refrigeration and air conditioning equipment	HFC, PFC, SF_6	Regulations	Implementation	MTES	0[f]	653	3455	5404	6885

a An asterisk (*) means that the measure is included in the "with existing measures" scenario
b MTES: Ministry of the Ecological and Inclusive Transition; ADEME: Environment and Energy Management Agency
c na: assessment not available
d Source: France's 2017 report in accordance with Article 13.1 of Regulation N° 525/2013 (pages 79-84)

C. LONG-TERM EFFECTS OF THE POLICIES AND MEASURES UNDERTAKEN

Greenhouse gas emissions have been reduced by 16.4% between 1990 and 2015 (within the scope of the Kyoto protocol, not including LULUCF). Over the same period, the population has increased by 14.6% and GDP by 106.0%. Among developed countries, France's per capita emissions are currently among the lowest in the world. This reflects the efforts to reduce the carbon intensity of the economy already undertaken in France, which will be further extended by 2030 and 2050. However, it also reflects the French economy's shift towards the service sector, with a corresponding loss of industrial sites.

The policies and measures applied have already led to:

- use being made of the major potential for energy savings, reversing the trend towards higher consumption;
- developing renewable energy sources;
- introducing a carbon price signal in energy taxation;
- introducing public policies in all business sectors targeting the various key areas for climate change mitigation;
- raising public awareness of climate change mitigation issues.

In addition, most of France's budget expenditure on combating climate is earmarked for long-term objectives. This expenditure concerns research and transport infrastructures in modes with the lowest greenhouse gas emissions. This is also the case for tax expenditure, most of which is to be used for supporting housing renovation. Finally, this also applies to regulatory action which requires investments to involve major energy savings throughout their life cycle. This is particularly the case for thermal regulation in buildings, which was particularly strengthened with the 2012 thermal regulation (RT) and which will result in the widespread appearance of positive-energy buildings, with low carbon footprints throughout their life cycle, in the next few years. In the longer term, financing for research and development is likely to exert the greatest impact. Support for the emergence of green sectors is an essential factor in responding to the challenge of energy transition. It is the only factor that can respond to the scale of the climate change challenge in terms of managing energy consumption and, more generally, lower-emission energy-saving lifestyles and production modes.

As detailed above, France has set a long-term target (reducing its greenhouse gas emissions by 75% between 1990 and 2050) and has adopted a national low-carbon strategy. To ensure overall consistency, this strategy sets out the steps to be taken to implement the greenhouse gas emissions mitigation policy in the medium and long term. It puts forward a structured and ongoing approach to reduce the carbon intensity of various sectors by 2050. In this way, the strategy helps to ensure that long-term effects are taken into account when prioritising measures to be implemented.

D. POLICIES AND MEASURES IMPLEMENTED IN ACCORDANCE WITH ARTICLE 2 OF THE KYOTO PROTOCOL

D.1 Policies and measures concerning international bunker fuels (article 2.2)

France supports the work of the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO) to introduce a global mechanism to reduce emissions from international air and sea transport.

As described in section B.1 on policies and measures affecting international transport emissions, the European Union has integrated air transport activities into the European emissions trading scheme (Directive 2008/101/EC) and has introduced a monitoring, reporting and verification (MRV) system for CO_2 emissions from shipping (Regulation N° 757/2015).

Initially the European emissions trading scheme was set to integrate emissions from all flights to and from the European Economic Area (EEA). In 2013, in order to obtain an International Civil Aviation Organisation agreement more easily, the EU agreed to limit the scope of the European system only to flights inside the European Economic Area until 2016 (a decision referred to as" Stop the clock"). The adoption, in October 2016, of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) by the Assembly of the ICAO led the EU to offer to extend the "Stop the clock" decision beyond 2016, until at least 2020. After 2020, the aviation component of the European emissions trading scheme will need to be developed so as to take into account the EU 2030 climate targets and the ability of CORSIA to meet all or part of these targets. In addition, France, along with all EU member states, will take part in CORSIA from its initial phase between 2021 - 2026 (voluntary implementation phase).

With regard to marine transport, following the adoption of a global data collection system by the IMO in 2016, the European Commission decided to review the situation in order to align the EU Monitoring, Reporting and Verification mechanism with the IMO data collection system in accordance with Article 22 of Regulation N° 757/2015, stipulating that: "In the event that an international agreement on a global monitoring, reporting and verification system for greenhouse gas emissions or on global measures to reduce greenhouse gas emissions [from maritime transport] is reached, the Commission shall review this Regulation and shall, if appropriate, propose amendments to this Regulation in order to ensure alignment with that international agreement." In September 2017 it initiated a public consultation process on the policy review on the monitoring, reporting and verification of CO_2 emissions from maritime transport. It may submit a legislative proposal to amend the EU monitoring, reporting and verification system in 2018.

D.2 Minimising the adverse effects on developing countries of the implemented policies and measures (Article 2.3)

In addition to technology and expertise transfers, France helps developing countries to strengthen and expand their climate change observation systems via its climate observation network and also though its research and cooperation projects (see chapter VIII).

Regarding the policies and measures implemented in the context of European policies, as a Member State of the European Union France is obliged to transpose European law into its legal system. Within the adoption process for European policies, Europe has introduced a system to estimate their positive and negative impact, including the effects on other countries by way of impact studies. Taking these impact studies into account is a key element in the final decision for establishing policies and measures. They ensure that the negative impacts of European policies on developing countries are minimized, thus ensuring that French legal provisions taken from European law comply with the commitments made under

the Kyoto Protocol in accordance with its Article 3.14. All these impact studies are published at http://ec.europa.eu/transparency/regdoc/?fuseaction=ia.

The table below sets out the estimated direct and indirect effects of certain French climate policies and measures.

Table 4.9: Direct and indirect effects on developing countries of France's main climate policies and measures

	Direct Effects			Indirect Effects		
Measure	**Social**	**Environmental**	**Economic**	**Social**	**Environmental**	**Economic**
European emissions trading scheme			Potentially positive economic effect on countries outside the European Union in the case of competitiveness differences brought about by introducing a carbon price signal on European economic activity		Incentives for international firms subject to quotas to develop more efficient processes from an environmental viewpoint that are potentially transferable to developing countries	
Developing biofuels	Positive impact of maintaining or potentially creating jobs in biofuel exporting developing countries	Positive effect on condition that sustainability criteria are put in place especially as regards the issue of land use change	Positive effect on biofuel imports sourced from developing countries		Negative impact on deforestation and food resources. Setting up sustainability criteria for biofuels by means of agreements between the European Commission and developing countries	Effect of decreasing demand on fossil energies and potentially reduced price sensitivity
Promoting energy efficiency	Positive impact of maintaining or potentially creating jobs in developing countries that export energy efficiency generating equipment		Positive effect on imports from developing countries for energy efficiency generating equipment		Improving air quality in developing countries Developing more energy efficient equipment that is potentially transferable to developing countries	Effect of decreasing demand on fossil energies and potentially reduced price sensitivity
Promoting renewable energies	Positive impact of maintaining or potentially creating jobs in developing countries that export renewable energy generating equipment		Positive effect on imports from developing countries for renewable energy generating equipment		Improving air quality in developing countries Developing renewable energy generating equipment that is potentially transferable to developing countries	Effect of decreasing demand on fossil energies and potentially reduced price sensitivity
Measures to foster low greenhouse gas emitting vehicles	Positive impact of maintaining or potentially creating jobs in exporting developing countries		Fostering imports of low greenhouse gas emitting vehicles from developing countries		Improving air quality in developing countries	Increasing demand for raw materials and potentially increased price sensitivity
					Developing low emissions vehicles that are potentially transferable to developing countries	Effect of decreasing demand on fossil energies and potentially reduced price sensitivity

E. NATIONAL AND REGIONAL PROGRAMS, LEGISLATIVE ARRANGEMENTS AND LEGALLY BINDING AND ADMINISTRATIVE PROCEDURES TO MEET THE REQUIREMENTS OF THE KYOTO PROTOCOL

E.1 Description of national and regional forms of institutional organisation to meet Kyoto Protocol commitments

The National Low Carbon Strategy described in detail in section A.2 (The foundations of climate policy) is the framework for meeting France's commitments under the Kyoto Protocol. As previously mentioned, meeting greenhouse gas emissions reduction targets is organised on the basis of carbon budgets established in the National Low Carbon Strategy. Carbon budgets are greenhouse gas emissions caps that must not be exceeded at national level over five-year periods.

The system for regularly revising the National Low Carbon Strategy and monitoring its implementation (see section A.2) allows France to assess its position in relation to its targets and to introduce any required adjustments to sectoral and regional/municipal policies if the situation is found to diverge from the reference trajectory.

At the regional and local level, local authorities take action on the basis of local and regional planning instruments developed in accordance with the national priorities established in the National Low Carbon Strategy: Regional Planning, Sustainable Development and Inter-Regional Equality Schemes (SRADDET) at a regional level, and Territorial Climate-Air-Energy Plans (PCAET) for inter-municipality groupings of more than 20,000 inhabitants (see section A.1. Institutional foundations).

E.2 Description of efforts to publicize these actions

All information about the National Low Carbon Strategy is published on the MTES website: https://www.ecologique-solidaire.gouv.fr/strategie-nationale-bas-carbone#. In addition, civil society is involved both in drafting and in implementing the National Low Carbon Strategy.

The National Low Carbon Strategy is based on a reference scenario developed over the course of the future trends data modelling exercise carried out between September 2014 and August 2015. This scenario and the National Low Carbon Strategy recommendations were developed together with representatives of civil society, working in close collaboration with the organisations represented in the National Council for Ecological Transition (which includes representatives of employees and employers, consumers, environmental NGOs, local and regional authorities and members of Parliament).

Following this work, a public online consultation process was organised for the draft decree, establishing the National Low Carbon Strategy and setting the first three carbon budgets. A total of 46 replies were received, including 26 from organisations and 20 from private individuals. The suggestions gathered from the public consultation were taken into account as much as possible in the drafting process.

In addition to its involvement in developing the National Low Carbon Strategy, civil society is also involved in monitoring its implementation. As mentioned in section A.2., a group of almost 150 indicators has been defined, in relation to which the policies and measures envisaged in the strategy are assessed, monitored and applied. These monitoring indicators are presented on a biennial basis to the stakeholders involved in preparing the strategy, thereby allowing them to take part in its monitoring. At the end of this biennial review, the results of the indicator monitoring are published on the MTES website.

The process of revising the National Low Carbon Strategy initiated in 2017 will involve the public by way of prior consultation. This prior consultation will include an online questionnaire on the National Low

Carbon Strategy for the public to suggest strategic priorities. A second, more interactive consultation phase will be launched in the 1st quarter of 2018, with procedures that are yet to be established (e.g. an online participatory platform for citizens to express their views on more targeted questions, or a face-to-face public conference with the participation of a panel of citizens to draft a citizens' opinion).

On a regional and local level, civil society representatives are involved in drafting SRADDETs and PCAETs, which are also subject to public consultation. These planning documents also schedule actions to raise public awareness in their region or municipality. ADEME coordinates a documented PCAET resource centre (http://www.territoires-climat.ademe.fr); adopted plans and the interim PCAET implementation reports are published here.

E.3 Description of the institutional arrangements introduced to coordinate participation in the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol

The role of the Carbon Markets office at the Directorate General for Energy and Climate at the Ministry of the Ecological and Inclusive Transition is to draft and put forward the strategy for managing the carbon assets of the State, and to intervene in the carbon markets in the event of a purchase or transfer of emissions rights or quotas. It has the additional role of strengthening the consistency of administrative actions, by grouping together the State's main areas of responsibility regarding of carbon markets: reforming the operation of the European emissions trading scheme, defining the French position on the interconnection of carbon markets in the post-Kyoto framework, and managing the approval procedure for project-based mechanisms (Clean Development Mechanism (CDM) and Joint Implementation (JI) Mechanism, particularly in its "domestic" component).

By ratifying the Kyoto Protocol and agreements subsequent to implementation of the Protocol (particularly those signed in Marrakesh in 2001), France has opted to contribute its support to the introduction and development of innovative finance instruments of which the Protocol's project-based mechanisms are made up.

Through Decree N° 2006-622 of 29 May 2006, the Order of 2 March 2007 and the Order of 27 December 2012, France has established a legal framework and the necessary procedures required to implement CDM projects (Article 12 of the Kyoto Protocol) and JI projects (Article 6 of the Kyoto Protocol), including within the country (the so-called "domestic projects" system). On an institutional level, the carbon markets office fulfils the roles of Designated National Authority (DNA) for CDM and the Designated Focal Point (DFP) for JI.

The Ministry of Ecology notifies the project developer of the administration's decision in the form of an official Letter of Approval (LoA) within one month of receipt of the full documentation with regard to projects implemented outside the country, and within six months for projects taking place in France.

Practical guidelines were drafted and disseminated in November 2008[47] under the aegis of the Ministry in charge of the environment, the Ministry of the Economy and the French Global Environmental Facility (FGEF) to assist project developers in better understanding the flexible mechanisms under the Protocol and dealing with the underlying legal and institutional mechanisms.

The websites of the MTES[48] and of the United Nations Framework Convention on Climate Change (UNFCCC)[49] provide detailed information on the methods and projects approved under the "Domestic projects" system.

[47] https://www.ecologique-solidaire.gouv.fr/sites/default/files/R%C3%A9aliser%20un%20projet%20MDP%20ou%20MOC.pdf
[48] https://www.ecologique-solidaire.gouv.fr/mecanismes-internationaux-et-nationaux-reduction-des-emissions
[49] http://ji.unfccc.int/JI_Projects/ProjectInfo.html (select "France" and tick "Track 1")

E.4 Biodiversity and implementation of policies and measures under Articles 3.3 and 3.4 of the Kyoto Protocol

Biodiversity conservation within the day-to-day management of publicly owned forests is subject to a variety of arrangements. In 2004 the State established a National Biodiversity Strategy (NBS 2004-2010) in the form of action plans, including one dedicated to forestry which was approved in September 2006. The National Biodiversity Strategy was revised in 2010 for the 2011-2020 period (NBS 2011-2020).

In 2006, the National Forestry Office (ONF) adopted its environmental policy, of which biodiversity is one of the strategic areas of focus. This priority was confirmed in the contract between the State and the National Forestry Office for the 2007 - 2011 period. In line with the 2016-2020 targets and performance contracts between the State, the National Forestry Office and the National Federation of Forest Communities, the National Forestry Office has initiated and is carrying out action on a voluntary basis, via partnerships and by setting examples for taking biodiversity into account in sustainable multi-functional management of publicly-owned French forests (4.7 million hectares in mainland France and almost 6 million ha in overseas territories).

Law N° 2009-967of 3 August 2009 on an implantation schedule for the Grenelle Environment Forum (Articles 29 and 20) supplemented the regulatory provisions establishing national forestry policy, specifying that “ordinary and notable forest diversity must be conserved and valued under more dynamic management of the timber sector and with a view to counteracting climate change,” and that the State undertakes in particular “to protect forests and biodiversity under community and international plans as one of the pillars of the international framework of action to combat climate change”.

In 2009, the National Forestry Office published a circular establishing the procedures for implementing biodiversity conservation in the everyday multi-functional management of publicly owned forests. Moreover, these forests are home to notable habitats and species which justify the establishment of biological reserves or reservations supported by a national action plan. The National Forestry Office plays an active role in these policies.

The Biodiversity, Nature and Landscape Recovery Act of 9 August 2016 strengthened and renewed public policies to strengthen biodiversity. It establishes the principle of non-regression of environmental protection. Under this principle, any future change in legislation can only result in constant improvements in environmental protection.

This law also establishes the French Agency for Biodiversity (AFB). This new entity, in operation since 1 January 2017, brings together four pre-existing bodies: the National Office for Water and Aquatic Environments (ONEMA), the Technical Workshop for Natural Areas, the Marine Protected Areas Agency and the French National Parks. This is a unique expertise and management instrument, which exists for the purposes of strengthening knowledge, research and training in the field of biodiversity. With 1200 personnel working for the organisations it contains, the Agency has a budget of €226 million. The French Agency for Biodiversity is the second-largest state environmental operator after the Environment and Energy Management Agency (ADEME).

Chapter V

Projecting Greenhouse Gas Emissions and Quantifying the Impact of Policies and Measures

A. GREENHOUSE GAS EMISSION PROJECTIONS

A.1 Identification of scenarios: updating the scenario with existing measures

Between April 2016 and February 2017, France carried out a scenario-based projection exercise for the period until 2035. A “with existing measures” or WEM scenario taking into account all policies and measures adopted and implemented before 1 July 2016 was developed. This scenario updates the 2014 WEM scenario, including all policies and measures adopted and implemented between 1 July 2014 and 1 July 2016. In particular this scenario includes measures adopted under the energy transition act of August 2015.

All of the policies and measures presented in Chapter 4 and marked with an asterisk (*) have been integrated. In addition to the description of the measures, additional information on the WEM scenario in 2020 and 2030 is provided below for the main sectors:

A.1.1 Carbon tax (transversal)

For non-ETS sectors, the WEM scenario includes a carbon component on domestic energy consumption taxes with a value of €7 /tCO_2 in 2014, €14.5 /tCO_2 in 2015, €22 /tCO_2 in 2016, €30.5 /tCO_2 in 2017, €39 /tCO_2 in 2018, €47.5 /tCO_2 in 2019, €56 /tCO_2 in 2020 then a linear growth until €100 /tCO_2.

A.1.2 Energy saving certificates (transversal)

The energy saving certificates scheme has been extended until 2020, beyond which it will be discontinued.

A.1.3 Renewable energies

The heat fund has been extended until 2020 beyond which it will be discontinued. Biofuels are incorporated up to 7% for gasoline and diesel until 2022, and up to 9% beyond. Electric renewable energies are expected to grow at the current rate.

A.1.4 Transport

The WEM scenario takes into account the strengthening of the measures for the deployment of electric vehicles arising under the Energy Transition for Green Growth Act of 2015. The share of electric vehicles in registrations should thus increase from 1.1% in 2015 to 3.2% in 2020 and 12.1% in 2030. The share of plug-in hybrid vehicles should go from 0.4% in 2015 to 1.1% in 2020 and 4% in 2030.

With regard to thermal vehicles, the WEM scenario forecasts a significant increase in the performance of passenger cars and light commercial vehicles by 2020 thanks to the implementation of the European regulation on CO_2 emissions from new vehicles (EU Regulation No. 443/2009) and the maintenance of the bonus-malus at the national level. The theoretical target of 95 gCO_2/km should reach 95% by 2020, but a gap between actual emissions and emissions measured in the laboratory has been taken into account. As a result, unit consumption of new private passenger cars fell by 9% between 2015 and 2020. Beyond 2020, the average emissions of new private passenger cars should be almost stable (the average consumption in 2030 is expected to be 5.0 l/100 km for gasoline vehicles and 4.4 l/100 km for diesel vehicles).

In the WEM scenario, passenger traffic for all land modes increases by 10% between 2015 and 2030. The increase in traffic is 7% for private passenger cars, 22% for rail and 23% for urban public transport. The commissioning of four high-speed rail lines (already mentioned in the previous WEM) and new public transport infrastructure (metros, trams and bus rapid transit) contribute to the development of public transport.

Freight traffic in tonnes-km is expected to increase by 27% between 2015 and 2030 after falling by 18% between 2007 and 2015 due to the economic crisis. This recovery is due to economic growth and catching up in the years of crisis. If the tonne-km transported by road evolves at the same rate as the total growth, the increase in heavy goods vehicle traffic is contained at 17% over the period thanks to the improvement of their loading rate. The energy consumption of heavy goods vehicles is also improving by 10% over the period. The tonne-kms transported by rail transport increases by 24% for rail and by 17% for river.

A.1.5 Building sector

New buildings (residential and tertiary) all comply with the 2012 thermal regulations (the "RT 2012") from 2013 and over the entire projection period. The energy-positive building and carbon reduction label is taken into account but has little impact given its optional nature covering only a limited number of buildings.

Regarding the thermal renovation of dwellings, the tax credit and subsidies for the energy efficient renovation of disadvantaged households are extended until the end of 2017. The eco-PTZ (subsidised loans for individuals) has been extended until the end of 2018. The Eco-PLS (subsidised loan for renovating social housing) is being applied at the current rate until 2020. The measures adopted since the previous WEM (energy renovation obligations during major works and individualisation of heating costs) have been taken into account.

As regards the energy renovation of the tertiary sector, the scenario takes into account the implementation of the European Energy Efficiency Directive for the renovation of State buildings as well as the measures for energy renovation obligations during major works (adopted since the previous WEM).

A.1.6 Industry

Industrial production is growing in line with the macroeconomic framework (average annual growth rate of industrial value added). A general trend of improvement in the energy efficiency of the processes supported by energy audit obligations and energy saving certificates is nonetheless represented, which offsets the first effect and leads to an energy consumption of the industrial sector which is almost stable between 2015 and 2030.

A.1.7 Fluorinated Gases

Regulation 842/2006 (F-Gas) on fluorinated greenhouse gases and Directive 2006/40/EC (vehicle air conditioning) and the related French regulations (R 543-75 et seq., R 543 -99 of the French Environmental Code) are taken into account.

A.1.8 Agriculture and forestry

In this WEM scenario, between 2015 and 2030, cattle herds remain almost stable, but the productivity of dairy cows increases by 17%. The share of large-scale agricultural land dedicated to organic farming increases to 13%.

A.1.9 Waste management and processing

The scenario includes the impact of strengthening the measures in favour of the separate collection and recovery of waste adopted since the latest WEM.. In addition, the rate of capture of biomethane increases by 10 points between 2015 and 2030. The portion of captured biomethane that is recovered remains stable at 70%.

A.2 Presentation of the results

Within the scope of the Convention, emissions (excluding the LULUCF sector) represented 464 $MtCO_2$-eq in 2015, that is, a16% reduction compared to 1990. In projections, emissions decrease under the WEM scenario to reach:

- 434 $MtCO_2$-eq in 2020, that is, a 21% reduction compared to 1990.
- 403 $MtCO_2$-eq in 2030, that is, a 27% reduction compared to 1990.

Within the scope of the Kyoto Protocol, emissions (excluding the LULUCF sector) represented 457 $MtCO_2$-eq in 2015, that is, a16% reduction compared to 1990. In projections, emissions decrease under the WEM scenario to reach:

- 426 $MtCO_2$-eq in 2020, that is, a 22% reduction compared to 1990 and a 23% reduction compared to 2005.
- 392 $MtCO_2$-eq in 2030, that is, a 28% reduction compared to 1990.

In this chapter, the detailed results are presented within the scope of the Kyoto Protocol. Projections within the scope of the convention are presented in appendix 5.

A.2.1 Overall projections

The following table shows the development of emissions including and excluding the LULUCF sector.

With the scope of the Kyoto Protocol, excluding the LULUCF sector, emissions diminish by 22% between 1990 and 2020 and by 28% between 1990 and 2030. With LULUCF, emissions diminish by 28% between 1990 and 2020 and by 35% between 1990 and 2030.

	1990	2000	2005	2010	2015	2020	2025	2030	2035
	Observed	Observed	Observed	Observed	Observed	Projected	Projected	Projected	Projected
Total (excluding LULUCF)	547,074	551,846	553,309	511,485	457,129	425,757	403,001	391,907	385,730
Total (including LULUCF)	520,595	528,762	504,018	472,139	421,319	373,868	350,532	336,224	326,911

Table 5.1: Greenhouse Gas Emission Projections (inkt equivalents CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

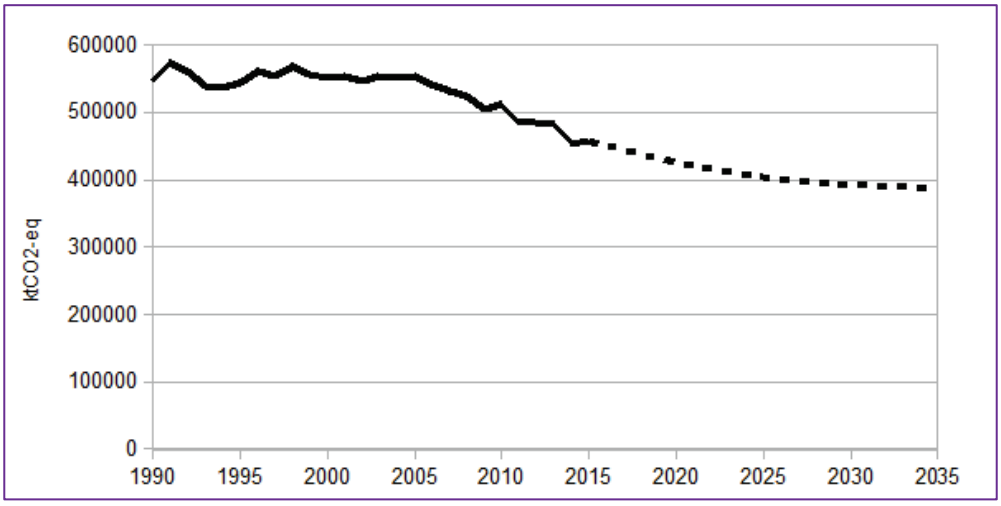

Figure 5.1: Projections in kt CO_2-eq, excluding LULUCF, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

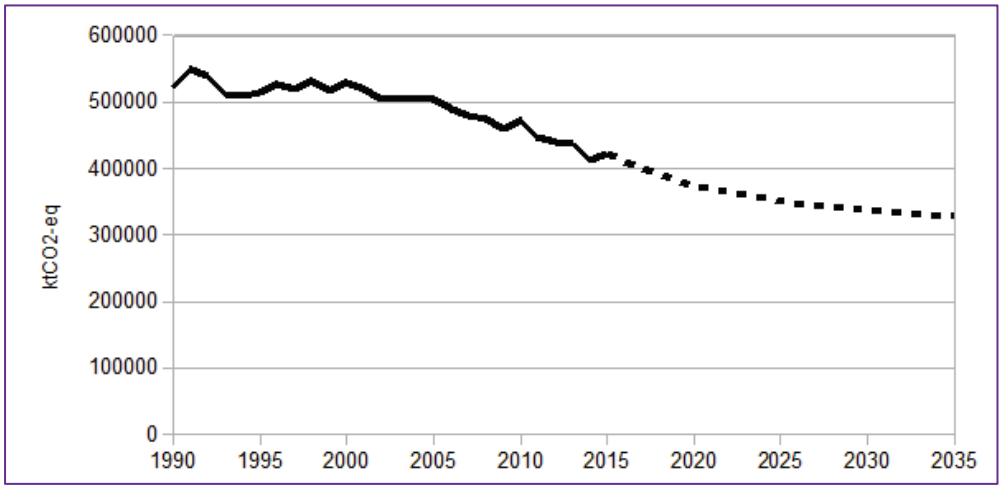

Figure 5.2: Projections in ktCO_2-eq, including LULUCF, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

A.2.2 Change by sector

The tables and graphs below show the breakdown of France's emission projections for 2020 and 2030 by industry, firstly by major sector of activity, then by sub-detailing the energy sector. The results are presented using the CRF categories defined in the IPCC Guidelines for national GHG inventories.

Macro-sector presentation (energy, agriculture, industrial processes and waste treatment)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
	Observed	Observed	Observed	Observed	Observed	Projected	Projected	Projected	Projected
Energy	380,316	392,868	400,304	366,665	316,861	292,241	278,428	272,057	269,484
Industrial Processes, Solvents and Other Products	66,798	53,474	52,766	46,643	44,519	43,280	37,440	34,552	33,644
Agriculture (Excl. Energy)	83,105	83,696	78,602	77,781	78,373	75,255	74,275	73,176	71,999
LULUCF	-26,479	-23,084	-49,291	-39,345	-35,810	-51,889	-52,469	-55,683	-58,820
Waste	16,855	21,809	21,638	20,396	17,376	14,981	12,858	12,122	10,602
Total (excluding LULUCF)	**547,074**	**551,846**	**553,309**	**511,485**	**457,129**	**425,757**	**403,001**	**391,907**	**385,730**
Total (including LULUCF)	**520,595**	**528,762**	**504,018**	**472,139**	**421,319**	**373,868**	**350,532**	**336,224**	**326,911**
Memo items:									
International Bunkers	*16,921*	*24,228*	*24,754*	*24,261*	*23,174*	*24,887*	*27,134*	*29,518*	*32,181*
Aviation Bunkers	*8,698*	*14,515*	*15,826*	*16,197*	*17,478*	*17,115*	*19,200*	*21,518*	*24,103*
Maritime Bunkers	*8,223*	*9,713*	*8,928*	*8,064*	*5,696*	*7,771*	*7,934*	*8,000*	*8,078*

Reading the table: Energy = category CRF1; industrial processes and solvents = category CRF2 and 3; agriculture (excluding energy) = category CRF4; waste treatment = category CRF 6.
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.2: Greenhouse Gas Emission Projections by business sector (in kt eqt. CO_2) in the Kyoto format under the WEM Scenario (With Existing Measures)

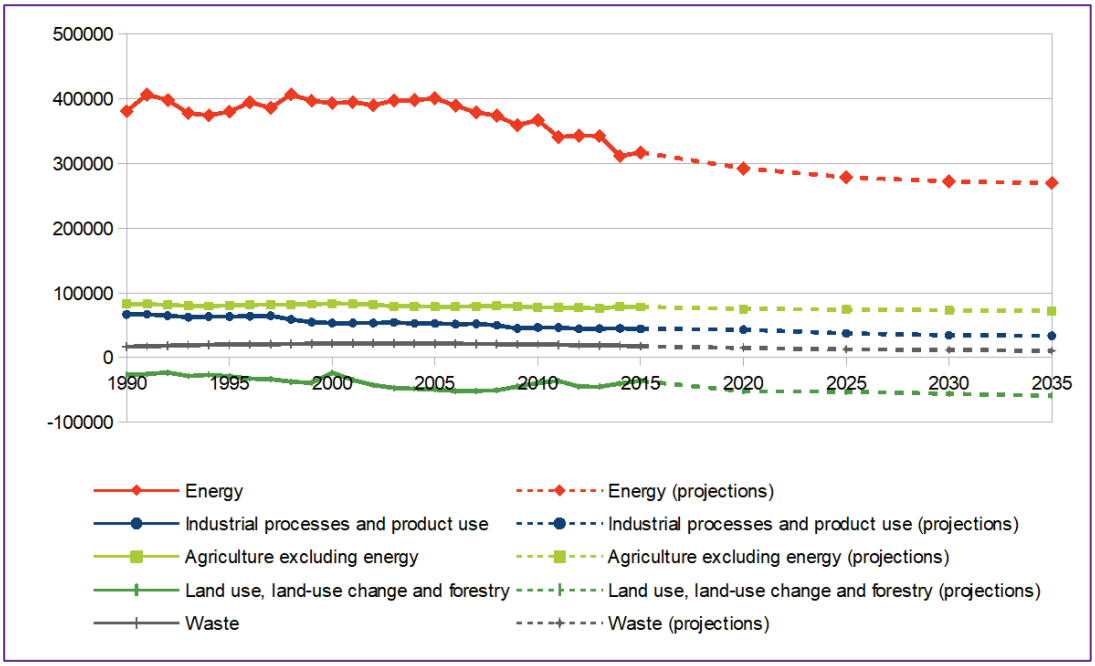

Figure 5.3: Projections per sector in kt CO_2-eq, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Detail of the energy sector categories

	1990	2000	2005	2010	2015	2020	2025	2030	2035
	Observed	Observed	Observed	Observed	Observed	Projected	Projected	Projected	Projected
Energy Industry	77,388	69,971	73,041	65,924	46,264	53,475	53,128	52,507	52,680
Manufacturing and Construction Industries	82,110	79,417	73,358	61,936	50,505	51,612	49,021	48,018	47,487
Transport	120,655	139,175	140,724	133,621	132,502	116,390	112,783	112,416	114,272
Other Sectors (Residential, Tertiary, Agricultural)	100,163	104,304	113,181	105,183	87,589	70,764	63,495	59,117	55,045
Total Energy	**380,316**	**392,868**	**400,304**	**366,665**	**316,861**	**292,241**	**278,428**	**272,057**	**269,48**

Reading the table: Energy industry = category CRF1A1 and 1B; manufacturing industry and construction = category CRF1A2; transport = category CRF 1A3; other sectors = category CRF 1A4.
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.3: Detail of the energy sector categories (in kt eq. CO_2) within the scope of the Kyoto Protocol under the WEM Scenario (With Existing Measures)

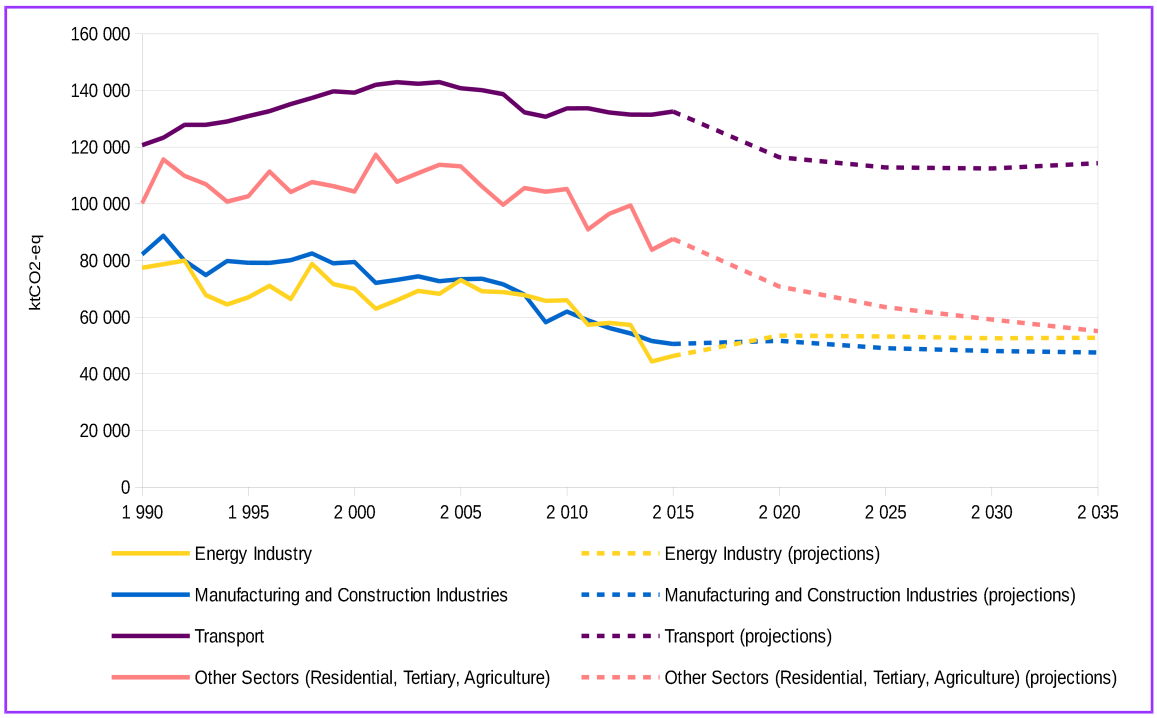

Figure 5.4: Detail of the energy sector categories (in kt eq. CO_2) within the scope of the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

The previous figures show that the measures adopted before 1 July 2016 have allowed the emissions of the various activity sectors to be reduced or stabilised.

In particular the existing measures have allowed:

- a reduction in emissions from the transport sector to return to emissions below 1990 levels from 2020;
- a substantial reduction in emissions in the residential/tertiary sector;
- a reduction in emissions from industrial processes, agriculture (excluding energy) and waste treatment by -48%, -12% and -28% respectively between 1990 and 2030.

A.2.3 Change by gas

In accordance with UNFCCC guidelines, changes in gas emissions are presented in the tables and graphs below (overall and then by sector).

Global changes

	1990	2000	2005	2010	2015	2020	2025	2030	2035
	Observed	Observed	Observed	Observed	Observed	Projected	Projected	Projected	Projected
CO_2 excluding LULUCF	399,551	414,590	424,221	387,984	336,588	313,511	300,231	294,442	292,546
CO_2 including LULUCF	369,744	387,555	371,638	345,234	297,501	258,346	244,487	235,485	230,452
CH_4 excluding LULUCF	69,645	70,364	65,170	62,814	58,905	55,621	53,446	52,548	50,805
CH_4 including LULUCF	70,592	72,029	66,369	63,996	60,016	56,729	54,554	53,655	51,913
N_2O excluding LULUCF	66,038	54,886	47,404	41,794	41,300	39,592	38,560	37,518	36,561
N_2O including LULUCF	68,419	57,171	49,497	44,016	43,467	41,759	40,727	39,685	38,728
HFCs	4,402	6,612	13,365	17,356	19,264	16,091	9,856	6,528	4,974
PFCs	5,202	2,997	1,760	617	540	499	460	423	394
SF_6	2,218	2,377	1,358	888	521	434	436	438	440
NF_3	16	20	31	32	11	11	11	11	11
Total (excluding LULUCF)	**547,074**	**551,846**	**553,309**	**511,485**	**457,129**	**425,757**	**403,001**	**391,907**	**385,730**
Total (including LULUCF)	**520,595**	**528,762**	**504,018**	**472,139**	**421,319**	**373,868**	**350,532**	**336,224**	**326,911**

Table 5.4: Greenhouse Gas Emission ProjectionsbyGas (in k t eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

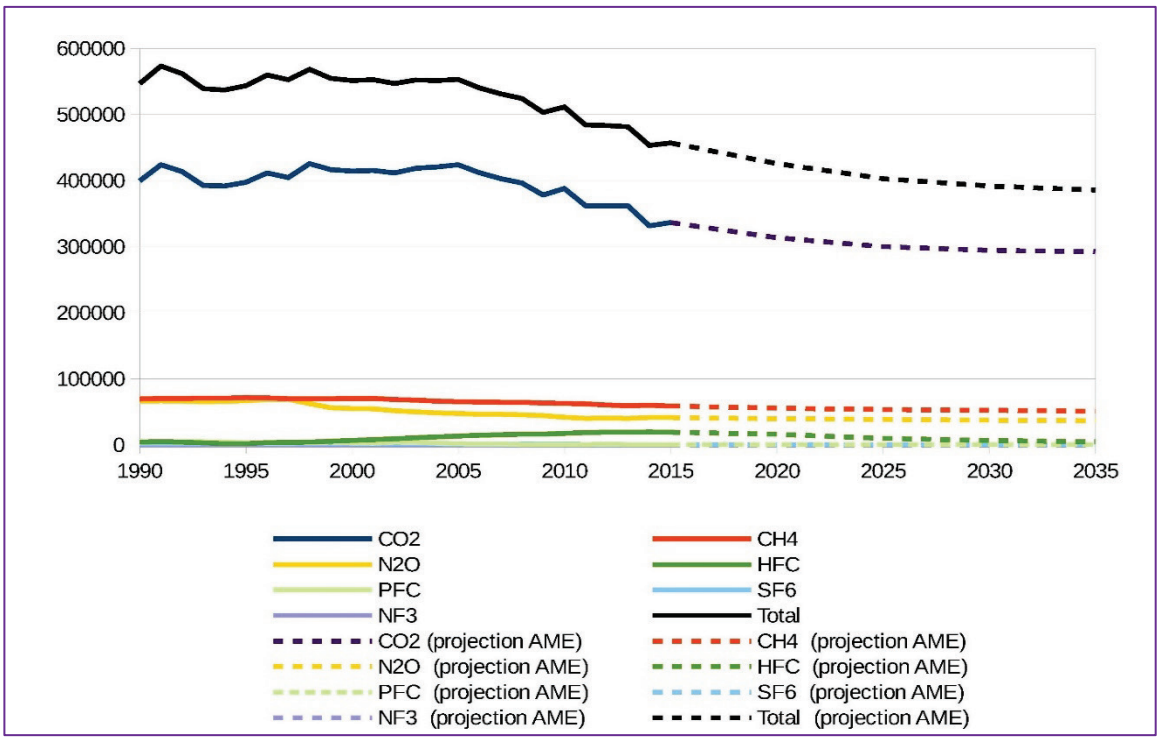

Figure 5.5: Projections by gas in kt CO_2-eq, excluding LULUCF, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

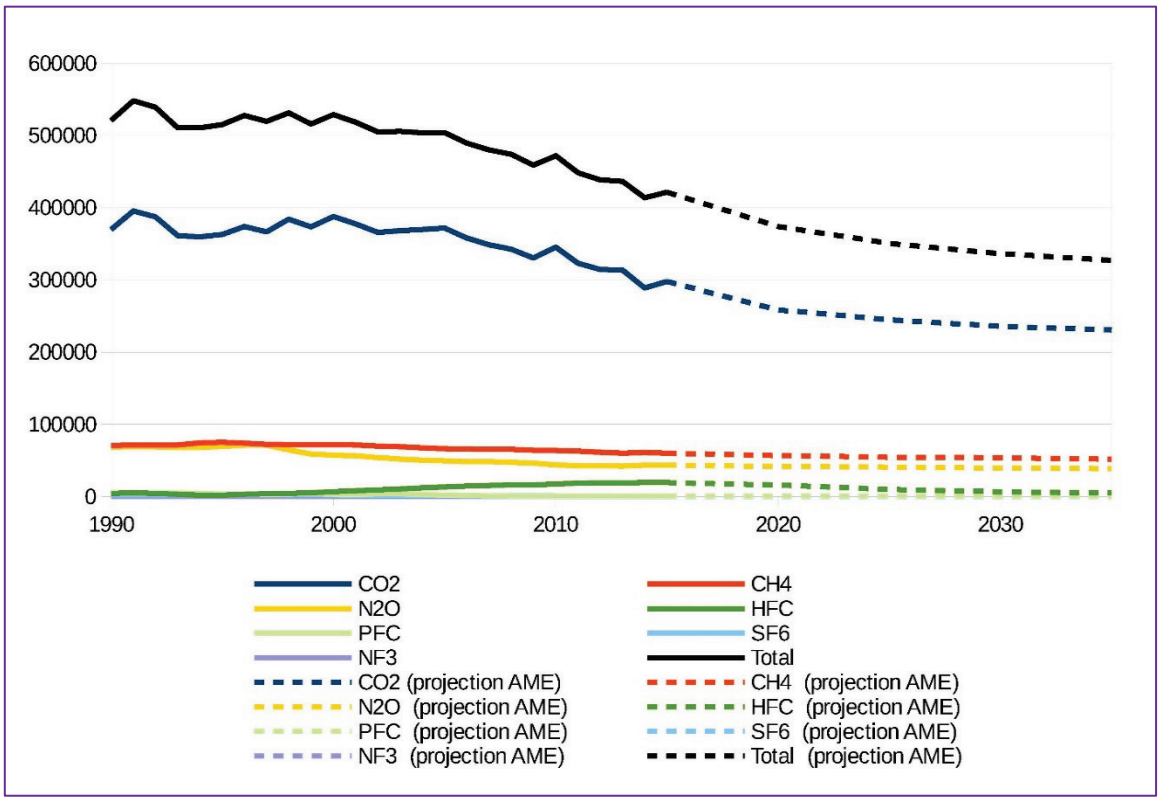

Figure 5.6: Projections by gas in kt CO_2-eq, excluding LULUCF, in the Kyoto format, WEM scenario
Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Cross-sectoral changes by sector of activity and by gas

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	364,477	381,608	391,452	359,165	310,205	285,202	271,474	265,193	262,700
Industrial Processes, Solvents and Other Products	31,100	29,444	29,402	25,393	22,851	24,975	25,479	26,031	26,703
Agriculture (Excl. Energy)	1,765	1,819	1,802	1,812	2,006	1,920	1,842	1,763	1,680
LULUCF	-29,807	-27,035	-52,583	-42,750	-39,087	-55,164	-55,744	-58,957	-62,094
Waste	2,209	1,719	1,565	1,614	1,526	1,414	1,436	1,455	1,463
Total (excluding LULUCF)	399,551	414,590	424,221	387,984	336,588	313,511	300,231	294,442	292,546
Total (including LULUCF)	369,744	387,555	371,638	345,234	297,501	258,346	244,487	235,485	230,452

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.5: CO_2 Emissions Projections (in kt eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	12,594	7,653	4,954	3,907	2,910	3,279	3,261	3,224	3,155
Industrial Processes, Solvents and Other Products	85	108	100	81	50	50	50	50	50
Agriculture (Excl. Energy)	43,221	43,451	40,873	40,871	40,930	39,562	39,549	39,460	39,330
LULUCF	947	1,666	1,199	1,182	1,110	1,108	1,107	1,107	1,107
Waste	13,744	19,151	19,244	17,955	15,015	12,730	10,586	9,814	8,271
Total (excluding LULUCF)	69,645	70,364	65,170	62,814	58,905	55,621	53,446	52,548	50,805
Total (including LULUCF)	70,592	72,029	66,369	63,996	60,016	56,729	54,554	53,655	51,913

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.6: CH_4 Emissions Projections (in kt eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	3,245	3,607	3,898	3,593	3,745	3,760	3,694	3,640	3,630
Industrial Processes, Solvents and Other Products	23,773	11,914	6,749	2,277	1,283	1,222	1,147	1,072	1,073
Agriculture (Excl. Energy)	38,118	38,426	35,928	35,098	35,438	33,773	32,883	31,953	30,989
LULUCF	2,381	2,285	2,093	2,222	2,167	2,167	2,167	2,167	2,167
Waste	902	939	829	827	834	838	836	853	869
Total (excluding LULUCF)	66,038	54,886	47,404	41,794	41,300	39,592	38,560	37,518	36,561
Total (including LULUCF)	68,419	57,171	49,497	44,016	43,467	41,759	40,727	39,685	38,728

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.7: N_2O Emissions Projections (in kt. eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0	0
Industrial Processes, Solvents and Other Products	4,402	6,612	13,365	17,356	19,264	16,091	9,856	6,528	4,974
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	4,402	6,612	13,365	17,356	19,264	16,091	9,856	6,528	4,974
Total (including LULUCF)	4,402	6,612	13,365	17,356	19,264	16,091	9,856	6,528	4,974

Table 5.8: HFC Emissions Projections (in kt. eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0	0
Industrial Processes, Solvents and Other Products	5 202	2 997	1 760	617	540	499	460	423	394
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	5 202	2 997	1 760	617	540	499	460	423	394
Total (including LULUCF)	5 202	2 997	1 760	617	540	499	460	423	394

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.9: PFC Emissions Projections (in kt. eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0	0
Industrial Processes, Solvents and Other Products	2,218	2,377	1,358	888	521	434	436	438	440
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	2,218	2,377	1,358	888	521	434	436	438	440
Total (including LULUCF)	2,218	2,377	1,358	888	521	434	436	438	440

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.10: SF_6 Emissions Projections (in kt. eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

	1990	2000	2005	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0	0
Industrial Processes, Solvents and Other Products	16	20	31	32	11	11	11	11	11
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	16	20	31	32	11	11	11	11	11
Total (including LULUCF)	16	20	31	32	11	11	11	11	11

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission and MTES Emissions Projections, 2017

Table 5.11: NF_3 Emissions Projections (in kt. eqt. CO_2) within the scope of the Kyoto Protocol under theWEM Scenario (With Existing Measures)

A.2.4 Achievement of France's objectives

Reaching the 2020 targets under the Kyoto protocol

Projected emissions in 2020 are 426 $MtCO_2$-eq and are 23% lower than their 1990 level. Projected emissions from the sectors covered by the ETS are down 30% from their 2005 level, while projected emissions from non-ETS sectors are 20% lower than their 2005 level.

In 2010, the EU committed to reducing its greenhouse gas emissions by 20% by 2020 compared to 1990 levels. This objective was submitted by the EU-28 within the framework of the Convention, and there are no specific objectives for each Member State. Within the framework of the Energy-Climate Package, the EU has established internal rules that underpin the implementation of this objective. This is divided into two sub-objectives compared to 2005, one for the ETS sectors for the entire EU (target of -21% in 2020 compared to 2005 emissions) and the other for non-ETS sectors shared by each Member State (target of -14% in 2020 compared to 2005 emissions for France).

With non-ETS emissions forecast to show a 21 % reduction by 2020 compared to 2005, existing policies and measures should enable France to reach its target by 2020.

Reaching the objectives set by France for 2030

Under the Paris Agreement, the EU has undertaken to reduce its greenhouse gas emissions by 40% by 2030. In the same way as for 2020, this reduction effort will be allocated between ETS and non-ETS sectors and shared between Member States. These texts are currently being adapted. France's reduction target for non-ETS sectors is -37% from 2005.

In addition, France has set itself a national reduction target for all its emissions of 40% by 2030 compared to 1990.

According to the WEM scenario, in 2030, projected emissions are expected to amount to 392 $MtCO_2$, i.e. a 29 % reduction from 1990. Projected emissions from the sectors covered by the ETS are down 31% from their 2005 level, while projected emissions from non-ETS sectors are 28% lower than their 2005 level.

By 2030, the existing measures taken into account in the WEM scenario will significantly reduce emissions. Additional efforts must be implemented beyond the measures already adopted. The July 2017 climate plan will enhance reduction efforts. The purpose of regularly revising the national low carbon strategy is to make the adjustments required to reach the targets.

A.3 Sensitivity analysis

Four sensitivity tests were conducted on the projections for the WEM scenario (with existing measures).

- A first test looked at the effect of a 25% reduction in the GDP growth rate compared to the baseline scenario.
- A second test focused on the potential effect of a reduction in the share of value added in the manufacturing sector. The sensitivity test consists of evaluating the impact on the energy consumption and GHG emissions of an accelerated tertiarisation of the French economy: it is assumed that the weight of the industry in the value added in 2030 decreases by 25%. This decline is gradual over the period and is accompanied by an equal deferral on offices, shops, health and other services.
- A third test was to evaluate the impact of higher fossil fuel prices. The sensitivity test consists of evaluating the impact of doubling the price of fossil fuels instead of the parameters used in the central scenario.

- A fourth test consisted of evaluating the combined impact of a change in the three macro-economic parameters: a 25% increase in GDP, the reduction of fossil fuel prices by 15% for oil and 20% for gas in 2030 and a rise in the annual population growth rate of +0.2 points a year until 2035.

The results are shown in the table below.

	2020	2025	2030	2035
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
25% reduction in GDP compared to the reference scenario	-2,130	-4,206	-5,570	-6,442
25% reduction in the share of industrial value added in the economy	-2,630	-4,404	-5,798	-5,663
Higher price of fossil fuels (doubled compared to 2010)	-1,430	-3,732	-5,894	-7,947
Simultaneous impact of a rise in GDP (+25%), changes in the price of imported energy (+15% for oil and +20% for gas compared to 2010) and an annual growth rate of the population of +0.2 points/year until 2035	4,879	10,237	15,897	21,053

Source: Citepa/MTES, 2017 Submission and MTES Emissions Projections, 2017

Table 5.12: Results of the sensitivity tests (emissions compared to the WEM scenario)

B. ESTIMATION OF THE TOTAL IMPACT OF POLICIES AND MEASURES

The estimation of the total effect of the policies and measures is carried out by adding the measures assessed individually in Chapter 4. The scope of the measures evaluated is smaller than the set of measures actually implemented.

The sum of the measures evaluated in the different sectors is evaluated at:

- for the implementation of a carbon tax (transversal): 6.1 $MtCO_2$ in 2020 and 9.1 MCO_2 in 2030.
- for the implementation of Energy Savings Certificates and the Heat Fund, transversal measures supporting the improvement of energy efficiency and the use of biomass: 22.6 $MtCO_2$ in 2020 and 25.9 MCO_2 in 2030.
- for transport (European Regulations on private passenger cars and accompanying measures for the improvement of the performance of private passenger internal combustion vehicles, European Regulations on light commercial vehicles, measures for the development of electric vehicles, high-speed rail lines, and segregated-lane public transport within the province): 4.5 $MtCO_2$ in 2020 and 10.4 $MtCO_2$ in 2030
- for construction (thermal regulations for new buildings that came into force in 2012, energy renovation obligations during major works, energy transition tax credit and interest-free eco-loan): 11.5 $MtCO_2$ in 2020 and 18.4 $MtCO_2$ in 2030
- for fluorinated gases (European F-Gas II regulation, decree on sealing and European regulations on car air conditioning): 1.6 $MtCO_2$ in 2020 and 8.2 $MtCO_2$ in 2030
- for waste, obligation to sort and recycle glass, paper/cardboard, metals, plastic, and timber from business activities: 1.8 $MtCO_2$ in 2020 and 4.0 $MtCO_2$ in 2030
- for the agriculture sector, (measures to foster the development of agricultural methane): 1.4 $MtCO_2$ and 3.1 $MtCO_2$

All the measures that have formed the scope of individual evaluations come to a total of 50 $MtCO_2$ in 2020 and 79 $MtCO_2$ in 2030.

C. ROLE OF CREDITS RESULTING FROM THE MECHANISMS CREATED BY ARTICLES 6, 12 AND 17 OF THE KYOTO PROTOCOL TO ACHIEVE THE QUANTITATIVE OBJECTIVES ASSIGNED TO FRANCE

The public policies put to work by France will enable it to reach its Kyoto goals without having to purchase international credits.

On the other hand, French companies subject to the European Union Emissions Trading System (EU ETS) may, for their compliance, return Emission Reduction Units (ERU) and Certified Emission Reduction (CER) Units up to a maximum of 13.5% of their initial allowance allocation (National Allowance Allocation Plan for the 2008-2012 period) for the 2018-2020 period. This percentage is limited to 4.5% for the new sectors that joined the EU ETS in 2013.

Aircraft operators are authorised to use international credits up to a maximum of 1.5% of their verified emissions during the 2013-2020 period.

Beyond 2020, other mechanisms should be available for States in accordance with Article 6 of the Paris Agreement.

D. METHODOLOGICAL INFORMATION

D.1 Modelling Used

The MTES (Ministry for Ecological and Inclusive Transition) ran an update of the previous climate - air- and energy forecast scenarios in 2016. The work of updating the forecast scenarios is carried out under the aegis of a steering committee, which brings together experts from the Ministries and the sectors. This steering committee is co-chaired by the departments of the MTES (Directorate-General for Energy and Climate - DGEC and Commissioner-General for Sustainable Development - CGDD) and the French Environment and Energy Management Agency (ADEME).

This steering committee is gathered in a cross-cutting grouping and in the form of sectoral committees (energy, transport, building, industry, waste, agriculture, forest). The macro-economic framework (based on the recommendations of the European Commission) is set out by the cross-cutting grouping, whereas the sectoral committees make it possible to state the list of policies and measures coming under the scenarios "With Existing Measures" (WEM) and for other scenarios of the type "With Additional Measures" (when such a scenario is prepared). These committees also provide the opportunity to specify the main assumptions to be used for representing the different measures in the projection work.

The exercise has made it possible to provide projections on energy consumption, greenhouse gas emissions and pollutants up to 2035. It models emissions from the mainland, from the DOM-COM (overseas territories and local authorities) and deals with the three aspects of the forecasts in an integrated way: energy, climate and air quality. In this way, the results that arise from that scenario exercise are used in the context of the present report amongst others.

In order to complete the exercise, several teams of modellers were mobilised:

- The French Agency for the Environment and Energy Management (ADEME) for the sector of residential buildings
- The General Sustainable Development Commission (CGDD) for the transport sector
- The Ministry of Agriculture for the agricultural and forestry sectors.

- The Enerdata design office that has implemented the modelling of energy scenarios using the Medpro model
- The French Institute for Oil and New Energy (IFP New Energy) which handled the modelling of oil supplies
- The Energy and Processes Centre (CEP – Armines) which handled the modelling of coolant liquid emissions
- CITEPA (Interprofessional Technical Study Centre for Air Pollution) which also prepares the GHG emission and pollutant listings in France and which performed the modelling of the greenhouse gas and air pollutant emissions, in accordance with the national inventory method.

The modelling of the energy scenarios was performed using the Medpro long term energy demand simulation model. Medpro was fed with the output of various sectoral models for the sectors of transport, building and agriculture. Modelling greenhouse gas emissions was performed downstream by Citepa based on the results of those energy scenarios, the data from the activity scenario areas and additional models (especially on fluorinated gases) in compliance with the inventory methodology.

D.1.1 The Sectoral Models

Modelling the Transport Sector

Traffic projections were made based on the Modev model from the General Commission for Sustainable Development. Modev models the changes in passenger and goods traffic according to demographic variables and economic growth (GDP, final consumption of households, sectoral added values), changes in infrastructure and transport services and prices of different modes of transport. Modev models the change in the global transport demand (passengers and goods) as well as the change in the modal split between the different modes of transport and the traffic on the network.

Traffic modelling is supplemented by fleet models that include modelling the distribution of electric vehicles andchanges in the distribution of diesel / gasoline engines, based on assumptions about the changes in the cost of vehicles and changes in unit consumption of different types of vehicles.

Modelling the Construction Sector

The residential sector is modelled with the Menfis model of the French Environment and Energy Management Agency. The Menfis model models the change in the energy performance of the stock of residential buildings over a set time-frame from 2008 to 2035. Energy performance dynamics are achieved through renovations, building destruction, and new constructions. The renovation process is a central part of Menfis. With technical-economic calculations, Menfis annually determines which parts of the building can be renovated and at what level of energy performance. By modelling the rebound effect, it forecasts changes in energy consumption and greenhouse gas emissions.

The tertiary sector was modelled using the Energies Demain Enerter® Tertiary tool dedicated to the assessment of the energy consumption of commercial buildings and the impact assessment of rehabilitation actions on this stock.

Modelling of the agriculture and forestry sector

The agriculture and forestry sector was modelled by the ClimAgri® model initially developed in 2009 by Solagro and Bio Intelligence Service on behalf of ADEME. ClimAgri models energy consumption and greenhouse gases in the agricultural sector based on assumptions about characteristics of crop production (description of productions, inputs, technical practices and routes, yields) and bioconversions, that is, transformations of forages and concentrates in egg, milk and meat production, describing herds, inputs and breeding practices.

Modelling of the Industrial Sector

The changes in tonnages and energy performance developed during the latest WEM were updated within the framework of a group of experts taking recent developments in the sector into account.

Modelling of fluorinated gases

For the fluorinated gases sector, the evaluation of HFC emissions was carried out using the RIEP software developed by the Energy and Process Centre of MINES ParisTech. In the RIEP software, equipment containing fluorinated gases is grouped into eight areas of application: domestic refrigeration, commercial refrigeration, refrigerated transport, industry, air conditioning, chillers, on-board air conditioning (including automotive air conditioning) and heat pumps. Each database describes, for 41 equipment sub-sectors, the markets and national productions of equipment, the technical characteristics of the equipment (related to the load, installed power, service life, etc.) as well as emission levels and recovery efficiency of maintenance and end-of-life channels. Market and production data come from statistical sources available for mainland France and referenced in the French Inventory studies updated each year. Other assumptions come from field survey results, communications from equipment manufacturers, results of experimental measurements and expert assessments.

D.1.2 Modelling of energy scenarios

Enerdata's Medpro model is a technical and economic model to simulate the long-term final energy demand, based on a detailed representation of energy consumption by sector, use and energy. Medpro models all the sectors (industry, transport, buildings, energy in agriculture) by integrating the outputs of the sectoral models for transport, buildings and agriculture described above as well as the assumptions relating to the industrial sector.

D.1.3 Modelling greenhouse gas emissions

Based on the activity scenarios described above, CITEPA has developed emission projection scenarios for 2020. Emissions projections are consistent with the national greenhouse gas emissions inventory submitted to the UNFCCC. The methods applied to convert activity data into emissions are therefore consistent with the inventory report.

D.2 Baseline scenario assumptions

The economic framework used to develop scenarios is as follows:

Assumptions on the changes in energy prices

The assumptions made for the price of fossil fuels come from the economic framework proposed by the European Commission to all the countries of the Union.

	2015	2020	2025	2030	2035
Oil (Brent crude oil)	48.19	75.01	85.15	93.8	97.85
Coal (CIF ARA 6000)	11.47	14.31	17.09	20.51	21.72
Gas (NCV, CIF average EU import)	38.8	48.25	52.21	56.77	60.63

Source: Economic framework of the EU

Table 5.13: Assumptions of prices of imported energies (in €2013/boe)

Assumptions on the change in the carbon price under the ETS

Assumptions on the change in the price of carbon for companies included in the ETS come from the economic framework proposed by the European Commission to all the countries of the Union.

	2015	2020	2025	2030	2035
EU ETS carbon price	7.5	15	22.5	33.5	42

Source: Economic framework of the EU

Table 5.14: Assumptions on the price of carbon under ETS (in €2013/tCO_2)

Demographic assumptions

Population growth assumptions come from INSEE (the French National Institute of Statistics and Economic Studies), which produces the reference demographic projections for France.

Population (in thousands of inhabitants)	2015	2020	2025	2030	2035
France	66,391	67,820	69,093	70,281	71,417
of which mainland France	64,293	65,684	66,918	68,064	69,157
of which Dom-Com	2,098	2,136	2,175	2,217	2,260

Source: Insee

Table 5.15: Population growth assumptions

Assumptions on economic growth

The assumptions on economic growth are those recommended for France by the European Commission. These assumptions are also consistent with the assumptions used by the French Ministry of the Economy for long-term economic frameworks.

Average annual growth rate	2015-2020	2020-2025	2025-2030	2030-2035
GDP	1.6	1.3	1.4	1.7

Source: Economic framework of the EU for France

Table 5.16: GDP growth assumptions

Average annual growth rate	2015-2020	2020-2025	2025-2030	2030-2035
Industrial value added	1.4	1	1.1	1.3

Source: Economic framework of the EU for France

Table 5.17: Assumptions of changes in industrial value added

Chapter VI

Vulnerability and adaptation

Humanity has always faced many natural threats: storms, cyclones, earthquakes, floods, ground movements, droughts. The consequences of natural disasters are often tragic from the point of view of both the human toll and economic damage. However, in the context of climate change, the expected increase in extreme events which will certainly occur and whose impacts will be the strongest particularly in terms of risks, health and fragility of ecosystems and agricultural and industrial production are those related to heat waves, droughts, intense rainfall and rising sea levels.

Since 1993, France has been carrying out study and research programmes with the specific objective of assessing the possible impacts of climate change on the national territory (including overseas departments and territories) and the adaptation measures that can be implemented in the most vulnerable geographical areas and sectors of activity. As early as 1993, the REGCLIM programme was launched: "Regionalisation of climatic effects"[50] (MTES, 2001). It was followed from 1999 by the Management and Impacts of Climate Change (GICC) programme[51]. Since its creation, the GICC programme (see Research and Systematic Observation chapter) has funded more than one hundred projects on impacts and adaptation in the most diverse fields. The most significant project is Drias, the Futures of the Climate. The resultant Drias, *the Futures of the Climate* portal, responds to an important need expressed by all stakeholders concerned by climate change, which is to have easy access to information and help to study

[50] MTES, 2001: "Regionalisation of Climatic Effects" Programme (REGCLIM), Final report of the MTESresearch contract/METEO France, February 2001
[51] MTES: Calls for research proposals from the "Management and Impacts of Climate Change" programme (GICC) www.gip-ecofor.org

impacts and decide on adaptation measures for climate change. By providing some of these elements in a simple way for users, it is an essential first step in the development of a base for French climate services. The next step is under construction.

The French National Research Agency launched the "Vulnerability: Environment, Climate and Societies" programme followed by the "Global Environmental Changes and Societies" programme which have given rise to several calls for projects since 2006. These research programmes aim to strengthen national scientific production, generate knowledge that is useful for public action and strengthen French capacities in international negotiations in the field of "Environmental Change".

At the institutional level, the French National Observatory on the Effects of Global Warming (ONERC) was created by a law of 2001. Its mission is to collect and disseminate information and make recommendations on prevention and adaptation measures that can limit the risks associated with climate change. ONERC is also the French focal point of the Intergovernmental Panel on Climate Change (IPCC). Within the Ministry of Ecological and Solidarity Transition (MTES), ONERC is attached to the General Directorate for Energy and Climate, so that issues relating to adaptation are treated in the same context as those of mitigation. ONERC reports are given to the Prime Minister and to Parliament, which present the main consequences of global warming in France including recommendations for adaptation. Between the creation of ONERC and the end of 2017, 10 reports have been published. The 2014and 2015 reports present thematic impacts. They are entitled “Trees and Forests in the Face of a Changing Climate" and “The Coastline in the Context of Climate Change", respectively. In 2016, the report presented the 2011-2015 evaluation of the NAPCC, as well as the resulting recommendations. In addition, ONERC organises and participates in thematic seminars and issues a bi-monthly technical newsletter (29 editions have already been sent to approximately 850 subscribers). A specific publication is written for elected officials on a quarterly basis (28 editions have been published, with more than 5800 copies sent out for the latest editions). The ONERC website[52] aims to serve as a portal for adaptation by presenting a selection of publications and the results of research and studies, as well as data and methodological guides that can be directly used by most stakeholders.

Analyses of current and future vulnerabilities help to put recommendations and prevention and adaptation measures in place to reduce the risks associated with climate change. These measures concern land use planning, water resources, public health, the protection of people and property, biodiversity and cultural heritage, and are to be developed in the economic sectors. Taking the results of all the research and studies into account in the plans and laws will help consolidate the implementation of these adaptation measures, which are dependent on the strong involvement of local stakeholders.

The Land Use Planning and Environmental Protection Laws and the 2004 Climate Plan have paved the way for the implementation of climate change adaptation strategies, with the adoption of the first French National Climate Change Adaptation Plan in 2011, with the second plan scheduled for the end of 2017. The Grenelle Environment Forum has enabled measures related to regional and local planning systems to be strengthened, in particular with the SRCAE (Regional Energy, Air and Climate Plan) and the PCET (Regional Climate and Energy Plan). Enacted in 2015, the law on the New Territorial Organisation of the Republic (*NOTRe*) strengthens the territorial aspect of adaptation by obliging groups of municipal areas with a total of more than 20,000 inhabitants to draft a PCAET.

[52] https://www.ecologique-solidaire.gouv.fr/observatoire-national-sur-effets-du-rechauffement-climatique-onerc

A. THE IMPACTS OF CLIMATE CHANGE

A.1 Observed developments and trends

According to the World Meteorological Organization (WMO), the year 2016 will be remembered for being the hottest year on record, the exceptionally low sea ice extent, and the inexorable continuation of rising sea levels and warming of the oceans. Its annual climate declaration confirms that, with an increase in temperature of 0.9°C compared to the 1961-1990 reference period, the 2016 global average land-sea temperature exceeded 2015 by 0.06°C. Although 2016 was not a record-breaking year in mainland France, the effects of climate change are still reflected, mainly in the rise in average temperatures. From 1900 to today, warming in 2014 reached a record of +1.9°C compared to the 1961-1990 reference period.

The warming is comparable from one French region to another, but its rhythm is not regular. In particular, an acceleration has been seen since the 1980s. From 1959 to 2009, there was a trend of an increase in the annual average by +0.3°C per decade, with an even greater increase in the spring and summer.

The change in precipitation levels varies depending on the region and season. From 1959 to 2009, there was a general increase in annual rainfall in the northern half of the country and a decrease in the southern half. Precipitation levels are rising in most of mainland France in spring and autumn. In winter and summer, precipitation trends are more variable between regions. In particular, there is a drop in precipitation levels in the southern regions. However, with the exception of a few areas in eastern France or near the Mediterranean, precipitation trends are often not very marked and may vary according to the study period covered by the analysis.

Since the middle of the 20th century, there have also been changes in the frequency and intensity of extreme events: the number of hot days (maximum temperatures above 25°C) is increasing, while the number of days with freezing temperatures is decreasing. Heat waves have become more frequent and intense. On the other hand, there is no marked trend in changes to the number of intense rain events or storms.

Climate change is observed at all levels with direct impacts such as an increase in the average annual temperature, but also by less significant impacts such as reductions in the average duration of the snow-cover period in the mountains, an increase in evaporation from soils, which leads to more frequent and intense droughts.

As on a global scale, the evolution of average annual temperatures in mainland France shows a net warming since 1900. This warming has had a variable rhythm, with a particularly marked increase since the 1980s. The year 2016 was once again a hot year that exceeded the average annual reference (1981-2010), but it was not exceptional throughout mainland France and ranks 10th, far behind 2014 (+1.2°C), 2011 (+1.1°C) and 2015 (+1.0°C).

The consequences of changing climatic conditions are being felt in many areas. The glaciers of the French Alps have experienced a loss in surface mass balance and the Pyrenees glaciers are showing the same trend. Despite fluctuating accumulation and ablation values, the balance has been negative every year since the 2001 to 2002 cycle. On average, between 2001 and 2013, the glaciers studied in mainland France have lost the equivalent of 18.8 metres of water, that is, a 21-metre loss in ice thickness.

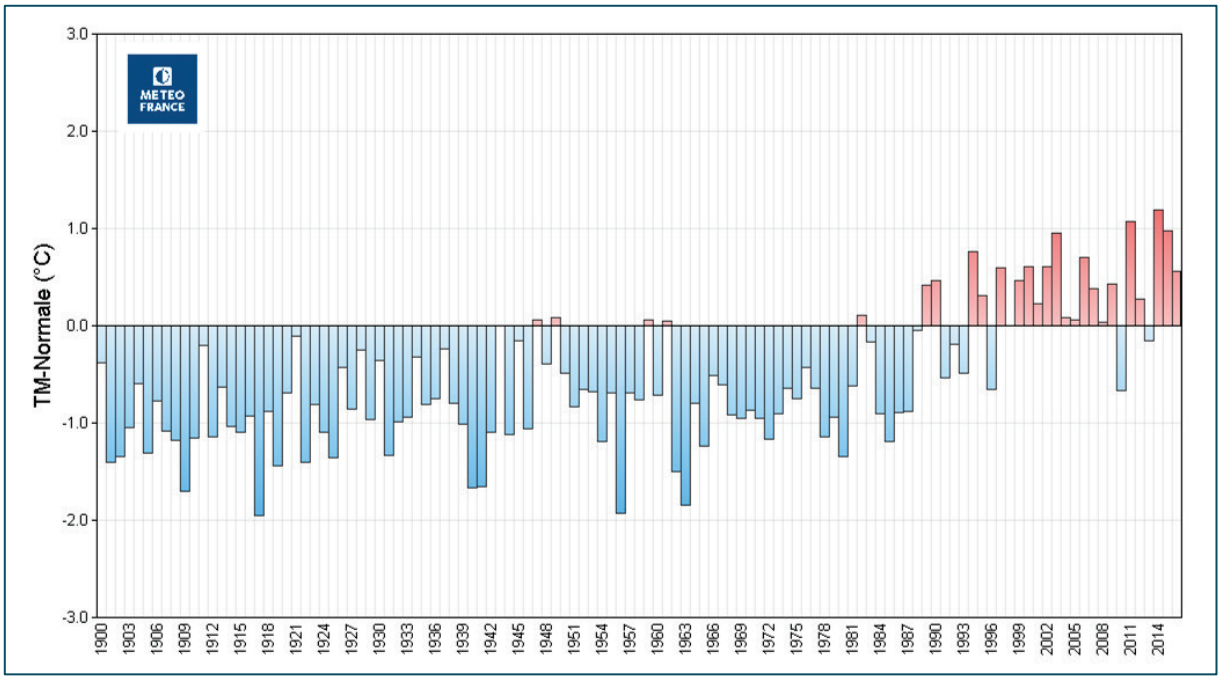

Figure 6.1: Evolution of the average temperature in mainland France from 1900 to 2016 - Source: Météo-France

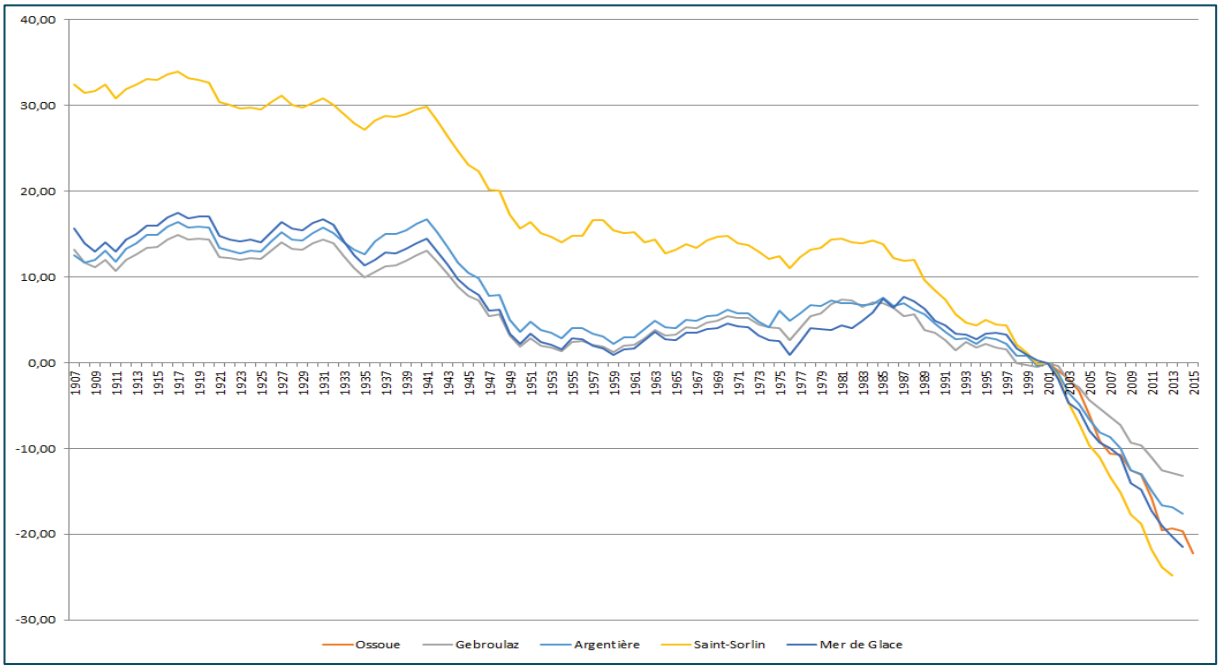

Figure 6.2: Water loss from glaciers - Sources : Moraine Association (Pyrenees Association of Glaciology), LGEE (Gebroulaz, Argentière, Saint-Sorlin and Mer de Glace glaciers)

A.2 Characterisation of the future climate

In 2010, the Ministry of Energy and Solidarity Transition requested the expertise of the French climate science community composed of researchers from CNRS/INSU/IPSL and LGGE, Météo-France, BRGM, CEA, CETMEF and CNES to produce a scientific assessment of French climatic conditions in the 21st century. The series "The French climate in the 21st century" provides the reference climate indices to serve as a basis for the development of climate change adaptation policies.

This tool is indispensable for the many actors working towards adaptation, in particular the local authorities, private economic sector, associations and State services. For this reason, producing these baseline data is a flagship action in the National Climate Change Adaptation Plan[53], which came into effect on 19 July 2011. The French National Observatory on the Effects of Global Warming (ONERC) has organised and disseminated this scientific information under the title "The French Climate in the 21st Century".

Volumes 4 and 5 of this collection provide updates of Volumes 2 and 3 based on the results available within the Drias the Futures of the Climate department. This first climate department comes from the Drias project (Giving access to French regional climate scenarios for the Impact and Adaptation of our Societies and Environment) financed by the Management and Impact of Climate Change Programme (GICC) of the Ministry of Energy and Solidarity Transition (MTES). It responds to an important need expressed by all stakeholders concerned by climate change, which is to have easy access to information and help to study impacts and decide on adaptation measures for climate change.

Providing some of these elements in a simple way for users, it is an essential first step in the development of a French climate department, since it facilitates and simplifies access to and use of information on regionalised French climate projections. It also contributes to highlighting research work and further harmonising the productions of French modelling groups, which are now accessible in one single place.

TheDrias, the Futures of Climate portal is intended for a wide range of users, from experts (such as researchers and academics) to non-specialists (such as project leaders and decision-makers), who are involved in climate change impact and adaptation studies. It is thus aimed at regional actors, who are working within the framework of implementing climate-related plans, or working with an observatory, private actors who are faced with climate forecasts within their own company, environmental and adaptation consultation professionals, researchers who are involved in impact studies or works regarding adaptation, as well as teachers who would like to access information from climate projections. Access to these data is essential in order to enable vulnerability studies for the regions that need them to be carried out, so that local authorities can define climate change adaptation policies.

This department has been further reinforced for the general public by the "Climate HD" web application: the climate of yesterday and tomorrow, which offers an integrated view of the evolution of the climate in the past and future, at national and regional levels. Climate HD summarises the latest work of climate scientists: key messages and graphics to better understand climate change and its impacts.

In the near future, an agreement on the allocation of financial support for the benefit of climate departments signed between the Ministry of Ecological and Solidarity Transition and the CNRS will allow open and free dissemination of a set of data, methods and training materials to enable decision-makers and manufacturers to interpret climate projections, extreme events and national contributions to emission reductions. After three years, two operational departments and five departmental demonstrators will be set up. A major training programme, including both initial training and a vocational training programme, to educate engineers on these issues, will complement the existing training offer.

[53] http://www.developpement-durable.gouv.fr/IMG/pdf/ONERC-PNACC-complet.pdf

A.2 Predicted impacts of climate change

A 2°C increase in the average global temperature by the end of the century will manifest itself differently around the world and will be accompanied everywhere by significant changes in rainfall patterns and in the frequency and severity of extreme events. These changes will have strong impacts in all socio-economic sectors and on the global environment.

In mainland France and the overseas territories, an average temperature increase of 2°C would result in major changes in many regional climatic characteristics, particularly with regard to extreme events. It is essential to have the best possible knowledge of these changes, their impacts and associated uncertainties in order to identify the most relevant adaptation measures.

In line with the latest IPCC assessment report, several projects initiated under the first NAPCC have made it possible to specify the changes to be expected in the different regions and to make the corresponding quantitative data available to all adaptation actors. From a qualitative point of view, the main characteristics expected, consistent with the changes already in progress, are as follows:

- a temperature increase higher than the global average of 2°C, particularly in areas further away from the coast, with heat waves becoming increasingly frequent and severe and extending beyond traditional summer periods. Cold waves will be less severe and less frequent, yet without reducing the risks from spring frosts, exacerbated by the earlier growth of vegetation;
- more intense rainfall, even in areas where the annual amount of precipitation will decrease, increasing the risk of a rise in water levels and flooding. At the same time, droughts will become more frequent and severe with the water flows of rivers falling sharply, increased pressure on the water resources needed for ecosystems and human activities and an increased risk of forest fires;
- rising sea levels that will continue to accelerate and increase the risk of submersion;
- Major climate change trends are better known today in the overseas territories, with the exception of very small islands. Over the last forty years, temperatures have increased from +0.65°C to +1.5°C depending on the region. Climate projections are between +1.4°C and +3°C by the end of the 21st century.
- an uncertain change in the frequency and severity of storms, except in tropical overseas regions where the severity of hurricanes is expected to increase.

The expected impacts are summarised on the map below.

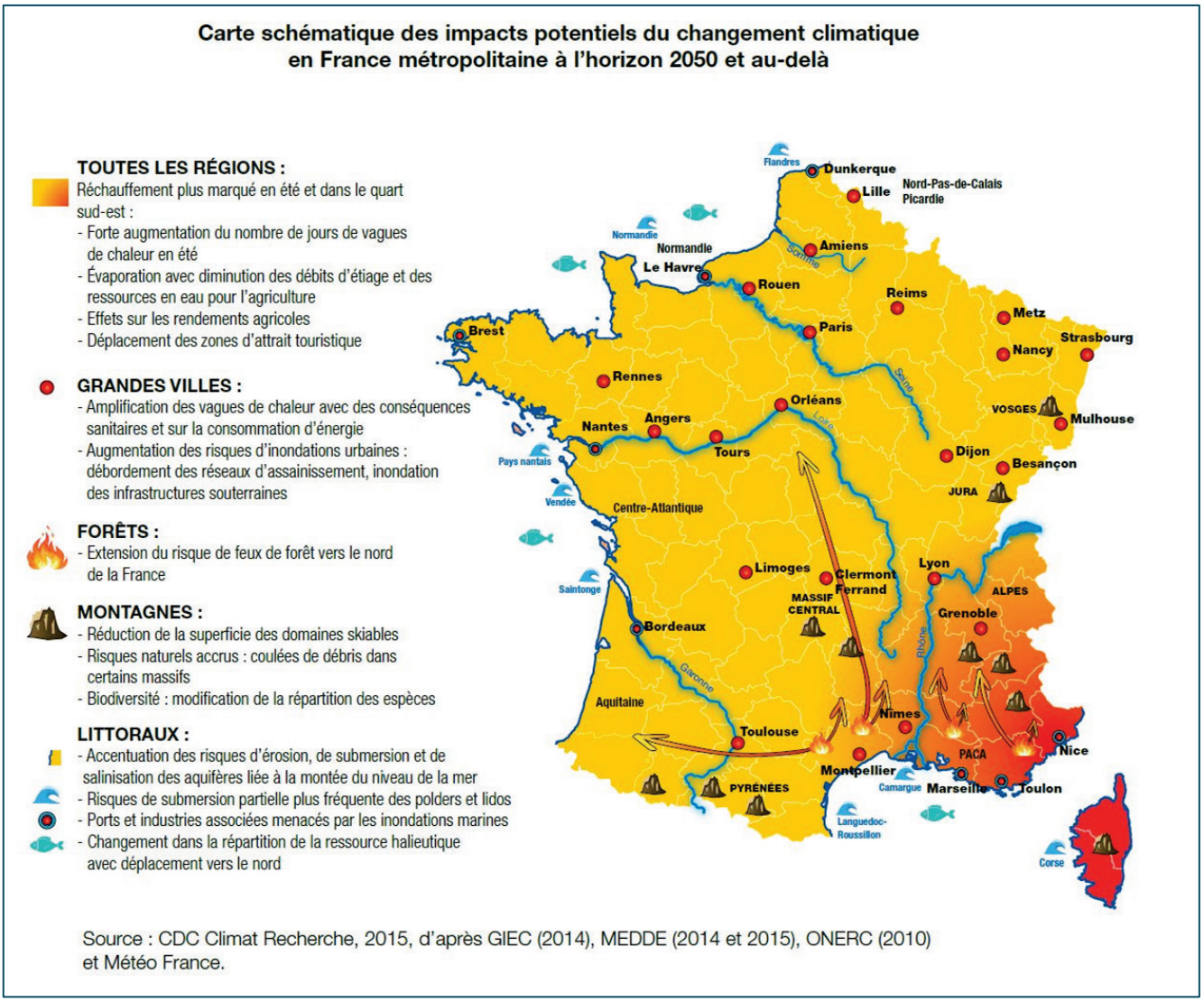

Figure 6.3: Potential Impacts in 2050 and Beyond – Source: Météo-France

Significant consequences for biodiversity are also expected. For example, the geographical distribution of the bioclimatic zones of tree species will be modified faster than their natural adaptation capacity allows.

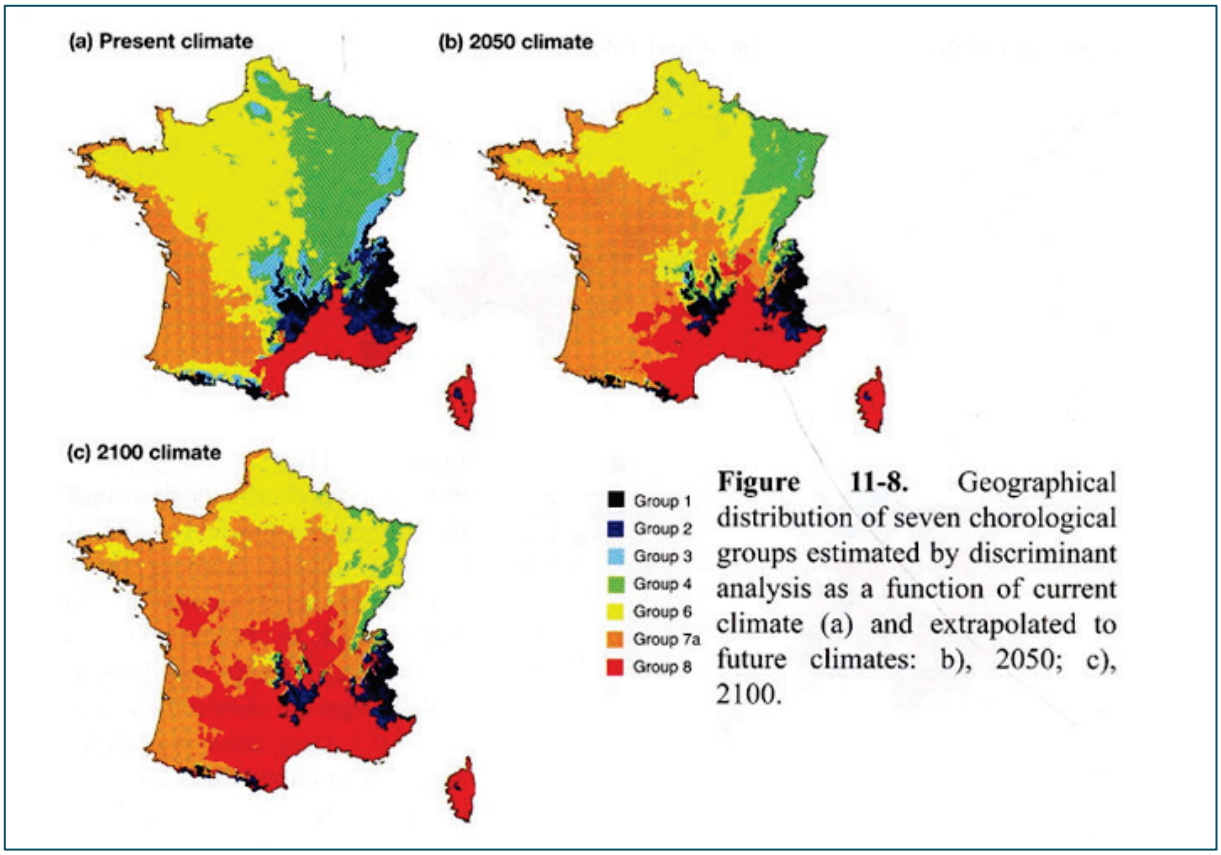

Figure 11-8. Geographical distribution of seven chorological groups estimated by discriminant analysis as a function of current climate (a) and extrapolated to future climates: b), 2050; c), 2100.

(a) Geographical distribution of 7 groups of species with the same climatic affinity, obtained by discriminant analysis of the current climate
(b) Projection of these bioclimates in 2050
(b) Projection of these bioclimates in 2100
Scenario A2 Arpeggio
Source Badeau in Loustau Ed 2011, Quae
Figure 6.4: The bioclimates of France and their projection in the future climate

Sea level rise

Because of the distribution of French overseas territories over all the world's oceans and the number of French people living in coastal areas, the issue of rising sea levels is fundamental to France.

All satellite and hydrographic observations corroborate that the global rise in sea level is unequal both geographically and temporally. For example, in some regions the sea level will rise at a much faster rate than the world average, while in other regions the sea level is falling.

Overall, sea levels will rise even faster in the 21st century. The two main causes of global sea level rise are the thermal expansion of the oceans (water expands with heat) and the disappearance of continental glaciers due to an increase in melting ice. Sea level increases have grown from less than 3 mm/ year to more than 5 mm/ year over the last 20 years; the projections from now to the end of the 21st century range from +40 cm to +60 cm and even +1 m for extreme cases.

Most overseas territories have a lower capacity to cushion pressures and implement territorial redeployment than do mainland areas. This reduces the room for manoeuvre of companies and stakeholders, both public and private, in the face of constraints.

Current environmental and development conditions determine the adaptability of territories and therefore their ability to undertake a long-term adaptation process. Climate change will essentially have the effect, at local level, of exacerbating existing pressures related to unsustainable development patterns.

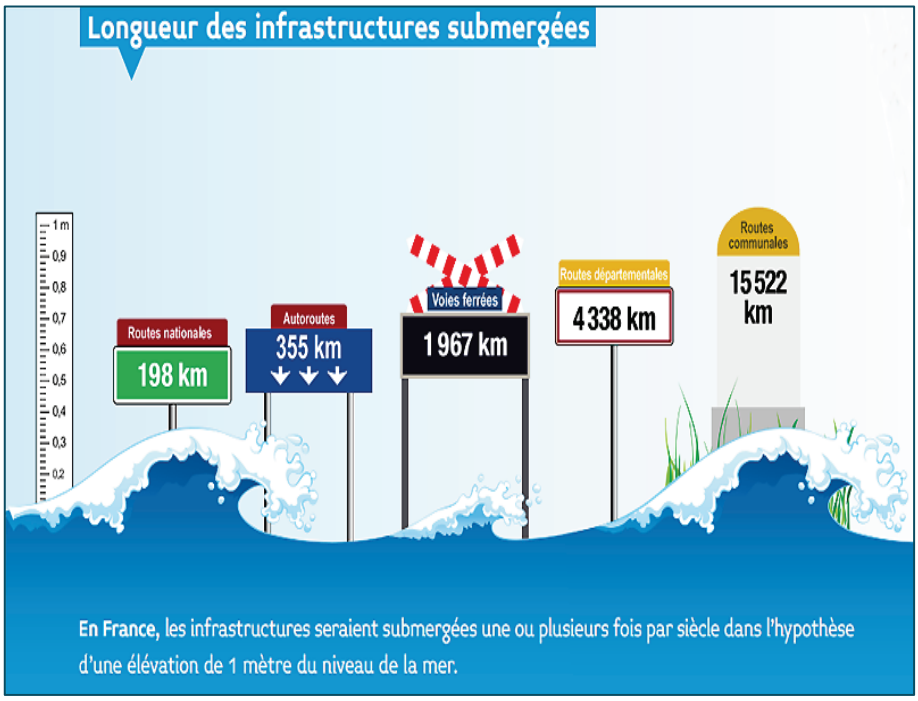

Figure 6.5: Infrastructure length depending on its submerged nature in the event of a 1-metre rise in sea level, which is superimposed on a flood hazard with a return duration of 100 years - Source: ONERC

B. VULNERABILITY ASSESSMENT

Man and Nature may have the capacity to adapt spontaneously, to some extent, to the upheavals caused by climate change, but it is certain that, if we do not prepare for this change, it will bring about costs and damage far greater than any efforts to predict them. It is therefore necessary to reduce our vulnerability to climatic variations today, in order to avoid significant environmental, material, financial and human damage. It should be recalled that the cost of inaction, as estimated by economist Nicholas Stern[54], is between 5% and 20% of global Gross Domestic Product (GDP) and that the cost of action is 1% to 2% of global GDP.

The ONERC report published in 2009 "Climate change impacts, associated costs and lines of adaptation" shows that the annual costs linked to climate change could reach several billion euros per year for mainland France if no adaptation measures are taken.

To make the effects of climate change easier to perceive, several indicators are published on the ONERC website. Some are aggregations of available data to show the influence of climate change.

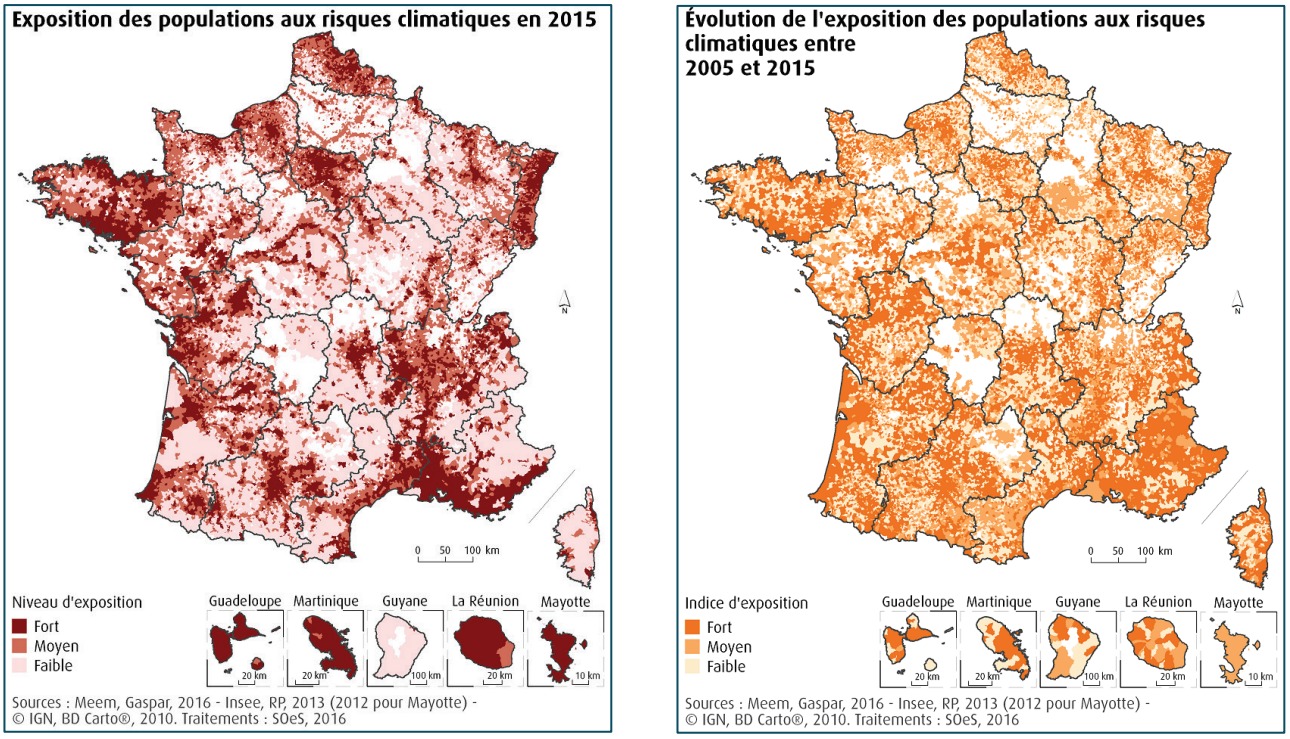

Figure 6.6: Population exposure Source ONERC SDES
Source: ONERC/ SOeS processing/ INSEE data/ MEDDE/ DGPR

These maps illustrate the level of exposure of the French population to natural climate-related risks. The higher the population density and the higher the number of climate risks identified per municipality, the higher the risk index is.

These risks are likely to increase with climate change, as some weather events and extremes may become more frequent, more widespread and/or more intense. We must therefore put adaptation actions in place in exposed territories to limit their vulnerability to climate risks.

[54] Lord Nicholas Stern, "The Economics of Climate Change", Cambridge University Press, 2006

An analysis of statistical data shows that 18.5% of towns in mainland France are highly exposed to climate risks, with this figure rising to 50% if moderately exposed towns are included. At regional level, the regions most affected are the overseas territories, with more than 90% of their towns having high exposure. For mainland France, the most exposed regions are Brittany (46%), the Provence-Alpes-Côte d'Azur region (PACA) (44%) and Ile-de-France (40%). While in Ile-de-France it is primarily the population density that is the overriding factor, in PACA and Brittany the high population density is exacerbated by the large number of towns for which at least 3 climate risks have been identified.

Comparing the indicators of population exposure to climate risks in 2005 and 2015 shows a very significant increase in the number of towns that are highly exposed to climate risks (+175%), while the number of towns moderately (+44%) or slightly exposed (+68%) increase to a lesser extent. On the other hand, the proportion of unexposed towns fell sharply (-65%). Several factors influenced the change in the exposure indicator between 2005 and 2015. However, it should be noted that the increase in this indicator is related not only to the variation in the occurrences of climatic events, but also to improvements in knowledge of the climatic risks identified and declared by State services and to the population increase.

In comparison with other countries, particularly those in the southern hemisphere, France (with the exception of the French overseas territories) is presently relatively unaffected by climate change. However, the situation could change and significantly worsen from 2060.

Published in 2009, the ONERC report entitled "Impacts of Climate Change, Associated Costs and Lines of Adaptation" highlights the expected economic impacts in the near and distant future.

Several lines of adaptation have been identified that would limit the negative impacts of climate change. Most adaptation measures, however, are largely dependent on territorial characteristics and should therefore be considered on a case-by-case basis at the local level.

In keeping with the 2009 ONERC Climate Change report, "Impact Costs and Lines of Adaptation", it has been established that France will be faced with an increased strain on water resources (e.g. 2 billion m3 deficit per year), a marked change in natural risks (e.g. damage caused to homes by the shrinkage-swelling of clays that can exceed 1 billion euros per year), marked impacts on biomass production (e.g. costs of more than 300 million euros per year for the cultivation of wheat alone should there be an increase in events comparable to the 2003 heat wave) to name just a few examples foreseeable by 2050-2100. Several of the papers presented in this publication focus on the cost of climate change in the regions.

The current findings should not encourage inaction but rather encourage the development of expertise, know-how and the collective mobilisation essential for adaptation. It appears however that the notion of "adaptation" is understood by actors in a variety of ways. This confusion can lead to misinterpretations that are prejudicial to public action. The clarification of the meaning to be given to this term and its appropriation by all relevant actors is a fundamental prerequisite from this point of view.

C. ADAPTATION

C.1 France's Climate Plan

The fight against climate change is a national priority and the measures needed to limit its impact, by reducing our greenhouse gas emissions (i.e. climate change mitigation), are the subject of the France's Climate Plan, which is updated regularly, the latest version of which was published in July 2017. Drawn up at the request of the French President and Prime Minister, the Climate plan aims to mobilise the entire government over the coming months and years in order to make the Paris Agreement a reality for French citizens, for Europe, and for France's wider diplomatic initiatives. With the Climate Plan, France is accelerating the operational application of the Paris Agreement and will exceed its initial objectives through six priorities in 23 areas, including:

- making the implementation of the Paris Agreement irreversible;
- improving the daily lives of all French people;
- ending the use of fossil fuels and committing to carbon neutrality;
- making France the leader in the Green economy;
- developing the potential of ecosystems and agriculture;
- increasing international mobilisation on climate diplomacy.

Before the end of 2017, following a period of consultation, the Government will publish a new National Climate Change Adaptation Plan, which will be implemented during the five-year term. Its aim will be to better protect French citizens against extreme climatic events, and also to build resilience to climate change in the main sectors of the economy (agriculture, industry and tourism). France will increase its dedicated funding for the adaptation of its territories and its economy throughout the five-year term for actions in mainland and overseas territories on the prevention of the impacts of climate change, resilience and the mobilisation of adaptive solutions based on nature. The adaptation of our territory to climate change is also a major issue that should now be considered as an essential addition to mitigation actions that have already been undertaken."

The beginning of the State's action in the field of adaptation to climate change began in 2001 with the creation of the French National Observatory on the Effects of Global Warming (ONERC), which has the explicit mission of adaptation to climate change. This was followed by the adoption of the National Adaptation Strategy in 2006. The National Plan for Adapting to Climate Change was adopted in July 2011. At regional and local level, adaptation policies are presented in the Regional Air and Energy Climate Plans and in the Energy and Territory Climate Plans, which must also have an adaptation component. At the end of 2017, the second National Plan for Adapting to Climate Change will be made public.

C.2 France's national adaptation strategy

Adopted in 2006, the objectives of the National Adaptation Strategy are to underpin all the approaches recommended for adaptation to climate change, namely:

- taking action for safety and public health,
- taking social inequalities into account,
- limiting costs, taking advantage of benefits,
- preserving the natural heritage.

Adaptation must be taken into account in all professions. Because of their transversal nature and their relationships with the economic, social and environmental sectors, the following cross-cutting approaches are given priority: water, risks, health, biodiversity. Insights are then provided on the following economic activities: agriculture, energy and industry, transport, construction and housing, tourism.

Finally, adaptation must also be understood in an integrated way, no longer considering individual business sectors but rather the most relevant combination of sectoral policies within selected "environments" because of their particular vulnerability: cities, the coastline and sea, mountains and forests.

C.3 National Plan for Adapting to Climate Change

Since 1992, with the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the international community has been working to limit the major increase of greenhouse gas emissions. Yet the concentration of greenhouse gases in the global atmosphere continues to increase and because of the inertia of atmospheric and oceanic systems, the climate will continue to change for at least a few more decades. We must therefore adapt to life in a climate in transition, that of today as well as that of tomorrow.

In view of the conclusions of the 4th IPCC summary report published in 2007, the Planning Act on the implementation of the Grenelle Environmental Forum, approved on 3 August 2009, provided for the preparation of a National Adaptation Plan for the different sectors of activity by 2011.

The adaptation of our territory to climate change has thus become a major challenge that has called for national mobilisation. Adaptation is now considered as an essential addition to the mitigation actions already undertaken.

The report by the inter ministerial group "Climate Change Impacts, Associated Costs and Lines of Adaptation"[55], published by ONERC in September 2009, provides evidence showing the extent of climate change impacts and associated costs, but also possible opportunities for France.

In 2010, a wide dialogue bringing together the associations of the Grenelle Environmental Forum (the State, elected representatives, civil society, Employers' and Employees' Union) was behind the development of the National Adaptation Plan.

The purpose of this national plan was to present the measures to prepare France to face and take advantage of new climatic conditions, from 2011 to 2015.

This first adaptation plan only addressed measures that applied to national level. The specific territorialisation of adaptation at local level was the responsibility of Regional Climate, Air and Energy Plans (SRCAE) and Territorial Climate and Energy Plans (PCET).

In June 2015, an evaluation was entrusted to the General Council for the Environment and Sustainable Development. The report submitted to Minister Ségolène Royal in October 2015 contains a summary of the evaluation and recommendations for a future plan covering the period 2017-2021.

In June 2015, an overall evaluation of this first adaptation plan was entrusted to the Council for the Environment and Sustainable Development (CGEDD). The report submitted to Minister Ségolène Royal in October 2015 contains a summary of the evaluation and recommendations for a future plan covering the period 2017-2021. This evaluation serves as a basis for the development of a second plan, which will

[55] http://www.developpement-durable.gouv.fr/IMG/spipwwwmedad/pdf/rapport_onerc_cle098a8d-1.pdf

also benefit from the knowledge acquired in particular through the study and research carried out under the first plan and from the fifth IPCC report published in 2013 and 2014.

The overall objective of the 2017-2022 National Adaptation Plan (NAPCC-2) will be to implement the necessary actions to **adapt the territories of mainland and overseas France to regional climate change consistent with the long-term objective of the Paris Agreement**.

Based on the recommendations from the evaluation of the first NAPCC (2011-2015), the NAPCC-2 was developed according to one of the main principles that govern the Climate Plan, namely the mobilisation of the collective intelligence of a wide variety of stakeholders, which has allowed the actions included in this Adaptation Plan to be co-constructed. The dialogue was organised according to 6 policy areas structuring the priorities of the NAPCC-2: Governance, Prevention and Resilience, Economic Sectors, Knowledge and Information, Nature and Environments, International.

C.4 The actions of local authorities

While the impacts of climate change are not yet very acute in France, apart from episodes of heat waves and drought, they may, and very probably will, increase over time (several decades). This trend will be even more marked as efforts to reduce greenhouse gases have been limited. The main impacts in France would be a summer warming markedly more pronounced than the winter warming and affecting the southern regions in particular, an amplification of the long-term impacts on the territories (in particular the coastal and mountainous areas) and consequently a greater exposure of populations to natural, technological and health risks.

Three types of adaptation can be identified. Adaption can be spontaneous and respond to a climate constraint in an immediate and non-strategic way. It can also be planned and the result of deliberate strategic decisions based on a clear understanding of the conditions that will change and the steps that need to be taken to achieve the desired situation. Finally, adaptation can be transformational and seek to change the fundamental elements of a system in response to the climate and its effects.

However, spontaneous adaptation can lead to conflicts with other policies, and even to maladaptation due either to the inefficient use of resources, the transfer of vulnerability (to another sector, another territory), a reduction in the possibilities of future adaptation, or to a calibration error (under-adaptation).

Adaptation measures can be physical (construction of sea walls, insulation of housing), institutional (crisis management mechanisms or the introduction of specific regulations) or strategic (the relocation of an activity or property).

The impacts of climate change will affect all sectors and, beyond implementing specific climate change adaptation plans, adaptation thinking should also be included in all sectoral policies. The actions of these policies already contribute to making our society less vulnerable to this climatic evolution, first and foremost through participation in our adaptation to the current climate and its natural variability and therefore to the modified climate in the long term.

For a theme as recent and transversal as adaptation, "good governance" regarding the local population requires, on the one hand, a territorial and citizen consultation that requires prior awareness on the part of stakeholders and the dissemination of knowledge about climate change, and on the other hand, the creation of networks of actors to allow the exchange of good practices, which can lead to improvements in the measures recommended by the communities. These networks can go beyond administrative boundaries and the scope of action of sub-national strategic documents. Vulnerabilities often go beyond the classic geo-administrative framework.

From 2009 to 2013, DATAR (now CGET, the General Commissariat for Equality of the Territories) entrusted the piloting of six studies addressing the issues of vulnerability and adaptation at inter-regional level to the regional prefects (excluding Île-de-France and the overseas territories). Whenever possible, this work has been organised with those related to the preparation of Regional Air Energy Climate Plans (SRCAE) in conjunction with the Regional Councils. They have also helped develop the Territorial Energy and Climate Plans (PCET) A conclusive study was conducted in 2013-2014, in order to have a national summary of territorial issues and the possible areas for public policies. From 2009 to 2013, DATAR entrusted the piloting of 6 inter-regional studies (outside Île-de-France and the overseas territories) to the regional prefects. These studies were carried out in the Grand Sud-Est, Grand Sud-Ouest, Grand Ouest, Pays du Nord, and Grand Est administrative regions, as well as in Normandy. Some of these works have been organised with the Regional Air Energy Climate Plans (SRCAE). They also helped develop the Territorial Energy and Climate Plans (PCET).

These studies adopted a global approach integrating the evolution of local climatic parameters, global socio-economic trends related to climate change and their consequences on the territory and on populations. The inter-regional scale has made it possible to establish an inventory of vulnerabilities across sub-national territories and go beyond the sectoral approach which is not very integrated.

Similar studies with cross-border ambitions have also been conducted in mainland France (Meuse basin with the AMICE project, the Alps with the Alpine convention, the Pyrenees with the Pyrenees climate change observatory) and in overseas territories (Indian Ocean Islands with the ACClimate project).

C.4.1 The Regional Model for Organisation, Sustainable Development and Inter-regional Equality (SRADDET)

The framework of the Regional Climate, Air and Energy Plan (SRCAE) was defined by law 2010-788 of 12 July 2010 on national commitment to the environment.

The regional plans are jointly developed between the regional prefect and the president of the regional council, in consultation with local actors. They are made available to the public for a minimum of one month before being finally adopted by the regional prefect. The SRCAEs have defined regional scenarios for 2020 and 2050, compatible with European and national commitments on reducing greenhouse gas emissions, climate change adaptation and air quality. These documents include, in particular, an analysis of the region's vulnerability to the effects of global warming, which identifies the most exposed territories and sectors of activity. Planned to strengthen territorial coherence, they integrate, in a single framework, various planning documents with a strong link with energy and the climate, including former wind patterns and public service energy plans. All the SRCAE plans were approved no later than early 2014.

As defined by law No. 2015-991 of 7 August 2015 on the new territorial organisation of the Republic, the objectives of the Regional Planning, Sustainable Development and Territorial Equality Scheme (SRADDET) relating to the climate, air and energy must include climate change mitigation and adaptation measures. Thus, for the sake of coherence and simplification, the SRADDET will eventually have to take over several pre-existing sectoral planning tools, including the Regional Infrastructure and Transport Scheme (SRIT), the Regional Intermodality Plan (IRS), Regional Climate, Air and Energy Plan (SRCAE), or even the Regional Plan for Waste Prevention and Management (PRPGD). The SRADDETs will need to be approved by 28 July 2019.

C.4.2 The Territorial Climate Air Energy Plan (PCAET)

Consistent with the strategic orientations of the SRCAE and the town planning documents, the Territorial Climate Energy Plans (PCET) concern all levels, from the region to the town. They have been mandatory[56] for local authorities with more than 50,000 inhabitants since 2010. These plans define the programme of actions to be implemented to improve energy efficiency, increase renewable energy production and reduce the impact of activities in terms of greenhouse gas emissions. These are operational measures, such as energy audits of social housing, photovoltaic investments, construction of bicycle parking, and waste treatment plans, which require support and funding. According to an ADEME estimate, around 15% of national greenhouse gas emissions are related to the activities of regional and local authorities (transport, housing, construction, town planning) with an even high percentage if we include their indirect effects. A framework for the specific treatment of adaptation, in addition to mitigation, is now in place. The ultimate goal is to integrate climate change into all medium and long-term considerations, in all sectors.

Source Ademe

As part of its mission to support communities in the development of their Territorial Energy Climate Plan, ADEME has a tool that can make a preliminary diagnosis of the impact of climate change on the region: "Impact'Climat" has published four studies respectively dealing with carrying out a vulnerability diagnosis[57], constructing a climate change adaptation policy[58], following-up the adaptation policy[59] and constructing vulnerability indicators[60]. The whole system consisting of this tool and these publications makes it possible to fully support the territorial approach, from its elaboration to its evaluation. A fifth study, “PCAET: Understanding, Building and Implementing” recently completed the collection (December 2016).

Since the enactment of the NOTRE law in 2015 and the implementation decree of June 2016, communities of more than 50,000 inhabitants have had to adopt a Territorial Climate Air Energy Plan (PCAET) before 1 January 2017, and before the end of 2018 for those with 20,000 to 50,000 inhabitants. Below this threshold, this document becomes optional. These new provisions affect 268 intercommunal bodies (EPCI) with more than 50,000 inhabitants and 372 EPCIs with more than 20,000 inhabitants.

C.5 Adaptation governance in terms of actors and tools

C.5.1 Territorial governance

The governance of adaptation policies requires the establishment of practices that are characteristic of "good governance" as regards local populations. In this way, territorial and civic dialogue requires prior awareness on the part of stakeholders and the dissemination of knowledge about climate change. Local public action on adaptation must involve all relevant stakeholders in order for the projects to be socially accepted.

C.5.2 Inter-territorial governance

For a theme as recent and transversal as adaptation, it is important to create networks of actors to allow the exchange of good practice, which can lead to improvements in the measures recommended by communities. These networks can also be tools, among others, to strengthen inter-territorial cooperation. Indeed, administrative boundaries and the scope of action of sub-national strategic documents cannot be limited just to themselves. Vulnerabilities often go beyond the classic geo-administrative framework.

[56] Article L. 229-26 of the Environmental Code
[57] Diagnosis of a region’s vulnerability to climate change, Ref.: 7405, August 2012, ADEME Edition
[58] Developing and implementing a regional adaptation strategy or action plan, Ref.: 7408, August 2012, ADEME Edition
[59] Monitoring and evaluating regional adaptation to climate change, Ref.: 7407, August 2012 ADEME Edition
[60] Indicators of a region’s vulnerability to climate change, Ref.: 7406 February 2013, ADEME Edition

C.5.3 The coherence of adaptation policies with other policies to combat climate change

The majority of guidance documents (such as SRCAEs or PCETs) look for as much collaboration between climate, air and energy policies as possible. This involves mutual integration to promote the implementation of the measures, and above all ensuring that the different policies do not contradict each other. This integrating role has been developed with the SRADDET with the merger of existing or planned thematic regional schemes. Indeed, it tends towards a simplification of the policies carried out in the field of land use planning, through regional planning.

(SRCE: Regional Ecological Coherence Scheme – SRCAE: Regional Climate Air Energy Plan – SRIT: Regional Infrastructure and Transport Plan – SRI: Regional Intermodality Scheme – PRPGD: Regional Waste Prevention and Management Plan

More broadly, all traditional public policies must integrate the issues of adaptation within them. In addition, the topic of adaption is still very recent, and uncertainties on the impacts of climate change too great, for the implementation of strictly "adaptation" policies to be realistic.

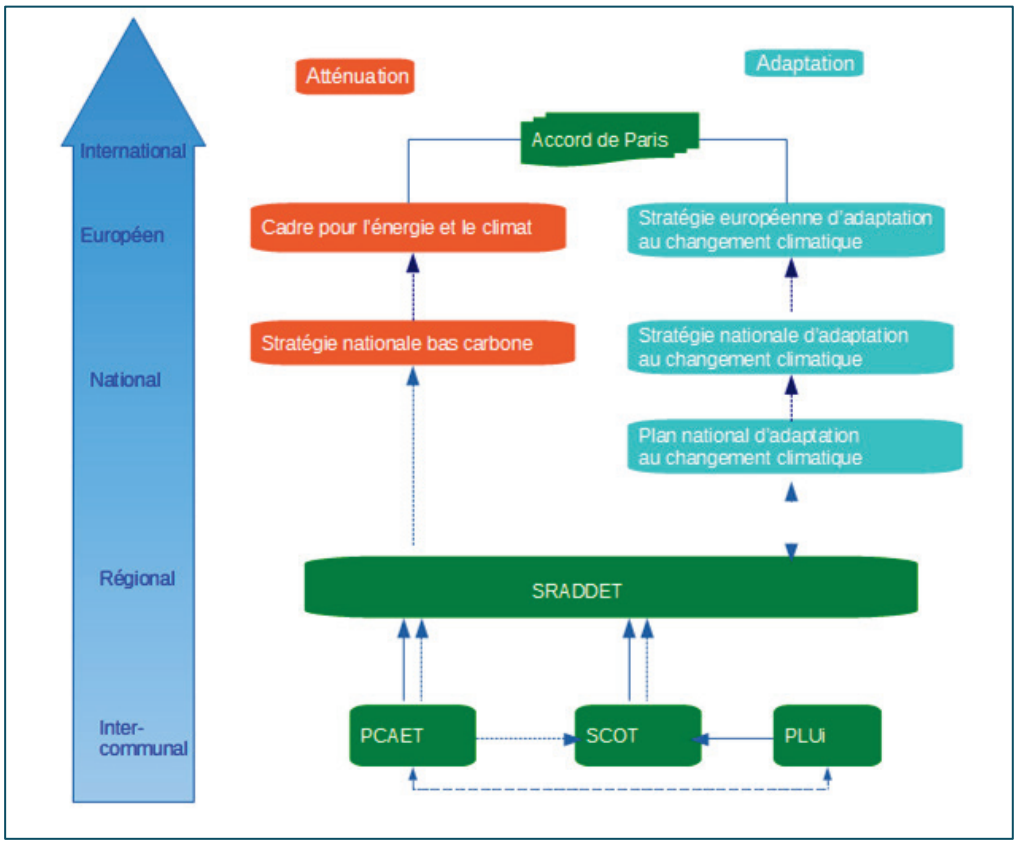

Figure 6.7: Simplified diagram of the coordination of mitigation and adaptation policies at several levels, from the international to the intercommunal level
Key: SRADDET, Regional Planning, Sustainable Development and Equality of Territories Scheme
PCAET: Territorial Climate Air Energy Plan; SCoT: Territorial Coherence Plan; PLUI: Local Intercommunal Urban Plan

Chapitre VII

Assistance given to developing countries in the form of financial resources and transfer of technology

During the United Nations General Assembly in September 2015, France announced an increase in its annual climate funding from €3 billion in 2015 to €5 billion in 2020, of which €1 billion will be dedicated to funding adaptation to climate change. The Interministerial Committee for International Cooperation and Development (CICID) confirmed this commitment on the 30th November 2016 and again mentioned its goal of doubling French funding supporting adaptation to climate change to reach at least €1 billion per year by 2020. In addition, it specifies strategic directions regarding tackling climate change, including strengthening the French Development Agency (AFD) and developing its strategy and means of intervention to contribute to the implementation of the objectives of the Paris Agreement and the commitments made by States by means of nationally determined contributions (NDCs). The CICID also re-affirms its main focus of providing French development aid to Africa.

Between 2013 and 2016, France increased public funding for climate change mitigation and adaptation in developing countries by 48.5% through bilateral and multilateral sources. In 2016, the total volume of funding provided by France amounted to over €3.3 billion ($3.7 billion), compared with €2.2 billion in 2013 ($3 billion).

In addition, France provides technological cooperation and supports capacity building in developing countries through numerous channels described in this report.

The methodological rules used to calculate the reported data are explained in the appendix.

A. FINANCIAL RESOURCES

A.1 Mobilisation of financial resources from bilateral sources

A.1.1 Financial support provided by the French Development Agency

France is a major player in bilateral development aid in the climate sector with a very large field of intervention, a recognised level of expertise and a substantial financial commitment. It is mainly supported by the French Development Agency (AFD) group (and its subsidiary for the private sector, PROPARCO), the main operator for French bilateral public development aid, which has committed more than €24 billion in funding to support the climate since 2005.

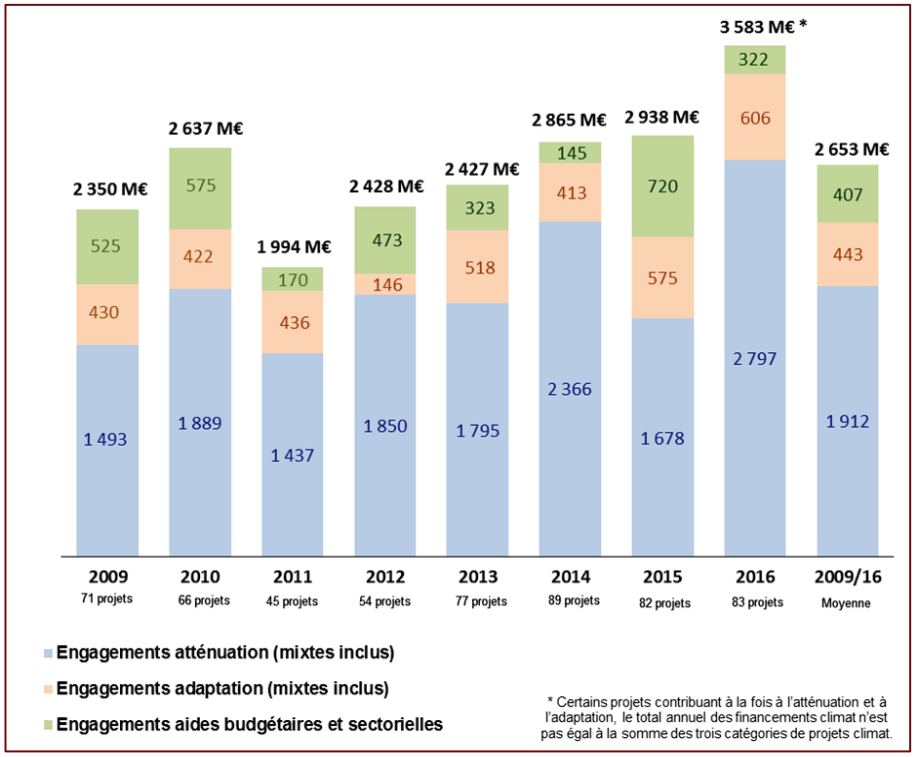

Figure 7.1: The AFD's 'climate' commitments over the period 2009-2016, by category of climate co-benefit[61] - Source: AFD

In 2016, 'climate co-benefit' funding approved by the French Development Agency Group amounted to €3.06 billion (i.e. $3.38 billion), in comparison to €2.6 billion in 2015. Finance granted by the Group in 2016 for mitigation purposes increased substantially (+31.5% from 2015), reaching almost €2.2 billion (excluding combined mitigation/adaptation projects). Adaptation finance amounted to €334.5 million in 2016, accounting for 11% of the "climate" activities of the French Development Agency (excluding combined mitigation/adaptation projects). The share of adaptation within cross-cutting projects is estimated to represent 166,4 M euros, which would bring the overall rate of adaptation finance of AFD to 16.4% of its total commitments in 2016. With a level of climate commitments in 2016 that corresponds to 52% of the AFD's activity (55% in 2015) and 36% of PROPARCO's activity (32% in 2015), the group also exceeded its annual targets[62].

[61] The amounts indicated in this graph differ from the financial volumes provided as part of the bilateral financial flows declared to the UNFCCC. This variation can be explained by the different methods and scopes considered (AFD, OECD DAC, UNFCCC). The financial volumes specified in the reporting tables attached to this document correspond to data recorded under the UNFCCC.
[62] See the section 'AFD group's accounting methodology for "climate" commitments'.

In order to ensure that the funding provided meets the climate change mitigation and adaptation needs of recipient countries, local agencies of the French Development Agency identify the projects and needs of recipient countries together with partners and project developers provided by these countries. It also relies on funding contracts being signed with national and local authorities in the countries where there is intervention. In addition, the AFD deployed, following COP21, several specific tools to enable it to support the implementation of climate commitments in developing countries, for example a 'NDC facility' at a sum of €30 million. This facility is intended to support fifteen or so countries in converting their voluntary commitments to reduce greenhouse gas emissions and to adapt investment plans, with a focus on Africa and on adaptation. Several other facilities, using European Union co-financing, also aim to support the implementation of climate commitments in developing countries. By way of an example, one can note a €24 million facility for renewable energy in Africa, or the 'CICLIA fund', provided with €12 million, intended to support African cities in implementing their policies for combating climate change, which will continue to be rolled out until 2020.

A.1.2 AFD group's accounting methodology for 'climate' commitments

The AFD group has developed an ambitious climate strategy for the period 2012-2016, based on three factors: annual 'climate' commitment target figures, the systematic measurement of the climate footprint of the projects it funds, and a selectivity policy in accordance with that climate footprint.

- 1- **In terms of annual commitments to support the climate**, the AFD Group committed, during the 2012-2016 period, to reach a level of climate activity representing at least 50% of AFD's activity in developing countries and 30% of Proparco's activity. For the AFD, these objectives can be broken down geographically: 70% are in Asia and Latin America, 50% in the Mediterranean and 30% in sub-Saharan Africa.
- 2- The AFD Group has implemented **a procedure to systematically assess the 'climate' impact of projects funded by the AFD and Proparco** in developing countries. All projects that are directly funded should be subject to an ex-ante analysis of their greenhouse gas emissions level (excluding budgetary support, financial intermediation and capacity building) and/or their impact in terms of adaptation to the effects of climate change.
- 3- **The effect of projects in terms of greenhouse gas emissions** is taken into account through the application of a selectivity matrix which can lead to certain projects being found as ineligible for AFD funding depending on the country's level of development and its climate policy. This matrix has three categories: 'neutral' or mitigation project, emissive project or highly emissive project. Moreover, the AFD supports the integration of better 'climate' practices within financial institutions through the 'Mainstreaming' initiative. The AFD is one of the instigators and leaders of this initiative.

The AFD Group's 'climate' activity is monitored based on a systematic review, during the evaluation process, of the assistance granted by the AFD and Proparco with regard to their climate impact. Development projects are classified as 'climate' projects by the AFD providing they have one or more of the following three types of co-benefits on the climate issue.

Mitigation of greenhouse gas (GHG) emissions or carbon sequestration

A project contributes to mitigation when it makes it possible to reduce greenhouse gas emissions in comparison to a reference situation without a project. A project is considered as a 'climate/mitigation' project when: (1) either the estimate of its carbon footprint shows that it reduces or saves (for renewable energy projects) GHG emissions; (2) or if its carbon footprint cannot be estimated at the time the commitment is approved, this funding is dedicated to initiatives that contribute to mitigation (study, capacity-building and lines of intermediated bank-based financing supporting renewable energy and energy efficiency projects). This methodology is completely compatible with the Common principles for mitigation finance tracking agreed by the International Development Finance Club (IDFC) and multilateral development banks.

Adaptation to climate change

Projects (or project components) are considered to contribute to adaptation if they make it possible to limit or reduce the vulnerability of property, people or ecosystems to the consequences of climate change. The AFD's approach to accounting for adaptation finance is built around the Common principles for mitigation finance tracking agreed by the International Development Finance Club (IDFC) and multilateral development banks. A project (or a project component) is considered as a 'climate/adaptation' project following (1) an analysis of the situation regarding vulnerability to climate change in the area the project is implemented; (2) demonstration of the beneficial effect of the initiatives planned as part of the project on the challenges posed by vulnerability to climate change identified in the area; and (3) expression in the project's documentation of the willingness to address the climate risks and vulnerabilities to climate change identified.

Support for implementing policies to tackle climate change

For budgetary support and sectoral aid, there are three accounting possibilities: (1) budgetary support specifically dedicated to the climate (climate loans or support for national climate plans) are 100% accounted for; (2) for other budgetary aid for sectors or intended for local authorities, the methodology used aims to summarise the content of the political and sectoral dialogue discussed with the other party (monitoring of shared indicators) and the impact, in terms of combating climate change, of the integrated approach it promotes. This method is based on accounting for 'climate' monitoring indicators on a pro-rata basis in relation to all the indicators in the matrix for monitoring the public policy implemented, and is supported by a positive list of actions that are considered by their very nature to have a climate co-benefit; (3) in the absence of indicators, standardised and shared with the other party, for monitoring its public policy, there is the possibility of accounting for 40% of the funding provided, on the condition that there is cross-sector 'climate' activity making it possible to understand the underlying dynamic behind the State or authority's initiative.

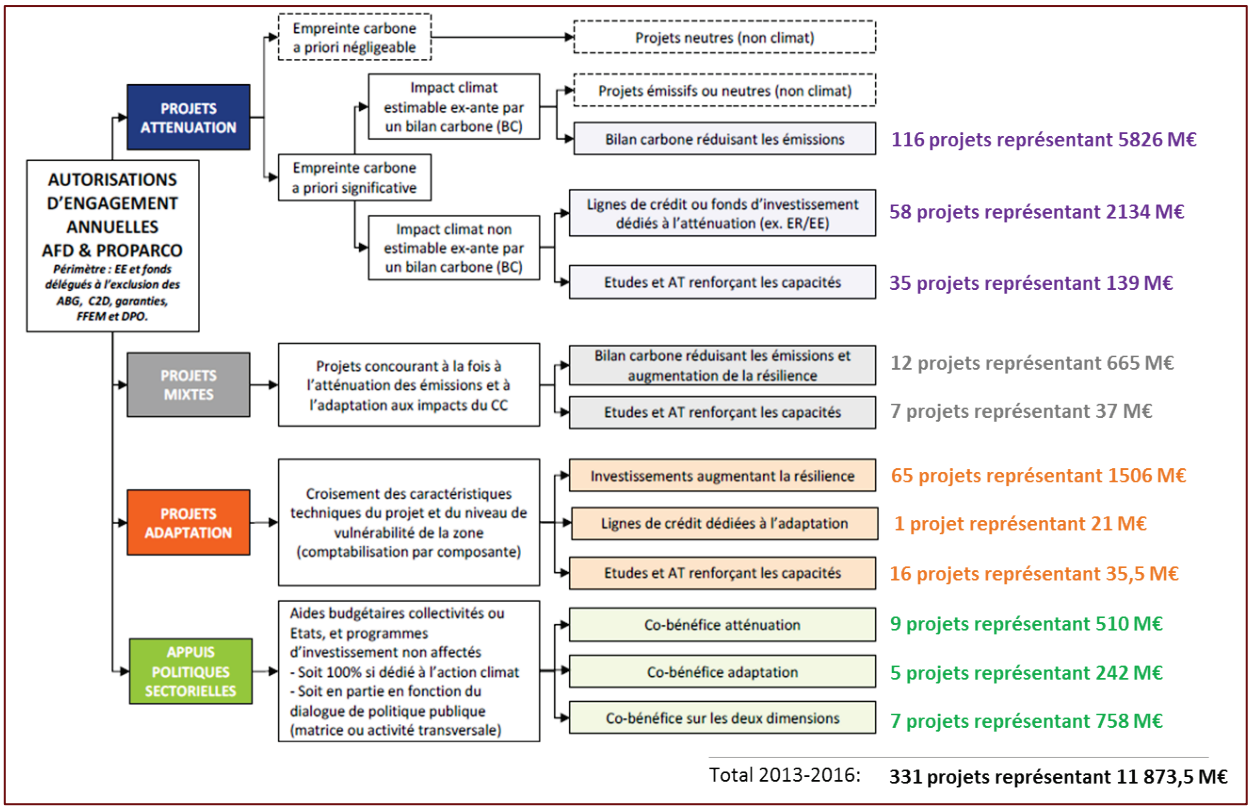

Figure 7.2: Diagram of the AFD's 'climate' projects - Source: AFD, MEF

A.1.3 Private climate finance mobilised by funding provided by the AFD Group

France has estimated the private climate finance mobilised by bilateral public funding provided by the AFD group in developing countries since 2013. **In total, the private finance mobilised in 2016 was estimated to be about €1019 million (i.e. about $1130 million) and €691 million (i.e. about $767 million) in 2015. These volumes represent a significant increase compared to recorded data for 2013 and 2014, with €593 million and €668 million respectively of mobilised private funding**.

The methodological approach used is consistent and is based on the work carried out under the aegis of the OECD Development Assistance Committee's (DAC) working group on development funding statistics, and is incorporated within the framework of the OECD's collaborative research work on monitoring private climate funding.

However, despite significant improvements to the methods used to estimate private climate funding mobilised by the AFD's climate interventions during the period considered, some aspects are still based on standardised approaches (for example, accounting for lines of credit). Therefore, the figures given should be considered as estimates.

A.1.4 Financial support provided by the French Global Environment Facility

The French Global Environment Facility (FFEM) is a public bilateral fund created in 1994 and intended to support the protection of the environment in developing countries in six key areas: climate change, biodiversity, international waters, land degradation including desertification and deforestation, persistent organic pollutants and protecting the ozone layer. It operates in compliance with France's strategic commitments and the multilateral environmental agreements it has signed, and distinguishes itself from other national public initiatives by putting innovation at the heart of its action.

The FFEM's geographical and thematic priorities correspond to the guidelines set by the French government as part of the Interministerial Committee for International Cooperation and Development (CICID).

The basic thematic approaches of the FFEM, corresponding to the production of global public goods such as those defined in major international conventions or international forums related to them, concern:

- combating climate change, with, among others, a particular focus on adaptation (at least 35% of total commitments);
- preserving and managing biodiversity and natural resources (at least 35% of commitments);
- protecting continental, marine and international waters;
- tackling desertification and land degradation, including deforestation;
- combating chemical pollutants, and in particular, mercury;
- eliminating substances that deplete the stratospheric ozone layer.

FFEM's geographical priorities include Africa and the Mediterranean. For the 2015-2018 period, the target is to commit at least two-thirds of the Fund's resources to these regions.

Since 1994, it has funded 301 projects for a total sum of more than €354 million, and co-funded almost €3.5 billion. Of this total, the share dedicated to climate change represents 103 projects for a total of €129 million, distributed as follows:

- Afrique et Méditerranée: 69 %
- Amérique latine et Caraïbes: 16 %
- Asie-Pacifique: 11 %
- Europe de l'Est: 4 %.

The reconstitution of the FFEM's financial commitments is carried out in four-yearly periods. In the period 2015-2018, **the FFEM mobilised €90 million in funding, with an objective of allocating at least 35% of its funds to combating climate change, half of which to the specific topic of adaptation. In 2015-2016, the FFEM allocated a total of €39 million to 28 projects, of which €18.8 million was dedicated to tackling climate change (i.e. 48% of its financial commitments during this period)**.

A.1.5 Financial support provided in the form of grants (FASEP) and loans from the French treasury

The Ministry of Economy and Finance contributes, in the form of grants, to funding feasibility studies, technical assistance and demonstrating innovative technologies dedicated to the environment and to sustainable development, as part of its private sector study and aid fund (FASEP). This tool funds services provided by French research departments and benefits public bodies in countries eligible for Public Development Aid and for sustainable economic development projects that meet the needs of those countries (better access to water, to renewable energies, and improved transport services, etc.).

The Ministry of Economy and Finance also supports, by means of highly concessional loans from the French Treasury (grant element of at least 35% compared with reference market rates), infrastructure projects supported by public bodies in emerging countries eligible for public development aid. Since 2015, non-concessional loans can also be granted in many geographical areas[63]. The sectors concerned mainly focus on sustainable development and the topic of climate change (mass transport, water and the environment, renewable energies, etc.).

[63] This tool is not accounted for in the French flows for public development aid but as Other Official Flows (OOF).

Over the 2013-2016 period, €342 million has been committed in the form of loans from the French Treasury having a climate co-benefit and €21.5 million in the form of grants under the FASEP[64].

A.2 Mobilisation of financial resources from multilateral sources

With a contribution of $9.5 billion in 2016, France is the fifth-largest donor in the world by volume among OECD countries in terms of public assistance for multilateral development[65] and is ranked third among G7 countries in terms of its contribution related to gross national income. France thinks that the multilateral system should be exemplary and drive the fight against climate change, with in particular, the purpose of supporting the implementation of nationally determined contributions in developing countries that are signatories to the Paris agreement. In this respect, France is one of the main contributors to financial institutions and multilateral funds dedicated to the climate.

A substantial part of France's action is dedicated to its participation in development banks and multilateral development funds such as the International Development Association (IDA), the World Bank concessional financing facility, the African Development Fund (ADF), the African Development Bank concessional financing facility, the Asian Development Fund (AsDF), the Special Inter-American Development Bank Fund and the International Fund for Agricultural Development (IFAD). These banks and funds dedicate part of their resources to tackling the effects of climate change. For the first time, France has accounted for the 'climate' share attributable to its contribution to these subsidised funds. **In 2016, the amount of 'climate' disbursements made in these institutions is estimated to be €103 million.**

A.2.1 Contribution to the Green Climate Fund

The Green Climate Fund, established during the climate conference in Copenhagen in 2009, aims to become the main multilateral fund dedicated to funding the mitigation and adaptation of developing countries towards low-carbon and resilient economies. Its initial capital amounts to $10.3 billion. It aims for a balanced distribution between mitigation and adaptation and to allocate a minimum of 50% of its resources dedicated to adaptation to the least developed countries, African States and small island developing States.

On the 31st December 2016, out of commitments totalling $1.5 billion, 47% of the funding commitments were intended for mitigation projects, in comparison with 28% for adaptation. Combined mitigation-adaptation projects represent 25% of the volume committed.

Besides, by the end of 2017, 54 projects totalling more than $2.6 million. In terms of geographical distribution, 35% of the projects approved to date are in Africa. Funding which benefits the least developed countries accounts for more than $500 million. The French Development Agency (AFD) and its subsidiary Proparco, specialising in private sector funding, have been accredited with the Green Climate Fund.

France contributes $1 billion to the Green Climate Fund, which represents the fourth largest amount contributed and the fifth largest in grant equivalents. This contribution includes €489 million in grants alone and €285 million in concessional loans guaranteed by the French state. After an initial grant payment of €104 million was made in 2015, a second payment of €62 million was made in 2016, as an advance on commitments made. In 2017, in accordance with the planned payment schedule, France will continue with its commitment to the amount of €162 million in grants and in addition, it will disburse all of

[64] Belarus, Turkey and Ukraine, which are countries that are eligible for Public Development Aid (PDA), and thus for concessional loans from the French Treasury and the FASEP, are however deemed to be developed countries within the UNFCCC (countries in Appendix I), and are not considered in the context of the UNFCCC report.
[65] Source: http://www2.compareyourcountry.org/oda?cr=oecd&lg=fr

the concessional loan. The Green Climate Fund aims to strike a balance between funding dedicated to mitigating climate change and funding dedicated to adaptation.

A.2.2 Contribution to the Global Environment Facility

Created in 1991, the Global Environment Facility, of which France was one of the main backers together with Germany, is one of the main multilateral tools in terms of preserving the global environment. This fund is involved, in addition to reducing greenhouse gas emissions, in the fields of protecting biodiversity, protecting international waters, and combating not only the depletion of the ozone layer, but also soil degradation and persistent organic pollutants.

The GEF is the financial mechanism behind five conventions:

- Convention on Biological Diversity (CBD);
- United Nations Framework Convention on Climate Change (UNFCCC);
- Stockholm Convention on Persistent Organic Pollutants (POP);
- United Nations Convention to Combat Desertification (UNCCD);
- Minamata Convention on Mercury.

France will contribute €200.7 million ($300 million) to the Global Environment Facility during the period 2015-2018 (of which 28.4%, i.e. €57 million, is specifically dedicated to funding initiatives related to climate change). France makes the fifth largest contribution in terms of value to this fund. All Global Environmental Facility (GEF) climate funding corresponds to climate change mitigation projects.

A.2.3 Contribution to the Least Developed Countries Fund

The Least Developed Countries Fund (LDCF) is dedicated to adaptation and the transfer of technology in developing countries, hosted and managed by the GEF. France has provided **€15 million in grants in 2016** to the fund (a second additional payment of €10 million will be made in 2017).

A.2.4 Contribution to the Adaptation Fund

The Adaptation Fund was established in 2007 and comes under the Kyoto Protocol. It has mobilised about $650 million since its creation. It is exclusively dedicated to funding adaption projects in developing countries, targeting those that are most vulnerable in particular. Since its creation, the fund has financed 66 projects, of which 22 were in Africa, 20 in Latin America and the Caribbean, 18 in Asia, 5 in the Pacific and a project in Eastern Europe. 27% of beneficiaries are in the least developed countries and 18% are Small Island Developing States (SIDS) France, the seventh-largest contributor to the fund, contributed $5.6 million in 2015.

A.2 5 Contribution to initiatives carried out as part of the ‘action agenda’ following COP21.

In addition, France has largely supported the funding of multilateral initiatives launched as part of the action agenda, following COP21. French support has focused in particular on the following initiatives: €10 million for CREWS (climate warning systems) in 2016-2017, €3 million for the CAFI (forests in the Congo basin) initiative, €0.3 million for the establishment of the Land Degradation Neutrality (LND) fund with the desertification convention, €0.2 million for the IPCC’s technical support unit, €2.5 million for InsuResilience in 2016 for the African Risk Capacity (an additional €2.5 million is planned for 2017), €3 billion for renewable energy initiatives in Africa.

Table 7.1: Summary of provision of financial and technology support to developing countries from 2013 to 2016

Allocation channels	Climate-specific in euros			Climate-specific in dollars		
	Mitigation	Adaptation	Cross-cutting	Mitigation	Adaptation	Cross-cutting
2016						
Total contributions through multilateral channels	**14,381,146**	**15,000,000**	**165,011,422**	**19,953,840**	**16,592,920**	**182,534,758**
Multilateral climate change Funds	14,381,146	15,000,000	62,000,000	19,953,840	16,592,920	68,584,071
Multilateral financial institutions, including regional development banks	-	-	103,011,422	-	-	113,950,688
Total contributions through bilateral, regional and other channels	**2,265,358,951**	**334,823,936**	**540,264,768**	**2,505,928,044**	**370,380,461**	**597,638,017**
TOTAL climate specific by funding type	**2,279,740,097**	**349,823,936**	**705,276,189**	**2,525,881,884**	**386,973,381**	**780,172,776**
TOTAL climate specific finance	**3,334,840,223**			**3,693,028,040**		

Allocation channels	Climate-specific in euros			Climate-specific in dollars		
	Mitigation	Adaptation	Cross-cutting	Mitigation	Adaptation	Cross-cutting
2015						
Total contributions through multilateral channels	**14,432,949**	**5,000,000**	**207,510,936**	**19,953,840**	**5,546,609**	**230,196,426**
Multilateral climate change Funds	14,432,949	5,000,000	104,000,000	19,953,840	5,546,609	115,369,477
Multilateral financial institutions, including regional development banks	-	-	103,510,936	-	-	114,826,948
Total contributions through bilateral, regional and other channels	**1,635,665,732**	**661,437,836**	**372,500,000**	**1,814,479,815**	**733,747,476**	**413,222,407**
TOTAL climate specific by funding type	**1,650,098,681**	**666,437,836**	**580,010,936**	**1,834,433,655**	**739,294,086**	**643,418,833**
TOTAL climate specific finance	**2 896 547 453**			**3 217 146 573**		

Allocation channels	Climate-specific in euros			Climate-specific in dollars		
	Mitigation	Adaptation	Cross-cutting	Mitigation	Adaptation	Cross-cutting
2014						
Total contributions through multilateral channels	**-**	**-**	**10 875 200**	**-**	**-**	**14 429 083**
Multilateral climate change Funds	-	-	10 875 200	-	-	14 429 083
Total contributions through bilateral, regional and other channels	**2,232,149,678**	**279,138,362**	**245 032 419**	**2 961 589 064**	**370 357 386**	**325 106 036**
TOTAL climate specific by funding type	**2,232,149,678**	**279,138,362**	**255 907 619**	**2 961 589 064**	**370 357 386**	**339 535 119**
TOTAL climate specific finance	**2,767,195,659**			**3,671,481,569**		

Allocation channels	Climate-specific in euros			Climate-specific in dollars		
	Mitigation	Adaptation	Cross-cutting	Mitigation	Adaptation	Cross-cutting
2013						
Total contributions through multilateral channels	**-**	**-**	**10 875 200**	**-**	**-**	**14 438 662**
Multilateral climate change Funds	-	-	-	-	-	0
Total contributions through bilateral, regional and other channels	**1,641,670,415**	**380,500,631**	**213 801 978**	**2 179 594 284**	**505 178 745**	**283 858 176**
TOTAL climate specific by funding type	**1,641,670,415**	**380,500,631**	**224 677 178**	**2 179 594 284**	**505 178 745**	**298 296 837**
TOTAL climate specific finance	**2,246,848,224**			**2,983,069,866**		

Table 7.2: Financial support provided to developing countries from 2013 to 2016

1- Multilateral contributions

2016	Core/general		Climate-specific						
Donor Funding	**Euros**	**USD**	**Euros**	**USD**	**Status**	**Funding source**	**Financial instruments**	**Type of support**	**Sector**
Multilateral climate change funds	**50,637,838**	**70,260,000**	**91,381,146**	**105,130,831**					
Global Environment Facility	50,637,838	70,260,000	14,381,146	19,953,840	provided	ODA	Grant	mitigation	mitigation
Least developed countries Fund	-	-	15,000,000	16,592,920	provided	ODA	Grant	adaptation	adaptation
Green climate Fund	-	-	62,000,000	68,584,071	provided	ODA	Grant	Cross-cutting	Cross-cutting
Multilateral financial institutions, including regional development banks	**517,300,000**	**572,234,513**	**103,011,422**	**113,950,688**					
African Development Fund	127,000,000	140,486,726	27,263,992	30,159,283	provided	ODA	Grant	Cross-cutting	-
AsDB Special Funds	23,100,000	25,553,097	3,866,970	4,277,622	provided	ODA	Grant	Cross-cutting	-
IDB Special Fund	9,500,000	10,508,850	763,114	844,153	provided	ODA	Grant	Cross-cutting	-
International Fund for Agricultural Development	11,800,000	13,053,097	8,285,752	9,165,655	provided	ODA	Grant	Cross-cutting	-
International Development Association	345,900,000	382,632,743	62,831,594	69,503,975	provided	ODA	Loan	Cross-cutting	-
Total contribution through multilateral channels	**567,937,838**	**642,494,513**	**194,392,568**	**219,081,519**					

2015	Core/general		Climate-specific						
Donor Funding	Euros	USD	Euros	USD	Status	Funding source	Financial instruments	Type of support	Sector
Total contribution through multilateral channels									
Multilateral climate change funds	**50,820,241**	**70,260,000**	**123,432,949**	**140,869,927**					
Global Environment Facility in 2015	50,820,241	70,260,000	14,432,949	19,953,840	provided	ODA	Grant	mitigation	mitigation
Adaptation Fund	-	-	5,000,000	5,546,609	provided	ODA	Grant	Adaptation	Adaptation
Green climate Fund in 2015	-	-	104,000,000	115,369,477	provided	ODA	Grant	Cross-cutting	Cross-cutting
Multilateral financial institutions, including regional development banks	**511,658,696**	**567,594,196**	**103,510,936**	**114,826,948**					
African Development Fund	152,469,332	169,137,569	32,731,674	36,309,963	provided	ODA	Grant	Cross-cutting	-
AsDB Special Funds	23,125,000	25,653,069	3,871,155	4,294,357	provided	ODA	Grant	Cross-cutting	-
IDB Special Fund	1,728,105	1,917,025	138,815	153,990	provided	ODA	Grant	Cross-cutting	-
International Fund for Agricultural Develop-ment	11,600,000	12,868,134	8,145,316	9,035,777	provided	ODA	Grant	Cross-cutting	-
International Development Association	322,736,259	358,018,399	58,623,976	65,032,861	provided	ODA	Loan	Cross-cutting	-
Total contribution through multilateral channels	**562,478,937**	**637,854,196**	**226,943,885**	**255,696,875**					

2013-2014	Core/general		Climate-specific						
Donor Funding	Euros	USD	Euros	USD	Status	Funding source	Financial instruments	Type of support	Sector
Multilateral climate change funds									
Global Environment Facility in 2013	33,985,000	45,120,818	10,875,200	14,438,662	provided	ODA	Grant	Cross-cutting	Cross-cutting
Global Environment Facility in 2014	33,985,000	45,090,885	10,875,200	14,429,083	provided	ODA	Grant	Cross-cutting	Cross-cutting

2- Bilateral contributions

2016	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
FASEP - Morocco	340,952,	377,159	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
Treasury loan - Morocco	28,000,000,	30,973,451	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
FASEP - Nigeria	437,370,	483,816	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
FASEP - South Africa	347,410,	384,303	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
Treasury loan - Senegal	38,000,000,	42,035,398	Committed	OOF	Non concessional loan	Mitigation	TRANSPORT AND STORAGE
FASEP - Brazil	195,588,	216,358	Committed	ODA	Grant	Mitigation	TRANSPORT AND STORAGE
FASEP - Mexico	159,626,	176,578	Committed	ODA	Grant	Mitigation	TRANSPORT AND STORAGE
FASEP - Morocco	165,779,	183,384	Committed	ODA	Grant	Cross-cutting	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
FASEP - Colombia	300,000,	331,858	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
FASEP - Jordan	308,000,	340,708	Committed	ODA	Grant	Cross-cutting	WATER AND SANITATION
FASEP - Lebanon	226,942,	251,042	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
FASEP - Djibouti	271,994,	300,879	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
FASEP - Azebaïdjan	281,987,	311,932	Committed	ODA	Grant	Cross-cutting	Other (WATER AND SANITATION / EFFICIENCY)
FASEP - Myanmar	700,000,	774,336	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
FASEP - Kenya	350,000,	387,168	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
FFEM - Bolivia	950,000	1,050,885	Committed	ODA	Grant	Cross-cutting	AGRICULTURE / FORESTRY
FFEM - multi-country (Asia)	2,000,000	2,212,389	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY

2016	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
FFEM - multi-country (Africa)	2,000,000	2,212,389	Committed	ODA	Grant	Cross-cutting	OTHER (URBAN DEVELOPMENT)
FFEM - Central Africa	2,000,000	2,212,389	Committed	ODA	Grant	Cross-cutting	FORESTRY
FFEM - Guatemala	1,510,000	1,670,354	Committed	ODA	Grant	Cross-cutting	OTHER (URBAN DEVELOPMENT)
FFEM - Burkina Faso and Mali	1,000,000	1,106,195	Committed	ODA	Grant	Adaptation	AGRICULTURE
FFEM - Senegal and Mauritania	1,500,000	1,659,292	Committed	ODA	Grant	Cross-cutting	AGRICULTURE
FFEM - Mauritius	400,000	442,478	Committed	ODA	Grant	Cross-cutting	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
FFEM - Cameroon	500,000	553,097	Committed	ODA	Grant	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - South Africa	100,000,000	110,619,469	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - South Africa	20,465,001	22,638,275	Committed	ODA	Concessional loan	Cross-cutting	WATER AND SANITATION
AFD - Benin	50,000,000	55,309,735	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Burkina Faso	22,000,000	24,336,283	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Burkina Faso	13,000,000	14,380,531	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
AFD - Ivory coast	120,000,000	132,743,363	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Guinea	9,900,000	10,951,327	Committed	ODA	Grant	Adaptation	AGRICULTURE
AFD - Madagascar	3,500,000	3,871,681	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Madagascar	280,000	309,735	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
AFD - Madagascar	22,000,000	24,336,283	Committed	ODA	Concessional loan	Adaptation	OTHER (URBAN DEVELOPMENT)
AFD - Madagascar	3,000,000	3,318,584	Committed	ODA	Grant	Adaptation	OTHER (URBAN DEVELOPMENT)
AFD - multi-countries	4,000,000	4,424,779	Committed	ODA	Grant	Mitigation	BANKING AND FINANCIAL SERVICES

2016	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - multi-countries (Africa)	1,410,000	1,559,735	Committed	ODA	Grant	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - Namibia	45,000,000	49,778,761	Committed	ODA	Concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Namibia	1,000,000	1,106,195	Committed	ODA	Grant	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Niger	8,100,000	8,960,177	Committed	ODA	Concessional loan	Adaptation	AGRICULTURE
AFD - Niger	1,890,000	2,090,708	Committed	ODA	Grant	Adaptation	AGRICULTURE
AFD - Senegal	64,400,000	71,238,938	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Senegal	700,000	774,336	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
AFD - Senegal	100,000,000	110,619,469	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Bolivia	60,000,000	66,371,681	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Bolivia	66,000,000	73,008,850	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Brasil	70,000,000	77,433,628	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Colombia	182,000,000	201,327,434	Committed	ODA	Concessional loan	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - Dominican Republic	50,000,000	55,309,735	Committed	ODA	Concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Ecuador	39,169,001	43,328,541	Committed	ODA	Concessional loan	Cross-cutting	WATER AND SANITATION
AFD - Haiti	210,000	232,301	Committed	ODA	Grant	Adaptation	AGRICULTURE
AFD - Mexico	12,000,000	13,274,336	Committed	ODA	Concessional loan	Cross-cutting	OTHER (RURAL DEVELOPMENT)
AFD - Mexico	250,000,000	276,548,673	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Myanmar	10,750,000	11,891,593	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - China	25,600,000	28,318,584	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - China	75,000,000	82,964,602	Committed	ODA	Concessional loan	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - China	25,000,000	27,654,867	Committed	ODA	Concessional loan	Mitigation	OTHER (WASTE MANAGEMENT)
AFD - China	25,000,000	27,654,867	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY

2016	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - India	180,000,000	199,115,044	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - India	130,000,000	143,805,310	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Laos	795,000	879,425	Committed	ODA	Grant	Adaptation	AGRICULTURE
AFD - multi-countries	4,000,000	4,424,779	Committed	ODA	Grant	Adaptation	GENERAL ENVIRONMENTAL PROTECTION
AFD - Pakistan	75,000,000	82,964,602	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Pakistan	21,000,000	23,230,088	Committed	ODA	Concessional loan	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - Pakistan	105,000	116,150	Committed	ODA	Grant	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - Pakistan	90,000,000	99,557,522	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Sri Lanka	30,000,000	33,185,841	Committed	ODA	Concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Vietnam	100,000,000	110,619,469	Committed	ODA	Concessional loan	Cross-cutting	GENERAL ENVIRONMENTAL PROTECTION
AFD - Egypt	100,000,000	110,619,469	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Egypt	60,736,000	67,185,841	Committed	OOF	Non concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Egypt	50,000,000	55,309,735	Committed	ODA	Concessional loan	Mitigation	WATER AND SANITATION
AFD - Jordania	32,000,000	35,398,230	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Morocco	34,000,000	37,610,619	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Morocco	40,000,000	44,247,788	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Morocco	1,000,000	1,106,195	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
AFD - Morocco	30,000,000	33,185,841	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Morocco	500,000	553,097	Committed	ODA	Grant	Mitigation	TRANSPORT AND STORAGE
AFD - Morocco	20,000,000	22,123,894	Committed	ODA	Concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Tunisia	60,000,000	66,371,681	Committed	ODA	Concessional loan	Adaptation	WATER AND SANITATION
AFD - Tunisia	75,000,000	82,964,602	Committed	ODA	Concessional loan	Mitigation	TRANSPORT AND STORAGE
AFD - Tunisia	650,000	719,027	Committed	ODA	Grant	Mitigation	TRANSPORT AND STORAGE

2016	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - multi-countries	80,000,000	88,495,575	Committed	ODA	Concessional loan	Cross-cutting	AGRICULTURE
AFD - multi-countries	1,500,000	1,659,292	Committed	ODA	Grant	Adaptation	WATER AND SANITATION
AFD - Senegal	34,500,000	38,163,717	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - El Salvador	26,242,000	29,028,761	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Armenia	13,394,000	14,816,372	Committed	OOF	Non concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - multi-countries (Asia)	6,888,000	7,619,469	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - multi-countries (Africa)	17,494,001	19,351,771	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - India	986,000	1,090,708	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Guatemala	1,513,000	1,673,673	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Jordania	44,373,000	49,085,177	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Jordania	35,499,000	39,268,805	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Panama	17,270,000	19,103,982	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - multi-countries (Africa)	13,633,001	15,080,753	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - multi-countries	15,000,000	16,592,920	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Senegal	18,433,001	20,390,487	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY

2016	Total amount Climate specific						
Recipient country/ region/project/programme	**EUR**	**USD**	**Status**	**Funding source**	**Financial instruments**	**Type of support**	**Sector**
AFD - Chile	37,764,000	41,774,336	Committed	OOF	Non concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Sri Lanka	8,000,000	8,849,558	Committed	OOF	Non concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - Brasil	11,309,001	12,509,957	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Morocco	25,000,000	27,654,867	Committed	OOF	Non concessional loan	Mitigation	BANKING AND FINANCIAL SERVICES
AFD - multi-countries (mediterranean)	4,789,001	5,297,567	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - multi-countries	23,948,001	26,491,151	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
AFD - Pakistan	4,807,000	5,317,478	Committed	OOF	Non concessional loan	Mitigation	ENERGY GENERATION, DISTRIBUTION AND EFFICIENCY
Total contributions through bilateral, regional and other channels	**3,140,447,655**	**3,473,946,522**					

2015	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - Africa	21,225,544	23,545,961	Committed	OOF	Non concessional loan	Mitigation	Renewable energies (without hydro)
AFD - Africa	31,556,448	35,006,259	Committed	OOF	Non concessional loan	Mitigation	Hydroelectricity
AFD - Africa	3,000,000	3,327,966	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Africa	50,000,000	55,466,095	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Africa	80,000,000	88,745,752	Committed	ODA	Concessional loan	Mitigation	Renewable energies (without hydro)
AFD - Africa	10,000,000	11,093,219	Committed	ODA	Concessional loan	Mitigation	Waste
AFD - Africa	90,000,000	99,838,971	Committed	ODA	Concessional loan	Mitigation	Hydroelectricity
AFD - Africa	166,000,000	184,147,435	Committed	ODA	Concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Africa	90,000,000	99,838,971	Committed	ODA	Concessional loan	Mitigation	Energy Distribution
AFD - Africa	35,000,000	38,826,266	Committed	ODA	Concessional loan	Mitigation	Urban mass trasmport
AFD - Africa	18,000,000	19,967,794	Committed	ODA	Grant	Adaptation	Urban planning
AFD - Africa	500,000	554,661	Committed	ODA	Grant	Adaptation	Water
AFD - Africa	5,300,000	5,879,406	Committed	ODA	Grant	Adaptation	Agriculture
AFD - Africa	5,000,000	5,546,609	Committed	ODA	Grant	Mitigation	Forestry
AFD - Africa	430,000	477,008	Committed	ODA	Grant	Mitigation	Waste
AFD - Latin America and the carribean	87,197,447	96,730,038	Committed	OOF	Non concessional loan	Mitigation	Renewable energies (without hydro)
AFD - Latin America and the carribean	59,541,462	66,050,648	Committed	OOF	Non concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Latin America and the carribean	36,761,409	40,780,237	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Latin America and the carribean	21,000,000	23,295,760	Committed	ODA	Concessional loan	Adaptation	Energy efficiency or Renewable energy
AFD - Latin America and the carribean	40,000,000	44,372,876	Committed	ODA	Concessional loan	Mitigation	Cross-cutting
AFD - Latin America and the carribean	93,659,268	103,898,276	Committed	ODA	Concessional loan	Mitigation	Energy distribution
AFD - Latin America and the carribean	275,000,000	305,063,522	Committed	ODA	Concessional loan	Cross-cutting	Cross-cutting

2015	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - Latin America and the carribean	50,000,000	55,466,095	Committed	ODA	Concessional loan	Cross-cutting	Agriculture
AFD - Latin America and the carribean	105,000,000	116,478,799	Committed	OOF	Non concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Asia	7,577,108	8,405,452	Committed	OOF	Non concessional loan	Mitigation	Renewable energies (without hydro)
AFD - Asia	27,685,493	30,712,123	Committed	OOF	Non concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Asia	18,720,000	20,766,506	Committed	ODA	Concessional loan	Adaptation	Urban planning
AFD - Asia	126,700,000	140,551,084	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Asia	63,750,000	70,719,271	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Asia	52,500,000	58,239,400	Committed	ODA	Concessional loan	Adaptation	Irrigation
AFD - Asia	50,000,000	55,466,095	Committed	ODA	Concessional loan	Adaptation	Cross-cutting
AFD - Asia	84,000,000	93,183,039	Committed	ODA	Concessional loan	Mitigation	Cross-cutting
AFD - Asia	20,000,000	22,186,438	Committed	ODA	Concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Asia	29,600,000	32,835,928	Committed	ODA	Concessional loan	Mitigation	Waste
AFD - Asia	130,000,000	144,211,847	Committed	ODA	Concessional loan	Mitigation	Hydroelectricity
AFD - Asia	40,000,000	44,372,876	Committed	ODA	Concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Asia	20,000,000	22,186,438	Committed	ODA	Concessional loan	Mitigation	Cross-cutting
AFD - Asia	112,500,000	124,798,714	Committed	ODA	Concessional loan	Mitigation	Transport
AFD - Asia	1,000,000	1,109,322	Committed	ODA	Grant	Adaptation	Water
AFD - Asia	4,000,000	4,437,288	Committed	ODA	Grant	Adaptation	Irrigation
AFD - Asia	200,000	221,864	Committed	ODA	Grant	Mitigation	Hydroelectricity
AFD - Mediterranean	20,000,000	22,186,438	Committed	OOF	Non concessional loan	Mitigation	Renewable energies (without hydro)
AFD - Mediterranean	38,123,947	42,291,729	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Mediterranean	50,000,000	55,466,095	Committed	ODA	Concessional loan	Adaptation	Agriculture
AFD - Mediterranean	117,432,480	130,270,421	Committed	ODA	Concessional loan	Adaptation	Water
AFD - Mediterranean	4,500,000	4,991,949	Committed	ODA	Concessional loan	Mitigation	Energy efficiency
AFD - Mediterranean	50,000,000	55,466,095	Committed	ODA	Concessional loan	Mitigation	Energy efficiency or Renewable energy

2015	Total amount Climate specific						
Recipient country/ region/project/programme	EUR	USD	Status	Funding source	Financial instruments	Type of support	Sector
AFD - Mediterranean	66,000,000	73,215,245	Committed	ODA	Concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - Mediterranean	99,665,280	110,560,877	Committed	ODA	Concessional loan	Mitigation	Cross-cutting
AFD - Mediterranean	42,000,000	46,591,520	Committed	ODA	Concessional loan	Cross-cutting	Water
AFD - Mediterranean	1,500,000	1,663,983	Committed	ODA	Grant	Adaptation	Agriculture
AFD - Mediterranean	30,000	33,280	Committed	ODA	Grant	Mitigation	Energy efficiency
AFD - Mediterranean	245,000	271,784	Committed	ODA	Grant	Mitigation	Energy efficiency or Renewable energy
AFD - Mediterranean	5,000,000	5,546,609	Committed	OOF	Non concessional loan	Mitigation	Energy efficiency or Renewable energy
AFD - multi-country	3,500,000	3,882,627	Committed	ODA	Grant	Cross-cutting	Cross-cutting
FFEM - Burkina Faso	125,610	139,342	Committed	ODA	Grant	Mitigation	Energy
FFEM - Colombia	1,500,000	1,663,983	Committed	ODA	Grant	Mitigation	Transport
FFEM - Philippines	1,510,000	1,675,076	Committed	ODA	Grant	Adaptation	Capacity-building / Coastal zone manage-ment
FFEM - Asia	2,000,000	2,218,644	Committed	ODA	Grant	Cross-cutting	Energy
FFEM - Cameroun	1,500,000	1,663,983	Committed	ODA	Grant	Adaptation	Cities
FFEM - Rwanda	300,000	332,797	Committed	ODA	Grant	Mitigation	Energy
FASEP - Haïti	271,900	301,625	Committed	ODA	Grant	Mitigation	Renewable energy
FASEP - Philippines	231,305	256,592	Committed	ODA	Grant	Mitigation	Waste
FASEP - Egypte	100,000	110,932	Committed	ODA	Grant	Mitigation	Urban transport
FASEP - Côte d'Ivoire	140,000	155,305	Committed	ODA	Grant	Adaptation	Water
FASEP - Tunisie	77,917	86,435	Committed	ODA	Grant	Mitigation	Marine energies
FASEP - Tanzanie	260,031	288,458	Committed	ODA	Grant	Mitigation	Public transport
FASEP - Liban	77,162	85,597	Committed	ODA	Grant	Mitigation	Renewable energies
FASEP - Serbie	463,557	514,234	Committed	ODA	Grant	Mitigation	Renewable energies - geothermal
FASEP - Jordanie	420,000	465,915	Committed	ODA	Grant	Mitigation	Electric vehicles
FASEP - Serbie	225,200	249,819	Committed	ODA	Grant	Mitigation	Waste
Total contributions through bilateral, regional and other channels	**2,669,603,569**	**2,961,449,698**					

2014							
Donor funding in 2014	Climate specific		Status	Funding source	Financial instruments	Type of support	Sector
	Euros	Dollars					
AFD - Africa	36 900 000	48 958 472	Committed	ODA	Concessional loan	Adapation	Agriculture, forestry and natural ressources
AFD - Africa	62 000 000	82 260 846	Committed	ODA	Concessional loan	Adapation	Cliamte risk prevention
AFD - Africa	7 284 000	9 664 323	Committed	ODA	Concessional loan	Adapation	Water resources
AFD - Africa	56 166 056	74 520 441	Committed	ODA	Concessional loan	Cross-cutting	Urban infrastructure
AFD - Africa	57 909 645	76 833 813	Committed	ODA	Concessional loan	Mitigation	RE/EE credit line
AFD - Africa	87 000 000	115 430 543	Committed	ODA	Concessional loan	Mitigation	Renewable energy
AFD - Africa	56 000 000	74 300 119	Committed	ODA	Concessional loan	Mitigation	transmission lines
AFD - Africa	120 000 000	159 214 542	Committed	ODA	Concessional loan	Mitigation	Urban infrastructure
AFD - Africa	50 000 000	66 339 392	Committed	ODA	Concessional loan	Mitigation	Urban transport
AFD - Africa	20 740 000	27 517 580	Committed	ODA	Grant	Adapation	Agriculture, forestry and natural ressources
AFD - Africa	2 200 000	2 918 933	Committed	ODA	Grant	Adapation	Climate risk prevention
AFD - Africa	7 500 000	9 950 909	Committed	ODA	Grant	Mitigation	Agriculture, forestry and natural ressources
AFD - Africa	2 500 000	3 316 970	Committed	ODA	Grant	Mitigation	Renewable energy
AFD - Africa	14 697 237	19 500 115	Committed	OOF	Non concessional loan	Mitigation	Renewable energy
AFD - Latin America	43 505 037	57 721 954	Committed	ODA	Concessional loan	Adapation	Water resources
AFD - Latin America	154 366 363	204 811 414	Committed	ODA	Concessional loan	Cross-cutting	Urban infrastructure
AFD - Latin America	150 400 000	199 548 892	Committed	ODA	Concessional loan	Mitigation	RE/EE credit line
AFD - Latin America	120 500 000	159 877 936	Committed	ODA	Concessional loan	Mitigation	Urban transport
AFD - Latin America	11 059 325	14 673 379	Committed	OOF	Non concessional loan	Adapation	Water resources
AFD - Latin America	100 000 000	132 678 785	Committed	OOF	Non concessional loan	Mitigation	Energy efficiency
AFD - Latin America	223 697 785	296 799 502	Committed	OOF	Non concessional loan	Mitigation	RE/EE credit line
AFD - Latin America	97 437 063	129 278 311	Committed	OOF	Non concessional loan	Mitigation	Renewable energy
AFD - Asia	5 400 000	7 164 654	Committed	ODA	Concessional loan	Adapation	Agriculture, forestry and natural ressources
AFD - Asia	57 000 000	75 626 907	Committed	ODA	Concessional loan	Adapation	Climate risk prevention
AFD - Asia	12 000 000	15 921 454	Committed	ODA	Concessional loan	Cross-cutting	Agriculture, forestry and natural ressources
AFD - Asia	20 000 000	26 535 757	Committed	ODA	Concessional loan	Cross-cutting	Climate policy
AFD - Asia	50 000 000	66 339 392	Committed	ODA	Concessional loan	Mitigation	Energy efficiency

2014							
Donor funding in 2014	Climate specific		Status	Funding source	Financial instruments	Type of support	Sector
	Euros	Dollars					
AFD - Asia	4 481 625	5 946 166	Committed	ODA	Concessional loan	Mitigation	RE/EE credit line
AFD - Asia	41 500 000	55 061 696	Committed	ODA	Concessional loan	Mitigation	Renewable energy
AFD - Asia	121 591 981	161 326 763	Committed	ODA	Concessional loan	Mitigation	Transmission lines
AFD - Asia	315 805 047	419 006 298	Committed	ODA	Concessional loan	Mitigation	Urban transport
AFD - Asia	2 500 000	3 316 970	Committed	ODA	Grant	Cross-cutting	Agriculture, forestry and natural ressources
AFD - Asia	775 000	1 028 261	Committed	ODA	Grant	Mitigation	Agriculture, forestry and natural ressources
AFD - Asia	25 000	33 170	Committed	ODA	Grant	Mitigation	RE/EE credit line
AFD - Asia	144 477 320	191 690 753	Committed	OOF	Non concessional loan	Mitigation	RE/EE credit line
AFD - Asia	23 434 838	31 093 058	Committed	OOF	Non concessional loan	Mitigation	Renewable energy
AFD - Mediterranean	30 000 000	39 803 635	Committed	ODA	Concessional loan	Adaptation	Water ressources
AFD - Mediterranean	70 000 000	92 875 149	Committed	ODA	Concessional loan	Mitigation	Fuel switch and other
AFD - Mediterranean	100 000 000	132 678 785	Committed	ODA	Concessional loan	Mitigation	Renewable energy
AFD - Mediterranean	56 859 635	75 440 673	Committed	ODA	Concessional loan	Mitigation	Urban transport
AFD - Mediterranean	50 500 000	67 002 786	Committed	OOF	Non concessional loan	Mitigation	Fuel switch and other
AFD - Mediterranean	5 000 000	6 633 939	Committed	OOF	Non concessional loan	Mitigation	RE/EE credit line
AFD - Mediterranean	38 399 242	50 947 647	Committed	OOF	Non concessional loan	Mitigation	Renewable energy
AFD - Multi-country	500 000	663 394	Committed	ODA	Grant	Adaptation	Agriculture, forestry and natural ressources
AFD - Multi-country	3 675 660	4 876 821	Committed	ODA	Grant	Mitigation	Agriculture, forestry and natural ressources
FFEM - Africa	1 200 000	1 592 145	Committed	ODA	Grant	Mitigation	Agriculture
FFEM - Africa (Cameroun)	500 000	663 394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Asia (Indonesia)	500 000	663 394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Africa (Kenya)	500 000	663 394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Latin America (Argentina)	1 000 000	1 326 788	Committed	ODA	Grant	Adaptation	Cities
FFEM - Africa (Madagascar)	1 065 000	1 413 029	Committed	ODA	Grant	Mitigation	Energy
FFEM - Africa (Guinée)	1 000 000	1 326 788	Committed	ODA	Grant	Mitigation	Energy

FFEM - Africa	2 000 000	2 653 576	Committed	ODA	Grant	Mitigation	Energy
FFEM - Latin America (Mexico)	1 550 000	2 056 521	Committed	ODA	Grant	Adaptation	Cities
FFEM - Africa (Sénégal)	500 000	663 394	Committed	ODA	Grant	Mitigation	Energy
FASEP - Asia	387 600	514 263	Committed	ODA	Grant	Mitigation	Sustainable urban planning
RPE - Asia	5 280 000	7 005 440	Committed	ODA	Concessional loan	Mitigation	Transport
RPE - Mediterranean	68 800 000	91 283 004	Committed	ODA	Concessional loan	Mitigation	Transport
FASEP - Asia	90 000	119 411	Committed	ODA	Grant	Mitigation	Transport
FASEP - Africa	498 000	660 740	Committed	ODA	Grant	Mitigation	Renewable energy
FASEP - Mediterranean	62 400	82 792	Committed	ODA	Grant	Mitigation	Energy
RPE - Asia	34 000 000	45 110 787	Committed	ODA	Concessional loan	Mitigation	Transport

2014							
	Climate specific						
Donor funding in 2014	Euros	Dollars	Status	Funding source	Financial instruments	Type of support	Sector
FFEM - Africa	1200000	1592145	Committed	ODA	Grant	Mitigation	Agriculture
FFEM - Africa (Cameroun)	500000	663394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Asia (Indonesia)	500000	663394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Africa (Kenya)	500000	663394	Committed	ODA	Grant	Mitigation	Energy
FFEM - Latin America (Argentina)	1000000	1326788	Committed	ODA	Grant	Adaptation	Cities
FFEM - Africa (Madagascar)	1065000	1413029	Committed	ODA	Grant	Mitigation	Energy
FFEM - Africa (Guinée)	1000000	1326788	Committed	ODA	Grant	Mitigation	Energy
FFEM - Africa	2000000	2653576	Committed	ODA	Grant	Mitigation	Energy
FFEM - Latin America (Mexico)	1550000	2056521	Committed	ODA	Grant	Adaptation	Cities
FFEM - Africa (Sénégal)	500000	663394	Committed	ODA	Grant	Mitigation	Energy
FASEP - Asia	387600	514263	Committed	ODA	Grant	Mitigation	Sustainable urban planning
RPE - Asia	5280000	7005440	Committed	ODA	Concessional loan	Mitigation	Transport
RPE - Mediterranean	68800000	91283004	Committed	ODA	Concessional loan	Mitigation	Transport
FASEP - Asia	90000	119411	Committed	ODA	Grant	Mitigation	Transport
FASEP - Africa	498000	660740	Committed	ODA	Grant	Mitigation	Renewable energy
FASEP - Mediterranean	62400	82792	Committed	ODA	Grant	Mitigation	Energy efficiency
RPE - Asia	34000000	45110787	Committed	ODA	Concessional loan	Mitigation	Transport

2013							
Donor funding in 2013	Climate specific		Status	Funding source	Financial instruments	Type of support	Sector
	Euros	Dollars					
AFD - Africa	20 000 000	26 553 372	Committed	ODA	Concessional loan	Adaptation	Agriculture and natural ressources
AFD - Africa	80 000 000	106 213 489	Committed	ODA	Concessional loan	Adaptation	Urban infrastructure
AFD - Africa	3 600 000	4 779 607	Committed	ODA	Concessional loan	Adaptation	Water resources
AFD - Africa	256 500 000	340 546 999	Committed	ODA	Concessional loan	Mitigation	Energy
AFD - Africa	3 830 140	5 085 157	Committed	ODA	Grant	Adaptation	Agriculture and natural ressources
AFD - Africa	3 900 000	5 177 908	Committed	ODA	Grant	Adaptation	Water resources
AFD - Africa	2 000 000	2 655 337	Committed	ODA	Grant	Cross-cutting	Agriculture and natural ressources
AFD - Africa	3 000 000	3 983 006	Committed	ODA	Grant	Mitigation	Energy
AFD - Africa	1 500 000	1 991 503	Committed	ODA	Grant	Mitigation	Forestry
AFD - Africa	88 000 000	116 834 838	Committed	ODA	Concessional loan	Adaptation	Urban infrastructure
AFD - Africa	100 000 000	132 766 861	Committed	OOF	Concessional loan	Mitigation	transport
AFD - Africa	102 398 496	135 951 269	Committed	ODA	Non Concessional loan	Mitigation	Energy
AFD - Latin America	664 998	882 897	Committed	ODA	Grant	Adaptation	Agriculture and natural ressources
AFD - Latin America	53 000 000	70 366 437	Committed	ODA	Concessional loan	Adaptation	Water resources
AFD - Latin America	300 000 000	398 300 584	Committed	ODA	Concessional loan	Mitigation	transport
AFD - Latin America	10 419 768	13 833 999	Committed	OOF	Non Concessional loan	Adaptation	Urban infrastructure
AFD - Latin America	36 734 994	48 771 899	Committed	OOF	Non Concessional loan	Cross-cutting	Agriculture and natural ressources
AFD - Latin America	30 000 000	39 830 058	Committed	OOF	Non Concessional loan	Cross-cutting	Urban infrastructure
AFD - Latin America	84 836 925	112 635 322	Committed	OOF	Non Concessional loan	Mitigation	Energy
AFD - Asia	91 995 725	122139000	Committed	ODA	Concessional loan	Adaptation	Water resources

2013							
Donor funding in 2013	Climate specific		Status	Funding source	Financial instruments	Type of support	Sector
	Euros	Dollars					
AFD - Asia	20 000 000	265 553 372	Committed	ODA	Concessional loan	cross-cutting	climate policy
AFD - Asia	42 880 000	56 930 430	Committed	ODA	Concessional loan	Mitigation	energy
AFD - Asia	8 000 000	10 621 349	Committed	ODA	Grant	Adaptation	Agriculture and natural ressources
AFD - Asia	3 300 000	4 381 308	Committed	ODA	Grant	Adaptation	water ressources
AFD - Asia	50 000 000	66 383 431	Committed	ODA	Concessional loan	cross-cutting	Agriculture and natural ressources
AFD - Asia	75 066 984	99 664 079	Committed	ODA	Concessional loan	cross-cutting	water ressources
AFD - Asia	351 900 369	467 207 075	Committed	ODA	Concessional loan	Mitigation	energy
AFD - Asia	180 000 000	238 980 351	Committed	ODA	Concessional loan	Mitigation	transport
AFD - Asia	20 699 625	27 482 242	Committed	OOF	Non Concessional loan	Mitigation	energy
AFD - Mediterranean	60 000 000	79 660 117	Committed	ODA	Concessional loan	Mitigation	urban infrastructure
AFD - Mediterranean	10 500 000	13 940 520	Committed	ODA	Grant	Adaptation	water ressources
AFD - Mediterranean	2 000 000	2 655 337	Committed	ODA	Grant	Mitigation	energy
AFD - Mediterranean	1 300 000	1 725 969	Committed	ODA	Grant	Mitigation	transport
AFD - Mediterranean	120 000	159 320	Committed	ODA	Grant	Mitigation	urban infrastructure
AFD - Mediterranean	30 000 000	39 830 058	Committed	ODA	Concessional loan	Mitigation	energy

2013							
	Climate specific						
Donor funding in 2013	Euros	Dollars	Status	Funding source	Financial instru-ments	Type of sup-port	Sector
FFEM - Palestinian territories	1 000 000	1 327 669	Committed	ODA	Grant	Mitigation	Energy
FFEM - Palestinian territories	1 500 000	1 991 503	Committed	ODA	Grant	Adaptation	Agriculture
FFEM - Africa	1 500 000	1 997 503	Committed	ODA	Grant	Mitigation	Energy
FFEM - Dominican Republic	400 000	531 067	Committed	ODA	Grant	Mitigation	Energy
FFEM - Cambodia	430 000	570 898	Committed	ODA	Grant	Mitigation	Energy
FFEM - India	40 000	531 067	Committed	ODA	Grant	adaptation	Energy
FFEM - Kenya	20 000	265 534	Committed	ODA	Grant	Mitigation	Energy
FFEM - Benin	1 200 000	1 593 202	Committed	ODA	Grant	Adaptation	Cities
FFEM - Morocco	1 000 000	1 327 669	Committed	ODA	Grant	Mitigation	Energy
RPE - Indonesia	32 000 000	42 485 398	Committed	ODA	Concessional loan	Mitigation	Transport
RPE - Ecuador	2 600 000	3 451 938	Committed	ODA	Concessional loan	Mitigation	Transport
FASEP - Indonesia	574 000	762 082	Committed	ODA	Grant	Mitigation	Geothermal
FASEP - Bolivia	377 000	500 531	Committed	ODA	Grant	Mitigation	Geothermal
RPE - Tunisia	63 800 000	84 705 258	Committed	ODA	Concessional loan	Mitigation	Transport
FASEP - Indonesia	74 000	98 247	Committed	ODA	Grant	Mitigation	Sustainable urban design
FASEP - Haïti	95 000	126 129	Committed	ODA	Grant	Mitigation	Solar Energy

B. TECHNOLOGY TRANSFERS

B.1 The Action Agenda as a Contributor to Financial and Technological Support in Developing Countries

The Action Agenda is a multi-player platform, that brings together States and non-state sector actors that engage in climate action, to find synergies and develop concrete local or global solutions, and accelerate the transition to a low carbon economy. It fits into a worldwide dynamic of mobilisation among non-state players and it constitutes decisive support for the implementation of the Paris Agreement and national commitments (NDC), because they form a reservoir of practical solutions, technological, political and financial innovations, and in particular enable a significant drop in the cost of low-carbon technologies.

The Action Agenda coalitions are characterised by great diversity both at the level of the format of the action performed and the kinds of actors involved, because they can be centred on advocacy, project implementation, capacity building, structuring goals in a sector or on innovation.

Accordingly, certain coalitions take part in the financial commitment of developed countries in supporting developing countries, by funding projects or assisting access to climate funding in multilateral and bilateral programmes. The “NDC Partnership”, launched at the COP22, intends, for example, to strengthen the cooperation between countries so they can access the technical knowledge and financial support they need to reach their goals in the spheres of the climate and sustainable development. It contributes to improved access to climate funding, especially through technical assistance and shared knowledge, analytical tools and good practices.

Other coalitions take part in capacity building in developing countries, to help them increase their skills and devise and implement policies to reduce emissions and adapt to climate change. For example, the programme for energy efficiency in buildings (PEEB), launched by the French Development Agency, the GIZ and ADEME at COP22, aims at creating a new international facility devoted to energy efficiency in buildings, for developing and emerging countries. Other examples illustrate the financial support and the contribution to capacity building, such as the “Mobilise your City” initiative, which helps cities and States provide themselves with low carbon policies, or the initiative on the Climate Risk and Early Warning Systems (CREWS), that acts on improving early warning systems for natural disasters in less advanced countries, with the goal of mobilising 100 million dollars by 2020 for this topic that is little represented in multilateral or bilateral aid.

Two other initiatives concerning renewable energy, which France is very much involved in and the driver of, very clearly illustrate how the action agenda takes part in the financial and technological support of developing countries: The African Renewable Energy Initiative (AREI), which works on projects by channelling €10 billion from various fund donors with the goal of reaching at least 10 GW of new and additional energy production capacity from renewable energy sources by 2020, and at least 300 GW from 2030, and the International Solar Alliance, that intends to harmonise and aggregate requests for funding, technolo-gies and innovation in order to massively reduce the cost of solar energy for the 121 countries in the inter-tropical zone.

In addition to bilateral and multilateral channels for public aid for development, France is also committed to various projects and international forums that generate large scale international cooperation with a host of actors. This cooperation is to be understood as a transfer in the widest sense of know-how, methods, and tools that are necessary to implement the transfer to low-carbon technologies.

There have been major developments in technology since the sixth national communication. Low-carbon industries have developed and been deployed on a large scale in the renewable energy and energy efficiency sector. An increasing number of countries wish to implement these technologies both in the

North and in the South, as it is estimated that more than 164 countries have set a renewable energy production target[66], half of which are developing countries.

B.1.1 On a bilateral level

This cooperation has taken place through work particularly with Africa, and also in countries such as Brazil, Indonesia and China. In particular this involves strategic cooperation in the area of renewable energy and energy efficiency.

In this phase of public policy implementation, the private sector and decentralised cooperation play a particularly important role as the operational stakeholders developing the capacity required on the ground to set up low-carbon projects and contributing to this technology transfer. French companies and authorities are especially active in the field and are developing both mature and innovative projects in an increasing number of countries. On 21 May 2015, Mr Laurent Fabius, Minister of Foreign Affairs and International Development, and Mr Matthias Fakie, Secretary of State for Foreign Trade, Promoting Tourism, and the French Abroad, appointed Mr Jean Ballandras, the Secretary General of AKUO ENERGY as the Export Coordinator for “Renewable Energy”. His mission is to promote the French approach to renewable energy internationally, and accelerate the deployment of practical solutions on the ground. This initiative will enable technological cooperation with a certain number of countries to be reinforced in the field of renewable energy.

B.1.2 At the multilateral level

French technological cooperation is performed through major international energy partnerships, like the International Energy Agency (IEA), and especially within the international IEA platform on low carbon technologies established in October 2010, the CEM (Clean Energy Ministerial) or the IPEEC (International Partnership for Energy Efficiency Cooperation). In the context of the wider operationalisation of the SE4All (Sustainable Energy for All) initiative, the rise of IRENA (International Renewable Energy Agency), a recent agency with a strong mission to support countries, is particularly notable. France is the sixth largest contributor to this agency. It is also worth referring to large scale multilateral treaties, foremost amongst which is the United Nations Framework Convention on Climate Change (UNFCCC) which permits technology transfers and shared experiences to be supported and accelerated, under which a Mechanism in favour of technology transfers to support mitigating and adapting to climate change for developing countries was created and is now fully operational. The work of the UNEP (United Nations Environment Programme) and that of the FAO (Food and Agriculture Organisation) also foster the sharing of experience and tools useful for a low carbon transition.

Technological cooperation such as that represented in the CTF table below must be understood in the widest sense, and in particular incorporates the know-how, methods and tool transfers that are required for implementing low carbon transition technologies. The CTF table presented is not exhaustive, but is rather intended to demonstrate via a few examples how the French public and private sectors have addressed the issue at all levels. This enables wide-scale technological cooperation to be generated beyond the classic bilateral and multilateral channels for public development aid.

[66] REN 21, 2015

Table 7.3: Provision of technology development and transfer support a, b

Country or Region	Objective	Measures and Activities Connected to Technology Transfer	Sectorc	Funding Source	Activities Undertaken by:	Status	Additional Information[d]
Kazakhstan	Mitigation	Since 2011, a consortium of French manufacturers has been undertaking a project in Kazakhstan to provide turnkey factories across the whole solar panel manufacturing process. This defining industrial programme has been able to emerge thanks to State financial support through a FASEP programme allocation to the CEIS company and the scientific and institutional support from the CEA public research body.	Energy, Industry	Private and Public	Public	Installed	The solar panel manufacturing factories are vertically integrated. With a total capacity of 60 MW, the various production technologies (wafers, cells and modules) are transferred from the French companies ECM Technologie and SEMCO Engineering, under CEIS coordination. This project, for a total amount of €165M, combines the supply of equipment manufactured in France by ten or so SMEs, and a transfer of technology and know-how by those companies. A training component has also been set up in France to train the Kazakh operating teams in advance of each stage. The first phases of production were initiated, thus enabling Kazakhstan to now be included among the industrial players that produce panels for solar power.
Chile	Mitigation	Engie's Research Department is supporting a concentrated solar installation pilot project, with the aim of capitalising on this full-scale experiment. This initiative enables local development and innovation to be reinforced.	Energy	Private	Private	Installed	This global pilot scheme called EOS I, for 2.5 MW, consists of directly injecting steam produced by a concentrated solar facility into a high pressure turbine at an existing coal fired electricity production unit at Mejillones, in northern Chile. This technology enables 800 kg of coal to be saved per second in this 2.5 MW unit.
Chile	Mitigation	The DCNS company, a world leader in renewable marine energy, is the head of an international consortium to build a research centre on renewable marine energy in Chile	Energy	Private	Private and Public	Installed	The consortium includes ENDESA, the largest Chilean Energy company, and Chilean universities, research institutes and centres of the first order, and technology developers. It was selected in October 2014 by CORFO (Corporación de Fomento de la Producción), the economic development body for the Chilean government, to set up an International Centre of Excellence for research and development in the field of marine energy, called MERIC (Marine Energy Research and Innovation).

Brazil	Mitigation	Tractebel, a subsidiary of the Engie group is developing a prototype converter for wave energy into electricity together with the Research Institute of the University of Rio de Janeiro, the National Electrical Energy Agency and Brazilian companies.	Energy	Private	Private and Public	Installed	Whilst this project demonstrates that is it possible to capture wave energy, research must still be continued in order to improve the technology and bring it to maturity.
Brazil	Adaptation	The Climate Energy Adaptation Plan is co-financed by AFD, ADEME and the Nord Pas de Calais Region. One of the sections of the PCET deals with developing renewable energy on the Minas Geiras territory.	Other (Cross-cutting)	Public	Public	In progress	Modelled on PACE at Rio Grande do Sul, the State of Minas Gerais launched its Territorial Climate Energy Plan in September 2013 in the context of decentralised cooperation (Nord Pas de Calais Region, ADEME and AFD). A cooperation agreement dealing with assistance in devising a global integrated climate strategy was signed in November 2013 by ADEME, FEAM and the Nord Pas de Calais Region. This project involves, on the one hand, making a diagnosis of GHG emissions and the vulnerability of the territory and on the other, preparing a Territorial Climate Energy Plan devoted to adapting to climate change and reducing emissions. In the end this plan should lead to implementing practical action.
Indonesia	Mitigation	The Indonesian company PT Pertamina and the French company Akuo Energy signed an agreement in February 2015 to develop and deploy new electrical production stations in Indonesia based exclusively on renewable energy. The goal is to reach a total portfolio of 560 MW in operation.	Energy	Private	Private	Installed	The partnership aims at jointly building and deploying fully integrated business lines that will cover both wind and solar power and ocean thermal energy (OTE). DCNS will be the industrial partner for Akuo Energy on the latter technology.
Indonesia	Mitigation	In Indonesia, Engie is using its know-how in the field of geothermal energy.	Energy, Industry	Private	Private	In progress	Engie is developing 3 projects (at Muara Laboh, Rajabasa and Rantau Dedap) in cooperation with the local company PT Suprem Energy. Located on the island of Sumatra, these projects have a total power of 680 MW.

India	Mitigation	Several French solar companies are active on the Indian market, and in particular EDF New Energy which entered the Indian solar power market in December 2013 by creating a joint venture with a local partner (ACME Cleantech with 50%) and a French partner (EREN, with 25%).	Energy	Private	Private and Public	Installed	After a year of work, ACME Solar, with 30 MWc in operation and 150 MW commissioned in July (NSM and Odisha) and about 420 MW awarded in various highly competitive tenders managed by various Indian States, is one of the most active and successful operators in the local market.
WATER	Mitigation	Total is taking part, in partnership with other companies, in the Shams Power Company joint venture that has enabled the building and development of Shams 1 in March 2013, the largest concentrated solar power station in the world, fitted with parabolic mirrors.	Energy	Private	Private	Installed	The solar thermal power station with a capacity of 100 MW will supply 20,000 households in the United Arab Emirates (UAE) and will enable avoiding 175,000 tonnes of CO_2 emissions per annum. By incorporating the latest cylindrical and parabolic technologies, together with a dry cooling system that significantly reduces the consumption of water, Shams 1 illustrates the efficiency of cooperation between various companies to result in large scale energy solutions that respect the environment, enable the increase in the worldwide demand for energy to be met and diversify the energy mix. Indeed, Total has contributed 20%, Abengea Solar 20% and Masdar 60%.
Algeria	Mitigation	The French company Vincent Industrie and the Algerian company Aurès Solar (in which Vincent Industrie is a 49% shareholder) are setting up a production factory for very high yield solar panels called NICE (New Industrial Cells Encapsulation) in Batna. This €10M project will enable an annual production of 25 MW of NICE solar panels (about 100,000 panels).	Energy, Industry	Private	Private	In progress	NICE technology was developed in partnership between the Apollon Solar company and Vincent Industrie, which is specialised in manufacturing automatic machines and equipment. The production line for solar panels will be set up in the industrial area at Ain Yagout in Batna.
Morocco	Mitigation	Engie, in partnership with the Moroccan energy company Nareva, is developing Africa's largest wind farm. The Tarfaya station has been designed to provide the National Electricity	Energy, Industry	Private	Private	Installed	The wind farm was built by the Tarfaya Energy Company (TAREC), a jointly owned company held 50/50 by the two partners. Commissioning took place on 8 December

		and Drinking Water Office (ONEE) in Morocco with electricity.					2014, at Tarfaya. The farm produces 301MW thanks to 130 2.3 MW wind turbines. Project funding came to €450 million, and loan financing was provided by a consortium of three Moroccan banks. It was finalised in December 2012.
Gabon	Mitigation	Redeveloping the "Anguilla" offshore drilling platform which opened in 1966 and is held by Total Gabon (75% under Gabon law - 58% held by the Total group and 25% by the Republic of Gabon).	Energy, Industry	Private	Private	Installed	This project will considerably reduce GHG emissions arising from the gas burnt off using the flare. During the two initial project stages, a large part was performed by Gabon companies. The third stage enabled the installation of a low pressure gas turbine for the neighbouring "Torpille"facility. Gabon teams are thus benefiting from the experience of the TOTAL group in order to limit the flared gas. They will be in charge of the everyday operations of the facility.
Africa	Mitigation and Adaption	The French Fund for the World Environment (FFEM) (€1.5M) and the French Development Agency (AFD) (€1.5M) are funding the support programme Africa4Climate, to define low carbon and climate change resistant development strategies, which was created in 2012 for a 4-year term and which has a technology transfer section and a marked adaptation component.	Other (Cross-cutting)	Public	Public	Installed	The strategy for low carbon and climate change resistant development aims at creating a global integrated framework, that enables an overview of the priority channels and creating synergies between them. The programme focuses on four countries: Uganda, Benin, Gabon and Kenya, and then it will be extended to other countries. In each target country, the project will incorporate a stage for identifying the technology and institutional structure needed, a stage for implementing the technical assistance and capacity building programmes initially defined, and a capitalisation stage.
Africa	Mitigation and Adaption	Creation of 6 decentralised service companies (SSD) by EDF with the support of ADEME, in 5 countries: South Africa, Botswana, Mali, Morocco and Senegal. This involves ensuring the viability of	Other (Cross-cutting)	Private and Public	Private	Installed	The purpose is to sell decentralised energy services, improve the everyday life of households in rural areas, health and the environment. The SSD is responsible for installing and maintaining electricity facilities for local authorities from 60 to 150,000 inhabitants.

		electrification projects in rural areas and their long-term productivity. These projects have brought electricity to more than 450,000 inhabitants since 2013.					The SSD's strength is its capacity to integrate at the local level, working with local companies and staff. EDF has the intention of extending these projects to 1 million extra inhabitants - mainly in Africa and Asia - over the next 5 years.
Africa, Asia	Mitigation and/or Adaption	A joint declaration on Franco-Chinese partnerships in third markets was adopted in June 2015 by France and China. Among the projects that have been implemented in this context, those that are part of the worldwide fight against climate change will be encouraged. The implementation of the declaration should be an opportunity to witness the capacity of the two countries to put innovative funding in place in the sphere of the climate.	Energy	Private and Public	Private and Public	In progress	The declaration in particular refers to the fields of renewable energy, energy efficiency and preventing, warning about and reducing natural disasters. New projects will be identified during the coming months in a COP21 perspective; the funding terms for the projects will form the scope of specific correspondence between France and China.
Islands of the Indian Ocean	Adaptation	The French Fund for the World Environment (FFEM), the French Ministry of Foreign Affairs, the French Development Agency (AFD) and the region of Reunion Island funded the ACClimate project to the tune of €1.7 million. This project deals with adapting to climate change in the Indian Ocean Islands.	Other (Cross-cutting)	Public	Public	Installed	Launched in 2008 on an initiative from the member states of the Indian Ocean Commission, ACClimate is the first project of its kind in the south-west of the Indian ocean. It mainly aimed to: - better understand climate change at the regional level; - identify the vulnerabilities to the impacts of climate change; - prepare a regional adaptation strategy that enables those vulnerabilities to be reduced. It ended on 31 December 2012. A framework document for the regional adaptation strategy to climate change was adopted by the IOC council. A request from Secretary General Jean-Claude de l'Estrac was prepared to seek financial resources to ensure the continuity of initiatives.
Worldwide	Mitigation	France is a founding member of the International Energy Agency (IEA) and hosts its headquarters in Paris. In	Energy	Public	Public	Installed	Founded by the OECD in 1974 following the first oil crisis, its initial mission was coordinating the measures to be taken at times of crisis in oil supplies. Whilst this

		particular, the latter enables the support and acceleration of technology transfers, and the sharing of experience in the fields of energy and energy efficiency.					mission remains at the heart of its activity, its mandate has gradually widened to take energy safety, economic and sustainable development and more recently, climate challenges into consideration. The IEA facilitates the coordination of energy policies between its 29 members, who work to ensure reliable, clean and affordable energy supplies for their citizens. The IEA is the reference organisation in the field of energy, and each year produces the reference report on energy at a global level, the World Energy Outlook (WEO).
Worldwide	Mitigation and Adaption	Though human and financial support, and constructive cooperation, France works actively within IRENA (International Renewable Energy Agency) to facilitate the energy transition towards low carbon growth in developing countries. In addition, France is the sixth largest contributor to the Agency (1.4 M USD in 2012).	Energy	Public	Public	Installed	The agency's rise to power, from its creation in 2009 to now where it includes more than one hundred members, deserves being saluted. This agency intends to be operational by supplying a support platform to countries that wish to implement renewable energy. It enables the development and sharing of tools that foster the deployment of renewable energy at a large scale and in all countries. The support it provides specifically to developing countries, including the least advanced and small islands, is deemed to be a priority by France. Nowadays the Agency incorporates its action in the overall context of the Sustainable Energy for All (SE4All) initiative proposed by the United Nations Secretary General. Promoting three major targets for low carbon development, this large scale initiative has enabled action to be catalysed by offering a shared framework and increased visibility of these challenges. France actively and directly participates in this initiative, by providing human support or mobilising its actors in cooperation on the ground, or indirectly through the action of the European Union and the funding facilities put in place. Access to energy is an important issue for France which it supports through its cooperation initiatives.

Worldwide	Mitigation and Adaption	France is one of the main financers of the United Nations Environment Programme (UNEP). The latter contributes to the distribution of technology and know-how to combat climate change via several programmes, such as the ten-year planning framework on sustainable modes of consumption and production (10FYP). UNEP is also the host of the Climate Technology Centre and Network, which is the military arm of the Technological UNFCCC Mechanism.	Other (Cross-cutting)	Public	Public	Installed	The main objectives of UNEP are to: - Promote international cooperation in the field of the environment and recommend policies oriented in that direction; - Study the environmental situation in the world in order to make sure that issues at the international scale in this field form the scope of appropriate studies on the part of governments; - Handle the resources of the Fund for the Environment, which funds the UNEP action programme. It should be noted that France is the 4th largest contributor to the fund, with an annual contribution of 5,850,000 USD in 2012. At the 10YFP level, France has been actively involved in preparing this framework and steered one of the seven process working groups in Marrakesh, the one on sustainable tourism. Nowadays, France holds the vice-presidency (2013-2015) of the World Sustainable Tourism Partnership after two years as president. France has also invested in other 10FYP programmes, especially those that deal with consumer information and sustainable buildings.

[a] To be reported to the extent possible.

[b] The tables should include measures and activities since the last national communication or biennial report.

[c] Parties may report sectoral disaggregation, as appropriate.

[d] Additional information may include, for example, funding for technology development and transfer provided, a short description of the measure or activity and co-financing arrangements.

C. CAPACITY BUILDING

C.1 The thematic breadth of France's capacity building has grown over the years

C.1.1 Adapting to Climate Change

France is committed to projects aimed at sharing its own experience in planning adaptation policies with developing countries. In fact, France has put an adaptation strategy in place since 2006. In 2011, a national adaptation plan was published. An assessment of the national plan was carried out in 2015.

In this context, France has taken part in several projects including the one on Indian Ocean Islands, especially through the continuation of the project (ACClimate) which aimed to strengthen its members' climate change adaptation capacities. Relying on studies that have already been carried out, a regional adaptation policy has been jointly prepared by ACClimate and the IOC countries. This strategy was approved in January 2013 during the 28th IOC Council of Ministers. The cooperation project is continuing with the goal of setting up a data sharing network among countries in the western part of the Indian Ocean (see site http://www.acclimate-oi.net/).

Launched in 2012 and provided with a budget of €3 million over 3 years, funded by the AFD and FFEM, the Africa4Climate project intends to strengthen capacities in four African countries by taking climate change into account in their national policies. This project's innovative approach is based on privileged access to national and international expertise to support local partners. In order to do this, since project launch, Expertise France has mobilised thirty or so experts specialised in analysing and taking the causes and consequences of climate change into account. Africa4Climate has the aim of creating links between locally developed initiatives and providing the authorities with the tools and skills required to actually incorporate climate change challenges into the initiatives they undertake. In the longer term, Africa4Climate could be adapted for other countries.

C.1.2 Preparing and Implementing the Intended Nationally Determined Contributions (INDCs)

In January 2015, the French Development Agency (AFD) funded an initial facility with a grant of €3.5 million in order to assist 26 developing countries, including African countries and Small Island Developing States (SIDS), to prepare their Intended Nationally Determined Contribution (INDC). All the countries that have benefited from that support filed their INDC with the UNFCCC secretariat before COP21.

In order to take part in making the Paris Agreement operational, responding to demands from developing countries in terms of support in implementing their NDC, especially for the adaptation aspect, and in order to ramp up investments for adapting to climate change in those countries, the AFD has decided to set up a new "AdaptaCtion" facility aimed at preparing the implementation of commitments made by countries in their NDC.

Launched in May 2017, AdaptaCtion, with a total amount of €30 million (in grants) to be deployed over 4 years, is intended to accompany some fifteen African countries and SIDS in the achievement of their

"climate" goals, especially as regards adapting to climate change, via running capacity building activities and technical assistance in accordance with 3 main themes:

- Theme 1: Support for "climate" capacity building and governance to consolidate, implement and monitor the NDC; this component is implemented by Expertise France.
- Theme 2: Support for improved NDC commitment integration into sectoral public policies;
- Theme 3: Support for structural project/programme preparation in the field of adaptation and renewable energy.

In the context of the first stage of AdaptaCtion, identification assignments will be performed in the various partner countries in order to determine needs with local counterparts in terms of institutional support that has to be funded by AdaptaCtion.

C.1.3 Setting up a National Reporting System (GHG Inventory, Projections and Preparing NAMAs)

Since 2014, France has taken part, technically and financially, in the activity of the "French-speaking cluster", which jointly finances capacity building workshops intended for French-speaking developing countries with Belgium and Germany. The French-speaking Cluster is an initiative from the International Mitigation Partnership and the MRV. It was created after the French language workshop for Africa on the Measurement, Reporting and Verification (MRV) challenges held at Gammarth, in Tunisia on 17 and 18 December 2013. It aims to enable information, know-how and experience sharing between French-speaking partners, developing and developed countries, concerning the inventory of GHGs, the development of NAMA, the MRV process and the formulation of intended nationally determined contributions (INDC). Several workshops have been organised since 2013 (see http://mitigationpartnership.net/cluster-francophone). A side event to present feedback from those workshops took place during COP21 in Paris. In 2015, two workshops were held (Paris and Rabat); in 2016, two workshops also took place in Abidjian and Casablanca, and a workshop was organised for a week in Rome in 2017. The workshop enabled 57 experts from 22 French speaking Parties to work together. Citepa, a public sector expert operator recognised at the global level, a specialist in French inventories since their foundation, is a major player in the French-speaking cluster and runs these workshops.

C.1.4 The Franco-Chinese Centre

The table below sets out a few capacity building initiatives.

Table 7.4: Provision of capacity building support

Recipient country/ region	Targeted area	Programme or project title	Description of programme or project [b,c]
Benin, Gabon, Uganda, Kenya	Mitigation, adaptation, INDC	Africa4Climate	Support for preparing and implementing low carbon development strategies that are resilient to climate change in Africa, funded by AFD and FFEM and implemented by Expertise France.
South Pacific	Adaptation	Climate change week 2015	Feedback and Testimony on the Implementation of the National Adaptation Policy
West Indian Ocean	Adaptation	Indian Ocean Commission	ONERC support in 2014 for defining a shared data network in the West Indian Ocean area with all national delegations in the area.
Africa	Multiple Areas	AMMA	Regarding the GCOS in Africa, the AMMA international experiment has been extended beyond 2010. AMMA-CATCH, an observation system that studies the long-term impact of monsoons in West Africa, has been maintained. It was initiated by MESR and benefits from the support of the IRD (Institute for Research and Development) and the INSU (National Institute for Sciences of the Universe). Data collection continued in 2015.
Mediterranean Basin	Multiple Areas	MISTRALS	Launched in 2008 for an anticipated period until 2020, MISTRALS mushroomed on the ground in 2010. This is an international meta-programme of fundamental research and systematic interdisciplinary observation devoted to understanding environmental functioning and changes in the Mediterranean basin under the pressure of global anthropogenic (human-induced) change in order to forecast future developments. Beyond its academic scope, MISTRALS also aims to transform the goals and results of research into concepts and data that are accessible to decision makers, and territorial actors and managers, in order to identify national and trans-national needs and to meet the societal, environmental and economic challenges involved in the sustainable development of the countries and populations that share the Mediterranean area.
Africa, SIDS	Mitigation, adaptation	French INDC Preparation Facility	http://www.mistrals-home.org/spip/spip.php?rubrique39
Africa	Mitigation	French-speaking Cluster	Preparing INDCs for some thirty countries
China	Mitigation	Franco-Chinese Centre	Training on NAMAs, GHG inventory and INDCs - 3 workshops in 2013-2014-2015
Southern Europe, Mediterranean Basin, Europe, Vietnam	Adaptation	Bilateral and Multilateral Cooperation	The National Observatory on the Effects of Global Warming took part in various works: - the adaptation steering group set up by the European Commission for preparing a community strategy for adapting to climate change (2013-2014-2015); - in the framework of the work of the European Environment Agency: - Updating the Climate-Adapt platform - Taking part in drafting topic-based reports - Multilateral meetings between European countries for sharing experience in the topic of assessing public adaptation policy (Copenhagen 2015); - Several interventions in seminars and conferences organised in the context of COP21, including for example: Oslo, Prague, Sofia, Bucharest, Zagreb, Algiers, etc. - Welcoming delegations from countries such as Bosnia, Japan, and Turkey, a. multilateral dialogue with countries bordering the Alps in the context of the Alpine Convention (Vienna, 2013, 2014 and 2015); b. bilateral workshop on adaptation policies Poland-France (Warsaw, 2014); c. Joint presidency of the Franco-Chinese high level experts group on climate change (Paris June 2014, Beijing, April 2015) Météo-France and the ministries involved take part in works to set up the global framework for climate services in the WMO framework.

Chapter VIII

Systematic observation and research

A. GENERAL VISION OF CLIMATE RESEARCH AND OBSERVATION IN FRANCE

A.1 Global public action in research

The evidence of the recent climate change undergone by the planet over more than a century results from research carried out by scientists throughout the world for some five decades. This research, brought together in the work of the IPCC (Intergovernmental Panel on Climate Change) since the late 1980s, drew decision-makers' attention to the risks related to anthropogenic emissions of greenhouse gases and to the likely future trajectories of the climate. Climate change, with its proven or probable impact on the environment including every area (water, agriculture, biodiversity, ocean, atmosphere, as well as risks to health) is a threat to societies and economic and social development.

Aware that the measured temperature rise is mainly of anthropogenic origin, political leaders have initiated policies to fight global warming (mitigation of greenhouse gas emissions and adaptation to changes). Countries' commitment to this action was formalised at the Paris climate conference (COP21) in December 2015, where 195 countries adopted the first ever worldwide climate agreement. The agreement sets a goal to limit the average air temperature rise to well below 2°C relative to pre-industrial levels and to continue to take actions to limit temperature increases to 1.5°C.

The action of global scientific research was therefore essential to diagnose and raise awareness of climate change. Therefore, climate prediction, which requires an understanding of its fundamental mechanisms and the role played by human activities, as well as the impacts, plus mitigation and adaptation to climate change, have become priorities of French research. Since these are global phenomena, this entails the sharing of research efforts on climate, its impacts and consequent measures to be taken in international programmes. This research also requires the implementation or maintenance of permanent operational observation systems, beyond the classic length of research programmes. Today, research plays a greater part in guiding decision-makers to define public policies for fighting climate change, and for mitigation and adaptation while preserving the environment, by proposing diagnoses or innovative solutions. With this in mind, France has mobilised and is mobilising significant resources to support climatic research at national, European and international levels.

A.1.1 General presentation of research actors in France

France finances research projects in public and private laboratories through the deployment of various support mechanisms. The total domestic expenditure on research and development (R&D) in France is €47.9 Bn (2014) and represents 2.24% of the GDP. In total, with the researchers, teacher-researchers and supporting staff, in 2014 almost 573,000 people were involved in R&D for part of their work (i.e. 417,000 full-time equivalent).

French public scientific research

The public sector's scientific research expenditure amounted to €16.9 Bn in 2014. This French public research, centred around the Ministry responsible for Research, is mainly carried out within the laboratories of higher education institutions (universities, national polytechnic institutes, higher teacher training colleges and large institutions) and research organisations. The two main types of establishments are brought together through the setting up of joint research units (or associated units) which are laboratories under the shared authority of one or several research organisations or universities.

The main public research organisations are represented by eight public institutions with a scientific and technological vocation (EPST) and twelve public institutions with an industrial and commercial vocation (EPIC). Placed under the authority of one or several ministries, in particular those responsible for research, environment, defence, health, and agriculture, all are entrusted with a public service mission and their main objective is to conduct research activities and actions undertaken during multi-annual objective and performance contracts signed with the State. By carrying out 54% of public research and almost a fifth of the research conducted on the national territory (administrations and companies combined), they are major actors of research in France. In 2014, the domestic expenditure on research and development of the main public research organisations totalled 9.1 billion euros (€ Bn).

The public research laboratories are partly financed by the budgetary allocations of universities, public research organisations and funding agencies, including the Agence Nationale de la Recherche (ANR - French National Agency for Research). They benefit from other endowments from other agencies (e.g. ADEME), from the Investment for the Future Programme (Programme d'Investissement d'Avenir - PIA), the French regions, charitable bodies, industry via competitiveness clusters, and from Europe.

Private scientific research

Companies carry out 65 % of the R&D work done on French territory and finance 61 % of national R&D expenditure. Small and medium-sized companies (SMEs) account for 13% of domestic expenditure on R&D, with more than half going to service activities. Large companies, accounting for 58 % of domestic R&D expenditure, expend three-quarters of their efforts on high and medium-high technology.

The State, via the Bpifrance institution and research tax credit, supports innovation programmes carried out by companies, including SMEs. France's international appeal and the hosting of foreign companies also contribute to the financing of industrial research.

A.1.2 An organisation by networks

The State encourages the participation of its research teams and mechanisms in the large international, European and national networks.

International level

At an international level, French teams are actively involved in the work of the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

As well as supporting these expert platforms, the Ministry responsible for Research supports major international programmes such as Future Earth, launched in 2015, which brings together three large international programmes (DIVERSITAS, the International Geosphere-Biosphere Programme (IGBP), and the International Human Dimensions Programme (IHDP)) in partnership with the World Climate Research Programme (WCRP).

European level

At European level, the Ministry responsible for Research fully supports the ten Joint Programming Initiatives[67] (JPIs). Each JPI develops common activities with the aim of coordinating European research and, in particular, uses European trans-national funding instruments such as ERA-NET co-funds. The States engaged in the JPIs are required to develop a common vision of the way cooperation and coordination in the field of research can make it possible to meet common challenges and map the research work conducted, the resources, the areas and activities that could benefit from coordination or from joint activities.

The Ministry responsible for Research also supports Article 185-type initiatives such as the PRIMA initiative which is being implemented in the Mediterranean.

Finally, France is playing a leading role in the development of the large Copernicus programme aimed at gathering all the data obtained from environmental satellites and on-site measuring instruments, in order to produce a global and complete view of the state of our planet.

[67] JPND: Alzheimer's and other neurodegenerative diseases
FACCE: Agriculture, food security and climate change;
HDHL: A healthy diet for a healthy life
Cultural Heritage: Cultural heritage and global change: a new challenge for Europe
MYBK: Live longer, and better - the issues and challenges of demographic evolution
JPIAMR: Antimicrobial resistance - an emerging threat to human health
CLIMATE: Coordinating climate knowledge for the benefit of Europe
Urban Europe: global challenges, local solutions
WATER: challenges related to water in a changing world
OCEANS: healthy and productive seas and oceans

National research alliances in France

In five key areas, national research alliances make it possible to bring together the various research stakeholders to decompartmentalise and strengthen the coordination of scientific programmes in France. The alliances do not constitute a new organisation of research, but aim, within the existing organisations, to better coordinate the actions and programmes of research bodies, by paving the way for research fields whose societal issues are decisive for the century to come.

These research alliances were created in 2009 and 2010:

- Aviesan: Alliance for health, created in May 2009
- Ancre: Alliance for energy, created in September 2009
- Allistène: Alliance for digital sciences, created in December 2009
- AllEnvi: Alliance for the environment, created in February 2010
- Athéna: Alliance for the humanities and social sciences, created in June 2010

The Specialised Inter-Organisation Commissions

In the field of Earth-system sciences, there are two national specialised commissions among public research organisations, under the coordination of the Institut National des Sciences de l'Univers (INSU - French National Institute of Sciences of the Universe) of the Centre National de la Recherche Scientifique (CNRS - French National Centre for Scientific Research):

- CSOA for the Ocean-Atmosphere domain,
- CSSIC for the Continental Surfaces and Interfaces domain.

A.1.3 The 2015-220 French National Strategy for Research (NSR)[68]

Under the Law for Higher Education and Research of 22 July 2013, a French national research strategy (NSR), comprising a multi-annual programming of resources, was developed with coordination by the Minister responsible for Research in consultation with civil society. This strategy aims to meet the scientific, technological, environmental and societal challenges while maintaining essential high-level research. The NSR includes the use of research results for the service of society. To this end, it oversees the development of innovation, technology transfer, expertise and support for public policies and for associations and foundations, recognised for their public utility. Scientific, technical and industrial culture is part of the national research strategy and is taken into account in its implementation.

The NSR, which is to be reviewed every 5 years, is organised and implemented through multi-annual contracts concluded with research organisations and higher education institutions, ANR programming and other public research funding.

Societal challenges of the NSR

In line with the Strategic Agenda for Research and Innovation France Europe 2020, the NSR defines the main French research priorities around ten major challenges:

- Challenge 1: Careful resource management and adaptation to climate change
- Challenge 2: Clean, safe and efficient energy
- Challenge 3: Stimulating industrial renewal
- Challenge 4: Health and well-being
- Challenge 5: Food security and demographic challenge

[68] http://cache.media.enseignementsup-recherche.gouv.fr/file/Strategie_Recherche/26/9/strategie_nationale_recherche_397269.pdf

- Challenge 6: Sustainable transport and urban systems
- Challenge 7: Information and communication society
- Challenge 8: Innovative, inclusive, and adaptive societies
- Challenge 9: A space ambition for Europe
- Challenge 10: Freedom and security of Europe, its citizens and its residents

Priority action programmes

In the NSR, five issues were considered as needing to be addressed with particular urgency, given the diversity of their economic and social impacts, the current international dynamics, and the maturity of the actions envisaged.

- Big data
- Earth System: observation, prediction, adaptation
- Systems biology and applications
- From the laboratory to the patient
- Man and cultures

A.1.4 French national strategy for research infrastructures[69]

Observation, measurement, experimentation, supercomputing, data storage and sharing, all entail large instruments with technical capacities beyond existing ones and integrating interdisciplinary porosity as a source of innovation. These tools are the conditions for future discoveries as much as the product of the last scientific and technological advances. Large equipment has therefore been created, managed by national, European or international organisations, requiring state-of-the-art instrumentation but also significant human and financial resources, with the support of the public powers. In parallel with these large instruments, a number of instruments shared between many actors on various sites have developed. In France, the support of the PIA (see below) was essential to this success.

Within this context, a national strategy for infrastructures was set up, leading to the publication of a first French roadmap in 2008 with updates in 2012 and 2016. The 2016 roadmap includes 95 research instruments and takes into account the new benefits of technology and the evolution of scientific practices, as well as the connection with European (ESFRI roadmap for European infrastructures) and international networks, the human or financial investments, the repercussions for innovation and the reshaping of the French research landscape. The national strategy for research infrastructure presents existing mechanisms which constitute a real “strike force” at the heart of the national research strategy, as well as projects forming a basis for building the future.

[69] In French: http://cache.media.enseignementsup-recherche.gouv.fr/file/Infrastructures_de_recherche/74/5/feuille_route_infrastructures_recherche_2016_555745.pdf
In English: http://cache.media.enseignementsup-recherche.gouv.fr/file/Infrastructures_de_recherche/16/4/infrastructures_UK_web_615164.pdf

A.1.5 The investments for the future programme[70]

The investments for the future programme (programme des investissements d'avenir - PIA) was provided for in the Amending Finance Law of 9 March 2010. The aim of the programme is to reinforce productivity, innovate, increase corporate competitiveness, and foster employment and equal opportunity by encouraging investment and innovation in 5 priority sectors, namely higher education, training, research, sustainable development, and digital technology. The programme has a budget of 35 billion euros, including 22 for higher education and research. It has been the subject of 3 programmes: the first in 2010, the second in 2013, and the third in 2016. The PIA provided an opportunity to support research and innovation in the field of environmental research and climate change and to structure the communities involved through various calls for proposals.

As a result, laboratories or groups of laboratories and teams of excellence have funding, which is particularly important to keep very high-level or high-potential scientists in France.

To date, the following amounts have been allocated:

- €1 Bn for the laboratories of excellence (LabEx) for a 10-year period (2010-2019): 171 laboratories were recipients of this funding including 17% in the field of sciences of the environment and the universe and 10% in the field of energy. Beyond 2019, the State has announced that some laboratories will be renewed for 5 years.
- 1€ Bn for equipment of excellence (EquipEx) for a 10-year period (2010-2019): 93 winning projects.
- €30 M for Convergence Institutes: 10 winning projects.

A.1.6 Competitiveness clusters

Launched in 2004, the competitiveness clusters are intended to support innovation by promoting the development of innovative and collaborative research and development (R&D) projects. The clusters are based on strong territorial roots and rely on existing structures (companies, research organisations, higher education and research institutions, collective infrastructures, etc.). These clusters have made it possible to strengthen the links between companies and research organisations. Specifically, one of their missions is to support business development and growth, in particular by placing on the market new products, services or processes derived from the results of research projects.

The State endeavours to promote a global environment that is favourable for companies and innovation by supporting the research and development efforts deployed within the clusters. At national and regional level, it supports their developments with the local authorities by providing, via the unique interministerial fund (fonds unique interministériel - FUI), grant financing for the best R&D and innovation platform projects, by financially supporting collective thematic actions and by involving various partners (Bpifrance, Caisse des Dépôts, etc.)

A.1.7 The research funding agencies

In support of research and innovation projects, there are two main French funding agencies: the Agence Nationale de la Recherche (ANR - French National Agency for Research) and the Agence de l'environnement et de la maîtrise de l'énergie (ADEME - French Environment and Energy Management Agency).

[70] https://www.performance publique.budget.gouv.fr/sites/performance_publique/files/farandole/res-sources/2016/pap/pdf/jaunes/jaune2016_investissements_avenir.pdf

The Agence Nationale de la Recherche (ANR - French National Agency for Research)

The ANR has the task of implementing the financing of research projects in France. In 2015, it had a budget of €528 M including €390 M for national or international calls for proposals. ANR has designed and deployed a range of funding instruments in response to its assigned role in France's public policy for research and innovation and to the project-based funding needs of the research communities. The great challenges addressed by ANR's action are in line with the national and European strategic agendas. ANR is also tasked with managing the State's large investment programmes in the field of higher education and research, and monitoring their implementation. It is for this purpose that ANR was designated in 2010 as the State's operator for the actions of the investments for the future programme and is responsible for organising the selection, formalisation by contract, financing, follow-up, evaluation and impact of the programme's projects and actions. Over 10 years (2005-2015), ANR has supported almost 14,300 projects.

The Agence de l'environnement et de la maîtrise de l'énergie (ADEME - French Environment and Energy Management Agency)

ADEME is a public institution under the joint authority of the Ministry of Ecological and Inclusive Transition and the Ministry of Higher Education, Research and Innovation. It works on the implementation of public policies in the fields of the environment, energy and sustainable development. It makes its expertise and consultancy capacity available to companies, local authorities, public authorities and the general public, to enable them to progress in their environmental strategy. The Agency also supports the financing of projects, from research to implementation, in the following areas: waste management, soil preservation, energy efficiency and renewable energy, savings in raw materials, air quality, noise abatement, transition to the circular economy and combating food waste.

In 2017, its budget was €590 M in State endowments and €20 M from own resources.

Its expenditure on the large programmes is as follows:

- €223 M for the "Renewable heat" programme,
- €191 M for the "Waste and circular economy" programme,
- €45 M for the "Buildings" programme,
- €13 M for the "Communication/Training" programme,
- €26 M for the "Energy/Climate local approaches" programme,
- €27 M for the "Polluted sites and urban wastelands" programme,
- M€30 M for the "Research" programme,
- €35 M for the other programmes.

A.2 Public action in climate change research

A.2.1 The large research organisations and the AllEnvi national research alliance

French public research on climate in the broad sense is carried out in higher education institutions represented in the AllEnvi alliance by the Conference of University Presidents (conférence des présidents d'université - CPU), which brings together the directors of the Universities, National Polytechnic Institutes, Higher Teacher Training Colleges and large institutions) and in twelve research organisations which dedicate a variable part of their activities to this area. These are:

- CNRS - Centre national de la recherche scientifique / French National Centre for Scientific Research

- CEA - Commissariat à l'énergie atomique et aux énergies / French Alternative Energies and Atomic Energy Commission
- INRA - Institut national de la recherche agronomique / French National Institute for Agricultural Research
- Météo-France
- CNES – Centre nationale d'études spatiales / French National Centre for Space Studies
- Cirad - Centre de coopération internationale en recherche agronomique pour le développement / Centre for International Cooperation in Agricultural Research for Development
- IRD - Institut de recherche pour le développement / Research Institute for Development
- MNHN - Muséum national d'histoire naturelle / French National Museum of Natural History
- Ifremer - Institut français de recherche pour l'exploitation de la mer / French Institute for Marine Research
- Ifsttar - Institut français des sciences et technologies des transports, de l'aménagement et des réseaux / French Institute of Transport Science and Technology, Planning and Networks
- BRGM - Bureau de recherches géologiques et minières / Office of Geological and Mining Research
- Irstea - Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture / Institute for Research in Science and Technology for the Environment and Agriculture

These organisations are founding members or associates of the alliance which aims to coordinate French research to achieve a successful ecological transition and meet the major societal challenges. The AllEnvi alliance was built around 4 challenges, including climate:

- Food: feeding nine billion human beings by the year 2050
- Water: ensuring access to water and natural resources, in both quantity and quality, on a worldwide scale.
- Climate: addressing climate changes and the erosion of biodiversity
- Territories: respecting the imperative of environmental quality in our territories

AllEnvi coordinates 12 thematic groups bringing together more than 300 national scientific experts: Agroecology and Soils, Food and Nutrition, Animals, Biodiversity, Plant Biology, Climate, Water, Environmental Assessment, Ecotechnology, Sea, Risks, Territories.

A.2.2 French national climate modelling centres

There are in France several climate modelling centres which have led to the development of two major climatic models, one developed by the Institut Pierre-Simon-Laplace (IPSL) and the other by Météo-France. These models were developed in partnership with many research units in France.

The Institut Pierre et Simon Laplace (IPSL)

created in 1995, counts 9 laboratories[71] in the Paris area, whose research topics concern the global environment. The institute's regulating bodies are CNRS, CNES, CEA, IRD, ENS, Ecole Polytechnique,

[71] the Atmospheric Environment Teaching and Research Centre (CEREA)
the Géosciences Paris-Sud (GEOPS) laboratory
the Atmospheres, Environments, and Spatial Observation Laboratory (LATMOS)
a team from the Laboratory for Studies of Radiation and Matter in Astrophysics and Atmospheres (LERMA)
the Inter-University Laboratory of Atmospheric Systems (LISA)
the Dynamic Meteorology Laboratory (LMD)
the Laboratory of Oceanography and Climate: Experiments and Numerical Approaches (LOCEAN)
the Laboratory of Climatological and Environmental Sciences (LSCE)
the Environments, Transfers and Interactions in Hydrosystems and Soil (METIS) laboratory

Université Paris et Marie Curie, Université Versailles St Quentin, Université Denis Diderot, Université Paris-Est Créteil and Université Paris-Sud. The institute's partner laboratories have developed a common strategy for the study of the "Earth System" as a whole (Earth's climatic system, climate variability and change, atmospheric chemistry and air quality, environment and society) and for the study of other objects in the Solar system.

The laboratories of IPSL have set up common services and large scientific projects to serve its scientific strategy on climate.

- The Climate Modelling Unit studies the natural and anthropogenic variability of the Earth's climatic system and is developing a digital tool that links atmosphere, ocean, continental surfaces and atmospheric chemistry models developed in the IPSL laboratories.
- The Data Centre manages the data and makes them available to the IPSL teams. At national level, it is responsible for the data of the ETHER data centre on atmospheric chemistry and participates in the ICARE expertise centre specialising in the study of aerosols and clouds.
- IPSL is responsible for several observation services (monitoring of stratospheric ozone, greenhouse gases and carbon flows in the ocean and atmosphere) and modelling services (ocean and atmospheric pollution) and for an instrumental site, all approved by CNRS-INSU.
- The "Solar System" Unit aims to understand the formation, dynamics and long-term evolution of the neutral and ionised atmospheres of the Earth and of the planets, and their interaction with solar wind.
- The "Regional Climates and Environments" Unit is interested in the water cycle and in the medium-scale processes involved in this cycle.

Météo-France

is the national meteorological and climatological service. Its annual budget is €379 M (2016). Its prime objective is to ensure the meteorological security of persons and goods by performing observations across the whole national territory (metropolitan France and overseas territories) and producing weather forecasts. Météo-France plays a significant role within the main meteorological cooperation organisations: The World Meteorological Organisation(WMO), the European Centre for Medium-Range Weather Forecasts (ECMWF), Eumetsat, the operator of European meteorological satellites, and Eumetnet.

The research activities of Météo-France represent a significant contribution to the efforts of the French, European and international scientific community in the fields of meteorology and climatology.

The Centre national de recherches météorologiques (CNRM - French National Meteorological Research Centre) is a joint research unit between CNRS and Météo-France. It brings together about 80 researchers, 150 engineers, technicians and administrative staff. It carries out most of these activities and coordinates all the R&D actions of Météo-France. It is made up of six research units and a set of common services distributed over several sites in France: mainly metropolitan France in Toulouse (about 80%) and Grenoble, with the Centre d'études de la neige (Snow Research Centre). To carry out its objectives and the experiments that are essential for the acquisition of new knowledge, CNRM relies on high technological means: supercomputers, satellites, instrumented aeroplanes, drones, fixed or mobile measuring stations, instrumented mountain sites, wind profiler radars, anchored and drifting buoys, cold chamber. Since 2016, Météo-France has had two new supercomputers with a peak computing power of more than 5 Petaflops.

French national climate modelling infrastructure (ClimERI-France)

ClimERI-France, bringing together CNRS, CEA, Météo-France, Université Pierre et Marie Curie, IRD, Cerfacs and GENCI, has the task of performing the international numerical simulations of the World Climate Research Programme and ensuring that their results are available to a variety of users. These coordinated experiments aim to understand the functioning of the climatic system, assess the capacity of the climate models by defining standard experiments, support mechanism and process studies and produce projections of future climate change. These experiments contribute to the preparation of IPCC reports. ClimERI-France includes the human resources ensuring the development and maintenance of the codes and tools necessary for their use, the preparation of the reference versions of the codes, the exploitation of the data produced by simulations, the computing resources allowing international experiments to be carried out as well as the data storage capacities and the software infrastructure enabling the management and control of data and metadata flows. The infrastructure provides a service for access to the data and analysis of the results of global and regional climatic models, as well as access to the simulations across France, as part of the development of climatic services coordinated at national level by the AllEnvi national alliance for environmental research.

A.2.3 The French National Strategy for Research (NSR)

Among the ten major scientific challenges set out in the NSR (see VIII.A.1.3) half concern climate research but also the impacts of climate change in particular on the great envelopes of the Earth, including the oceans, the atmosphere and the critical zone[72]. This research also focuses on vulnerabilities and necessary adaptations.

The “Efficient resource management and adaptation to climate change” challenge (or Challenge 1) is the main focus of climate research. In 2017, this challenge was divided into 6 research themes:

- Theme 1: Fundamental knowledge related to the challenge (environments and biodiversity)
- Theme 2: Dynamics of ecosystems and their components to improve their sustainable management
- Theme 3: Health-Environment - “One Health”
- Theme 4: Scientific and technological innovations to support ecological transition
- Theme 5: Society in the face of environmental change
- Theme 6: Integrated approaches for a sustainable development of territories

The three other major challenges also targeting, directly or indirectly, research questions on the climate and its impacts are the following:

- Challenge 2: Clean, safe and efficient energy
- Challenge 5: Food security and demographic challenge
- Challenge 6: Sustainable transport and urban systems

Several societal issues with a strong potential impact emerge from all the research directions. They require coordinated action extending beyond the usual research programming and objectives set with research organisations. Among the five issues considered by France as needing to be addressed with a particular urgency, given the diversity of their economic and social impacts, the current dynamics, and the maturity of the actions envisaged, two concern climate research:

[72] A thin layer of the planet which includes all life forms and which extends from non-weathered and aquifer rock to the tree canopy and the lower atmosphere. The critical zone is therefore the zone of interactions between the atmosphere, the biosphere, the hydrosphere and the Earth’s crust.

- Big data with the digital data growth explosion, in particular for the environment-climatology field; these data represent an exceptional source of new knowledge;
- Earth System: observation, prediction and adaptation. Understanding and observation of the Earth-system, and predictions of its evolution entail the organisation, acquisition and exploitation of Earth observation data. This is clearly a major societal and economic challenge in a context marked by climate change, and the scarcity and degradation of certain natural resources.

A.2.4 The investments for the future programme

France has recognised scientific expertise in the field of climate modelling and in observation systems targeting the planet's large fluid envelopes (atmosphere, oceans, continental hydrosphere) and the biosphere. The investments for the future programme has helped strengthen national research resources by creating laboratories and equipment of excellence.

French climate and environment research capacity has therefore been strengthened by the creation of fourteen laboratories of excellence (labEx) supported by €133 M over 10 years.

- AGRO (Montpellier): The LabEx Agro focuses on plants of agronomic interest. It brings together more than 1200 scientists constituting a continuum of multidisciplinary competences (biological sciences, engineering sciences, human and social sciences) from the study of genes to the end use of plants, and with recognised expertise on numerous plant species from temperate, Mediterranean and tropical areas.
- ARBRE (Advanced Research on the Biology of the Tree and Forest Ecosystems; Lorraine). The general objective of the labEx ARBRE is to understand the mechanisms that affect the evolution of forest ecosystems, to predict their medium- and long-term responses to global changes and to develop adapted management methods to ensure their sustainability or their mutation.
- BASC (Biodiversity, Agro-ecosystems, Society, and Climate; Paris-Saclay) is intended to explore how human activities interact with ecosystems, and by what means the resulting environmental and biodiversity degradation may be remedied.
- CAPPA (Physics and Chemistry of the Atmosheric Environment; Lille): The CaPPA laboratory of excellence studies on the one hand the "aerosols" and precursors system to better understand their role in climatic forcing and the hydrological cycle, and on the other hand, the evolution of air quality on a global, regional and local scale, with specific studies on radionuclides.
- CEBA (Centre for the Study of Biodiversity in Amazonia): Based in French Guiana, the CABA laboratory of excellence promotes innovation in research on tropical biodiversity. It brings together a network of high-level French research teams, contributes to university education and encourages scientific collaboration with South American countries.
- CeMEB (Mediterranean Centre for Environment and Biodiversity; Montpellier). The research conducted at the CeMEB focuses on the dynamics and functioning of biodiversity and ecosystems in a context of marked environmental change, induced in particular by human activities. One important objective is to predict the biological consequences of global change using scenarios, and to anticipate the evolution of ecosystem services and human societies.
- CORAIL (Perpignan): The aim of this labEx is to provide a knowledge platform on coral reef ecosystems, with a view to improving their management.
- COTE (Bordeaux): COTE brings together researchers in biology, physics, chemistry and socio-economic sciences, to understand and predict the responses of continental and coastal ecosystems to human-induced environmental changes and to provide tools and methods for regulating or driving their evolution.
- ITEM (Innovation and Mountain Territories; Grenoble): This labEx is a reference centre for mountain research in the field of human and social sciences, aiming to provide mountain territories with the

analytical capacity and expertise that are essential to cope with the various forms of change they face, including climate.

- L-IPSL (Paris). The labEx Pierre Simon Laplace aims to understand climate and help anticipate future changes.
- LabexMER (Brest): Within the context of climate change and resource scarcity, the LabexMER aims to strengthen knowledge and understanding of the way the ocean functions.
- OT-MED (Objective Earth: Mediterranean Basin; Aix en Provence): the aim of OT-Med is to create an interdisciplinary "Earth Institute" focusing on the environment in the Mediterranean basin and semi-arid southern regions, by establishing links between the physical-biological sciences of natural hazards, related in particular to climate change, and socio-economic sciences.
- OSUG@2020 (Grenoble): This labex develops innovative strategies for the observation and modelling of natural systems.
- VOLTAIRE (VOLatiles – Earth, Atmosphere and Interactions - Resources and Environment); Orléans): VOLTAIRE studies the complex natural fluids of our planet for applications to natural resources, CO_2 and energy storage, geothermal energy, water quality, soil and environmental conservation, and quality of the air and ozone layer.

Several pieces of equipment of excellence (EquipEx) were financed over the 2010-2019 period for a total of €61 M:

- ASTER-CEREGE: platform of isotopic geochemistry for the analysis of chemical elements as tracers of climate variations and of the impact of human activities.
- CRITEX: innovative fleet of instruments to study the critical zone.
- IAOSS: network of 15 floating platforms in the Arctic Ocean aiming to measure climatic parameters.
- NAOS (French contribution to the international network ARGO): temperature and salinity measurements down to a depth of 2000 m in the ocean throughout the globe over a period of 20 years.
- Climcor: Innovative coring drills for the high-resolution analysis of the climate archives contained in marine, continental and glacial sediments for research in paleoclimatology.
- Sense City: climatic chamber that can cover two 400m² areas. A portion of land, called Mini-City, equipped with many sensors, is built on each of these areas.
- Xyloforest; research, innovation and service platform for cultivated forest systems - wood products and materials

A.2.5 French National Roadmap for the Arctic

In view of the issues and challenges ahead in the Arctic region, the French Ministry of Foreign Affairs has decided to implement an inter-staff network between several ministries and governmental agencies, under the presidency of Mr Michel Rocard, former Prime Minister and ambassador for the polar regions, to prepare a "National Roadmap for the Arctic" that identifies, ranks and coordinates France's priorities with regard to the Arctic. Following two years of work, an interministerial document was adopted and presented in June 2016. This document provides a working framework and sets guidelines and priorities which will make it possible in the coming years to align and prioritise action on Arctic issues and challenges that concern France, with a broader focus on sustainability and the common interest. In France's foreign policy on the Arctic, the excellence of scientific research in polar environments and its integration into the international research fabric, is a major asset for our country.

Following the “French National Roadmap for the Arctic”, the heightened interest of France and the international community in the new scientific, environmental and economic issues in the Arctic region led to the implementation of an initiative to coordinate scientific research in Arctic environments, the “French Arctic Initiative”, steered by the Centre national de la recherche scientifique (CNRS) and complementing the actions undertaken by the public interest group Institut Paul-EmileVictor (GIP IPEV). A foresight exercise, extended to the whole national scientific community interested in the scientific issues in the Arctic, took place between 2010 and 2015.

A.2.6 Research towards the development of Southern countries

Two national organisations (IRD, Cirad) under the joint supervision of the Ministry responsible for Research and the Ministry of Foreign Affairs, conduct research and development activities with and for the Southern countries.

- The French Research Institute for Development (French: Institut de recherche pour le développement - IRD, staff of 2000 including 800 researchers and an annual budget of €230 M) has the task of contributing to the development of the research capacities of the Southern partners. Its research strategy is developed in more than 90 countries in the form of centres or temporary missions. The aim of IRD is to better understand the processes at the origin of climate variability and improve predictive capabilities in tropical environments, so as to refine climate change scenarios at ten-year and centennial time-scales.
- The Centre for International Cooperation in Agricultural Research for Development (French: Centre de coopération internationale en recherche agronomique pour le développement - Cirad) is a research establishment with a staff of 180, including 800 scientists (annual budget of €200 M), which addresses, with the Southern countries, the international issues of agriculture for development. Its activities concern life sciences, social sciences and engineering sciences as applied to agriculture, food and rural territories. Cirad works with its partners in Southern countries to generate and pass on new knowledge to support agricultural development and contribute to the debate on the major global issues of agronomy. Cirad has defined 6 priority research themes: ecological intensification; energy biomass; food; animal health, emerging diseases; public policies; rural areas. It is engaged in cooperation activities with more than 90 countries in Africa, the Indian Ocean, Asia and South America.

A.3 Research in the face of climate change issues

In 2015, the French National Strategy for Research identified several research challenges to be met and the research directions to be developed over the period 2015-2020. The climate change issues are also found in four challenges concerning knowledge about climate itself and all its interactions with natural resources, energy, agriculture, health and urban systems. These challenges are divided into research areas.

A.3.1 Efficient resource management and adaptation to climate change (Challenge 1)

In the context of climate change and degradation or sometimes even the depletion of natural resources, efficient resource management at the centre of Challenge 1 of the NSR concerns all the resources used or impacted by Man for his food, energy and industrial activity. Besides knowledge about resources, the question of adaptation to climate change implies a better understanding of climate functioning, which requires a dual approach combining monitoring and modelling, to improve long-term prediction and projection tools and then assess the potential impacts of climate change and build adaptive strategies for societies and economies to cope with ongoing local and global changes. This challenge leads to 5 priority research areas:

- Smart monitoring of the Earth-system

- Sustainable management of natural resources
- Assessment and control of climate and environmental risks
- Eco- and bio-technologies to support ecological transition
- The coastline, a natural 'laboratory' to study all the concerns related to resources and climate change.

A.3.2 Clean, safe and efficient energy (Challenge 2)

In light of increasing worldwide energy needs and the strong constraints imposed by the fight against global warming, France and other countries have become aware of the urgency to consider a new model based on greater energy sobriety, improved efficiency and the growing use of renewable energy. Transition trajectories are based on a complex combination of progress to be made in fundamental scientific concepts, technological innovation and behaviour changes. Efforts are therefore essential in research, development and innovation both to consolidate the competitiveness of existing sectors (fossil, nuclear and renewable forms of energy), a store of wealth and employment, and to enable the emergence of new energy systems and the industrial sectors that will arise from them. This concerns all sectors: biomass, wind power, solar power, geothermal energy, nuclear energy and fossil energies including non-conventional hydrocarbons with carbon capture and recycling. The research for this challenge is organised around 5 priority research areas:

- Dynamic management of energy systems
- Multi-scale governance of the new energy systems
- Energy efficiency
- Reduction of the dependence on strategic materials
- Fossil carbon substitutes for energy and chemistry

A.3.3 Food security and demographic challenge (Challenge 5)

Food security is threatened today by the combined impact of climate change, the growth of the world population and the evolution of eating habits. These factors exert increasing pressure on productive systems: greenhouse gas emissions, damage to soils and ground waters, competition for uses. They have implications for health. They generate high rates of loss and wastage. In France, research on food security covers areas ranging from production systems to population health by considering all organisation levels and scales: from genes to individuals, to populations and finally to the ecosystem, from new species, races or varieties to new social organisations and new markets. These areas are complex and interconnected. In this research challenge, two research areas indirectly incorporate climate hazards:

- Integrated approach of production systems
- From production to diversified use of biomass.

A.3.4 Sustainable mobility and urban systems (Challenge 6)

Cities and their transport infrastructures are complex physical, ecological, technical and societal systems. Therefore, the search for balanced and sustainable solutions should be multidisciplinary and in particular incorporate climate hazards. Four priority research areas related to the climate are considered:

- Urban Observatory
- New conception of mobility
- Tools and technology for sustainable cities
- Optimisation and integration of infrastructures and urban networks

A.4 France's influence in climate research

In the face of climate change issues, French research sets its priorities in line with the major European and international programmes. This is shown by France's participation in international authorities such as the IPCC (Intergovernmental Panel on Climate Change), the Future Earth programme, the Belmont Forum consortium of funders. Its active participation in the European joint programming initiatives (JPI of the Horizon-2020 programme), in articles-185 (future PRIMA programme) as well as the alignment of its research strategy with the challenges of the Horizon 2020 programme's European research strategy, demonstrate this coherence. At national level, France is mobilising resources for climate change, in particular around large research projects.

A.4.1 French climate research in line with the major international programmes (outside Europe)

Future Earth

Along with 4 other countries (United States, Japan, Canada and Sweden), France coordinates the secretariat for the global programme Future Earth launched in 2015. This programme is the result of the merging of three existing major research programmes in the area of global environmental change (IGBP, IHDP, Diversitas). The World Climate Research Programme (WCRP) is a partner of Future Earth.

The aim of Future Earth is to provide societies with the knowledge to address global environmental changes and to promote ecological transition. The secretariat is distributed over five hubs based in France (Paris), the United States (Boulder), Japan (Tokyo), Canada (Montreal) and Sweden (Stockholm). The French hub was formerly located in the CNRS headquarters and is now based at the Université Pierre et Marie Curie. It is managed in the form of a CNRS-multi-organisation Service and Research Unit involving the relevant AllEnvi organisations for environmental issues.

Through the Ministry responsible for Research (MESRI), which is the programme's coordinator for France with the support of the AllEnvi alliance, CNRS, INRA and ANR, all the French actors in environmental sciences are involved. Through this involvement, France aims to play a significant role in the global development of solutions to the major environmental challenges and to create synergies between the actors.

World Climate Research Programme (WCRP)

The World Climate Research Programme (WCRP) is an international research programme on the world's climate, set up in 1980. The IPSL (France) is in charge of the programme's Support Unit.

Belmont Forum

ANR, in partnership with the Ministry responsible for Research (MESRI) and the allEnvi alliance, for France, is a member of the Belmont Forum, a consortium which brings together representatives of the main funding agencies of the G7 countries and emerging countries. Its actions aim to "deliver the necessary knowledge to mitigate and adapt to harmful environmental changes and extremely dangerous events". ANR held the vice-chairmanship of the Belmont Forum from 2012 to 2015 and hosted its secretariat.

Global Framework for Climate Services (GFCS)

La France est partenaire du Cadre mondial pour les services climatiques (Global Framework for Climate Services - GFCS), une initiative de l'ONU dirigée par l'OMM qui vise à coordonner les efforts déployés à l'échelle du globe pour assurer la fourniture de services climatiques axés sur les besoins des utilisateurs et tirer ainsi le meilleur parti des connaissances sur le climat.

A.4.2 French climate research in line with the major European programmes

The framework programme Horizon 2020

In 2014, France published its five-year national strategy for research in line with the European Union's framework programme for the financing of research and innovation (Horizon 2020) for the period 2014-2020. The societal challenge of the NSR entitled "Food security and demographic challenge" (Challenge 5) reflects the Horizon 2020 programme's Challenge 2 "Food security, sustainable agriculture, marine and maritime research and the bioeconomy". The challenge of the NRS on "efficient resource management and adaptation to climate change" (Challenge 1) corresponds to Challenge 5 of the Horizon 2020 programme "Climate action, resource use efficiency and raw materials". The challenge for energy entitled "Clean, safe and efficient energy" (Challenge 2) is based on the H2020 challenge "Secure, clean and efficient energy" (Challenge 3). Challenge 6 of the NSR "Sustainable mobility and urban systems" partly corresponds to Challenge 4 of Horizon 2020 on "Smart, green and integrated transport".

The joint programming initiatives (JPI)

The joint programming initiatives introduce a new mode of cooperation between Member States to meet a series of essential societal challenges for Europe. They prompt the Member States to define a common vision and a strategic agenda for research on these societal challenges to which the national programmes in isolation cannot respond. It consists of defining and implementing, in a coordinated way at European level, research programmes on the major issues for European society, science and technology. France participates in the 10 joint programming initiatives approved to date, five of which fall under the climate research framework:

- JPI Climate (Coordinated development of climate knowledge for Europe): Launched in 2010, the JPI Climate, bringing together 17 countries, is a European initiative to coordinate the funding of climate research (in the broad sense). It contributes to the development of knowledge to improve scientific expertise on risks due to climate change and adaptation options. France, through ANR, held its presidency until 2017.
- JPI Oceans (Healthy and productive seas and oceans): The aim of this initiative, launched in 2010 and bringing together 22 countries, is to create a knowledge base that will enable the implementation of an integrated policy on the sustainable use of marine resources, while limiting the impact of climate change on the marine world and coastal regions.
- JPI Urban Europe: The JPI Urban Europe was created in 2010 and brings together 14 European countries to help European cities meet the many challenges they face: climate change, transport network congestion, energy management, ageing housing stock, migratory flows, social and economic changes.
- JPI Water (Water-related challenges in a changing world): This joint programming initiative aims to strengthen Europe's leadership and competitiveness in the fields of research and innovation on water, while enabling the safeguarding of the resource. France, through ANR, holds its presidency and ensures its coordination since November 2014. This JPI brings together 24 countries and the European Union.
- JPI FACCE: (Agriculture, food security and climate change): This is an initiative launched in 2010 which was coordinated by the Institut National de la Recherche Agronomique (INRA) until 2014. The secretariat of FACCE is provided by INRA. This joint programming initiative brings together 22 countries which are committed to building an integrated European Research Area addressing the challenge of sustainable agriculture, food security, and impacts of climate change. It provides research to support sustainable agricultural production and economic growth, and to contribute to a European bio-economy, while maintaining and restoring ecosystem services under current and future climate changes.

Partnership for Research and Innovation in the Mediterranean Area (PRIMA)

PRIMA (Partnership for Research and Innovation in the Mediterranean Area) aims to strengthen cooperation in research and innovation in Mediterranean countries to meet the challenges of sustainable food production and water resource management in the Mediterranean area. The PRIMA initiative is an Article 185-type research and innovation programme that will be conducted over a 10-year period from 2018.

European research infrastructures (European Strategy Forum on Research Infrastructures, ESFRI)

France actively participated, within the framework of the European Strategy Forum on Research Infrastructures (ESFRI), in the updating of the pan-European roadmap for research infrastructures officially published in March 2016. In parallel, it also re-examined the roadmap for its national installations published in 2008 and then updated in 2012 and 2016. The ESFRI Forum, which plays a key role in the development of policies on research infrastructures in Europe, identifies the essential European research infrastructures for the 10 to 20 next years. France built its roadmap for research infrastructures in line with this ESFRI roadmap. At the end of 2016, a new reflection was initiated for an updated version of the French roadmap for 2018 to be prepared in parallel with the updating of the ESFRI roadmap.

A.4. French participation in the Intergovernmental Panel on Climate Change (IPCC)

The French teams have widely contributed to the Fifth Assessment Report published by the IPCC, in particular the report of the Working Group 1 (“The Physical Science Basis”). Forty-Two French scientists contributed to the report of the GT1 published in 2013. French scientists also contributed to reports 2 and 3 published in 2014, dedicated to “Impacts, Adaptation, and Vulnerability” (57 French authors and proofreaders) and to “Mitigation of Climate Change” (7 French authors), respectively.

The Ministry responsible for scientific research (MESRI) jointly with the Ministry responsible for the Environment (MTES) through ADEME and the Ministry of Foreign Affairs (MEAE) has since 2016 provided support for the Technical Support Unit (TSU) of Working Group 1. This working group assesses the scientific aspects of the physics of the climatic system and climate change. Mrs Valérie Masson-Delmotte from the Laboratory of Climatological and Environmental Sciences (Laboratoire des Sciences du Climat et de l’Environnement - LSCE, Gif-Sur-Yvette) co-chairs this Working Group 1 for France, with Panmao Zhai from the China Meteorological Society (Beijing) for China. The TSU is based in the Université Paris Saclay in France, with a branch at the Abdus Salam International Centre for Theoretical Physics in Italy. The TSU also benefits from support for computing from the Laboratoire des Sciences du climat et de l’environnement (LSCE) of the Institut Pierre Simon Laplace (IPSL). France currently contributes €1.5 M/year to the IPCC.

B. SYSTEMATIC OBSERVATION

France is involved in the Global Climate Observation System (GCOS), a global observation system including four areas of observation and their networks: the atmosphere, the ocean, the land networks (glaciers and carbon flows), and the aerospace. This climate observation program operates under the aegis of the World Meteorological Organization (WMO, www.wmo.int/pages/prog/gcos), the International Council for Science (ICSU), the Intergovernmental Oceanographic Commission (IOC) and the United Nations Environment Program (UNEP). The purpose of the French national GCOS communication network is to check whether the French system can effectively monitor the climate (spatial resolution, temporal frequency, working condition) and complies with specific aspects relating to the Climate Convention (Rio, 1992) and the Kyoto Protocol (1997).

Two types of measurement networks can be used depending on the purpose: measurement research networks and public service measurement networks. Both networks are correlated.

In France, climate research leans on observation departments labelled by the National Institute for Universe Sciences (CNRS-INSU), which are managed locally by Universe Sciences Observatories (USO). These local departments are part of national infrastructures, which are registered on a national roadmap created in 2008 and updated in 2012 and 2016. For the last ten years, the landscape of national infrastructures has been reflecting the French will to sustain the existing observation systems, which are essential to climate research in accordance with the European or international research infrastructures.

Météo-France, the national department for meteorological and climate studies in charge of environment security of people and goods, is the research leader of observation, prevision and modelling of climate change. Due to its history, its links to the WMO and its location, it is the main actor of the systematic observation system.

B.1 Research and observation infrastructures of the atmosphere

Integrated carbon observation systems (ICOS)

The Laboratoire des Sciences du Climat et de l'Environnement (Laboratory of Environmental and Climate Sciences) in Gif sur Yvette, in France, coordinates the ICOS system on a European scale. The ICOS system is an integrated greenhouse gas effect observation system (stations plus data management). Its aim is to connect the various European atmospheric measurement stations to obtain precise, long-term data on climate change and the greenhouse effect. Finland is the coordinating country.

Integrated observation measurement systems (IAGOS)

IAGOS (In-service Aircraft for Global Observing System labelled by ESFRI) is a European research infrastructure establishing, operating and exploiting a global observation network of the composition of the atmosphere: trace gases (ozone, carbon monoxide, nitrogen oxide), GHG-gases (steam, carbon dioxide, methane, ozone), aerosols and fine particles (water drops and ice crystals). This data is being worked on by international research networks, international weather forecast centers, air quality forecast centers, the atmosphere department of the Copernicus program and on a wider scale the realm of GEOSS (Global Earth Observation System of Systems).

Research centers on aerosols, clouds and trace gases(ACTRIS)

ACTRIS-FR, Aerosols, Clouds, and Trace gases Research Infrastructure Network is the French component of ACTRIS, the European initiative responsible for the observation and exploration of aerosols, clouds and reactive gases and of their interactions.

B.2 Members of the physical and chemical measurement networks (GAW, NDACC, EMEP)

The VAG network (Veille de l'Atmosphère Globale) or GAW in English (Global Atmosphere Watch) measures physical and chemical data of the atmosphere and has been created 25 years ago to improve scientific knowledge on the increasing influence of anthropic activities on the atmosphere composition. The data is collected on aerosols GHG, some reactive gases, ozone, UV-rays and rain chemistry (atmospheric deposits).

NDACC (Network for Detection of Atmospheric Composition Change) is an international long-term survey network about stratosphere and high troposphere. It was created in 1991. Observations are made on various locations all over the world. France has 5 main offices:

- Observatory of Haute Provence (OHP);
- Atmosphere Research Center in Lannemezan, Observatory Midi-Pyrénées (OMP);
- Villeneuve d'Ascq ;
- Dumont d'Urville and Concordia basis (Dôme C) in Antarctic;
- Observatory of Atmosphere Physics on the island of la Réunion (OPAR) located in the Indian ocean.

The MERA network (Measure of Atmospheric deposits) is the French satellite of the European EMEP (European Monitoring and Evaluation Program) following on the long run the long distance atmospheric pollution in the framework of the Genova Convention on transboundary pollution (CLRTAP).

B.3 French measures in the Indian Ocean

Focusing on key-areas, a French network has been developed in the Indian Ocean. Hence the creation of the OISO (Océan Indien Service d'Observation) observation system labelled National Observation Service by CNRS-INSU in July 1997, which is based on the oceanic ship Marion-Dufresne. Since 2003, its observation activities are linked to the MINERVE observation campaign (Mesures à l'INterface Eau-aiR de la Variabilité des Echanges de CO_2), supplementing the international CO_2 oceanic measures network in a less documented area. The MINERVE program is based on campaigns led on the so called "Astrolabe" ship. It helps us in the observation and the global understanding of the seasonal variability of O2 pressure and of total non-organic carbon in the surface area of the ocean, in association with hydrological and biogeochemical in-situ measures, including data collected by satellites such as temperature or sea color.

B.4 Mountain network

NIVOSE is the name of the automatic high mountain weather forecast offices of Météo-France. Those offices have been implemented in order to publish real time meteorological data in the high mountains. The network consists of 22 offices and covers several big mountain areas in France: Alpes (15 stations), Pyrenees (5 stations) and Corse (2 stations).

B.5 Altitude network

Radio-measurements Météo-France built a radio-measurement system consisting on 2013 December 31th of 5 offices in metropolitan France, 10 over sea offices, 4 in French Polynesia, Kerguelen, Terre Adélie.

Aeromeasures To emphasize their data on the state of high atmosphere, the association of European meteorological radio-measure systems (Eumetnet) has been handling through the Amdar project

launched in 1995 by MMO the collection and control of data from the volunteering corporations since 2001.

Sea measurements Météo-France implemented radio-measurement systems on 4 ships between Le Havre and the French Antilles. Measures are done twice a day.

B.6 Oceanic RSO climate infrastructures

The French contribution to climate observation in the ocean has been developing in the framework of the GOOS system (Système Mondial d' Observation des Océans), which implementation is coordinated by the OMM-COI common Commission for Sea Météorology and Oceanography (JCOMM). This contribution consists of the following items: oceanographic ships, volunteering and occasional observation ships, among which (VOS) and (SOOP), tide-gauges, meteorologic drifting and fixed, sub-surface (ARGO) floats and a seaside and coastal infrastructure.

Global in-situ oceanic observation network (ARGO, Euro-ARGO)

France is involved in ARGO, an international 3800- profiling floats network, which measures in real time the temperature and the salinity of oceans from the surface to 2000 m depth.

French oceanographic ships (FOF)

The French oceanographic ships take geological, physical, biological and chemical measures.

Seaside infrastructure (I-LICO)

The national research, I-LICO is an observation system collecting samples and spreading sensors to characterize seaside evolutions and follow long-term evolutions on a wide scale. This helps us to anticipate and understand specific processes and to account for climate episodes.

B.7 Space climate observation

Progresses have been made through the collection of data from the French-American satellite Topex-Poséidon (1992-2005) and its successors from the Jason category: Jason 1 (2001-2013), Jason 2 (2008-), Jason 3 (2016-) in cooperation with the CNE and the NASA. Their successors, Jason CS/ Sentinelle 6 A (2020) and B (2025), built in cooperation between Europe (ESA, UE, Eumetsat, CNES) and USA (NASA, NOAA), belong to the Sentinelle satellites family from European program Copernicus. A new and better performing measurement systems generation (radar interferometer) will be used by the next French-American satellite SWOT (2021), dedicated not only to oceanography, but to continental hydrography too.

B.8 Support to developing countries for the implementation of observation systems

AMMA (2002-2020) and AMMA-CATCH networks

AMMA is an international program led by France (LOCEAN laboratory) studying West-African monsoon, its variability and its links with social and economic issues. Its second phases began in 2010 and will end in 2020. Its goals are:

- improving our understanding of this monsoon and of its impact on the environment both at a local and global scales.
- Using basic scientific knowledge to establish links between climate variability and health, water resources and food security and to define convenient surveys.
- Checking whether this multidisciplinary AMMA research improve our forecasts.

MISTRALS program (Mediterranean Integrated Studies at Regional And Local Scales)

Mistrals is an interdisciplinary and international meta-program of RSO working near the Mediterranean basin. MISTRALS' new vision consists of the incorporation of scientific analyses of the geophysical of Mediterranean area in association to the social needs of the local population, improving communication between researchers from complementary fields and from various decision levels. MISTRALS currently articulates around 8 international programs. Participating countries to the meta-program currently are: Albania, Algeria, Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Egypt, France, Germany, Greece, Ireland, Israel, Italy, Jordan, Lebanon, Malta, Monaco, Morocco, Netherlands, Norway, Portugal, the Palestinian Authority, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, the United Kingdom, Canada, New Zealand, the USA.

Chapter IX

Education and Public Awareness

A. PUBLIC OPINION

A.1 The French public's strong awareness of climate change

The level of awareness of the French population on climate change has continued to increase, in line with the levels observed in 2008 and 2013[73]. According to recent polls conducted in 2015 and 2016[74], 77% of French people say they are personally worried about climate change and 25% consider it to be the most important environmental problem, ahead of air pollution (19%), fauna and flora degradation (14%) and water pollution (13%). These surveys also measured how vulnerable the French population feels to the risks of climate change, with a marked concentration among the populations in overseas territories. Those who live in the French overseas territories state that they have already suffered the consequences of climate change much more frequently than their mainland compatriots: 47% compared to 27%. Conscious of their vulnerability, 71% of them also estimate that, if global warming continues, living conditions will become extremely difficult in the next fifty years, compared to 55% of people from mainland France. Those living in the overseas territories are also more optimistic, with 52% compared to

[73] See chapter 9 of France's 6th National Communication to the United Nations Framework Convention on Climate Change.
[74] See the polls "COP21: French opinions on climate change", Ipsos and Havas Worldwide, February 2015; "The environment and the 2017 presidential elections", Ifop and WWF, November 2016; and issue 52 of the publication "The Strategy Letter", French Environment and Energy Management Agency, March 2017.

43% in mainland France believing that global warming will be limited to acceptable levels by the end of the century.

A.2 An awareness that always depends on national and international current affairs

Following the same trend of the polls reported in France's 6th National Communication to the United Nations Framework Convention on Climate Change, the more recent results confirm the existence of a strong relationship between the awareness of the French, current affairs and international climate negotiations.

Unsurprisingly, this aforementioned high level of awareness was stimulated by two major events in 2015: the organisation of COP21, the most important international conference ever organised in France and which resulted in the Paris Climate Agreement, and debates on the Energy Transition for Green Growth Act. These two major events mobilised the media and public opinion in France for several months, which explains record levels of awareness.

This high level of awareness was reflected in the expectations of the French regarding candidates for the 2017 presidential elections. At the end of 2016, 73% of the French wanted the elected candidate to respect the commitments made in the framework of COP21; 83% wanted the new government to implement the entire Energy Transition for Green Growth Act.

Regarding future measures that could be adopted by the government, 53% of the French want more stringent legislation on diesel cars in the name of public health

A.3 The development of renewable energies, a high priority for the French

It has become essential, in the current context, to measure the French people's degree of awareness of the importance of the fight against climate change through their opinion on renewable energies. At the end of 2016, 77% of French people wanted the government to treat the development of renewable energies as a priority.

The French are in favour (94%) and even very much in favour (52%) of the development of renewable energies[75]. Seventy-three per cent of the French estimate that they could produce, within the next twenty years, the vast majority of energy needed for housing and office buildings, and 68% of the energy needed for transport. As regards technologies, it is above all solar energy (34%) that the French want to see develop, followed by ocean energy (25%), wind energy (13%), geothermal energy (13%), biomass energy (7%) and hydraulic energy (6%). The advantages of developing renewable energies mentioned by the French are above all environmental (they contribute to reducing air, soil and water pollution and help in the fight against climate change, in addition to being renewable sources which will always be available).

Certified projects

With the aim of demonstrating its support for projects supported by civil society and in keeping with the dynamics of COP21, France has created the "COP21 Label" certificate, which was set up in 2014. Through collaboration with the General Secretariat of COP21 and the General Commissariat for Sustainable Development of the Ministry for Ecological and Solidarity Transition, 600 projects have been certified and promoted on the COP21 website.

[75] Survey "The French and the environment", conducted by OpinionWay and Daniel Boy for ADEME, 2016.

B. EDUCATION AND TRAINING

B.1 L'éducation au développement durable irrigue désormais toutes les étapes de l'enseignement : à l'école, au collège, au lycée et dans l'enseignement supérieur

In France, education and training on the issues of climate change are implemented through a general awareness of the issues of sustainable development. This strategy brings together a variety of complementary actions ranging from raising awareness among all audiences to **higher education courses** or training.

French national education and higher education are an essential lever for implementing the energy and ecological transition of society as a whole, within a global approach to sustainable development. In French schools, environmental and sustainable development education has been on the syllabus since 2004. In **primary school**, science, humanist culture and geography programmes have included the notions of sustainable development since 2008. In **middle school**, notions of climate and energy have been incorporated since 2009. This framework evolved in 2013 with the Orientation and Programming Act for the Reformation of the Schools of the French Republic (Law No. 2013-595 of 8 July 2013).

From the time of this law, environmental and sustainable development education became one of the missions of school education and a part of the national education code:

"Faced with the environmental challenges of the 21st century, it is essential to provide students with environmental education throughout their school curriculum. This education must, on the one hand, aim to develop pupils' reflection on major environmental issues such as air quality, climate change, resource and energy management and the preservation of biodiversity. It must also, on the other hand, raise awareness of environmentally responsible behaviours and expertise that will preserve our planet by changing the way we live and consume. This education, of a multidisciplinary nature, must not be restricted to traditional lecture-based teaching and may include hands-on experiences." [76]

B.2 A circular to roll out this new mission for schools

In 2015, at the time of COP21, the **Ministry of National Education, Higher Education and Research** wanted to stimulate a new dynamic to make sustainable development education widespread throughout **primary schools and educational institutions** and take the lead with an exemplary policy in this area. A circular[77] on the rolling out of sustainable development education across all schools and educational institutions for 2015-2018 was published in February 2015, detailing the new school missions provided for in the aforementioned law. France's goal from this new circular is to integrate **education on sustainable development into all school and educational institution programmes by 2020**.

B.3 Training tailored to energy transition, both in higher education and other areas of training

Notable progress has also been made in **higher education** and **training**. In order for France to have competent professionals to ensure its energy transition, several training programmes have been introduced in several key sectors for the green economy (building, energy, agriculture, land use planning). The Energy Transition for Green Growth Act (Law No. 2015-992 of 17 August 2015) places vocational and higher education training at the heart of the policy on energy transition and combating climate change.

[76] Law No. 2013-595 of 8 July 2013 of the Orientation and Programming Act for the Reformation of the Schools of the French Republic, appendix.
[77] Instruction on the rolling out of sustainable development education into all school and educational institutions for 2015-2018, circular No. 2015-018 of 4 February 2015.

C. INFORMATION CAMPAIGNS

The information campaigns organised by France between 2014 and 2017 on the importance of the fight against climate change were, directly or indirectly, motivated by the organisation of COP21 and the adoption of the Paris Agreement. These two events were major and essential elements among actions to raise public awareness.

C.1 COP21, an exceptional opportunity to communicate on climate issues

COP21, the largest international conference ever held in France, mobilised the media for several months, before and after the conference, helping to keep the French population's attention focused on the challenges of climate change. Several communication tools were developed to highlight the issues and objectives of COP21, which has become a showcase for the fight against climate change in France and around the world.

One of the priorities for the teams in charge of reporting on the COP21 was to design a website that could serve as an interface between the preparation of the conference and the public. Intended to be international and for all audiences, including delegates who would attend the conference, the official COP21 website was launched in January 2015 in three languages (French, English and Spanish) and became the main internet portal in France for the popularisation of climate change issues, in addition to providing practical information about the conference.

In addition to the official website of the Paris conference, a communication kit was developed to bring the whole of France together for COP21 and to share its challenges with the greatest number of people. The aim was to help raise awareness of everything that would be decided at COP21 in order to best support the reception of those who came from all over the world to take part in the conference. From the beginning of 2015, a communication kit composed of many tools, such as a video in three languages, posters, a webzine dedicated to demystifying climate issues, and infographics, was made available to the public. This communication kit also helped to boost the presence of COP21 in social networks, accumulating tens of thousands of subscribers.

The positioning of journalists, who were the main information providers to the public, was also a priority in organising COP21. With the intention of raising awareness of the challenges of the fight against climate change and the objectives of COP21 among information professionals, several tools and explanatory factsheets have been written for them since 2014. In addition to the usual press conferences, which proliferated to meet the growing expectations of the media, press training workshops were offered to the editorial offices of the leading media outlets, in particular audiovisual media, to reach all teams and not just journalists in charge of environmental issues.

C.2 The general public, an active participant in COP21

During COP21, France wanted to create a dedicated space where civil society could participate in activities. To meet this ambition, it was decided to build the "Generation Climate" spaces: a 27,000m^2 area of for the use of civil society, adjacent to the official COP21 negotiation area. This venue, whose scope was unprecedented in the Conferences of the Parties to the Climate Convention, allowed French and international civil society to fully participate during COP21. These spaces proved to have a momentum all of their own, receiving nearly 90,000 visitors for more than 500 events - conferences and exhibitions - organised by 340 French and international civil society organisations between 1 -11 December 2015.

C.3 Using cinema for the climate

Two cultural projects that contributed to public awareness of climate issues and COP21 were organised as part of COP21.

- **Film Festival** - Organised by the General Secretariat of COP21 with the support of the International Environmental Film Festival (FIFE), a temporary film festival was held in the "Generation Climate" spaces from 1 to 12 December 2015. It allowed 70 films to be screened often followed by debates.
- **Film competition set up by the Institut Français *"24 heures pour le climat"*** (24 hours for the climate) - On the theme of climate and the city, the Institut Français' cultural network abroad swung into action, from Madagascar to Canada, from Thailand to Norway, from Peru to Switzerland. All across the world, these different artistic performances were the subject of one-minute short films, projected on the screens in the "Climate Generation" spaces.

C.4 Public participation

Public participation in developing national mitigation and adaptation policies has always been a major concern for France given the complexity and societal challenges of these topics. This topic was also the subject of a public and stakeholder consultation conducted by the Ministry of the Environment in November 2015, which brought together more than 200 representatives of several sectors of French society to establish a Charter for public participation. The purpose of this charter[78] is to foster the implementation of best practice for participation, particularly on climate and sustainable development projects and policies.

C.4.1 Systematic consultations

Following the Grenelle laws, it was decided to organise an annual Environmental Conference in France, which would make it possible to take stock of the progress of public action with regard to the environment, and to define a new work programme for sustainable development. Every year, these conferences bring together environmental dialogue partners (ministers, representatives of non-governmental organisations, trade unions, employers' organisations, local authorities and politicians). The 2014 Conference was focused on energy transition and preparation for COP21, and it helped launch projects to make France a nation of environmental excellence. The 2016 conference reported on the concrete progress made in favour of ecological and energy transition.

C.4.2 Youth delegates: youth representatives in the climate negotiation team, and the future vectors of public participation in France

In order to increase the transparency of the climate negotiation process within the United Nations Framework Convention on Climate Change, France set up the "Youth Delegates for the Climate" programme in 2009. Every year since COP15, young people have been included in the French interministerial team for climate negotiations to give French youth a voice in climate negotiations. The Youth Delegates take part in the sessions of subsidiary bodies and the Conference of the Parties to the UNFCCC, and their role is to contribute to the work of the French delegation and follow climate negotiations, with particular attention to issues related to youth participation in these forums. The experience and knowledge gained during these negotiations are then shared by the Youth Delegates in conferences and debates with other young French people to inform them and raise their awareness of the challenges of the fight against climate change.

[78] The Charter for Public Participation is available at:http://www.ecologique-solidaire.gouv.fr/sites/default/files/Charte_participation_public.pdf

C.5 Access to information: transparency through public participation and open access to data

France's action in the field of public participation and access to information on climate change received fresh impetus in April 2014 when France joined the Open Government Partnership, which today brings together 75 countries and hundreds of civil society organisations around the world for the transparency of public action, for its co-construction with citizens and for democratic innovation. As a member of the Open Government Partnership, France must develop a National Action Plan every two years, in an open and participatory manner.

In its first Action Plan, rolled out between 2015 and 2017, France gave a major place to sustainable development and the fight against climate change, with three commitments in this area: involving civil society in the COP21 conference and promoting transparency on the agenda and negotiations, providing data and models related to climate and sustainable development and engaging in new collaborations with civil society to develop innovative solutions to meet the challenges related to the climate and sustainable development. These three commitments were presented in a roadmap with eight concrete actions:

- 1-To bring together civil society representatives before each informal negotiation meeting;
- 2-To create a participatory platform to mobilise civil society in preparation for COP21;
- 3-To continue consultation on climate issues to respond to the global citizen debate[79];
- 4-To open and make available in open format models and simulators relating to climate, energy transition and sustainable development on the platform www.data.gouv.fr;
- 5-To publish data from impact studies carried out by the Ministry of the Environment;
- 6-To launch and organise the first steps of Operation C3[80] throughout 2015;
- 7-To reward the winners of Operation C3 at COP21;
- 8-To continue the C3 initiative in 2016 and 2017.

France has undertaken a mid-term participatory self-assessment exercise on the implementation of these commitments in 2016. By that time, six actions had already been fully completed while two others were in an advanced state of implementation. In 2017, a new National Action Plan within the framework of the Open Government Partnership was under preparation and tackling climate change was one of the priorities.

D. COOPERATION

D.1 Regional cooperation

Local authorities, who hold power in matters of town planning, territorial planning and energy, play an important role in the fight against global warming through the implementation of territorial energy and climate plans. A regional network of key ministries and public institutions is therefore supporting these communities in their efforts. Many publications, forums, conferences, guides and training are available to

[79] The global citizen debate "World Wide Views on Climate and Energy" was organised on 6 June 2015: 97 debates were organised in 76 countries. In each country, 100 citizens participated in a day of information and discussion. The results are available on the event's official website (http://climateandenergy.wwviews.org). The debate in France was organised by the National Commission of Public Debates (https://www.debatpublic.fr/debat-citoyen-planetaire-world-wide-views-climat-lenergie).

[80] The *Climate Change Challenge* (C3) is an initiative set up in 2015 by the Ministry of the Environment to promote innovation on mitigation and adaptation through collaborative workshops in Paris, Lyon, Nantes and Toulouse. The projects developed were part of a competition whose winners were presented at COP21.

them. As regards adaptation, the French National Observatory on the Effects of Global Warming (ONERC) has developed tools for communities to help them adapt to the impacts: indicators, future climate simulations and documentation to help communities better understand the impacts of climate change and to plan adaptation actions.

All of these activities are also being supported by planning associations: the AMF (Association of French Mayors), AMGVF (Association of Mayors of Major Cities of France), the ARF (Association of French Regions) have included the theme of climate change in their mission of regional cooperation.

D.2 International cooperation: French-speaking countries are the main beneficiaries

Governments must also cooperate with each other to promote the preparation, exchange and use of materials and programmes designed to meet the objectives of education, training and public awareness. In the name of the French-speaking world, France takes on an important role in implementing this obligation and also supports the work carried out by the Francophone Institute for Sustainable Development, in particular the drafting and editing of guides and explanatory notes on climate negotiations[81]. A large number of French language publications on climate change written by France are widely distributed within the international Francophone community. Finally, France, via its network of embassies, organises press workshops on the climate in several countries. Journalists from around the world are also invited to France to meet French climate experts.

[81] http://www.ifdd.francophonie.org/ressources/ressources-pub.php?id=13

Appendices

Annexe 1 - Contributions à la septième communication nationale de la France au titre de la CCNUCC

Ce document a été élaboré par le Département de lutte contre l'effet de serre de la Direction générale de l'énergie et du climat avec les contributions suivantes :

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Appendix 2 - The greenhouse gas inventory, CRF format and SECTEN format

a) CO_2

Format KP

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993
	(kt)				
1. Energy	364477,13	364477,13	389513,51	381165,24	361094,85
A. Fuel combustion (sectoral approach)	360147,53	360147,53	385079,88	376727,63	356853,57
1. Energy industries	66060,75	66060,75	67536,31	68657,62	56548,84
2. Manufacturing industries and construction	81384,07	81384,07	87937,95	79185,69	74133,38
3. Transport	118705,41	118705,41	121335,95	125835,20	125820,22
4. Other sectors	93997,30	93997,30	108269,67	103049,12	100351,13
5. Other	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	4329,60	4329,60	4433,64	4437,61	4241,28
1. Solid fuels	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
2. Oil and natural gas and other emissions from ene	4329,60	4329,60	4433,64	4437,61	4241,28
C. CO_2 transport and storage	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE
2. Industrial processes	31099,92	31099,92	30619,46	28606,52	27714,00
A. Mineral industry	16403,85	16403,85	15692,31	14240,74	13361,92
B. Chemical industry	7363,42	7363,42	7588,43	7527,00	7389,22
C. Metal industry	4732,87	4732,87	4798,59	4381,72	4540,98
D. Non-energy products from fuels and solvent use	2599,74	2599,74	2540,09	2457,04	2421,86
E. Electronic industry					
F. Product uses as ODS substitutes					
G. Other product manufacture and use	NA	NA	NA	NA	NA
H. Other	0,03	0,03	0,03	0,03	0,03
3. Agriculture	1765,49	1765,49	1765,79	1605,31	1756,37
A. Enteric fermentation					
B. Manure management					
C. Rice cultivation					
D. Agricultural soils					
E. Prescribed burning of savannas					
F. Field burning of agricultural residues					
G. Liming	915,32	915,32	891,07	757,66	902,28
H. Urea application	850,17	850,17	874,72	847,65	854,09
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry [2]	-29807,12	-29807,12	-28806,69	-26264,55	-31841,71
A. Forest land	-39418,23	-39418,23	-38310,04	-37568,84	-44297,38
B. Cropland	21023,03	21023,03	20974,67	21040,75	21129,72
C. Grassland	-14107,90	-14107,90	-14368,42	-14584,21	-14752,86
D. Wetlands	385,93	385,93	365,51	344,65	323,35
E. Settlements	9124,08	9124,08	9059,27	9009,80	8979,44
F. Other land	0,16	0,16	0,16	0,16	0,16
G. Harvested wood products	-6814,20	-6814,20	-6527,85	-4506,87	-3224,14
H. Other	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
5. Waste	2208,58	2208,58	2208,20	2249,24	2235,59
A. Solid waste disposal	NA	NA	NA	NA	NA
B. Biological treatment of solid waste					
C. Incineration and open burning of waste	2208,58	2208,58	2208,20	2249,24	2235,59
D. Waste water treatment and discharge					
E. Other	NO	NO	NO	NO	NO
6. Other ***(as specified in summary 1.A)***	NO	NO	NO	NO	NO
Memo items:					
International bunkers	16750,85	16750,85	16818,90	17975,17	18049,51
Aviation	8608,81	8608,81	8383,12	9815,58	10135,16
Navigation	8142,04	8142,04	8435,78	8159,59	7914,36
Multilateral operations	1,30	1,30	1,73	1,51	1,51
CO_2 emissions from biomass	43880,86	43880,86	50599,21	49601,28	48432,65
CO_2 captured	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
Long-term storage of C in waste disposal sites					
Indirect N_2O					
Indirect CO_2 [3]	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
Total CO_2 equivalent emissions without land use, land-use	399551,11	399551,11	424106,96	413626,31	392800,81
Total CO_2 equivalent emissions with land use, land-use cha	369743,99	369743,99	395300,27	387361,76	360959,10
Total CO_2 equivalent emissions, including indirect CO2, w	NA	NA	NA	NA	NA
Total CO_2 equivalent emissions, including indirect CO2, w	NA	NA	NA	NA	NA

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
																						%
358366,62	363770,61	378870,93	371621,62	391977,85	383710,31	381608,32	383192,44	379569,22	386614,61	387932,49	391452,01	380451,94	370848,46	365795,16	351526,82	359164,74	333757,01	335701,35	334981,31	304431,38	310205,22	-14,89
353855,93	359375,76	374300,31	367099,48	387538,67	379579,12	377326,81	378946,98	375571,03	382654,41	383940,64	387454,18	376145,94	366231,27	360894,18	346913,15	354958,37	329783,85	332315,98	331861,48	301391,46	307245,10	-14,69
52981,25	55709,10	60777,40	56766,06	69316,02	62682,55	61778,30	55029,85	58893,71	62258,18	61675,31	66819,99	62671,52	62306,93	60988,58	59244,71	59777,59	51481,13	52768,49	52388,73	39767,14	41799,00	-36,73
79126,90	78470,58	78452,40	79413,33	81613,76	78185,02	78710,47	71299,41	72197,18	73483,70	71775,32	72550,44	72754,15	70804,01	67246,05	57601,39	61366,91	58276,64	55630,62	53700,61	51062,73	50034,93	-38,52
126841,54	128557,71	130035,74	132331,60	134419,72	137578,91	137182,49	139936,00	140879,71	140369,83	140940,70	138866,40	138254,47	136864,38	130526,56	129161,37	132056,30	132067,72	130520,92	129717,57	129674,11	130731,02	10,13
94906,24	96638,37	105034,77	98588,48	102189,16	101132,64	99655,55	112681,72	103600,43	106542,71	109549,31	109217,35	102465,80	96255,96	102132,99	100905,68	101757,58	87958,37	93395,96	96054,56	80887,49	84680,15	-9,91
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4510,69	4394,85	4570,62	4522,14	4439,18	4131,19	4281,51	4245,46	3998,19	3960,20	3991,85	3997,83	4305,99	4617,18	4900,99	4613,67	4206,37	3973,16	3385,36	3119,84	3039,92	2960,12	-31,63
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
4510,69	4394,85	4570,62	4522,14	4439,18	4131,19	4281,51	4245,46	3998,19	3960,20	3991,85	3997,83	4305,99	4617,18	4900,99	4613,67	4206,37	3973,16	3385,36	3119,84	3039,92	2960,12	-31,63
NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0,00
29443,92	29883,10	28763,70	29118,56	29884,89	29201,75	29444,19	28775,23	28675,81	28534,47	29618,17	29402,28	28525,82	28855,81	27167,60	23327,88	25392,84	24969,10	23068,71	23403,56	23447,50	22851,09	-26,52
13896,88	13751,14	13414,99	13206,45	13899,36	13476,84	13752,11	13459,45	13539,55	13483,03	14065,61	13855,03	14130,33	14201,57	13347,24	11335,29	12015,30	12272,56	11499,53	11581,96	10947,35	10624,61	-35,23
7929,42	7695,08	8142,35	8297,32	8334,86	8241,97	8371,92	8400,01	7780,95	7581,23	7897,55	8060,60	7465,37	7771,11	7306,68	6447,35	6385,78	6354,44	6275,45	6186,69	6614,79	6534,42	-11,26
5215,55	6005,92	4784,45	5217,67	5102,68	5007,03	4793,57	4443,62	5070,93	5282,76	5527,62	5259,04	4864,07	4790,49	4651,32	3878,73	5248,43	4561,57	3644,93	3983,82	4153,90	4024,03	-14,98
2402,05	2430,92	2421,89	2397,09	2547,95	2475,88	2526,56	2472,11	2284,35	2187,42	2127,36	2227,58	2066,02	2092,61	1862,33	1666,49	1743,30	1780,50	1648,77	1651,07	1731,43	1667,98	-35,84
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,05	54,32
1739,46	1843,88	1793,37	1977,37	1969,75	1955,51	1819,07	1800,19	1798,93	1862,75	1827,41	1801,63	1747,85	1765,84	1774,40	1868,46	1812,13	1860,84	1978,86	1882,15	1960,28	2005,60	13,60

919,50	1048,78	994,62	1170,85	1117,15	1081,34	955,34	928,97	950,70	987,29	960,86	913,99	859,65	843,88	832,97	919,67	802,45	885,61	971,09	903,34	904,16	862,72	-5,75
819,95	795,10	798,76	806,52	852,60	874,17	863,73	871,22	848,22	875,46	866,55	887,64	888,20	921,95	941,43	948,80	1009,69	975,22	1007,77	978,80	1056,12	1142,88	34,43
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
-32314,33	-34790,49	-37749,09	-38003,36	-41594,03	-43075,17	-27035,04	-38146,31	-45888,68	-50371,19	-51239,02	-52582,86	-54612,78	-54415,79	-53754,47	-47976,75	-42749,74	-39211,21	-47993,03	-48243,77	-43063,31	-39087,21	31,13
-45823,05	-46528,38	-50619,67	-50511,72	-52988,62	-56892,41	-35322,74	-48001,17	-56742,14	-60788,56	-62466,70	-65166,07	-68659,31	-69980,62	-71318,93	-66517,49	-57375,20	-51938,96	-61787,06	-62202,26	-57304,96	-54130,06	37,32
21056,19	20571,19	20856,82	20448,04	20440,50	20356,67	19078,42	18948,42	17934,81	17049,89	16496,06	16273,04	16378,26	16791,75	18088,72	17404,42	17021,18	16311,57	16177,32	15813,69	15748,45	16016,41	-23,81
-14452,36	-15287,54	-14783,95	-14614,02	-14725,49	-13348,67	-14606,53	-13701,91	-13014,17	-12258,09	-10928,67	-10041,82	-9327,84	-8671,18	-9492,72	-9778,70	-10424,35	-11523,90	-11309,82	-11144,80	-10885,98	-10747,84	-23,82
379,00	232,50	435,03	404,19	259,05	352,76	252,26	390,74	222,98	179,09	349,62	522,51	695,55	847,47	393,64	468,57	355,37	498,66	498,56	498,47	498,38	498,29	29,12
9446,68	9254,03	9033,84	9652,26	9449,90	10695,09	9096,88	9442,86	9797,60	9358,08	9825,78	10401,70	11070,07	11639,23	12576,99	12328,93	11545,78	11345,01	11267,86	11167,33	11004,29	10944,00	19,95
0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,00
-3954,95	-4249,88	-3733,10	-4308,31	-4837,15	-4943,13	-6147,80	-5761,18	-4555,18	-4319,28	-4870,68	-4882,35	-5040,02	-5278,38	-4207,96	-2061,99	-4029,08	-4040,17	-2959,03	-2480,13	-2214,15	-1747,11	-74,36
1034,00	1217,43	1061,77	926,02	807,62	704,36	614,31	535,77	467,27	407,52	355,42	309,98	270,34	235,78	205,63	179,34	156,41	136,41	118,97	103,76	90,49	78,93	100,00
2287,14	2237,59	2109,73	1905,86	1772,14	1651,50	1718,60	1655,02	1628,92	1632,68	1503,97	1564,79	1626,62	1502,71	1556,84	1531,33	1614,03	1653,83	1543,49	1558,14	1821,62	1525,99	-30,91
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
2287,14	2237,59	2109,73	1905,86	1772,14	1651,50	1718,60	1655,02	1628,92	1632,68	1503,97	1564,79	1626,62	1502,71	1556,84	1531,33	1614,03	1653,83	1543,49	1558,14	1821,62	1525,99	-30,91
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
17601,21	17919,62	18928,37	19969,73	21726,45	23148,52	23990,41	22492,36	22308,32	23083,40	25182,86	24512,41	25721,52	26708,32	25635,55	24158,01	24024,64	25242,14	24432,00	23644,38	22704,52	22948,65	37,00
10537,09	10639,28	11294,83	11614,25	12535,87	13861,24	14373,60	14330,50	14400,39	14531,85	15497,21	15672,22	16538,67	17294,79	17407,89	15945,84	16040,17	16680,76	16334,66	16252,56	16390,65	17308,42	101,05
7064,11	7280,34	7633,55	8355,48	9190,58	9287,28	9616,81	8161,86	7907,93	8551,55	9685,65	8840,18	9182,84	9413,53	8227,66	8212,17	7984,47	8561,38	8097,34	7391,81	6313,87	5640,23	-30,73
1,73	2,16	2,38	2,59	2,38	2,16	2,59	1,73	2,59	0,86	0,65	1,08	1,08	1,30	1,30	1,58	1,35	1,13	1,35	0,90	0,90	1,35	4,17
44255,27	45076,71	48402,49	44948,10	45053,38	43712,50	42461,34	43792,89	42171,57	45087,82	45836,25	46482,19	46350,72	47926,00	53295,19	55368,00	59615,06	54311,69	56657,14	60828,68	55962,81	58381,78	33,05
NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
391837,14	397735,18	411537,74	404623,41	425604,63	416519,07	414590,18	415422,88	411672,88	418644,51	420882,04	424220,70	412352,22	402972,81	396294,01	378254,50	387983,75	362240,78	362292,41	361825,17	331660,79	336587,89	-15,76
359522,81	362944,69	373788,66	366620,05	384010,60	373443,91	387555,14	377276,57	365784,20	368273,32	369643,02	371637,84	357739,44	348557,02	342539,54	330277,75	345234,01	323029,57	314299,38	313581,39	288597,48	297500,68	-19,54
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

b) CH_4

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
												(kt)																%
1. Energy	503,75	503,75	533,06	516,51	512,26	467,71	485,30	444,88	391,32	382,99	360,61	306,10	292,44	250,17	246,84	222,41	198,16	177,96	161,41	156,30	150,12	156,28	155,05	135,38	136,13	115,86	116,41	-76,89
A. Fuel combustion (sec	240,31	240,31	203,46	261,05	250,03	222,46	224,25	233,68	203,65	196,77	183,33	165,35	160,71	142,04	141,98	136,93	126,05	109,93	102,55	97,50	91,48	94,64	76,67	76,30	81,49	66,75	68,36	-71,55
1. Energy indus	2,65	2,65	2,56	2,39	2,12	1,89	1,83	1,80	1,64	1,67	1,42	1,26	1,23	1,22	1,27	1,35	1,40	1,39	1,43	1,22	1,35	1,39	1,30	1,14	1,12	0,93	1,14	-57,11
2. Manufacturing	9,52	9,52	9,66	8,90	8,44	9,32	8,95	8,41	8,98	9,17	8,73	8,70	8,02	8,49	7,66	9,26	7,83	6,43	8,70	7,46	5,56	6,72	6,86	5,47	4,78	4,42	4,26	-55,28
3. Transport	39,74	39,74	39,36	39,35	37,31	34,61	31,78	29,86	28,25	27,02	25,98	24,29	23,00	21,46	19,72	18,59	17,14	15,28	13,93	12,07	10,86	10,02	8,82	8,07	7,58	6,94	6,59	-83,43
4. Other sectors	188,39	188,39	231,88	210,40	202,16	176,65	181,68	193,61	164,77	160,92	147,20	131,09	128,45	110,57	113,33	107,73	99,69	86,83	78,50	76,75	73,71	76,71	59,69	63,62	68,01	54,45	56,37	-70,08
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
B. Fugitive emissions fr	263,44	263,44	249,60	255,46	260,23	268,25	260,06	211,20	187,68	184,22	177,28	140,75	131,73	108,13	104,85	85,48	72,10	68,03	58,86	59,80	58,64	61,45	50,38	57,09	54,64	49,11	48,05	-81,76
1. Solid fuels	192,41	192,41	178,60	186,45	194,62	198,86	197,10	150,00	127,77	124,06	117,84	83,06	72,86	48,71	46,53	27,44	15,57	10,19	2,18	2,02	2,10	2,10	1,29	0,64	0,79	0,55	0,60	-99,69
2. Oil and natura	71,03	71,03	71,00	69,01	67,61	69,39	63,96	61,20	59,91	60,17	59,44	59,70	58,79	59,42	58,32	58,04	56,53	57,83	56,69	56,78	56,55	59,35	57,10	56,45	53,85	48,56	47,45	-33,20
C. CO_2 transport and st																												
2. Industrial processes	3,41	3,41	3,75	4,04	3,75	3,92	4,05	4,19	4,46	4,17	4,27	4,34	4,48	4,23	4,69	4,95	3,99	3,78	3,54	3,09	2,73	3,25	2,22	1,85	1,86	2,17	1,99	-41,67
A. Mineral industry																												
B. Chemical industry	3,23	3,23	3,57	3,87	3,59	3,75	3,89	4,03	4,29	4,01	4,12	4,19	4,34	4,10	4,57	4,83	3,88	3,64	3,44	3,02	2,69	3,20	2,17	1,80	1,82	2,12	1,94	-39,94
C. Metal industry	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,08	0,08	0,08	0,09	0,08	0,08	0,08	0,08	0,08	0,10	0,07	0,06	0,05	0,04	0,04	0,04	0,04	0,04	0,04	-33,57
D. Non-energy products from fuels and solvent use	0,12	0,12	0,12	0,12	0,11	0,11	0,10	0,09	0,08	0,08	0,07	0,06	0,06	0,05	0,05	0,04	0,03	0,03	0,03	0,02	0,02	0,02	0,01	0,01	0,01	0,01	0,01	-92,47
E. Electronic industry																												
F. Product uses as ODS substitutes																												
G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
3. Agriculture	1728,83	1728,83	1700,88	1681,29	1670,50	1677,24	1690,15	1692,56	1679,42	1673,43	1668,95	1733,06	1736,19	1706,93	1671,52	1633,71	1634,90	1652,25	1658,35	1673,17	1657,95	1634,84	1638,80	1604,31	1575,97	1642,29	1637,19	-5,30
A. Enteric fermentation	1504,53	1504,53	1478,99	1458,81	1446,68	1452,06	1460,65	1458,01	1442,59	1433,89	1433,20	1483,91	1489,11	1448,57	1405,61	1387,42	1384,13	1387,29	1397,22	1414,31	1398,99	1392,20	1388,90	1355,90	1338,11	1377,38	1382,21	-8,06
B. Manure management	215,67	215,67	212,96	213,09	214,02	215,01	219,77	225,29	227,96	230,85	240,41	245,46	243,94	250,23	258,71	240,27	243,69	258,60	255,25	252,90	252,19	235,99	283,33	242,00	231,90	259,77	248,77	15,35
C. Rice cultivation	5,88	5,88	6,08	6,63	7,04	7,38	6,99	6,55	6,07	5,67	5,38	5,72	5,58	5,25	5,08	5,84	5,20	4,49	4,27	3,99	4,75	4,69	4,62	4,42	4,09	3,33	3,25	-44,60
D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
E. Prescribed burning o	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Field burning of agric	2,78	2,78	2,85	2,86	2,76	2,80	2,74	2,91	2,89	3,02	2,96	2,97	2,56	2,58	2,11	2,18	1,89	1,86	1,81	1,97	2,02	1,96	1,95	1,99	1,87	1,91	1,96	-29,46
G. Liming																												
H. Urea application																												
I. Other carbon-containi																												
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00

4. Land use, land-use chan	37,89	37,89	41,20	42,29	39,98	136,93	146,54	118,28	98,86	83,04	72,42	66,62	58,68	55,24	51,83	48,30	47,95	46,02	45,83	44,88	46,52	47,27	45,76	43,10	41,53	42,89	44,41	17,22
A. Forest land	25,04	25,04	27,79	28,62	26,81	26,42	26,88	25,91	26,61	25,91	24,48	28,60	25,22	25,71	25,40	22,64	22,80	21,16	21,21	20,94	23,37	25,00	24,75	22,50	20,87	22,47	23,69	-5,39
B. Cropland	5,08	5,08	5,34	5,49	5,30	5,01	4,70	5,04	4,84	4,72	4,83	4,18	4,43	4,14	4,10	4,34	4,48	4,58	4,62	4,95	4,86	5,01	4,63	4,51	4,58	4,50	4,66	-8,29
C. Grassland	5,48	5,48	5,83	6,03	5,77	5,62	4,95	5,45	5,38	4,99	5,36	4,37	4,64	4,71	4,62	5,19	5,58	5,90	6,13	5,57	5,47	5,18	4,50	4,34	4,43	4,33	4,54	-17,26
D. Wetlands	0,29	0,29	0,28	0,27	0,26	0,29	0,21	0,32	0,30	0,22	0,28	0,22	0,29	0,21	0,18	0,27	0,37	0,46	0,54	0,30	0,35	0,29	0,37	0,37	0,37	0,37	0,37	26,31
E. Settlements	2,00	2,00	1,95	1,89	1,84	2,01	1,89	1,76	2,07	1,97	2,58	1,77	1,94	2,13	1,92	2,20	2,46	2,67	2,81	3,11	2,84	2,42	2,34	2,34	2,34	2,34	2,34	16,87
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
G. Harvested wood pro																												
H. Other	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	97,59	107,90	79,81	59,67	45,23	34,89	27,47	22,15	18,35	15,61	13,64	12,25	11,25	10,53	10,01	9,64	9,37	9,18	9,05	8,95	8,88	8,83	100,00
5. Waste	549,77	549,77	578,33	609,62	641,32	662,67	682,32	698,70	715,37	739,94	754,00	766,05	776,40	783,35	785,11	779,78	769,75	760,01	751,77	741,88	718,08	718,20	697,96	671,09	651,42	632,95	600,62	9,25
A. Solid waste disposal	485,77	485,77	511,36	539,65	568,37	586,60	603,12	616,53	630,44	651,79	664,35	675,30	684,71	692,48	695,05	690,51	679,74	669,38	660,59	650,19	625,29	624,46	603,39	575,95	555,70	535,62	502,13	3,37
B. Biological treatment	1,84	1,84	1,91	1,99	2,06	2,28	2,50	2,61	2,42	2,66	3,45	3,77	3,91	4,03	4,19	4,37	4,49	4,58	4,68	4,79	5,54	6,37	6,79	7,23	8,00	8,76	9,69	427,50
C. Incineration and ope	0,81	0,81	0,82	0,84	0,85	0,86	0,87	0,88	0,90	0,91	0,92	0,93	0,95	0,96	0,97	0,99	1,00	1,01	1,02	1,03	1,04	1,06	1,07	1,08	1,09	1,10	1,12	37,20
D. Waste-water treatme	61,36	61,36	64,23	67,14	70,04	72,93	75,83	78,68	81,62	84,58	85,28	86,05	86,84	85,88	84,89	83,91	84,52	85,03	85,48	85,87	86,20	86,32	86,71	86,82	86,63	87,46	87,68	42,91
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in su*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total CH_4 emissions without CH_4 from LULUCF	2785,79	2785,79	2816,02	2811,55	2827,83	2831,54	2861,83	2840,32	2790,57	2800,53	2800,83	2814,55	2809,51	2744,69	2708,16	2642,84	2606,80	2593,99	2575,27	2574,44	2528,88	2512,57	2474,03	2412,64	2365,38	2393,37	2356,21	-15,42
Total CH_4 emissions with CH_4 from LULUCF	2823,68	2823,68	2857,22	2853,85	2867,81	2968,47	3008,37	2958,60	2889,43	2883,57	2873,25	2881,17	2868,19	2799,93	2759,99	2691,14	2654,75	2640,00	2621,10	2619,32	2575,41	2559,85	2519,80	2455,74	2406,91	2436,25	2400,62	-14,98
Memo items:																												
International bunkers	0,94	0,94	0,93	0,90	0,85	0,77	0,78	0,81	0,87	0,94	0,95	0,93	0,83	0,80	0,86	0,96	0,88	0,92	0,94	0,83	0,82	0,80	0,86	0,82	0,75	0,65	0,59	-37,13
Aviation	0,21	0,21	0,17	0,16	0,14	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,10	0,09	0,08	0,09	0,09	0,09	0,09	0,09	0,08	0,08	0,09	0,09	0,08	0,08	0,08	-59,66
Navigation	0,73	0,73	0,76	0,74	0,71	0,64	0,66	0,69	0,75	0,83	0,84	0,87	0,74	0,71	0,77	0,87	0,80	0,83	0,85	0,74	0,74	0,72	0,77	0,73	0,67	0,57	0,51	-30,71
Multilateral operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
CO_2 emissions from bioma																												
CO_2 captured																												
Long-term storage of C in																												
Indirect N_2O																												
Indirect CO_2 [3]																												

TABLE 10 EMISSION TRENDS
N_2O
(Sheet 4 of 6)

Inventory 2015
Submission 2017 v1
FRANCE (KP)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
														(kt)														%
1. Energy	10,89	10,89	11,33	11,24	11,35	11,44	12,46	13,84	14,40	15,52	12,38	12,10	12,49	12,89	13,18	13,35	13,08	12,93	12,58	12,53	11,83	12,06	11,90	12,15	12,90	12,33	12,57	15,43
A. Fuel combustion (sectoral approach)	10,80	10,80	11,24	11,15	11,26	11,35	12,37	13,75	14,30	15,42	12,28	12,00	12,39	12,80	13,09	13,25	12,94	12,79	12,40	12,38	11,67	11,93	11,84	12,09	12,85	12,28	12,52	15,93
1. Energy industries	1,07	1,07	1,10	1,13	1,06	0,87	0,87	1,04	1,06	1,21	1,06	1,11	1,02	1,01	1,14	1,14	1,16	1,16	1,11	1,08	1,08	1,11	1,00	1,05	1,00	0,81	0,87	-18,29
2. Manufacturing industries and construction	1,64	1,64	1,72	1,60	1,58	1,37	1,50	1,51	1,42	2,04	1,81	1,64	1,89	2,37	2,32	2,19	2,05	2,02	1,81	1,68	1,43	1,35	1,35	1,27	1,30	1,25	1,22	-25,38
3. Transport	3,21	3,21	3,23	3,37	3,66	4,35	5,17	6,24	7,08	7,41	4,74	4,65	4,78	4,84	4,87	4,94	4,80	4,77	4,81	4,72	4,19	4,41	4,58	4,84	5,07	5,24	5,39	68,12
4. Other sectors	4,89	4,89	5,19	5,05	4,96	4,76	4,83	4,96	4,75	4,75	4,67	4,60	4,71	4,58	4,76	4,98	4,94	4,84	4,67	4,89	4,97	5,06	4,90	4,93	5,48	4,98	5,03	3,00
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
B. Fugitive emissions from fuels	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,10	0,09	0,10	0,10	0,10	0,10	0,10	0,14	0,14	0,18	0,15	0,16	0,13	0,07	0,05	0,05	0,05	0,05	-44,67
1. Solid fuels	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
2. Oil and natural gas and other emissions from energy production	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,10	0,09	0,10	0,10	0,10	0,10	0,10	0,14	0,14	0,18	0,15	0,16	0,13	0,07	0,05	0,05	0,05	0,05	-44,67
C. CO_2 transport and storage																												
2. Industrial processes	79,78	79,78	80,53	82,06	82,07	84,25	86,99	88,62	86,65	62,47	44,92	39,98	39,98	32,22	31,74	22,47	22,65	20,27	18,86	15,54	13,15	7,64	4,62	3,40	3,33	3,95	4,30	-94,60
A. Mineral industry																												
B. Chemical industry	79,36	79,36	80,11	81,64	81,65	83,83	86,56	88,19	86,23	62,04	44,49	39,55	39,55	31,78	31,31	22,03	22,21	19,83	18,42	15,10	12,71	7,20	4,17	2,95	2,88	3,49	3,85	-95,15
C. Metal industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
D. Non-energy products from fuels and solvent use	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	-7,61
E. Electronic industry																												
F. Product uses as ODS substitutes																												
G. Other product manufacture and use	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,42	0,42	0,42	0,42	0,42	0,43	0,43	0,43	0,43	0,43	0,43	0,44	0,44	0,44	0,44	0,44	0,44	0,44	9,03
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
3. Agriculture	127,91	127,91	128,65	126,20	123,12	121,20	122,37	125,30	127,20	128,33	128,94	128,94	127,26	125,43	119,75	123,29	120,56	119,37	121,83	122,10	120,25	117,78	115,88	117,36	115,94	120,27	118,92	-7,03
A. Enteric fermentation																												
B. Manure management	7,88	7,88	7,77	7,68	7,64	7,67	7,63	7,55	7,42	7,31	7,20	7,31	7,18	7,00	6,77	6,61	6,51	6,44	6,42	6,43	6,35	6,33	6,22	6,17	6,17	6,22	6,24	-20,85
C. Rice cultivation																												
D. Agricultural soils	119,96	119,96	120,81	118,45	115,41	113,46	114,67	117,68	119,71	120,94	121,66	121,55	120,01	118,36	112,93	116,63	114,00	112,89	115,36	115,61	113,85	111,40	109,60	111,14	109,73	114,00	112,63	-6,11
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Field burning of agricultural residues	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,07	0,08	0,08	0,08	0,07	0,07	0,05	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	-29,48
G. Liming																												
H. Urea application																												
I. Other carbon containing fertlizers																												
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry	7,99	7,99	7,93	8,05	8,03	7,95	7,89	7,88	7,89	7,81	7,64	7,67	7,41	7,37	7,26	7,01	7,02	6,98	7,06	7,27	7,42	7,46	7,40	7,23	7,09	7,15	7,27	-8,98
A. Forest land	1,36	1,36	1,22	1,26	1,19	1,16	1,18	1,14	1,17	1,13	1,06	1,23	1,07	1,13	1,13	0,98	0,99	0,91	0,91	0,90	0,99	1,06	1,07	0,98	0,91	0,97	1,04	-23,56
B. Cropland	6,39	6,39	6,45	6,51	6,58	6,55	6,49	6,50	6,48	6,46	6,36	6,24	6,14	6,05	5,94	5,83	5,82	5,87	5,94	6,17	6,22	6,18	6,13	6,06	5,97	5,98	6,02	-5,81
C. Grassland	0,22	0,22	0,25	0,26	0,25	0,23	0,21	0,23	0,22	0,21	0,21	0,19	0,19	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,20	-11,81
D. Wetlands	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	26,31
E. Settlements	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	9,69
F. Other land	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
G. Harvested wood products																												
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
5. Waste	3,03	3,03	3,10	3,07	3,06	3,09	3,16	3,14	3,03	3,04	3,10	3,15	3,10	3,00	2,91	2,82	2,78	2,82	2,64	2,61	2,66	2,77	2,60	2,64	2,63	2,73	2,80	-7,54
A. Solid waste disposal																												
B. Biological treatment of solid waste	0,30	0,30	0,30	0,31	0,32	0,35	0,39	0,39	0,34	0,38	0,49	0,51	0,54	0,56	0,60	0,62	0,65	0,70	0,70	0,71	0,78	0,88	0,91	0,95	1,00	1,05	1,11	276,30
C. Incineration and open burning of waste	0,31	0,31	0,31	0,31	0,31	0,32	0,31	0,31	0,29	0,29	0,29	0,30	0,29	0,29	0,30	0,29	0,30	0,31	0,27	0,24	0,22	0,20	0,20	0,19	0,12	0,15	0,16	-49,26
D. Waste water treatment and discharge	2,42	2,42	2,49	2,45	2,44	2,42	2,46	2,44	2,40	2,37	2,31	2,33	2,27	2,14	2,01	1,91	1,83	1,81	1,67	1,66	1,66	1,70	1,49	1,49	1,51	1,53	1,53	-36,78
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other ***(as specified in summary 1.A)***	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total direct N_2O emissions without N_2O from LULUCF	221,61	221,61	223,61	222,57	219,61	219,99	224,97	230,91	231,29	209,35	189,34	184,18	182,84	173,53	167,58	161,93	159,07	155,38	155,91	152,78	147,89	140,25	135,00	135,54	134,80	139,28	138,59	-37,46
Total direct N_2O emissions with N_2O from LULUCF	229,59	229,59	231,54	230,62	227,64	227,94	232,87	238,79	239,17	217,16	196,98	191,85	190,25	180,91	174,84	168,94	166,10	162,37	162,97	160,05	155,31	147,71	142,40	142,77	141,89	146,43	145,86	-36,47
Memo items:																												
International bunkers	0,49	0,49	0,49	0,53	0,53	0,52	0,53	0,56	0,59	0,64	0,69	0,71	0,68	0,67	0,69	0,75	0,74	0,77	0,80	0,78	0,73	0,73	0,76	0,74	0,72	0,70	0,71	44,38
Aviation	0,28	0,28	0,27	0,32	0,33	0,34	0,35	0,37	0,38	0,41	0,45	0,47	0,47	0,47	0,47	0,50	0,51	0,54	0,56	0,57	0,52	0,52	0,54	0,53	0,53	0,53	0,56	100,59
Navigation	0,21	0,21	0,22	0,21	0,20	0,18	0,19	0,20	0,22	0,24	0,24	0,25	0,21	0,20	0,22	0,25	0,23	0,24	0,24	0,21	0,21	0,21	0,22	0,21	0,19	0,16	0,15	-30,71
Multilateral operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
CO_2 emissions from biomass																												
CO_2 captured																												
Long-term storage of C in waste disposal sites																												
Indirect N_2O	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
Indirect CO_2 [3]																												

Note: All footnotes for this table are given at the end of the table on sheet 6.

d) Fluorinated gas

Format KP

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1991	1992	1993
Emissions of HFCs and PFCs - (kt CO_2	9604,67	9946,92	9336,12	7780,45
Emissions of HFCs - (kt CO_2 equivalent)	4402,20	5124,38	4417,81	2936,38
HFC-23	0,14	0,18	0,17	0,18
HFC-32	NO,NA	NO,NA	NO,NA	NO,NA
HFC-41	NO,NA	NO,NA	NO,NA	NO,NA
HFC-43-10mee	NO,NA	NO,NA	NO,NA	NO,NA
HFC-125	0,01	0,01	0,01	0,02
HFC-134	NO,NA	NO,NA	NO,NA	NO,NA
HFC-134a	NO,IE,NA	NO,IE,NA	0,01	0,08
HFC-143	NO,NA	NO,NA	NO,NA	NO,NA
HFC-143a	0,51	0,53	0,40	0,02
HFC-152	NO,NA	NO,NA	NO,NA	NO,NA
HFC-152a	NO,NA	NO,NA	NO,NA	NO,NA
HFC-161	NO,NA	NO,NA	NO,NA	NO,NA
HFC-227ea	NO,NA	NO,NA	NO,NA	NO,NA
HFC-236cb	NO,NA	NO,NA	NO,NA	NO,NA
HFC-236ea	NO,NA	NO,NA	NO,NA	NO,NA
HFC-236fa	NO,NA	NO,NA	NO,NA	NO,NA
HFC-245ca	NO,NA	NO,NA	NO,NA	NO,NA
HFC-245fa	NO,NA	NO,NA	NO,NA	NO,NA
HFC-365mfc	NO,NA	NO,NA	NO,NA	NO,NA
Unspecified mix of	NO,NA	NO,NA	NO,NA	7,79
Emissions of PFCs - (kt CO_2 equivalent)	5202,47	4822,54	4918,32	4844,06
CF_4	0,39	0,35	0,36	0,32
C_2F_6	0,16	0,15	0,16	0,18
C_3F_8	0,00	0,00	0,00	0,00
C_4F_{10}	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
c-C_4F_8	0,01	0,02	0,01	0,01
C_5F_{12}	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
C_6F_{14}	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
$C_{10}F_{18}$	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
c-C_3F_6	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
Unspecified mix of PFCs(4) (kt CO_2 equivalent)	241,29	241,83	242,35	270,08
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO,NA	NO,NA	NO,NA	NO,NA
Emissions of SF_6 - (kt CO_2 equivalent)	2221,77	2297,48	2349,23	2401,59
SF_6	0,10	0,10	0,10	0,11
Emissions of NF_3 - (kt CO_2 equivalent)	16,48	18,13	19,94	21,94
NF_3	0,00	0,00	0,00	0,00

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
																						%
6280,65	4962,43	6048,01	6961,95	7691,69	9596,77	9627,53	10730,59	13539,30	14591,22	14751,42	15168,26	15889,00	16497,59	16985,89	16904,37	18027,23	19382,71	19801,64	19874,32	20047,27	19864,57	106,82
1955,17	1897,87	3251,76	4065,97	4299,98	5378,36	6630,04	8077,62	9365,13	10740,37	12112,56	13407,94	14426,61	15318,16	16208,14	16345,56	17409,86	18608,67	19011,30	19203,82	19443,44	19324,39	338,97
0,08	0,02	0,03	0,03	0,02	0,04	0,03	0,03	0,03	0,02	0,03	0,04	0,04	0,03	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	-93,44
0,00	0,00	0,01	0,01	0,01	0,01	0,02	0,03	0,04	0,07	0,10	0,12	0,17	0,21	0,24	0,28	0,31	0,35	0,39	0,42	0,47	0,52	100,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
0,05	0,07	0,07	0,10	0,12	0,18	0,23	0,35	0,44	0,57	0,67	0,76	0,87	0,96	1,03	1,15	1,31	1,45	1,52	1,59	1,63	1,64	19026,21
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
0,25	0,72	1,43	1,85	2,00	2,24	2,70	3,01	3,40	3,86	4,19	4,51	4,68	4,95	5,11	4,81	4,93	5,08	5,02	4,96	5,03	5,06	100,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
0,05	0,06	0,09	0,11	0,14	0,20	0,30	0,42	0,49	0,58	0,67	0,75	0,80	0,86	0,93	1,01	1,09	1,17	1,20	1,21	1,21	1,17	129,65
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,19	0,26	0,31	0,32	0,30	0,33	0,37	0,35	0,35	0,37	0,37	0,28	0,25	0,21	100,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	0,00	0,01	0,01	0,01	0,01	0,02	0,02	0,03	0,03	0,04	0,04	0,05	0,06	0,06	0,06	0,07	0,07	0,08	0,08	0,08	0,08	100,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,04	0,04	0,06	100,00
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00	0,00	0,00	0,01	0,02	0,03	0,04	0,06	0,07	0,08	0,10	0,11	0,11	0,14	0,15	100,00
21,11	36,10	61,73	62,32	34,61	30,48	39,66	83,10	106,78	99,92	109,45	140,40	123,43	214,10	235,99	191,47	158,61	275,90	346,99	306,75	229,20	181,33	100,00
4325,49	3064,56	2796,25	2895,97	3391,71	4218,40	2997,49	2652,97	4174,16	3850,86	2638,86	1760,33	1462,40	1179,43	777,75	558,81	617,37	774,04	790,35	670,50	603,83	540,18	-89,62
0,28	0,24	0,22	0,22	0,28	0,37	0,24	0,20	0,35	0,34	0,22	0,13	0,10	0,08	0,04	0,02	0,02	0,03	0,02	0,02	0,01	0,01	-97,11
0,16	0,07	0,07	0,08	0,09	0,10	0,08	0,07	0,10	0,09	0,06	0,04	0,03	0,03	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	-97,01
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00	NO,IE,NA	NO,IE,NA	NO,IE,NA	
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-99,51
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	0,00
222,03	335,32	264,34	159,22	176,64	181,77	151,32	188,26	207,11	224,92	253,25	318,21	287,27	295,44	329,12	338,40	380,92	477,10	529,74	490,91	441,54	397,03	64,55
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
2562,89	2598,61	2639,52	2633,68	2764,19	2485,68	2379,77	1933,43	1602,90	1585,09	1616,31	1360,01	1256,29	1153,07	1148,36	963,42	889,10	660,15	668,05	596,93	489,72	521,91	-76,51
0,11	0,11	0,12	0,12	0,12	0,11	0,10	0,08	0,07	0,07	0,07	0,06	0,06	0,05	0,05	0,04	0,04	0,03	0,03	0,03	0,02	0,02	-76,51
24,13	6,26	11,46	17,18	21,16	28,41	19,89	28,45	35,54	30,47	35,54	31,27	29,76	42,11	46,35	24,96	32,13	31,36	20,40	10,63	10,63	10,63	-35,50
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-35,50

e) Résumé

Format KP

GREENHOUSE GAS EMISSIONS	Base year(1)	1990	1991	1992	1993
	CO_2 equivalent (kt)				
CO_2 emissions without net CO_2 from LULUCF	399551,11	399551,11	424106,96	413626,31	392800,81
CO_2 emissions with net CO_2 from LULUCF	369743,99	369743,99	395300,27	387361,76	360959,10
CH_4 emissions without CH_4 from LULUCF	69644,76	69644,76	70400,52	70288,87	70695,78
CH_4 emissions with C	70591,96	70591,96	71430,47	71346,25	71695,21
N_2O emissions witho	66038,45	66038,45	66636,88	66326,19	65442,85
N_2O emissions with N	68419,25	68419,25	68998,71	68724,98	67835,25
HFCs	4402,20	4402,20	5124,38	4417,81	2936,38
PFCs	5202,47	5202,47	4822,54	4918,32	4844,06
Unspecified mix of H	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
SF_6	2218,42	2218,42	2294,10	2345,82	2398,16
NF_3	16,48	16,48	18,13	19,94	21,94
Total (without LULUCF)	547073,89	547073,89	573403,52	561943,26	539139,98
Total (with LULUCF)	520594,77	520594,77	547988,60	539134,88	510690,10
Total (without LULUCF, with indirect)	NA	NA	NA	NA	NA
Total (with LULUCF, with indirect)	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK	Base year(1)	1990	1991	1992	1993
	CO_2 equivalent (kt)				
1. Energy	380315,69	380315,69	406215,38	397428,12	377283,83
2. Industrial process	66798,27	66798,27	66970,59	64863,00	62465,55
3. Agriculture	83104,55	83104,55	82627,07	81248,10	80209,40
4. Land use, land-us	-26479,12	-26479,12	-25414,91	-22808,38	-28449,89
5. Waste	16855,38	16855,38	17590,47	18404,04	19181,20
6. Other	NO	NO	NO	NO	NO
Total (including LULUCF)(5)	520594,77	520594,77	547988,60	539134,88	510690,10

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
																						(%)
391837,14	397735,18	411537,74	404623,41	425604,63	416519,07	414590,18	415422,88	411672,88	418644,51	420882,04	424220,70	412352,22	402972,81	396294,01	378254,50	387983,75	362240,78	362292,41	361825,17	331660,79	336587,89	-15,76
359522,81	362944,69	373788,66	366620,05	384010,60	373443,91	387555,14	377276,57	365784,20	368273,32	369643,02	371637,84	357739,44	348557,02	342539,54	330277,75	345234,01	323029,57	314299,38	313581,39	288597,48	297500,68	-19,54
70788,53	71545,72	71008,07	69764,23	70013,31	70020,87	70363,73	70237,81	68617,15	67704,09	66071,12	65169,95	64849,68	64381,85	64361,02	63222,04	62814,35	61850,85	60315,93	59134,46	59834,15	58905,16	-15,42
74211,80	75209,19	73965,06	72235,84	72089,27	71831,25	72029,34	71704,73	69998,27	68999,86	67278,57	66368,63	66000,06	65527,53	65482,98	64385,15	63996,19	62994,90	61393,55	60172,73	60906,36	60015,52	-14,98
65556,12	67042,19	68810,53	68923,32	62387,14	56421,97	54885,82	54485,57	51712,72	49939,77	48255,15	47403,73	46304,41	46461,26	45528,87	44071,25	41793,87	40230,53	40391,13	40171,48	41504,53	41300,15	-37,46
67925,31	69394,65	71159,58	71273,30	64714,56	58698,65	57171,24	56694,11	53909,84	52102,90	50344,09	49496,76	48385,56	48564,11	47694,39	46281,30	44016,27	42436,50	42545,76	42283,63	43635,23	43467,25	-36,47
1954,00	1890,62	3238,13	4051,78	4284,72	5361,55	6611,84	8056,38	9340,82	10708,14	12075,12	13365,15	14381,47	15264,90	16152,94	16294,95	17355,64	18551,98	18955,69	19146,83	19384,60	19263,86	337,60
4325,49	3064,56	2796,25	2895,97	3391,71	4218,40	2997,49	2652,97	4174,16	3850,86	2638,86	1760,33	1462,40	1179,43	777,75	558,81	617,37	774,04	790,35	670,50	603,83	540,18	-89,62
NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0,00
2559,43	2595,11	2636,12	2630,37	2761,12	2482,95	2377,39	1931,26	1600,80	1583,05	1614,33	1358,10	1254,42	1151,25	1146,53	961,64	887,55	658,82	666,74	595,70	488,61	520,70	-76,53
24,13	6,26	11,46	17,18	21,16	28,41	19,89	28,45	35,54	30,47	35,54	31,27	29,76	42,11	46,35	24,96	32,13	31,36	20,40	10,63	10,63	10,63	-35,50
537044,83	543879,65	560038,30	552906,26	568463,80	555053,22	551846,24	552815,32	547154,07	552460,89	551572,16	553309,23	540634,36	531453,60	524307,46	503388,15	511484,66	484338,36	483432,65	481554,76	453487,14	457128,58	-16,44
510522,95	515105,09	527595,25	519724,49	531273,14	516065,13	528762,33	518344,47	504843,64	505548,60	503629,53	504018,09	489253,10	480286,35	473840,48	458784,56	472139,16	448477,17	438671,86	436461,40	413626,74	421318,82	-19,07
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
																						(%)
373968,70	379614,94	394118,52	385694,43	406176,79	396414,20	392868,08	394226,48	389665,54	396713,98	397470,78	400303,90	388754,16	378632,55	373436,52	358805,14	366664,61	340680,65	342705,24	342228,93	311002,39	316860,83	-16,68
63511,99	63463,69	63958,18	64648,37	59062,85	54786,28	53473,66	53471,55	53533,02	54282,81	52800,71	52765,99	51787,77	52203,20	49999,26	45156,51	46643,38	46417,22	44561,83	44865,23	45165,03	44518,95	-33,35
79788,30	80563,37	81448,09	81869,48	82048,18	82428,47	83696,04	83127,12	81849,54	79336,78	79460,75	78601,81	78626,58	79534,12	79988,68	79150,97	77780,83	77362,01	77059,12	75832,11	78860,91	78372,94	-5,69
-26521,88	-28774,56	-32443,05	-33181,77	-37190,65	-38988,10	-23084,01	-34470,85	-42310,43	-46912,29	-47942,64	-49291,14	-51381,26	-51167,25	-50466,98	-44603,59	-39345,49	-35861,19	-44760,79	-45093,36	-39860,40	-35809,76	35,24
19775,85	20237,64	20513,51	20693,97	21175,97	21424,28	21808,56	21990,17	22105,96	22127,31	21839,92	21637,52	21465,85	21083,73	20883,00	20275,54	20395,83	19878,49	19106,46	18628,49	18458,81	17375,86	3,09
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
510522,95	515105,09	527595,25	519724,49	531273,14	516065,13	528762,33	518344,47	504843,64	505548,60	503629,53	504018,09	489253,10	480286,35	473840,48	458784,56	472139,16	448477,17	438671,86	436461,40	413626,74	421318,82	-19,07

f) Format Secten

Emissions de GES directs au format "Plan Climat" en France (périmètre Kyoto) (2)

Source CITEPA/ inventaire CCNUCC décembre 2016

Secteurs	Cat. CRF	*GES directs* - Emissions en Mt CO_2e (1)																								
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Transports		121,2	123,8	128,4	128,4	129,6	131,6	133,4	136,1	138,5	141,0	140,9	144,0	145,2	145,0	145,8	143,9	143,3	142,2	135,8	134,1	137,0	137,1	135,5	134,7	134,6	135,6
Aérien (3)	1A3a	4,4	4,4	4,4	4,4	4,6	5,1	5,6	5,7	5,8	6,0	6,1	5,7	5,6	5,1	5,1	5,1	4,8	4,6	4,7	4,6	4,6	4,8	4,9	4,8	4,6	4,6
Routier	1A3b, 2D(p)	114,5	117,0	121,6	121,7	122,6	124,0	125,2	127,6	129,6	131,6	131,1	134,3	135,2	135,0	135,4	133,3	133,0	131,9	125,5	124,0	127,0	126,9	125,3	124,7	125,0	126,1
Fer	1A3c	1,1	1,0	1,0	0,9	0,9	0,8	0,8	0,8	0,7	0,8	0,8	0,7	0,8	0,7	0,7	0,6	0,6	0,6	0,6	0,5	0,5	0,5	0,5	0,5	0,4	0,4
Maritime (3)	1A3d	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,2	1,3	1,2	1,2	1,3	1,3	1,3	1,3	1,2	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
Autre	1A3e	0,2	0,3	0,3	0,2	0,4	0,4	0,5	0,4	0,4	0,5	0,5	0,5	0,6	0,7	0,9	0,9	0,8	0,7	0,7	0,6	0,6	0,5	0,5	0,5	0,5	0,4
Consommation de gaz fluorés	2F (p)	0,0	0,0	0,0	0,0	0,1	0,2	0,3	0,4	0,6	0,9	1,2	1,5	1,9	2,2	2,5	2,8	2,8	3,1	3,2	3,0	3,0	3,0	3,0	2,9	2,8	2,7
Résidentiel Tertiaire Institutionnel et commercial		88,8	104,0	98,1	95,0	89,3	91,5	101,0	94,2	97,7	96,5	95,2	108,6	99,7	103,6	106,5	106,9	100,8	95,2	101,5	100,5	102,4	88,7	95,0	97,6	82,7	86,5
Résidentiel	1A4b, 2D (p), 5C (p)	59,6	71,0	65,5	63,9	61,1	61,0	65,3	61,0	63,7	62,8	61,5	71,5	66,6	67,5	67,8	68,2	63,2	58,6	62,9	61,3	63,7	51,9	58,3	59,4	46,7	50,2
Tertiaire	1A4a, 2G (p)	29,0	32,9	32,5	30,9	27,8	29,7	34,0	31,1	31,8	31,3	30,4	33,1	28,6	30,9	32,8	32,1	30,3	28,8	30,2	30,6	29,3	26,7	26,2	27,6	25,0	25,5
Consommation de gaz fluorés	2F (p), 2G (p)	0,1	0,1	0,1	0,2	0,4	0,9	1,7	2,1	2,2	2,5	3,3	3,9	4,5	5,3	6,0	6,6	7,2	7,8	8,4	8,6	9,5	10,2	10,4	10,7	11,0	10,9
Solvants et produits divers	2D (p), 2G (p)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Industrie manufacturière		147,5	154,3	143,4	135,9	141,6	140,4	139,9	141,0	137,4	129,1	127,2	118,9	119,1	120,0	115,8	115,6	114,1	111,6	105,2	90,6	95,0	91,0	86,3	84,5	81,9	80,4
Combustion industrie manufac. et construc.	1A2	82,1	88,7	79,9	74,8	79,8	79,1	79,1	80,1	82,5	78,9	79,4	72,1	73,1	74,4	72,7	73,4	73,5	71,6	67,9	58,2	61,9	58,9	56,1	54,2	51,5	50,5
Procédés industrie chimique	2B (p), 2D (p)	31,3	31,8	32,1	32,1	33,2	33,8	34,8	34,3	27,2	21,8	20,5	20,5	17,5	17,1	14,7	14,9	13,5	13,4	11,9	10,3	8,6	7,7	7,2	7,1	7,8	7,7
Procédés produits minéraux	2A, 2D (p)	16,4	15,7	14,2	13,4	13,9	13,8	13,4	13,2	13,9	13,5	13,8	13,5	13,5	13,5	14,1	13,9	14,1	14,2	13,3	11,3	12,0	12,3	11,5	11,6	10,9	10,6
Procédés production de métaux	2C	9,1	8,7	8,6	8,3	8,6	9,0	7,5	8,1	8,7	9,2	7,7	6,5	8,4	8,2	7,5	6,4	5,8	5,6	5,0	4,1	5,5	4,7	3,9	4,2	4,3	4,1
Solvants et produits divers	2D (p), 2G (p)	1,6	1,5	1,5	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,3	1,2	1,2	1,2	1,1	1,0	0,9	0,8	0,8	0,9	0,8	0,8	0,8	0,7
Production de gaz fluorés	2B (p)	5,7	6,4	5,6	4,3	2,9	1,1	1,2	1,3	1,0	1,4	1,2	1,3	1,2	1,3	1,3	1,2	1,1	0,7	0,7	0,3	0,2	0,1	0,1	0,1	0,2	0,2
Autres productions	2H, 2D (p)	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,5
Consommation de gaz fluorés	2E, 2F (p), 2G (p)	1,1	1,2	1,3	1,4	1,6	1,9	2,3	2,4	2,5	2,7	3,0	3,4	3,8	4,0	4,2	4,3	4,5	4,7	5,0	5,1	5,4	6,1	6,2	6,1	6,0	6,0
Industrie de l'énergie		77,9	79,1	80,4	68,3	65,0	67,5	71,5	66,8	79,3	72,1	70,4	63,4	66,4	69,6	68,6	73,4	69,5	69,2	68,1	66,1	66,2	57,5	58,2	57,5	44,5	46,5
Production d'électricité et chauffage urbain (4)	1A1a	49,7	50,8	51,8	39,9	36,0	38,6	43,2	38,5	51,1	44,9	44,2	37,6	42,3	45,7	44,8	50,1	45,8	45,6	44,6	43,8	45,9	38,0	41,5	41,5	28,8	31,4
Raffinage	1A1b	12,0	12,3	12,3	12,6	13,0	13,2	13,7	14,4	14,2	13,7	13,6	13,6	13,0	13,0	13,3	13,3	13,4	13,3	13,1	12,4	10,9	10,6	8,6	8,1	7,9	7,6
Transformation de CMS et autres	1A1c	4,8	4,9	4,9	4,5	4,3	4,3	4,3	4,2	4,4	4,4	4,3	4,1	3,9	4,0	4,0	3,8	3,8	3,8	3,7	3,4	3,3	3,3	3,0	3,1	3,3	3,1
Emissions fugitives des combustibles	1B	10,9	10,7	10,9	10,8	11,2	10,9	9,9	9,2	9,1	8,6	7,8	7,6	6,7	6,6	6,2	5,8	6,0	6,1	6,4	6,1	5,8	5,5	4,8	4,5	4,3	4,2
Consommation de gaz fluorés	2F (p), 2G (p)	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,3	0,3	0,3	0,2	0,2	0,2
Agriculture/ sylviculture		94,8	94,6	93,3	92,5	91,8	92,7	93,7	94,1	94,4	94,9	96,3	96,1	94,7	92,1	93,0	91,8	91,5	92,1	92,8	91,9	90,5	90,2	89,4	88,7	91,3	90,7
Consommation d'énergie	1A4c	11,7	12,0	12,0	12,3	12,0	12,2	12,2	12,2	12,4	12,4	12,6	12,9	12,8	12,7	13,5	13,1	12,8	12,5	12,6	12,6	12,5	12,6	12,1	12,6	12,2	12,1
Sols agricoles	3D, 3G, 3H	37,5	37,8	36,9	36,1	35,6	36,0	36,9	37,7	38,0	38,2	38,0	37,6	37,1	35,5	36,6	35,8	35,4	36,1	36,2	35,8	35,0	34,5	35,1	34,6	35,9	35,6
Fermentation entérique	3A	37,6	37,0	36,5	36,2	36,3	36,5	36,5	36,1	35,8	35,8	37,1	37,1	36,2	35,1	34,7	34,6	34,7	34,9	35,4	35,0	34,8	34,2	33,9	34,0	34,4	34,6
Déjections animales	3B	7,7	7,6	7,6	7,6	7,7	7,8	7,9	7,9	8,0	8,2	8,3	8,2	8,3	8,5	8,0	8,0	8,4	8,3	8,2	8,2	7,8	8,4	7,9	7,1	8,3	8,1
Culture du riz	3C	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Brulage de résidus de récolte	3F	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Consommation de gaz fluorés	2F (p)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Traitement des déchets		16,8	17,6	18,4	19,2	19,8	20,2	20,5	20,7	21,2	21,4	21,8	22,0	22,1	22,1	21,8	21,6	21,4	21,1	20,9	20,3	20,4	19,9	19,1	18,6	18,4	17,3
Mise en décharge	5A	12,1	12,8	13,5	14,2	14,7	15,1	15,4	15,8	16,3	16,6	16,9	17,1	17,3	17,4	17,3	17,0	16,7	16,5	16,3	15,6	15,6	15,1	14,4	13,9	13,4	12,6
Incinération (5)	5C, 2D	2,3	2,3	2,3	2,3	2,4	2,3	2,2	2,0	1,9	1,7	1,8	1,7	1,7	1,7	1,6	1,7	1,7	1,6	1,6	1,6	1,7	1,7	1,6	1,6	1,9	1,6
Eaux usées	5D	2,3	2,3	2,4	2,5	2,5	2,6	2,7	2,8	2,8	2,8	2,8	2,8	2,8	2,7	2,7	2,7	2,7	2,6	2,6	2,6	2,7	2,6	2,6	2,6	2,6	2,6
Autres	5B	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,5	0,5	0,5	0,6
Total hors UTCATF		**547,1**	**573,4**	**561,9**	**539,1**	**537,0**	**543,9**	**560,0**	**552,9**	**568,5**	**555,1**	**551,8**	**552,8**	**547,2**	**552,5**	**551,6**	**553,3**	**540,6**	**531,5**	**524,3**	**503,4**	**511,5**	**484,3**	**483,4**	**481,6**	**453,5**	**457,1**
UTCATF	4	-26,5	-25,4	-22,8	-28,4	-26,5	-28,8	-32,4	-33,2	-37,2	-39,0	-23,1	-34,5	-42,3	-46,9	-47,9	-49,3	-51,4	-51,2	-50,5	-44,6	-39,3	-35,9	-44,8	-45,1	-39,9	-35,8
Total		**520,6**	**548,0**	**539,1**	**510,7**	**510,5**	**515,1**	**527,6**	**519,7**	**531,3**	**516,1**	**528,8**	**518,3**	**504,8**	**505,5**	**503,6**	**504,0**	**489,3**	**480,3**	**473,8**	**458,8**	**472,1**	**448,5**	**438,7**	**436,5**	**413,6**	**421,3**

(1) d'après CCNUCC décembre 2016 (www.citepa.org)
(2) Métropole + Outre-mer faisant partie de l'UE
(3) trafic domestique uniquement
(p) partiel (catégorie CRF répartie entre plusieurs secteurs)
(4) y compris incinération des déchets avec récupération d'énergie
(5) hors incinération des déchets avec récupération d'énergie
(6) inventaire pré-estimé sur la base d'indicateurs et premières données disponibles
UTCATF : Utilisation des terres, changement d'affectation des terres et foresterie

Appendix 3 - Key sources evaluation and associated analysis without LULUCF

Supplementary elements required under Article 7.2. of the Kyoto Protocol

Information reported under article 7.2	7th National Communication paragraphs
National System – article 5.1	III.C
Elements relative to the mechanisms designated under articles 6, 12, 17	III. D
Adverse effects of policies and measures	IV.D.2
Regional and national plans	IV.A.1
Information – article 10	VII

Informations required by Article 11 of the Kyoto Protocol

Financial ressources on aid to public development required under article 11 of the Kyoto Protocol are presented in paragraph VII.A. Other financial resources under article 11 of the Kyoto Protocol are presented in §VII.B.

EVALUATION DES SOURCES CLES- Tier 1 - ANALYSE DES NIVEAUX D'EMISSIONS HORS UTCATF (*) - Périmètre

source CITEPA / format CCNUCC - janvier 2017 — s_cle_hors_UTCATF.xls/s_cle_niv

rang	CRF	Classement Source / Combustible	Gaz à effet de serre direct	CO_2 équivalent (Gg) 1990	CO_2 équivalent (Gg) 2015	contribution (%) 2015	cumul (%) 2015
1	1A3b	Road Transportation	CO2	112 120	124 065	27.1%	27.1%
2	3A	Enteric Fermentation	CH4	37 613	34 580	7.6%	34.7%
3	1A4b	Residential / gas	CO2	20 087	32 337	7.1%	41.8%
4	3Da	Direct N2O emissions from managed soils	N2O	29 048	27 319	6.0%	47.8%
5	2F1	Refrigeration and Air Conditioning	HFC	0	16 564	3.6%	51.4%
6	1A4b	Residential / oil	CO2	31 003	15 582	3.4%	54.8%
7	1A1a	Public Electricity and Heat Production / coal	CO2	37 572	14 160	3.1%	57.9%
8	1A4a	Commercial/Institutional / oil	CO2	19 380	13 506	3.0%	60.8%
9	5A	Solid Waste Disposal	CH4	12 144	12 553	2.7%	63.6%
10	1A4a	Commercial/Institutional / gas	CO2	8 619	11 423	2.5%	66.1%
11	1A2a	Iron and Steel / coal	CO2	18 998	10 978	2.4%	68.5%
12	1A4c	Agriculture/Forestry/Fishing / oil	CO2	10 435	10 380	2.3%	70.8%
13	1A1a	Public Electricity and Heat Production / gas	CO2	977	7 089	1.6%	72.3%
14	1A2g	Manufacturing Industries / Other	CO2	12 337	6 609	1.4%	73.8%
15	2A1	Cement Production	CO2	10 937	6 606	1.4%	75.2%
16	3Db	Indirect N2O Emissions from managed soils	N2O	6 700	6 245	1.4%	76.6%
17	3B	Manure Management	CH4	5 392	6 219	1.4%	77.9%
18	1A2e	Food Processing, Beverages and Tobacco / gas	CO2	3 629	5 876	1.3%	79.2%
19	1A1a	Public Electricity and Heat Production / other fossil fuels	CO2	2 558	5 781	1.3%	80.5%
20	1A1b	Petroleum Refining / oil	CO2	11 413	5 662	1.2%	81.7%
21	2B10	Chemical Industry / Other	CO2	4 399	4 820	1.1%	82.8%
22	1A2c	Chemicals / gas	CO2	6 631	4 777	1.0%	83.8%
23	1A3a	Domestic Aviation	CO2	4 306	4 550	1.0%	84.8%
24	1A1a	Public Electricity and Heat Production / oil	CO2	8 269	4 097	0.9%	85.7%
25	1A2f	Non-metallic minerals / gas	CO2	4 037	3 764	0.8%	86.5%
26	1A2c	Chemicals / oil	CO2	6 506	3 260	0.7%	87.2%
27	1A1c	Manufacture of Solid Fuels and Other Energy Industries / coa	CO2	4 065	3 067	0.7%	87.9%
28	1A2f	Non-metallic minerals / oil	CO2	7 214	3 024	0.7%	88.6%
29	1B2a	Fugitive Emissions from Fuels / Oil	CO2	2 951	2 519	0.6%	89.1%
30	1A2d	Pulp, Paper and Print / gas	CO2	2 313	2 354	0.5%	89.6%
31	2C1	Iron and Steel Production	CO2	2 918	2 311	0.5%	90.1%
32	2A2	Lime Production	CO2	2 743	2 253	0.5%	90.6%
33	5D	Wastewater treatment and discharge	CH4	1 534	2 192	0.5%	91.1%
34	1A2f	Non-metallic minerals / coal	CO2	4 184	1 949	0.4%	91.5%
35	2F4	Aerosols	HFC	0	1 937	0.4%	92.0%
36	3B	Manure Management	N2O	2 348	1 859	0.4%	92.4%
37	1A2a	Iron and Steel / gas	CO2	2 071	1 739	0.4%	92.8%
38	1A2c	Chemicals / coal	CO2	1 763	1 701	0.4%	93.1%
39	1A1b	Petroleum Refining / gas	CO2	36	1 655	0.4%	93.5%
40	1A3b	Road Transportation	N2O	893	1 544	0.3%	93.8%
41	5C	Incineration and open burning of waste	CO2	2 209	1 526	0.3%	94.2%
42	2D3	Non-energy products from fuels and solvent use / Other	CO2	1 988	1 296	0.3%	94.4%
43	1A3d	Domestic navigation	CO2	998	1 293	0.3%	94.7%
44	2A4	Mineral industry / Other process uses of carbonates	CO2	1 927	1 267	0.3%	95.0%
	…	…	…	…	…	…	…
	Total (*)			**547 074**	**457 129**		

(*) Analyse hors UTCATF (utilisation des terres, changement d'affectation des terres et foresterie)

Appendix 4 - Key sources evaluation and associated analysis with LULUCF

EVALUATION DES SOURCES CLES- Tier 1 - ANALYSE DES NIVEAUX D'EMISSIONS AVEC UTCATF (*) - Périmètre

source CITEPA / format CCNUCC - janvier 2017 — Secteurs_s_cle_avec_UTCATF.xls/s_cle_niv

rang	CRF	Classement Source / Combustible	Gaz à effet de serre direct	CO_2 équivalent (Gg) 1990	CO_2 équivalent (Gg) 2015	contribution (%) 2015	cumul (%) 2015
1	1A3b	Road Transportation	CO2	112 120	124 065	22.1%	22.1%
2	4A1	Forest Land remaining Forest Land	CO2	34 803	47 553	8.5%	30.6%
3	3A	Enteric Fermentation	CH4	37 613	34 580	6.2%	36.7%
4	1A4b	Residential / gas	CO2	20 087	32 337	5.8%	42.5%
5	3Da	Direct N2O emissions from managed soils	N2O	29 048	27 319	4.9%	47.4%
6	4B2	Land converted to Cropland	CO2	20 901	19 462	3.5%	50.8%
7	2F1	Refrigeration and Air Conditioning	HFC	0	16 564	3.0%	53.8%
8	1A4b	Residential / oil	CO2	31 003	15 582	2.8%	56.5%
9	1A1a	Public Electricity and Heat Production / coal	CO2	37 572	14 160	2.5%	59.1%
10	1A4a	Commercial/Institutional / oil	CO2	19 380	13 506	2.4%	61.5%
11	5A	Solid Waste Disposal	CH4	12 144	12 553	2.2%	63.7%
12	1A4a	Commercial/Institutional / gas	CO2	8 619	11 423	2.0%	65.7%
13	1A2a	Iron and Steel / coal	CO2	18 998	10 978	2.0%	67.7%
14	4E	Settlements	CO2	9 124	10 944	1.9%	69.6%
15	1A4c	Agriculture/Forestry/Fishing / oil	CO2	10 435	10 380	1.8%	71.5%
16	4C2	Land converted to Grassland	CO2	14 316	10 229	1.8%	73.3%
17	1A1a	Public Electricity and Heat Production / gas	CO2	977	7 089	1.3%	74.6%
18	1A2g	Manufacturing Industries / Other	CO2	12 337	6 609	1.2%	75.8%
19	2A1	Cement Production	CO2	10 937	6 606	1.2%	76.9%
20	4A2	Land converted to Forest Land	CO2	4 615	6 577	1.2%	78.1%
21	3Db	Indirect N2O Emissions from managed soils	N2O	6 700	6 245	1.1%	79.2%
22	3B	Manure Management	CH4	5 392	6 219	1.1%	80.3%
23	1A2e	Food Processing, Beverages and Tobacco / gas	CO2	3 629	5 876	1.0%	81.4%
24	1A1a	Public Electricity and Heat Production / other fossil fuels	CO2	2 558	5 781	1.0%	82.4%
25	1A1b	Petroleum Refining / oil	CO2	11 413	5 662	1.0%	83.4%
26	2B10	Chemical Industry / Other	CO2	4 399	4 820	0.9%	84.3%
27	1A2c	Chemicals / gas	CO2	6 631	4 777	0.9%	85.1%
28	1A3a	Domestic Aviation	CO2	4 306	4 550	0.8%	85.9%
29	1A1a	Public Electricity and Heat Production / oil	CO2	8 269	4 097	0.7%	86.7%
30	1A2f	Non-metallic minerals / gas	CO2	4 037	3 764	0.7%	87.3%
31	4B1	Cropland remaining Cropland	CO2	122	3 446	0.6%	87.9%
32	1A2c	Chemicals / oil	CO2	6 506	3 260	0.6%	88.5%
33	1A1c	Manufacture of Solid Fuels and Other Energy Industries / coa	CO2	4 065	3 067	0.5%	89.1%
34	1A2f	Non-metallic minerals / oil	CO2	7 214	3 024	0.5%	89.6%
35	1B2a	Fugitive Emissions from Fuels / Oil	CO2	2 951	2 519	0.4%	90.1%
36	1A2d	Pulp, Paper and Print / gas	CO2	2 313	2 354	0.4%	90.5%
37	2C1	Iron and Steel Production	CO2	2 918	2 311	0.4%	90.9%
38	2A2	Lime Production	CO2	2 743	2 253	0.4%	91.3%
39	5D	Wastewater treatment and discharge	CH4	1 534	2 192	0.4%	91.7%
40	1A2f	Non-metallic minerals / coal	CO2	4 184	1 949	0.3%	92.0%
41	2F4	Aerosols	HFC	0	1 937	0.3%	92.4%
42	3B	Manure Management	N2O	2 348	1 859	0.3%	92.7%
43	4B2	Land converted to Cropland	N2O	1 858	1 753	0.3%	93.0%
44	4G	Harvested wood products	CO2	6 814	1 747	0.3%	93.3%
45	1A2a	Iron and Steel / gas	CO2	2 071	1 739	0.3%	93.6%
46	1A2c	Chemicals / coal	CO2	1 763	1 701	0.3%	93.9%
47	1A1b	Petroleum Refining / gas	CO2	36	1 655	0.3%	94.2%
48	1A3b	Road Transportation	N2O	893	1 544	0.3%	94.5%
49	5C	Incineration and open burning of waste	CO2	2 209	1 526	0.3%	94.8%
50	2D3	Non-energy products from fuels and solvent use / Other	CO2	1 988	1 296	0.2%	95.0%

Appendix 5 - Projections for greenhouse gases (scope of the Convention)

This Appendix shows results using the Convention format.

1. Total Emission Projections

Table: Greenhouse Gas Emission Projections (in $ktCO_{2\text{-eq}}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Total tCO_2-eq. (excluding LULUCF)	550 069	555 748	516 767	463 650	434 281	412 949	403 468	398 575
Total tCO_2-eq. (including LULUCF)	523 589	532 664	477 421	427 841	382 391	360 480	347 785	339 755

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

2. Projections per sector

Table: Greenhouse Gas Emission Projections per sector (in $ktCO_{2\text{-eq}}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	382526	395884	371059	322395	300141	287742	282933	281800
Industrial Processes, Solvents and Other Products	67034	53812	47008	44957	43345	37514	34679	33816
Agriculture (Excl. Energy)	83529	84086	78109	78695	75577	74597	73498	72321
LULUCF	-26479	-23084	-39345	-35810	-51889	-52469	-55683	-58820
Waste	16979	21967	20591	17604	15217	13097	12358	10637
Total tCO_2-eq. (excluding LULUCF)	**550069**	**555748**	**516767**	**463650**	**434281**	**412949**	**403468**	**398575**
Total tCO_2-eq. (including LULUCF)	**523589**	**532664**	**477421**	**427841**	**382391**	**360480**	**347785**	**339755**
Memo items:								
International Bunkers	17415	24551	24720	23558	23199	27434	29955	32649
Aviation Bunkers	8997	14695	16484	17750	17389	19507	21862	24489
Navigation Bunkers	8417	9856	8236	5808	5810	7926	8093	8160

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: Energy Sector Breakdown (in $ktCO_{2\text{-eq}}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy Industry	77 622	70 545	66 541	46 892	54 221	53 967	53 456	53 759
Manufacturing and Construction Industries	83 039	80 634	64 334	54 047	55 984	54 472	54 642	55 100
Transport	121 583	140 284	134 897	133 749	119 017	115 633	115 521	117 671
Other Sectors (Residential, Tertiary, Agricultural)	100 282	104 420	105 287	87 707	70 919	63 670	59 314	55 270
Total Energy	**382 526**	**395 884**	**371 059**	**322 395**	**300 141**	**287 742**	**282 933**	**281 800**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

3. Projections by Gas type

Table: Greenhouse Gas Emission Projections by Gas (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
CO_2	372 167	390 861	349 902	303 372	266 195	253 741	246 292	242 689
CH_4	71 007	72 454	64 415	60 463	57 186	55 015	54 117	52 174
N_2O	68 573	57 323	44 155	43 609	41 919	40 894	39 861	38 912
HFC	4 402	6 630	17 410	19 324	16 148	9 921	6 643	5 134
PFC	5 202	2 997	617	540	499	460	423	394
SF_6	2 222	2 380	889	522	434	437	439	441
NF_3	16	20	32	11	11	11	11	11
Total tCO_2-eq (including LULUCF)	**523 589**	**532 664**	**477 421**	**427 841**	**382 391**	**360 480**	**347 785**	**339 755**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

4. Projections by Gas and by Sector

Table: CO_2 Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	366 668	384 597	363 525	315 701	293 045	280 720	275 992	274 928
Industrial Processes	31 332	29 761	25 701	23 226	24 981	25 487	26 040	26 712
Agriculture (Excl. Energy)	1 765	1 819	1 812	2 006	1 920	1 842	1 763	1 680
LULUCF	-29 807	-27 035	-42 750	-39 087	-55 164	-55 744	-58 957	-62 094
Waste	2 209	1 719	1 614	1 526	1 414	1 436	1 455	1 463
Total (excluding LULUCF)	**401 974**	**417 896**	**392 652**	**342 459**	**321 359**	**309 485**	**305 249**	**304 783**
Total (including LULUCF)	**372 167**	**390 861**	**349 902**	**303 372**	**266 195**	**253 741**	**246 292**	**242 689**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: CH_4 Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	12 602	7 660	3 915	2 919	3 291	3 275	3 241	3 174
Industrial Processes	85	108	81	50	50	50	50	50
Agriculture (Excl. Energy)	43 513	43 721	41 099	41 152	39 784	39 772	39 682	39 552
LULUCF	947	1 666	1 182	1 110	1 108	1 107	1 107	1 107
Waste	13 860	19 299	18 138	15 231	12 953	10 811	10 036	8 291
Total (excluding LULUCF)	**70 059**	**70 788**	**63 234**	**59 352**	**56 079**	**53 908**	**53 010**	**51 067**
Total (including LULUCF)	**71 007**	**72 454**	**64 415**	**60 463**	**57 186**	**55 015**	**54 117**	**52 174**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: N_2O Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	3 257	3 627	3 619	3 775	3 806	3 747	3 701	3 699
Industrial Processes	23 774	11 915	2 278	1 284	1 223	1 148	1 073	1 075
Agriculture (Excl. Energy)	38 250	38 546	35 197	35 537	33 873	32 983	32 053	31 088
LULUCF	2 381	2 285	2 222	2 167	2 167	2 167	2 167	2 167
Waste	911	949	839	846	850	850	867	884
Total (excluding LULUCF)	**66 192**	**55 037**	**41 932**	**41 442**	**39 752**	**38 727**	**37 694**	**36 745**
Total (including LULUCF)	**68 573**	**57 323**	**44 155**	**43 609**	**41 919**	**40 894**	**39 861**	**38 912**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: HFC Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0
Industrial Processes	4 402	6 630	17 410	19 324	16 148	9 921	6 643	5 134
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	**4 402**	**6 630**	**17 410**	**19 324**	**16 148**	**9 921**	**6 643**	**5 134**
Total (including LULUCF)	**4 402**	**6 630**	**17 410**	**19 324**	**16 148**	**9 921**	**6 643**	**5 134**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: PFC Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0
Industrial Processes	5 202	2 997	617	540	499	460	423	394
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	**5 202**	**2 997**	**617**	**540**	**499**	**460**	**423**	**394**
Total (including LULUCF)	**5 202**	**2 997**	**617**	**540**	**499**	**460**	**423**	**394**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: SF_6 Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0
Industrial Processes	2 222	2 380	889	522	434	437	439	441
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	**2 222**	**2 380**	**889**	**522**	**434**	**437**	**439**	**441**
Total (including LULUCF)	**2 222**	**2 380**	**889**	**522**	**434**	**437**	**439**	**441**

Source: UNFCCC, Citepa/MTES Inventory, 2017 Submission, and MTES Emissions Projections, 2017

Table: NF3 Emissions Projections (in $ktCO_{2-eq}$) within the scope of the Convention with the WEM Scenario (With Existing Measures)

	1990	2000	2010	2015	2020	2025	2030	2035
Energy	0	0	0	0	0	0	0	0
Industrial Processes	16	20	32	11	11	11	11	11
Agriculture (Excl. Energy)	0	0	0	0	0	0	0	0
LULUCF	0	0	0	0	0	0	0	0
Waste	0	0	0	0	0	0	0	0
Total (excluding LULUCF)	**16**	**20**	**32**	**11**	**11**	**11**	**11**	**11**
Total (including LULUCF)	**16**	**20**	**32**	**11**	**11**	**11**	**11**	**11**

Source: UNFCCC, Citepa/MTES Inventor

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