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COP21·CMP11

Booklet for sub-national stakeholders heading towards the COP 21

Agricultural and forestry focus

Key concepts

on the impacts of climate change,
climate policies and economic tools:
insight from French territories

cdc climat research | Caisse des Dépôts GROUP

METEO FRANCE

ONERC
Observatoire national sur les effets du réchauffement climatique

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
Ministère de l'Écologie, du Développement durable et de l'Énergie

in collaboration with: afd | ADEME Agence de l'Environnement et de la Maîtrise de l'Énergie

Booklet for sub-national stakeholders heading towards the COP 21
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Since most of the material used for this booklet is based on French work and experience, original web-sources are provided when no English version is available.

Contents

Preface

At a time when the international community is striving to construct an overall framework for the future fight against climate change, regional actors have already been taking measures for several years to mitigate their greenhouse gas emissions and adapt to the changing climate.

The purpose of this booklet is to present **the situation, tools and actions of French local authorities** in this field. It will attempt to offer open, direct and informative access to the most up-to-date knowledge on climate change to encourage and facilitate the continuation of these approaches.

It has been jointly produced by CDC-Climat Research, ONERC and Météo-France, in partnership with ADEME and AFD which have also contributed to developing its content.

DGEC and research laboratories such as CIRED and the CSTB also contributed with their expertise.

This booklet is aimed at local authorities, as well as public and private actors working alongside them, and addresses four themes identified by colour:

- **The impacts of climate change**
- **Climate policies at a global, European and French level**
- **Economic tools available to local authorities**
- **Agricultural and forestry focus**

It includes two types of factsheets, identified by icons: (i) factsheets to **«understand»** the local, national or supranational context of the themes addressed (ii) factsheets to **«act»**, setting out the main principles, systems and tools to offer responses to the problems raised at a regional level.

The **«act»** factsheets are accompanied by good practice illustrating the type of approaches and measures implemented in French regions, which are in operation and can be adapted in France or around the world. These illustrations have been selected as being interesting examples among others.

The **«find out more»** boxes indicate documents, websites and reference tools to obtain more in-depth information on the themes addressed.

Throughout the files, specific or technical terms are indicated in bold and defined in a glossary at the end of the booklet.

Most of the content of this booklet is sourced from analyses and exchanges carried out since 2008 in the context of CDC Climat Research Clubs: the Club VITECC (the Cities, Subnational Governments & Climate Change Club) with Météo-France and ONERC, the Carbon Forest-Wood Club with ASFFOR, FPF, ONF, Société Forestière and SuSSO, and the Agriculture Climate Club with INRA and APCA. These Clubs offers mediation of scientific knowledge and discussion to better understand major issues, identify local climate change challenges and define action and financing resources available to regional actors. Most of the examples and «good practices» mentioned in this booklet stem from feedback presented by members of these three Clubs.

Authors

CDC Climat Research
Vivian Dépoues, Alexia Leseur, Claudine Foucherot, Julia Grimault, Mariana Deheza, Valentin Bellassen, Cécile Bordier

Météo France
Serge Planton, Michèle Blanchard, Aude Lemonsu, Éric Martin, Valéry Masson, Jean-Michel Soubeyroux, Gaëlle Ouzeau, Philippe Dandin, Grégoire Pigeon

Observatoire national des effets du changement climatique, Medde – DGEC - SCEE
Jerôme Duvernoy, Sylvain Mondon

Contributors and partners

ADEME
Aude Bodiguel, Laurence Gouthiere, Cécile Martin-Phipps

French Development Agency
Sabrina Archambault, Marion Joubert, Nicole Madriaga

Caisse des Dépôts
Marie-Alexandra Coste

CIRED
Vincent Viguié, Paolo Avner, Christophe Cassen, Céline Guivarch

CSTB
Jean-Luc Salagnac

Medde – DGEC - SCEE
Marie Carrega, Yann Ménager

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Members of Clubs in 2015:
Local authorities: the Conseils Régionaux of Aquitaine, Bourgogne, Bretagne, Corse, Guyane, Ile-de-France, Haute-Normandie, Midi-Pyrénées, Provence-Alpes-Côte d'Azur, and Rhône-Alpes, the Conseils Généraux of Seine-et-Marne, Val-de-Marne, and Oise, Brest Métropole Océane, Communauté de l'Agglomération Havraise, GIP Massif Central, Métropole de Lyon, Montpellier Méditerranée Métropole, Communauté d'Agglomération de Plaine Commune, GRE-Liège, Nantes Métropole, Métropole Nice Côte d'Azur; Eurométropole de Strasbourg, Ville de Paris and Saint-Malo.
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Climate change and its causes

Definition of climate change

The **IPCC** defines climate change as «a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.»

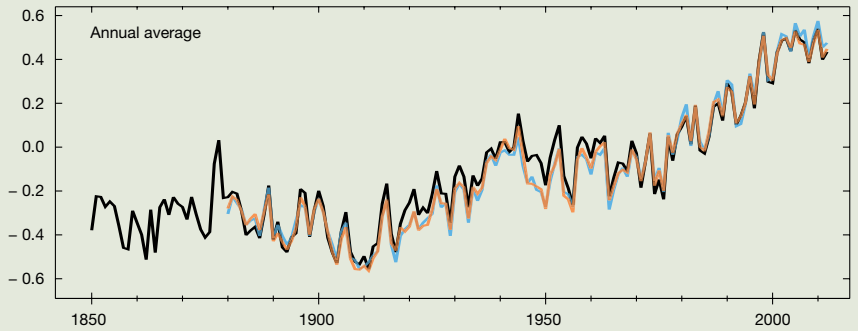
It therefore refers to a long-term, measurable phenomenon which disrupts the balance of natural and human systems.

Causes of climate change

- Climate change may result from alterations to the Earth's energy balance due to natural and anthropogenic processes.
- According to the IPCC, it is an increase in the concentrations of greenhouse gases (GHGs) resulting from human activities which, by trapping more and more energy in the atmosphere, is a major cause of recent climate change. Carbon dioxide, methane, halogenated hydrocarbons and nitrous oxide are the main contributory gases.

The IPCC therefore concludes, in volume one of its fifth Assessment Report, that it is extremely likely that human influence is the main cause of the warming observed since the mid-20th century.

■ Changes in °C in the annual global average temperature compared with the period 1961-1990 according to three observation datasets



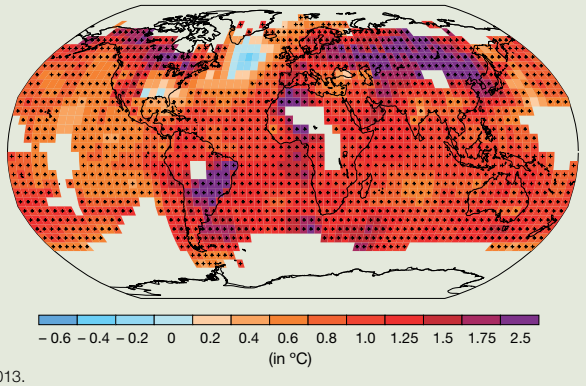
Source: IPCC, 2013.

Unequivocal global warming

Many changes recorded since the 1950s are unseen in the past decades and beyond. A range of observations gives a coherent image of the warming of the climate system:

- Significant increase in average surface temperatures, of 0.85°C between 1880 and 2012 – 19 out of the last 20 years, for instance, are among the top 20 hottest years since 1850.
- Warming of oceans and increase in their level: between 1901 and 2010, the average global sea level increased by 17to 21cm, mainly due to melting ice sheets and expansion due to the increase in the water temperature.
- Reduction in the cryosphere (water in its solid state): the Arctic ice pack in particular shrank at a rate of between 3.5% and 4.1% per decade during the period 1979-2012.

■ Changes observed in the surface temperature of the Earth between 1901 and 2012



Source: IPCC, 2013.

■ Further information:

IPCC, 2014: Fifth Assessment Report, Vol. 1 and 2, summaries for policymakers
http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf

Socio-economic impacts of climate change

Definition and main impacts

The socio-economic impacts of climate change can be positive or negative and affect infrastructure, sanitary conditions, economic activity and biodiversity.

Over the past decades, all continents and oceans have been impacted by climate change. The second volume of the fifth IPCC Assessment Report presents an overview of the impacts observed and specifies the level of certainty with which these impacts can be attributed to climate change:

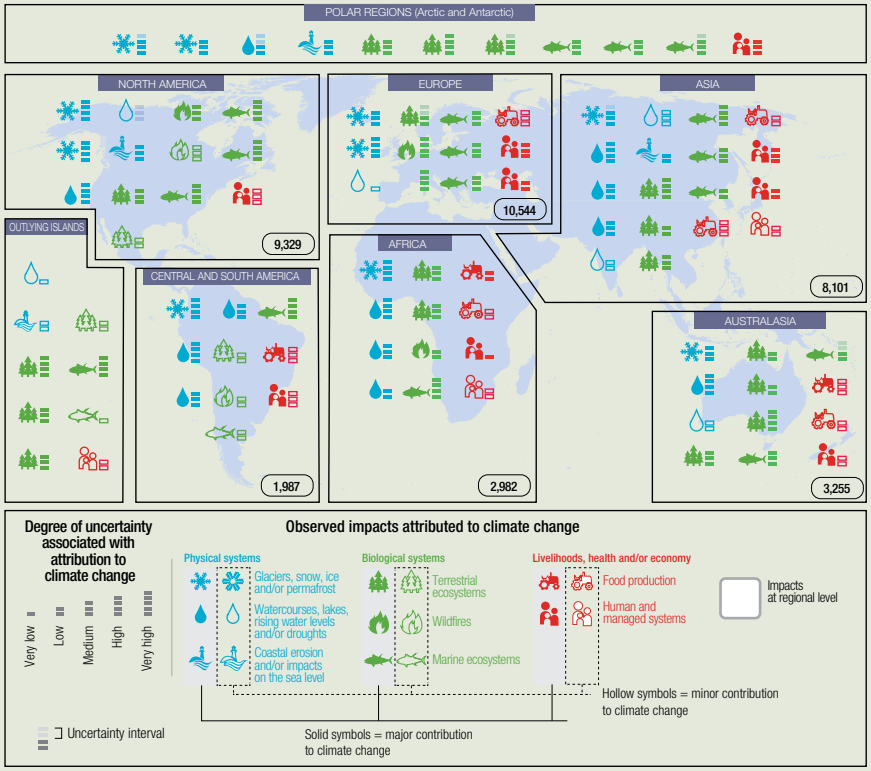
- **Water resources:** in many regions, changes to rainfall or snow and ice melt are affecting the quality and quantity of water resources (level of confidence: medium).
- **Ecosystems:** many animal and plant areas are adapting to changes in climate conditions, habitats, seasonal activities, migration patterns and the abundance of populations.
- **Agriculture:** negative impacts on crop yields have been recorded more frequently than positive impacts (level of confidence: high).
- **Health:** possible impacts on health have been identified although insufficiently quantified.

Unequal distribution

Significant geographical disparities, for instance, have been recorded in terms of climate risk. Institutional, political and cultural conditions, as well as social and economic inequalities influence the different systems' degree of vulnerability and exposure to these impacts. Recent extreme events such as flooding, cyclones and heatwaves have revealed that there is already significant vulnerability to current climate conditions.

These impacts have major social implications, since they increase other stress factors such as access to water, food and safe housing, particularly for the poorest populations. Violent conflicts further aggravate this vulnerability.

■ Map of climate change impacts recorded in scientific literature



The studies used to produce this map were published between 2007 and 2013 but include the results of previous analyses.

The symbols indicate the type of impact, the relative contribution (minor or major) of climate change to the impact and the level of confidence with which each impact can be attributed to climate change, particularly considering natural climate variability.

Source: IPCC, 2013.

■ Further information:

IPCC, 2014: Fifth Assessment Report, Volume 2, summary for policymakers
http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf

IPCC reports and forecasts

The role of the Intergovernmental Panel on Climate Change

The IPCC was formed in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), in order to provide «comprehensive Assessment Reports about the state of scientific, technical and socio-economic knowledge on climate change, its causes, potential impacts and response strategies.» It is an intergovernmental body with 195 States as members. It brings together researchers from all backgrounds and nationalities to jointly study advances in scientific literature published on the climate. The IPCC does not carry out any research itself.

The Assessment Reports published by the IPCC every five to seven years and its Special Reports serve as scientific guidelines, particularly during international negotiations.

The Fifth Assessment Report (2013-2014)

With 2,500 scientific contributors, including 830 authors, the latest report has three volumes and a synthesis report:

- Volume 1 «The Physical Science Basis» presents the results of climate science.
- Volume 2 «Impacts, Adaptation, and Vulnerability» details recorded impacts and potential future impacts as well as related risks and adaptation possibilities in two sections: a thematic section and a methodological section, as well as a section covering major regions.
- Volume 3 «Mitigation of Climate Change» analyses scenarios compatible with the 2°C target.

The projections used in the report are based on global climate modelling exercises using models from some 30 laboratories around the world and a set of four Representative Concentration Pathways (**RCPs**), each corresponding to a scenario of potential atmospheric concentrations of GHGs.

Socio-economic scenarios are also used to study a variety of economic and political «pathways» resulting in these GHG concentrations.

Some key messages from scientists

Volume 1 asserts that the human influence on the climate has been clearly established. Depending on the scenario studied, it reports average levels of warming of between +1°C and +3.7°C by 2100 compared with 2005, accompanied by an increase in sea levels of between 40cm and 63cm. These forecasts are more pessimistic than those of the previous Assessment Report.
By way of comparison, the difference in the global temperature between an ice age and a period such as the one in which we are currently living, over a cycle of around 100,000 years, is no more than 3°C to 8°C.

■ Projected consequences of climate change in the period 2081-2100 compared with the period 1986-2005 (global averages)

Scenario	Surface Warming	Rise in the Level of Oceans
RCP2.6	From 0,3 to 1,7°C	26 to 55cm
RCP8.5	2,6 to 4,8°C	45 to 82cm

Volume 2 emphasises that the highest priority adaptation measure is to reduce current risks and that adaptation planning should involve all relevant stakeholders and decision-making tools in order to promote **climate-resilient development solutions.**
Volume 3 demonstrates that scenarios compatible with the 2°C target require zero emissions by 2100, implying major technical, economic, social and institutional challenges, including significant investment in low-carbon energies and energy efficiency, as well as behavioural changes, etc.

Implications for cities

The IPCC's fifth report is the first to include two chapters on cities, which are treated as a system. The first, devoted to mitigation, encourages the incorporation of climate policies into housing and transport policies in order to promote urban densification, the construction of low-energy housing, the development of low-emission transport systems and the search for co-benefits, for example in healthcare. A chapter on adaptation emphasises the vulnerability of cities and the importance of building resilient infrastructure.

■ Further information:

IPCC, 2013-2014: Fifth Assessment Report, www.ipcc.ch/report/ar5
MEDDE : www.developpement-durable.gouv.fr/-GIEC-et-expertise-climatique

Climate models and impacts in France

Climate modelling for France

A mission lead by climatologist Jean Jouzel has produced a summary of climate modelling for France. This regional view of overall climate simulations, based on **RCP scenarios** of changes in atmospheric GHG concentrations, magnifies the scale of around 200km, used in the IPCC reports, to a scale of 12km for the regional models of Météo-France and the Institut Pierre Simon Laplace.

In the short term, the conclusions' degree of certainty mainly depends on climate variability. And in the longer term, on the models and scenarios used.

Impacts of climate change in France between 2021 and 2100

Volume 4 of the report, *«The Climate of France in the 21st century»*, presents projections of the main potential changes compared with the 1976-2005 average, according to either a small or a large increase in atmospheric GHG concentrations.

By 2021-2050

- Average increase in temperatures of between 0.6°C and 1.3°C, particularly in the south-east of France in the summer, where it could reach 2°C. This increase could be equivalent to the warming recorded in France throughout the whole of the 21st century (around 1°C).
- Increase in the number of days of heatwave in the summer, particularly for south-eastern regions.
- Reduction in the number of unusually cold days in the winter, particularly in the north-east of the country.

By 2071-2100

- A significant increase in temperatures, varying by a factor of 1 to 4 depending on the scenario considered (+0.9°C to 3.6°C in the winter and +1.3°C to 5.3°C in the summer), and particularly pronounced in the south-east, where it could be well above +5°C in the summer.
- Significant increase in the number of days of heatwave in the summer.
- Reduction in extreme cold weather in winter.
- Sharp increase in extreme rainfall, as well as the in risk of drought, which could spread to the whole country.

■ Schematic map of potential impacts of climate change in France by 2100

Source: CDC Climat Research, 2015, based on IPCC (2014), MEDDE (2014 et 2015), ONERC (2010) and Météo France.

Overseas Territories

For all French overseas regions, the results of simulations, based on a single model, reveal:

- An increase in the average temperature of between 0.7°C and 3.5°C by 2100.
- A decrease in average rainfall, particularly during the dry season.
- A possible change in cyclone activity, particularly towards the end of the century, with similar or less frequency but potential increases in average rainfall and maximum winds.

■ Further information:

Drias, les futurs du Climat : www.drias-climat.fr

MEDDE - Mission Jouzel : www.developpement-durable.gouv.fr/-Rapports-climat-dela-France-au-.html

Météo France : www.meteofrance.fr/climat-passe-et-futur/changementclimatique/projections-climatiques

ADEME : Outil Impact' Climat

Adaptation to climate change

Definition of climate change adaptation

Adaptation is a response to the impacts of climate change. According to the IPCC (2001) *«adaptation is the process of adjustment to the current and forecasted climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.»* An adaptation measure may be:

- Spontaneous or planned (particularly by public authorities),
- «Soft» (information, prevention or organisational changes) or «hard» (protection infrastructure, re-dimensioning of networks, etc.),
- Incremental (based on actions which safeguard the system's initial integrity) or transformational (which agree to transform the system),
- Reactive (implemented once changes have been recorded) or anticipating changes.

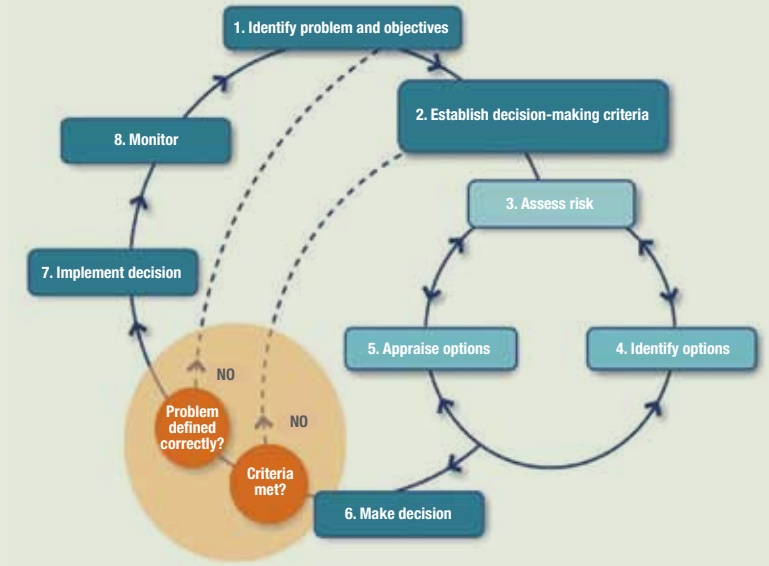
Adaptation aims to reduce the climate risks facing systems by addressing their exposure to uncertainty or their vulnerability – *i.e.* the degree to which the system can be negatively affected by an impact. Adaptation also makes systems more resilient, *i.e.* better prepared to absorb shocks.

Implementation of strategies and adaptation measures

It is necessary to act at all levels by implementing iterative and progressive adaptation strategies (see diagram below). Prioritising adaptation actions is a research field which is still being explored, although several principles can already be applied:

- Combine «soft» and «hard» adaptation measures.
- Promote no-regrets measures, i.e. beneficial even without climate change, adjustable over time (flexible) and robust, i.e. effective in a broad spectrum of possible futures.
- Avoid **maladaptation** which occurs when an adaptation measure increases a region's vulnerability, is ineffective or exacerbates climate change.
- Prioritise the most immediate, important and certain impacts.
- Involve all stakeholders in decisions and actions.
- Systematise climate risk analysis based on future projections for long-term investments.

■ Diagram of a typical adaptation process



Source: UKCIP, Willows, R.I. and Connell, R.K. (2003).

Adaptation in international discussions

At a global level, adaptation costs may reach $150bn (€120bn) by 2030 and $500bn a year by 2050, under **scenario 2°C**. According to UNEP, expenses could even double if the current GHG emissions trend is not reduced. The cost of inaction highlighted by the **Stern Report** in 2006 and the financing of adaptation, particularly in developing countries, are a major focus of international negotiations. The UNFCCC has dedicated working groups to the subject and specific financial tools such as **adaptation funds** have been set up. The **Green Climate Fund** is expected to devote 50% of its capitalisation, to adaptation.

■ Further information:

IPCC, 2014: Fifth Assessment Report, Volume 2, ipcc-wg2.gov/AR5
UNEP, 2014 : *The gap between needs and outlooks in relation to adaptatio* (Adaptation gap report)
ADEME : Objectif'Climat tool
ONERC : www.onerc.gouv.fr

Droughts

Definition of drought

Different types of drought are traditionally identified:

- **Meteorological drought:** when rainfall is lower than average for a prolonged period,
- **Agricultural drought:** when the moisture level in the soil becomes too low for crops, which is not only the result of rainfall but also evaporation from the soil and transpiration from plants,
- **Hydrological drought:** when water reserves in aquifers, lakes and reservoirs become scarcer and river flow falls significantly.

The average intensity of droughts and the time of year when they occur have a major influence on the impacts on ecosystems and economic activity, particularly farming.

Changing trends concerning droughts in France

France is particularly affected by the risk of an increase in the frequency and intensity of droughts linked to climate change. The results of the **CLIMSEC** study on possible changes concerning droughts in cities in the 21st century indicate a consistent trend:

■ Impact of climate change on droughts in the 21st century

- 2020s:

No particular change in the characteristics of meteorological droughts compared with the period 1961-1990 but a worsening of agricultural droughts.

- 2050s:

Very significant changes in agricultural droughts and risk of unusual droughts in terms of geographical extent and intensity. Severe droughts ,similar to those, experienced in 1990 could become steadily worse.

- 2080s and the end of the century:

More extreme meteorological droughts, events such as experienced in 1976 becoming steadily worse and a more severe situation in relation to agricultural droughts. Climate projections indicate that a large part of the territory could experience very long periods of drought, with normal conditions based on the current climate becoming extremely rare.

Source: findings of the CLIMSEC project, based on a range of climate projections, 2010.

Adaptation strategies – major levers in farming practices

Agricultural uses represent 70% of the water used at a global level.
This sector is therefore particularly impacted by droughts, but also has adaptation levers:

- **Choice of species and varieties,** avoiding varieties that have a critical growth phase that coincides with droughts (e.g. winter crops, bringing forward sowing dates and planting of early varieties) or opting for drought-tolerant species.
- **Mixed agriculture and forestry** – trees planted at regular intervals on arable land – which has demonstrated a positive effect on the water stress of crops, particularly at the end of the summer.
- **Irrigation** from water reserves in aquifers, watercourses and artificial reservoirs to offset the lack of natural water and therefore limit impacts on activities. This measure is increasingly controversial, however, due to the depletion of some aquifers and greater conflicts of use during periods of drought. Irrigation methods and practices may evolve to tackle different local situations.
- **Management of conflicts of use** via collaborative governance in relation to the watershed, involving all stakeholders and water users (hydroelectric power, agriculture, nautical activities, tourism, biodiversity, fishing, etc.)

Good practice: The Garonne 2050 project

As part of its development of the SDAGE (Water Development and Management Master Plan), the Adour-Garonne water agency conducted a prospective study on changing needs and availability of water resources in the watershed. Having carried out a current-state assessment, the impact of several climate change scenarios was opened up to water users for discussion. This allowed an action strategy to be developed, with a particular focus on more proactive management of water, including development of storage, promotion of water savings, improvements to rainwater management, modernisation of networks to reduce leaks, etc. To find out more: www.garonne2050.fr

■ Further information:

INRA - Drought and agriculture

Météo France – CNRM, 2011: CLIMSEC project

MEDDE: water resources, www.developpement-durable.gouv.fr/-La-ressource-en-eau

ONERC, 2014: Annual urban drought index

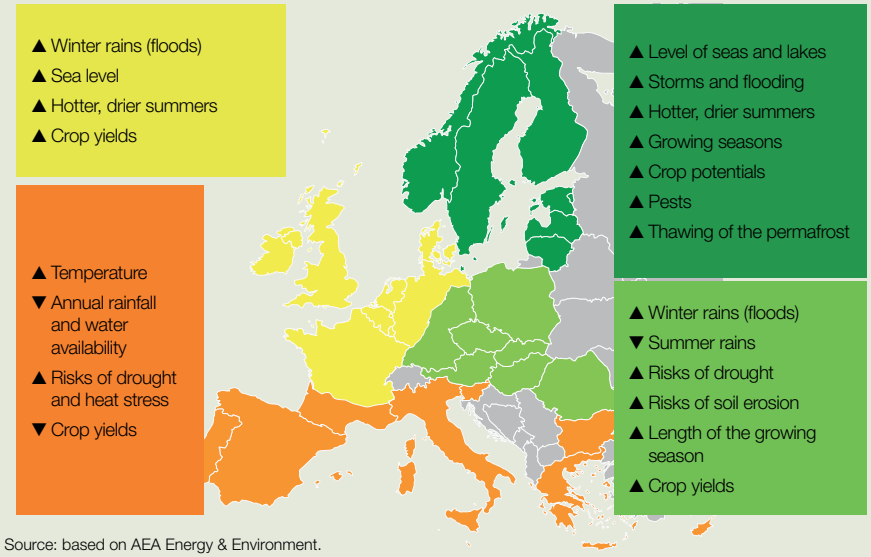
Agriculture

Factors impacting the agricultural sector

The agricultural sector is affected by several factors linked to climate change:

- Changing trends: the increase in the prevalence of CO_2 and other GHGs, the rise in temperatures, new precipitation and evaporation as well as drainage and run-off patterns, and changes to cloud cover and therefore to sunlight levels are bioclimatic developments which influence the functioning of ecosystems and can therefore have an impact on agricultural systems.
- Accentuation of climatic extremes: an increase in the frequency and intensity of extreme climatic events such as droughts, storms, heatwaves and heavy rainfall can impact the quantity and/or quality of agricultural production.
- Indirect effect of pests: a link between global warming and an increase in pests is also strongly suspected although it has not yet been demonstrated. The consequences of these changes are highly variable depending on regions, at both a global and European level (see map).

■ Projection of the impact of climate change on various agro-climatic zones in Europe



Source: based on AEA Energy & Environment.

Impacts on yields

In most regions of the world, a stagnation in agricultural yields has been observed for certain crops. In France, wheat yields have remained at the same level since the 1990s, despite having previously risen sharply since the 1950s and ongoing agronomic and genetic improvements.

The increase in the frequency of extreme events will also have consequences for agricultural yields. The heatwave in Europe in 2003 and the droughts of 2010 in Russia and 2012 in the United States had an impact on global production, pushing up prices. Climate change is therefore among the direct external factors of agricultural price volatility.

The IPCC's Fifth Assessment Report is more alarming than the previous one regarding crop sensitivity to the accentuation of climate extremes. It also predicts a change in the geographical distribution of vines, a decrease in dairy production in the Mediterranean due to heat stress (level of confidence: medium) and an increase in irrigation needs, as well as highlighting risks to global food security.

Tackling climate risks to regions

The main adaptation strategies for cropping systems are:

- Agricultural: crop diversification and changes to cropping and/or varietal practices,
- Governance-related: better water management, from the field to the regional level, including consideration for conflicts of use,
- Economic: better management of residual risks (*e.g.* via the storage of production, insurance systems, national solidarity funds, etc.).

■ Further information:

IPCC, 2013-2014: Fifth Assessment Report, Volume 1 and synthesis report, www.ipcc.ch/report/ar5/

OECD, 2012: *Comparative study of risk management in agriculture in a context of climate change*

CDC Climat Research, to be published in 2015: *Climate Report – Management of climatic risks in the agriculture sector*

UNDERSTAND

Kyoto Protocol

Implementation of the Kyoto Protocol

The United Nations Framework Convention on Climate Change

The text adopted in Kyoto in 1997 is an additional protocol to the United Nations Framework Convention on Climate Change (UNFCCC). Signed at the Earth Summit in Rio in 1992, the UNFCCC was the first international climate change treaty. It draws on three principles: 1) the precautionary principle, 2) the principle of common but differentiated responsibilities and 3) the right to development. Since 1992, the Conferences of the Parties to the agreement (COP) have met each year to stipulate targets and implementation procedures.

Kyoto Protocol targets

- The GHGs from the 38 most industrialised countries (listed in Annex B to the protocol) must be reduced by at least 5% during the period 2008-2012 compared with 1990. The targets are differentiated by country.
- The emissions taken into account cover six anthropogenic GHGs: CO_2, CH_4, N_2O, HFC, PFC, SF_6 and, since 2013, NF_3.
- Non-Annex B countries have no GHG emissions reduction commitments.

Implementation

The protocol came into force in 2005 after ratification by Russia, meeting the quorum of 55 States, representing 55% of Annex B emissions in 1990.

Results

In 2012, the overall targets of the first period of the Protocol were reached despite Canada's withdrawal and the absence of the United States, thanks to the use of flexibility mechanisms. Participating countries reduced their emissions by 24% compared with the reference year (generally 1990).

However, without the United States and following the withdrawal of Canada, the first commitment period was only binding on 36 countries representing just 24% of 2010 emissions, while global emissions increased by 30%, particularly due to growth in developing countries. Since the Kyoto Protocol is non-binding on the main countries responsible for emissions, it has not been sufficient to stabilise GHG emissions.

A second commitment period while awaiting a new international agreement

Discussions regarding post-Kyoto have been ongoing since 2005. However, given the difficulties in establishing a new agreement and to avoid a period of no commitments, the principle of a second Kyoto Protocol commitment period covering 2013 to 2020 was agreed in Durban in 2011. Its ratification is under way and is due to be completed in 2015.

■ Declarations of Kyoto emissions reduction targets by Annex B countries compared with 1990

	First period 2008-2012	Second period 2013-2020
EU-15+ [1]	–8%	–20% (UE27, Croatia and Iceland, jointly, in application of article 4 of the protocol)
Croatia	–5%	
Iceland	10%	
Hungary, Poland	–6%	
Switzerland	–8%	–15.8%
Ukraine[3]	0%	–24%
Norway	1%	–16%
Australia	8%	–0.5%
Belarus[3]		–12%
Kazakhstan[3]		–5%
New Zealand	0%	
Japan	–6%	
Russian Federation	0%	
Canada[2]	–6%[3]	
United States[2]	–7%	

1. UE-15 + Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia.
2. Canada and the United States decided not to ratify or withdraw from the Kyoto protocol and are therefore not bound by it.
3. Ukraine, Belarus and Kazakhstan may not commit to the second period.

■ Further information:

UNFCCC: unfccc.int/

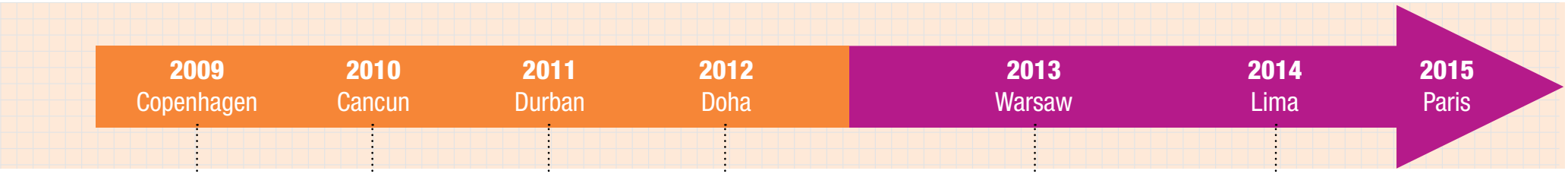
MEDDE : Kyoto Protocol www.developpement-durable.gouv.fr/Le-Protocole-de-Kyoto,13782.html

CDC Climat Research, 2014: Climate Report n°44 - *Ex-post evaluation of the Kyoto Protocol : Four key lessons for the 2015 Paris Agreement*

Summary of climate negotiations towards post-Kyoto

Several rounds of negotiations have taken place since 2005 to prepare for post-Kyoto. In 2007, the Bali road map provided a framework for discussions around four main themes: mitigation, adaptation, development and technology transfer, and financing. Since Copenhagen (2009), the reduction in GHG emissions to limit warming to 2°C has remained the key target of the process.

Faced with the difficulty of reaching a new agreement involving all countries by the Kyoto Protocol deadline, it was extended until 2020. This decision to set a new time horizon enabled a single negotiation process to be launched for post-2020, which is expected to reach a global agreement in Paris in 2015.



COP 15

Agreement between 28 countries outside the UNFCCC framework

Recognition of the +2°C target

Voluntary commitments by countries, maintaining a distinction between industrialised and developing countries

Principle of establishing a **green climate fund**[1]

COP 16

Reintegration of the 2009 decisions into the UNFCCC framework

Launch of negotiations for a second commitment phase to follow the Kyoto Protocol

COP 17

Extension of the Kyoto Protocol until 2020

Creation of the «**Durban platform**» to negotiate a post-2020 agreement by 2015

Establishment of an executive committee for technology transfers and an adaptation committee

1st green climate fund mechanisms defined

COP 18

The rules of the Kyoto Protocol's second commitment period are fixed

Conclusion of the negotiation cycle initiated in Bali and setting a next deadline of 2015

Launch of a «**losses and damages**» work programme

COP 19

Little progress on the issue of financing (€100m for the Adaptation Fund)

Technical progress on points such as mechanisms for monitoring, reporting and verification (**MRV**) of emissions

Finalisation of the REDD+ mechanism on deforestation discussed since 2009

COP 20

Definition of a framework for the submission of national emissions reduction contributions

Presentation of a draft negotiation text to form the basis for 2015 discussions leading up to Paris

■ Further information:

UNFCCC: unfccc.int

French government, 2015: official site of COP21, www.cop21.gouv.fr

French Ministry of Foreign Affairs: http://www.diplomatie.gouv.fr/en/french-foreign-policy/climate-7436/2015-paris-climate-conference/

French Ministry of Ecology: http://www.developpement-durable.gouv.fr/-Les-negociations-climat-post-2012-.html

CDC Climat Research, 2014-2015: Climate Briefs no. 24, 33 and 37 on international negotiations

1. This green fund is designed to finance mitigation and adaptation projects in developing countries. It is set to significantly contribute to the $100bn a year financing target for 2020.

Overview of carbon prices

Putting a price on carbon

Three main economic instruments are usually proposed to reduce GHG emissions at lower costs. These involve attributing a price to GHGs in order to pass on the costs of the damage they cause to those responsible for producing them and thereby giving those producers an incentive to reduce their emissions. The three instruments are based either on price (taxes), or volumes (standards and markets):

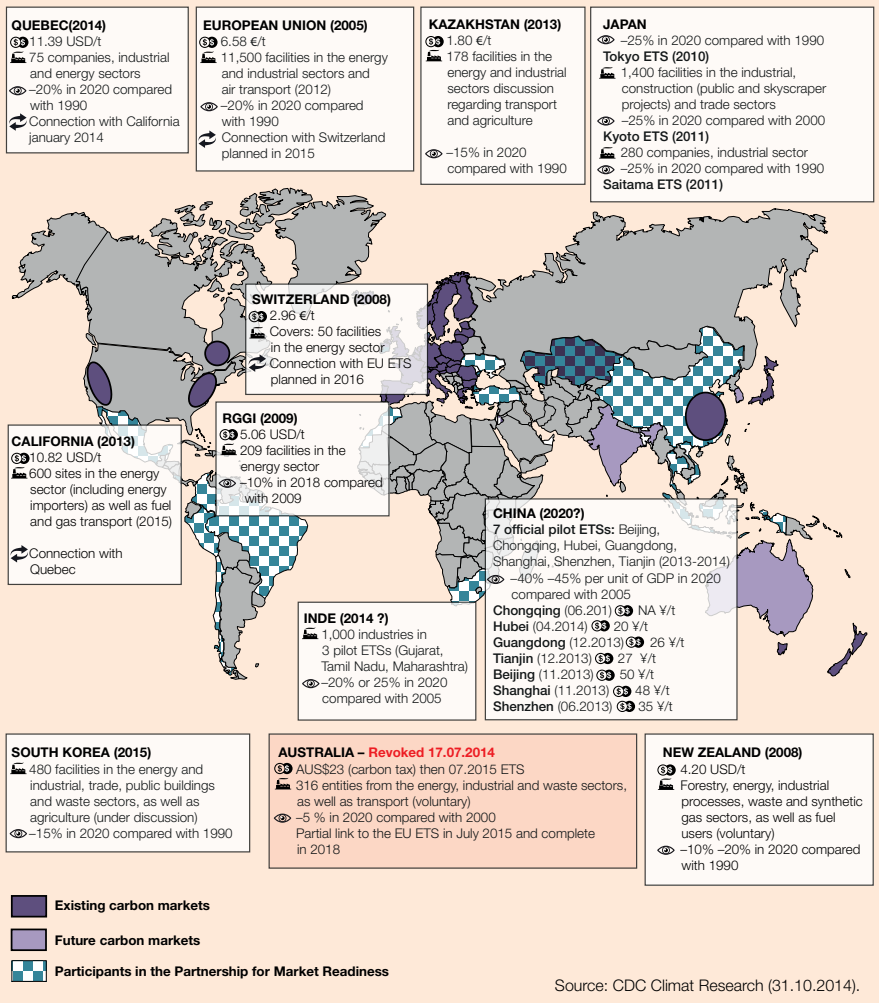
- **Carbon tax:** tax added to the sale price of products such as fossil fuels depending on the quantity of GHGs released during use (see table).
- **Emissions standard:** this standard, fixed by the regulator, defines a limit on the quantity of GHG emissions which can be released, *e.g.* gCO_2/km for a car.
- **Carbon market:** the regulator defines an emissions cap and distributes a certain number of emissions quotas to market participants. Participants must ensure that they have enough quotas for the number of tonnes of GHGs they release. Market players can buy quotas to offset any surplus emissions or sell their quotas in the event that they achieve further reductions – thereby determining a price for carbon based on supply and demand (see map).

■ Overview of carbon taxes worldwide

Country	Applies to	2014 price per tC02e (€)
South Africa (2016)	Fuels	0.82 - 3.29
British Columbia (2008)	Fossil fuels Exception: use in aviation, maritime transport and journeys outside the province	20.37
Chile (2017)	Geothermal plants of more than 50MW	3.68
Mexico (2014)	Use of fossil fuels - Exception: natural gas	0.57 - 2.83
South Korea (2016)	Consumers purchasing new vehicles with high fuel consumption	Unknown
India (2010)	Coal producers and importers	0.61
Japan (2012)	All fossil fuels - Exception: some sectors of agriculture, transport, industry and the energy sector	2.09
Kazakhstan (2013)	Subjects of Administrative regulation = entities responsible for less than 20,000 tCO_2 in the energy, mining, chemicals, agriculture, transport and housing sectors	Unknown
Australia (2012-2015)	Industry, energy, gas consumers and waste	16.72
Denmark (1992)	All energy products used by households and companies (gas, diesel, oil, petrol, kerosene, coal) - Exemption: Sectors covered by the EU ETS	22.38
Finland (1990)	All consumers of fossil fuels	Domestic fuel: 35 Petrol for transport: 60 Coal and natural gas: 30
France (2014)	According to the carbon content of five energy products (2014): coal, diesel (non-road), natural gas, E85 super ethanol, heavy fuel oil.	7
Iceland (2010)	All fossil fuels	7,25
Ireland (2010)	All consumers of natural gas, mineral oil equivalents and solid fossil fuels	20
Norway	Consumption of mineral oil, petrol and natural gas	3.08 - 51.55
United Kingdom	Fossil fuels used for the production of electricity	11.95
Sweden (1991)	All fossils fuels used for vehicles and heating	35.9 - 119.66
Switzerland (2008)	Fossil fuels for heating and lighting, electricity from thermal and cogeneration power plants	49.27

Source: CDC Climat Research, 2014.

■ Carbon taxes worldwide



Source: CDC Climat Research (31.10.2014).

■ Further information:

World Bank, 2014: State and Trends of Carbon Pricing

Bureau of the UN Global Compact, 2009: Carbon markets explained

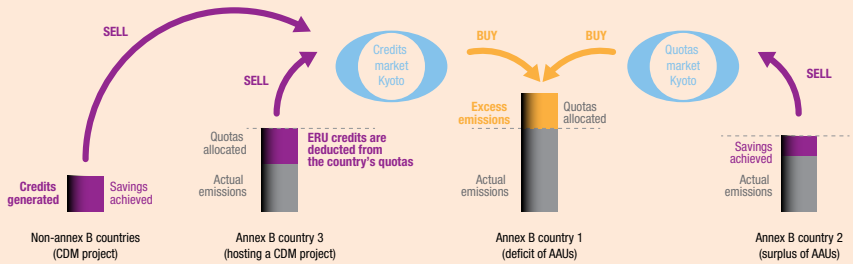
Kyoto Protocol flexibility mechanisms

Definition and operating principle

The GHG emission reduction targets applicable to developed countries which ratified the Kyoto Protocol (listed in Annex B) correspond to a number of carbon quotas attributed to each country. Annex B countries must return as many carbon assets as GHG emissions they have produced, based on national inventories submitted annually to the UNFCCC. In order to be compliant, they can reduce their emissions internally as well as using the three flexibility mechanisms:

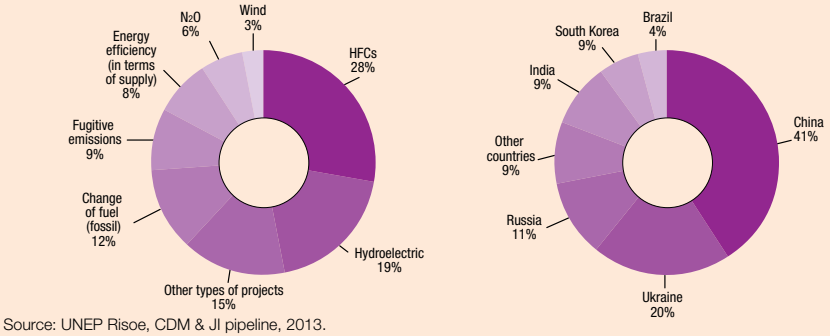
- Buying Kyoto quotas from countries with a surplus,
- Buying credits from CDM (Clean Development Mechanism) projects,
- Buying credits from JI (Joint Implementation) projects.

■ Market mechanisms resulting from the Kyoto Protocol



Source: CDC Climat Research, 2014.

■ Sectoral and geographical distribution of certified carbon credits (CDM and JI) over the period 2008-2012 (% of the total, ± 2 GtCO2e)



Source: UNEP Risoe, CDM & JI pipeline, 2013.

Joint Implementation (JI)

This mechanism concerns emissions reduction projects established in Annex B countries. They can be carried out by investors from Annex B countries in another Annex B country. The financial incentive involves the issuing of a number of emissions reduction units (ERUs) corresponding to the GHGs avoided.

Projects can be undertaken in most business sectors, provided they are not already covered by the European Union Emissions Trading Scheme (EU ETS). JI projects need to be validated then recorded by the UNFCCC secretariat based on precise criteria and methodologies.

Clean Development Mechanism (CDM)

This mechanism concerns emissions reduction projects implemented in developing countries, excluding Annex B. An Annex B country, or a project coordinator based in an Annex B country, can obtain Certified Emissions Reductions (CER) by financing emissions reduction projects in a developing country (excluding Annex B). The number of CERs received corresponds to emissions avoided by the project. CDM projects also need to be validated then recorded by the UNFCCC based on precise criteria.

Use of these mechanisms by local authorities

Worldwide, fewer than 10% of registered projects concern cities. The ones that do are mainly energy generation projects involving landfill gas, energy efficiency or reducing energy consumption. A few projects have also been developed in the water and transport sectors

■ Further information:

UNFCCC: cdm.unfccc.int and ji.unfccc.int

CDC Climat Research, 2012: Climate Report 33 - JI: a frontier mechanism within the borders of an emissions cap and Climate Report 37 – 10 lessons from 10 years of the CDM

OECD - CDC Climat Research, 2011: *Cities and Carbon Market Finance: Taking Stock of Cities' Experience with CDMs and JIs*

UNDERSTAND

European Climate and Energy Package

From the Climate and Energy Package 2020 to the Climate and Energy Package 2030

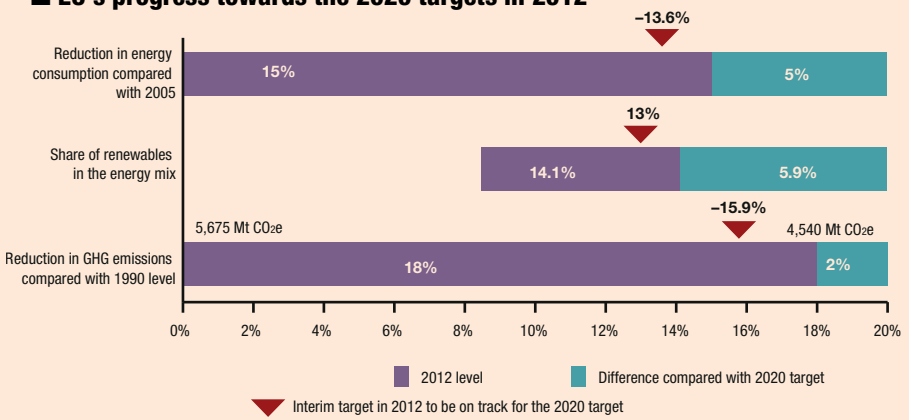
The European Climate and Energy Package (CEP) is restrictive legislation setting the European Union's targets for combating climate change and strengthening energy security. It is also the basis for the EU's climate commitments in international negotiations.

Objectives for 2020 were defined by the European Council in 2009 based on «3 x 20» targets: 20% renewable energies in the European energy mix, a 20% improvement in energy efficiency (i.e. a 20% reduction in primary energy consumption compared with a baseline scenario established in 2005) and a 20% reduction in GHG emissions compared with their 1990 levels.

These targets were updated and revised for 2030 at the European Council meeting in October 2014 which agreed on:

- A strict GHG emissions reduction target in the EU of at least 40% compared with 1990 levels;
- A target of at least 27% for the share of renewables in EU energy consumption. According to the European Commission's impact assessment, an emissions reduction target of 40% automatically requires this share of renewables in the EU energy mix;
- An indicative energy efficiency improvement target of at least 27% compared with the 2007 reference scenario, which will be revised in 2020.

■ EU's progress towards the 2020 targets in 2012



Source: CDC Climat Research, 2014.

Tools of the European policy

The EU's main tools to achieve these targets are:

- an emissions trading scheme (with a target of a 43% reduction by 2030 compared with 2005 levels),
- national emissions reduction targets for non-EU-ETS sectors (for a reduction target at European level of –30% in 2030 compared with 2005 levels),
- national renewable energy development targets defined in the «Renewable Energies» directive (directive 2009/28/EC) which sets out the general target for each sector,
- an energy efficiency plan and directive (directive 2012/27/EU) committing States to define national targets.

Achieving the 2030 GHG emissions reduction target relies on principles of flexibility, solidarity and fairness between Member States and takes account of specific national characteristics.

In 2014 (see figure), the EU was on track to achieve its 2020 emissions reduction and renewable energy development targets.

Achieving the energy efficiency target seems more difficult however.

In the longer term the EU has an energy Road Map for 2050, particularly including a reduction.

■ Further information:

European Commission: Climate and Energy Package 2020 and Climate and Energy Package 2030

MEDDE: Climate and Energy Package 2030, www.developpement-durable.gouv.fr/Paquet-Energie-Climat-2030-Par-I.html

European carbon market: EU ETS

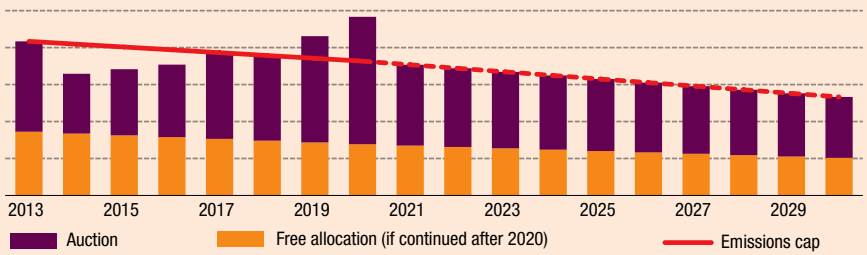
Description and functioning of the European Union Emissions Trading Scheme (EU ETS)

EU ETS is a regulated system for exchanging CO_2 emissions quotas, called **EUAs** (European Union Allowances) concerning approximately 12,000 facilities representing 50% of European CO_2 emissions. Established by directive 2003/87/EC and implemented in 2005, it is one of the EU's main tools to achieve its GHG emissions reduction targets of 20% by 2020 and 40% by 2030.

Functioning since 2013

- An emissions cap is set for industrial facilities in four main sectors: energy production, (main sector), ferrous metals, mineral industries and the paper industry.
- Most facilities are allocated a certain number of emissions quotas free of charge (1 quota = 1 tCO_2), according to the performance grids established with the 10% of existing facilities responsible for the least pollution (benchmark method). Industrial companies in the power sector, meanwhile, have been obliged to buy all their quotas at auction since 2013.
- Each year before 30 April, operators must return the number of quotas corresponding to their CO_2 emissions in the previous year or pay a fine of €100 per missing quota and submit the missing quotas the following year. Players who are able to reduce their emissions at a low cost can sell their surplus quotas to those with high reduction costs. The system therefore ensures economic efficiency through minimisation of overall costs for a fixed emissions level.

■ Change to the EU ETS emissions cap



Source: CDC Climat Research, 2014.

Assessment of the first phases

The EU ETS is now in its third phase of operation:

- Phase 1, preparatory: 2005-2007 with a target of a 5% reduction in European emissions compared with 1990;
- Phase 2: 2008-2012, –10% compared with phase 1;
- Phase 3: 2013-2020, in the framework of the Climate and Energy Package 2020, to achieve 21% reduction in emissions compared with 2005.

At the end of phase 2, the mechanism had led to a 12% reduction in European emissions between 2005 and 2012. Emissions have been reduced in all countries (except Malta and Estonia) and all sectors. Most sectors had an overall quota surplus, with only power generation having a deficit.

Changes and structural reform

The scope of the EU ETS was gradually expanded (inclusion of new GHGs and sectors), the emissions cap was lowered and the proportion of quotas auctioned increased.

However, the EU ETS continues to suffer from structural weaknesses that limit its effectiveness. Uncontrolled interactions with renewable energy development policies, the influx of international loans and the lack of flexibility concerning supply in the event of variations in demand have led to a significant surplus in quotas. This has pushed down prices over the long term and damaged the mechanism's credibility.

Although the central role of the EU ETS appears to have been confirmed by preparations for the **Climate and Energy Package 2030**, where a new target of –43% in emissions compared with 2005 was set for the sectors in question, the need to reinforce the mechanism's resilience by pursuing structural reforms was also highlighted. A proposal was made to create an instrument to stabilise the market.

■ Further information:

European Commission - Directorate-General for Climate Action: EU ETS

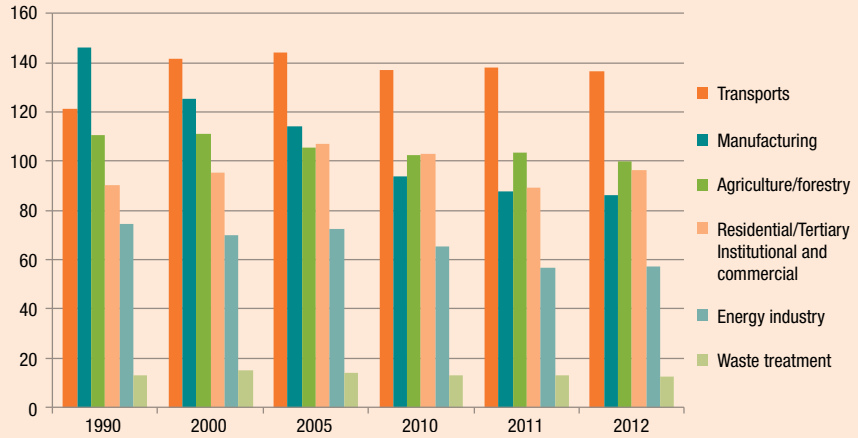
GHGs in France

National emissions inventory

France produces a relatively low level of GHGs per inhabitant and per GDP point compared with the average for OECD countries. It is responsible for 1.2% of global emissions and contributes 4.2% of total GDP.

This advantage is largely explained by the low proportion of coal and gas in the French energy mix, which has a higher percentage of nuclear and hydroelectric power.

■ Changes in direct GHG emissions by sector in France from 1990 to 2012



Source: Citepa, 2014

Sectoral analysis: The transport sector was responsible for the largest share in GHG emissions in France in 2012, as it had been since 1998. Several other sectors also make very significant and fairly close contributions, including agriculture, residential/tertiary and manufacturing.

Achievement of targets: In 2011, emissions were 12% lower than in 1990, falling from 557 to 490 Mt CO_2 eq. while GDP increased by almost 40% over the same period. GHG emissions have fallen by an average of 2% a year since 2005 and the Kyoto target has been met. This result is not yet sufficient to meet the target of quartering emissions by 2050 compared with 1990, which would require a 3% reduction each year.

Sectoral changes

The most significant changes since 1990 have been recorded in the manufacturing industry (–41%), which has reduced **energy consumption and** taken **energy efficiency** measures, as well as being impacted by the economic crisis in recent years. The second highest reduction has been seen in the energy industry (–23%).

The transport sector's emissions increased by 9% overall between 1990 and 2012, although they reached a peak in 2004 and are currently falling by 0.5% a year on average. The main mitigation levers have been improvements to infrastructure, the development of alternative means of transport to rival roads and new standards applicable to petrol and diesel vehicles.

Emissions from the residential and tertiary sectors are highly dependent on weather conditions. The new thermal regulations and a range of tools to assist with building renovations are designed to minimise this phenomenon.

Factor 4 trajectories: ADEME scenarios

ADEME has presented two energy scenarios as part of the energy transition debate:

- the first, looking ahead to 2030, involves a 40% reduction in emissions based on trends in voluntary actions, half of which concern the energy efficiency of buildings;
- the second, looking to 2050, sets out the conditions for achieving factor 4 (quartering of emissions) and relies, among other things, on increased efforts in the transport sector.

The energy mix is also likely to evolve, through greater use of biomass for example. Agriculture and industry also play a key role.

■ Further information:

CITEPA: www.citepa.org/fr/

MEDDE: Greenhouse effect and climate change, www.developpement-durable.gouv.fr/-Effet-de-serre-et-changement-.html

MEDDE, 2015: *Climate and energy efficiency policies: summary of France's commitments and results*

ADEME, 2012: *Contribution to development of 2030-2050 energy scenarios*

Objectives and governance in France

Climate and energy policies in France – background

French climate and energy policy is based partly on nationally transposed European regulations and targets.

A series of planning and implementation laws have been developed in recent years to define principles, targets and tools for these policies.

Legislation made the fight against climate change a national priority in 2001 and the first national climate plan was adopted in 2004. This has since been updated four times.

In 2005, the **POPE** law fixed strategies to secure energy supplies, improve environmental preservation, ensure a competitive energy price and access to energy for all.

■ The main French targets

	GHGs (compared with 1990)	Energy efficiency	Renewable
EU			
CEP 2020	14% reduction between 2005 and 2020 in sectors not covered by the EU ETS	20% (Energy Efficiency directive) adapted into national action plans (NEEAPs) in 2008 and 2011	20% of final consumption
National legislation			
POPE law	Quartering of emissions by 2050	Target of a 2% reduction in energy intensity by 2015 and 2.5% by 2030	10% of energy needs by 2010 (21% of electricity)
Grenelle laws	Previous target confirmed	Adaptation into sectoral measures and targets	23% of final consumption by 2020
Energy Transition (draft law)	–40% by 2030 (+ reduction in the share of nuclear to 50% of electricity generation by 2025)	–20% in 2030 and –50% of final energy consumption by 2050 compared with 2012	32% by 2030 (with –30% of primary consumption of fossil fuels)

Source: CDC Climat Research, 2015.

The Grenelle environmental pact (2007-2012)

Initiated in 2007, the Grenelle environmental pact established a multi-stakeholder governance combining the government, local politicians, social partners, companies and NGOs. These were split intoworking groups examining a range of themes, including combating climate change and energy demand, biodiversity and resources, production and consumption modes, ecological democracy, employment and competitiveness.

The proposed measures are divided into the Grenelle I (2009) and II (2011) legislation as well as into more than 250 decrees. The main implications for local authorities include the establishment of SRCAEs (regional climate, air and energy plans) and PCETs (regional climate and energy plans) and of regulatory GHG assessments.

Energy transition (2012-2015)

Since 2012, the energy transition approach has taken over, with the organisation of national and regional debates on energy transition and discussion of a draft law on energy transition for green growth, due to be definitively adopted in 2015.

The draft law addresses transport, the circular economy, renewable energy and building renovation. A governance aspect is also included, notably introducing a national carbon budget – *i.e.* emissions cap – and a multi-annual energy programme.

In parallel, an environmental conference has been organised in November each year since 2012, to collectively discuss environmental topics to be prioritised and define the working plan for the following year.

■ Further information:

National Climate Plan: http://www.developpement-durable.gouv.fr/Le-plan-climat-de-la-France-plan-d,1449

Monitoring of Grenelle measures: www.developpementdurable.gouv.fr/Le-suivi-du-Grenelle-de-l.html

The ecological transition on the French Environment Ministry's website: www.developpement-durable.gouv.fr/-Qu-est-ce-que-latransition,7312-.html

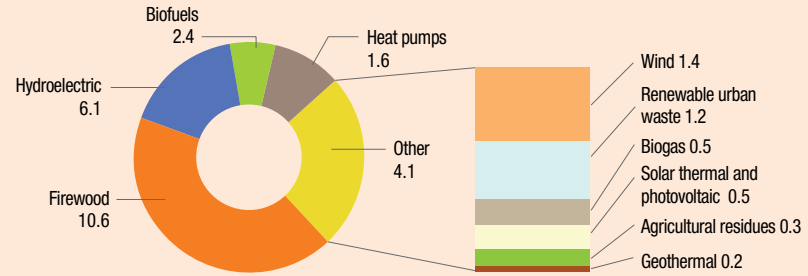
Climate and energy efficiency policies: Summary of France's results and commitments, 2015

Renewable energies in France

French position and targets

France has significant potential in terms of hydroelectric, wind and geothermal power, making it the second-largest producer of renewable energies in Europe after Germany, the 14th largest consumer and a net exporter. In 2013, primary production of all renewable energies in France was 24.8 Mtep, reflecting a continued upward trend of +9.2 Mtep between 2005 and 2013.

■ Production of primary energy per renewable energy sector (in Mtep)
2013 share: 24.8 Mtep



Source: SOeS, 2014.

In 2008, in the context of the **Climate and Energy Package 2020**, France committed to achieving a 23% share of renewable energy in its final consumption by 2020, up from 14.2% in 2013. Achieving this target should lead to an 18 Mt CO_2eq. reduction in annual emissions from 2020.
The energy transition law is due to raise the bar by doubling the share of renewable energy production within 15 years, to meet 32% of total energy demand by 2030.

Tools and policies

To achieve its targets, several sectoral policies have been put in place, including a methanisation plan, calls for tenders for offshore wind and solar projects, power feed-in tariffs, a heating fund, modernisation of the fleet of hydroelectric plants, financing assistance, simplification of procedures, etc.
Measures currently being implemented are set out in the national renewable energy action plan submitted to the European Commission in 2010.

Role of local authorities in the development of renewable energies

The renewable energy development targets can only be met with significant support from regional authorities.

In France, these targets have not been rolled out at local level, although the Grenelle laws delegated a large share of responsibility for local development of renewable energies to local authorities via the requirement to produce a PCET and a SRCAE setting production targets and actions to achieve them. The SRCAE also features an appendix – the regional wind power plan – listing the most favourable locations for wind farms. French regional authorities can become involved in all aspects of energy:

- In relation to awareness-raising and support for inhabitants and, more broadly, regional actors, by supporting and structuring sectors via information for users and training for professionals.
- In relation to energy consumption, firstly in terms of their own portfolio (property and vehicles), as well as the whole region via development, urban planning, housing and transport policies.
- In relation to electricity and heat production.
- In relation to the distribution of electricity, gas and heat.

Wind power and renewable heating – accounting for a half and a quarter respectively of the Grenelle target – are particular priorities.

Good practice: producing electricity from biomass in Martinique

In Martinique, energy production is highly dependent on petroleum products, with almost all electricity produced (94%) being generated by thermal plants. The Albioma-Galion 2 cogeneration plant, which runs on various types of biomass, aims to provide the region with clean and stable energy, and will be capable of meeting half the annual demand from Martinique households. Built on a site adjacent to the Le Galion sugar refinery, the plant will operate on various types of biomass including wood pellets and bagasse from the neighbouring refinery. In exchange, the refinery will operate on part of the energy produced by the plant.

■ Further information:

CGDD, 2014: Repères, *Chiffres Clés des Energies Renouvelables (Key Renewable Energy Figures) http://www.cdcclimat.com/IMG//pdf/key_figures_on_climate_2014_cdc_climat_research_medde-eng-hd.pdf*

MEDDE, 2010: National renewable energy action plan

Renewable energy observatory: www.energies-renouvelables.org

Renewable energy syndicate: www.enr.fr

ADEME, 2012: French expertise in the field of renewable energies

SRCAEs and PCETs

ACT

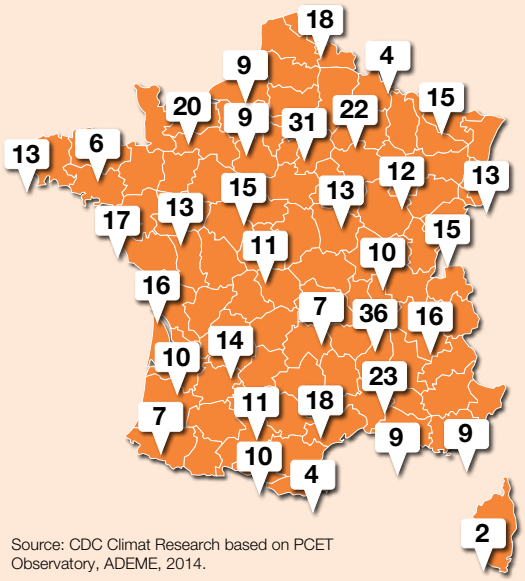
Definitions

In 2011, the Grenelle II law introduced two key planning documents for regional climate policies:

• The «Schéma Régional Climat Air Énergie» (SRCAE – regional climate, air and energy plan): SRCAEs are drawn up by each region and fix strategies for 2020 and 2050 to mitigate and adapt to the effects of climate change. They particularly include developing renewable energy production segments, as well as covering improvements to air quality. They are designed to ensure the coherence of regional public policies in relation to climate and energy. SRCAEs are also coherent with the measures contained in the national climate change adaptation plan.

• The «Plan Climat Énergie Territorial» (PCET – regional climate and energy plan): regional project defining climate change targets and mitigation and adaptation actions to increase the region's short-term resilience and robustness. The PCET is a mandatory commitment framework for local authorities with more than 50,000 inhabitants. It is accompanied by a GHG emissions assessment, a vulnerability assessment and a system for monitoring measures.

■ Map of PCETs identified in France in 2014



Source: CDC Climat Research based on PCET Observatory, ADEME, 2014.

In September 2014, the national PCET observatory set up by the ADEME identified 558 PCETs, 363 of which are mandatory (for approximately 500 local authorities) and concern 30 million inhabitants.

State of progress - 2014

Assessment of first generation SRCAEs

- All French regions have validated and adopted their SRCAE. The plans have been drawn up jointly by the government and regional councils, in many cases following consultation sessions with local inhabitants.
- However, some topics, such as adaptation to climate change, are less well reflected in the documents.
- SRCAEs have chosen different methodologies, making them hard to compare. Their aggregated effect is also difficult to understand.

PCET

- Out of the 558 PCETs identified, 60% have effectively been implemented.
- Political backing and coordination of approaches are key factors in the success of PCETs according to ADEME. Current challenges include maintaining commitment over time and monitoring and assessing the effectiveness of PCET measures.
- The draft law on energy transition and green growth adds air quality as a focus for PCETs, which therefore now become PCAETs. Furthermore, local authority groupings with more than 20,000 inhabitants will be expected to take a partnership approach to developing these plans.

Good practice: International and European policies

Local authorities elsewhere in the world are also implementing energy and climate strategies at a local level, according to more or less formalised processes . The methodological framework of the PCET is also being experimented outside France, notably in Johannesburg in collaboration with the Greater Paris region, as well as in Minas Gerais, in Brazil.

In Europe, the Covenant of Mayors includes more than 5,000 local authorities that have committed to complying with or exceeding the target of a 20% reduction in their GHG emissions by 2020. Signatories must submit an action plan setting out the resources implemented to achieve this target. The approach adopted by French cities via PCETs fits in very well with this type of approach. To find out more: www.conventiondesmaires.eu

■ Further information:

ADEME: PCET Observatory, observatoire.pcet-ademe.fr and Le Savoir-faire Français, « *Agir Face au Changement Climatique* « (Acting Against Climate Change)

MEDDE: PCETs and SRCAEs, http://www.developpement-durable.gouv.fr/Plan-climat-energie-territorial.html & http://www.developpement-durable.gouv.fr/Schemas-regionaux-climat-air,32879.html

CDC Climat Research, 2012: Climate Report no. 36 Regional Climate – Air – Energy Plans: a tool for guiding the energy and climate transition in French regions

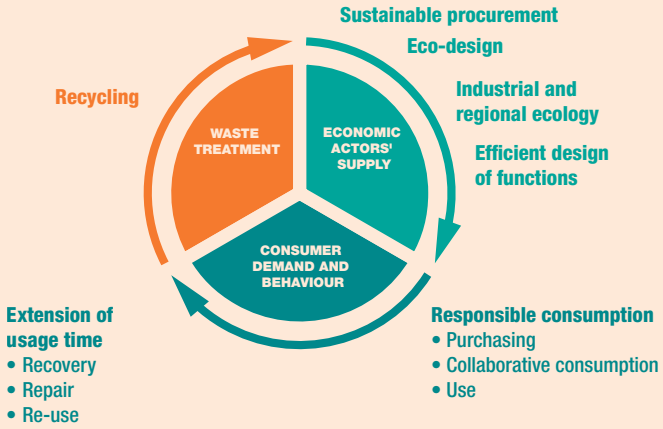
Circular economy

Definition and concept

According to ADEME, the circular economy is a *«system of economic exchange and production which, at every stage in the life cycle of goods and services, aims to increase the efficient use of resources and reduce the environmental impact, while developing individual well-being».*

It is based on seven pillars:

■ Pillars of the circular economy



Source: ADEME, 2014.

The circular economy aims to model itself on natural ecosystems to break the link between economic growth and the depletion of natural resources. Its development is based on creating loops of interconnected materials, involving new value models, with all actors and at every stage in a life cycle:

- **Supply and economic actors** with: procurement optimisation; **eco-design**; **industrial and regional ecology** initiatives designed to pool the needs of companies in a region by creating synergies and efficient design of functions favouring sequential use;
- **Consumer demand and behaviour** with: the fight against product obsolescence, responsible consumption, recovery and repair;
- **Waste management** favouring recycling.

In France and Europe

In France, circular economy has been incorporated into various public policies such as the National Ecological Transition Strategy Towards Sustainable Development, the draft law on energy transition for green growth, as well as sectoral industrial policy agreements concerning reduction targets, waste recovery and the promotion of new economic models.

In Europe, the forthcoming «circular economy» package will contains policies regarding waste and resources with the aim of improving recycling, preventing the loss of resources, creating jobs, demonstrating the effectiveness of new value models and reducing the EU's environmental impacts. The reduction in GHG emissions resulting from complete implementation of a first version of the package released by the Commission in 2014, is estimated at 62 Mt CO_2 eq. per year, or 1.4% of European emissions by 2030.

Good practice: Partnerships for a systematic regional approach

Many companies providing services (water, energy and waste) to local authorities are now trying to limit consumption of primary resources and recover waste. Waste from construction sites, household waste and organic waste are therefore being recycled or transformed into energy, *e.g.* in the form of bio-methane injected into natural gas networks for biowaste. Various industrial ecology and regional initiatives are also being developed: 40 projects were identified in the region in 2014 by the Orée association. This new approach to materials chains at regional level is part of a systematic policy in relation to urban flows, allowing collaboration between large integrated industrial groups and local authorities.

■ Further information:

Oree: Circular economy, www.oree.org/3priorites/economie-circulaire.html
Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org/fr/economie circulaire
ADEME: Circular economy, www.oree.org/3priorites/economie-circulaire.html
MEDDE: Circular economy, http://www.developpement-durable.gouv.fr/Economie-circulaire,33986.html
Institut de l'Economie Circulaire: www.institut-economie-circulaire.fr

European funds

European cohesion policy

The European Regional Development Fund (ERDF), the European Social Fund (ESF) and the European Agricultural Fund for Rural Development (EAFRD) are the main tools in the European cohesion policy. The aim of the policy is to reduce disparities between EU regions and ensure their competitiveness.

€278bn were allocated for the period 2007-2013 and €352bn for 2014-2020.

French allocation and prioritisation of energy transition

For the period 2014-2020, France has been allocated €11bn for the ERDF, €6bn for the ESF and €8bn for the EAFRD.

Having been within the competence of the State until 2013, the management of these funds was mostly transferred to regions in 2014. The budget is now distributed regionally according to GDP/inhabitant and is subject to a partnership agreement with the European Commission.

The categorisation of regions has an impact on priority themes. In particular, the most developed regions and those in transition must allocate at least 20% of total ERDF resources to thematic objective 4: transition to a low-carbon economy. This objective is reduced to 6% for the least developed regions.

■ Categorisation of French regions

Less developed regions (GDP/inhab < 75% EU av.)	Regions in transition (75% EU av. < GDP/inhab < 90% EU av.)	More developed regions (GDP/inhab > 90% EU av.)
Martinique	Franche comté	Ile-de-France
Guadeloupe	Basse-Normandie	Rhône-Alpes
Réunion	Limousin	Alsace
Guyane	Lorraine	Haute-Normandie
Mayotte	Poitou-Charentes	Champagne Ardennes
	Picardie	PACA
	Nord-Pas de Calais	Bourgogne
	Languedoc-Roussillon	Aquitaine
	Corsica	Pays de la Loire
	Auvergne	Centre
		Midi-Pyrénées
		Bretagne

Principles and objectives of the Multiannual Financial Framework 2014-2020

The new financial framework is still multiannual and operates through co-funding according to a partnership approach based on six principles:

- Common rules completed by provisions specific to each fund;
- A greater concentration of funds on **Europe 2020 Strategy** objectives: creating growth and jobs, tackling climate change and energy dependency and reducing poverty and social exclusion;
- More monitoring and the creation of a performance reserve, setting aside part of the funds for the most effective programmes;
- Greater coherence with the EU's economic governance;
- New regional development tools, such as integrated territorial investment (**ITI**) and community-led local development (**CLLD**);
- Increased potential for use of financial instruments.

These funds are likely to be increasingly used to create leverage effects via new financial instruments (**NFIs**).

Good practice: Third Industrial Revolution

European structural funds, particularly the ERDF, are among the levers used by the Nord-Pas-de-Calais region to implement its Third Industrial Revolution. This allows research and innovation projects, energy efficiency initiatives and the development of renewable energy (support for technological change, sustainable energy system solutions, financing of demonstrators in production, distribution and storage of renewable energy, etc.) to be jointly funded for between 20% and 50%. The Nord-Pas-de-Calais region's 2014-2020 operational programme allocates a significant share of its €847m budget to economic development and energy transition, which account for 33% of ERDF loans. To find out more: www.latroisiemerevolutionindustrielleennordpasdecalais.fr

■ Further information:

European Commission: European funds, ec.europa.eu/regional_policy/thefunds/regional

EU: www.europe-en-france.gouv.fr and www.partenariat20142020.fr

EIB: www.eib.org

ACT

White certificates

Presentation and functioning of the scheme

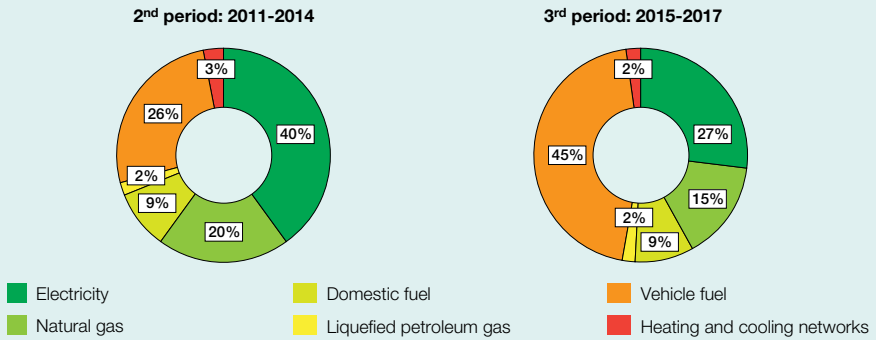
White certificates (certificats d'économie d'énergie) are an instrument for controlling energy demand created in 2005 by the **POPE law** to encourage energy suppliers to promote energy efficiency among their customers.

- Energy-saving obligations are imposed for three-year periods on suppliers of electricity, gas, LPG, home heating oil, heating and cooling and, since 2011, vehicle fuel suppliers.
- At the end of each period, the suppliers must be in a position to return sufficient white certificates to meet their energy saving obligation or pay a penalty of two euro cents per kWh missing.
- White certificates are allocated throughout the period by the French Energy Ministry (MEDDE) directly to suppliers or other eligible organisations (local authorities, ANAH, social housing providers and public-private joint ventures offering third-party financing services) that carry out energy savings projects. These projects may relate to the residential sector, tertiary buildings, transport or the industrial and agricultural sectors.

The suppliers can purchase white certificates from other eligible actors. All white certificates allocated and traded are recorded in a national register at www.emmy.fr.

To simplify procedures, a number of actions have been defined in standardised information sheets. Other specific projects are studied on a case by case basis.

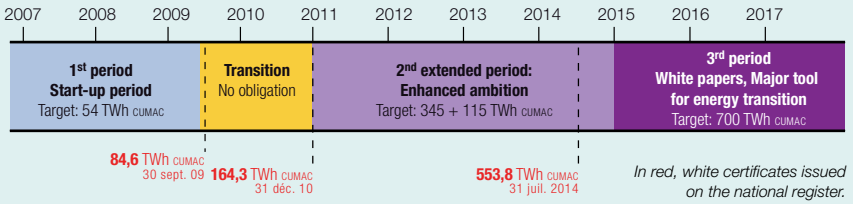
■ Breakdown of the energy savings target between energy sources



Sources: DGEC, May 2014.

An evolving system

■ The various phases of the system since 2007: objectives and achievements



Source: ADEME, 2014.

White certificates issued during the second period represented €24bn of investments in energy savings, avoiding some 28 Mt of GHG emissions, or 5.2% of the construction sector's emissions.

The target for the current period is 700 TWh Cumac (cumulated and discounted). The procedure for obtaining white certificates was simplified at the launch of the third period on 1st January 2015. It is now declaratory with subsequent verification.

Use of white certificates by local authorities

Local authorities use their energy consumption reductions (thermal renovation, optimisation of public lighting, etc.) to obtain white certificates to finance new projects or assist households with their home improvements. It is also possible to pool administrative engineering between several local authorities or entities (public housing services, hospitals, etc.), or take on management of white certificates on behalf of households.

■ Further information:

MEDDE: White certificates, www.developpement-durable.gouv.fr/-Certificats-d-economies-d-energie,188-.html

ADEME: White certificates, www.ademe.fr/expertises/changement-climatique-energie/passer-a-laction/comment-valoriser-economies-denergie-cee

Association Technique Énergie Environnement (ATEE): www.atee.fr/c2e

Carbon offsetting

Principle of an offset project

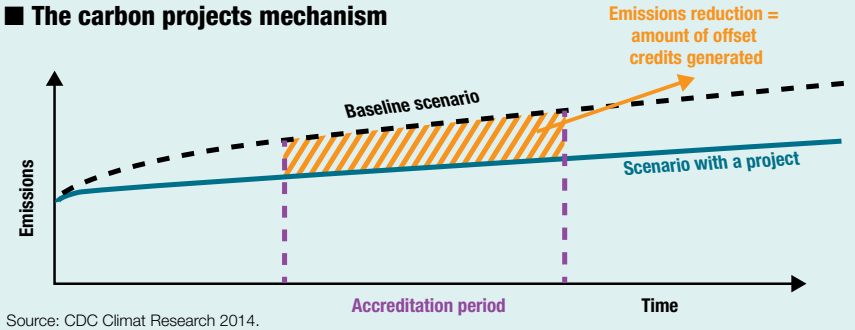
Carbon offset projects generate carbon credits equivalent to the emissions avoided by the projects, which can be traded on quota exchange markets (see figure). Various gases are targeted by the various systems, although they are always converted into tonnes of CO_2 eq.

Demand for these credits can be divided into two categories:

- **«Compliance» demand** resulting from a regulatory obligation. This is because carbon pricing systems (Kyoto Protocol intergovernmental cap-and-trade system, EU ETS, etc.) allow participants to return credits purchased from other actors instead of quotas or a tax payment. The regulatory then defines quality criteria, to ensure that carbon credits generated by these projects are accepted.

- **«Voluntary» demand** from entities, often local authorities or companies, which are not subject to regulatory constraints with regard to GHG emissions, but have set themselves a carbon-reduction or neutrality target. If they do not achieve this target through their own internal reductions, they buy credits to make up the difference. Since they are not covered by any regulatory framework, these entities use «Kyoto credits» generated by JI or CDM projects, or credits from projects certified by voluntary labels such as the Gold Standard or Verified Carbon Standard.

■ **The carbon projects mechanism**



Source: CDC Climat Research 2014.

Five quality criteria of an offset project

Offset projects must fulfil five main quality criteria to be certified and marketable:

1. **Additionality:** the project coordinator must demonstrate that the project would not have been implemented without carbon credits. It must also be proved that the project goes beyond regulatory obligations.
2. **Monitoring:** emissions or sequestration must be subject to a quantitative monitoring plan throughout the accounting period. Certified methodologies set out the project's emissions calculation methods and a reference scenario. The difference between the two corresponds to the quantity of carbon credits generated.
3. **Verification:** credits are only obtained once the emission reductions have been achieved and verified by an independent and accredited third party.
4. **Permanence:** most labels have established insurance mechanisms to guarantee the replacement of credits in the event that an offset project proves inadequate (*e.g.* carbon sequestered in the ground or in a forest is not stored indefinitely).
5. **Avoidance of double counting:** a project can only issue carbon credits in the framework of a single programme or reduction incentive and a carbon credit can only be sold once.

Offsetting by local authorities

Some local authorities, including Eastleigh, Toronto, San Francisco, Perth, British Columbia and the Ile-de-France region, have chosen to measure, internally reduce and offset all or part of their GHG emissions. They have a range of motives (visibility, innovation, desire to support a region and/or a sector by buying credits from them) and take various forms (purchasing of credits directly or via an association or fund consolidating private capital).

■ **Further information:**

Bellassen, V and Leguet, B. 2009, *Comprendre la Compensation Carbone (Understanding Carbon Offsetting). Pearson*

Ecosystem Marketplace, 2014: *State of the Voluntary Carbon Markets*

CDC Climat, 2011: *Climate Report no. 29, Voluntary Carbon Offsetting by Local Authorities: Practices and Lessons*

Carbon compatibility tools

Challenges of measuring and monitoring GHG emissions

Quantifying GHG emissions, identifying their sources and monitoring changes is necessary for the implementation of any climate change mitigation policy. Various GHG measurement tools have been developed according to specific scales of analysis or needs. These approaches also favour the appropriation of climate issues by local actors.

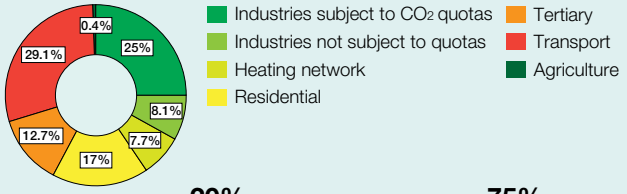
Assessments and inventories

GHG audits are carried out at various levels and stages in order to:

- Conduct an initial audit, identify action levers and coordinate actions;
- Respond to a regulatory obligation: in France, local authorities with more than 50,000 inhabitants have to conduct a regulatory GHG assessment of their portfolio and competencies;
- Promote progress achieved and report to internal stakeholders or external partners, *e.g.* in the context of international commitments such as the Covenant of Mayors. The audits must be detailed and transparent. Various guides and methodologies exist to assist with measuring and reporting results, *e.g. The methodological guide to conducting regulatory GHG emission assessments for local authorities* published by MEDDE, the regional Bilan Carbone® (carbon assessment) and the *GPC Protocol*. Taking into account indirect emissions remains a challenge for these methodologies, which are continuing to evolve.

■ Example of the initial GHG audit by Greater Lyon by scope

Total CO_2 emissions: 7.6 million tonnes



5%

Bilan Carbone® for Greater Lyon's portfolio and services
- Public order
- Buildings
- Waste management
- Water services
- Agents' travel

20%

Emissions under the influence of current community public policies
- New housing in urban development zone
- Social housing
- Public transport
- District heating
- Urban planning

75%

All other emissions
- Companies: industrial facilities, transport of goods, etc.
- Municipalities
- Inhabitants: private housing, transport, consumption

Sources: Bilan Carbone® for Greater Lyon and register of CO2 emissions (Air Rhône-Alpes), 2009.

Technical and normative choices

Accounting of GHG emissions may vary significantly according to the methodological parameters resulting from technical as well as normative choices made according to the scale and final use of the assessment, *i.e.* voluntary or regulatory, internal use (to plan mitigation policies and/or serve as progress indicators) or external use (comparison or reporting). The main parameters include:

- **Scope:** three main GHG emissions scopes (ISO 14064) can apply to a project, an entity or a region:
  - Scope 1: direct emissions,
  - Scope 2: indirect emissions, i.e. produced in a different location and linked to production of electricity, steam, heat or cooling,
  - Scope 3: all other indirect emissions, upstream and downstream (particularly linked to the consumption of goods and services).
- **Gases taken into account:** often the six gases mentioned in the Kyoto Protocol: CO_2, N_2O, CH_4, SF_6 , HFC and PFC.
- **Sectors included:** often those in the IPCC standard framework.
- **Attribution of responsibility:** based on production (allocation of emissions at the site of their production) or consumption (allocation of emissions at the point of consumption).
- **Calculation methodology:** the most commonly used is the emission factors methodology (estimated according to standard values that have been either modelled or measured).

Sectoral carbon tools

One of the current challenges is to design tools to assess the actual impact of mitigation policies in order to facilitate the integration of climate change into sectoral policies such as development or transport. Various complementary tools, with varying levels of precision, can be used depending on the objectives pursued. A choice must be made between cost and precision, since the more precise an assessment, the more time and resources it takes, while a high level of precision is not always necessary.

■ Further information:

MEDDE: Method for establishing GHG emissions assessment www.developpement-durable.gouv.fr/Methode-d-etablissement-des-bilans,24300
ADEME: Greenhouse gases resources centre, bilans-ges.ademe.fr
Association Bilan Carbone: www.associationbilancarbone.fr
CITEPA: www.citepa.org/fr/
GPC Protocol: www.ghgprotocol.org/city-accounting

The impact of climate change on forests

Forests are vulnerable to climate change

While forests play an important role in the ecosystems' and societies' adaptation to climate change, they are also vulnerable to its impacts. The increase in temperatures and concentration of CO_2 in the atmosphere, as well as changes to rainfall patterns, will result in profound impacts on forestry environments in the space of a few decades, when species such as oak have taken almost 2000 years to colonise the whole of France. It is possible that the changes will be too quick to allow species time to migrate and populations to evolve. Experts particularly expect that we will observe:

- an **increase in risks linked to extreme events**: the frequency and impact of extreme weather events (droughts, fires and storms) is likely to increase, resulting in significant carbon discharges. In the United States, forest fires account for 6% of annual emissions (NCAR). The wave of bushfires in Australia in 2003 was responsible for a third of the country's annual emissions.
- an **increase in diffuse pressure on forestry ecosystems**: the increase in temperatures has already led to a northward movement in pests, while the change in rainfall patterns risks increasing trees' water stress.

These effects therefore lead to a decrease in the quantities of carbon stored in forests and an increase in tree mortality.

Nevertheless, climate change can also reinforce forests' capacity to sequester carbon.

- The rise in the concentration of carbon dioxide in the atmosphere promotes the growth of trees: that is **CO_2** fertilisation.
- The increase in temperatures extends the growth period of trees during the year, although it also increases water needs.

Adaptation strategies

Addressing climate change presents a challenge for forestry managers. Adaptation strategies can be established according to local conditions, for example:

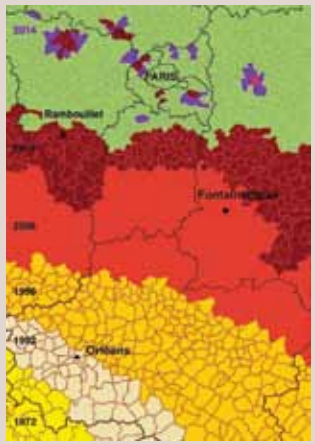
- Mixing and diversifying tree species increases resistance to pests.
- Reducing density makes trees more drought resistant.
- Avoiding growing tall slim trees reduces their vulnerability to storms.

Dynamic forestry management adapted to local conditions ensures better adaptation.

The expansion of pests: example the pine processionary caterpillar

The increase in temperatures allows the processionary caterpillar, which weakens pines by feeding on their needles, to move further north and to higher altitudes each year. Modelling by INRA indicates that colonisation will reach Paris by 2025. Nevertheless, integrated management solutions are gradually being developed. According to INRA, the introduction of islands of deciduous trees among populations of maritime pine reduces the rate of infestation of those pines by pests.

■ Expansion of the pine processionary caterpillar in the Parisian basin



The expansion of the pine processionary caterpillar is a climate change indicator used by ONERC.

Each colour corresponds to a year: 1972, 1992, 1996, 2006, 2011, 2014.

Source: ONERC based on © INRA URZF.

■ Further information:

Network for forests' adaptation to climate change:
www.reseau-aforce.fr/

INRA – The processionary caterpillar: www.inra.fr/Grand-public/Sante-des-plantes/Tous-les-dossiers/Processionnaire-du-pin-une-chenille-sous-haute-surveillance

ONERC – Trees and forests tested by climate change:
www.developpement-durable.gouv.fr/L-arbre-et-la-foret-a-l-epreuve-d.html

ECOFOR – Climate change projects:
www.gip-ecofor.org/?q=node/224

SHEET 24

UNDERSTAND

The role of agriculture in the fight against climate change

The agricultural sector's contribution to GHG emissions

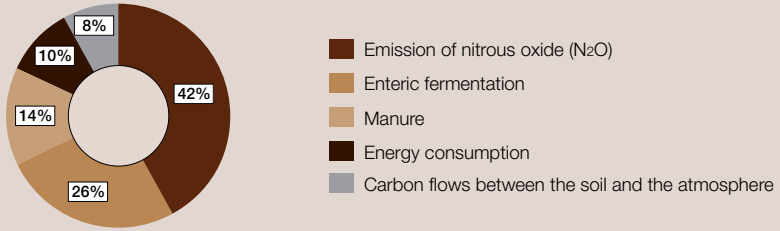
Generally, when we talk about agricultural emissions, we are only talking about N_2O and CH_4 emissions linked to crops and livestock.

The share of these agricultural emissions varies around the world, depending on the region or country. Agricultural N_2O and CH_4 emissions represent 13.5% of anthropogenic emissions globally, 10% at a European level and just under 20% for France. The FAO showed in a study that 80% of these emissions could be attributed to livestock if emissions from crops grown for animal feed are taken into account.
The high figure for France is explained by two factors. Firstly, France is the biggest agricultural producer in Europe. Secondly, the electricity sector in France produces lower GHG emissions than elsewhere due to the high proportion of nuclear and hydroelectric power.

Besides these N_2O and CH_4 emissions the agricultural sector produces CO_2 emissions linked to energy consumption (livestock buildings, heated greenhouses, tractors, etc.). There are also flows of carbon between the soil and the atmosphere linked to the management of agricultural land. Depending on the type of use (crops or grasslands) and the practices in place (direct sowing or ploughing, return of crop residues to the soil or export, etc.) these flows may result in a reduction or increase in carbon storage in agricultural land.

Breakdown of agricultural emissions in France

Agricultural emissions represent 90 million tonnes equivalent of carbon dioxide (Mt CO_2e). If we add emissions linked to energy consumption (11 Mt CO_2e) and those linked to a reduction of carbon in the soil (9 Mt CO_2e), the total stands at 110 Mt CO_2e.



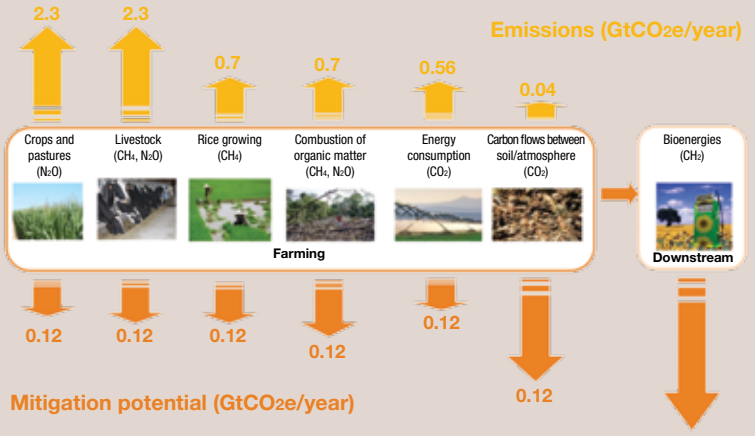
Source: CITEPA, 2014.

Three mitigation levers for the agricultural sector

The agricultural sector has significant potential to mitigate greenhouse gas (GHG) emissions. The sector's balance sheet in terms of GHG emissions can be improved using three levers:

- Reduction of emissions: "low carbon" practices, technologies and systems exist. This is the case, for example, when a farmer introduces legumes into his crop rotation, reducing the use of nitrogen fertilisers and consequently nitrous oxide (N_2O) emissions from crops and pastures.
- Increase in carbon storage: for example agroforestry or the sowing of intermediate crops (crops not intended for harvest) allows greater sequestration of carbon in the soil.
- Substitution of fossil fuels with biomass: biomass intended for energy production comes from crop residues – rice husks, bagasse, etc. – or dedicated crops such as miscanthus or sugar cane. It can be burnt directly or turned into biofuel. Methanisation can also be used to produce energy.

■ Summary of emissions and mitigation potential around the world



Source: CDC Climat Research.

■ Further information:

Climate change 2014 - Climate change mitigation - Contribution of Working Group III to the IPCC's Fifth Assessment Report

SECTEN report from CITEPA: www.citepa.org/images/III-1_Rapports_Inventaires/secten_avril2014_sec.pdf

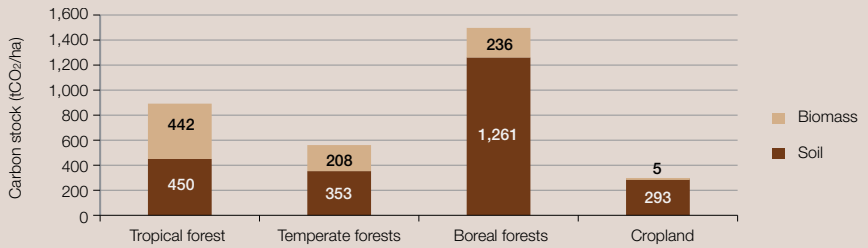
INRA Study: www.institut.inra.fr/Missions/Eclairer-les-decisions/Etudes/Toutes-les-actualites/Etude-Reduction-des-GES-en-agriculture

The role of the forestry and wood sector in the fight against climate change

Forests – a carbon sink

Forests store carbon in living and dead biomass, in decomposing organic matter and in the soil. At a global level, forests are net carbon sinks, meaning they store more carbon than they release. The total amount of carbon stored by forests is estimated at around 19% of annual anthropogenic greenhouse gas (GHG) emissions, or around 10 $GtCO_2e$/yr. The quantity of carbon stored per hectare of forest depends mainly on local conditions (soil, climate and species) and the type of management (primary forest, selective farming, short rotations, etc.).

■ Carbon content of forests



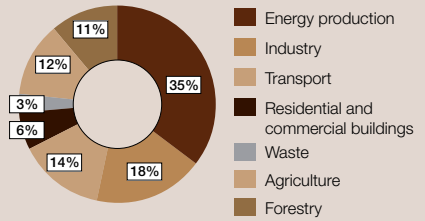
Source: CDC Climat Research and ONFI.

Deforestation: a major source of CO_2 emissions

Human pressure on forests also means that this sector is responsible for significant carbon emissions via deforestation and the draining of swamp forest. The latest scientific estimates rank it as the fifth sector for emissions, with around 11% of global GHG emissions, representing an average of 4.9 $GtCO_2e$/year during the period 2000-2010 (IPCC, 2014).

The main cause of deforestation is the conversion of forests into agricultural land. This mainly concerns South America, Africa and some Asian countries.

■ Forestry sector's contribution to global emissions



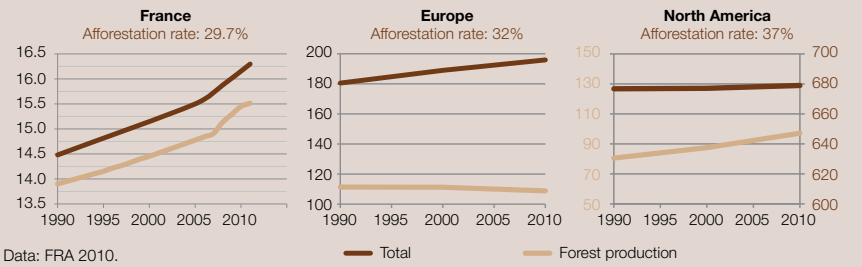
Source: CITEPA, 2014.

Three different mitigation levers in the forestry and wood sector

In addition to carbon sequestration in forests, the forestry and wood sector contributes to the mitigation of climate change through three mechanisms:

- **the substitution of fossil fuels:** for equivalent energy production and allocating a zero emissions factor to biomass, substituting wood for fossil fuels (coal, gas and oil) significantly reduces the energy sector's emissions.
- **the substitution of carbon-intensive materials:** manufacturing wood products requires less fossil fuel that the production of other materials such as steel and concrete.
- **the storage of carbon in wood products,** such as furniture and frameworks. Storage in products depends on their lifespan and the level of moisture: 1 tonne of dry wood is considered to contain 500kg carbon. At a global level, the carbon stored in wood products is estimated to be 55$GtCO_2e$, or 0.7% of the storage in vegetation.

■ Surface area of forests (in millions of hectares)



Data: FRA 2010.

Focus: The increase in the surface area of forests in Europe and the United States

Worldwide, forests occupy 31% of land, representing more than 4 billion hectares (FAO, 2010). Half of these forests are in Russia, Brazil, Canada, the United States and China. In North America and Europe, the surface area of forests is increasing, contributing to an increase in forestry carbon sinks.

■ Further information:

FAO – forests: www.fao.org/forestry/

Forêt Privée Française: www.foretpriveefrancaise.com/data/info/149182-FE168_FORETS_PUITSDECARBONE.pdf

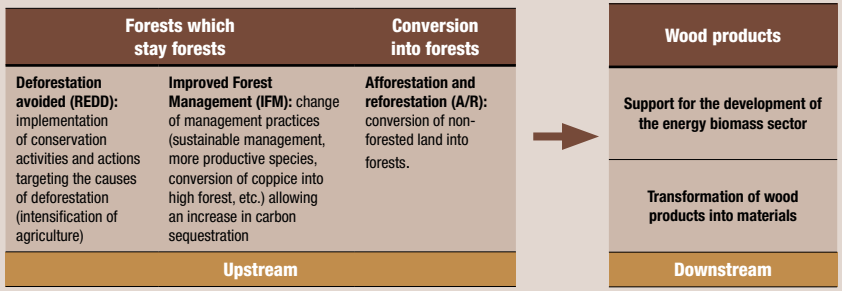
Office National des Forêts: www.onf.fr/

Forestry projects to mitigate climate change

Mitigation projects in the forestry and wood sector

One of the main climate change mitigation levers in the forestry and wood sector is the increase or maintenance of carbon sequestration in forests. Various types of projects can be established upstream of the sector, while also supplying products for use downstream.

■ Types of forestry products

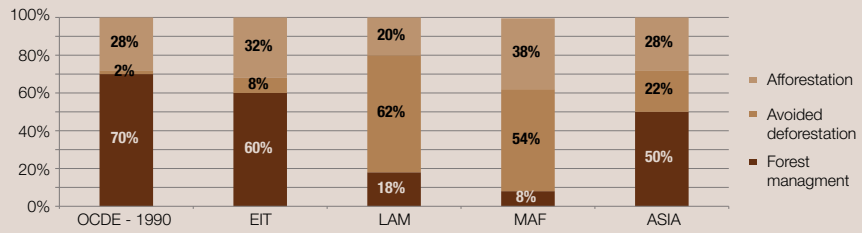


Source: CDC Climat Research and ONFI.

Forests' mitigation potential by region of the world

The various types of projects have different mitigation potentials depending on the region of the world in which they are carried out.

■ Mitigation potential of types of forestry project by region of the world ($20/tCO2)



Source: IPCC 2014.

Support for the development of firewood

The potential for climate change mitigation downstream of the sector relies in particular on the substitution of fossil fuels and/or carbon-intensive materials with wood products.

In France, a particular effort has been made to develop the firewood sector. The ADEME, for instance, facilitates project funding via the Heat Fund (Fonds Chaleur), and more specifically through a national call for projects called BCIAT (Biomasse Chaleur Industrie Agriculture Tertiaire). This financing is accompanied by environmental requirements in terms of controlling emissions of dust, carbon monoxide and fine particles. Biomass facilities supported as part of this initiative have avoided 2.6 million tonnes of CO_2 emissions/year.

Good practice: improved forestry management project in the Bas Dauphiné

In 2012, the Centre National de la Propriété Forestière and the Syndicat des Forestiers Privés de France launched a carbon project involving improved forestry management in the Bas Dauphiné (Rhône-Alpes). A 150 ha forest of chestnut coppice (products offering low economic added value and low carbon storage), was converted into high forest, with a longer rotation system fixing more carbon in the forest and the timber.

The project was made possible by bringing together numerous small foresters, for whom the investment required for the conversion was too great, and developing an innovative financing structure combining public grants and private carbon funding. The project ultimately combines the sequestration of 14,500 tCO_2 and supports a local sawmill business, while giving French economic actors an opportunity to invest in a national mitigation project.

■ Further information:

IPCC's 5th Assessment Report, volume 3: www.ipcc.ch/report/ar5/wg3/ (AFOLU chapter)

CDC Climat Research – Climate Report no. 20: Getting carbon value out of the forestry and wood sector in France

MEDDE – Project in Bas Dauphiné: www.developpement-durable.gouv.fr/IMG/pdf/6_Lo_c_Casset.pdf

Private Forest: Carbon projects: www.foretpriveefrancaise.com/projets-carbone-388744.html

Carbon accounting by the agriculture and forestry sectors

What is the AFOLU sector?

In the latest IPCC report, Agriculture, Forestry and Other Land Uses were grouped under the label AFOLU. The **AFOLU** sector represents a merger of two separate sub-sectors used for the purposes of UN accounting:

- The **LULUCF (Land Use, Land-Use Change and Forestry)** sector includes emissions and absorption of carbon in relation to living biomass and organic matter in soil. These emissions and absorptions may be due to:
  - A change in land use, in other words its conversion into forests, crops, grasslands, wetlands and urban areas;
  - A change in practice on land kept for the same use (forestry management, use of no-ploughing methods, improved pasture management, etc.).
- The **Agriculture sector** includes CH_4 and N_2O emissions from enteric fermentation, animal waste management, rice growing, crops and grazing or burning of crop residues on site.

UN accounting rules for the LULUCF sector

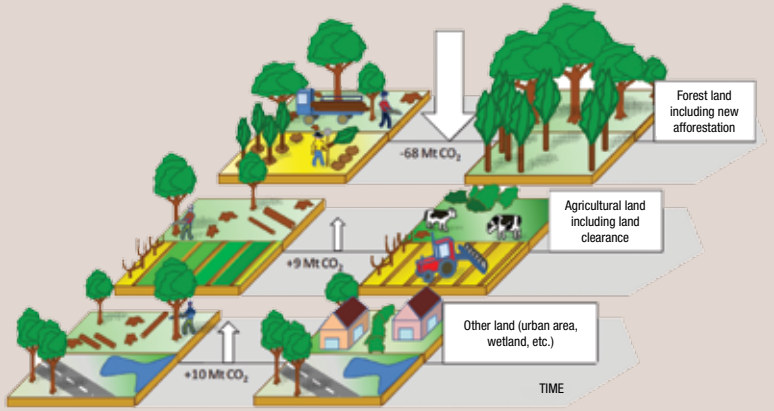
The LULUCF sector is very specific in that it is the only one able to form a carbon sink as a result of the carbon absorption capacity of vegetation (forests) and soil. It therefore has a special status in international agreements and possesses its own rules.

Accounting rules and definitions linked to the land sector are established in particular by articles 3.3 and 3.4 of the Kyoto Protocol:

- **Article 3.3** applies to **land which has changed use** since 1990 (*e.g.* afforestation and deforestation). The balance is the difference between the sequestration generated by afforestation and the emissions generated by clearing.
- **Article 3.4** concerns **land whose use has remained the same** since 1990. In the case of forestry use, a comparison is made between the sinks of "forests which remain forests" and a projected reference level for the same period (2013-2020).

Accounting of forestry management in relation to article 3.4 is mandatory for the second Kyoto Protocol's second commitment period. In respect of changes to carbon storage in farmland and grasslands, accounting also follows the rules of article 3.4, although it remains optional. France has chosen not to count these flows, although their monitoring is required by European Union decision no. 529/2013.

■ Presentation of estimated greenhouse gas (GHG) flows in cities over the period 2008-2012 broken down by main land used



Source: CITEPA (2014)

The "sectoral" approach in the UN framework

In the framework of the UNFCCC, national inventories cover all anthropogenic emissions of the six greenhouse gases (CO_2, CH_4, N_2O, HFC, PFC and SF_6) at national level. The inventories separate national emissions into six sectors: 1) energy, 2) industrial processes, 3) solvents, 4) agriculture, 5) waste and 6) LULUCF. The agricultural and forestry sectors' emissions, excluding AFOLU, are again included in two categories:

- **Energy:** including CO_2 emissions linked to combustion by agricultural industries (production of inputs, farming machinery, agri-food industries, etc.), consumption by livestock buildings, heated greenhouses, tractors as well as some emissions downstream of the forestry and wood sectors (paper mills, etc.);
- **Industrial processes:** include N_2O emissions attributed to production of nitrogen fertilizers and CO_2emissions produced by use of limestone in sugar manufacturing and some wood industry emissions.

■ Further information:

GHG emissions inventories in France for AFOLU - CITEPA: www.citepa.org/fr/activites/inventaires-des-emissions/ominea

Kyoto Protocol accounting rules for the land sector: www.unfccc.int/land_use_and_climate_change/lulucf/items/4129.php

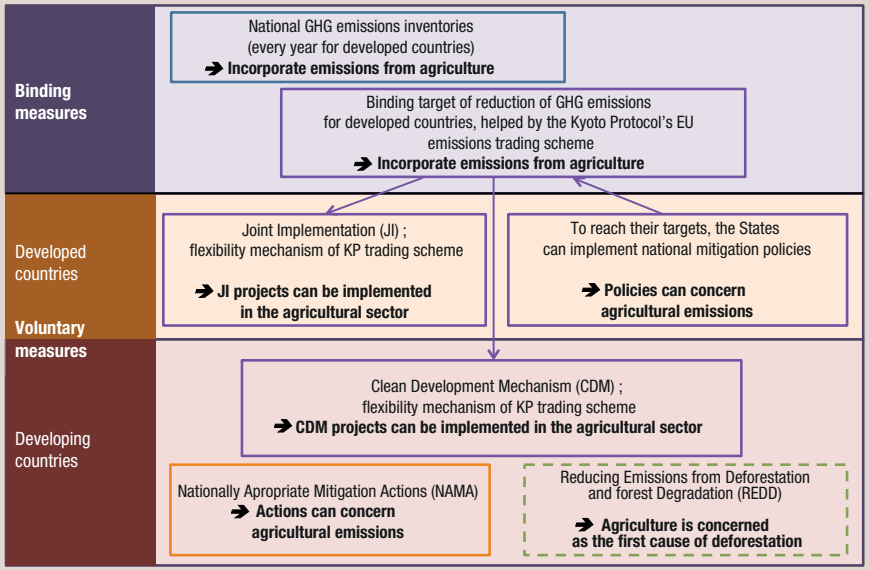
European accounting decision 529/2013/EU: www.eur-lex.europa.eu/legal-content/FR/TXT/HTML/?uri=CELEX:32013D0529&from=EN

The role of the agricultural sector in international climate negotiations

How is the agricultural sector taken into account in UNFCCC mitigation systems?

Agriculture is treated generically in international climate negotiations and included in a range of UN measures to tackle climate change in the same way as other economic sectors.

■ UNFCCC mitigation measures featuring agriculture



Source: CDC Climat Research.

Although the agricultural sector is covered by these mechanisms, it is not the most represented. For example, the CDM chose to focus on industrial and energy projects, only examining the mitigation potential of agriculture very late in the day. Countries have also paid little attention to agriculture in their national mitigation policies.

The difficulty of measuring agricultural emissions, the complexity of the biophysical mechanisms involved, the diversity of agricultural systems and the diffuse nature of emissions makes it difficult to establish tools and policies dedicated to that sector.

Adaptation solutions dependent on funding levers

Agriculture, a sector highly impacted by climate change, is taken into account in the various programmes addressing the impacts of climate change and in the adaptation plans.

This is particularly the case for NAPAs (National Adaptation Programmes of Action) within a work programme devoted to the Least Developed Countries. Out of the 490 adaptation projects resulting from around 50 NAPAs, 20% relate to food security.

Furthermore, the work carried out by the UNFCCC's Subsidiary Body on Scientific and Technological Advice (SBSTA) is very "adaptation" focused, with projects in 2015 looking at early warning systems and meteorological emergency plans, as well as on the risks and vulnerability of agricultural systems.

Challenges for future COPs

Not all the agricultural sector's challenges can be addressed by COP 21 since it is a long process. The key challenges are:

- To agree on the choice of a "priority adaptation" approach or "simultaneous mitigation and adaptation" approach preserving food security. For some mitigation is a tool to attract funding and assist development, while for others it is a threat to food security and local populations;
- To agree on a rigorous and transparent joint **MRV** (Monitoring Reporting Verification) framework for the land sector's emissions and absorption;
- To link agricultural climate ambitions to other UN processes relating in particular to the environment and development;
- To avoid market distortion and integrate the balance of trade in carbon accounting, ensuring avoidance of carbon leakage and greater consideration for the effort linked to consumption.

■ Further information:

Climate Report no. 48: www.cdcclimat.com/Etude-Climat-no48-Developpement-et.html?lang=fr

Climate change and global agriculture, 2015, Torquebiau E. et al.

The REDD+ mechanism

Background and establishment of an international framework

Deforestation represents almost 12% of global emissions, mainly in developing countries. In order to reduce these emissions, an international mechanism has been created to encourage these countries to protect and replenish their forest carbon stocks. The idea of a financing tool to combat deforestation and degradation of forests by developed countries emerged for the first time in 2005 at the Conference of the Parties (COP) in Montreal. In 2010, various types of activities covered by REDD+ were defined:

- reduction in emissions linked to deforestation;
- reduction in emissions linked to the degradation of forests;
- conservation of forest carbon stocks;
- sustainable management of forests;
- improvement of carbon stocks.

The framework for implementation of REDD+ initiatives at an international level

The Warsaw COP in 2013 and the negotiating session in Bonn in June 2015 led to the finalisation of an operational international methodological framework for implementation of REDD+ initiatives.

The developing countries concerned are obliged to draw up:

- a national strategy or action plan to control any carbon leakage from one region to another;
- a benchmark emissions scenario linked to deforestation at a national level;
- a national system for MRV of activities based on remote detection measurements and measurements on the ground.

Safeguard clauses must also be included. These clauses set out environmental guarantees (such as the non-conversion of natural forests to crops), social guarantees (such as the recognition of the rights of indigenous peoples) and guarantees of developing countries' sovereignty in decision-making.

The financing can be of any kind – public, private, bilateral or multilateral. It currently passes through various international funds, soon to be joined by the **Green Climate Fund**. The GCF, agreed in Cancun in 2010 and established in 2014 with US$10bn of the projected US$100, has a specific framework for the financing of REDD+ initiatives since 2014.

This financing is based on results, i.e. on precise emissions reductions subject to MRV, supported by national and international verification systems.

■ Annual deforestation per country, 2005-2010

Source: FAO 2010.

Focus on a REDD+ initiative: the State of Acre in Brazil

The initiative by the State of Acre in Brazil to encourage environmental services, called SISA (*Acre's State System of Incentives for Environmental Services*) is considered to be the first REDD+ jurisdictional programme. Created by regional law in 2010, the programme includes various ecosystem services in addition to carbon sequestration (water, soils, biodiversity, crops, etc.). The law creating the system also clarified the institutional framework required for implementation of REDD+ in the region with the creation of a regulatory and supervisory institute, a validation committee and an associated register. The State of Acre has already signed results-based payment contracts with German development bank KfW as part of its REDD Programme for Early Movers, and receives annual payments for duly verified emission reductions. This financing programme requires the Acre authorities to distribute at least 70% of profits to local communities. The State has also signed an agreement with the government of California to supply sectoral credits once the Californian carbon market authorises their use.

■ Further information:

UNFCCC – REDD+ decisions: www.unfccc.int/land_use_and_climate_change/lulucf/items/6917.php

Wildlife Works: www.wildlifeworks.com

Economic and political instruments to reduce agricultural emissions

The main policies impacting agricultural emissions

Several regulations, at a European and national level, offer an incentive to reduce the agricultural sectors' emissions. These regulations may have been implemented with this precise aim, or result in a reduction in agricultural sectors' emissions as a "co-benefit".

The main policies are:

- The 2020 Climate and Energy Package, particularly its aim to reduce emissions by 20% by 2020. Two tools have been established to achieve this target:
  - The European Union Emissions Trading Scheme (EU ETS) which covers producers of agricultural inputs, large heated greenhouses and facilities in the agri-food sector. The target for these sectors is a 21% reduction in 2020 compared with 2005.
  - The Effort Sharing Decision (ESD) which covers agricultural emissions (N_2O and CH_4) as well as emissions linked to transport, construction and waste. The target for these sectors is a 10% reduction in 2020 compared with 2005.

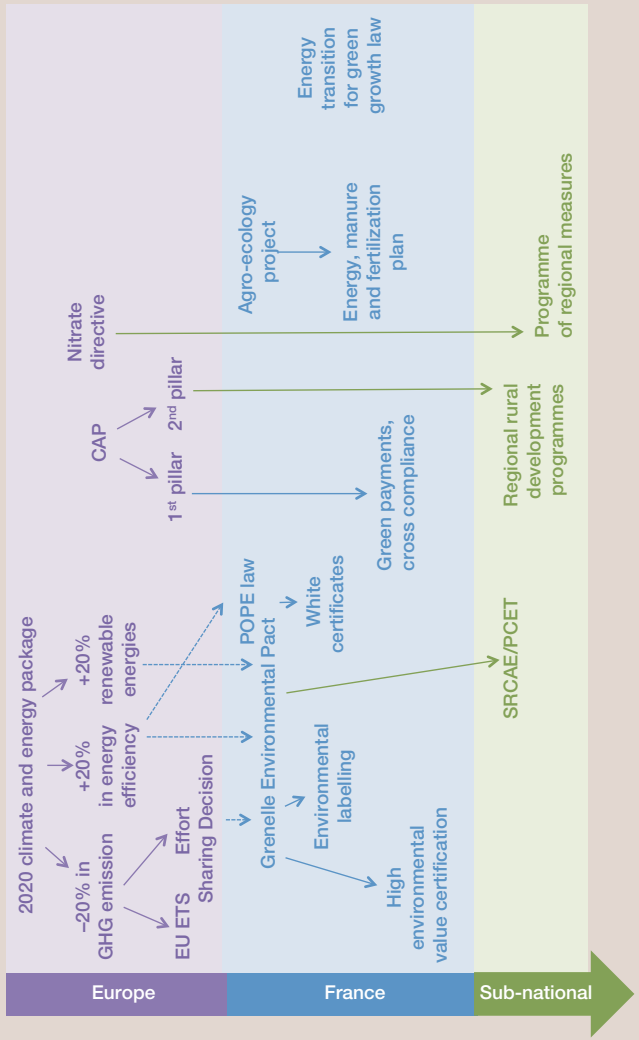
  No target exists for the **LULUCF** sector however.
- The European Common Agricultural Policy (CAP), particularly its agri-environmental and climate measures, may offer a source of financing for mitigation of agricultural emissions.
- The nitrate directive and the NEC (*National Emission Ceilings*) directive, limiting the use of nitrogen fertilisers, are also having a positive impact on N_2O emissions.
- At a national level, the French law on energy transition for green growth, and in particular the national carbon strategy, will set a cap on agricultural emissions.

Reflections under way on the future AFOLU climate policy in Europe

The European Commission is in the process of considering how to integrate the agricultural and **LULUCF** sectors into the 2030 climate package. Three options are on the table:

- keeping agriculture in the ESD and addressing **LULUCF** separately;
- creating a third pillar, in addition to the EU ETS and the ESD specific to agriculture and **LULUCF**;
- incorporating **LULUCF** and keeping agriculture in the ESD.

■ **Overview of policies impacting emissions from agricultural sectors**



Source: CDC Climat Research.

■ **Further information:**

European Commission: www.ec.europa.eu/clima/policies/forests/index_en.htm

French Ministry of Agriculture – EMAA plan: www.agriculture.gouv.fr/Plan-Energie-Methanisation

SHEET 31

UNDERSTAND

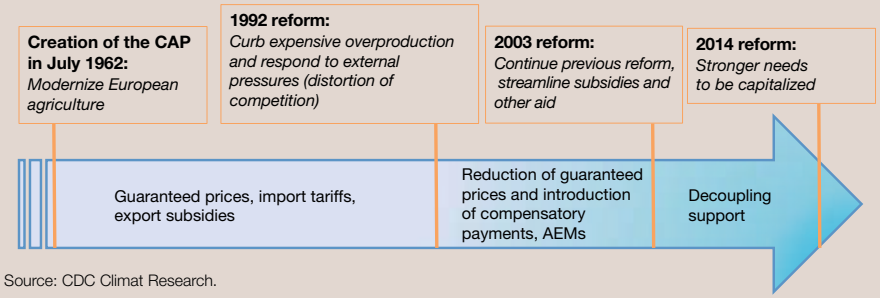
The CAP's impact on GHG emissions

A brief history of the CAP

Initially created to modernise European agriculture and ensure food self-sufficiency, the **CAP** has undergone numerous reforms to create the structure we know today, based on two pillars:

- the **first pillar** corresponds to direct aid, whose allocation rules are mandatory and common to all countries.
- the **second pillar** corresponds to rural development and is cofinanced by States. This particularly includes AEMs (agri-environment measures) which are voluntary and adapted to specific regional characteristics.

■ The main CAP reforms



Source: CDC Climat Research.

What role can the CAP play in the agricultural emissions reduction target?

The latest CAP reform strengthened the climate aspect by clearly stating the reduction in agricultural emissions as a target. A number of measures contained in the two pillars have an indirect effect on greenhouse gas (GHG) emissions. That is the case for example with grass strips, grants for organic farming, grants to modernise farming businesses and AEMs. Despite this stated aim to reduce GHG emissions, the CAP's impact is very hard to quantify and little work has been done in this area. This would be a prerequisite, however, for reinforcing the CAP's contribution to the transition to lower carbon agriculture.

Greening of the CAP

One of the main aspects of the 2014 reform was the greening of the CAP, particularly including a climate component. This involves three major points:

- Strengthening of the climate aspect of the GAEC (Good Agricultural and Environmental Conditions) – **1st pillar**
- The introduction of green payments dependent on compliance with three criteria (maintenance of grasslands, diversification of crops and preservation of areas of ecological interest) – **1st pillar**
- One of the priorities of the second pillar is the "promotion of the effective use of resources and the transition to a low carbon economy". Furthermore, at least 30% of financing must be earmarked for measures linked to land management and the fight against climate change. AECMs (agri-environment and climate measures – formerly AEMs) are part of this pillar – **2nd pillar**.

A more important role for regions

In France, the regions now have authority over implementation of the second pillar.

They have established their regional rural development programmes (PDRRs), replacing the French rural development programmes (PDRHs) choosing from among the measures proposed by the European Commission, in line with the national framework which defines the list of measures which must be included in PDRRs as well as implementation procedures and nationally harmonised conditions linked to the measures. For other measures however, they have room for manoeuvre concerning their selection and application methods (*e.g.* beneficiaries, projects' eligibility conditions, selection criteria, etc.).

For 2014-2020, France will receive €11.5 billion from the EAFRD fund distributed between regions in mainland France and its overseas territories, compared with approximately €7 billion for the recent period.

■ Further information:

Climate Report no. 49: www.cdcclimat.com/Etude-Climat-no49-La-precedente.html?lang=fr

European Commission: www.ec.europa.eu/agriculture/cap-post-2013/index_fr.htm

The role of agricultural sectors in the European Union Emissions Trading Scheme (EU ETS)

Around 20 activities in agricultural sectors are covered by the EU ETS

Agricultural emissions *per se* are not covered by EU ETS quotas, although upstream industries (producers of inputs, farming machinery, etc.), downstream industries and some heated greenhouses are covered.

These 1,400 facilities represent 9% of the total subject to the EU ETS. On average, these are low-emission facilities and represent just 3% of emissions covered or 47 $MtCO_2e$.

In terms of facilities covered, sugar manufacturers take the lead, followed by the milk processing, canning plants, heated greenhouses and producers of nitrogen fertilisers. In terms of emissions, fertiliser producers are the clear leaders with 39 $MtCO_2e$ in 2013.

Some changes since 2013 (start of phase III)

Requirements have tightened:

While agricultural facilities recorded a surplus on average during the first two phases of the EU ETS (*i.e.* they received more free quotas than their emissions in tonnes of GHGs), that is no longer the case since 2013 with the tightening of requirements in phase III. On a like-for-like basis, facilities in this sector recorded a surplus of 9 million quotas/year on average during the 2008-2012 period, but recorded a deficit of 11 million in 2013 and in total (including facilities included for the first time in 2013) the deficit stood at 13 million in 2013.

In France, phase III features the inclusion of dehydrators and grain dryers:

These facilities had been granted the right to defer their inclusion in the EU ETS until 2013. Prior to their entry into the EU ETS, alfalfa dehydrators were able to establish carbon offset projects to transform their efforts (pre-wilting of the alfalfa in the field to save energy and substitution of coal with wood chips) into carbon credits.

■ Facilities subject to the EU ETS within agricultural sectors

Sectors	Activities	Number of facilities in 2013	Average verified emissions by facility in 2013
Production of agricultural inputs	Extraction of raw materials for the production of chemical inputs	3	23,476
	Manufacturing of farming machinery	4	2,770
	Production of nitrogen fertilisers	126	313,228
	Production of chemical inputs	6	26,328
	Seed production	1	2,912
	Animal feed	33	36,038
	Drying	27	3,120
Operating scope	Farming production/heating greenhouses	134	8,181
Downstream of the sector	Processing and packaging of meat	53	11,045
	Processing and packaging of fruits and vegetables	165	11,530
	Production of dairy products	189	17,002
	Processing of sugar	246	35,712
	Processing of cereals and starch	67	62,448
	Production of oils	95	27,646
	Production of malt	19	10,545
	Production of beer	102	8,876
	Production of alcoholic drinks – other	36	15,132
	Production of non-alcoholic drinks	11	9,974
	Other Agri-food	89	15,342
	Sale of agricultural products	1	14,506
	Catering	1	7,452
	Totals	**1,408**	**663,263**

Source: CDC Climat Research.

■ Further information:

Climate Report no. 39: www.cdcclimat.com/Etude-Climat-no39-Plus-de-800-installations-des-filieres-agricole-et-agroalimentaire-concernees-par-l-EU-ETS.html

European Commission – EU ETS: www.ec.europa.eu/clima/policies/ets/index_en.htm

European policies for the forestry sector

The role of the European forestry sector in European climate targets

The forestry sector does not feature in the targets of the European 2020 Climate and Energy Package, the EU's central policy in terms of climate change mitigation. With a view to the sector's future inclusion in climate targets, in 2013 the EU adopted a decision regarding the accounting of the LULUCF sector's greenhouse gas (GHG) emissions. (Decision No. 529/2013/EU). The aim was to establish common and harmonised accounting rules , in accordance with UNFCCC decisions, in order to take into account these sectors' emissions reduction efforts. The adoption of these rules therefore constitutes a first step in the future inclusion of the LULUCF sector in the 2030 Climate and Energy Package, a decision on which is expected at the start of 2016.

The EU ETS meanwhile prohibits the use of carbon credits from forestry projects. Nevertheless, the principle of the carbon neutrality of firewood applied by the EU ETS, as well as strict targets for the share of renewable energies in the European energy mix, create an incentive for the energy use of biomass, consumption of which is set to increase sharply between now and 2020.

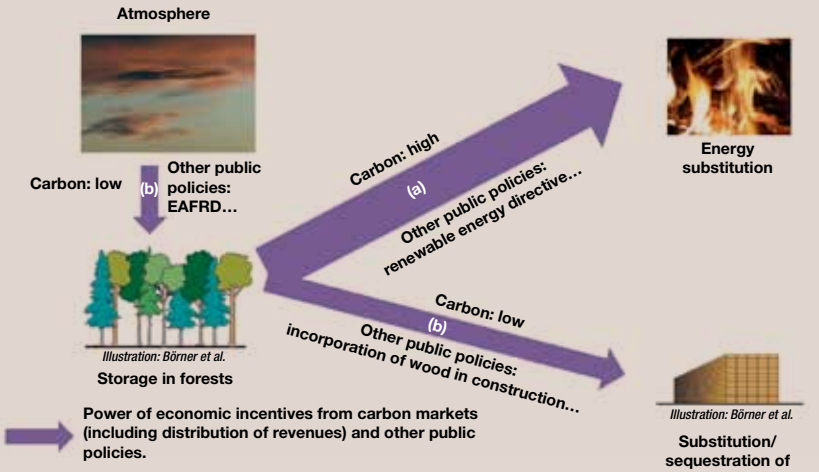
Climate change in European forestry policies

Within the EU, the forestry sector is directly affected by non-regulatory policies. These policies are:

- **The Forest Strategy for forests and the forest-based sector.** This involves a range of proposed measures available to Member States to deal with threats to forests such as storms, droughts, fires, etc. Since 2014, it has encouraged the increased use of wood and the development of the sector, underlining the importance of the hierarchy of wood uses (priority for timber, then industrial use and finally energy).
- **The European Agricultural Fund for Rural Development** (EAFRD) which finances rural development measures implemented by Member States, particularly measures recommended by the Forest Strategy. The EAFRD is the main European fund in terms of support for the forestry and wood sector, particularly via support for the firewood sector (€1.7 billion/year) and renewal of wood resources (€415 million/year) over the period 2007-2013.

Overall, European policies favour the promotion of energy substitution. Forest sequestration is seen as secondary, and not systematically addressed in a climate change mitigation target.

■ Level of incentives to reduce emissions in the forestry and wood sector



Proposed values in euros for carbon incentives are rough estimates.
Source: CDC Climat Research.

Sustainability criteria for solid biomass

The Climate and Energy Package sets out sustainability criteria concerning the type and source of raw materials used in the production of renewable energy. These criteria are not obligatory for solid biomass, including wood. The establishment of tighter common sustainability criteria for solid biomass would allow the creation of a harmonised framework between States, which could facilitate trade inside and outside the EU. The benefits of such a measure are still being debated between European countries. The subject is being studied by the European Commission in preparation for the post-2020 biomass policy.

■ Further information:

French Ministry of the Ecology – The Climate and Energy Package: www.developpement-durable.gouv.fr/Paquet-Energie-Climat-2030-Par-I.html

European Commission: the EU forestry strategy: www.ec.europa.eu/agriculture/forest/strategy/index_en.htm

CDC Climat Research: Forests and climate change mitigation in European policies: www.cdcclimat.com/IMG/pdf/13-04-15_etude_climat_40_-_politique_forestiere_ue.pdf

The contribution of the agricultural and forestry sectors to renewable energies

What is biomass?

Biomass refers to all organic matter which can be used to generate energy. It is the largest renewable resource in France in terms of primary energy production. Various forms of biomass exist, contributing to the production of heat, power and fuel:

Solid biomass (firewood)	These can come directly from forests, non-forest trees (agroforestry, hedgerows, etc.), by-products resulting from the processing of wood and also end-of-life wood products.
Biofuels	The first generation of biofuels is divided into two sectors: • The ethanol sector, mainly produced from sugar beet and sugar cane as well as wheat, corn and potatoes. • The biodiesel sector, mainly produced from rape and sunflower oil. Second generation biofuels can come from straw, wood or non-agricultural or forestry products.
Biogas or biomethane	This is produced by fermenting organic matter (e.g. livestock effluents or crop residues) in anaerobic conditions.

French biomass targets

• **The European framework**

The target for 2020 is to achieve 20% of the EU's total energy consumption from renewable energies, corresponding to a French target of 23%. Biomass is one sector to be developed, along with solar, wind, hydroelectric and geothermal. The transport sector has a specific renewable energy target of 10% for 2020. This obviously includes biofuels, but also hydrogen and electricity produced from renewable energies.

• **The national framework**

The 2020 development targets assigned to biomass relate to electricity production and heat production. They aim to achieve a production capacity of 2,300 MW for power and 16,455 ktoe for heat (including 555 ktoe from biogas), representing 83% of total renewable heat production.

Significant use of biomass is also planned by 2030, to achieve the national target of 38% of renewable heat. It is estimated that biomass will cover approximately 70% of this target.

Tools for the development of biomass in France

Various tools have been established to achieve these objectives, particularly:

- **Feed-in tariffs** for electricity and biogas: electricity and gas distribution companies are obliged to buy renewable energy at a minimum regulatory price, which depends on the energy concerned.
- **The aim of the heat fund,** managed by the ADEME, is to finance projects to produce renewable thermal energy, particularly using biomass (mainly from forests).
- **Biomass calls for tenders to produce electricity,** relating to the construction of combined heat and power biomass plants.
- **The energy transition tax credit (CITE),** allowing households to deduct part of the cost of energy renovation for their home from their income tax.

Sustainability criteria

First-generation biofuels were accused of indirectly aggravating deforestation and impacting food production, making them controversial within the EU. The Climate and Energy Package therefore imposes sustainability criteria concerning the type and source of raw materials used in the production of biofuels and bioliquids. The raw materials must not come from land with high biodiversity value (wooden areas, grasslands or protected areas), nor land with a high level of carbon sequestration (*e.g.* peatlands or wetlands).

For solid biomass, including wood, sustainability criteria may also be imposed by Member States, although this is not obligatory.

■ Further information:

National renewable energy action plan:
www.developpement-durable.gouv.fr/IMG/pdf/0825_plan_d_action_national_ENRversion_finale.pdf

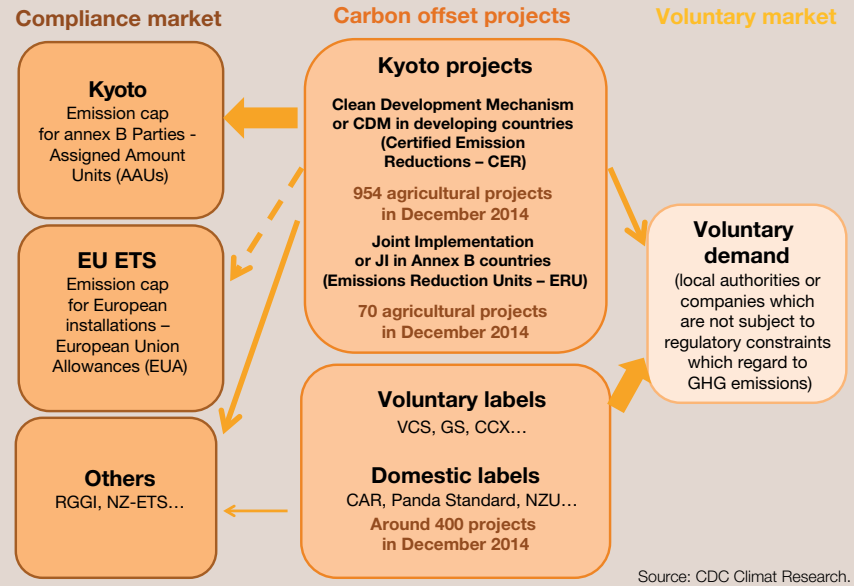
ADEME – Heat fund: www.ademe.fr/expertises/energies-renouvelables-reseaux-stockage/passer-a-laction/produire-chaleur/fonds-chaleur-bref

The role of agricultural sectors in carbon offset projects

The agricultural sector is covered by all carbon labels (voluntary and regulatory)

The agricultural sector is involved in **"Kyoto" CDM and JI labels**, **voluntary labels** such as VCS and Gold Standard as well as **national labels** resulting from domestic climate policies – even if that involvement remains moderate.

■ Overview of carbon labels



Source: CDC Climat Research.

CDM: The 954 agricultural CDM projects represent 7% of all credits generated under this standard (330 million agricultural credits have been generated in total). These mainly involve biomass, methanisation of livestock effluents and improvement to the process for manufacturing nitrogen fertilisers.

JI: The 70 agricultural projects have generated 70 million ERUs, representing 9% of all credits generated by the JI mechanism. These are the same types of projects as for the CDM, as well as no-till agriculture projects.

There is still a shortage of agricultural projects

The development of agricultural projects has so far been limited:

- few sub-sectors are concerned by these projects, which include substitution of fossil fuels with agricultural biomass, methanisation and production of nitrogen fertilisers. This is due to the fact that for these type of projects GHGs can be measured relatively precisely and easily;
- these mechanisms are limited to certain regions: mainly in Asia and Latin America;
- certain barriers, mainly technical, limit the scope for agriculture in carbon offsetting mechanisms. Access to data, the diffuse nature of agricultural emissions, the diversity of agricultural systems and the complexity – and consequently cost – of measuring and monitoring are all factors making the development of agricultural projects more difficult.

Development prospects in France

Only two labelled agricultural projects exist in France: one managed by the Bleu-Blanc-Cœur association concerning enteric fermentation and one managed by the InVivo cooperative on the insertion of legumes into crop rotations.

However there is real demand for local agricultural projects from French companies and local authorities looking to offset their emissions.

Agricultural emissions are also among the emissions which could benefit from this tool since they are not covered by the EU ETS.

Adopting this type of approach makes it possible to anticipate future constraints, to identify relevant information such as the reduction costs incurred for each practice and system, and to reward the efforts of those taking action now.

■ Further information:

Ecosystem Market Place – State of the Voluntary Carbon Markets 2014: www.forest-trends.org/vcm2014.php

MEDDE – JI: www.developpement-durable.gouv.fr/Procedure-d-agrement-des-projets.html

UNFCCC – CDM: www.cdm.unfccc.int/

Forests and carbon offsetting

Limited space within regulated markets

The Kyoto Protocol established two flexibility mechanisms to allow the development of regional emissions reduction projects (see sheet 11), within which forestry projects have been developed to a moderate extent:

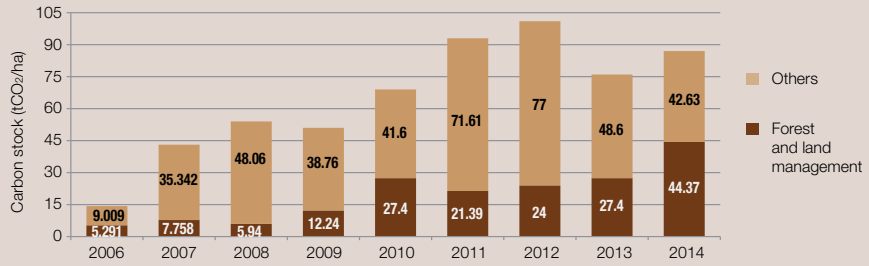
- The **Clean Development Mechanism (CDM)**, allowing developed countries to finance projects in developing countries. It only covers afforestation and reforestation projects, excluding in particular project to improve management and conservation. There are currently 55 CDM forestry projects (excluding biomass) representing just 0.7% of registered projects.
- **Joint Implementation (JI)**, allowing the financing of a project in another developed country (Appendix 1). Three afforestation and improved management projects as well as around 30 biomass projects using forestry products are registered.

The carbon credits generated from these projects are sold mostly to Parties subject to regulatory obligations in the context of the Kyoto Protocol, but they can also be sold on the voluntary market.

A major development in voluntary markets

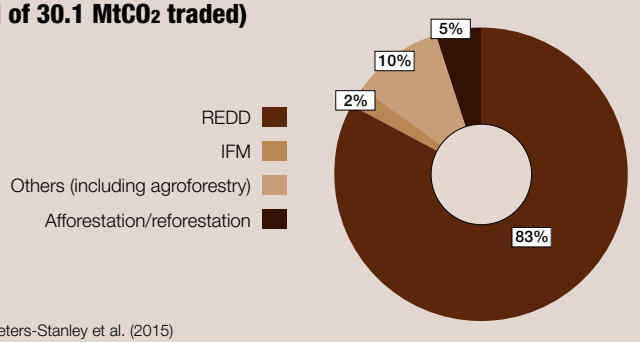
Carbon credits from voluntary projects have developed more in voluntary markets, which are seven times smaller than regulated markets in terms of volume. In 2014, 87 million tonnes equivalent of CO_2 was traded on the voluntary market, 51% of which came from "land and forestry management" projects (45% from forestry projects *per se, i.e.* deforestation avoided, afforestation and improved management). Avoided deforestation projects (REDD) account for more than 80% of volumes traded.

■ Volumes of CO_2 credits traded on voluntary markets



Source: Peters-Stanley et al. (2015)

■ Breakdown of forestry projects by type of project in 2014 (total of 30.1 $MtCO_2$ traded)



Source: Peters-Stanley et al. (2015)

Private labels and internal multi-actor frameworks

Fewer than 10 private certification labels or standards currently exist in addition to the two UN labels (CDM and JI). Their purpose is also to guarantee the environmental integrity of the projects they certify, i.e. ensuring that the tonnes of carbon traded on the voluntary market correspond to actual emissions reductions. They therefore offer validation and certification processes, based in large part on the CDM, although with a few specific features and innovations. In 2013, 96% of credits traded on the voluntary market were certified by a standard, compared with just 15% in 2002. The labels most used to certify voluntary projects across all sectors in 2014 were:

- The Verified Carbon Standard (VCS): 57% of credits traded
- An internal or proprietary standard (specific to a region or a small number of projects): 17%
- The Gold Standard: 15%
- The Climate Action Reserve (California): 3.6%
- The American Carbon Registry 3.3%
- The CDM and JI: 1.4%

■ Further information:

Ecosystem Market Place – State of the Voluntary Carbon Markets 2015: www.forest-trends.org/releases/uploads/SOVCM2015_FullReport.pdf

Ecosystem Market Place – State of the Forest Carbon Markets 2014: www.forest-trends.org/documents/files/doc_4770.pdf

MEDDE – CDM and JI: www.developpement-durable.gouv.fr/Procedure-d-agrement-des-projets.html

Appendices

Abbreviations and acronyms

AFOLU: Agriculture, Forestry and Other Land Uses – *see sheet no. 27.*

CAP: Common Agriculture policy – *see sheet no. 31*

CIDD: Sustainable Development Tax Credit (Crédit Impôt Développement Durable) – *see sheet no. 31.*

COP: Conference of the Parties (here, signatories to the UNFCCC) – *see sheet no. 13*

EIT: Industrial and regional ecology (Écologie Industrielle et Territoriale)

DRIAS (portal): Provides access to regionalised climate scenarios – *see sheet no. 5.*

EAU: European Union Allowances, carbon credits traded on the EU ETS

EnR: Renewable energies (Énergies renouvelables)

EU ETS: European Union Emissions Trading Scheme – *see sheet no. 19.*

ERDF, EAFRD, ESF: European Regional Development Fund, European Agricultural Fund for Rural Development and European Social Fund – these are the main three European structural funds – *see sheet no. 28.*

GHG: Greenhouse gas, found in the atmosphere, either natural or anthropogenic which absorb and radiate infrared rays

GPC Protocol: Greenhouse Gas Protocol – *see sheet no. 34*

UHI: Urban Heat Island – *see sheet no. 9.*

SRI: Socially Responsible Investment – *see sheet no. 35.*

Mt CO_2 eq.: million tonnes CO_2 equivalent, CO_2 equivalence is a method of measuring greenhouse gases, taking account of the warming potential of each gas relative to that of carbon dioxide.

Mtep: millions of tonnes equivalent of petroleum, a unit for measuring energy

CDM: Clean Development Mechanism – *see sheet no. 17.*

JI: Joint Implementation – *see sheet no. 17.*

LULUCF: Land Use, land use Change and Forestry – *see sheet no. 27*

MRV: Monitoring, Reporting and Evaluation of greenhouse gas emissions

PC(A)ET: Regional climate, (air) and energy plans (Plan Climat (Air) Énergie Territorial) – *see sheet no. 24.*

CEP 2020 and 2030: European climate and energy package 2020 and 2030 – *see sheet no. 18.*

PNACC: National climate change adaptation plan (Plan National d'Adaptation au Changement Climatique), 2011-2015 – *see sheet no. 26.*

NEEAP: National Energy Efficiency Action Plan – *see sheet no. 20.*

POPE (law): Law no. 2005-781 of 13 July 2005 setting out the direction of French energy policy – *see sheet no. 21.*

SRCAE: Regional climate, air and energy plan (Schéma Régional du Climat de l'Air et de l'Energie) – *see sheet no. 24.*

TEE: Energy and ecology transition (Transition Énergétique et Écologique)

TICPE: Domestic consumption tax on energy products (Taxe Intérieure de Consommation sur les Produits Énergétiques)

Organisations and institutions

EEA: European Environment Agency www.eea.europa.eu

EIB: European Investment Bank www.eib.org

EBRD: European Bank for Reconstruction and Development www.ebrd.com

CEREMA: Centre for risk, environment, mobility and regional development studies (Centre d'Études et d'expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement) www.cerema.fr

CGDD: General Sustainable Development Commissariat (Commissariat Général au Développement Durable), attached to the French Ministry for Ecology, Sustainable Development and Energy

CITEPA: Interprofessional technical centre for studies on air pollution (Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique) *www.citepa.org*

UNFCCC: United Nations Framework Convention on Climate Change www.unfccc.int

CNRM-GAME: National metereological research centre (Centre National de Recherches Météorologiques) *www.cnrm.meteo.fr*

IPCC: Intergovernmental Panel on Climate Change *www.ipcc.ch*

ICLEI, C40, R20, UCLG, R20: www.iclei.org www.c40.org/cities www.uclg.org/fr www.regions20.org main international networks of local authorities

IPSL: Institut Pierre Simon Laplace *www.ipsl.fr*

MEDDE: Ministry for Ecology, Sustainable Development and Energy (Ministère de l'Écologie, du Développement durable et de l'Énergie) *www.developpement-durable.gouv.fr*

OECD: Organisation for Economic Cooperation and Development *www.oecd.org*

WMO: World Meteorological Organization *www.wmo.int*

UNEP: United Nations Environment Programme *www.unep.org*

CDC Climat Research: *www.cdcclimat.com*

Météo France: *www.meteofrance.com*

ONERC: National Observatory of the Effects of Climate Change (Observatoire National des Effets du Changement Climatique), attached to the French Ministry for Ecology, Sustainable Development and Energy *www.onerc.gouv.fr*

ADEME: Environment and Energy Control Agency (Agence de l'Environnement et de la Maîtrise de l'Energie) *www.ademe.fr*

AFD: French Development Agency (Agence Française de Développement) *www.afd.fr*

Appendices

Glossary

Positive agenda or «solutions agenda»: range of concrete initiatives and mitigation and adaptation solutions to climate change implemented by various civil society organisations (companies, NGOs, public institutions, local authorities, etc.) and presented as high-potential actions in national discussions.

Energy performance contract: contract concluded with an energy efficiency services company designed to legally ensure a certain level of improvement to buildings' energy efficiency compared with a reference scenario through an investment in works, supplies or services. (MEDDE)

Eco-design: way of designing a range of environmentally-friendly products (goods or services). (ADEME)

Efficient design of functions: economic models favouring usage over possession by selling services linked to products rather than products themselves. (ADEME)

Energy efficiency: capacity to produce as much or more energy and/or reduce energy consumption for the same service provided.

Externality: costs or benefits created by an economic activity supported by or benefiting others and not accounted for.

Factor 4: objective of quartering greenhouse gas emissions by 2050, in order to restrict global warming to a temperature rise of 2°C (according to the IPCC). This corresponds to a reduction in French emissions of around 3% a year. This target was enshrined in the French law of 12 July 2005 fixing the direction of energy policy. (ADEME)

Adaptation fund: fund created by the Kyoto Protocol and operational since 2010, with the objective of financing adaptation projects in developing countries which are parties to the Kyoto Protocol.

Green Climate Fund: one of the main tools to finance mitigation and adaptation projects in developing countries. It was proposed and adopted at the Conferences of the Parties in Cancun and Durban (2010-2011).

Grenelle environmental pact: consultation and debating process initiated in 2007 aiming to define French environment and sustainable development policy. It culminated in the passing of two laws in 2009 and 2010 – a law setting the framework for implementation of the proposed measures and a law defining the national commitment to the environment.

Horizon 2020: the European Union's main research and innovation programme, allocated a budget of €80bn over the period 2014-2020. It follows on from the 7th research framework programme and the programme for competitiveness and innovation.

Energy intensity: the ratio between consumption and an economic variable (GDP, added value at constant prices), measuring energy efficiency from an economic perspective. It is above all an indicator of energy productivity gains. (ADEME)

LIFE: European financial instrument supporting projects relating to the environment, nature conservation and the fight against climate change.

Maladaption: change in natural or human systems exposed to climate change which unintentionally increase vulnerability instead of reducing it (ONERC).

Jouzel project: established by Jean Jouzel in 2010, by ministerial order, to define and submit reference scenarios for the future climate in France for use by those working on adaptation to climate change. The scenarios are updated on multiannual basis. (Météo France)

New financial instruments (NFI): financing mechanisms distinct from subsidies, such as venture capital, guarantees or loans, involving European funds (particularly structural or investment funds).

2°C target: target of limiting global warming to 2°C by 2100 officially pursued in international negotiations since 2009 and generally considered (since the IPCC's 4th report) as an adequate threshold to avoid dangerous climate change.

Loss and damage: human and financial cost of climate change experienced despite efforts to mitigate greenhouse gas emissions. A mechanism was established by the UNFCCC in 2013 to tackle this.

Durban Platform: working group set up at the 17th UNFCCC Conference of the Parties (COP17) in Durban in 2011 to develop a new universal regime to tackle climate change, due to come into force in 2020.

Polluter pays principle: principle defined by the OECD in 1972 stipulating that «the polluter should bear the expenses of carrying out the measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption.»

Stern Review: report commissions by the UK government in 2006 from a committee chaired by the economist Nicholas Stern, comparing for the first time in monetary terms the costs of mitigation of climate change and the costs of inaction against climate change.

REDD+: Reducing Emissions from Deforestation and Forest Degradation, a mechanism launched in 2008 and coordinated by the UN, to reduce GHG emissions linked to deforestation in developing countries. It relies on market mechanisms.

RCP scenarios: Representative Concentration Pathways – a set of four climate scenarios developed ahead of the IPCC's 5th Assessment Report defining representative profiles of changes in greenhouse gas concentrations in the atmosphere. «These scenarios correspond to efforts of varying magnitudes to reduce GHG emissions at a global level. For each of these four representative profiles, climatologists deduce the climate conditions and associated impacts of climate change. In parallel, sociologists and economists are working on scenarios presenting various characteristics of socio-economic development and various adaptation and mitigation strategies.» (ONERC)

Scopes: scopes of greenhouse gas emissions included in the emissions assessment of a project, an entity or a region (direct or indirect emissions which may or may not take account emissions linked to imports and exports). Defined in standard ISO 14064.

Energy savings: reduction in energy needs due to a change in habits and practices.

Europe 2020 Strategy: the European Union's 10-year growth strategy. Adopted in 2010, this takes over from the Lisbon Strategy. (EC)

Climate-resilient pathways: development pathways combining mitigation and adaptation policies to achieve sustainable development objectives, avoiding dangerous disruption to the climate system. (IPCC)

■ More detailed glossaries:

Glossary (in French) compiled by the national PCET observatory, ADEME, www.pcet-ademe.fr/ressources/glossaire

The Repères collection published by MEDDE, particularly «Highlights: Key Figures on Climate France and Worldwide - 2015 Edition», November 2014

This report, released in the year of the Paris Climate 2015 summit (COP21), reviews concepts vital for understanding and acting to address climate change at a regional level. Based on the experience of French territories it presents 36 factsheets aimed at local players, providing concise and informative access to the most up-to-date knowledge. It also offers feedback on the impacts of climate change, climate policies at a global, European and French level, and economic tools supporting climate change mitigation and adaptation.

CDC Climat Research
47, rue de la Victoire
75009 Paris
contact@cdcclimat.com

Météo France
73, avenue de Paris
94165 Saint-Mandé Cedex

ONERC
(Observatoire National sur les Effets du Réchauffement Climatique)
French Ministry for Ecology, Sustainable Development and Energy
92055 La Défense Cedex
onerc@developpement-durable.fr