Progress report on the promotion and use of energy from renewable sources in France

5th report

This fifth report has been drawn up for the European Commission pursuant to Article 22(1) of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, on the basis of the template provided by the Commission.

1. Sectoral and overall shares and actual production and consumption of energy from renewable sources in 2017 and 2018

Steady progress

Since 2005 the renewable energy share, including heat sold and electricity produced from renewable energy, has increased by more than 7.3 percentage points, reaching 16.6% of gross final energy consumption in 2018 (see table below). This increase is due on the one hand to significant growth in gross final consumption of renewable energy as a result of investments to encourage development (+10.4 Mtoe since 2005, an increase of 68%), and on the other hand to an overall fall in gross final energy consumption (-10.0 Mtoe since 2005, a fall of 6%).

Since 2005 the role of renewable energy has grown at the same rate in electricity (+7.4 percentage points) and transport (+7.0 percentage points), and more significantly in heating (+10.1 percentage points) (see table below). Despite these increases, in 2018 the renewable energy share remains below the trajectory set in the national renewable energy action plan to achieve the objectives laid down in the EU Directive by 2020.

Share of renewable energy in gross final energy consumption (in %)

	achieved			trajectory	target	target
	2005	2017	2018	2018*	2020	2030**
Electricity	13,8	19,9	21,2	24,0	27,0	40,0
Heating/cooling	11,7	21,1	21,8	29,0	33,0	38,0
Transport	2,0	8,8	9,0	9,4	10,5	15,0
Total	**9,3**	**16,0**	**16,6**	**20,5**	**23,0**	**32,0**

p: provisional data subject to change.
** The 2020 target for the transport industry laid down in the NAP (10.5%) is higher than that laid down in Directive 2009/28/EC (10%).*
*** Targets introduced by the Act on the Energy Transition for Green Growth (loi relative à la transition énergétique pour la croissance verte).*
Field: Metropolitan France and DOM.
Source: SDES calculations, based on sources by type of energy (actual) and NREAP (trajectory)

Final gross renewable energy consumption reached 25.8 Mtoe in 2018, compared with 15.4 Mtoe in 2005 – an increase of 68%. The renewable industries that have made the greatest contribution to this development are wind power, solid biomass and renewable waste, biodiesel and heat pumps, which represent around 85% of the increase (see table below).

Final gross renewable energy consumption per sector
In thousand toe

	Achieved				Change
	2005	2016	2017	2018	2018/2017
Final gross renewable energy consumption for the calculation of the overall target (A) + (B) + (C)	**15 378**	**24 592**	**25 062**	**25 820**	**3 %**
Electricity, total (A)	**6 124**	**8 553**	**8 855**	**9 354**	**6 %**
Standardised renewable hydropower	5 685	5 173	5 120	5 206	2 %
Standardised wind power	96	1 935	2 184	2 467	13 %
of which onshore wind power	*96*	*1 935*	*2 184*	*2 467*	*13 %*
of which offshore wind power	*0*	*0*	*0*	*0*	
Photovoltaic and concentrated solar power	2	745	824	909	10 %
of which photovoltaic	*2*	*745*	*824*	*909*	*10 %*
of which concentrated	*0*	*0*	*0*	*0*	
Marine energy	41	43	45	41	-8 %
Geothermal electricity	9	8	11	11	-3 %
Solid biomass and renewable urban waste	250	478	488	517	6 %
Biogas	41	171	182	203	11 %
Heating (and cooling), total (B)	**8 663**	**13 052**	**13 070**	**13 324**	**2 %**
of which district heating	*nd*	*966*	*1 053*	*nd*	*nd*
Solar thermal power	49	166	172	181	5 %
Geothermal thermal	106	145	170	187	10 %
Heat pumps	203	2 180	2 375	2 601	9 %
of which geothermal	*77*	*270*	*270*	*267*	*-1 %*
Solid biomass and renewable urban waste	8 256	10 194	9 878	9 792	-1 %
of which household wood consumption	*6 627*	*6 856*	*6 592*	*6 386*	*-3 %*
Biogas	49	239	277	307	11 %
Biofuels excluding transport	0	127	198	256	29 %
Fuels, total (C)	**591**	**2 988**	**3 137**	**3 142**	**0 %**
Bioethanol	103	474	539	586	9 %
Biodiesel	488	2 514	2 598	2 556	-2 %
Others (biogas, vegetable oil)	-	-	-	-	-
Gross final consumption in the transport sector (C) + (D) + (E)	**895**	**3 744**	**3 942**	**3 944**	**0 %**
Renewable fuels (C)	591	2 988	3 137	3 142	0 %
Renewable electricity in transport (D)	122	255	269	264	-2 %
of which railways	*122*	*229*	*240*	*235*	*-2 %*
of which road	-	*4*	*5*	*7*	*29 %*
of which other modes of transport	-	*22*	*24*	*22*	
Bonuses* (E)	182	501	536	539	-

nd: no data

* Bonuses are provided for in the Directive for second-generation transport biofuels and electricity consumed by electric vehicles and trains. They are relevant only for the calculation of the renewable energy target for the transport sector.

Field: metropolitan France and overseas departments. Source: SDES, based on sources per sector and NAP (trajectory)

2. Measures taken in the preceding two years and/or planned at national level to promote energy from renewable sources

- **Electricity**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
Feed-in tariffs for electricity produced from renewable energy sources	Financial	Increase in the number of renewable electricity generation projects.	Individuals, investors	Existing	2000
Increase in volume of calls for tender for solar and wind power	Financial	Increase in number of projects supported	Investors	Existing	2017
Renewable electricity guarantees of origin	Regulatory	Highlighting the renewable nature of the energy produced	Investors	Existing	2011
Speeding up the dispute process regarding onshore wind farms and associated works through proceedings at first and last instance before the Administrative Court of Appeal.	Regulatory	Speeding up project development	Investors	Existing	2017
Simplifying the legal process for wind farms by automatically freezing the pleas (of procedural or substantive legality) after two months.	Regulatory	Speeding up project development	Investors	Existing	2018
Removal of need for approval for electrical work for inter-array cabling and the connection of onshore and offshore wind farms.	Regulatory	Speeding up project development	Investors	Existing	2018
Simplifying mast lighting schemes	Regulatory	Improving local acceptability	Investors	Existing	2019
Adjustment of the flat-rate taxation of network companies for wind and solar power	Fiscal	Tax relief and improving local acceptability	Investors, local authorities	Existing	2018
Implementation of a bonus for crowdfunding	Financial	Improving local acceptability	Investors, local authorities, individuals	Existing	2017
Maintaining the tax exemption for small-scale projects for individual personal consumption	Financial	Tax advantage	Investors, individuals	Existing	
Increasing the maximum power for projects eligible for the call for tenders regarding personal consumption	Regulatory	Increasing the size of projects for personal consumption	Investors, local authorities, individuals	Existing	2019
Maintaining the exemption from property tax for public structures equipped with solar panels.	Fiscal	Facilitating projects on public land	Investors, local authorities	Existing	2019
Simplification of the planning rules for solar canopies (setback distance, coverage ratio, etc.), former roads or areas designated in a technological risk prevention plan (PPRT).	Regulatory	Speeding up project development	Investors	Existing	2019

Obligation to install solar panels or green roofs on commercial or industrial buildings larger than 1000 m^2.	Legislative	Increase in number of solar panel projects	Investors	Existing	2019
Public participation in offshore wind power projects organised prior to the launch of tender procedures.	Legislative	Improved project acceptability Savings in development time	General public Investors	Existing	2018
Site characterisation studies carried out by the State for offshore wind power projects	Legislative	Better knowledge of project risks Reduction in costs of public funding Savings in development time	Investors	Existing	2018
Possibility of authorisations for offshore wind farms laying down variables	Legislative	Possibility of adapting projects to technological developments	Investors	Existing	2018

- **Heat**

Name and reference of the measure	**Type of measure**	**Expected result**	**Targeted group and or activity**	**Existing or planned**	**Start and end dates of the measure**
Heat Fund: increase in the Heat Fund from EUR 258 million in 2018 to EUR 350 million in 2020.	Financial	Fivefold increase in renewable and recovered heating and cooling supplied by district heating networks by 2030, as compared to 2012.	Collective, service and industrial sectors	Existing	2009-/
Reduced VAT rate for district heating networks using more than 50% renewable or recovered energy.	Financial	Fivefold increase in renewable and recovered heating and cooling supplied by district heating networks by 2030, as compared to 2012.	Developers, investors – district heating networks	Existing	2009-/
Possible classification of district heating networks	Regulatory	Fivefold increase in renewable and recovered heating and cooling supplied by district heating networks by 2030, as compared to 2012	Developers, investors – heating networks	Existing	1997-/
Classification of district heating networks: The Energy and Climate Act will make it compulsory to classify networks in accordance with procedures to be determined.	Regulatory	Fivefold increase in renewable and recovered heating and cooling supplied by district heating networks by 2030, as compared to 2012	Developers, investors – heating networks	Act adopted – procedures to be determined	Pending
Extension of concession period (public service delegation)	Financial	Fivefold increase in renewable and recovered heating and cooling supplied by district heating networks by 2030, as compared to 2012	Developers, investors – district heating networks	Existing	2010-/
Promotion campaign by ADEME targeting local authorities with more than 10 000 inhabitants	Information, training and awareness-raising	Fivefold increase in renewable and recovered heating and cooling supplied by	Developers, investors – district heating networks	From 2020	2020

		district heating networks by 2030, as compared to 2012			

- **Biogas**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
Feed-in tariff for biomethane injected into gas grids	Financial	Increase in production of biomethane.	Waste producers: farmers, local authorities, waste water treatment plants.	Existing	2011-/
Guarantees of origin for biomethane injected into gas grids	Regulatory	Promotion of the renewable nature of part of the gas transported through grids	Investors	Existing	2012-/
Help to upgrade natural gas networks in order to connect a biogas production facility	Regulatory	Facilitating connection of projects	Investors	Existing	2019-/

- **Fuel**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
General tax on polluting activities (TGAP)	Fiscal	Achievement of biofuel incorporation targets.	Fuel distributors	Existing	2005-/
Partial exemption from domestic consumption tax (TIC)	Fiscal	Reduction in additional costs of biofuel production	Fuel producers	Ended on 31 December 2015	2002-2015

- **Energy efficiency**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
Renovation bonus	Fiscal	Increase in the quality of energy improvement works to have wood-fired heating installed in 10.2-11.3 million dwellings and heat pumps in 8.8 million dwellings by 2028. 15 % reduction in energy consumption of buildings by 2023. Renovate half of the 1.5 million uninsulated dwellings inhabited by low-income owner-occupiers over a period of 5 years.	Individuals (owner-occupiers)	Existing, project to extend it to co-owners' associations and landlords.	1 January 2020
Energy Transition Tax Credit (CITE, formerly the Sustainable Development Tax Credit)	Fiscal	Increase in the number and quality of energy improvement works to have wood-fired heating installed in 10.2-	Individuals	Existing and being stepped up to focus scheme on most effective	2005-2020, until 2021 for transitional measures

		11.3 million dwellings, heat pumps in 8.8 million dwellings and solar thermal equipment in 4 million dwellings by 2028. 15 % reduction in energy consumption of buildings by 2023. Renovate half of the 1.5 million uninsulated dwellings inhabited by low-income owner-occupiers over a period of 5 years.		measures (energy and RES).	
Reduced VAT rate for energy improvement works carried out on housing over two years old	Fiscal		Individuals	Existing	1 January 2014
Interest-free eco-loan for works to improve the overall energy performance of housing.	Fiscal		Banking	Existing	1 April 2009 - 31 December 2021
National Housing Agency (ANAH) aid	Fiscal	The Building Energy Improvement Plan provides for an industrial policy for renovating uninsulated dwellings. To this end, the ANAH's target has been increased to energy improvements in 75 000 homes occupied by low-income households per year ('Habiter Mieux' programme).	Individuals – occupants and landlords	Existing	2007-/
Renovation of public buildings	Regulatory and financial	The renovation of state and local authority building stock must contribute to the general objectives of the Climate Plan, i.e. a 15 % reduction in the energy consumption of buildings by 2023, as compared to 2010. Removal of oil-fired boilers from government buildings by 2029.	Central government and local authorities	Existing	2018-2031
Social housing renovation plan	Financial and regulatory	Social housing: work required on homes with high heat loss	Social housing managers, state and local authorities	Existing	2009-2028
Energy savings certificates	Regulatory	Increasing the number of energy-saving measures based on renewable heat production in construction and industry. Expanding the ESC programme	Energy suppliers	Existing	2011-2014: 2nd period 2015-2017: 3rd period 2018-2021: 4th period
2012 Heating Regulation	Regulatory	Stricter heating standards for new buildings.	Individuals, anyone constructing buildings for residential or service-sector use.	Existing – analysis of the practical application of the 2012 Heating Regulation.	28 October 2011 - 2020 or 1 January 2013 - 31 December 2020, depending on the type of building
2020 Environmental Regulation	Regulatory	Stricter technical and environmental	Individuals, anyone constructing buildings	Project	From 1 January 2021

		standards for new buildings.	for residential or service-sector use.		
Service-sector buildings decree	Regulatory	Requirement for energy savings in service-sector buildings of more than 1,000 m^2: Reduction in final energy consumption of -40% in 2030, -50% in 2040 and -60% in 2050	Businesses, central government and local authorities (owners and occupiers)	Ongoing	2021-2050
Energy-plus and low carbon buildings scheme ('E+C- scheme')	Semi-regulatory	Gradual introduction of labels to encourage the widespread use of renewable energy in new buildings. Furthermore, requirement for the state, public institutions and regional authorities to lead by example.	State, local authorities, individuals, anyone constructing buildings for residential or service-sector use.	E+C- pilot launched in 2016 to prepare future environment legislation with stakeholders.	Labels: 2016-/ Full introduction. 2020-/
Energy Performance Diagnosis (DPE)	Regulatory	The Renovation Plan states that by 2021, the state will amend the DPE so as to ensure its reliability and modernise it for regulatory purposes.	Individuals, property developers	Existing Revision ongoing	2007-/
Buildability Bonus	Regulatory	Incentive to ensure sound energy performance and to use renewable energy in construction.	Individuals	Existing – currently being stepped up in connection with Article 8 of the Act on energy transition for green growth.	2005-/
Exemption from property tax on developed property	Regulatory	Incentive to ensure high energy performance, use renewable energy and take account of environmental performance.	Social housing, landlords	Planned	2018
Public service for home energy performance (SPPEH)	Information/awareness raising	Creation of a common brand, FAIRE. Consolidating and expanding the network of FAIRE centres through the CEE SARE programme.	Individuals	Existing	Mid-2018
ADEME campaigns	Data	Multiple awareness campaigns regarding energy improvements, under the banner of FAIRE. Drawing up a commitment charter for professionals	Individuals and businesses	Existing	2018 -/

- **Innovation**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
Calls for tender for renewable energy production	Financial	Increase in installed capacity for renewable energy generation (wind, offshore wind, biomass, photovoltaic). NB: since 2016, support has been granted in the form of additional payments for installations of more 500 kW. Below this, support is still granted in the form of feed-in tariffs.	Investors	Existing for biomass, biogas, photovoltaic, small-scale hydropower, offshore and onshore wind.	2005-2023
ADEME demonstration fund, extended by Future Investments programmes	Grants	Stimulation of R&D	Investors, researchers	Existing	2009-2013
Future Investments	Grants	Stimulation of R&D	Investors, researchers	Existing	2010
ANR (National Research Agency)	Grants	Stimulation of R&D	Researchers	Existing	2009
Competitiveness hubs	Grants	Stimulation of R&D	Public-private partnership	Existing	2005

- **Fossil fuel energy**

Name and reference of the measure	Type of measure	Expected result	Targeted group and or activity	Existing or planned	Start and end dates of the measure
Closure of coal-fired power stations	Legislative	Reduction of the share of fossil fuels in the electricity mix	Energy companies	Existing	2019
Carbon component in energy taxes, primarily in the field of transport, buildings and industry not subject to the ETS. This component has been €44.60/tCO_2 since 2018.	Financial	Reduction of the share of fossil fuels in the energy mix	Consumers	Existing	2014

1. Evaluation and improvement of administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy

The French Government has launched a plan for the deregulation of renewable energy for all RES sectors in order to encourage their development. Four working groups – on wind power, biogas, solar power and heat – operated between 2017 and 2019 and resulted in around 50 administrative simplification or support measures. Significant simplifications have also been implemented to speed up the development of offshore wind projects.

Measures to promote onshore wind power

Onshore wind power is one of the RES sectors with the greatest development potential and is sufficiently competitive and well-established for large-scale and rapid development. The draft multi-annual energy programme, published in late 2018, sets a target for 2028 for the sector of between 34.1 and 35.6 GW (as compared with 15 GW in late 2018). To

achieve this target, an additional 7,000 wind turbines will need to be installed, bringing the total number to around 15,000 in Metropolitan France (current estimate 8,000). If these targets are reached, in 2028 onshore wind power will represent between 12.7% and 13.2% of national electricity production and will be the primary renewable electricity source ahead of hydroelectric power.

Between 20 October 2017 and 18 January 2018, the national wind power working group gathered all stakeholders in the development of wind power and agreed ten measures to help speed up the development of the sector and improve local acceptability of installations. These measures focus on three objectives – saving time at the various stages of the project (the current average for a wind power project is 8-10 years), simplifying procedures and smoothing the relationship between projects and the local area.

One key objective for the wind power working group is improving the way wind farms blend into the landscape. To this end, ADEME and the Ministry of the Green and Inclusive Transition (DHUP) will finance a call for proposals for 'landscape plans' with the aim of funding local reflections on the integration of renewable energy into the landscape, in particular onshore wind power.

Finally, the Order of 23 April 2019 on lighting for air obstructions simplified the regulations on mast lighting. Notably, the measures permitted under this Order include changing half of the masts in a wind farm from a flashing light to a fixed light.

Measures to promote offshore wind power

The Government has taken strong action to accelerate the development of offshore wind power, which is a major challenge for the energy transition. Based on international best practice, the Government has modernised and simplified the regulatory framework for the next calls for tender for offshore wind power, through the Government Reform Act for a Trust-Based Society of 10 August 2018 (the ESSOC Act). It will now be possible to organise public participation (public debate or consultation with the guarantor) and technical and environmental studies before the call for tender. The new framework also provides the possibility for the successful tenderer to apply for a variable permit that enables changes to be incorporated and the project to be adjusted, within set limits, after authorisation has been obtained.

In addition, the offshore wind power objectives were revised upwards within the multi-annual energy programme in line with the Energy and Climate Act of 8 November 2019, which provides for a gradual increase in the number of projects awarded, to reach 1 gigawatt a year by 2024.

Measures to promote biogas production

The biogas industry is developing rapidly. By the end of March 2019, there were 751 installations producing biogas and injecting it into the natural gas networks (88) or producing electricity (663), an increase of 135 installations on the previous year. The Energy Code lays down a target for renewable energy to account for 10% of gas consumption by 2030.

A number of measures are being implemented in order to speed up the development of the biogas industry, following the working group on anaerobic digestion launched in early 2018. This working group led to the implementation of 15 measures to speed up the development of biogas production, covering objectives aiming to give farmers an opportunity to top up their revenue, to make the biogas industry more professional, to accelerate biogas projects to reduce production costs, and to develop the industry in France.

In 2019 measures were taken by the Government to develop the biogas industry, in particular with regard to the 'right to inject', which made it easier to connect plants located in areas served by a gas network, in June 2019, reduced the cost of connecting production plants to natural gas distribution and transport networks, adapted the purchase obligation scheme to the specific nature of biogas projects, and enabled the implementation of a guarantee fund by the public investment bank in mid-2019 within the framework of the Grand Plan d'Investissement to support agricultural biogas projects.

In addition, a technical and economic assessment on biogas injected into natural gas networks is being carried out in order to obtain objective economic data that will enable the feed-in tariff for biogas injected into natural gas networks

to be revised as necessary. One measure planned under the Mobility Framework Act (*loi d'orientation des mobilités*) is the establishment of a support scheme for biogas utilised directly as fuel, without being injected into a gas network. The feed-in premium scheme for plants with an electrical output of between 500 kW and 1 MW is currently being drawn up.

Measures to promote solar power

A dedicated solar power working group was launched in April 2018 and its conclusions – drawn from discussions with local elected representatives, professionals and public services involved in the development of the solar industry – were presented on 28 June 2018.
Further contributions to the development of the solar industry include launching new calls for tender for solar power with or without storage in the overseas departments and Corsica, increasing the volumes in calls for tender for innovative solar power projects, simplifying the specifications for solar power projects of less than 500 kW and launching a call for tender for 'the energy transition in Fessenheim'.

Measures to promote district heating

A working group proposed 25 measures to increase the attractiveness of district heating and cooling networks, their benefits for consumers and the environment and their economic competitiveness. The aim is to encourage local authorities and their partners to take action now in order to achieve the national targets of a fivefold increase in renewable heating and cooling and recovery by 2030 compared with 2012 figures.

The measures announced today are focused on five key objectives:

- Increasing the use and attractiveness of the networks;
- Improving consumer information and protection;
- Strengthening the competitiveness of the networks;
- Contributing to greening the energy supplied by the networks;
- Promoting innovation and investing in research and development.

2. Measures under environmental law

Introduction of the single environmental licence

Since 1 March 2017, the different procedures and environmental decisions needed for projects subject to licensing for installations classified for environmental protection purposes and projects subject to licensing under the Water Act have been merged under the environmental licence. The reform will also reinforce the stage prior to applying for a licence, so that applicants are better able to understand the rules governing their projects.

For onshore wind power

- Fast-track legal disputes relating to onshore wind farms and the associated works through proceedings before the Administrative Court of Appeal as the court of first and final instance (Decree of 1 December 2018);
- Simplifying the legal process by automatically freezing the pleas (of procedural or substantive legality) after two months (Decree of 1 December 2018);
- Clarifying the rules for projects to renew ('repower') wind farms reaching the end of their lifespan by means of a ministerial instruction (Government Instruction of 11 July 2018 on the assessment of onshore wind farm repowering projects);
- Simplifying mast lighting schemes (publication of the Order of 23 April 2018 on lighting for air obstructions).

For offshore renewable energy

- **Simplification and consolidation of the legal framework for offshore wind power**

In 2016 the Government undertook a safety and simplification exercise in which it published Decree No 2016-9 containing a number of provisions:

- Appeals concerning the administrative licensing of offshore wind farms, grid connection systems and port infrastructure needed for their construction to be handled at first and last instance by the Nantes Administrative Court of Appeal, with a view to limiting the duration of appeals;
- Licences to occupy public maritime property extended from thirty to forty years;
- Appeal period reduced to four months for licences under the Water Act.

- **Publication of Decree No 2017-627 of 26 April 2017 on an insurance scheme for marine renewable energy installations so as to make marine renewable energy projects easier to insure**

This Decree of the Council of State implementing Article 84 of Act No 2016-816 of 20 June 2016 on the Blue Economy is aimed at encouraging the insurance of offshore renewable energy projects by adding 'marine renewable energy installations' to the list of 'major risks' set out in Article L.111-6 of the Insurance Code.

The single procedure has three objectives:

- simplify the procedures without reducing the level of environmental protection;
- improve the overall vision of all environmental challenges relating to a project;
- increase project promoters' planning, understanding and legal stability.

- **Publication of Decree No 2018-1204 of 21 December 2018 on authorisation procedures for offshore renewable energy plants**

This Decree lays down the following:

- conditions for referral of offshore wind projects to the national public consultation commission prior to tender procedures;
- rules for implementing variable authorisations granted to developers of offshore wind projects once they are connected.

3. Measures under planning law

For solar power

Measures have recently been taken with regard to maintaining the exemption from property tax for public structures equipped with solar panels (Article 171 of the 2019 Finance Act) and to simplifying the planning rules for the installation of solar panels on solar canopies (Articles 45 and 48 Energy and Climate Act).

These measures address:

- the retention of the exemption from property tax for public structures equipped with solar panels (Article 171 of the 2019 Finance Act);

- the simplification of the planning rules for the installation of solar panels on solar canopies (Articles 45 and 48 Energy and Climate Act);
- the authorisation of solar panel projects on former roads (Article 44 Energy and Climate Act);
- the obligation for renewable energy production or green roof systems to be installed on at least 30% of the building roof or parking canopies for supermarkets that require a new operating licence or industrial buildings, workshops, warehouses, storage buildings for commercial use not open to the public, and covered car parks of more than 1000 m^2 accessible to the public (Article 47 Energy and Climate Act and Implementing Order drawn up by the Directorate-General for Risk Prevention (consultation ongoing until 11 December 2019));
- the simplification of procedures for installing solar panels in areas designated in a technological risk prevention plan (Energy and Climate Act).

4. Measures under energy law

For wind power

- Removal of need for approval for electrical work for inter-array cabling and the connection of onshore and offshore wind farms (ESSOC Act of 11 August 2018).

For offshore renewable energy

- **Introduction of specific compensation for offshore renewable energy projects in the event that connection to the transmission system overruns**

The Act on energy transition amended Article L.342-3 of the Energy Code by limiting the connection period for renewable energy to 18 months and by stating that failure to comply with the time period 'may give rise to compensation according to a scale established by Decree of the Council of State'. The Act also stated that the 18 month period could be exceeded for certain categories of installation on account of special technical or administrative constraints.

Decree No 2017-628 of 26 April 2017 sets out the conditions for compensation in the event of a delay in connecting offshore renewable energy projects to the high and very high voltage grid.

- **Modernisation of the connection framework for offshore wind farms**

The reform of the arrangements for connecting offshore wind farms under a call for tender carried out by virtue of Act No 2017-1839 of 30 December 2017 stopping hydrocarbon prospecting and exploitation and laying down various provisions pertaining to energy and the environment, laid down that the transmission system operator (RTE) must ensure, at its own expense, that wind farms are connected to the grid by a deadline indicated in the tender specification. Under this new framework, two compensation mechanisms were introduced to benefit producers, namely compensation for delays in providing a grid connection system, and compensation in the event that the system breaks down. Compensation is paid by RTE and covered by the public electricity distribution network tariffs (TURPE).

Injection of biomethane (purified biogas) into natural gas grids

The Order of 7 April 2016 establishing various measures for adapting the gas sector laid down a possibility whereby the administrative authority may use a tender procedure if capacity for producing biogas intended for injection into the gas grid does not meet the quantitative targets set out in the multi-annual energy programme.

2.2 Measures ensuring the transmission and distribution of renewable electricity and improving the framework or rules for the bearing and sharing of costs related to grid connections and grid reinforcements

It should be noted that all producers have a right of access to the grid that is guaranteed by law. If the system operator refuses to grant access, the regulator may impose a penalty, unless the refusal is justified by objective, non-discriminatory and open criteria. These criteria may be based only on imperatives connected with the proper performance of public service tasks and on technical grounds relating to grid safety and security and the quality of grid operation. Producers are entitled to obtain a technical and financial proposal for their connection under the conditions laid down in the system operator's technical reference documentation.

In 2010, Act No 2010-788 of 12 July 2010 on the national commitment to the environment (known as 'Grenelle 2') set out schemes intended to improve coordination and speed up grid connection procedures for renewable energy. These provisions are now codified in Articles L.321-7, L.342-1 and L.342-12 of the Energy Code. Decree No 2012-533 of 20 April 2012 on regional renewable energy grid connection plans provides more detail on how they are to be applied.

The regional renewable energy grid connection plans are drawn up by the transmission system operator, in conjunction with the distribution system operators concerned, on the basis of the renewable energy development targets set by the regional climate, air and energy plans (SRCAEs), and are approved by the Regional Prefect. Under these plans, the connection capacities for renewable energy considered necessary to achieve the targets set by the SRCAEs can be reserved for 10 years. In accordance with Article 1 of the Decree of 20 April 2012, as amended by Decree No 2014-760 of 2 July 2014, all RES facilities with an installed capacity of more than 100 kVA are to be connected according to the methods set out in the grid connection plans.

The regional renewable energy grid connection plans specify how the costs of any electricity works are to be shared among producers. All renewable energy producers connected under such a plan must therefore pay the same share. This mechanism helps to prevent the barrier and dead-weight effects resulting from the application of ordinary legislation on connection that was in force before regional renewable energy grid connection plans came into existence and according to which the first producer whose connection required works to take place bore the costs of those works alone, with subsequent producers benefiting from them free of charge.

Electricity works requiring reinforcement are financed by system operators. As in the ordinary connection scheme, 'own works', i.e. works from the production facility up to renewable energy grid connection plan works, are financed by producers. To date, the 22 regional renewable energy grid connection plans from former French administrative regions have been approved. A number of these plans are currently being revised (e.g. Hauts-de-France).

The Act of 24 February 2017 also reintroduced the principle of a reduction for renewable energy producers on the price of connecting to the electricity grid by means of tariff reductions. The implementing rules were laid down in a Decree of 30 November 2017 and entered into force on 4 December 2017. Installations of less than 5 MW receive a discount on connection costs of up to 40%. The greater the capacity of the installation, the smaller the reduction. Consequently, small installations for which connection costs may be a barrier to the development of projects receive a bigger discount. Similar arrangements have been introduced for reducing the cost of connecting biomethane installations to the public natural gas grid.

3. Description of support schemes and measures to promote renewable energy and developments with respect to the National Renewable Energy Action Plan

3.1 Support scheme for renewable heat production

1. Heat Fund

In France, heat generation represents half of energy consumption. It still relies primarily on fossil fuels, despite alternatives being readily available. The Heat Fund contributes to the objectives of the European Energy and Climate Package, which aims to increase the proportion of renewable energy to 23% of national energy consumption by 2020. The fund must therefore enable an increase in production of 5.5 million tonnes of oil equivalent (Mtoe) of renewable heat or heat recovery by 2020 (1 toe = 11,630 kWh).

The Heat Fund is targeted at local authorities and businesses and aims to enable them to achieve their energy transition through extensive use of renewable heating and cooling in their area and their activities. The sectors concerned are public buildings, multi-unit residential buildings, the service sector, industry and agriculture, with the aim of making renewable technology financially competitive when compared with installations using conventional energy. The challenge is to achieve the targets under the Act on the Energy Transition for Green Growth of 32% renewable energy and a fivefold increase in the amount of renewable energy and energy recovery supplied by district heating and cooling by 2030.

Over the period 2009-2018, ADEME committed EUR 2.16 billion in support to almost 4,813 measures, generating a total investment amount of EUR 6.7 billion and production of 2.37 Mtoe/year (approximately 27.5 TWh/year). The target for the increase in generation of renewable heat or heat recovery laid down in the Heat Fund is 5.47 million tonnes of oil equivalent (Mtoe), corresponding to 63.6 TWh, by 2020. At present, only 43% of the 2020 target has been achieved (2.37 Mtoe of 5.47 Mtoe), at a very reasonable cost to the public authorities of €4.95/MWh. The biomass industry, which represented almost half of the initial investments from the Heat Fund, represents 24% of the total in 2018. New sectors have been developed since 2015, such as biogas and waste heat recovery. These have a very good aid to production ratio in €/MWh.
The table below provides a summary of the different projects which have been granted support since the fund was set up and shows the effectiveness of public money invested in the Heat Fund, as highlighted by the Court of Auditors.

Summary by sector

Key figures 2009-2018	No of projects	Amount of eligible investment (€ m)	ADEME aid (€ m)	Toe RES/year	ADEME aid (€/toe over 20 years)
BCIAT wood	169	1,023	406	904	3.19
Non-BCIAT wood	1,032	1,597	418	626	3.65
Geothermal	572	745	165	174	4
Biogas	146	676	89	174	1.79
Solar	1,754	186	86	9	48

District heating	925	2,279	790	338	17.5
Waste heat recovery plants	74	141	30	141	0.69
Property renewables contract	33	25	9	3	12.5
TOTAL investment measures			1,991	2,370	4.95
Matching contribution under Geothermal Guarantee Fund			35		
Support activities			137		
Total	4,705	6,672	2,166	2,370	4.95

2. Energy transition tax credit

In order to achieve the targets of the multi-annual energy programme, it is estimated that support of €600 million a year is needed for renewable heat generation equipment that is currently eligible for energy transition tax credit (CITE).

Article 23 of the 2017 Finance Act extended the CITE until the end of 2017 to speed up and expand energy improvements. It also lays down that the Government is to present a report to Parliament by 1 September 2017 on the implementation of the tax credit.

In addition, the performance criteria for high-efficiency boilers, solar-powered heating or hot water installations and heat pumps have been enhanced through the Order of 30 December 2016 amending Article 18 *bis* of Annex IV to the General Tax Code as of 1 January 2017. The Order also extends eligibility to hybrid heat pumps that include a booster. The cost of the scheme in 2018 (based on the expenditure in 2017) is estimated at €1,670 million. The Tax Legislation Directorate has estimated the actual cost at 1,675 million (source: Ways and Means volume 2, 2019 Finance Bill).

For work carried out in 2018, a transitional scheme has been put in place for glass walls and oil-fired boilers in order to shift the focus of the CITE onto the most efficient equipment (in terms of energy and greenhouse gas savings at a minimal cost). For work carried out in 2016, the tax cost of insulating glass walls, windows, shutters and doors was almost €1 billion, triple the cost of wall insulation, while the latter is 10 times more effective (on average across private dwellings), as calculated in the 2017 spending review. In addition, from 1 January 2018 the cost of energy audits in cases where they are not required by law and the representative share of equipment in the cost of connection to a district heating and cooling network are also included.

The cost of the scheme in 2019 (based on the expenditure in 2018) is estimated at €1,150 million. The actual cost will be communicated in due course by the Tax Legislation Directorate.

For work carried out in 2019, windows are reinstated as eligible for tax credit, but under more restrictive conditions than before, in order to improve the correlation between the support scheme and the effectiveness of this improvement. Support is limited to 15% of expenditure, with a ceiling of €100 per item for the replacement of individual single-glazed windows with double glazing.

The efforts to refocus the CITE on the most efficient equipment have led in particular to the tightening of the eligibility conditions for gas boilers, which from now on must have 'very high energy efficiency'. On the other hand, in order to facilitate access to the CITE for low-income households, the range of measures supported has been broadened. The costs of removing an oil-fired boiler and installing equipment powered by a renewable energy source or a heat pump,

are included. The cost of the scheme in 2020 (based on the expenditure in 2019) is estimated at €890 million. The actual cost will be communicated in due course by the Tax Legislation Directorate.

As of 1 January 2020, the CITE is being phased out and replaced by MaPrimeRénov', initially for the households with the lowest income and then for everyone. The CITE will be finally phased out on 31 December 2021.

3. Interest-free eco-loans

The link between the interest-free loan and the energy transition tax credit (CITE) has been improved by harmonising the types of equipment and the eligibility criteria for the two schemes from 1 January 2015. The 2017 Finance Act removed means testing to qualify for both the CITE and the eco-loan. The aim of this measure was to simplify the range of support schemes and to provide a financial incentive for all households to make energy improvements to their property by removing the need to choose between the two schemes.

Furthermore, since 1 July 2016 it has been possible to take out a second interest-free loan for the same property within three years of the initial eco-loan, up to a combined ceiling of €30,000. The 2019 Finance Act extended the scheme for three years (until 31 December 2021). In connection with this extension, the eco-loan was made more practical and was radically simplified, making it easy to understand for households, businesses and banks.

Finally, Article 184 of Act No 2018-1317 of 28 December 2018 on the 2019 budget simplifies the conditions for granting the interest-free eco-loan for loan offers made from 1 July 2019.

4. Reduction in VAT rate for district heating

The table below sets out the cost to the public purse of the reduced rate of VAT for district heating and cooling networks once the 50% renewables threshold is met. This estimate takes into account the district heating and cooling targets laid down in the multi-annual energy programme.

Base year 2016	2017-2023	2023-2028 Low:	2023-2028 High:
55	65	70	75

Cost to the public purse of a reduction in VAT rate for district heating networks (€ million)

5. 2012 Thermal Regulation

Following a period of strong growth until 2008, the market for individual solar power in particular is in decline. Despite an obligation for a minimum of 5 kWh/m^2 of renewable energy in individual new houses, solar thermal energy is struggling to compete with other renewable energy equipment that has a lower installation cost but also meets the criteria of the 2012 Thermal Regulation (TR). Strengthening these criteria would help to make the most efficient solar equipment more attractive.

It should be stressed that the 2012 TR makes the use of renewable energy compulsory in individual homes through the adoption of one of the following options:

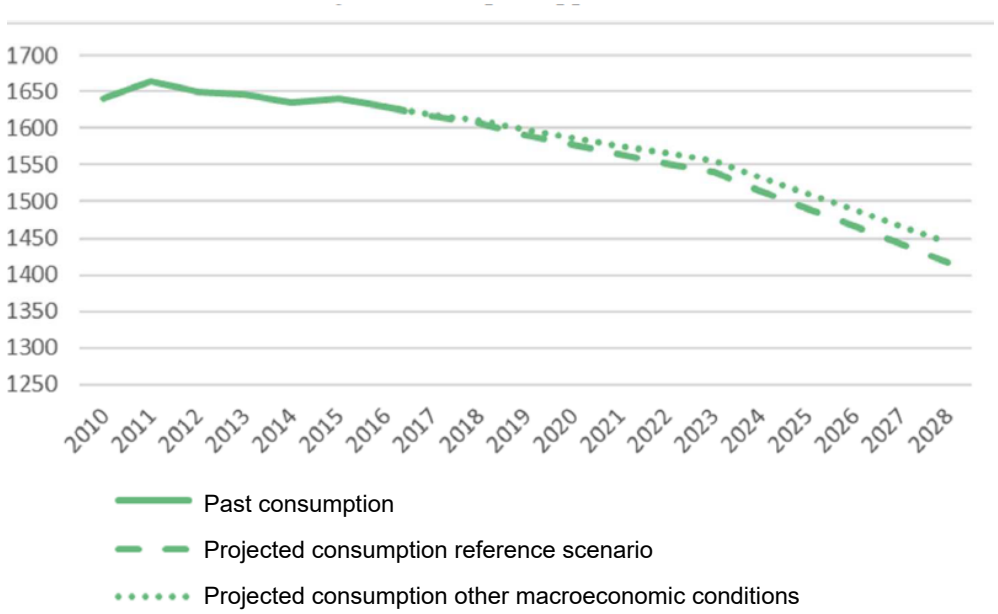
- producing domestic hot water using a solar thermal water heater;
- connecting to a heating network for which renewable or recovered energy accounts for more than 50% of the fuel supply;
- proving that the building's energy consumption includes a minimum of 5 kWh/m2 per year of primary energy produced from an individual renewable energy source;
- producing domestic hot water using a thermodynamic water heater;
- producing heating and/or domestic hot water using a micro-combined heat and power boiler.

The 2012 TR will be replaced by the 2020 Environmental Regulation as of 1 January 2021, which will raise the thermal and environmental standards in new-builds.

6. Energy savings certificates

Energy efficiency improvements are mainly based on a market mechanism – energy savings certificates. They oblige the supplier to carry out energy efficiency measures, directly or indirectly. Each energy saving measure carried out under the scheme is credited with certificates that can be exchanged to meet the obligation. This system enables around 530 TWh of cumulative energy savings a year, generating between €2 and 3 billion of investment. The multi-annual energy programme provides for the certificates scheme to be extended to cover the entire period, laying down the targets based on the estimated potential savings. The projection of the energy scenario enables us to anticipate the development of final energy consumption. The figure below shows the desired range for final energy consumption. The curves indicate the extremes associated with different macroeconomic situations. The details of the development per sector are set out in the sections below. In the reference scenario, the multi-annual energy programme should lead to a reduction of 16.5% in final energy consumption by 2028 compared with 2012.

The figure below shows the desired range for final energy consumption. The curves indicate the extremes associated with different macroeconomic situations. The details of the development per sector are set out in the sections below. In the reference scenario, the multi-annual energy programme should lead to a reduction of 16.5% in final energy consumption by 2028 compared with 2012.



3.2 Support schemes for biomethane injection

In late 2017 there were almost 400 projects relating to installations producing biomethane, with total potential production of 8 TWh a year. Taking into account this large number of projects, some stakeholders would like to see a target for renewable gas production higher than the target of 10% by 2030 laid down in Article L.100-4 of the Energy Code. The cost of generating biomethane is significantly higher than the price of natural gas. In 2018 the average purchase price for injected biomethane was €102/MWh GCV, as opposed to an average price for natural gas on the French market of €23/MWh GCV. The development of this sector therefore requires public funding. Even with the expected cost reductions, it is not possible to envisage the development of the sector without public funding in the period covered by the multi-annual energy programme.

The two support schemes currently in place are the feed-in tariff and the support from the ADEME Heat Fund. The tender scheme currently being used in the field of renewable electricity has been extended by an order to cover the injection of biomethane. This scheme, which aims to offset any disparity between production capacity for biomethane

and the targets in the multi-annual energy programme, first needs to be regulated by a Decree of the Council of State. This is currently being drawn up.

3.3 Support schemes for renewable energy production

In order to achieve the renewable energy production targets, the Government has two main types of support scheme available:

- direct support, open to all eligible installations. In accordance with European guidelines, this is now reserved for 'small' installations.
- tenders, where support is granted to the successful tenderers.

This support may take two forms, a feed-in tariff or a feed-in premium, introduced by the Act on the Energy Transition for Green Growth (*loi relative à la transition énergétique pour la croissance verte*).

For each sector, the feed-in tariffs and feed-in premium are intended, in accordance with the law, to ensure normal profits on invested capital and are reviewed regularly in order to keep in line with the maturity of the sector and the falling production costs.

Within these support schemes, this may take two forms, a feed-in tariff or a feed-in premium, the choice depending on the output of the installation.

The additional costs resulting from these support schemes form part of the public energy service charges that are reimbursed to the operators that bear them. Since the reform of the CSPE through the 2015 Amending Finance Act, these costs are included in the national budget. The costs of support for renewables in particular are expenditure reported by programme 764 in the account earmarked for the energy transition.

1. Tariff Orders

Solar power in mainland France: Order of 9 May 2017 laying down the conditions of purchase for electricity generated by installations sited on buildings using photovoltaic power with installed peak capacity no higher than 100 kilowatts as referred to in paragraph 3 of Article D.314-15 of the Energy Code and located in mainland France.

Solar power in non-interconnected areas: Order of 4 May 2017 laying down the conditions of purchase for electricity generated by installations sited on buildings using photovoltaic power with installed peak capacity no higher than 100 kilowatts as referred to in paragraph 3 of Article D.314-15 of the Energy Code and located in Corsica, Guadeloupe, French Guiana, Martinique, Mayotte and La Réunion.

Geothermal: Order of 13 December 2016 laying down the conditions for the feed-in premium for electricity generated by installations primarily using energy extracted from geothermal deposits as referred to in paragraph 5 of Article D.314-23 of the Energy Code.

Biogas: Order of 13 December 2016 laying down the conditions of purchase for electricity generated by installations mainly using biogas produced by anaerobic digestion of non-hazardous waste and crude vegetable matter located in mainland France with installed capacity lower than 500 kW as referred to in paragraph 4 of Article D.314-15 of the Energy Code.

Biogas from waste water treatment plants: Order of 9 May 2017 laying down the conditions for the purchase of and feed-in premium for electricity generated by installations mainly using biogas produced by anaerobic digestion of material resulting from the treatment of urban or industrial waste water.

Wind: Order of 6 May 2017 laying down the conditions for the feed-in premium for electricity generated by power plants using wind power with a maximum of six wind turbines.

Wind power in cyclone regions: Order of 8 March 2013 laying down the conditions of purchase for electricity generated by installations using wind power located in regions particularly at risk of cyclones and with a forecasting and electricity generation smoothing system.

Hydroelectric: Order of 13 December 2016 laying down the conditions for the purchase of and the feed-in premium for electricity generated by installations using hydropower from lakes, watercourses and water collected by gravity flow.

2. Calls for tender

Offshore wind power

The schedule of calls for tender for offshore wind projects is laid down in the multi-annual energy programme, which identifies seven projects to be awarded between 2019 and 2023 with a total output of between 3.85 and 4.35 GW. A 600 MW project off the coast of Dunkirk was awarded in June 2019. The public consultation prior to the launch of the tender procedure for the 1 GW project off the coast of Normandy runs from 15 November 2019 to 15 May 2020. The public consultation prior to the launch of the tender procedure for the 250 MW floating project south of Brittany will start in May 2020.

Onshore wind power

Between February 2018 and July 2019, four periods of calls for tender were organised for 500 MW projects. A total of 1,787 MW of projects were selected.

Solar

Between March 2017 and August 2019, calls for tender resulted in the selection of:

- 4,040 MW of ground-based photovoltaic projects;
- 1,164 MW of projects on buildings;
- 100 MW of projects for own consumption.

Biomass

Between March 2017 and August 2019, three periods of calls for tender resulted in the selection of 182 MW of co-generation projects using wood as biomass and 7 MW of co-generation projects using biogas.

3.4 Support scheme for the transport sector

1. Earmarked account

The earmarked account 'Support for the purchase of clean vehicles' traces the revenue from vehicle penalties and the expenditure on the environmental bonus for cars, light commercial vehicles, electric two- or three-wheeled vehicles and quadricycles, and electric bicycles.

The account covers the two following programmes:

- programme 797 – support for the purchase of clean vehicles by natural persons, to fund the bonus for natural persons.
- programme 798 – support for the purchase of clean vehicles by legal persons, to fund the bonus for legal persons.

In the first half of 2019, the Services and Payment Agency, which is in charge of processing bonus files, paid 27,956 bonuses for passenger cars and light commercial vehicles totalling €166.9 million, which corresponds to an increase of 11.4% on the first half of 2018.

It also paid 7,093 bonuses for two- or three-wheeled motor vehicles and electric quadricycles totalling €5.4 million, which corresponds to a twofold increase on the first half of 2018.

The revenue from the penalties in the first half of 2019 amounted to €246.9 million, corresponding to a fall of 10% on the first half of 2018.

2. The new vehicle purchase bonus

In 2019 the environmental bonus applies to cars and light commercial vehicles that emit less than 21 gCO_2/km, vehicles in category M2 or N2 under the weight exemption provided for in paragraph IV of Article R.312-4 of the Highway Code and with a total maximum authorised mass of no more than 3.5 tonnes that emit less than 21 gCO_2/km, new electric two- or three-wheeled vehicles and quadricycles and electric bicycles.

Trend in vehicle sales

Number of registrations	**2018**	**1st half 2019**
New electric cars	32,093	20,745
New electric light commercial vehicles	8,049	4,217
New electric two- or three-wheeled vehicles and quadricycles	6,070	6,020

Environmental bonuses paid by the Services and Payments Agency in the first half of 2019

Vehicle categories	**Number of files paid (including carried over from 2018)**	**Amount of programme expenditure (in € million)**
Cars and LCVs	35,049	166.9
Two- or three-wheeled vehicles and quadricycles	7,093	5.4

In the first half of 2019, 32,093 passenger cars benefited from a bonus out of a total of 1,060,251 new cars registered, corresponding to 3% (compared with 1.6% in 2018).
The expenditure for the bonus in 2020 is estimated at €395 million in the 2020 Finance Bill (taking into account the effect of payments carried over from one year to the next).

3. Public support mechanisms for biofuels

The development of alternative fuels has been clearly identified as an important instrument to achieve our renewable energy target for transport, which is set at 10% by 2020 under the Renewable Energy Directive (RED) and 15% by 2030 (Act on the Energy Transition for Green Growth; RED II lays down 14%). All vehicle fuels currently on the market contain a proportion of biofuels. All French vehicles therefore have biofuels in their engine. Biofuels help to reduce greenhouse gas emissions from fuel and maintain the economic balance of farms.
France has a policy of promoting biofuels. The blending targets are laid down in law, with a particular emphasis on combating the greenhouse effect. In the multi-annual energy programme, biofuels contribute to achieving a number of quantified objectives that France has set, such as a reduction in greenhouse gases of 40% between 1990 and 2030, carbon neutrality by 2050, a reduction in fossil fuels of 40% by 2030 compared with 2012 and 32% of final energy consumption from renewable energy by 2030 (while bearing in mind the target of a 50% reduction in energy consumption by 2050).

Article 266 *quindecies* of the Customs Code lays down the support scheme for the blending of biofuels. It entails a reduction in the incentive tax for the blending of biofuels in proportion to the amount of biofuels blended (measured as energy) relative to the annual target set (7.9% as energy for petrol and diesel in 2019). In order to be eligible for this tax reduction, biofuels must be certified as sustainable in accordance with the criteria laid down in the Energy Code. In particular, they must be shown to reduce greenhouse gas emissions by at least 50% over their lifecycle compared with fossil fuels and be shown not to contain plant matter from areas with high biodiversity.

This tax scheme helps to reduce the price at the pump for fuel with a higher proportion of biofuels than the target and to increase the price of fuels with a proportion below the target. As it is a dissuasive tax, it does not yield a return for the State, but of course this does not mean that the blending of biofuels does not have a cost to the consumer. The cost depends on the price of the various materials and on the prices charged, but a frequent estimate is a surcharge for biofuels of between 0.5 and 3 cents per litre at the pump.

Some fuels that contain a high proportion of biofuels (E85, B100, ED95) also benefit from a very low domestic consumption tax on energy products, which increases the price difference at the pump, despite their production cost being higher overall than for petroleum products.

3.5 Research and innovation

Support for research is one of the key strategies driving energy transition and is intended to help the relevant sectors to mature and become competitive.
Our public research bodies actively contribute to various sectors: IFPEN works actively on biofuels and offshore wind power in particular, CEA works on solar power and hydrogen, and the CNRS laboratories make important contributions to more basic research.

The ‘Future Investments’ programme, established through the initial 2017 Finance Act(Act No 2016-1917 of 29 December 2016), has a budget of €10 billion in commitment authorisations to implement the third future investments programme (PIA 3), in addition to the €47 billion from the previous two programmes.

- Our institutions for the energy transition actively contribute to advancing research and innovation through their public-private partnership. For renewable energy, IPVF and INES 2 are working on solar power, FEM on marine energy and Supergrid on networks.
- ADEME demonstration funding. Between 2010 and 2018, support was granted to 758 projects focusing on new technology under 85 calls for proposals. The total funding amounted to €2.5 billion (project budgets totalled over €7.2 billion). In relation to renewable energy alone, 70 demonstration projects and pre-production trials received a total of €302 million in funding (excluding marine renewable energy), contributing to a total investment of over €815 million. In addition, 88 SMEs have received support under the SME Initiatives and the Innovation Competition.
- Numerous model projects have been supported, such as:
    - four pilot floating wind farms;
    - Wagabox (inaugurated in December 2018), which enables biogas from landfill sites for non-hazardous waste to be purified so that it can be injected into methane grids.
- Support for projects is increasing, with significant funding provided by ADEME and numerous ongoing and forthcoming calls for proposals – the innovation competition aimed at start-ups and SMEs, a series of calls for proposals for demonstration projects, in particular for energy systems and sustainable cities, autonomous and low-carbon vehicles, and the bioeconomy.

Additionally, the DGEC is proposing a range of tools for the pre-deployment of innovation to complement the more traditional tools.

- Call for tender for innovative solar power: innovative ground-based power plants and plants mounted on buildings, including agricultural buildings, car park solar canopies and agrivoltaics (with a control system).
- Inclusion of funding innovations in the renewable electricity support schemes: bonus for crowdfunding in the context of a feed-in tariff, a scheme for encouraging own consumption.
- The energy savings certificate scheme, which could yield significant additional revenue for innovative projects.

France must continue its efforts to deploy innovations:

- Continue and expand support for R&D and innovation for the energy transition, in particular through the Future Investments programme in line with the broad guidelines drawn up by the Innovation Council, which was established in 2018.
- Strengthening French participation in major international research programmes, in particular the future framework programme Horizon Europe.

A number of challenges remain:

- Offering renewable energy systems to the public at an acceptable cost;
- Innovating for tomorrow's electricity grid: developing integrated energy systems to address the intermittent nature of certain renewables. There are significant challenges relating to storage, in particular of hydrogen, demand-side management and vehicle-to-grid;
- Encouraging acceptance, in particular by using digital technology to get the public more involved in their own energy transition.

3.6. Amount of expenditure on support for renewable energy

1. Electricity generation

The cost of renewable energy generation support schemes has risen from €1.5 billion in 2011 to €4.4 billion in 2016, i.e. a threefold increase in the space of five years. According to the initial estimates made in the context of the multi-annual energy programme, by 2023 these costs were expected to reach between €9.7 billion and €10.4 billion. The Energy Regulation Commission (CRE) has re-evaluated these projections, taking into account the observed or expected rate of development of installations. Its hypotheses now include only 1.5 GW of actual installed offshore wind capacity by 2023. Following this adjustment, the provisional cost of support for renewable electricity should be €7.5 billion in 2023.

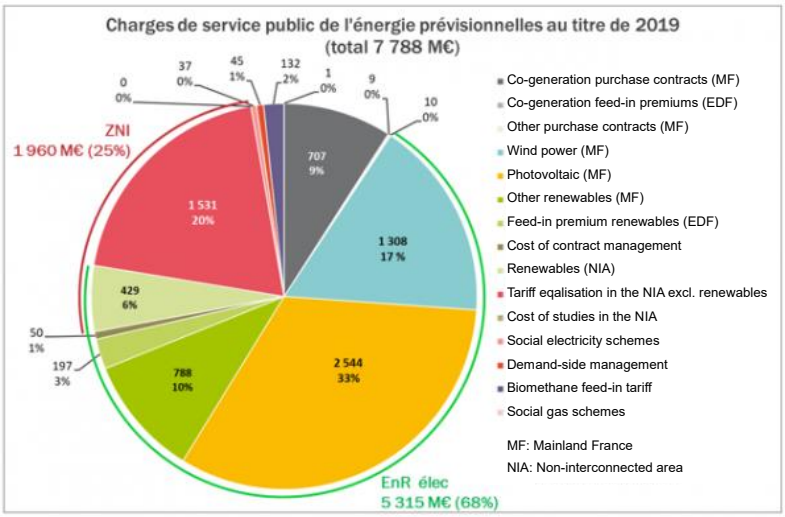
Equipment	Complete cost of renewable electricity generation in €/MWh Range Min - Max
Wind	68 - 108
Offshore wind	130 - 329
Residential photovoltaic	223 - 407
Commercial photovoltaic	139 - 246
Ground-based photovoltaic	92 - 167
Solar thermal	113 - 249
Geothermal	51 - 301

Source : ADEME – complete costs of renewable electricity generation in EUR/MWh, 8% discount rate

Each year, the CRE records the costs that purchase contracts, additional payment contracts and other public service tasks (price adjustments and the application of social measures) have represented for operators in the previous year and, at the same time, draws up a forecast for the following year and updates the forecast for the current year. This forecast is used for the draft Finance Act, so that the amounts to be charged to the budget for the coming year can be adopted. For the feed-in tariff, the purchaser's avoided costs are set by sector. For each sector, the CRE distinguishes between production considered to be 'quasi-certain' and 'chance' production. The avoided cost of quasi-certain production is calculated by reference to forward market prices, while the cost of chance production is calculated by reference to the spot price.

The cost of support for renewable energy is borne by the 'energy transition' earmarked account.

The total cost of support for the generation of renewable electricity is €5,315 million, or 68% of all public energy service charges in 2019. This amount is 5% higher than the forecast for 2018 (€5,047 million) and 16% higher than the actual charges for 2017 (€4,596 million). This increase is primarily the result of efforts to develop sectors for the generation of electricity from renewable sources, in particular solar power (€2,874 million) and wind power (€1,333 million).



Source : CRE – Figure: Projected public energy service charges for 2019

2. Injection of biomethane into gas grids

There is also a rapid rate of change in support for injected biomethane. There was €20.9 million of support in 2016 and this should reach €326 million in 2023.

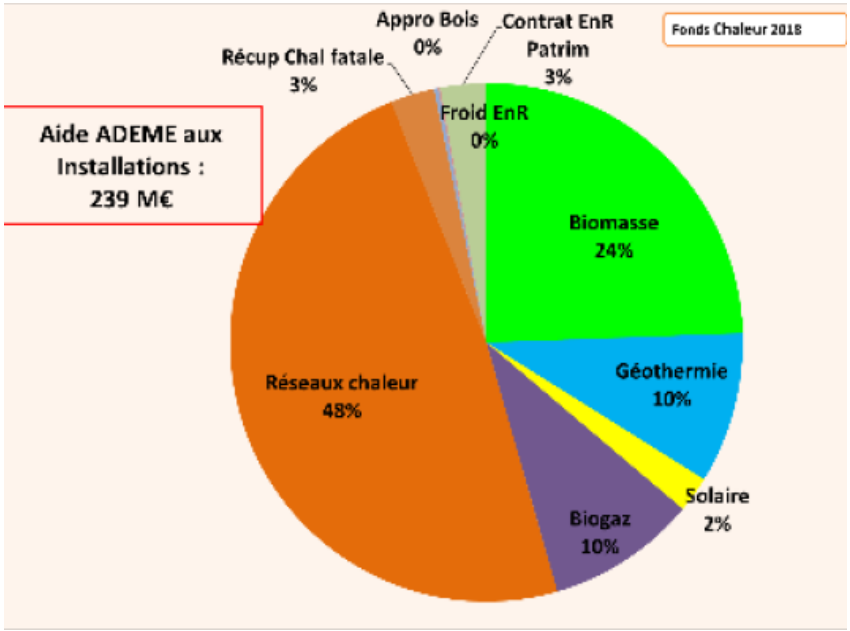
In its decision of 12 July 2018, the CRE estimated the cost of support for biomethane injection in 2019 at €132.1 million, or 1.7% of the total public energy service charges in 2019. This is over twice the forecast for 2018 (€63.9 million) and four times the actual charges in 2017 (€32.8 million). This increase is mainly due to an increase in the number of plants producing biomethane, which should lead to a twofold increase in the amount of gas being injected.

3. Heat production

The Act on the Energy Transition for Green Growth has laid down a target of 38% for heat consumed that comes from renewable sources by 2030. The share was 21% in 2018 and has increased by an average of 0.8% a year since 2010.

The Act on the Energy Transition for Green Growth has also set a target for a fivefold increase in the amount of renewable heating and cooling and heat recovery from district heating and cooling networks by 2030. In 2017 district heating supplied 25 TWh of net heating, of which 56%, or 14 TWh, was from renewable energy and recovery. This is a twofold increase on 2012. The multi-annual energy programme breaks these targets down by sector and sets targets for 2018 and 2023. The Heat Fund contributes to achieving these targets. The Heat Fund will enable a reduction of 4.9 million tonnes of CO_2 emissions a year and will also have a positive impact on imports of fossil fuel energy. In the period 2009-2018, the Heat Fund resulted in the additional replacement of 2.37 Mtoe a year. Based on a price of €53 for a barrel of oil (1 barrel = 0.136 toe), the reduction in imports of fossil fuels was around €923 million in 2018 (this saving will be repeated every year for around 20 years). The Heat Fund therefore contributes to the trade balance and to France's energy independence.

Furthermore, 505 investments benefited from support from the Heat Fund in 2018, corresponding to a total investment amount of €892 million, which will enable 225 ktoe/year (2.6 TWh/year) to be generated, compared with 180 ktoe/year (2.1 TWh/year) in 2017. The total commitments amount to €258 million (of which €239 million for investments and €19 million for support activities). The rate is €4.95/MWh, which is slightly higher than the 2017 rate of €4.80/MWh.



Aide ADEME aux installations: 239 M€	ADEME support for installations: €239 million
Fonds chaleur 2018	Heat Fund 2018
Biomasse	Biomass
Géothermie	Geothermal
Solaire	Solar
Biogaz	Biogas
Réseaux chaleur	District heating
Récup. chal. fatale	Waste heat recovery
Appro bois	Wood supply
Contrat EnR patrimoine	Property renewables contract
Froid EnR	Renewable cooling

The Heat Fund generates investments three times higher than the support granted.

4. Cross-cutting support

CITE

The 2015 Finance Act introduced the energy transition tax credit (CITE) with retroactive effect from 1 September 2014. There are currently 900,000 households benefiting from the CITE, with an average tax credit of around €1,000 per household. It is supporting around €3.6 billion of investments in 2019.The 2019 Finance Act continued efforts to streamline the CITE by increasing the performance requirements for gas boilers and by reintroducing windows, with stricter efficiency requirements than previously. Increased support was also introduced for low-income households, with some measures introduced specifically for such households (removal of oil-fired boiler and installation of renewable heating equipment).

Eco-loans

Tax expenditure due to the interest-free eco-loans occurs one year after the loan is granted and is spread over five years. The tax expenditure corresponding to the year of the budgetary impact has therefore been calculated for the years 2009 to 2019 and estimated for 2020, as shown in the table below.

Year of budget impact	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tax expend-iture	0	€30 million	€70 million	€95 million	€110 million	€120 million	€110 million	€75 million	€57 million	€46 million	€39 million	€35 million (estimate)

Energy Improvements Guarantee Fund

Finally, the funding from the Energy Improvements Guarantee Fund was made operational in 2019 through a contribution from EDF in the context of a programme under the energy savings certificate scheme. Up to €57 million could be paid into the fund over the next three years.

3.7. Information on how supported electricity is allocated to final customers for the purposes of Article 3(6) of Directive 2003/54/EC

In accordance with Article 5 of Decree No 2004-388 of 30 April 2004, electricity suppliers are required to inform final customers of the origin of the electricity supplied, as laid down in Article 3(6) of Directive 2003/54/EC. Suppliers must therefore specify in their electricity bills to final customers:

- the various primary energy sources used to generate the electricity that they sold over the preceding year;
- the contribution of each primary energy source to the supplier's overall electricity supply over the preceding year;
- a reference to publications concerning the environmental impact of the electricity generated by all the primary energy sources used by the supplier.

This decree was initially amended by Decree No 2012-62 of 20 January 2012 on electricity origin guarantees in order to stipulate that the amount of energy generated from renewable sources corresponding to guarantees of origin transferred from an electricity supplier to a third party is not to be taken into account when determining the share of primary energy sources, in accordance with Article 15(8) of Directive 2009/28/EC.

The provisions were then amended again by Decree No 2016-944 of 11 July 2016 laying down various provisions for adapting the Energy Code to European Union law as regards the production of electricity from renewable sources and co-generation. The Decree introduced into legislation the concept of the residual mix (consumption mix from which used and exported guarantees of origin are deducted) such that the information used by suppliers who do not apply a traceability system to their supply (and therefore indicate the national production mix) is as accurate as possible and rules out any possible double counting for green electricity. The Decree also lays down that suppliers must use guarantees of origin if offering a renewable share which is greater than the renewable share in the residual mix.

Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market for electricity currently lays down that this information must be provided per product supplied. This provision will soon be transposed into French law.

4. Information on how the support schemes have been structured to take into account, where applicable, RES applications that give additional benefits, but may also have higher costs (including biofuels made from waste, residues, non-food cellulosic material, and ligno-cellulosic material)

For electricity and heat generation, support schemes are matched to each sector to ensure that support is given to all technologies, including those which have additional advantages (in terms of the environment, jobs, security of supply) but entail higher costs.

Examples include calls for tender targeting both photovoltaic energy and storage in order to overcome the issue of intermittence, or the anaerobic digestion sector, which contributes to waste management policy, in particular as regards agricultural waste (manure).

With regard to the generation of renewable heating and cooling, aid amounts are calculated such that heating is approximately 5 % cheaper than the price of the reference fossil-based alternative.

With regard to the transport sector, the TIRIB scheme (incentive tax for biofuel blending) was amended in the 2019 Finance Act. Biofuels produced from waste and residue may be counted twice under the TIRIB. In other words, the share of renewable energy represented by such biofuels is counted twice for the purposes of the blending target. Double counting gives the products in question a competitive advantage. It encourages the development of biofuels not competing with food whilst helping to draw value from used cooking oils, animal fat, grape marc and wine lees, or raw ligno-cellulosic material.

Article 266 *quindecies* of the Customs Code lays down the implementing arrangements for double counting and lists the biofuels eligible for the reduction under the TIRIB. In particular, it provides:

- the targets for renewable energy content of fuels released for consumption;
- a ceiling of 7% of energy from raw materials for production of conventional biofuels, i.e. from food crops;
- the list of raw materials from which it is possible to produce advanced biofuels eligible for double counting, with direct reference to Annex IX-A to the Renewable Energy Directive (2009/28/EC);
- the list of raw materials from which it is possible to produce biofuels other than advanced biofuels eligible for double counting, with direct reference to Annex IX-B to the Renewable Energy Directive (2009/28/EC);

For 2020, it limits the amount of advanced biofuels under Annex IX-A to Directive 2009/28/EC that can be double counted to 0.5% blending for the diesel sector and 0.6% for the petrol sector, and the amount of biofuels under Annex IX-B to Directive 2009/28/EC to 0.45% for the diesel sector and 0.05% for the petrol sector. This helps to limit the dead-weight effects which resulted in considerable imports of waste and biofuels produced from waste in 2011.

5. Information on the functioning of the system of guarantees of origin for electricity and heating and cooling from renewable energy, and the measures taken to ensure reliability and protection of the system against fraud

France did not consider it appropriate to establish a system of guarantees of origin for heating and cooling from renewable energy sources, this not being a requirement under EU legislation. However, it did set up such a system for biomethane injected into the gas grid.

As regards the guarantees of origin for electricity generated from renewable sources or by co-generation, Articles L.314-14 to L.314-17 of the Energy Code and Decree No 2012-62 of 20 January 2012 brought the guarantee of origin system into line with the requirements under Article 15 of Directive 2009/28/EC. These articles state, in particular, that guarantees of origin are the only possible means of certifying the renewable nature of electricity generation.

Powernext was appointed to hold the French national register of guarantees of origin from 1 May 2013 to 30 April 2018 by an Order of the Minister for Energy of 19 December 2012, published on 15 January 2013 in the Official Journal of the French Republic. This appointment was extended until 31 December 2018 by an Order of 18 August 2018. By an Order of 24 August 2018, Powernext's appointment was renewed for a further five years following a call for tender. The renewal came into effect on 1 January 2019 and will expire on 31 December 2023. On 1 January 2020 Powernext merged with European Energy Exchange AG (EEX), which was appointed to hold the national register of guarantees of origin in place of Powernext by Ministerial Order of 12 December 2019. Thus, EEX was entrusted with ensuring the accuracy, reliability and protection against fraud of the guarantee of origin system. EEX sends a yearly report to the Minister responsible for energy on the guarantees of origin issued in the course of the preceding year.

Since September 2019, the guarantees of origin for electricity generated by renewable electricity installations have benefited from a support scheme (in the form of a purchase obligation or feed-in premium) and have been auctioned by the State in accordance with Article L.314-14-1 of the Energy Code. The provision follows on from Act No 2017-227 of 24 February 2017 and amends the framework previously in force which laid down that purchasers bound by the obligation replaced producers in their right to obtain guarantees of origin. This replacement was introduced to stop consumers from double counting the value of the renewable share of electricity. The economic valuation of the guarantee of origin by purchasers under obligation was systematically deducted from the overall amount of compensation that they receive via public energy service charges. With the introduction of the feed-in premium in which producers sell their production themselves and receive a premium to cover the difference between their production costs and the market price, it was impossible to replicate this system. This is why France wished to set up a new auction mechanism, thereby also preventing any doubling of value. Producers will still be unable to directly draw value from the guarantees of origin in addition to their support scheme. Moreover, the auction revenue will reduce the cost of support for renewable electricity borne by the local authorities.

Producers wishing nevertheless to issue guarantees of origin whilst benefiting from a support scheme will be able to do so, but will lose their support and will have to reimburse the funds received.

6. Description of developments in the preceding two years in the availability and use of biomass resources for energy purposes

The biomass sector represented 14.2 Mtoe (165.3 TWh) or more than 55% of final renewable energy consumption in France in 2018 (December 2019 estimates) in the form of electricity, heat and fuel. The sector therefore represented around 9% of total final energy consumption in France, which was 153.2 Mtoe (1,782 TWh) in 2018 (December 2019 data).

Of this biomass, 73% is consumed in the form of heat (10.4 Mtoe) produced from solid biomass, renewable waste and biogas and represents three quarters of the renewable heat consumed in France (the rest being produced primarily by heat pumps). Of the remainder, 5% is consumed in the form of electricity and 22% in the form of biofuels.

Solid biomass is the largest source (73% of total consumption). It is used for heat generation or for co-generation, mainly using wood, but also using renewable waste, paper industry by-products (black liquor) and agri-foodstuffs or agricultural products.

Energy generation from gaseous biomass (4% of the total) is carried out through the recovery of landfill gas and anaerobic digestion of agricultural residues and domestic and food industry waste.

Renewable energy (capacity in MW)	Achieved 2017	Achieved 2018	Target 2018 PPE 1	Target 2023 PPE 2	Target 2028 PPE 2 low	Target 2028 PPE 2 high
Wood energy	559	635[(1)]	540			
Biomass co-generation (excl. biogas)		692[(2)]		800[(3)]	800	800
Anaerobic digestion	147	163	137	270	340	410

In order to accelerate the use of biomass in a sustainable manner whilst preventing conflicts of use, the Act on the Energy Transition and Green Growth laid down that action plans should be drawn up at regional and national level. Decree 2016-1134 of 19 August 2016, adopted pursuant to Article L.211-8 of the Energy Code and Article L.222-3-1 of the Environmental Code, lays down the content of the national biomass action strategy and the regional biomass plans and the arrangements for coordinating them.

The national biomass mobilisation strategy was published on 26 February 2018. It links in to the national low-carbon strategy (SNBC) and the multi-annual energy programme (PPE), reproducing the targets regarding biomass demand for energy use. The national biomass action strategy (SNMB) also links in to the national forest and wood programme (PNFB), also reproducing the targets for timber. It offers recommendations to improve and increase the use of domestic biomass in order to fulfil the needs identified for biomass for energy purposes and for construction or biomaterials and green chemistry from domestic resources as far as possible.

7. Information on changes in commodity prices and land use in the preceding two years associated with increased use of biomass and other forms of energy from renewable sources

With regard to wood energy, the Wood Economy Research Centre (CEEB) has been carrying out surveys since 2011 on behalf of the Statistical and Forecasting Department (SSP) of the Ministry of Agriculture on wood energy from forests and on behalf of the Ministry of Finance for other types of wood energy.

This work has enabled wood energy price indices to be published in France (32 indices in 17 categories).

Development in the price of various commodities 2017/2011

	2011	2014	2015	2016	2017-T4	2015/2011	2016/2011	2017/2011	2015/2014	2016/2014	2017-T4/2016
Woodchips, sawmill	37,48 €	45,83 €	43,60 €	42,69 €	42,91 €	16,33%	13,90%	14,49%	-4,87%	-2,09%	0,52%
Softwood sawdust	35,70 €	44,50 €	41,45 €	39,03 €	41,62 €	16,11%	9,33%	16,58%	-6,85%	-5,84%	6,64%
EOW woodchips, packaged (ex A woodchips)	30,43 €	48,07 €	48,84 €	49,16 €	47,39 €	60,50%	61,55%	55,73%	1,60%	0,66%	-3,60%
Roadside timber	31,60 €	40,29 €	39,82 €	36,46 €	34,45 €	26,01%	15,38%	9,02%	-1,17%	-8,44%	-5,51%
Forest woodchips C1	79,56 €	84,40 €	79,70 €	80,08 €	82,58 €	0,18%	0,65%	3,80%	-5,57%	0,48%	3,12%
Forest woodchips C3	42,83 €	57,73 €	51,23 €	49,31 €	44,24 €	19,61%	15,12%	3,29%	-11,26%	-3,75%	-10,28%
Pellets, bag	201,85 €	196,35 €	183,33 €	175,25 €	185,92 €	-9,18%	-13,18%	-7,89%	-6,63%	-4,41%	6,09%
Pellets, loose	174,80 €	223,40 €	201,21 €	192,52 €	204,88 €	15,11%	10,14%	17,21%	-9,93%	-4,32%	6,42%

Source: CEEB, étude bois énergie 2018

8. Development of the share of biofuels made from waste, residues, non-food cellulosic material, and ligno-cellulosic material

France is one of the countries in Europe that has made most progress in the development of biofuels. It is the world's fourth largest producer of biofuels (5% of global production) after the United States, Brazil and Germany, with over two million tonnes of biofuel production.

The development of alternative fuels has been clearly identified as an important instrument to achieve our renewable energy target for transport, which is set at 10% by 2020 under the Renewable Energy Directive (RED) and 15% by 2030 (Act on the Energy Transition for Green Growth; RED II lays down 14%). All vehicle fuels currently on the market contain a proportion of biofuels. All French vehicles therefore have biofuels in

their engine. Biofuels help to reduce greenhouse gas emissions from fuel and maintain the economic balance of farms.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Petrol	7	7	7	7	7	7	7	7	7.5	7.5	7.9
Diesel	7	7	7	7	7	7.7	7.7	7.7	7.7	7.7	7.9

Development of biofuel blending targets since 2009 (energy share, in %)

Among these biofuels, the share of biofuels produced from advanced raw materials listed in Annex IX-A to Directive 2009/28/EC was 0.09% in 2018 and 0.13% in 2019 (by volume, without double counting, across all petrol and diesel fuels). This corresponded to 50 million litres of advanced biofuels in 2018 and 73 million litres in 2019. These biofuels are mainly produced from wine industry residues. In 2018, 234 million litres of biofuels produced under Annex IX-B (used oil and animal fat) were also included, representing 0.42% of fuels released for consumption (by volume, without double counting).

9. Estimated impact of the production of biofuels and bioliquids on biodiversity, water resources, water quality and soil quality in the preceding two years

The impact of biofuel production on these natural resources has not been assessed in the last two years.

10. Estimated net greenhouse gas emission savings due to the use of renewable energy

Greenhouse gas savings linked to the development of renewable energy (in Mt CO_2 eq)

Form of renewable energy	2016	2017	2018
Total estimated net GHG emission saving from using renewable energy	**69.1**	**71.1**	**74.1**
Estimated net GHG saving from the use of renewable electricity	40.1	41.4	43.7
Estimated net GHG saving from the use of renewable energy in heating and cooling	21.7	22.1	22.8
Estimated net GHG savings from the use of renewable energy in transport	7.3	7.6	7.6

Methodology:

The greenhouse gas emission savings from the development of renewable energy have been estimated for 2017 and 2018. An estimation has also been made for 2016. The estimation was carried out using a lifecycle analysis (LCA), comparing the emissions from renewable energy with the emissions from their fossil fuel equivalents. Certain changes in methodology (updating certain emission factors) led to a re-estimation of the emission savings for 2016 compared with the previous reporting.

10.1. Estimated net GHG saving from the use of renewable electricity

In line with current standards, the counterfactual scenario to the development of renewable energy is to rely on gas-fired plants. The net GHG emissions saving from the use of renewable electricity is therefore calculated based on consumption of electricity produced from different renewable sources compared to the 'combined-cycle gas' reference mix.

The LCA emission values are taken from the Environment and Energy Management Agency's (ADEME) 'carbon database'[1] and records[2] (version of March 2020).

GHG emissions savings from the production of **renewable electricity** are estimated at **41.4 and 43.7 Mt CO_2eq in 2017 and 2018** respectively.

Electricity	Emissions (kg CO2/kWh)	Reduction vs reference mix	Amount of energy 2016 (MWh)	Emission savings 2016 (Mt CO2eq)	Amount of energy 2017 (MWh)	Emission savings 2017 (Mt CO2eq)	Amount of energy 2018 (MWh)	Emission savings 2018 (Mt CO2eq)
Gas reference mix	418	0.0 %						
Hydro	6.0	-98.6 %	60,162	24.8	59,546	24.5	60,546	24.9
Onshore wind	14.1	-96.6 %	22,504	9.1	25,400	10.3	28,691	11.6
Solar	55.0	-86.8 %	8,664	3.1	9,583	3.5	10,572	3.8
Marine energy	6.0	-98.6 %	500	0.2	523	0.2	477	0.2
Geothermal	45.0	-89.2 %	93	0.0	128	0.0	128	0.0
Solid biomass and renewable municipal waste	36.0	-91.4 %	5,559	2.1	5,675	2.2	6,013	2.3
Biogas	67.0	-84.0 %	1,989	0.7	2,117	0.7	2,361	0.8

Total renewable electricity	**40.1**	**41.4**	**43.7**

[1] https://www.bilans-ges.ademe.fr/fr/basecarbone/donnees-consulter/index/siGras/1

[2] For electricity generated from biogas and solid biomass, the emission factors were not available in the carbon database. For biogas, an emission factor of 67 g CO_2/kWh was used, identical to the emission factor used in the previous report and consistent with a ratio of 4 between the emission factor of biogas heating and the emission factor of electricity generated from biogas. For solid biomass and renewable municipal waste, an emission factor of 36 g CO_2/kWh was used, in line with the emission factors laid down in the preparatory documents for the regulations on electricity emission factors for buildings.

10.2. Estimated net GHG savings from the use of heating and cooling from renewable energy sources

The estimation was carried out using an LCA, comparing the lifecycle emission factors of different renewable energy sources with the lifecycle emission factor of gas.

The emission factors for gas, solid biomass, biogas, biofuels and solar thermal energy were taken from the ADEME carbon database.

For geothermal energy, a hypothesis was made of an emission factor of 10 g CO_2/kWh, consistent with a ratio of 4 between the emission factor of electricity from geothermal energy and the heat generated by geothermal energy.

For heat pumps, an emission factor of 79 g CO_2/kWh was used for the lifecycle emissions of the electricity feeding the heat pump. This emission factor takes into account the electricity consumption for heating over the course of a year and the monthly emission factor of the electricity. In addition, an average performance co-efficient is used for heat pumps of 3.0. The emissions linked to any HFC leaks from heat pumps are negligible in this context.

The differences in efficiency (conversion of primary energy to useful energy) between the different energy forms are taken into account. For gas-fired heating, efficiency of 90% is used. For wood-fired heating, efficiency of 60% is used.

Overall, GHG emissions savings from the production of **renewable heat** were estimated at **22.1 and 22.8 Mt CO_2eq in 2017 and 2018** respectively.

Heat	Emissions (kg CO2/kWh)	Yield	Amount of energy 2016 (MWh)	Emission savings 2016 (Mt CO2eq)	Amount of energy 2017 (MWh)	Emission savings 2017 (Mt CO2eq)	Amount of energy 2018 (MWh)	Emission savings 2018 (Mt CO2eq)
Gas reference mix	227	0.90						
Solar thermal	13	1.00	1,931	0.46	2,000	0.48	2,105	0.50
Geothermal thermal	10	1.00	1,686	0.41	1,977	0.48	2,175	0.53
Heat pump	26	1.00	25,353	5.73	27,621	6.24	30,250	6.83
Solid biomass and renewable municipal waste	30	0.60	118,556	14.38	114,881	13.94	113,881	13.82
Biogas	16	0.90	2,780	0.59	3,222	0.68	3,570	0.75
Biofuels excl. transport	116	0.90	1,477	0.16	2,303	0.26	2,977	0.33

Total renewable heat	**21.7**	**22.1**	**22.8**

10.3. Estimated net GHG savings from the use of renewable energy in transport

The estimation was carried out using an LCA, comparing the lifecycle emission factors of biofuels with the lifecycle emission factor of fossil fuels.

The emission factors used were taken from the ADEME carbon database.

GHG emission savings from **biofuels** are estimated at **7.6 Mt CO_2eq in 2017 and 2018**.

Transport fuels	Emissions (kg CO2/GJ)	Reduction vs reference mix	Amount of energy 2016 (GJ)	Emission savings 2016 (Mt CO2eq)	Amount of energy 2017 (GJ)	Emission savings 2017 (Mt CO2eq)	Amount of energy 2018 (GJ)	Emission savings 2018 (Mt CO2eq)
Petrol								
Fossil petrol for reference	88.4							
Bioethanol	37.0	-58 %	19,845	1.02	22,573	1.16	24,542	1.26
Diesel								
Fossil diesel for reference	91.6							
Biodiesel	32.3	-65 %	105,286	6.24	108,804	6.45	107,045	6.35

Total renewable biofuels		**7.3**		**7.6**		**7.6**

11. Values and estimates for the excess/deficit production of energy from renewable sources compared to the indicative trajectory

Since 2005 the role of renewable energy has grown at the same rate in electricity (7.3 percentage points) and transport (7.2 percentage points), and slightly more significantly in heating (9.3 percentage points).

In %

	achieved			trajectory	target	target
	2005	2017	2018p	2018	2020	2030**
Electricity	13,8	19,9	21,1	24,0	27,0	40,0
Heating/ cooling	11,7	20,8	21,0	29,0	33,0	38,0
Transport*	2,0	9,1	9,2	9,4	10,5	15,0
Total	**9,3**	**16,1**	**16,5**	**20,5**	**23,0**	**32,0**

Final gross renewable energy consumption reached 25.7 Mtoe in 2018, compared with 15.4 Mtoe in 2005 – an increase of 67 %. The renewable industries that have made the greatest contribution to this development are wind power, solid biomass and renewable waste, biodiesel and heat pumps, which comprise over 86% of the increase. However, this increase is still not sufficient to meet the targets set.