

# Science for Climate Action

## Some JRC examples

JRC work identifies opportunities and constraints for the electrification of transport and investigates the grid interoperability with, for example ICT and transport systems. The [Vehicle Emissions Laboratory \(VELA\)](#) assesses emissions and the environmental impacts of vehicles using standard test protocols on a variety of vehicles and engines. The findings made at VELA provide scientific support for the development and revision of EU directives and regulations as well as for the assessment of new measurement techniques and procedures. Its findings also support international (UNECE) legislation. The JRC also carries out research on fuel cells and hydrogen with tank testing, hydrogen storage and sensor testing.

Strategic Energy Technologies Information System: SETIS - <https://setis.ec.europa.eu/>

European Solar Test Installation: ESTI - <https://ec.europa.eu/jrc/en/research-facility/european-solar-test-installation>

Vehicle Emissions Laboratory: VELA - <https://ec.europa.eu/jrc/en/research-facility/vehicle-emissions-laboratory-vela>

## Capping industrial emissions

As agro-industrial activities account for a considerable share of the overall pollution, driving emissions into the air, water and soil is subject to the Industrial Emissions Directive (IED). This directive regulates about 50 000 industrial installations across the EU. All installations covered by the directive must comply with permit conditions, including emission limit values, which are based on the Best Available Techniques (BATs). BATs are defined as the most effective techniques for preventing or reducing emissions. They cover not only the technology use, but also the way in which the installation is designed, built, maintained, operated and decommissioned. A specific look into the emission levels and other environmental performance of several techniques is also included.

## Joint Research Centre

### The European Commission's in-house science service

#### JRC mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle. Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

To this end, the JRC runs the [European Integrated Pollution Prevention and Control Bureau \(EIPPCB\)](#) and provides the competent authorities in the Member States with BAT reference documents, which are necessary to issue permits for the installations that represent a significant pollution potential in Europe.

European Integrated Pollution Prevention and Control Bureau: EIPPCB - <http://eippcb.jrc.ec.europa.eu/>

#### Systematic observation for climate science and policy

Systematic observation of the climate system is vital for advancing scientific knowledge on climate change and for making informed policy decisions.

The JRC supports the Copernicus Climate Change Service, by helping to standardise Earth Observation products and services related to climate change. This involves making in-situ measurements, developing and benchmarking new satellite products and assuring compliance with international standards. The JRC regularly contributes to international assessments carried out on climate change, such as the climate reports of the Intergovernmental Panel on Climate Change (IPCC) or the 'State of the Climate' reports of the US National Oceanic and Atmospheric Administration (NOAA). It also helps key organisations such as the World Meteorological Organization (WMO) and its Global Framework for Climate Services, which develops science-based climate information and forecasts that can be incorporated into planning, policy and practice on a global, regional or national scale to achieve better climate risk management.

### Serving society Stimulating innovation Supporting legislation

#### Contact details

European Commission  
Joint Research Centre  
Geraldine BARRY (Head of Unit) Tel: +32 (2) 297 41 81  
Communication Unit Fax: +32 (2) 299 63 22  
BE-1049 Brussels Website: <https://ec.europa.eu/jrc>  
Belgium Contact: <https://ec.europa.eu/jrc/en/contact>

**Without further action, climate change will have a significant impact on natural resources, ecosystems, the world economy and our life in general. It will lead to higher temperatures, altered precipitation patterns, rising sea levels, and an increased frequency of extreme weather events. Only a substantial and sustained reduction of gas greenhouse (GHG) emissions, together with adaptation measures, might reduce the negative effects of climate change.**

**In spite of progress prompted by the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, sustained and coordinated action beyond 2020 is necessary to keep global warming below 2°C. In this context, the UNFCCC Conference of the Parties (COP 21) seeks to conclude a new agreement to succeed the Kyoto Protocol.**

The EU is at the forefront of the fight to tackle climate change and a key player in the negotiations under the UNFCCC. Climate is an integral part of EU policy and the target is to reduce GHG emissions by at least 40% by 2030 compared to 1990 levels. Legislation to achieve these targets is developed under the so-called 2030 Climate and Energy Framework, a cornerstone of the 2015 Energy Union Strategy (2015) to achieve a low-carbon, climate-resilient economy. The EU also has in place a strategy for adaptation to climate change to increase its economic resilience to the effects of global warming.

On the international stage, the EU has been a precipitating force for a new international agreement to tackle climate change beyond 2020. It has deployed important means to secure an ambitious, fair and legally binding deal applicable to all parties at the Paris climate conference COP 21 in December 2015.

As the European Commission's in-house science service, the Joint Research Centre (JRC) is instrumental in the development and implementation of the EU's climate change driven policies. Its research helps to deliver the EU's domestic and international legal commitments to reduce GHG emissions, design the policies of the future to achieve the transition to a low carbon economy, enhance

societies' resilience to climate change both in the EU and beyond, and spur technological innovation and deployment for a low carbon future.

The JRC works with a wide array of partners, including governmental bodies, as well as academic and research organisations worldwide. In the area of climate action internationally, the JRC performs much of its work through its contributions to the Intergovernmental Panel on Climate Change (IPCC), the United Nations Environment Programme (UNEP) and the United Nations Economic Commission for Europe (UNECE). Its research serves European decision-makers as well as Member States and the international community.

#### Informing EU climate change policy

The EU's climate action relies on solid scientific evidence to make informed decisions. In the transition to a low carbon economy, JRC modelling contributes to the design of future policies. It identifies major drivers of the economy and produces projections of future emissions and their impacts on key sectors over time. It also evaluates mitigation policy options. In parallel, the JRC contributes to the implementation of existing policies.

In this context, JRC scientific evidence was used for the 2015 European Commission's Communication '[The Paris Protocol – a blueprint for tackling global climate change beyond 2020](#)', which set out the European Union's vision for a new international agreement, including its Intended Nationally Determined Contribution (INDC). As part of its research, the JRC investigated pathways to cut CO<sub>2</sub> and other GHG emissions. It also assessed the macroeconomic impacts of global mitigation efforts by studying interactions between the economy, the energy system and the environment.

Previously, the JRC contributed to scenarios for GHG emission reductions required by the EU to meet the 2°C target in preparation for the Communication '[A Roadmap for moving to a competitive low carbon economy in 2050](#)' as well as to the climate and energy scenarios in the Communication '[2030 Framework for Climate and Energy Policies](#)'.



## Delivering greenhouse gases reduction targets

The EU and its Member States are working hard to cut GHG emissions. The JRC helps them with [accurate monitoring, reporting and verification systems of GHG emissions](#), which are critical to check whether the EU and its Member States are on track in meeting their international emission targets. These tools are also central to the transparency and accountability provisions in the new agreement on climate change.

In particular the JRC provides technical support to EU countries so that they can meet their legal obligations under the Kyoto Protocol to report GHG emissions from [agriculture](#) and [land use, land use change and forestry \(LULUCF\)](#). In this respect, the JRC is responsible for quality assurance and control of procedures and produces a consistent estimate for the EU's overall emissions in these two sectors. Moreover in support of the UNFCCC's [Reducing Emissions from Deforestation and Degradation \(REDD+\)](#) activities, the JRC is developing internationally-agreed methods for modelling and monitoring GHG emissions from deforestation and forest degradation in tropical countries.

Land Use, Land Use Change and Forestry (LULUCF) - <http://forest.jrc.ec.europa.eu/activities/lulucf/>

## Getting to know the facts: harmonising air and GHG monitoring and modelling

Despite continued efforts to reduce emissions of harmful air pollutants, air pollution remains a worldwide concern. Although climate and air quality have been traditionally considered as different policy areas, strong synergies and some trade-offs exist between the reduction of GHG emissions and air pollutants.

The JRC supports the continued adaptation of EU air pollution and climate change legislation and works on the [harmonisation of air and climate monitoring and modelling methodologies](#) to develop coherent GHG and air pollutant emission inventories and projections.

To study the effects of emissions on climate, air pollution and GHG trends, the JRC has been maintaining and updating an online inventory of emissions of GHG and air pollutants via the online [Emission Database for Global Atmospheric Research](#) since 1970. The JRC has developed in-house expertise on the [co-benefits of climate and air quality policies](#). It runs coupled chemistry-climate models, where air pollutants are considered as climate forcers and air quality benefits from climate action. This helps to identify climate change mitigation strategies that will also reduce air pollution, and therefore policies to improve air quality that are positive for the climate. The JRC's integrated assessment platform to compile GHG gases and air-pollutant emission inventories on a global scale has been used in several international assessments mainly to monitor and predict environmental change in the Arctic region.



Greenhouse gas emissions per capita in the world in 2010.

The JRC participates in two scientific networks on air quality: the [Air Quality Reference Laboratories \(AQUILA\)](#), and the [Forum for Air Quality](#)

[Modelling in Europe \(FAIRMODE\)](#) and contributes to several European and international efforts to reduce air pollutant emissions, including the UNECE's European Monitoring and Evaluation Programme (EMEP) and the United Nations Environment Programme (UNEP).

Emission Database for Global Atmospheric Research: EDGAR - <http://edgar.jrc.ec.europa.eu/index.php>

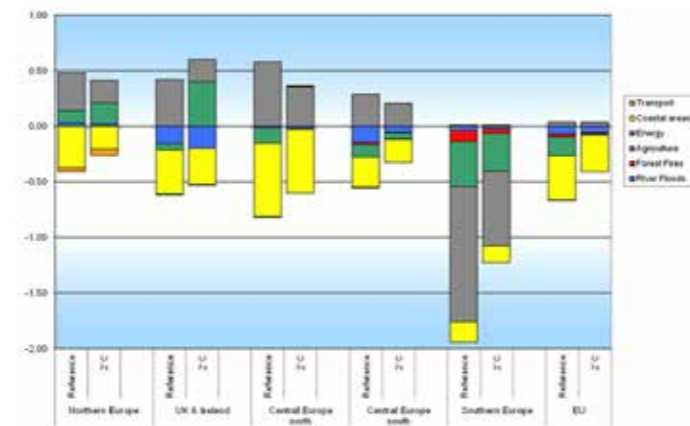
Air Quality Reference Laboratories: AQUILA - <https://ec.europa.eu/jrc/en/network-bureau/national-air-quality-reference-laboratories-and-european-network>

Forum for Air Quality Modelling in Europe: FAIRMODE - <http://fairmode.jrc.ec.europa.eu/>

## Defining the most effective adaptation policy and enhancing resilience to climate change

Climate change will put more pressure on water, food and energy supplies as well as on health, infrastructure, and the economy as a whole. Even if some ambitious mitigation policies are being currently put in place, this is not enough. Adaptation measures to limit and prevent the damage caused by climate change which is already happening as well as to make key economic and policy sectors more resilient to its effects are also necessary.

In this context, the JRC produces [climate change projections](#) and assesses its impacts on key areas such as agriculture, tourism, transport, infrastructures, or on disasters such as floods, forest fires and droughts, and further values and integrates the impacts in economic terms ([PESETA studies](#)). Its work is vital to defining the most appropriate and effective adaptation policy in the European Union and vulnerable developing regions such as Africa. This work is done in collaboration with international partners.



The PESETA II report assessed the expected welfare impacts (as percentage of GDP) in EU regions under two main simulations: a reference scenario assuming current trends are maintained in time and under a mitigation scenario, where coordinated action achieved to maintain global temperature increase below 2°C.

Agro-economic modelling is used for the [impact assessment of different mitigation policy options](#) on agriculture. This is very important in the context of providing food security to a growing world population and increased meat consumption.

An understanding of the relationship between climate change and development and the identification of the countries, groups of people and sectors most seriously threatened by climate change are needed to increase global resilience to climate change. In this context, the JRC has designed a global index to allow an ex-ante evaluation of the structural features of vulnerability to climate change to support the EU [Global Climate Change Alliance plus \(GCCA+\)](#) programme, which is the EU's largest programme to combat climate change in developing countries

until 2020. The GCCA+ index is a 'fit for purpose' index that addresses the GCCA+'s policy objective of boosting the efficiency of response to the needs of vulnerable countries and groups. A web platform has been established as an interface between science and policy. It provides transparent, reliable, accurate, and open source information on the indicators, data and methodology applied to build the index and allows users to examine the factors behind the index and the indicators.

The [Climate-ADAPT portal](#), a partnership between the European Commission (DG CLIMA, the Joint Research Centre and other DGs) and the European Environment Agency provides the scientific information needed to assess climate change risks in Europe or to find out more about ongoing adaptation projects at all levels, from EU down to national, regional and local level.

PESETA II project: <https://ec.europa.eu/jrc/en/peseta>

Global Climate Change Alliance plus (GCCA+) programme: <http://www.gcca.eu/>

GCCA+ index: <http://knowsdgs.jrc.ec.europa.eu/>

Climate-ADAPT portal: <http://climate-adapt.eea.europa.eu/>

## Running early warning systems for extreme weather events

The JRC also contributes to enhancing resilience to climate change by developing appropriate early warning systems for extreme weather events. These provide decision-makers with valuable lead time to take preventive steps and to limit the impacts of extreme events.

Over the past 10 years, the JRC has been developing pan-European monitoring and early warning systems on forest fires ([EFFIS – European Forest Fire Information System](#)), floods ([EFAS – European Flood Awareness System](#)) and droughts ([EDO – European Drought Observatory](#)). EFAS and EFFIS are the first operational early warning systems in the framework of the Copernicus Emergency Management Service. In response to the need for global multi-risk information which is being highlighted both in the disaster risk management community, such as the Sendai Framework, as well as the adaptation to climate change community, the JRC is now extending the European systems on a global scale and is developing a multi-hazard global warning system to support the humanitarian aid sector.



EFFIS screenshot showing risks of forest fire in Europe during May 2015.

For other type of phenomena, such as typhoons, the JRC has developed and operates the only worldwide operational automatic impact-based alerting system, the [EU-UN Global Alert and Coordination System \(GDACS\)](#). GDACS, which is managed by the JRC, can calculate the capacity of the affected country to cope with the disaster and send alerts to the international cooperation community.

European Forest Fire Information System (EFFIS) - <http://forest.jrc.ec.europa.eu/effis/>

European Flood Awareness System (EFAS) - <https://www.efas.eu/>  
European Drought Observatory (EDO) - <http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000>  
EU-UN Global Alert and Coordination System (GDACS) - <http://www.gdacs.org/>

## Tackling emissions by decarbonising energy production and transportation

Europe is a leading player in [research, development and deployment of low-carbon technologies](#) and maintains its leading position with a range of evidence-informed policy initiatives. The JRC manages the [Strategic Energy Technologies Information System \(SETIS\)](#), which offers information on low-carbon energy technologies and related innovations. SETIS regularly produces analyses on a European and global level on low-carbon technologies such as wind, solar or bioenergy, including their market penetration. This information is used to support the effective strategic planning, monitoring and assessment of the SET-Plan, conceived to accelerate the development and deployment of cost-effective low carbon technologies.

Another example for supporting the uptake of renewable energies by the JRC is the development of standards for photovoltaic cells. Its [European Solar Test Installation \(ESTI\)](#) is a worldwide reference for the assessment of the performance of new and improved photovoltaic devices, according to international standards.

On [bioenergy and biofuels](#), the JRC conducts sustainability and resource assessments. The JRC also evaluates technological developments, estimates the land use change (environmental impact), and calculates the direct and indirect emissions from biofuels. Finally, the JRC analyses the availability of straw and other types of biomass for energy purposes. Its international partners in this field include the International Energy Agency, the European Environment Agency and the Organisation for Economic Co-operation and Development (OECD).

For [energy efficiency](#), the JRC contributes to the design, implementation and monitoring of EU energy efficiency policies as well as to the eco-design and energy labelling initiatives. It assesses Member States' national action plans on energy efficiency and takes part in voluntary initiatives such as the Covenant of Mayors that aim to encourage private and public actors, including local authorities to increase their energy savings.

The [decarbonisation of the transport sector](#) is also a key component of the Energy Union Strategy and the JRC plays an important role in shaping this process and developing standards.



An electric vehicle being tested at the JRC Vehicle Emissions Laboratory (VELA).