



National low carbon strategy



**The ecological and inclusive transition towards
carbon neutrality**

Summary



March 2020

THE ECOLOGICAL AND INCLUSIVE TRANSITION TOWARDS CARBON NEUTRALITY

The National Low-Carbon Strategy

Implemented via the law of 17 August 2015 relating to energy transition for green growth, **the National Low-Carbon Strategy (SNBC) serves as France's policymaking road map in terms of climate change mitigation.** It is one of the two prongs of French climate policy, along with the National Adaptation to Climate Change Plan:

- This second edition of the SNBC puts into action the Government's ambition, presented in July 2017 via the Climate Plan and enshrined in the law (n° 2019-1147 of 8th November 2019 relating to energy and climate), to accelerate the implementation of the Paris Agreement by setting a target of achieving carbon neutrality by 2050 within French territories, this being understood as achieving a balance between anthropogenic emissions and anthropogenic absorption of greenhouse gas, i.e. that which is absorbed by the natural environment managed by man (forest land, grassland, agricultural soils, wetlands, etc.) and certain industrial procedures (carbon capture, storage and reuse).
- On the basis of a forward-looking trajectory to 2050, it defines short- and medium-term greenhouse gas (GHG) emission reduction targets for France: carbon budgets. These are greenhouse gas emission ceilings not to be exceeded at the national level over five-year periods, expressed in millions of tons of CO₂ equivalent¹.
- It is consistent with France's commitments to the European Union under the Paris Agreement, as well as national commitments including the 40% reduction in greenhouse gas emissions (GHG) by 2030 compared to 1990.
- It provides public policy guidelines for implementing the transition to a low carbon economy, sober in energy and materials, with circularity principles applied in all activity sectors and lower production of waste.

This strategy is the result of wide-ranging consultations with:

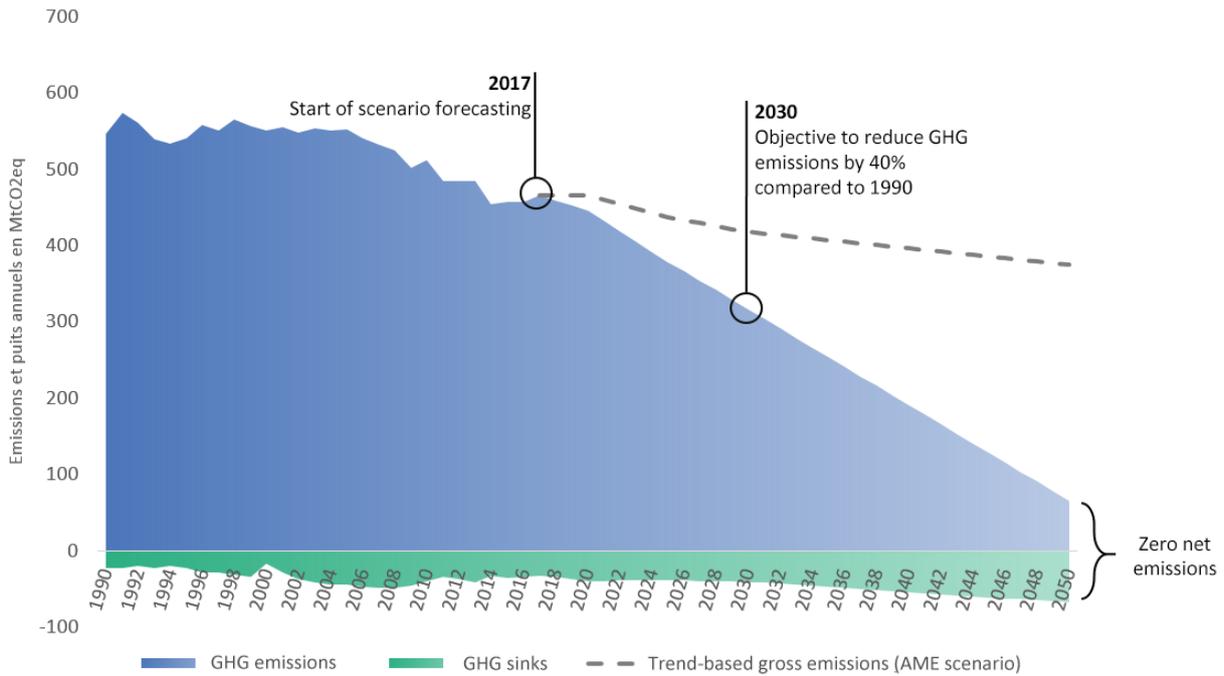
- stakeholders (businesses, NGOs, trade unions, consumer representatives, MPs, local authorities, scientific experts), over the course of thirty or so meetings with the Information and Orientation Committee (ICO) and seven themed working groups.
- the public, via a prior consultation in November and December 2017 under the supervision of a guarantor, in which an online questionnaire received more than 13,000 responses from citizens. Public discussion workshops ahead of the Multi Annual Energy Plan, which took place from March to June 2018, have also led to changes to the SNBC.

This strategy will also take into account the opinions of the Committee of Experts on Energy Transition on the implementation of the SNBC in 2015 and the compliance with the first carbon budget. The opinions issued in 2019 by the Environmental Authority, the National Ecological

¹ The carbon budgets account for the emissions recorded in mainland France, Guadeloupe, French Guiana, Martinique, Réunion, Saint Martin and Mayotte, as well as emissions from transport between these geographical areas. Emissions from international air and maritime links are not included in these readings.

Transition Council, the High Council for Climate, the Corsican Assembly, Overseas authorities and the public consultation on this strategy and its strategic environmental analysis were also taken into account.

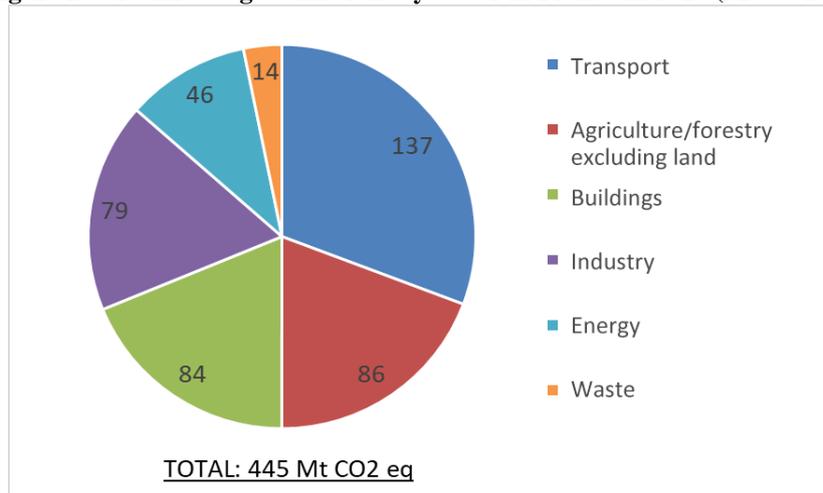
Figure 1 - Changes in greenhouse gas emissions and sinks in the national territory between 2005 and 2050



*Business-as-usual emissions are calculated using a so-called “With Existing Measures” scenario (AME scenario), which takes into account policies already implemented or enacted in 2017.

Where are we now?

Figure 2: Greenhouse gas emissions by sector in France in 2018 (Mt CO2 eq)



In 2018, France's territorial emissions were 445 MtCO2eq compared to 546 MtCO2eq in 1990 (excluding the land sector); they therefore fell by 18.5% over this period, i.e. a decrease of around 0.7% per year, and their per capita level is now one of the lowest among developed countries (6.4 tCO2eq/capita). In particular, 2018 was marked by a 4.2% decrease in emissions compared to 2017.

For the sake of simplicity, this summary will subsequently refer to French emissions in 2015, which was the last reference year when the SNBC and its scenario were drawn up and drafted (see below). These emissions were 458 Mt CO₂eq.

Since 2000, France has implemented climate policies to reduce its emissions through the National Climate Change Action Plan (2000) and successive Climate Plans. Following a national debate on energy transition in 2013 and the adoption of the energy transition for green growth act in 2015, an initial National Low-Carbon Strategy was published in 2015. This aimed to reduce greenhouse gas emissions four-fold in France by 2050, compared to 1990 levels. It was the first road map for the reduction of greenhouse gas emissions, and set the first carbon budgets up to 2028 to achieve its targets.

However, the carbon footprint of the French, which takes into account the emissions associated with imported goods and services and subtracts those associated with exports, is not decreasing. On a per capita basis, in 2018, the French carbon footprint (11.2 t CO₂eq/capita) is slightly higher than in 1995 (10.5 t CO₂eq/capita) and has remained more or less constant since 2000. Indeed, the drop in emissions in France is offset by an increase in emissions associated with imports (doubled since 1995).

In December 2015, the adoption of the Paris Agreement marked a turning point by establishing **an international framework for cooperation on climate change**, which:

- sets an objective **to limit global warming “to well below 2 °C, and pursuing efforts to limit the temperature increase to 1.5 °C”**, and to achieve a global balance between emissions and absorptions of greenhouse gas in the second half of the 21st century;
- **introduces an idea of equity to climate action:** those countries that have contributed the most to climate change (due to their past and current greenhouse gas emissions) and which are in a position to do so (capacity and potential to reduce emissions) must play a more active role in global climate action².

The Climate Plan put forward in July 2017 renewed France's long-term ambition by setting a target of carbon neutrality for France by 2050, i.e. at least a six-fold reduction in greenhouse gas emissions compared to 1990. This goal is now enshrined in legislation. Carbon neutrality is an ambitious target, but its achievement is, as evidenced by the recent work carried out by the IPCC, essential on a global level as soon as possible in order to keep global warming down to 1.5°C.

The baseline scenario

The National Low-Carbon Strategy is based on a baseline scenario developed through a joint modelling exercise in the Multi-Annual Energy Program. **This baseline scenario highlights public policy measures in addition to those already in place, which will allow France to adhere to its short, medium and long-term climate and energy objectives.**

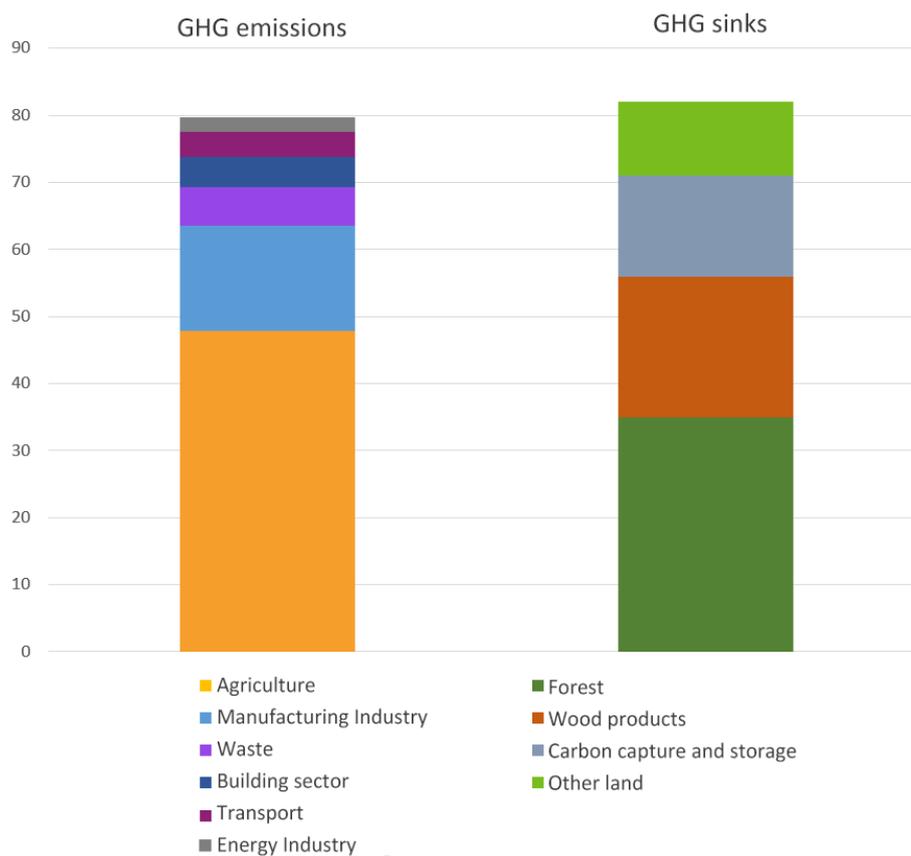
The baseline scenario is intended to be both ambitious in its objectives and reasonable in the way it is achieved, without betting on technologies that would only be at the idea stage or early R&D stage today. Nevertheless, the scenario makes use of a number of new technologies (carbon capture, use, and storage (CCUS), power-to-gas, energy storage, hydrogen...).

² The principles of “equity and common but differentiated responsibility, and respective capacities in terms of the various national situations in question.”

What lessons can be drawn from the scenario?

By 2050, France will reach a level of emissions that can be considered incompressible, particularly in the non-energy sectors (agriculture and industrial processes): around 80 Mt CO₂eq. Achieving carbon neutrality therefore involves compensating for these emissions with carbon sinks. The estimated scale of the land sector sink (forest and agricultural land) at an optimal and sustainable level of performance, coupled with an estimated capture and storage sink, only allows the offsetting of these residual non-energy emissions and the residual emissions from fossil fuels for one part of the transport sector (domestic air transport).

Figure 3 - Sinks and greenhouse gas emissions in France in 2050 according to the baseline scenario



To achieve carbon neutrality, it is necessary to:

- **fully decarbonise³ energy production by 2050** and rely only on the following energy sources: biomass resources (agricultural and wood product waste, wood energy, etc.), heat from the environment (geothermal energy, heat pumps, etc.) and carbon-free electricity; **to significantly reduce energy consumption in all sectors** (a reduction of more than 40% compared to 2015), by substantially increasing energy efficiency and developing sobriety (slightly lower population needs in all sectors compared to the business-as-usual scenario, associated with a significant change in consumption patterns, without loss of comfort);

³ In reality, decarbonisation will be “near-total”, as there will remain both residual leaks of renewable gas that cannot be reduced and the partial use of fossil fuels in air transport.

- **reduce non-energy-related emissions as much as possible** (e.g. from agriculture (reduction of almost 40% between 2015 and 2050), or from industrial processes (halving the emissions between 2015 and 2050));
- **increase carbon sinks (natural and technological) by a factor of 2 compared to today** to absorb incompressible residual emissions by 2050, while developing biomass production. In view of a certain degree of tension on biomass resources due to the current structure of the system, which is very much oriented towards liquid and gaseous fuels, biomass resources should be allocated as a priority to high value-added uses that are hardly replaceable by other processes (e.g. biofuels for maritime or air transport).

Macro-economic assessment of the revised SNBC

The results of the macro-economic assessment show that the SNBC allows for a slight increase in growth and job creation compared to a business-as-usual trajectory. It would thereby create an additional 300,000 to 500,000 jobs by 2030 and 700,000 to 800,000 jobs by 2050 compared to a business-as-usual scenario, in a context of international low-carbon transition.

The low-carbon transition has long-term benefits for household bills, as energy performance improvements will outweigh the rise in energy prices. Nevertheless, the energy transition requires significant investments (building renovations, purchase of clean vehicles, etc.). If these investments are profitable in the long term, the transition period requires support for households, in particular via investment aid targeting the most modest households and economic players.

The carbon budgets

Balance of the first carbon budget (2015-2018)

Taking stock of the balance of the first carbon budget for 2015-2018 shows an estimated overrun of 65 MtCO₂eq over the entire period, i.e. 3.7% of the first budget⁴, i.e. an average surplus of around 16 MtCO₂eq per year. Emissions only decreased by -1.0% per year on average between 2015 and 2018, whereas the SNBC 2015 scenario projected a decrease in emissions of -2.2% per year on average. The overrun of the first carbon budget is partly linked to certain unfavourable cyclical factors, the two main ones being the low price of energy and, for the years 2016 and 2017, the unavailability of part of the nuclear power generation fleet (approximately +15MtCO₂eq over the entire period).

However, most of the overrun is attributable to more structural factors. The differences are due in particular to significantly worse than expected results in the transport and building sectors (respectively about +41 and +39 Mt CO₂eq over the whole period) and agriculture (about +8 Mt CO₂eq over the whole period). These poor results are partly offset by results in the power generation sector⁵ that are better than first SNBC targets, despite the unavailability of part of the nuclear fleet (about -25 Mt CO₂eq over the whole period).

⁴ The final balance of the 2015-2018 carbon budget will be published in spring 2020, based on updated inventory data.

⁵ The cap for this sector, which includes electricity production, was set in 2015 conservatively awaiting arbitration on the electricity mix.

In addition to low energy prices, the stagnation of emissions in the transport sector can be explained in particular by the slight improvement in the performance of new vehicles (about 110 gCO₂/km in 2018 for cars, whereas the target was about 90 gCO₂/km) and a rebound in road traffic (whereas a slight decrease in traffic was expected). In the building sector, the difference is mainly due to renovations, the pace and scale of which are still insufficient.

The next carbon budgets

The baseline scenario of this strategy over the periods 2019-2023 and 2024-2028 of the second and third carbon budgets highlights:

- an overrun of the second carbon budget set by the first SNBC, which could be around 6% of the budget, closely linked to the inertia of the gaps already observed in the first budget. This leads us to revise the overall level of the second carbon budget in this strategy as well as its sectoral distribution, in line with the new baseline scenario and in the interest of transparency, without calling into question France's ability to meet its European and international commitments.
- unequivocal adherence to the third carbon budget set out in the first SNBC, on the condition that all the additional measures outlined in the baseline scenario are put in place. **These measures must be implemented fully and effectively, with regular monitoring, in order to return to the budget levels adopted in 2015.**

Moreover, compliance with the fourth carbon budget should make it possible to achieve the objective of -40% of emissions compared to 1990 set in 2015 by the law relating to energy transition for green growth.

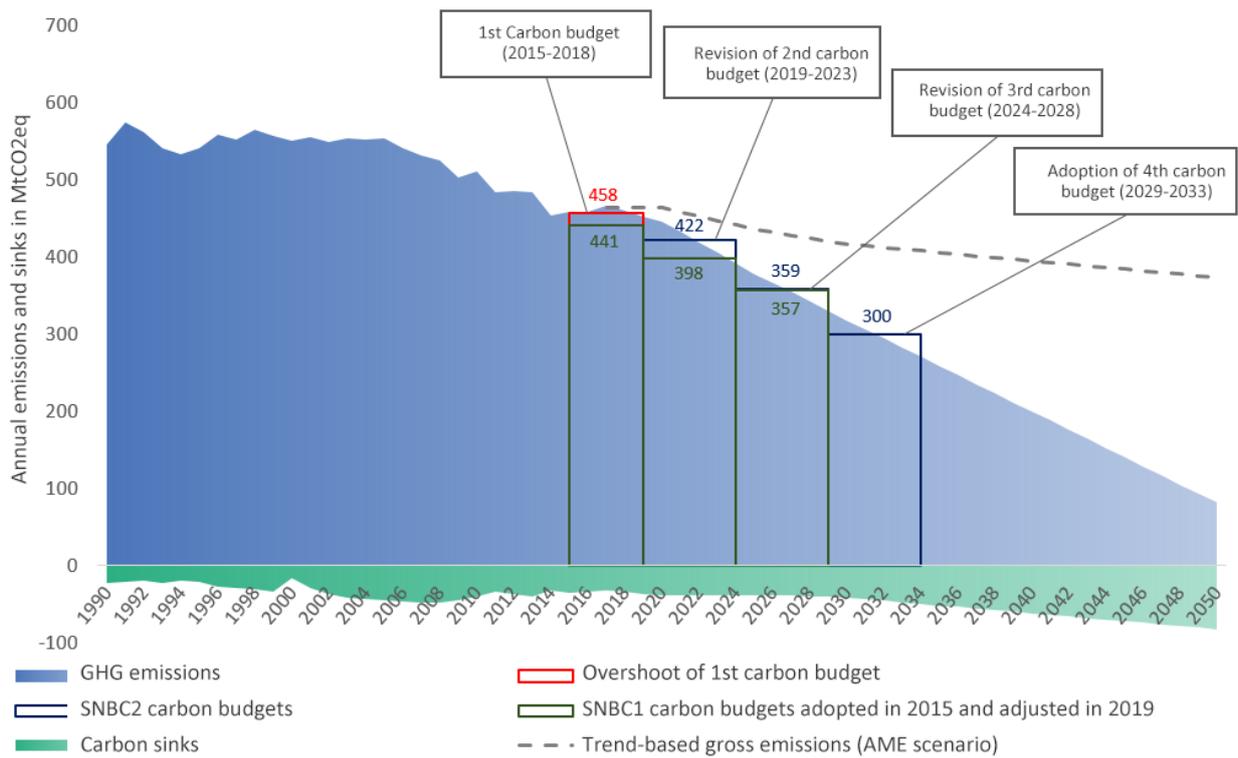
It can be noted that the rate of emission reductions foreseen by the carbon budgets of this strategy is more ambitious than that set by the budgets of the strategy adopted in 2015. In fact, the decrease expected in 2015 between the first and third budgets is nearly 20% (from 442 to 358 Mt CO₂eq), while this decrease is nearly 30% between the 2nd and 4th carbon budgets (see table below). This underlines the additional efforts expected in all sectors to meet our commitments and achieve carbon neutrality by 2050.

Figure 4 - next three carbon budgets of the revised strategy

Mean annual emissions (in Mt CO ₂ eq)	Baseline years			2nd carbon budget	3rd carbon budget	4th carbon budget
	1990	2005	2015	2019 -2023	2024 -2028	2029 - 2033
Total (excluding land sector)	546	553	458	422	359	300
Total (including land sector)	521	505	417	383	320	258
<i>Carbon budgets adopted in 2015 (excluding land) – adjusted in 2019 (for reference)</i>				398	357	

The baseline year emissions are from the April 2018 CITEPA inventory in the SECTEN format

Figure 5 - History and trajectory of net greenhouse gas emissions in France between 1990 and 2050



Source (data 1990 to 2017): setcen CITEPA inventory - Kyoto Climate Plan format - April 2018

Figure 6 – Sectoral distribution of the next three carbon budgets in MtCO₂eq

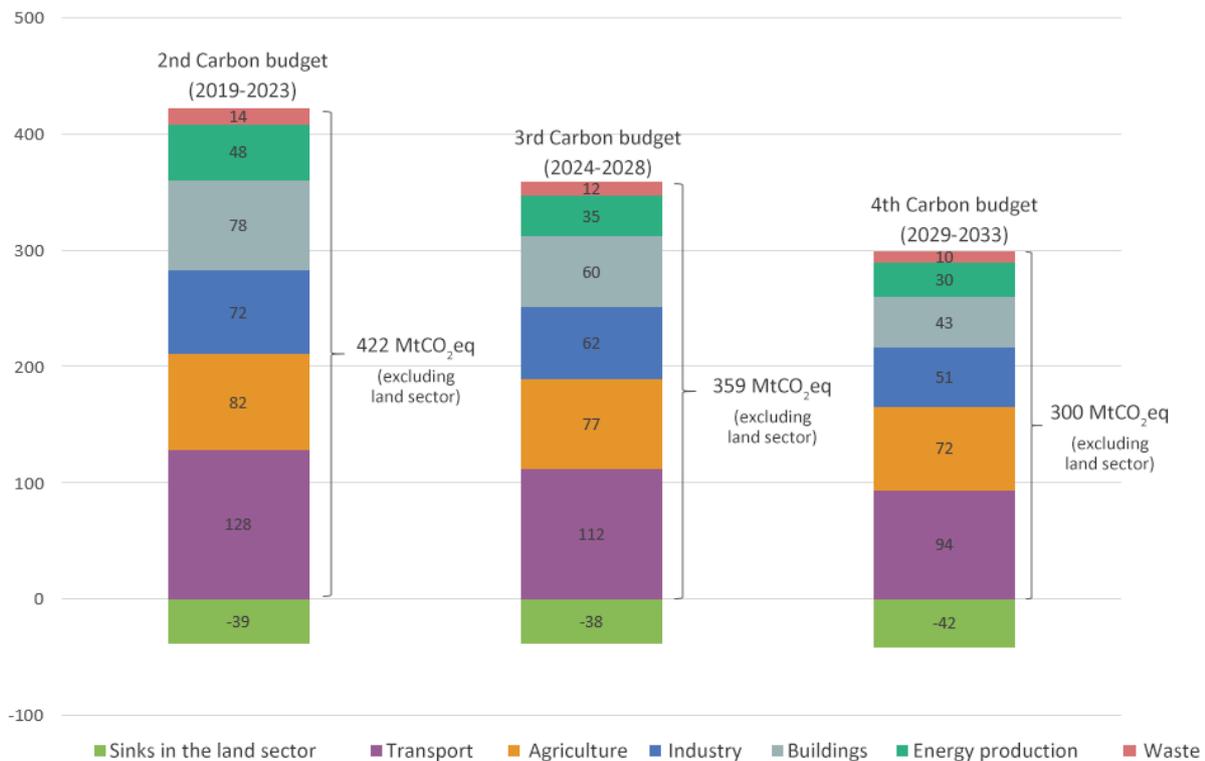
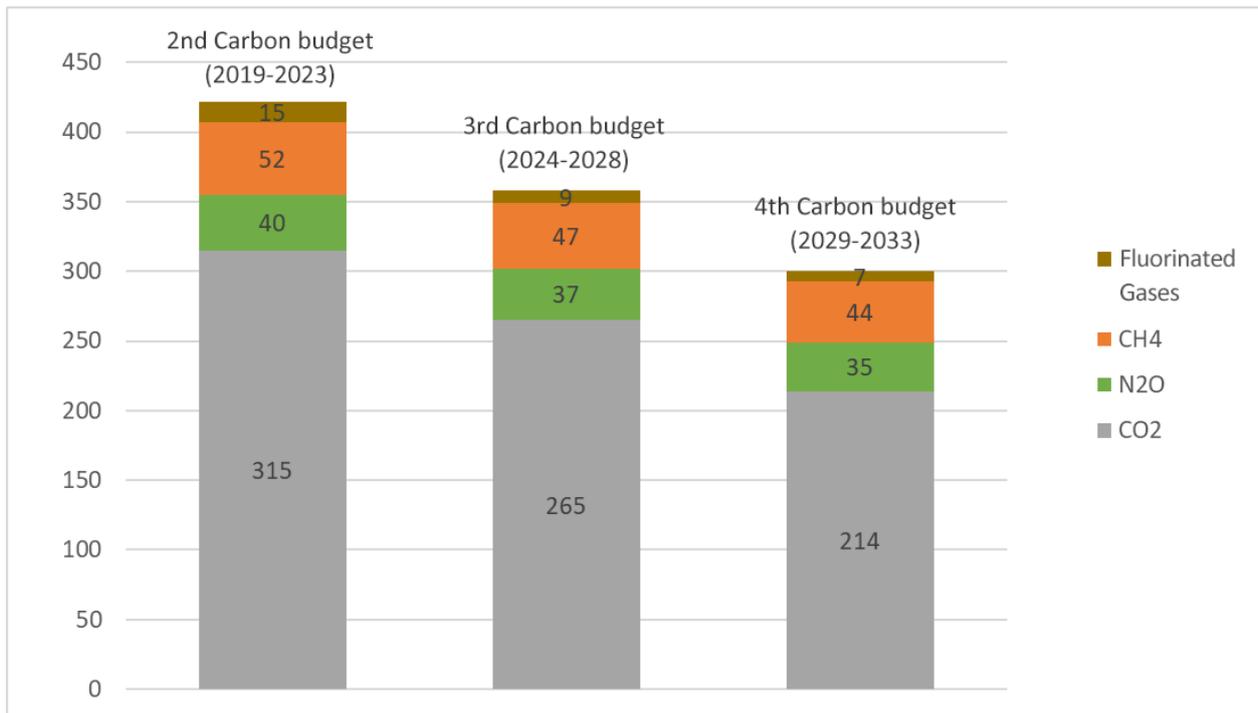


Figure 7 - Greenhouse gas distribution of the next three carbon budgets (excluding land) in MtCO₂eq



HOW CAN WE GET THERE? THE APPROACH OF THE NATIONAL LOW-CARBON STRATEGY

The national low-carbon strategy formulates public policy guidelines concerning:

- the governance of the implementation of the strategy at the national and territorial levels,
- cross-cutting subjects such as the economy, research, education and employment,
- each sector of activity: transport, buildings, agriculture, forestry, industry, energy production, waste.

Governance and implementation

Ensure the implementation of the SNBC's guidelines in all public policies **AT THE NATIONAL LEVEL...**

The transition requires the mobilisation of all actors and at all levels, which will be facilitated by the implementation of an integrated approach to ensure **that the SNBC's guidelines and objectives are taken into account in all public policy decisions** (plans, programs, bills, laws, public procurement, etc.).

What the SNBC says:

- **To ensure the coherence** of all national public policies with the national low-carbon strategy, by strengthening **governance**, and by generalising **the evaluation of the impact on the climate** of each political decision.

... AND AT THE TERRITORIAL LEVEL

Regional planning, sustainable development and territorial equality schemes (SRADDET), regional climate, air and energy schemes (SRCAE) in Ile-de-France and Corsica and regional planning schemes (SAR) in Overseas France, as well as territorial climate, air and energy plans (PCAET) must take into account the SNBC and ensure the regionalisation of its objectives and guidelines.

What the SNBC says:

- Establish **governance and regulatory tools** in order to structure solidarity between territories.
- To ensure linkage between the different territorial scales, initiate work to **develop comparable and aggregated data** across all perimeters.

Cross-sectoral guidelines

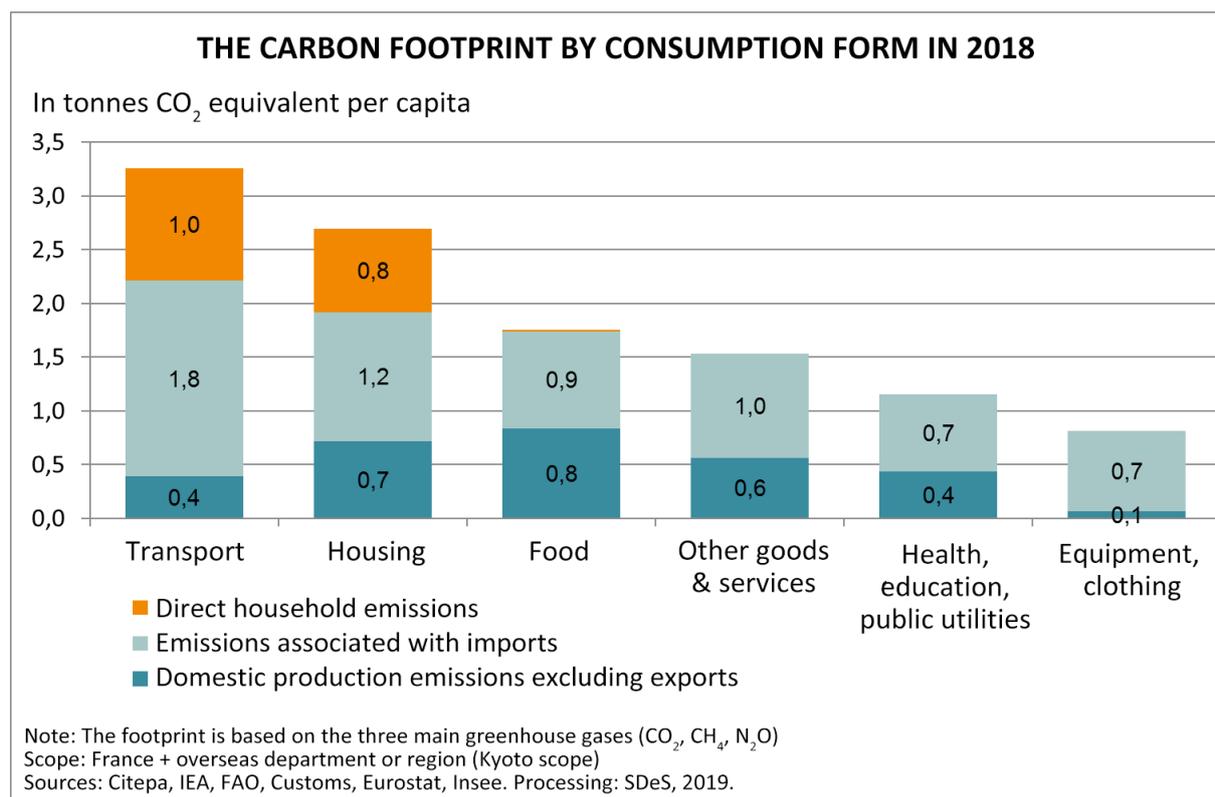


CARBON FOOTPRINT

Decrease emissions related to French consumption of goods and services

Beyond national emissions, the strategy aims to **reduce the carbon footprint of the French population (11,2 tCO₂eq / capita in 2018 or 1.8 times the territorial emissions)**. This involves reducing emissions linked to the consumption of goods and services, whether these are produced within the national territory or imported, including emissions related to international transport.

Figure 8 – Carbon footprint by forms of consumption in 2018



What the SNBC says:

- **Better control the carbon content of imported products**, by consolidating environmental standards at the European and international levels (carbon pricing, commitments in trade agreements) and by supporting competitiveness by effectively combating industry leakage at the European carbon level (implementation of a "carbon inclusion mechanism" tax at Europe's borders "compatible with the rules of the World Trade Organisation").
- **Encourage all players to better control their carbon footprint**, by encouraging a more systematic quantification of greenhouse gas emissions, including indirect emissions, induced by public plans, programmes and projects as well as for products and services (strengthening the regulation of greenhouse gas balance sheets).



ECONOMIC POLICY

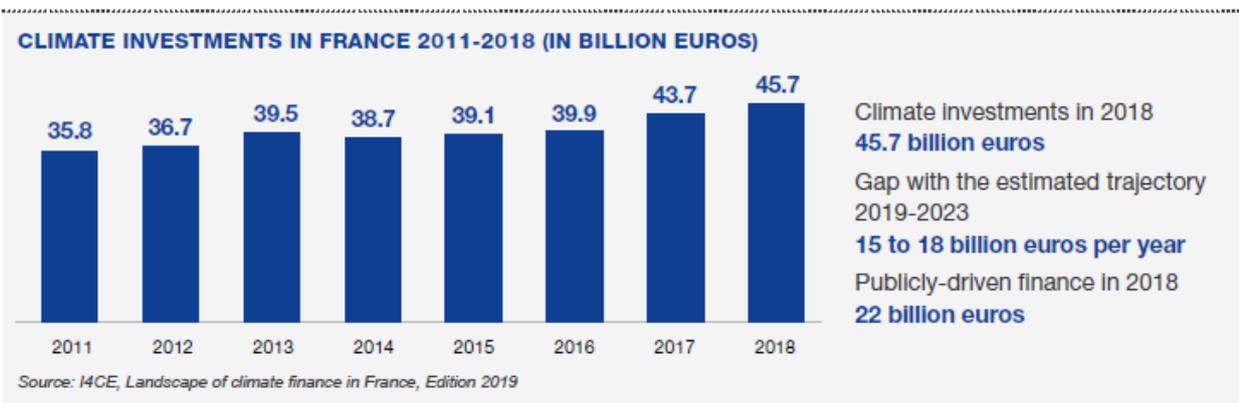
Reorienting financial flows for an ecological and inclusive transition

The work carried out by the Institute for Climate Economics (I4CE) estimates that the low-carbon transition **will require additional investments in favour of the climate** in the short and medium term, estimated at between 15 and 18 billion €/year to reach the objectives of the 2nd carbon budget, and 32 to 41 billion €/year to comply with the 3rd carbon budget, i.e. a doubling of current investments estimated at 45.7 billion € in 2018⁷. Some of these needs will have to be covered by

⁷ Source: I4CE's Overview of climate finance, 2019 edition. It should be stressed that investment needs are estimated only for sectors with assumptions that I4CE could convert into quantified investment trajectories, thereby excluding agriculture, industry and nuclear power. These needs cannot therefore be compared to

additional new financial resources, but a significant part of future expenditure will correspond to investments that would have taken place anyway (construction of housing, renewal of the car fleet) and which need to be redirected so that they contribute to the decarbonisation of the economy.

Figure 9 - Evolution of climate-friendly investments in France



Thus, **redirecting public and private financial flows so that they contribute to achieving the objectives of the Paris Agreement**, ensuring the effectiveness of this financing and diverting financial flows away from climate-unfriendly investments are crucial to underpin the low-carbon transition.

What the SNBC says:

- Giving the right signals to investors, including by **strengthening the price of carbon**, and incentives to reduce HFC⁸ emissions as well as **redirecting climate-unfriendly subsidies and investments** towards those that contribute to achieving the objectives of the Paris agreement (by developing labels for green financial products, and phasing out environmentally damaging public subsidies). Encourage private and public financial actors to take into account **climate-related risks** (anticipation of the effects of climate change or depreciation of assets as a result of climate policies) **and associated opportunities** (investments that become profitable as a result of the strengthening of climate policies).
- Ensuring a just transition for all by taking care **to preserve household purchasing power and business competitiveness** (taking into account the socio-economic impacts and sustainability of the measures, setting up targeted support measures to reduce inequalities).
- **Supporting European and international climate-friendly actions** in terms of finance and carbon prices (support for the most vulnerable developing countries, standardisation of price signals between countries, support for increasing the share of financing consistent with the Paris Agreement in the European Union budget).
- Encouraging investment in projects that promote low-carbon transition, by developing **financial tools to limit investors' risk-taking** (continue the work of France Transition Ecologique) and by defining **substantial criteria to determine which projects are**

the total investments observed over the 2015-2018 period of the 1st carbon budget (nearly €42 billion/year) but to a total of €31.6 billion/year on average for the sector perimeter under consideration.
 8 Hydrofluorocarbons (HFCs) are greenhouse gases with high global warming potential, and are subject to specific regulations that set emissions reduction targets.

favourable to low-carbon transition (support the European Commission's work on sustainable finance).

- Ensuring that actions that are contrary to the achievement of our climate objectives do not benefit from public funding, by continuing the "**green budget**" **approach** to government expenditure and revenue, by studying options for gradually extending this "green budget" approach to other stakeholders and by **gradually eliminating expenditure and financial support identified as unfavourable** to climate change mitigation.



RESEARCH AND INNOVATION

Developing technical, social and organisational innovations that will help reduce France's emissions

The transition to a low-carbon economy **implies innovations in all sectors and an adaptation of production and consumption patterns**. It makes it necessary to step up research and innovation initiatives in order to develop technologies and social and organisational innovations that will help reduce France's emissions. It is important to give France the best position in these sectors of the future **in order to be competitive on tomorrow's markets and to offer goods and services that are necessary and adapted to the development of a low-carbon society**.

What the SNBC says:

- **Supporting innovative companies and facilitating the adoption and dissemination of innovations on a large scale**, by supporting the experimentation and industrialisation phases, but also through communication and training, taking into account social expectations and obstacles, and setting up price signals representative of avoided emissions.
- **Developing fundamental and applied research focused on the needs of a low-carbon society** (decarbonisation of the energy sectors, energy efficiency, carbon sinks and storage and use technologies), in particular by directing research towards the long term, via dedicated public funding, calls for projects, regular updating of technological roadmaps, multi-stakeholder collaborative projects, etc.



TOWN PLANNING, DEVELOPMENT

Limiting land take⁹ and developing resilient and carbon-efficient urban forms

Urban planning and development have a significant direct and indirect very long-term effect on greenhouse gas emissions through their impact on bio-based production, carbon storage in soils, habitat typologies, travel patterns and vulnerability to climate change.

What the SNBC says:

In the short term, the land take of natural, agricultural and forest areas must be limited and its pace reduced by encouraging the inclusion of **all new development projects in the existing urban envelope**, by promoting **functional mix** (housing, employment, services, etc.) and by adopting more moderate urban forms in terms of land use while ensuring the quality of the living

⁹ Land take: the process of changing the use of natural or agricultural land through development actions towards artificial land (buildings, roads, car parks, gardens, building sites, etc.).

environment. Set urban planning and development policies on a **trajectory of zero net land take**, taking into account the impact on territorial projects and housing and property costs.

- To this end, **strengthen urban centres** and already urbanised areas by facilitating the resettlement of households, commerce and crafts in the centres, and optimise the use of space by diversifying uses, while promoting urban forms that are resilient to the effects of climate change.
- **Stopping urban sprawl and the degradation of agricultural, natural and forest areas** and limiting or even halting the drying up of wetlands. Encourage the re-marketing of vacant buildings and housing by bringing them up to standard and promote the development of renewable energies in areas where their impact on the soil will be limited.



CITIZENS' EDUCATION, AWARENESS, AND ASSIMILATION OF ISSUES AND SOLUTIONS

Involve citizens in the transition to a low-carbon culture.

To achieve the ecological transition to carbon neutrality, it is necessary to take action in the emitting sectors, **but also to introduce a new "low-carbon" culture, promoting new ways of living and consuming.**

What the SNBC says:

- Enriching and sharing a **low-carbon culture**, through mobilising **communication** on the challenges of climate change and solutions, as well as **awareness raising and education** from a very young age and throughout life, through **strengthening the exemplary nature of all public services** and mobilising citizens through **leadership actions** or **voluntary commitments** (civic service, universal national service, etc.).
- **Supporting citizens in their transition**, by providing them with **information tools** (environmental labelling in particular) and tools for **calculating** their own impact on the climate and by facilitating repair and reuse procedures.
- Ensuring the **acceptability by citizens of public policy measures dedicated to the low-carbon transition**, based on **sociological studies**, **public participation** in the development of action plans and **socio-economic impact studies**.



EMPLOYMENT, SKILLS, QUALIFICATIONS AND OCCUPATIONAL TRAINING

Make the low-carbon transition an opportunity for the economy and employment by supporting occupational transitions.

The enrichment of skills, improvements in levels of qualifications, incentives to follow new career paths and new gateways between professions are all strategic factors that make the low-carbon transition an opportunity for the economy and employment.

What the SNBC says:

Encouraging **better integration of the low-carbon challenges by industrial sectors, businesses and territories** to facilitate occupational transitions and conversions. To this end, develop **tools to analyse the evolution of jobs and skills** linked to the transition and set up actions to **support the sectors**, particularly those most affected in their core business (building, bio-economy, mobility and energy production sectors).

- **Adapting the initial and in-service training system** to support the transformation of activities and territories (relating to both revising curricula to meet the needs of the professional world and updating the knowledge of teachers and trainers to enable them to develop their courses).

Sectoral Guidelines

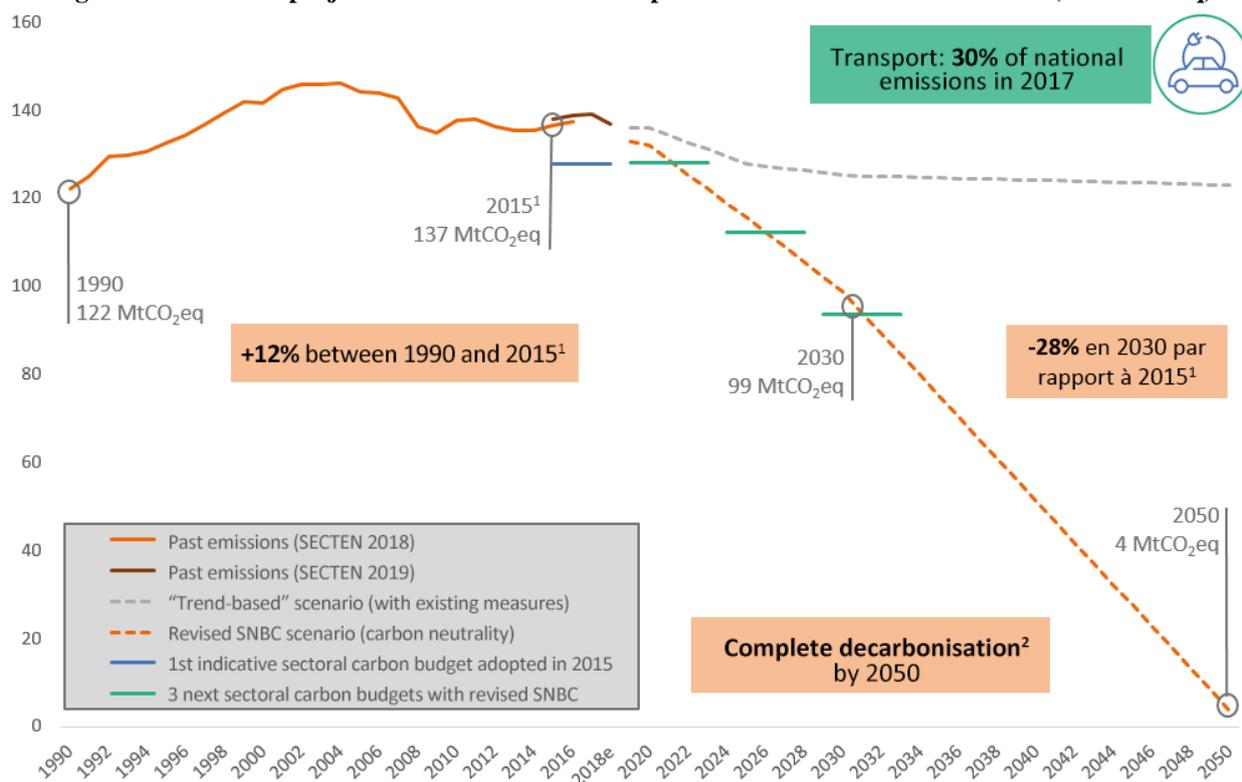


Low-carbon TRANSPORT

The transport sector is currently the largest greenhouse gas emitting sector in France (30% of national emissions in 2015). As all of these emissions are energy-related, the strategy aims for a 28% reduction in emissions in 2030 compared to 2015 and a complete decarbonisation of transport by 2050.¹⁰

This assumes an average annual decrease in emissions of 3.8 Mt CO₂ eq/year between 2015 and 2050, whereas on average annual emissions increased by 0.5 Mt CO₂ eq/year between 1990 and 2015, and decreased by only 0.8 Mt CO₂ eq/year over the most recent period 2005-2015.

Figure 10 - Past and projected emissions in the transport sector between 1990 and 2050 (in MtCO₂eq)



¹The emissions used for the year 2015 are those of the CITEPA SECTEN 2018 inventory.

²Does not take into account "incompressible" residual leakage of gases (fluorinated gases, renewable gases) and residual emissions from domestic air transport.

¹⁰ With the exception of domestic air transport and without taking into account "incompressible" residual gas leaks (fluorinated gases, renewable gases).

What the SNBC and its baseline scenario say:

- **Give the sector price signals that encourage the development of low-carbon mobility** (standardising fuel tax rates between European countries, internalising external costs for road use, etc.) **and strengthen existing market mechanisms** (European Emissions Trading Scheme - ETS, International Emissions Trading Scheme for Aviation - CORSIA), in order to accelerate the decarbonisation of air transport.
- In line with the sector's energy transition, **set ambitious targets in terms of the energy performance of vehicles**, both for passenger cars (targets of 4 L/100 km in 2030 in real conditions for internal combustion vehicles and 12.5 kWh/100 km by 2050 for electric vehicles, compared with around 17.5 kWh/100 km today), heavy goods vehicles (target of 21 L/100 km in 2040 in real conditions, i.e. a drop of almost 40% compared with 2015)¹¹ and sea and air transport. In addition to energy efficiency gains, **set ambitious targets for the decarbonisation of energy consumed** by vehicles, such as
 - By 2040, 100% of light vehicles sold will have to be **zero-emissions**.
 - For domestic maritime transport that is 100% carbon-free in 2050, develop **low-carbon** in all French ports and facilitate **conversion to other low-carbon technologies** (batteries, biofuels, hydrogen, sailing, etc.).
 - For air transport, replace **a very large proportion of fossil fuels with biofuels** (50% in 2050) and develop hydrogen or electric-powered aircraft.
- **Support the development** of all modes of transport, in particular **by providing aid for vehicle renewal** and by **adapting infrastructures** (infrastructures for bio-NGV refuelling or electric recharging).
- **Support local authorities and businesses** in setting up innovative initiatives and **involve them in** clean mobility policies (deployment of **low-emission zones**, development of action plans for reducing emissions and fleet renewal, etc.).
- Spur a **modal shift to modes of transport that consume the least energy and produce the lowest emissions**, such as rail or public transport, and **support active modes**, such as cycling (with an objective of 12% of the short distance modal share by 2030, and 15% by 2050), which can also improve health through regular physical exercise.
- **Optimize the use of vehicles** in terms of volumes and weight of goods loaded so as to make logistics operations more fluid (increasing the current loading rate of heavy goods vehicles from 9.8 to 12 tonnes per vehicle in 2050).
- **Control the growth in demand for passenger transport** (+26% between 2015 and 2050 for all modes of transport combined¹²) and freight transport (+40% between 2015 and 2050-2013), in particular by promoting working from home, carpooling, short routes and the circular economy.

Transition in this sector must be upscaled quickly, while taking account of air quality issues - an area in which major co-benefits should be obtained. The transition should also make it possible to reduce land take by limiting construction of new infrastructures.

¹¹ Energy efficiency objectives are also set for vehicles powered by natural gas and electricity.

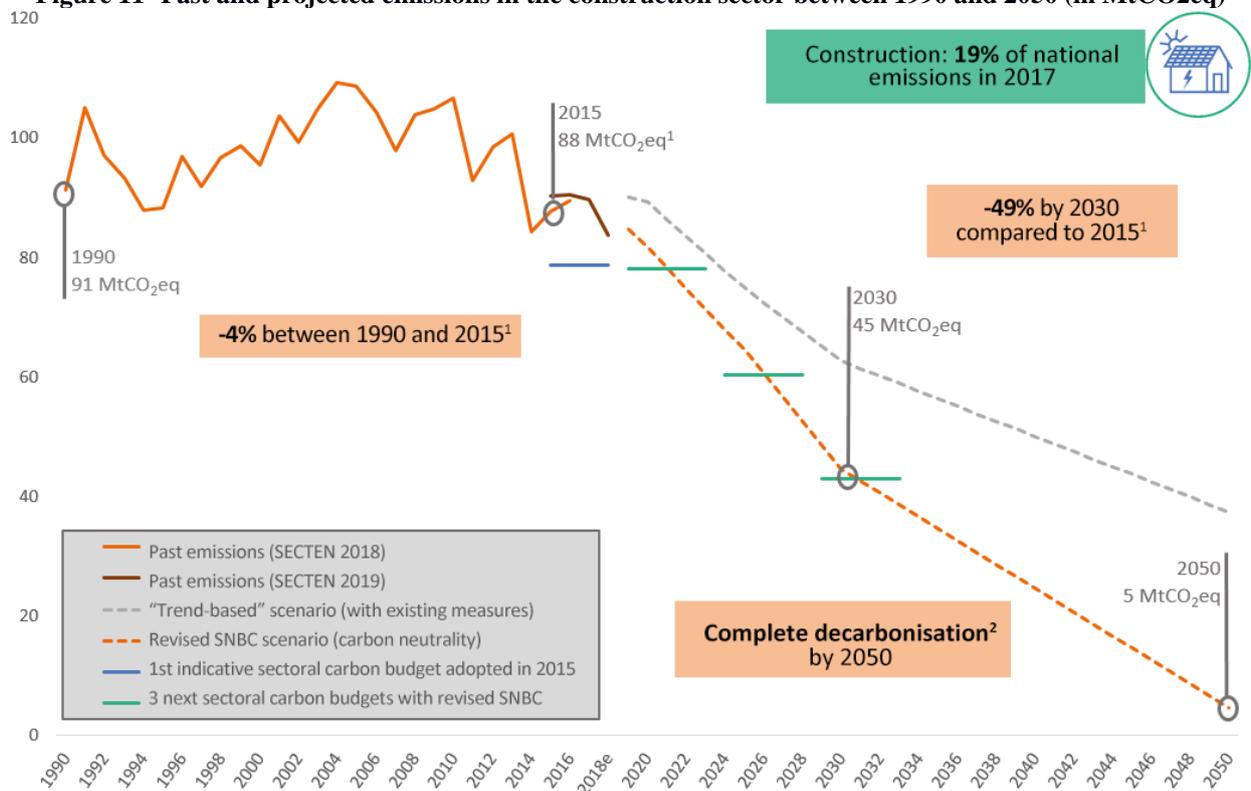
¹² More restrained increase than with a business-as-usual scenario.



The residential-tertiary sector is the most energy-consuming sector and the second largest emitter of greenhouse gases in France (19% of national emissions in 2015, and 28% if we add to direct emissions the emissions linked to the production of energy consumed in buildings). The SNBC defines an ambitious emission reduction trajectory for this sector¹³ with a target of -49% in 2030 compared to 2015 and reaching complete decarbonisation of the energy consumed in buildings in 2050 (only emissions linked to residual leakage of fluorinated and renewable gases will remain).

This assumes an average annual decrease in emissions of 2.5 Mt CO₂ eq/year between 2015 and 2050, whereas emissions have remained globally stagnant between 1990 and 2015 and have decreased by 2.1 Mt CO₂ eq/year over the most recent period 2005-2015.

Figure 11- Past and projected emissions in the construction sector between 1990 and 2050 (in MtCO₂eq)



¹The emissions used for the year 2015 are those of the CITEPA SECTEN 2018 inventory.

²Does not take into account "incompressible" residual gas leaks (fluorinated gases, renewable gases).

What the SNBC and its baseline scenario say:

- **Guiding the sector towards a 100% carbon-free energy use in 2050** (via price signals, GHG criteria in public policy instruments, etc.) **and favouring the use of the solutions best suited to each type of building.** In the short term, prioritize the elimination of fuel and coal heating.
- **Encourage a strong acceleration in the pace and quality of housing renovations** (to reach 500,000 renovations per year over the current five-year period, with a minimum

¹³ The majority of emissions from construction/deconstruction are from the industry sector as defined in this strategy.

target of 370,000 high-performance complete renovations per year from 2022, 700,000¹⁴ per year in the longer term) **and tertiary buildings** (in particular by setting an example through the implementation of high-performance renovations of public buildings) **to radically improve the energy efficiency of residential and tertiary buildings by 2050 (allowing a decrease of around 40% in the sector's energy consumption in 2050 compared to today)**. Prioritize energy sieves to eliminate them by 2028 and fight against fuel poverty. Develop the use of the least carbon-intensive renovation and insulation products and carbon-storing materials.

- **Increase the energy and carbon performance levels of new buildings** via future environmental regulations by favouring integrated life cycle analysis approaches (taking into account summer comfort to limit the use of air conditioning, systematically achieving high-performance building insulation, using renewable energies and materials with a low carbon footprint, particularly those with a carbon storage capacity).
- Aiming for **better energy efficiency of equipment** (for unit consumption gains, depending on the appliances, ranging from 15 to 60% between now and 2050) **and a more moderate use** by encouraging households to use equipment less and better and strengthening the dissemination of intelligent demand management technologies, in particular to enable heating temperatures to be lowered by an average of 1°C by 2050.

A sharp acceleration is required in the speed of transition in this sector, which will necessitate mobilisation of financing to make the required investments. Behavioural changes are also necessary to reduce energy consumption. For this sector, **training of professionals and transformation of businesses are crucially important**. It is vital to support low-income households for insulation work in dwellings, and to change heating systems. This can be carried out through investment aid (energy transition tax credits, eco loans, energy saving certificates, etc).



Low-carbon AGRICULTURE

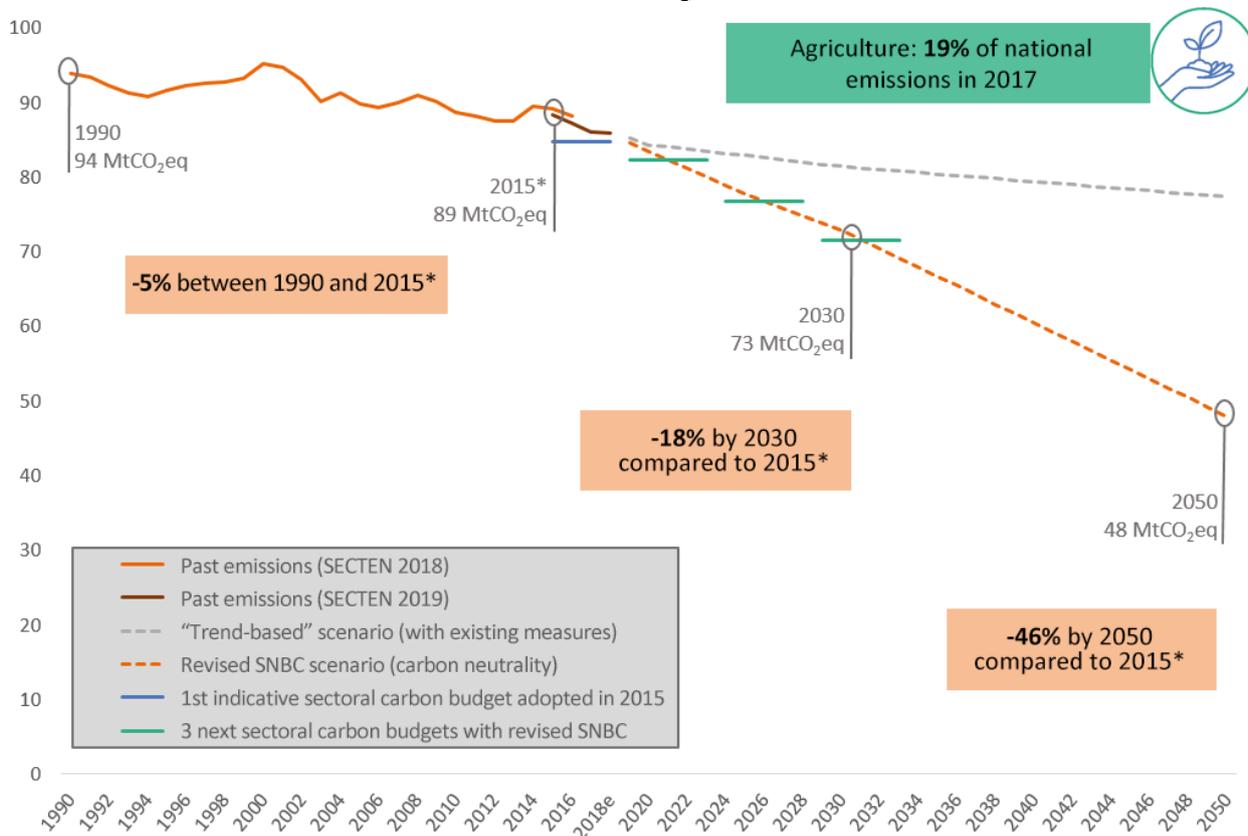
The agricultural sector (19% of national greenhouse gas emissions in 2015) is subject to several major challenges: feeding populations, ensuring the sustainability of landscapes and biodiversity, responding to growing demands in terms of the sanitary quality of production, coping with pressure on land use and the impact of climate change. The other particularity of the sector is that it is a consumer of inputs whose manufacture can emit high levels of greenhouse gases (mineral fertilizers for example). The strategy aims to halve the agricultural sector's emissions between 1990 and 2050, i.e. a reduction of nearly 46% between 2015 and 2050. In terms of reduction rate, this implies an acceleration compared to the past: -2%/year will be necessary over the 2015-2050 period compared to -0.1%/year observed over the 2005-2015 period. Indeed, emissions from the agricultural sector are mostly non-energy (45% of methane mainly related to animal husbandry and 43% of nitrous oxide mainly related to nitrogen fertilisation of crops). Although these emissions can be greatly reduced by optimising agricultural practices, they cannot be completely eliminated: N₂O emissions related to plant growth and CH₄ emissions related to ruminant metabolism. Therefore, in 2050, in view of the full decarbonisation of energy emissions, agriculture could become the sector that emits the most greenhouse gases that are difficult to compress. At the same time, the strategy promotes the development of carbon storage potential in agricultural soils.

¹⁴

The energy renovation plan for buildings objective - April 2018

This assumes an average annual decrease in emissions of 1.2 Mt CO₂ eq/year between 2015 and 2050, whereas emissions decreased on average by 0.2 Mt CO₂ eq/year between 1990 and 2015 and, in particular, by 0.1 Mt CO₂ eq/year in the most recent period between 2005 and 2015.

Figure 12- Past and projected emissions in the agriculture sector (excluding land) between 1990 and 2050 (in MtCO₂eq)



What the SNBC and its baseline scenario say:

- Reduce non-energy emissions from the agricultural sector (objectives of -17% in 2030 and -38% in 2050 compared to today) by developing agro-ecology (including organic farming) and precision agriculture:
 - For nitrous oxide (N₂O) emissions, reduce nitrogen input and optimize the nitrogen cycle, by reducing excess protein in animal feed and by developing plant protein autonomy.
 - For methane (CH₄) emissions, improve the management of livestock manure, optimise herd management and limit enteric fermentation.
- Reduce the sector's energy emissions (CO₂), by **halving energy consumption by 2050 and by developing and generalising the use of renewable energies**, up to a complete decarbonisation of the energy consumed by the sector in 2050.
- Develop **carbon-free energy production and bioeconomy to supply energy and materials that emit less GHG** to the French economy (methanisation, wood energy, second-generation liquid biofuels, wind, solar, etc.), which will make a positive contribution to the sector's added value.

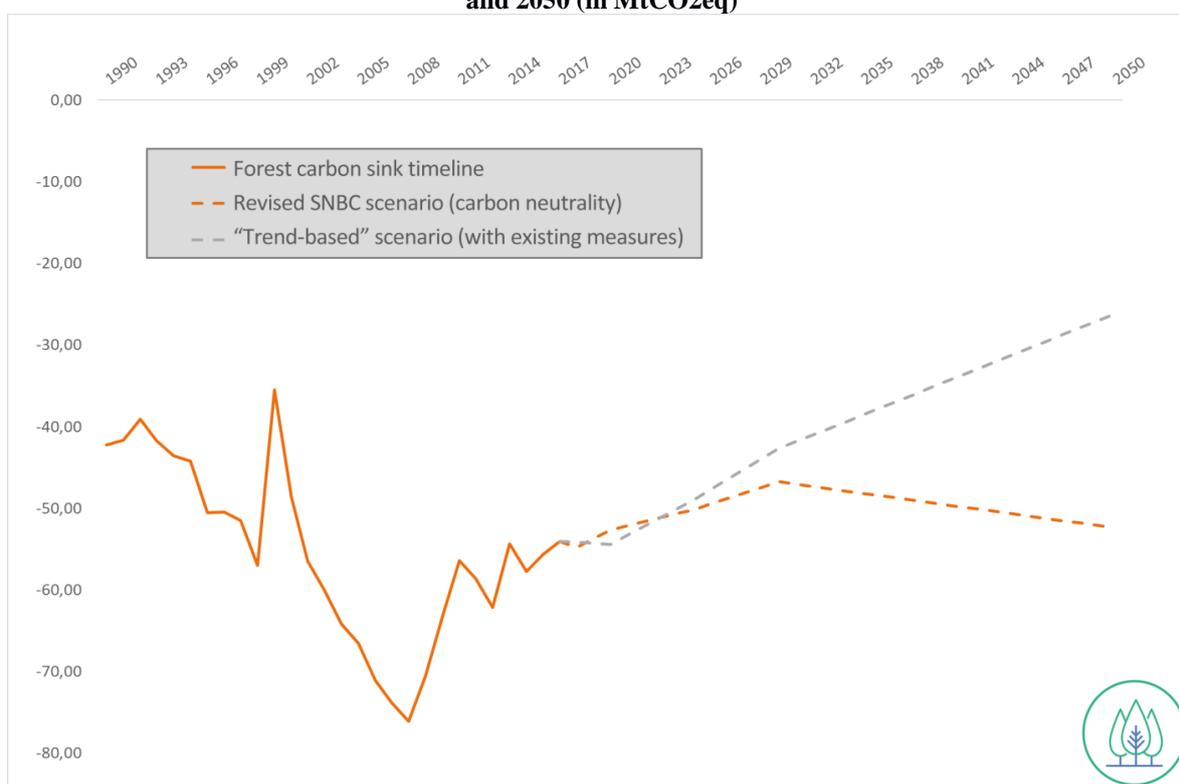
- Halt the sector's current carbon destocking: according to current inventory methodologies, agricultural land (crops and grasslands) released about 9 MtCO₂eq into the atmosphere in 2015. Reverse the trend through **agroforestry, changes in practices (notably maintaining permanent grasslands) and a decrease in land take**.
- Change **food demand in line with the latest nutritional recommendations** (less charcuterie and meats other than poultry and more legumes, fruit and vegetables) and towards **local, better quality and sustainable products** (including those from organic farming). **Reduce food waste** (from 14% in 2015 to 5% in 2050 for post-production waste).

In the long term, **the movement towards decarbonisation could bring with it a relocation of production activities in France**. This movement is backed by a strong demand from French consumers for local high-quality produce.

FORESTRY

The forest-wood-biomass sector is a strategically important sector in achieving carbon neutrality, because it enables carbon sequestration and the production of bio-sourced renewable materials capable of replacing fossil-based products. With 31% of the metropolitan territory covered by forest, the forest sector represents the largest proportion of the French carbon sink (along with agriculture) and makes it possible to offset part of the emissions from other sectors. The strategy envisions an ambitious development trajectory for the forest sector well up to 2050 (+87% compared to a business-as-usual scenario, with an increase in the wood products sink by a factor of 8 compared to today).

Figure 13 - Past and projected forest sector carbon sink (forest and wood product ecosystems) between 1990 and 2050 (in MtCO₂eq)



The forestry-biomass sector is a strategically important sector in achieving carbon neutrality, because it enables carbon sequestration and the production of bio-sourced renewable materials and energy capable of replacing fossil-based products. With 31% of the metropolitan territory and 96% of the territory of French Guyana covered by forest, the sector represents the largest proportion of the French carbon sink (along with agriculture) and makes it possible to offset part of the emissions from other sectors.

What the SNBC and its baseline scenario say:

- **Maintain carbon capture and stocks in the forest ecosystem** through improved forestry management that allows both the adaptation of forests to climate change and the preservation of carbon stocks in the forest ecosystem, including soils (whose observation and statistical monitoring must be guaranteed and improved). Strengthening the carbon sink in the forest-wood sector will also require **the development of afforestation initiatives and a reduction in forest clearance**. All of these factors would make it possible to slow down the declining trends in the forest sink currently observed, particularly in connection with increased mortality and a forest growth that is tending to decrease.
- Maximise the effects of substitution and carbon storage in wood products, via increased **wood harvesting (increase in wood harvesting by 12 Mm³ per year by 2026, and further increase thereafter, with + 0.8 Mm³ per year from 2036)**, while ensuring the preservation of biodiversity, directed towards **longer-life uses** (in particular broadening the market base of wood in construction, with the objective of tripling the production of wood products for long-life material use between 2015 and 2050) and by increasing **recycling and energy recovery of end-of-life wood products**.
- **Evaluate the implementation of the resulting policies, particularly in terms of impacts on biodiversity, and adjust them regularly** in turn, to ensure that the expected results and co-benefits are achieved.

These policies are combined with the French National Forests and Wood Programme (PNFB) which oversees forestry policy for the 2016-2026 period and sets a target for additional use of wood as part of sustainable and multifunctional forest management (involving challenges in terms of protecting biodiversity, soils, water resources and landscapes). One of the characteristics of the sector is its integration into a particularly long time frame: combined action is needed for mitigation purposes and to adapt to climate change and to manage risks linked to natural hazards in forest land in order to meet the various challenges, while at the same time preserving the high economic value of the sector.

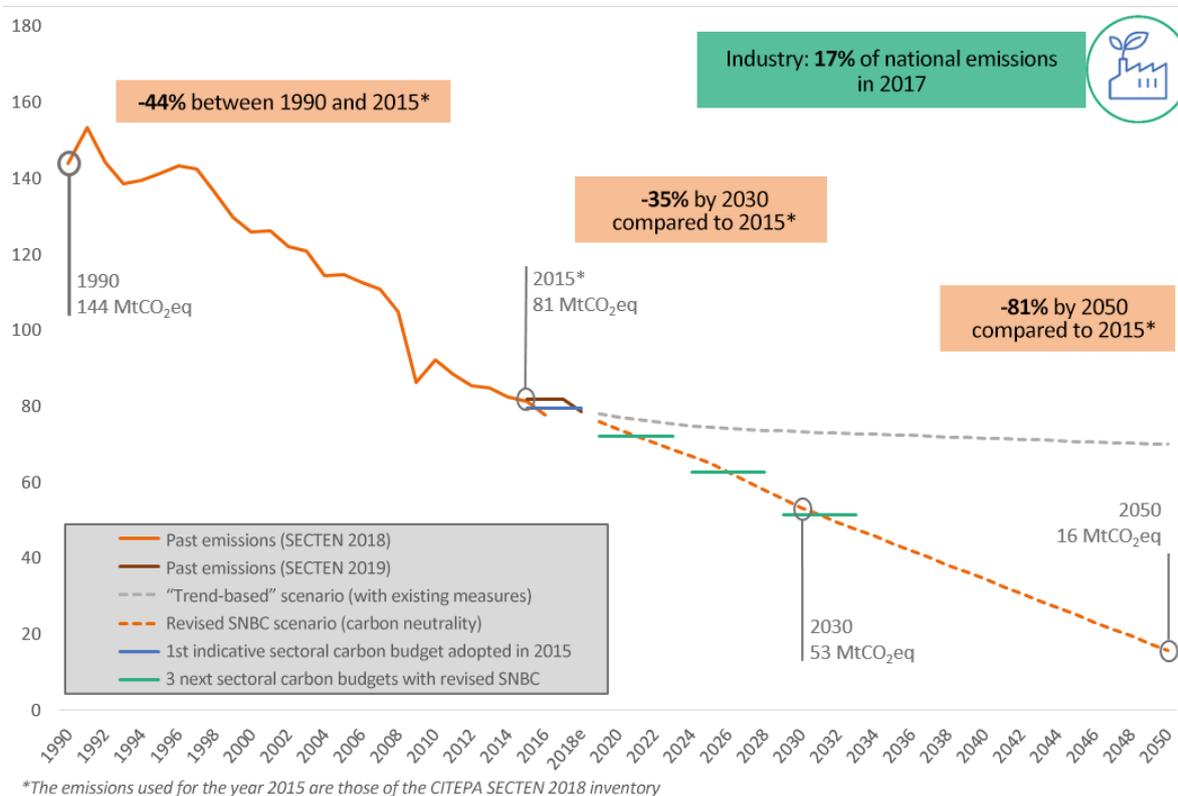


Low-carbon INDUSTRY

In 2015, the sector will account for 18% of national GHG emissions. 84% of the sector's emissions are subject to the European Union Emissions Trading Scheme (EU ETS). Industrial emissions are partly due to the combustion of energy required for production and partly to the industrial processes themselves. The strategy aims to achieve an ambitious reduction in emissions from the sector by 2050, with only those emissions deemed to be incompressible according to current knowledge and available technologies, i.e. a 35% reduction in emissions in 2030 compared to 2015, and an 81% reduction in 2050.

This implies an average annual decrease in emissions of 1.9 Mt CO₂ eq/year between 2015 and 2050, whereas these emissions decreased on average by 2.5 Mt CO₂ eq/year between 1990 and 2015, with a higher rate of decrease of 3.4 Mt CO₂ eq/year over the most recent period 2005-2015. This decrease is partly due to the phenomenon of industrial relocation, which explains why the French carbon footprint has not decreased.

Figure 14 - Past and projected emissions in the industrial sector between 1990 and 2050 (in MtCO₂eq)



What the SNBC and its baseline scenario say:

- **Support companies in their transition** to low-carbon production systems, by developing decarbonisation roadmaps for the different industrial sectors and by supporting them in their transition, in particular through public and private financing tools. Support the emergence of means of production of key technologies in the transition in France. This support should enable companies to take full advantage of the economic opportunities of the ecological transition, while avoiding carbon leakage.
- **Reduce and, if possible, eliminate emissions from industrial processes** by starting to develop and adopt **breakthrough technologies** now (objective of a 60% reduction in non-energy emissions from industry between now and 2050). Carbon capture, use, and storage (CCUS) technologies will also have a role to play in achieving carbon neutrality and could capture 15 MtCO₂eq by 2050.
- **Strongly improve energy efficiency** (+20 to +40% gains depending on the sector between 2015 and 2050) and **use carbon-free sources of energy** (the objective being to completely decarbonise the energy consumed by this sector in 2050), namely by heavily electrifying the industrial sector (aiming to make 70% of the sector's consumption in 2050 electric), a very efficient use of biomass and renewable energies and the recovery of waste heat (with the objective being to recover 10 TWh of heat from annual discharges at over 100°C by 2030).

- **Control demand for materials** by developing the **circular economy** in order to eco-design products, limit the resource waste from the production phase, optimize the rate of incorporation of recycled materials in products (to aim for incorporation rates of at least 80% for steel, aluminium, plastic, glass and paper in 2050), their recyclability and reparability rates.
- A transition to industry as close as possible to zero carbon by 2050 will require a profound transformation of the sector. For this reason, the most efficient measures must be envisaged today, and it is important to avoid being locked in to using ineffective technologies leading to failed investments.

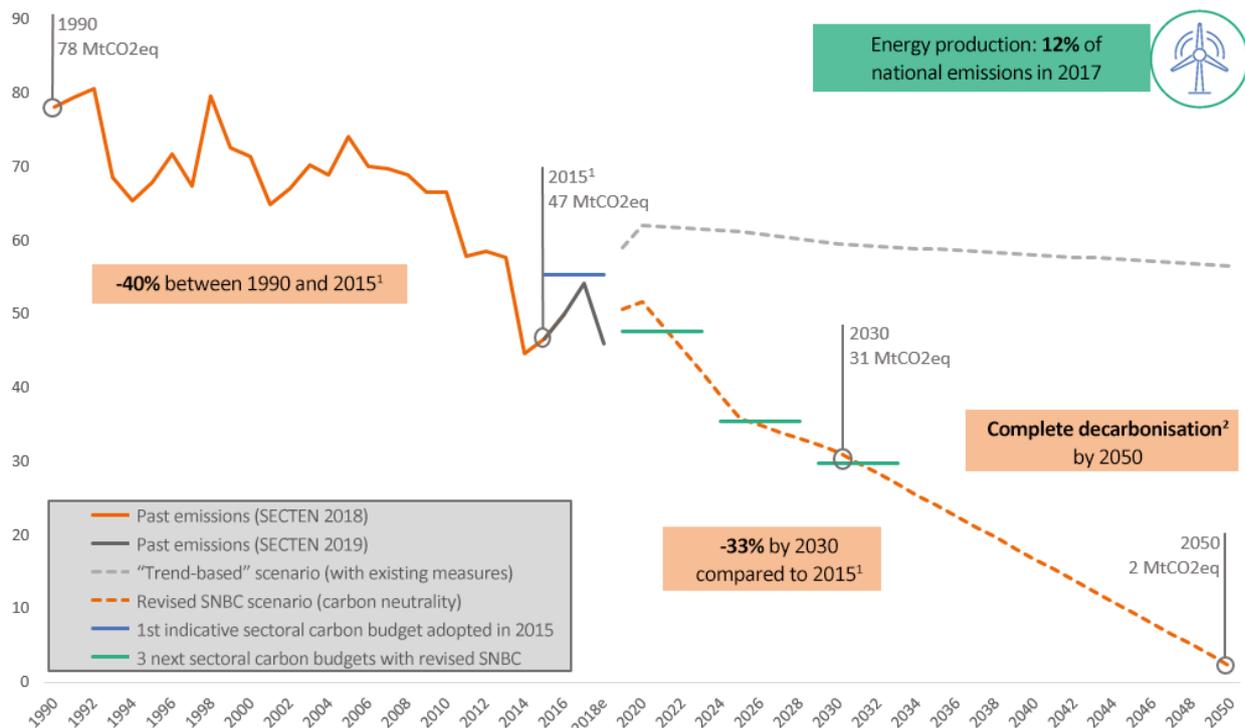


CARBON-FREE energy production

In 2015, energy production generated around 10% of national greenhouse gas emissions, particularly due to the fact that winter peaks lead to the use of carbon means of production. The strategy aims for a 33% reduction in the sector's emissions by 2030 compared to 2015 and an almost complete decarbonisation of energy production by 2050 (the residual part being made up of fossil fuels for air and sea transport, and residual leakage, in particular methane leakage). 74% of the sector's GHG emissions are subject to the European Union Emissions Trading Scheme (EU ETS) (2017 figure).

This assumes an average annual decrease in emissions of 1.3 Mt CO₂ eq/year between 2015 and 2050. Emissions decreased by an average of 1.3 Mt CO₂ eq/year between 1990 and 2015, with a higher rate of decrease of 2.7 Mt CO₂ eq/year over the most recent period 2005-2015.

Figure 15 - Past and projected emissions in the energy production sector between 1990 and 2050 (in MtCO₂eq)



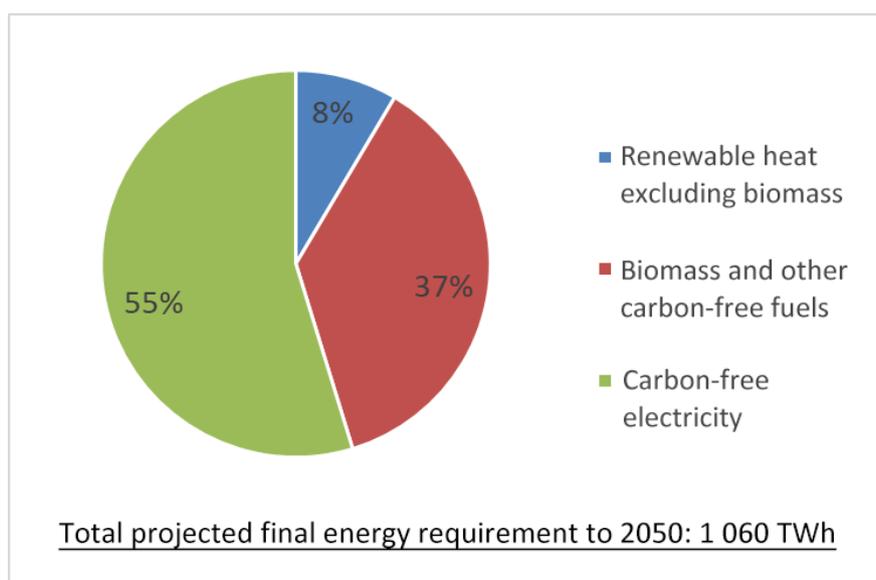
¹The emissions used for the year 2015 are those of the CITEPA SECTEN 2018 inventory.

² Excludes residual emissions from fossil fuels for aviation and marine transport and residual leakage, including methane.

What the SNBC and its baseline scenario say:

- **Control demand** and round off the electricity demand curve by mitigating the seasonal and daily peaks in consumption. This can be achieved via:
 - **energy efficiency**, through implementation of effective technologies that must be supported by public policies providing incentives to optimise resources. A decisive role will be played by research and development in energy efficiency and storage.
 - By promoting **moderate uses and behaviour relating to energy consumption**. Deployment of intelligent devices and awareness-raising concerning best practices will make it possible to introduce and facilitate this careful attitude.
- **Decarbonising and diversifying the energy mix (see the projected mix in 2050 below)**. To achieve this, continue actions to **develop renewable and recovery energies** (carbon free heat, biomass and carbon-free electricity). Identify the potential and needs in terms of heating and cooling networks by territory. **Strongly develop** the mobilisation of biomass, in order to reach a production 2.5 times higher than today, while considering all the underlying issues (biodiversity, resources, economic and environmental conditions) and by favouring local uses.

Figure 16 - Sources of energy which could meet the final energy needs in 2050



- **Specify the options**, in particular in terms of mobilising and allocating biomass resources, **to better inform the structural choices for balancing energy supply and demand in the long term**, in particular the future of gas and heating networks.

The changes to the energy mix and the energy efficiency objectives are determined within the framework of the Multi Annual Energy Plan (PPE). The PPE is based on the same reference scenario as the SNBC and is compatible with its guidelines.

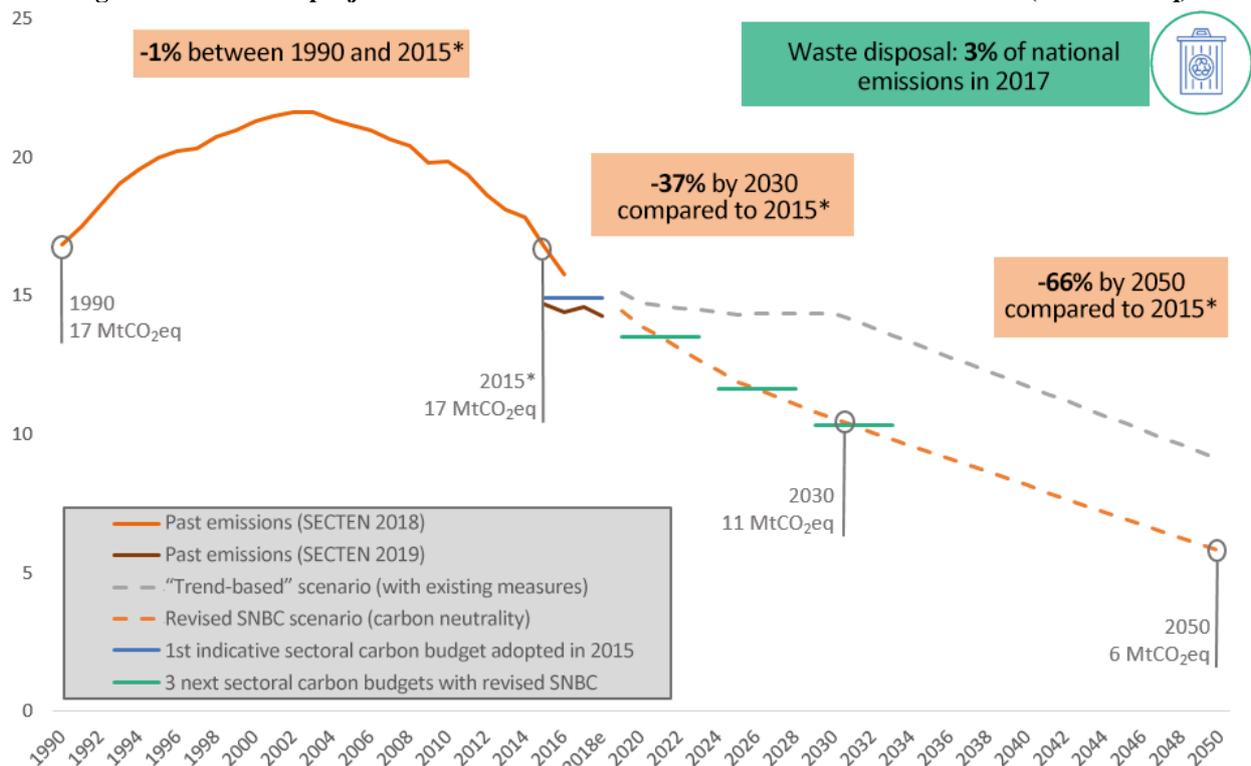


WASTE processing for a circular economy

The waste sector currently accounts for 3% of national greenhouse gas emissions. The strategy aims to reduce the sector's emissions by 37% in 2030 compared to 2015 and by 66% by 2050 (i.e. to eliminate all emissions that can be eliminated according to current knowledge).

This assumes an average annual decrease in emissions of 0.3 Mt CO₂ eq/year between 2015 and 2050, whereas emissions stagnated on average between 1990 and 2015. However, a positive trend in the decrease in emissions has been observed since the early 2000s: -0.4 Mt CO₂ eq/year on average between 2005 and 2015.

Figure 16 - Past and projected emissions in the waste sector between 1990 and 2050 (in MtCO₂eq)



*The emissions used for the year 2015 are those of the CITEPA SECTEN 2018 inventory.

What the SNBC and its baseline scenario say:

- **Reduce the amount of waste** (including food waste) to reduce per capita waste generation by 20% by 2050:
 - by preventing the generation of waste from the design phase at the producers, in particular through **eco-design** (limiting packaging, product life and reparability...) and the **Extended Producer Responsibility channels**;
 - by promoting **the circular economy, product reuse and repair** with consumers;
- **Improve collection** (more sorting at source, better waste characterisation, generalisation of organic waste collection) and **waste management by developing material recovery** (reuse, recycling or organic recovery) **then energy recovery** (cogeneration, co-incineration, energy recovery from sorting rejects, waste water heat recovery) to reduce waste sent to landfill by 90% by 2035. Limit greenhouse gas leaks from waste storage facilities (biogas capture and recovery) and wastewater collection and treatment facilities.

For this sector, the strategy is essentially the 2018 circular economy roadmap strategy, which aims to improve production (eco-design, incorporation of recycled materials), consumption habits (development of reuse and repair facilities, extension of products' life cycle), and waste management (optimisation of waste sorting, development of recycling and recovery), and to mobilise all relevant stakeholders. The anti-waste law for a circular economy, published in February 2020, sets out this roadmap and endorses it with additional measures based on four guidelines: putting an end to the various forms of waste in order to preserve natural resources, strengthening consumer information so that consumers can make informed choices, mobilising economic players to transform production and distribution methods, improving waste collection and sorting, and fighting against illegal dumping.

MONITORING, ASSESSMENT AND REVISION OF THE STRATEGY

Regular monitoring of the Strategy using a set of indicators

Monitoring of the national low-carbon strategy is based on a set of indicators, consisting of:

- performance indicators directly comparable to national targets and illustrating the results of the strategy as a whole.
- contextual indicators to help put the results into perspective.
- indicators relating to the implementation of each cross-cutting and sectoral guideline (pilot indicators).
- indicators of the level of integration of the strategy's guidelines into public policies.
- additional environmental indicators provided as part of the strategic environmental assessment.

The results indicators are updated every year following publication of the greenhouse gas emission inventories. This annual monitoring makes it possible to progressively assess compliance with the carbon budget for the current period.

A holistic monitoring of all the indicators is carried out at least every two years as of the adoption of the strategy and its future revisions.

All of the stakeholders will be included in the SNBC monitoring process.

A regular review process

Every five years, the National low-carbon strategy (SNBC) undergoes a complete revision cycle. It includes, starting with the next revision cycle, the adoption of a five-year law setting energy and climate objectives and priorities for action after parliamentary debate, the revision of the strategy's baseline scenario and the definition of a new carbon budget, the revision of the strategy and its guidelines (stages in which stakeholders are also strongly involved) and the performance of regulatory consultations. The revision of the strategy notably allows for the adaptation of the baseline scenario to changes, particularly in knowledge (technical, economic, social and geopolitical).

This revision is based on a retrospective assessment of the implementation of the national low-carbon strategy. It examines compliance with the indicative annual periods of the current carbon budget, compliance with the trajectories of the strategy's baseline scenario, and the level of integration of the guidelines into public policies. This assessment makes it possible to identify any deviations from the trajectory and the target objectives, and to analyse their causes, providing valuable feedback in order to draw up a realistic revision of the Strategy.

Strengthened governance

The *Haut Conseil pour le Climat* (HCC - High Council for Climate) has its own dedicated resources. It will participate in regular monitoring and assessment of the strategy, in particular regarding implementation of operational actions resulting from the strategy, and adherence to the trajectory for reducing greenhouse gas emissions.

Strategic Environmental Assessment of the SNBC

The strategic environmental assessment of the SNBC highlights notable probable positive effects on the following environmental challenges:

- **Limiting of greenhouse gas emissions** (the primary objective of the strategy) via the guidelines defined for all of the emitting sectors or sectors with storage potential;
- **Strengthening of territories' resilience in the face of climate change and limiting of natural risks**, through the guidelines concerning land use planning and the construction sector;
- **Limiting of resource depletion and development of the circular economy**, via the guidelines concerning waste prevention and management, recovery of local resources and promotion of bio-sourced materials.
- **Preserving soil and water quality and improved spatial management**, via the guidelines in the agriculture and forestry sectors, aiming to reduce pollution in soils and to increase their carbon storage. The strategy also proposes guidelines aiming specifically to limit land take. Nevertheless, the development of low-carbon processes and technologies, and the installation of new infrastructures, must be carefully examined in order to avoid any impacts in terms of soil and water pollution. The Multi Annual Energy plan (PPE) contains environmental recommendations on this topic.

The strategic environmental assessment also raises some other points of interest, in particular concerning:

- **The preservation of biodiversity and the loss of natural, agricultural and forest spaces.** Increased use of biomass may have indirect impacts due to the intensification and extension of agricultural and forestry production systems. The environmental recommendations of the National Biomass Mobilisation Strategy aim specifically to limit this type of impact;
- **Management of non-energy mineral resources** associated with development of renewable energy sources, electrification of transport systems (production of batteries, photovoltaic panels, grids, etc.), and renovation of energy systems in buildings. These challenges are taken into account in a more operational manner in the Multi Annual Energy Plans (PPE) and the Resources Plan for France;
- **Air quality**, which could potentially be affected by the use of biomass and its combustion, and by the energy renovation operations in buildings (maintenance of indoor air quality by means of ventilation systems). This challenge is included in the guidelines of the SNBC, and taken into account on an operational level in the National Plan for Reduction of Atmospheric Pollutants, and in the Plan for Energy Renovation of Housing. Probable positive impacts of the SNBC should also be noted regarding the quality of outdoor air, notably associated with the guidelines concerning energy decarbonisation and widespread electrification of transport.