



# A-Z

GUIDE TO THE

# JOINT RESEARCH CENTRE

the European Commission's  
in-house science service

## SCIENCE FOR POLICY MAKERS



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# DG JRC – THE COMMISSION’S IN-HOUSE SCIENCE SERVICE

*In today’s world, ill-conceived policies usually have grave economic and social costs in themselves but also erode trust in governing institutions. The risk of mistakes is also growing as problems become more global, systemic and complex.*

*In particular science can help to avoid the risk of policy mistakes, to identify innovative policy alternatives and to provide early warnings of new challenges. It can help to put policy decisions on a sound factual basis and to focus political debate on the values at stake not the facts. In this regard, science can support the proper functioning of the political decision-making process mediated through democratic institutions.*

*As the Commission’s in-house science service, the Directorate-General Joint Research Centre’s (JRC) mission is to support EU policies through evidence-based scientific and technical advice. Working in close cooperation with almost all policy Directorates-General, DG JRC tackles the main societal challenges, stimulates innovation through developing new methods, tools and standards, and shares its know-how with the Member States, the scientific community and international partners.*

## How does DG JRC add value to policy-making?

DG JRC provides the scientific and technical expertise needed for a very wide range of EU policies. It is the only Commission service that carries out research and scientific activities in-house. DG JRC supports more than 20 policy Directorates-General of the European Commission throughout the whole policy cycle:

- **Policy anticipation:** DG JRC identifies emerging issues, anticipates future policy needs and contributes to the agenda-setting of the Commission and beyond.

- **Policy formulation:** DG JRC provides the scientific evidence that enables policy DGs at all stages of the inter-institutional decision-making process to compare the impacts of various policy options

as well as of amendments proposed by the Council or the Parliament.

- **Policy implementation and evaluation:** DG JRC ensures the smooth operation and the monitoring of numerous policies through the development of indicators, maintenance of databases and information systems, through EU Reference Laboratories, observatories, networks, etc. DG JRC contributes to the ex-post evaluation of the effectiveness of policies.

## How can DG JRC contribute to better policies?

In order to contribute to better policies based on appropriate scientific evidence, DG JRC builds upon a number of unique characteristics:

- **A broad range of recognised natural and social science expertise**, covering all major scientific disciplines and a vocation to work in a multi-disciplinary way and to deploy new approaches to networking and data gathering based on “Science 2.0” (the revolution in social networks, communications technologies and “Big Data”).

- **Membership or leadership of strong networks** in the world of science, policy and business at EU, national, but also global level and a vocation to act as a bridge between science and policy. DG JRC helps the Commission to reach out to the scientific community worldwide. Through its science hub and its “collaborative DNA”, DG JRC has created a platform to host conversations with internal and external stakeholders.

- Independence of private and national interests and **recognition as an unbiased and policy-neutral science service** contributing to the strategic thinking of the Commission and beyond.

- Significant human resources and physical assets such as **42 large scale research facilities** in five Member States. More than **140 online data bases** (such as the Emission Database for Global Atmospheric Research (EDGAR), knowledge centres (such as the one for energy efficiency) and observatories (such as the Bio economy Observatory) as well as more than **100 economic, bio-physical and nuclear models**.

## Who is DG JRC?

Headquartered in Brussels, the JRC is divided into 10 Directorates, of which 7 are research institutes located in 5 European countries. DG JRC shares

know-how with the Member States, the scientific community and international partners. **DG JRC collaborates with over 1000 organisations worldwide**, whose scientists have access to JRC facilities and knowledge through various collaboration agreements.

**DG JRC draws on over 50 years of expertise** and continually adapts and builds its capacity from the knowledge and skills of its scientists, using state-of-the-art laboratories and unique research facilities. The current set of JRC priorities focuses on: agriculture and global food security; Economic and Monetary Union; low-carbon economy and resource efficiency; single market, growth, jobs and innovation; nuclear safety and security and public health, safety and security.

Through its activities, **DG JRC has a direct impact on the life of European citizens**. It contributes in particular to their protection from a wide variety of risks and threats which do not recognise any national borders, thus providing strong European added-value and contributing to the creation of more sustainable and resilient societies.



*The following pages provide a **comprehensive overview of EU policy areas and the related support of DG JRC**, aimed at helping the EU become a more competitive and sustainable economy. The content is organised in alphabetical order as a dictionary of 23 self-standing chapters – each describes our work in a specific policy area.*

*For further information on the JRC please visit the Science Hub: <https://ec.europa.eu/jrc>.*

# AGRICULTURE AND RURAL DEVELOPMENT

*Through its response to the new economic, social, environmental, climate-related and technological challenges facing our society, the Common Agricultural Policy (CAP) can contribute more to developing intelligent, sustainable and inclusive growth.*

*The Directorate-General Joint Research Centre (JRC) provides scientific and technical support to the design and implementation of the CAP, sustainable management of resources/resource efficiency and food security. A range of quantitative models are used to assess the economic and environmental impacts of EU agricultural policies at global, European, national/regional and local levels. In support of the greening of the CAP, special emphasis has been given in recent years to better understanding the impact of agriculture on the environment and identifying measures to mitigate it.*

*We work with a wide range of international organisations (e.g. FAO, OECD, World Bank), peers and stakeholders in the EU. In this area, support is provided to the European Commission's Directorates-General for agriculture, environment, climate action, regional policy and cooperation with developing countries.*



## Support to the common agricultural policy (CAP)

The JRC provides scientific and technical support to the formulation and implementation of the Common Agricultural Policy (CAP), including the administration of direct aid and control methods.

Modelling platforms developed in-house, such as the integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP), are used to assess the economic and environmental impact of the CAP. These models provide projections for the Annual Agriculture Outlook; assess the consequences of International Free Trade agreements on the agriculture sector in terms of welfare, income, exports/imports; and analyse the effects of the CAP on farm-household incomes including investment behaviour and on structural change.

In order to assist in the implementation of payments to farmers, the JRC contributes by developing innovative satellite-based methodologies and tools to analyse farmers' declarations of crops and area. Further contributions include monitoring of the environmental impact of the greening of the CAP and supporting the implementation of the legislation concerning Areas with Natural Constraints.

In addition, our scientists also analyse the coherence of agricultural policies with other policy areas such as climate, energy and regional development. More specifically, our work provides economic impact analysis of agriculture's contribution to green growth, investigating alternative policy options to adapt to and/or mitigate climate change, to enhance energy recovery from agricultural residues and to estimate indirect land use changes due to new policies.

## Resource efficiency

### SOILS

Sustainable agriculture depends on the good condition and use made of soil. In cooperation with the UN Food and Agriculture Organisation (FAO), the JRC has set up the Global Soil Partnership, which provides policy makers with scientific evidence on soil quality and its likely impacts on food

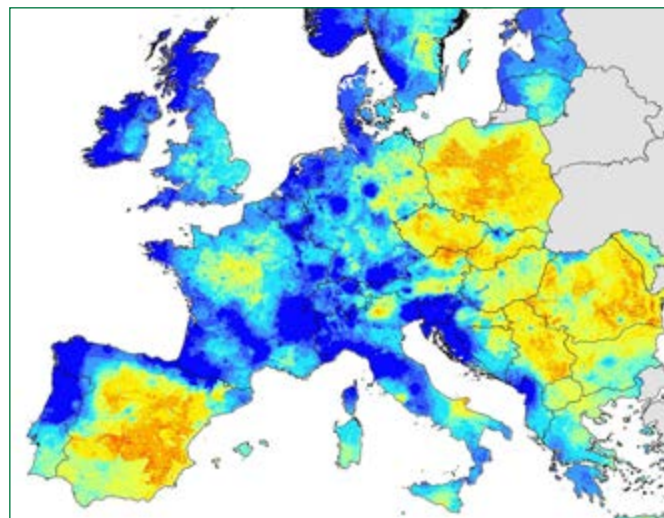
production. We are responsible for monitoring the quality of EU soils through the land cover/use statistical survey, carried out by the EU's statistical office EUROSTAT and the Commission's services for agriculture, environment and climate action.



*The JRC published the soil atlas of Europe in 2005.*

### WATER

Agriculture is the main water-consuming sector in Europe. JRC scientists have developed an integrated modelling framework in order to assess the impact of water demand from agriculture and energy sectors on water availability at European and regional levels, and it helps to identify adaptive and more efficient water management practices.



*Total annual freshwater generation.*



## Food security

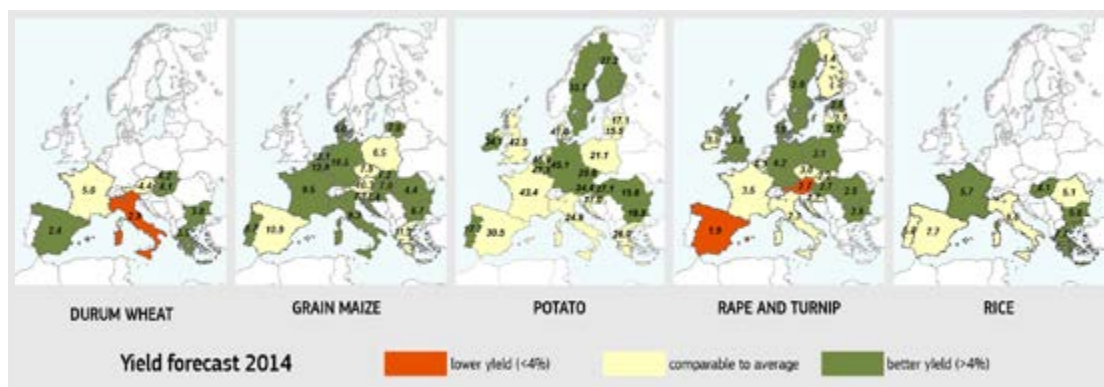
The JRC provides economic analyses of agricultural resources and farm systems, which include alternative scenarios for sustainable agriculture. In this context, our experts also examine the competitiveness of the European agro-food sector at global level.

We provide monthly crop monitoring and yield forecasting at European level by using the Crop Yield Forecasting System. This information supports the management of food supply carried out by the Commission's service for agriculture. It also forms part of the Commission's contribution to the G20 initiative of Agricultural Markets Information System (AMIS), established to develop global transparency of food supply and help avoid damaging price speculation in markets. Our

scientists are currently investigating the expansion of crop yield forecasting to the other main grain producing areas in the world.

The JRC helps assess the impact of EU food security policies and related trade negotiations through economic modelling. For instance, we have developed tools to understand the relationship between food consumption, farm incomes and food prices. In addition, we have studied the potential of agricultural production in the Black Sea cereal-producing region (Russia, Ukraine, etc.), since these regions may play a critical role in grain supply to the world markets.

JRC experts are also conducting a foresight study to analyse what the EU should do to meet the major food security challenges the world will face by 2030.



The JRC publishes a monthly Monitoring Agricultural Resources (MARS) bulletin. It provides crops and yields forecasts for the EU. The image above compares 2014 yield versus average yield 2009-2013. Figures are expressed in t/ha and rounded to 100 kg.



# CLIMATE ACTION

*Global warming is a challenge for humanity on an unprecedented scale. The EU has established itself as the world leader on combating and managing climate change. It is committed to achieving a transition to a low-carbon and climate-resilient economy, and is a key driving force in the negotiations held under the UN Framework Convention on Climate Change (UNFCCC) to secure a global agreement to curb greenhouse gas (GHG) emissions globally and keep warming to no more than 2°C.*

*The Directorate-General Joint Research Centre's (JRC) activities in support of climate action and the transition towards a low-carbon and climate-resilient economy in the EU span the entire policy cycle and spectrum – from mitigation to adaptation. Given its unique mandate and position, the Commission's in-house science service strives to develop integrated approaches to the climate challenge deriving synergies between adaptation and mitigation considerations, and between climate and other policies, for example air quality and climate.*

*The JRC provides scientific support on climate-related issues to the European Commission's Directorates-General for climate action, energy, environment, mobility, agriculture and development and cooperation. As climate is a cross-cutting issue, our capabilities in this field are pertinent to other Commission services, for instance when it comes to mainstreaming climate objectives into sectoral policies. We also work with a wide array of international partners under the auspices of United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC), or the Arctic Council.*



## Supporting the transition to a low-carbon and climate-resilient economy

The JRC supports climate policy by analysing policy scenarios and their potential impacts. It also monitors policy implementation on emission reductions. It addresses both mitigation - reducing GHG emissions - and adaptation - adapting to climate change - and helps to mainstream climate objectives into sectoral policies across the EU policy spectrum. In addition, our participation in numerous climate research projects serves to provide a broader evidence-base for climate policies.

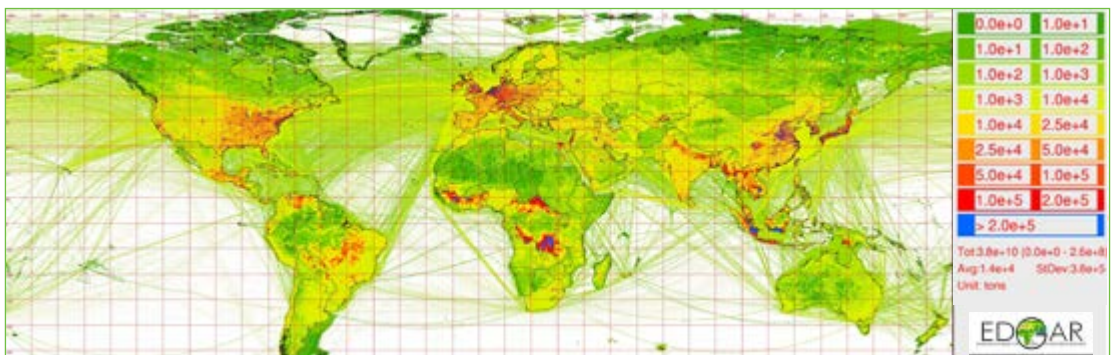
Our modelling studies feed into impact assessments to evaluate potential impacts of EU long-term climate policies such as the 2012 Commission Communication on Fluorinated Greenhouse Gases. They are also used to support the EU's position in international climate negotiations, such as those under the UN Framework Convention on Climate Change (UNFCCC). The analysis covers not only mitigation costs in energy-intensive sectors, but also - based on a multi-sectoral approach - the mitigation costs of the entire economy of the EU, of individual Member States, and of major global economies. A series of continuing studies also encompasses the analysis of climate change impacts and the adaptation options in different economic sectors, for example the PESETA study - "Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis". These have, in the past, contributed to the 2013 EU Strategy on Adapting to Climate Change. Finally, in the context of the EU's 2030 Policy

Framework for Climate and Energy proposed by the Commission in 2014, our researchers developed a new energy model which, in conjunction with existing models, could diminish reliance on external consultants for the assessment of climate policies.

The JRC supports the mainstreaming of climate change considerations (e.g. vulnerability, risks, adaptation) by considering climate impacts in the modelling exercises it carries out in support of sectoral policies.

## Monitoring emission reductions

We provide substantial support to Member States and the EU to help them achieve emission reduction goals. Technical support is provided to meet legal obligations concerning monitoring and reporting of GHG emissions in two sectors under the UNFCCC Kyoto Protocol: agriculture and Land Use, Land Use Change and Forestry (LULUCF). The JRC is responsible for quality assurance and control of procedures for reporting in both sectors and produces a consistent estimate for the EU's overall emissions in these two sectors. In addition, we provide technological expertise in support of sectoral policies in this area. For instance we analyse strategic energy technologies and emissions from road transport. Finally, our scientists also produce inventories and information tools on emissions and adaptation strategies and measures that are made available to the general public, such as Climate-ADAPT, the European Climate Adaptation Platform.



Global CO<sub>2</sub> emission for year 2010 from the Emissions Database for Global Atmospheric Research - EDGAR, managed by the JRC and the Netherlands Environmental Assessment Agency (PBL).

# CUSTOMS AND ANTI-FRAUD

*The customs union is an essential element in the functioning of the single market, which can only function properly when there is common application of common rules. These rules go beyond customs tariffs and extend to all aspects of trade policy, such as preferential trade, health and environmental controls, the common agricultural and fisheries policies, etc.*

*The Directorate-General Joint Research Centre (JRC) actively provides state-of-the-art, multidisciplinary scientific knowledge and innovative solutions for the conception, development and implementation of customs and anti-fraud policies.*

*This involves close working relationships with the European Commission's Directorate-General for taxation and customs union, the European Anti-Fraud Office, and with customs authorities worldwide.*



## Enforcement of customs policies

The EU has a coastline of over 90 000 km along 23 countries. Over 70% share of the EU's exports to the rest of the world and 40% of intra-EU trade exchanges are transported by sea. Despite this, only a small percentage of maritime containers are physically inspected by customs authorities, providing ample opportunity for illicit activities.

The JRC contributes to improving container security without the need for manual inspection or screening. Its Contraffic technology, helps customs authorities in targeting suspicious containers by analysing their itineraries, stopover times and transshipments. In addition, it carries out experimental activities on the performance of innovative structural materials in this sector. The so-called "smart shipping containers" allow the improvement of anti-tamper capacity to facilitate legitimate trade and provide controls to guarantee the safety and security of the shipments.

Customs play a crucial role to control and ensure that chemicals, food products, medicines, toys and textiles imported in the EU do not pose risks for consumers and the environment. Our work contributes to fraud prevention through detection and investigation techniques that can be applied to food origin and authenticity, prohibited goods (e.g. GMO), plant grains or animal species in danger of extension, and facilitating the rapid classification of new psychoactive substances by customs laboratories.

For instance, the recent horse meat scandal has highlighted the need for a coordinated approach towards food authenticity and food fraud. We have experience in the application of analytical tools to fight fraud, not only in the food and beverages domain, for example classification of meat according to heat treatment, content of milk fat or wine authentication, but also in other areas such as the discrimination of tobacco varieties. These tools are based on reference materials and methods developed by the JRC and that allow for the comparability and reliability of results across the EU.

It also contributes to customs authorities' capacity-building in order to improve their efficiency,

delivering for instance customs officers' training in analytical methods. As the facilitation of information and exchange between customs authorities is a priority at EU level, we also organised pilot programmes aimed at reinforcing knowledge transfer in the fields of illicit traffic of radiological and nuclear substances or the identification, export control of dual use goods.



*The JRC operates the European Reference Centre for Control in the Wine Sector aiming to fight major frauds in this area.*

## Antifraud policy

The fight against fraud to protect EU taxpayers' money is a strong priority for the Union. The aim of the antifraud policy is to protect the financial interests of the EU by combating fraud, corruption and any other illegal activities.

Increasingly, online commerce is threatened by the counterfeiting of goods. Following the adoption of the EU Customs Action Plan to combat intellectual property rights infringements, the JRC assists Commission services to conduct a feasibility study to develop a tailored search tool to anonymously survey/audit websites (enterprises or portals) dedicated to online sales in order to detect illegal activities comprising counterfeit goods.

We also assist the European Anti-Fraud Office on the possibilities to synchronise tools for the detection, tracking and classification of small non-commercial vessels used in illicit activities.

# DEVELOPMENT COOPERATION AND HUMANITARIAN AID

*The overarching objective of EU development policy is to eradicate world poverty in the context of sustainable development. To achieve this goal, it promotes human rights, democracy and good governance – through sustainable and transparent management of natural resources - and fosters inclusive and sustainable growth for human development. The EU humanitarian policy provides rapid help and relief to preserve life and alleviate the suffering of the victims of natural disasters and man-made crises.*

*The Directorate-General Joint Research Centre (JRC) has developed targeted methodologies and tools to better assess humanitarian needs and make aid more efficient and transparent. Our work provides essential information for short- and long-term planning of EU intervention in response to food security crises and supports the development of policy instruments to increase the resilience of the world's most vulnerable people. Climate change, biodiversity and ecosystem services, the sustainable management of natural resources and renewable energies are also a strong focus of our research in support of EU development policy.*

*The JRC cooperates with a wide array of international partners such as the United Nations, the African Union, the OECD and the World Bank, and provides assistance to the European Commission's Directorates-General for development and cooperation, humanitarian aid and civil protection and the European External Action Service (EEAS).*

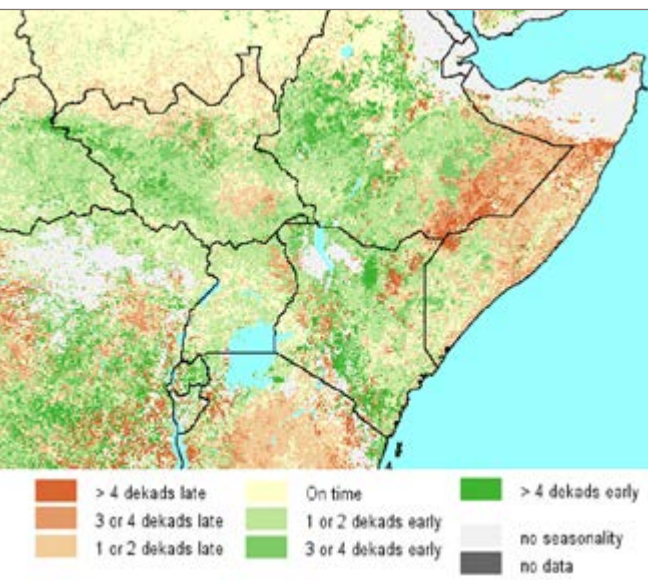


## Food security

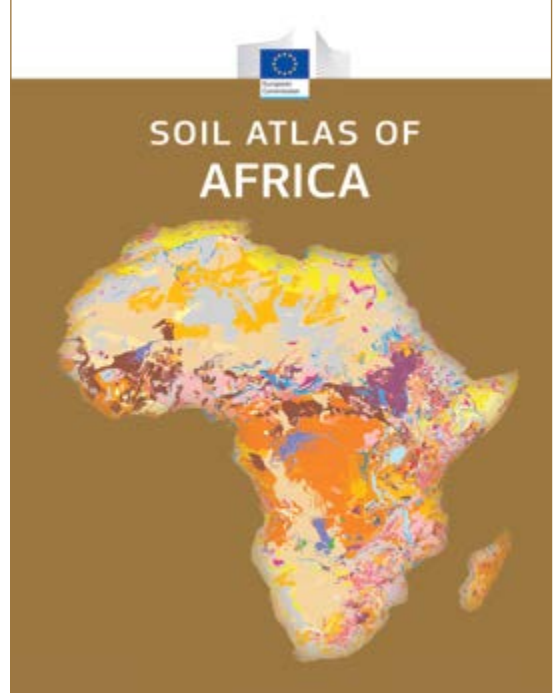
The JRC supports the implementation of the EU's food and nutrition security policy and helps the EU meet its commitments to international food security-related initiatives. Our work is conducted in close cooperation with the EEAS and relevant UN organisations.

Current activities of policy and economic analysis to support decision-making focus mainly on the improvement of information systems on agriculture, nutrition and food security; and scientific advice on a series of issues in Sub-Saharan Africa (GMOs, biotechnologies, intellectual property rights, changing demand drivers, etc.).

Our research covers, in particular, crop modelling and remote-sensing monitoring activities enabling timely forecasts, early warning on crop production and pasture availability, and livelihood and household vulnerability assessments. Support is also provided to minimise post-harvest losses in Africa and to develop and implement tools that help analyse and classify the severity of food security situations according to scientific international standards.



*The JRC, in cooperation with the UN Food and Agriculture Organisation (FAO) produces reports on meteorological conditions affecting agriculture in the Horn of Africa.*



*The Soil Atlas of Africa is a unique reference produced by the JRC in collaboration with the African Union, the FAO, the African Soil Science Society and soil scientists from Africa and Europe.*

## Climate change, water, environment and natural resources

Climate change, water, environment and the sustainable management of natural resources need to be integrated into all development activities, according to the new global public goods and challenges thematic programme (2014-2020) and the policy coherence for development approach. We actively support this integration through projects and programmes on climate change, biodiversity and ecosystem services, agriculture, soil, land, forestry and water management.

The scope of this work is global, with major focus on Africa. Research networks and institutional partnerships developed by the JRC over the last 20 years (e.g. with the African Union, OECD, United Nations, World Bank) are the pillar of these activities. The Soil Atlas of Africa and the Soil Atlas of Latin America – produced in collaboration with leading soil scientists in the concerned regions – are a good example of our role in bridge-building international efforts. Cooperation frameworks include dissemination of information, capacity-building and scientific advice to national and regional authorities.

The JRC has installed and continues to develop monitoring systems using earth-observing and

communication satellites that maintain an intelligent watch on the conditions of resources and the environment in 47 Sub-Saharan African countries. It also develops management systems for protected areas in support of biodiversity-related decision-making and fund allocation processes across the African, Caribbean and Pacific group of states as well as in Latin America. Further support is provided by mainstreaming climate change adaptation into sectoral policies of developing countries through research on the extent, vulnerability and risk from weather-driven disasters.

### Renewable energy

We support the UN “Sustainable energy for all initiative, in particular through the assessment of national and regional renewable options in Africa. The analysis includes comparison of policy measures with respect to resources and technology, and evaluation of non-technical barriers to the rapid deployment of renewable energy technologies. The overall aim is to speed up access to energy services in Africa.

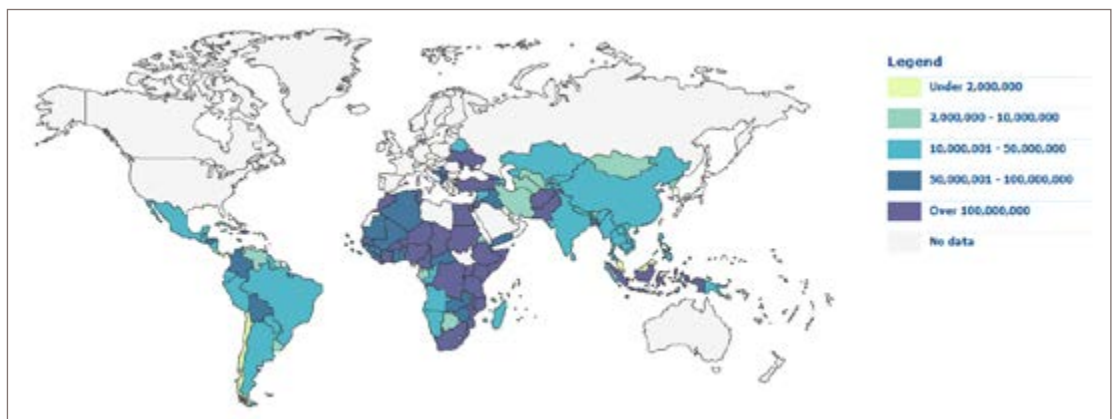
Under the European Neighbourhood & Partnership Instrument and the Southern Mediterranean project on cleaner, energy-saving Mediterranean cities, our service supports the extension of the Covenant of Mayors initiative to partner countries to develop the capacities of local authorities in formulating and implementing sustainable local energy policies.

### Aid effectiveness

To help the EU meet its commitments on aid effectiveness, in close cooperation with the Commission services for development and cooperation and humanitarian aid and civil protection, we have developed the EU Aid Explorer to facilitate the sharing of data on aid funding and support coordination among EU donors. By providing access to clear, complete and accurate data on development and humanitarian aid around the world, it also improves transparency and accountability to European citizens. Our experts are currently improving this tool by developing the visualisation, mapping and analysis of projects at the level of their local geographic implementation, which will improve programme planning and impact monitoring.

### Needs-based approach to humanitarian aid

The JRC has helped develop the Global Vulnerability and Crisis Assessment (GVCA) methodology, which supports humanitarian needs assessment decision-making process in the Commission, and the fund allocation per country or region. A new tool for global humanitarian risk analysis – InfoRM – is currently being developed in collaboration with other humanitarian donors and UN agencies. Once released, InfoRM will support the decision-making of donor programmes focused on mitigation, anticipation and preparedness for humanitarian emergencies.



The EU Aid Explorer provides easy access to clear, complete and accurate data on development and humanitarian aid around the world. This map shows the contributions of EU Institutions for 2012 (USD).

# DIGITAL AGENDA

*The Digital Agenda for Europe aims to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies.*

*Bringing together socio-economic and scientific research, the Directorate-General Joint Research Centre (JRC) supports the Digital Agenda through its work on cybersecurity, digital identity and privacy, the digital economy, information and communication technologies (ICT) industrial analysis and Digital Earth applications. The JRC also provides analyses for strategy development, including foresight and horizon scanning, and develops qualitative and quantitative scientific tools and databases relevant to all aspects of the digital society and economy.*

*This involves close cooperation with the European Commission's services for research and innovation, regional policy and communications networks, content and technology.*





## Cyber-security

Our activities in the area of cyber-security include security-related standards, identification and classification of cyber-incidents, critical infrastructure protection against cyber-attacks, planning and executing cyber-security exercises and providing an infrastructure for cyber-security research and training. By developing state-of-the-art technologies and tools such as a privacy and data protection toolbox, measures to verify source ID documents against data theft, ICT tools to support criminal investigations, and EU-CERT (Computer emergency response team) monitoring tools, our experts ensure that advances in technology are accompanied by an appropriate level of security.

We collaborate with a number of external bodies, including the European Network and Information Security Agency (ENISA), European law enforcement bodies including Europol, the European cybercrime centre, and the European network of law enforcement technical services group, as well as with Member State law enforcement bodies.

Our service also coordinates the European reference network for critical infrastructure protection which allows for the exchange of information on threats against critical infrastructures and their vulnerabilities during times of cyber-attack. It also develops harmonised test methodologies and proposes quality assurance methods and standards.

## Privacy and data protection

The JRC supports the implementation of the EU data protection reform through its analysis of Europe-wide privacy certification schemes/privacy seals applicable to processes, technologies, products and services and the design of cost effective tools and mechanisms to support cooperation between data protection authorities. It also evaluates best available methods for privacy-by-design and privacy impact assessment and provides technical support to EU-US discussions on data protection and privacy.



*Users of social networking services.*

In addition, it provides support to the enhancement of trust and security in the digital single market through its work on digital identity, online anonymity in the cloud, trust enforcement mechanisms in digital interactions, smart-device privacy and information disclosure, online identity and behaviour of smart-devices, digital privacy and the security of smart homes, ethical aspects of digital life, empowering citizen's rights in a digital world, and digital awareness and education.

## Digital living

In the area of active and healthy ageing, we are contributing to an analytical framework to monitor the innovation potential of Member States in this area by analysing the role of ICT in facilitating a sustainable integration of health and social care.



The INSPIRE geoportal (<http://inspire-geoportal.ec.europa.eu/>) provides the means to search for and view spatial data sets from the EU Member States.

The JRC contributes to the enhancement of interoperability of e-infrastructures (in support of the digital European Research Area) for large-scale scientific collaboration and to open access to public sector information, scientific information and services in support of digital science. It assures the technical coordination of the INSPIRE (Infrastructure for Spatial Information in the European Community) Directive in support of interoperability solutions for European public administrations.

### Information & Communication Technologies (ICT)

We are investigating the economic impact of ICT production and use in the areas of cross-border e-commerce, copyright in digital media and ICT impacts on jobs and growth. Our researchers also collect evidence on policies and measures towards enhancing ICT innovation in Europe, with particular attention to the commercialisation phase of the innovation process.

The JRC also researches the conditions for the development of digital competences and innovative and creative learning, as well as the influence of information and communication technologies for employment and employability, cultural diversity and socio-economic inclusion.

Through our smart specialisation platform, together with the Commission's communications networks, content and technology service we have developed the Digital Agenda toolbox, which provides recommendations on how to develop a regional ICT innovation strategy, and contains examples of more than 20 areas of investments or possible parts of an ICT strategy as an enabler of regional growth. The smart specialisation platform has incorporated digital agenda components in a large number of workshops and events, allowing regions and Member States to meet with experts who can review their work on developing digital growth strategies and provide suggestions for improvements.



# ECONOMIC GOVERNANCE

*The challenge of improving economic governance in the Member States during the financial and economic crises has led to the adoption of a new set of rules for the surveillance of national economic and fiscal policies. Greater economic policy coordination is addressed by tackling medium-term budgetary objectives, debt development and budgetary deficits, as well as macroeconomic and competitiveness imbalances. Monitoring and corrective procedures are implemented through the Europe 2020 Strategy, the Euro Plus Pact and the Pact for Stability and Growth.*

*The Directorate-General Joint Research Centre (JRC) participates in these efforts with a contribution to the development of the macroeconomic model QUEST, which allows for the monitoring of public deficits, reform programmes and public finances, as well as with the maintenance of the GAP platform used to monitor the fiscal policies of Member States. It carries out modelling work for the estimation of the fiscal impact of tax reforms and cooperates with the European Systemic Risk Board in developing methodologies for macro-prudential oversight.*

*The JRC works closely with the European Commission's Directorate-General for economic affairs, as well as with the European Systemic Risk Board (ESRB) and its advisory technical committee.*



## Monitoring of economic developments and Member States' fiscal policies

The JRC has supported the Commission's economic affairs service in the development of a macroeconomic model (QUEST) which provides integrated surveillance of the economic stance of EU Member States, including national fiscal policy, budget imbalances, reform programmes and overall sustainability of public finances. QUEST is based on a number of parameters, such as debt, inflation or GDP, and its different model versions can be applied to specific sectors, Member States or groups thereof. Examples of our analyses include the evaluation of the drivers of current account surpluses in Germany, as well as of the drivers of deficits in Spain and Portugal. We provide econometric, computational and methodological expertise in estimation and calibration of QUEST, and maintain dedicated IT resources.

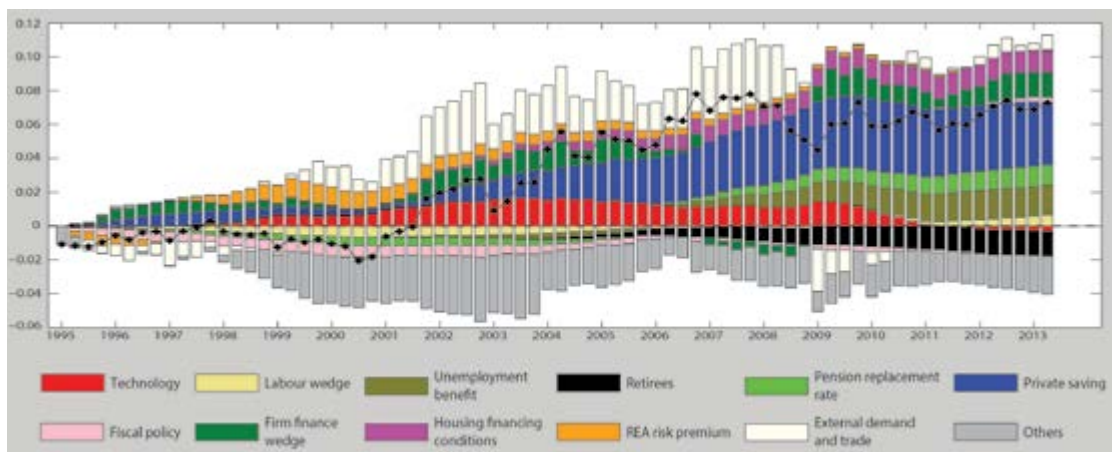
For monitoring the Member States' fiscal policies, we have developed the GAP platform, which allows a comparison of the real fiscal position of a Member State economy against the theoretically optimal situation of a sustainable GDP equilibrium. The output gap is calculated for every EU country as required by the Stability and Growth Pact. This indicator helps identify potential structural weaknesses or other problems of national economies and at the same time allows for fixing their root cause.

## Estimating the impact of tax reforms

The JRC carries out modelling work for the estimation of the fiscal impact of Member States' tax reforms in several thematic areas. Some examples include the fiscal cost of tax expenditure, labour taxation policy reforms, housing taxation reforms, as well as the cost of shifting strategies between labour and housing taxes. This analysis provides a toolbox for designing country-specific policy recommendations as well as for assessing the stability and convergence programmes of the EU Member States.

## Monitoring systemic risk in the EU

Our service collaborates with the European Systemic Risk Board (ESRB), which is responsible for the macro-prudential oversight of the financial system in the EU. We support the development of the ESRB Risk Dashboard, both as an analytical and communication tool. Our methodologies – recently approved by the ESRB advisory technical committee – will be incorporated in the ESRB general risk analysis and also used for internal purposes, such as briefings for the ESRB General Board meetings or, discussions with Member States.



Example of QUEST analysis on the historical decomposition for the current account of Germany. QUEST is one of the analytic instruments for monitoring the EU 2020 objectives and the impact of the flagships initiatives e.g., integrated surveillance of member countries economic stance, budget imbalances, reform programmes, and overall sustainability of public finances.

# EDUCATION AND CULTURE

*Education and training programmes are in the hands of the EU Member States. EU policy in this field supports national actions and addresses common challenges, such as ageing societies, skills mismatch and global competition. These challenges are addressed in the EU 2020 agenda.*

*The Directorate-General Joint Research Centre (JRC) provides expertise on indicator-based evaluations and monitoring of education systems to contribute towards meeting education objectives. We research upcoming developments in information and communication technologies (ICT), ensuring the EU is prepared to equip its workforce with the necessary skills to remain productive and competitive in open education and life-long learning.*

*The JRC supports the work of the European Commission's service for education and culture in this area.*





More than 10 000 people visited the JRC during the latest Open Day.

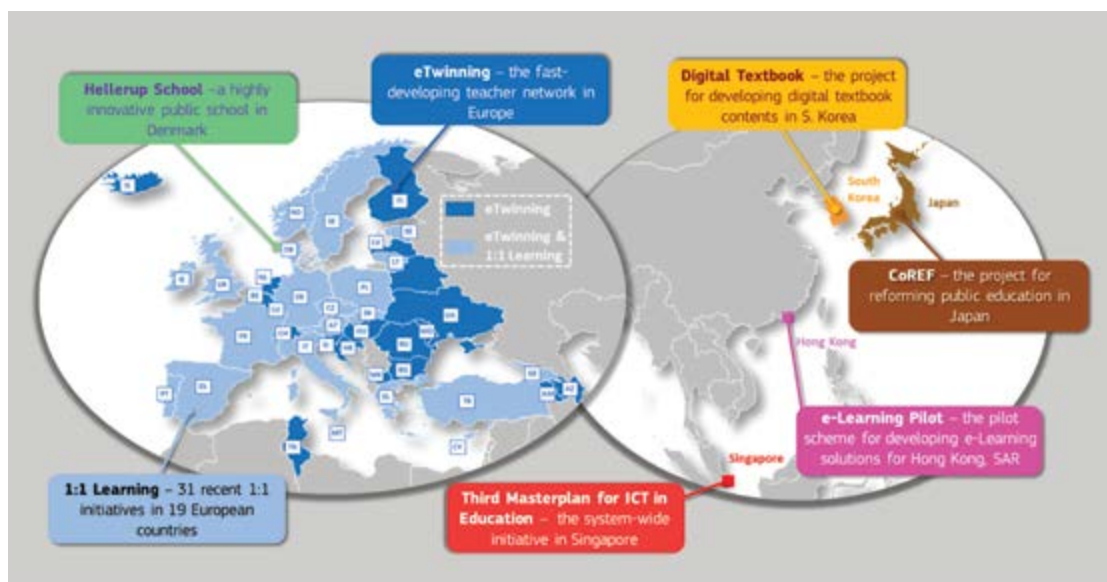
### Centre for Research on Education and Lifelong Learning (CRELL)

The Centre for Research on Lifelong Learning (CRELL), established by the JRC in 2005, provides

expertise in the field of indicator-based evaluation and monitoring of education and training systems. It has a pivotal role in strengthening the evidence base for EU policy coordination in the field of education and training in the context of the Europe 2020 strategy and the European Semester. CRELL combines expertise in the fields of economics, econometrics, education, social sciences and statistics in an interdisciplinary approach to research.

### The use and impact of ICT in education and training

In the context of meeting the aims and objectives of the agenda for new skills and jobs, the JRC has provided support to various Commission initiatives on open education and life-long learning. This research focuses on analysing resources used in the open education field and on implementing and scaling up practices in this area. It also supports the identification and assessment of newly emerging certification and recognition mechanisms. The focus of the research is to understand where and how ICT-based innovation emerges in education and training and how to maximise its benefits.



The JRC has examined seven projects on ICT-enabled learning innovation in school settings.

# EMPLOYMENT, SOCIAL AFFAIRS AND INCLUSION

*The EU and its Member States work closely together in the fields of employment, social affairs and inclusion. The Commission coordinates and monitors national policies, promotes the sharing of best practices, makes proposals and monitors their implementation in areas such as rights at work and coordination of social security schemes.*

*The Directorate-General Joint Research Centre (JRC) supports the European Commission's service for employment, social affairs and inclusion in a limited number of important fields, such as the Social Investment Package, the evaluation of the European Social Fund and exposure to chemicals in the workplace. It also uses modelling to analyse the impact of tax reforms and how they affect society.*

*Research and support activities are carried out in close cooperation with the Commission Directorates-General for education and culture, taxation and customs union and economic and financial affairs.*





In 2013 together with the Commission's service for employment, social affairs and inclusion, the JRC established the Centre for Research on Impact Evaluation which supports Member States in preparing and carrying out impact evaluations in the programming period 2014-2020. It supports the Commission in preparing, carrying out and promoting impact evaluations; and promotes targeted dissemination activities including seminars, conferences, networks and exchanges of experience on the use of impact evaluation methods.

### **Support to the implementation of the Social Investment Package**

In the context of the European employment strategy, the JRC supports the Commission and Member States in the implementation of the Social Investment Package. The Package gives guidance to Member States on adopting more efficient and effective social policies. Our input addresses information and communication technologies (ICT)-based social innovation and how it can support social investment, in particular, long-term care strategies promoting youth inclusion and independent living of elderly people. For example, it provides a deeper understanding of how Member States can make better use of ICT-enabled innovation to implement the actions suggested in the Social Investment Package. We have also prepared manuals for policy-makers on long-term care strategies to increase independent living of elderly people with the use of technology.

### **Centre for Research on Impact Evaluation**

The Commission encourages Member States to conduct more impact evaluations identifying the net effects of European Social Fund support in current and future programming periods. Counterfactual impact evaluation allows for an assessment of such net effects through a comparison of the outcome with and without EU funded-intervention.

### **ICT skills for employment and inclusion**

The JRC has finalised the first step of a research project on ICT and employability. The preliminary findings show how ICT is crucial for employability of individuals, thus proving the importance of digital inclusion and skills policies. It has also identified a set of unexploited policy opportunities, such as the use of ICT by labour market intermediaries and employers.



### **Analysing the impact of tax reforms on different strands of the population**

We use EUROMOD, a multi-country tax-benefit model for the European Union, to calculate and analyse labour tax reforms, housing and equity issues, as well as the application of the model to indirect taxation and the equity impact of tax reforms on different strands of the population, such as the elderly, children or unemployed.



# ENERGY

*The EU Energy Roadmap 2050 aims at ensuring security of energy supply and competitiveness in an environmentally sustainable, cost-efficient, effective, safe and socially acceptable way, which enables diversified technology approaches, taking into account the national energy-mix, preferences, potential and characteristics of each Member State. Policy challenges include the completion of a fully functioning and interconnected internal energy market, facilitation of the required investment in energy, diversification of Europe's supplies and enhanced energy efficiency. It also calls for increased efforts to reduce Europe's high energy dependency and supports the immediate implementation of a set of most urgent measures to strengthen Europe's resilience and increase its energy security also in the short term.*

*The Directorate-General Joint Research Centre (JRC) provides scientific support to the EU's energy policies in a vast array of areas, such as energy efficiency, renewables, integration into electricity grids, fossil fuels, energy technologies (Strategic Energy Technology Plan), nuclear safety and nuclear security.*

*We work with international partners and support EU energy policy-making across a broad range of related policies including work for the European Commission's Directorates-General for energy, climate action, research and innovation, mobility, environment, enterprise and industry, development and cooperation, humanitarian aid and civil protection, and the European External Action Service (EEAS).*



## Energy security

The JRC develops and implements techno-economic models to identify potential crises and flaws affecting gas infrastructure and supply (markets). It provides Member States with guidance on the security of gas supply and on reviewing gas systems' risk assessments. This includes international gas trade via liquefied natural gas, and the new gas transport infrastructure through Turkey to the Middle East and the Caucasus.

Our scientists also analyse the impact of the potential exploitation of shale gas in the EU on energy markets and trade, in addition to work on environmental aspects such as land- and water use and waste. We will manage the scientific secretariat of the European Science and Technology Network on Unconventional Hydrocarbon Extraction. We are currently elaborating Best Available Techniques for the treatment of waste from unconventional fuels/shale gas exploration/production through the Mining Waste BREF (reference document for the best available techniques) review under the Mining Waste Directive.

Furthermore, we perform research on offshore gas and oil resources, focusing on the safety of deep water explorations and exploitations.

## Renewable energies

The JRC analyses and compares national and regional policy measures on resources and technology, and evaluates non-technical barriers to renewable energies deployment in Europe and Africa, in support of the United Nations' "Sustainable energy for all" initiative.

The European Solar Test Installation (ESTI) is a world-wide reference for the assessment of the performance of new and improved photovoltaic devices, according to international standards.

On bioenergy and biofuels, the JRC addresses complex policy questions related to sustainability, greenhouse gas emissions savings and land-use change. Our regular biofuels life-cycle analyses,

done in collaboration with industry, have become the European scientific reference in this field.



*JRC's European Solar Test Installation (ESTI).*

## Energy storage and electricity grids

Hydrogen and fuel cells can facilitate the storage and uptake of renewable intermittent energies. The JRC acts as a reference body for the fuel cells and hydrogen Joint Undertaking, an industry-led public-private partnership, which brings together organisations from the EU, the US and Japan and feeds into European and international standardisation and regulatory bodies. We have also developed analytical and modelling tools for market and techno-economic evaluation of energy storage.

In addition, we contribute to the roll-out of smart grids through work on the safety (stability) and security of smart grids, as well as international standardisation. Together with the US Department of Energy (DoE) we are establishing electric vehicle smart grid interoperability centres at the Argonne National Laboratory (inaugurated in July 2013) and at the JRC premises in Italy.



Emission test facility for light duty vehicles (passenger cars and light commercial vehicles). Energy efficiency test on a hydrogen fuel cell vehicle.

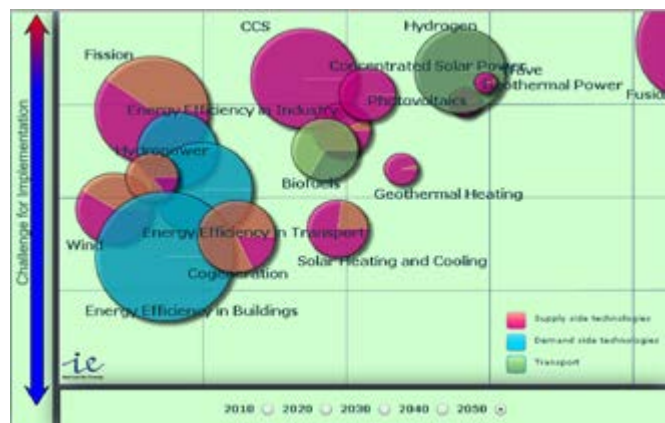
### Assessing the role of energy technologies

Our service manages SETIS, the Strategic Energy Technologies (SET Plan) Information System. It regularly produces European and worldwide analyses of low carbon technologies identified as key for the future EU energy mix in the Strategic Energy Technology (SET) Plan. We also have the scientific lead in the development of the SET Plan Integrated Roadmap which will consolidate the (updated) technology roadmaps of the SET Plan and thus provide a basis for Member States and the Commission to develop an action plan for coordinated and/or joint investments. The scientists also do techno-economic assessments to support emerging technologies such as marine – wave and tidal – offshore wind and geothermal energy.

The JRC supports energy and climate longer-term strategies with an array of modelling tools. A new modelling instrument for an EU-specific energy market scenario analysis between 2020 and 2050 is being developed. This will be adapted by simulating the Energy Reference scenarios, a key exercise projecting future developments of energy systems, transport and greenhouse gas emissions and used as a basis for the longer-term policies in the fields of energy, climate and environment.

In the context of its knowledge centre on energy efficiency, the JRC assesses technology deployment and market uptake, develops energy-consumption calculation methodologies and defines criteria to assess policy measures. The overall aim is to contribute to the implementation of energy efficient technologies.

Since early 2013, we have been carrying out the ‘sustainable product policy’ pilot project, in which we contribute to the standardisation of products under the frame of the eco-design and energy labelling Directives.



The JRC's bubble graph illustrates the maturity, energy potential and challenge for implementation of different energy technologies in different periods of time.

# ENTERPRISE AND INDUSTRY

*The headline target of EU industrial policy is for industry's share in Europe's GDP to be 20% by 2020. In March 2014, European Council conclusions on Industrial Competitiveness and Policy confirmed that industry is a key driver for growth and jobs and set out the current policy priorities. These include mainstreaming industry; fully exploiting the internal market, notably for SMEs; full use of EU (funding) instruments, including smart specialisation; international trade; modernising state aid rules; skills; IPR and patenting; and Key Enabling Technologies. The Commission is expected to report on progress on these priorities as part of the Europe 2020 Strategy review in March 2015.*

*The Directorate-General Joint Research Centre (JRC) support to this policy area is characterised by the wide range of topics addressed, covering almost all of the European Commission's enterprise and industry-related activities. Key areas of collaboration include clean transport; construction; chemicals, including REACH legislation; sustainable product policy; advanced manufacturing and Key Enabling Technologies; nanomaterials; standardisation; space policy, including Copernicus and Galileo; and raw materials. Analyses of the implementation and interaction of EU legislation and how they collectively support re-industrialisation and competitiveness are also done as part of the Commission's Regulatory Fitness and Performance Programme (REFIT).*

*There is therefore very close cooperation with several Commission services dealing with enterprise and industry, energy, home affairs, transport, regional policy and research and innovation.*



## Industry performance analysis and monitoring

Outputs include the EU industrial R&D investment scoreboard analysing top EU based research and development investing companies. Other analyses provide a quantitative assessment of EU industry performance, contributing to the Commission's annual European competitiveness reports, as well as work on intangible assets (i.e. non-financial, non-physical), design and innovation plus monitoring business and industrial innovation trends for the Business Innovation Observatory.

The JRC's Research and Innovation Observatory (RIO) provides timely data and analysis to monitor research and innovation policies in EU Member States, whilst the EU Bioeconomy Observatory assesses the progress and impact in this area and develops forward-looking and modelling tools.

The European Forum for Science and Industry enhances regular and structured dialogue and cooperation, for example via roundtables and joint projects, on the science and innovation needs of industry.

## Standardisation

To accelerate EU growth, industry needs framework conditions that provide them with the basis upon which to invest, to innovate and to gain global market share in an increasingly competitive world. Standards are a cornerstone of these conditions and will be an integral part of Horizon 2020. The JRC contributes substantially to supporting the standardisation system. This ranges from pre-normative research, harmonised methods and the development of reference measurements and methodologies. A measurements and standards helpdesk exists to support the Commission's services and there is Commission participation in the various working groups of European and international standardisation bodies. Additionally, certified reference materials demanded by EU legislation are provided, as well as metrological support.

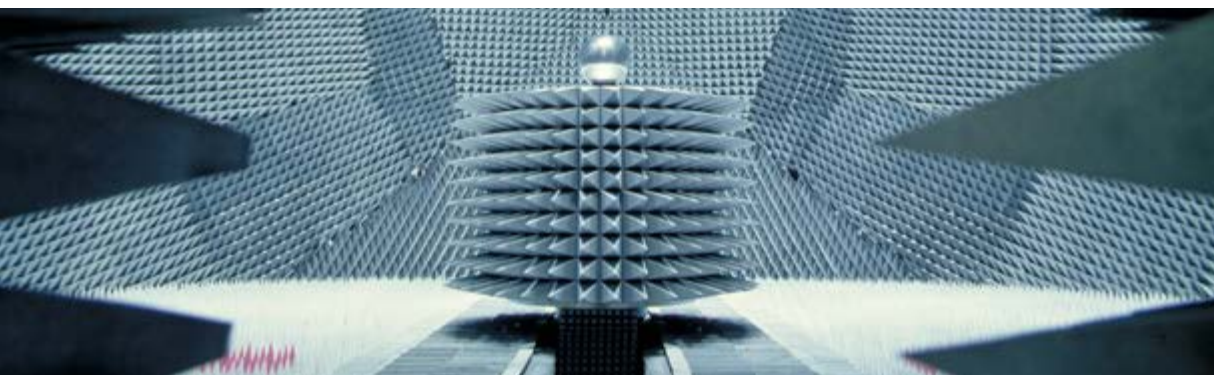
We also provide harmonised methodologies for the characterisation of (nano)materials and

products (e.g. textiles, toys) and contribute to EU standardisation in bio- and nanotechnologies. We have developed the first industrial-based measurement standards which are of relevance to EU legislation defining a 'nanomaterial' and for provisions in REACH legislation (the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals).

The JRC brings together users and suppliers of security systems and solutions to define in-practice standards and test protocols, most recently for aviation security screening products. We also support the Construction 2020 action plan, which aims at promoting climate, environmental and energy-related objectives. Our experts also lead the implementation and further development of the Eurocodes (European standards for structural design in construction). Reference tests on full-scale specimens of buildings and civil infrastructure are done at the JRC's European Laboratory for Structural Assessment (ELSA).



*Setup of a large-scale structural test at the ELSA Laboratory: positioning and mounting of servo-hydraulic loading actuators.*



*The European Microwave Signature Laboratory (EMSL) is a multi-purpose facility that can be used to carry out reference measurements of wireless communications systems, GNSS navigation and timing receivers, and active/passive microwave sensors (i.e., radar).*

## Space policy

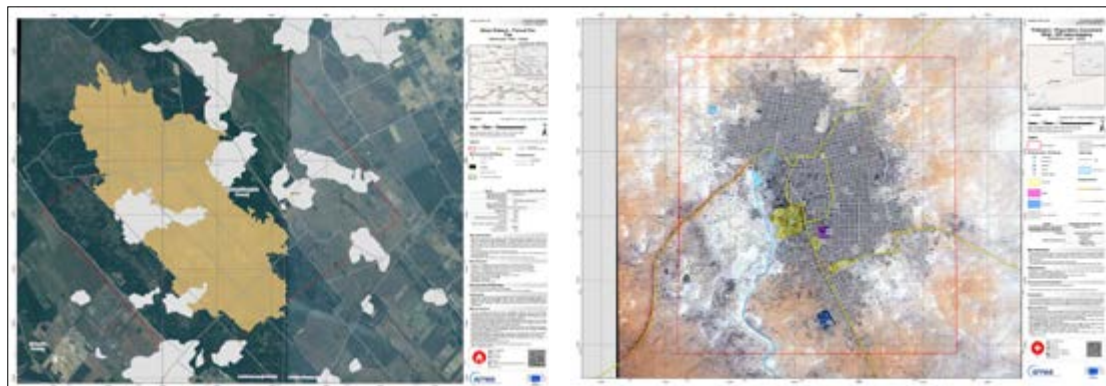
We actively support space policy, covering (international) dialogues, bilateral agreements, as well as Copernicus and Galileo. We have many collaborative links with other relevant European and US entities. A European energy source for space exploration satellites is also being investigated.

The JRC has been instrumental in the development of Copernicus Earth Observation Programme and has competences in all of the existing and planned Copernicus services, such as land, marine, atmosphere, climate change, emergency management and security, plus some aspects of the ground and space components.

Our service played a key role in establishing the

Emergency Management Service (EMS). Under the new Copernicus Regulation, we will develop and monitor technical performance and in particular increased use of data, products and services. Work will also address the global added-value of Copernicus products and services.

The JRC is closely engaged in the Galileo Global Navigation Satellite System (GNSS), notably in the area of signals, frequencies and security. It operates the GNSS Security Laboratory, for the use of industry and research organisations, and co-organises summer schools, together with the European Space Agency. With the responsibility of managing the Commission's IPR (intellectual property rights) portfolio, we are also involved in negotiations on the Galileo trademark and contribute to the Galileo intellectual property rights strategy.



*The JRC is the technical coordinator of the Copernicus Emergency Management Service. A delineation map on the left produced by the JRC in May 2012, showed a forest fire in Bacs-Kiskun, Hungary. On the right, a reference map of the population movement in Timbuktu, Mali, March 2012.*

## Clean transport

The Vehicle Emissions Laboratory (VELA) assesses emissions and the environmental impacts of vehicles using standard test protocols. The JRC supports development and implementation of global technical regulations (via United Nations Economic Commission for Europe, UNECE) plus European legislation in vehicles' and engines' environmental performance and energy efficiency. It also develops on-road, real-world measurement methodologies.

Other work covers electrification of transport (e mobility). We host one of two EU-US electric vehicle and smart grid interoperability centres, supporting UNECE regulatory efforts on the safety of electric vehicles and components. A comprehensive modelling approach looking at all relevant aspects complements these activities.



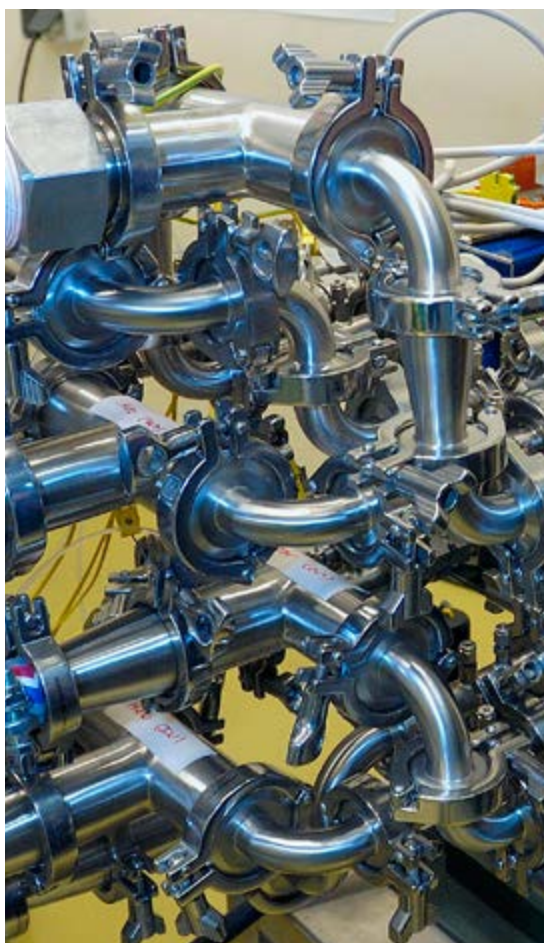
*The JRC's Vehicle Emissions Laboratory (VELA).*

## Key Enabling Technologies (KETs)

The JRC supports the deployment of KETs in the EU's regions via smart specialisation. It participates in policy relevant activities and organises events to promote collaborations amongst relevant stakeholders (e.g. regions, industry). It is also involved in the Commission's KETs Observatory, which serves to monitor KETs deployment via business indicators, such as number of patents issued.

## Raw materials

We support the European Innovation Partnership on raw materials via international dialogues and diplomacy, by developing a sustainable supply, improving the EU's knowledge base, promoting resource efficiency and recycling, plus monitoring the implementation of legislation relating to waste shipment. Our scientists also participate in various working groups and international dialogues on this matter.

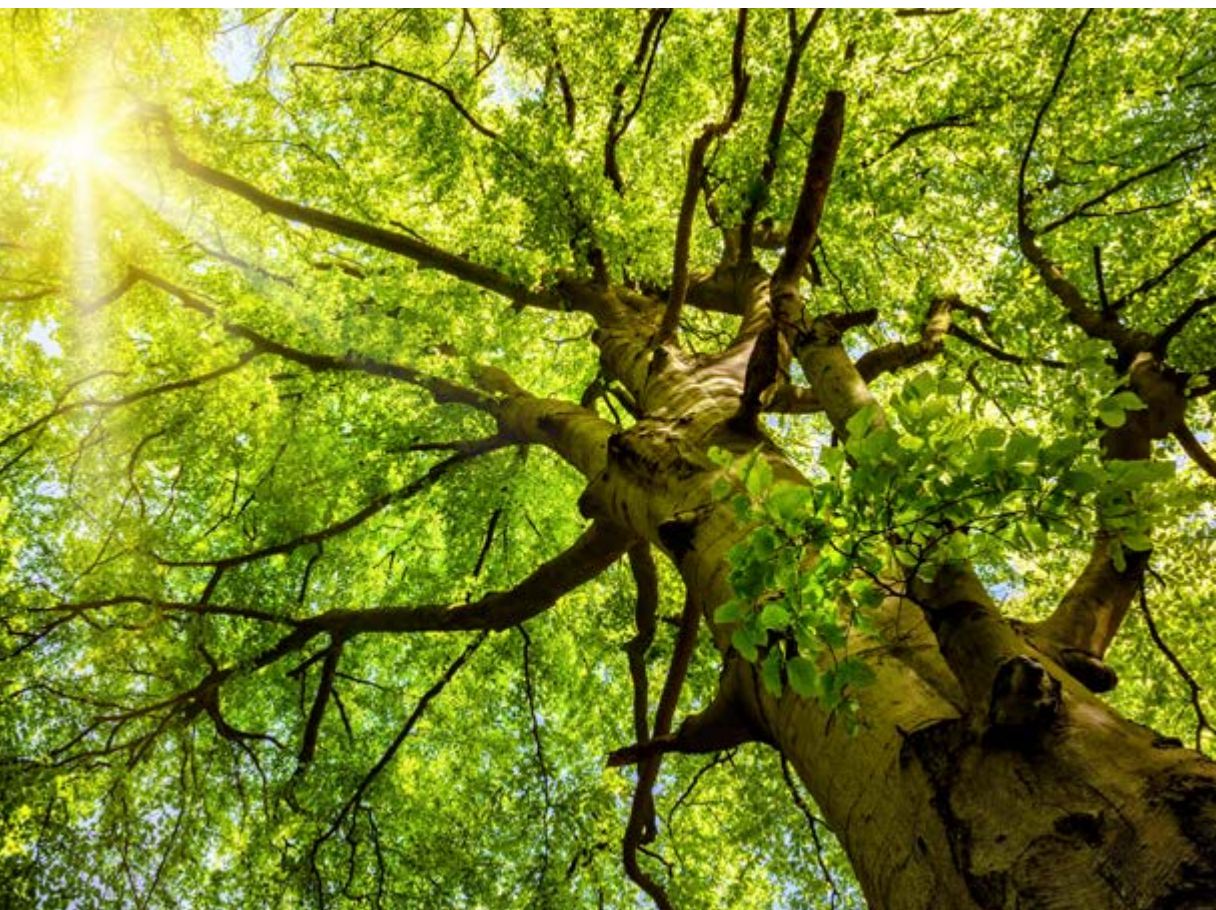


# ENVIRONMENT

*The EU has some of the world's highest environmental standards. Environment policy helps protect Europe's natural capital, encourages business in 'greening' the EU economy, and contributes to safeguarding the health and wellbeing of people living in the EU.*

*The Directorate-General Joint Research Centre (JRC), with its breadth of expertise in environmental science, devotes a substantial part of its activities to supporting environmental policy-making. It helps to achieve the goals of the 7th Environmental Action Plan through its contributions to the enabling framework, in particular improving the knowledge and evidence base for the Union's environment policy and the implementation of EU policies. Our service provides data, assessments and information/early warning systems and develops appropriate indicators.*

*The JRC can draw on a large network of peers and close cooperation with the European Commission's policy Directorates-General, notably those for environment, statistics, climate action, energy, enterprise and industry, health and consumers, agriculture, development and cooperation, research and innovation, as well as the European Environment Agency.*





## Preservation of natural capital

Regarding land and soil, the JRC's work focuses on improving information at the EU and global level on the state of resources (soil characteristics and quality), quantifying changes (in land use) and predicting impacts (on soil quality and erosion). We maintain the European soil data centre and coordinate Europe's contribution to the global soil partnership of the Food and Agriculture Organisation (FAO). In collaboration with key international partners, we have produced the first Soil Atlases of Africa (2013) and of Latin America (2014). Our experts are developing indicators to quantify land availability for food production or other uses.

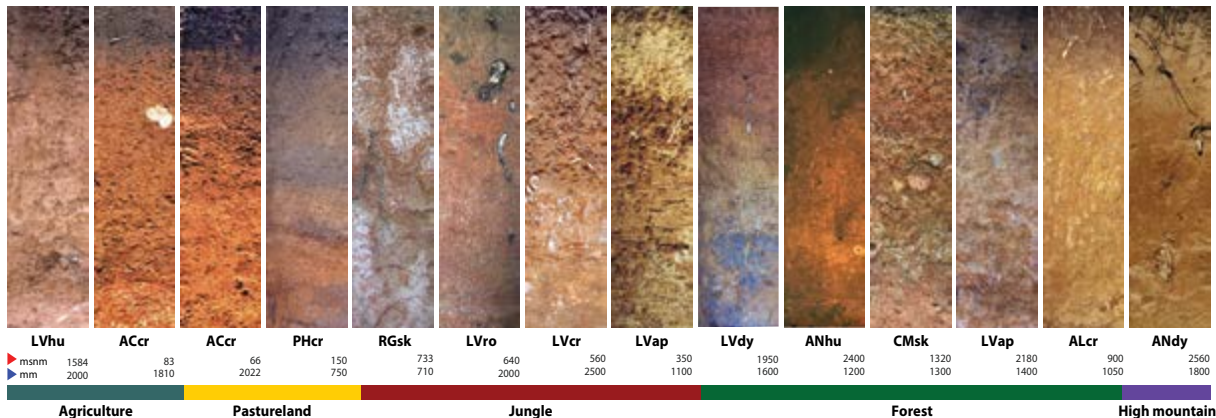


Students being instructed on soil description and sampling techniques.

The JRC also supports EU policy analysis through models and indicators. It has set up the Land Use-based Integrated Sustainability Assessment (LUIISA) modelling platform to assess the environmental and economic impacts of EU policies. It develops indicators on soil quality and erosion to support the integration of environmental aspects in the Common Agricultural Policy and the Resource Efficiency Roadmap. It is also undertaking an assessment of organic carbon in soils.

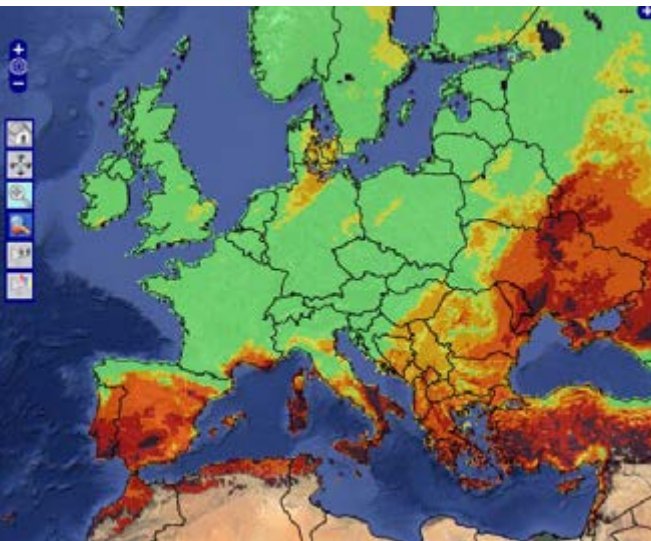
Following the support to the adoption of the Water Framework Directive and the Blueprint for water, our service now supports their implementation with monitoring and modelling activities. Efforts are made to strengthen inter-disciplinary approaches to assess water, food, energy, and ecosystem aspects at a regional scale (e.g. Danube, Mediterranean) and to model cross-border cooperation in water management.

In the European Drought Observatory, we compile drought indicators for the entire European continent thus allowing the mapping and tracing of the evolution of ongoing droughts. A forecasting ability for droughts is the subject of ongoing research, while it is already operational for floods (EFAS – the European Flood Alert System). Our scientists also collaborate with the European Innovation Partnership on water to propose solutions for water conservation.



Series of profiles showing the soil characteristics according to the main pedogenic factors, i.e. landscape relief climate (Soil Atlas of Latin America and the Caribbean).

The JRC is a main provider of forestry information and of assessments of EU and global forest resources. It investigates the role of forests in providing ecological services and in supporting economic activities, taking into account competing needs and the impact of climate change. It supports the EU forest strategy, notably by analysing ecosystem fragmentation and contributing to the definition of a green infrastructure. It manages the European Forest Data Centre, which includes the European Forest Fire Information System (EFFIS). EFFIS provides fire danger predictions up to six days in advance of their occurrence, as well as daily updated information on active fires and fire damage in Europe.



*The JRC manages the European Forest Fire Information System.*

We contribute to the implementation of the EU biodiversity strategy by playing a leading role in the mapping and assessment of ecosystems and their services in the EU. The JRC has developed the European Alien Species Information Network (EASIN) portal and is modelling the spread of invasive species. It works with the International Union for Conservation of Nature and Natural Resources (IUCN) and the United Nations Environment Programme (UNEP) on the Digital Observatory of Protected Areas (DOPA), which underpins interventions related to the development agenda and reporting to the Convention on biological diversity.

## **Protecting the environment and health**

Our service is responsible for the scientific and technical basis for secondary legislation on industrial pollution (i.e. Best Available Techniques – BAT) in the framework of the Industrial Emissions Directive. This relies on the consensus-building ‘Sevilla process’, involving industry, EU countries, NGOs and other Commission services.

The reference documents for BATs (called BREFs) are used by competent authorities in the Member States when issuing permits for industrial installations that represent a significant pollution potential. They inform relevant decision makers about what may be technically and economically available to industry in order to improve their environmental performance.

Air quality remains a major source of concern. Our experts work with Member States and the Commission’s service for the environment to harmonise assessment methodologies. We run the European Reference Laboratory for Air Pollution (ERLAP) and the ENSEMBLE Project (Forecasting medium and long range atmospheric dispersion) as well as the network of Air Quality reference laboratories (AQ-UILA) and air quality modelling (FAIRMODE), which have led to improved comparability of data and model outputs. The JRC is developing integrated assessment methodologies at an urban scale to link emissions and impacts and to help develop local / regional solutions for “hotspots”.



*The European Reference Laboratory for Air Pollution (ERLAP), contributes to the harmonisation of air pollution measurements and the correct implementation of air quality legislation in Europe.*

The JRC has been supporting the preparation, implementation and review of EU chemicals legislation with a focus on REACH, test methods regulation, endocrine-disrupting substances, combination effects of chemicals, methodologies and tools for exposure assessment, as well as the development of non-animal test methods. We manage the EU Reference Laboratory for Alternatives to Animal Testing (EURL-ECVAM), and our work has contributed to the establishment of a European network of 26 qualified laboratories on this area in 2013.

### **Promoting a green and resource efficient economy**

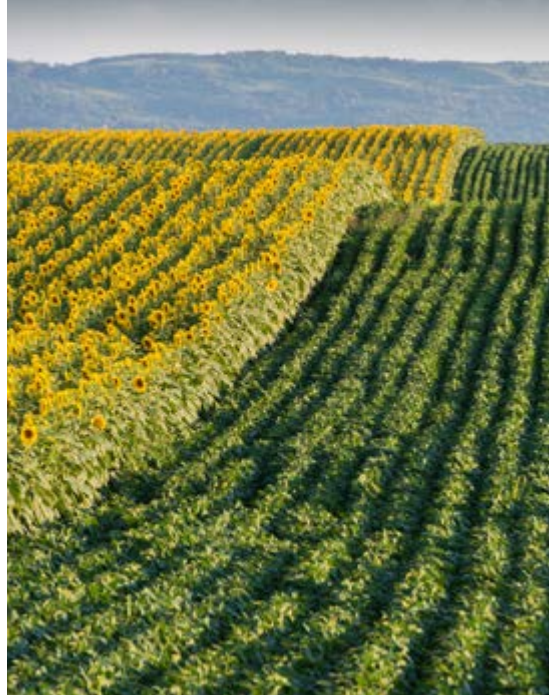
Together with the Commission's service for environment, the JRC has developed guidelines on how to apply life-cycle thinking to waste management, and methods to assess the resource efficiency of products, so as to prolong the life and improve their recoverability and recyclability.

The implementation of waste legislation is another area of our activities. We have elaborated the methodology for developing the criteria for end-of-waste, as well as, in cooperation with Member States and stakeholders, the criteria for a number of recyclable materials (of which the ones for iron and steel, aluminium, copper scrap and glass cullets have been adopted).

Our experts are reviewing the existing reference document (BREF) on extractive waste under the Mining Waste Directive so as to cover, amongst others, the management of waste from unconventional hydrocarbon exploration and production.

The JRC contributes to the development of life cycle methodologies in the EU, in the frame of sustainable product policies. Current work in collaboration with the Commission's service for the environment is testing the application of the environmental footprint of products and the integration of material efficiency into policy instruments.

We are in charge of developing secondary legislation under the Ecolabel Regulation by elaborating



criteria to reduce environmental impacts of products, in consultation with stakeholders. We also develop criteria for green public procurement and sectoral reference documents on best environmental management practice under the European Eco-Management and Audit Scheme (EMAS) Regulation.

Since 2013, the JRC has been carrying out the 'sustainable product policy pilot project' which involves market and environmental analysis of selected product groups to underpin the choice of policy instruments (Ecodesign, Energy labelling, Ecolabel and Green Public Procurement) and the definition of implementing measures.

### **Providing better information**

The JRC contributes to the integration of environmental information systems. It plays a key role in the implementation of the Infrastructure for Spatial information in the EC (INSPIRE) and the Shared Environmental Information System (SEIS). It is responsible for ensuring the viability and evolution of the INSPIRE technical infrastructure, guaranteeing cooperation with the international research community. It also plays an active role in standardisation bodies, thus helping to address demands from the Member States on interoperability between INSPIRE infrastructures for environmental policy and other e-infrastructures.

# FINANCIAL REGULATION AND SUPERVISION

*Well-defined financial regulation and supervision are a prerequisite to stability and therefore growth. To address the causes of the financial crisis, the Commission has put in place reinforced mechanisms for economic governance, created a set of new supervisory authorities, and adopted an ambitious and far-reaching package of financial reforms, including the Banking Union.*

*With its expertise in financial and economic modelling, the Directorate-General Joint Research Centre (JRC) plays a key role in the development of analytical tools which are used extensively in supporting the Commission on the financial reform agenda.*

*Our research on financial stability supports the work of the European Commission's Directorates-General for internal market and economic and financial affairs.*



## Scientific support to the Banking Union

In support of the initiatives on Banking Union, the JRC's analyses on the Single Resolution Mechanism and the Single Resolution Fund demonstrated that a common fund would better contain systemic crises than a system of national funds acting individually. We also helped estimate the optimum size of the fund at around EUR 60bn.

## EU Banking structural reform

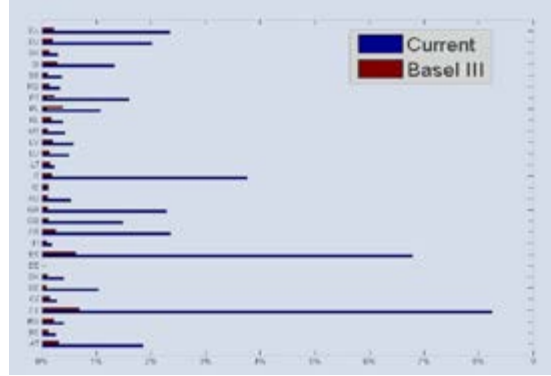
The JRC has played a key role in the preparation of the quantitative analyses underpinning the Commission proposal for restructuring the EU banking sector. The work conducted includes the definition of examination thresholds for structural separation, estimates of the size and the determinants of implicit state subsidy to EU banks (these estimates show that the total funding cost advantage for the largest EU banks was roughly EUR 90bn in 2011 and EUR 80bn in 2012), the existence of regulatory incentives to banks towards trading activities, and the cost-benefit analysis behind the proposal.

## Modelling

Our scientists developed a powerful tool to carry out modelling of the EU banking sector. The SYMBOL (Systemic Model of Banking Originated Losses) model relies on regularly updated data from the balance sheets of almost 4 000 EU banks. It was developed in cooperation with the Commission's service for internal market and experts from academia and is used to assess the impact of planned policies in the EU banking market.

## Directive on deposit guarantee schemes

Adopted in 2014, this directive foresees reimbursements to depositors of up to EUR 100 000 if their banks fail. The JRC, in collaboration with the European Forum of Deposit Insurers, assessed the impact of alternative policy options from the perspective of different stakeholders. The upgrade of



*SYMBOL simulation 2012 data: probability of losses in excess of capital plus recapitalisation needs higher than 0.1% GDP.*

the ceiling from 20 000 to 100 000 protects 95% of all bank account holders within the EU.

## Bank recovery and resolution Directive

The new EU framework for bank recovery and resolution (2014) aims to minimise the impact of closure or restructuring of failing banks and to avoid the burden of bailout falling on taxpayers' shoulders. The package introduced the creation of resolution funds and a bail-in tool, meant to act as safety nets. The JRC's analysis showed that, in combination with capital requirements as proposed by the Commission, the framework would reduce the level of public finance intervention in case of a banking crisis, compared with recent actions required during the banking crisis.

## Capital requirements Directive

In capital requirement Directive IV (2013), which would require banks to hold more capital of better quality in order to be able to absorb losses, JRC scientists analysed the new rules applying the SYMBOL model. The analysis showed that the implementation of the directive would reduce the risk of systemic banking crisis.

## Cumulative impact

Our service has also helped assess the cumulative impact of the overall coherence of the reform agenda and the expected or actual economic impact, by contributing to the economic review of the Financial Regulation Agenda. In particular, we estimated potential public finances and macro-economic benefits of implementing the capital requirement Directive IV package and the bank recovery and resolution Directive.

# FOOD, FEED AND PRODUCT SAFETY AND QUALITY

*EU legislation in the field of consumer protection strives to ensure that products, including food, available on the common market, are safe and accurately labelled. The Directorate-General Joint Research Centre (JRC) supports preparation of the legislative framework in this area by helping to define implementable maximum limits for certain substances and harmonised methods for measurement, based on state-of-the-art scientific and technical knowledge. The JRC develops scientific tools and compiles databases of information relevant to all aspects of consumer health and protection. Much of its research related to health and consumer protection takes place in the context of and in support of the JRC-hosted European Union Reference Laboratories.*

*Our work on food, feed and product safety and quality supports mainly the European Commission's Directorates-General for health and consumers, but also those for taxation and customs union, maritime affairs and fisheries, agriculture, as well as the European Food Safety Authority (EFSA).*



## Food and feed safety

Our service provides analytical tools to assure safety along the food supply chain, allowing Member States to achieve reliable and comparable measurement results to support the harmonised implementation of the strict rules set up in EU food safety legislation (e.g. allergens or nano-materials in food, artificial flavouring, antibiotics in feed). These tools include validated methods, reference materials, proficiency tests, and competence building through training. They are available to laboratories across and beyond the EU. Activities are partly coordinated within the framework of six European Union Reference Laboratories (EURL) managed by the JRC: EURL for heavy metals, EURL for mycotoxins, EURL for Polycyclic Aromatic Hydrocarbons (PAHs), EURL for feed additives, EURL for food contact materials, and EURL for genetically modified food and feed.



*The JRC hosts the European Reference Laboratory for Feed Additives.*

## Genetically modified organisms (GMOs)

The JRC supports the implementation and further development of the GMO regulatory framework regarding the detection, identification and quantification of GMOs in food and feed through the operation of the EU reference laboratory in this area and relevant research. Based on their expertise, our researchers assist in emergency situations arising from the appearance of undeclared and/or unauthorised GMOs in the EU market, verifying respective detection methods.



*The JRC has developed a broad variety of food related reference materials in support of food and feed safety.*

Our laboratories also provide certified reference materials for calibration and quality control purposes for many GMOs authorised in the EU. Through the European coexistence bureau, we work directly with Member States to develop best agricultural practices for technical segregation of GM and non-GM crops at farm level. The European GMO Socio-Economics Bureau analyses the socio-economic impacts of the cultivation of GMOs in the EU. It is composed of experts of Member States and managed by JRC scientists and provides indicators on the EU supply chain, from seed producers to final consumers. Strategic studies on R&D and commercial developments of new biotechnologies in agriculture complement the policy support provided to the European Commission's directorate for health and consumers in this area.

## Food authenticity and quality

Labelling of food products needs to be accurate and clear in order to inform and protect consumers and facilitate trade inside and outside Europe. A number of foods such as wine, olive oil, fish, honey, dairy products and meat are the target of fraudulent activities. The JRC develops widely accepted standard methods of analysis and best practice guides, underpinned by advanced measurement science, also used by the Commission's service dealing with taxation and customs union (e.g. for the classification of meat according to heat treatment, content of milk fat, and discrimination of tobacco varieties). It also manages the European Reference Centre for Control in the Wine Sector (BEVABS), which ensures the authenticity of wines especially concerning sugaring and watering. The scope of this reference centre will be extended to include grape varieties in addition to geographical origin and vintage years.



*JRC scientists develop scientific tools and methods of analysis in support of food authenticity and quality.*

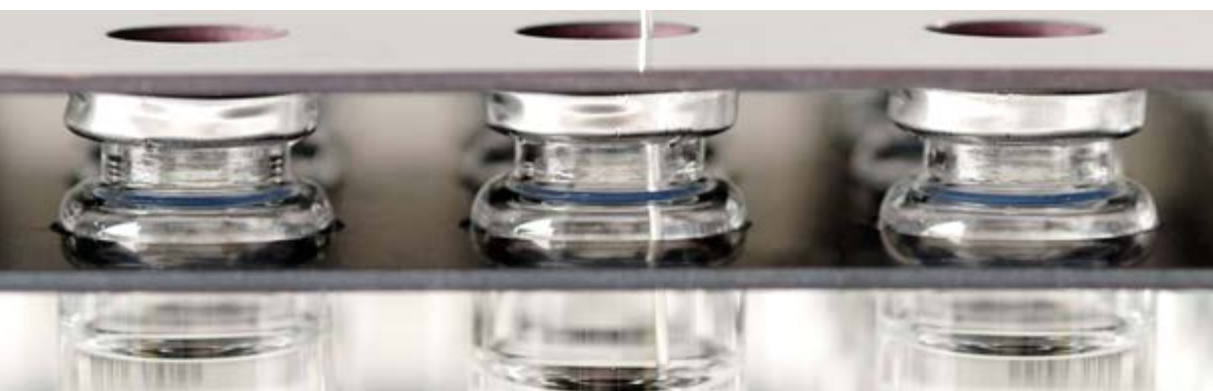
### **Product safety and quality**

Products placed on the EU market are subject to safety requirements. Our scientists produce technical guidelines and harmonised/validated methods for identification and quantification of chemicals in consumer products (e.g. cosmetics), and integrated approaches, methodologies and tools for chemical exposure and toxicological hazard assessment.

One example concerns nanomaterials, for which we develop and support the harmonisation of methods needed for the implementation of respective EU regulation (e.g. labelling requirements for cosmetics or food), including the development and provision of reference materials. We also develop in-vitro methods for hazard assessment of nanomaterials, represent the Commission in

related European and international standards organisations, and support international consensus on risk assessment methodologies for nanomaterials (OECD, ISO, CEN).

The JRC supports the development and validation of a new generation of alternative methods to reduce the necessity for testing on animals, and to provide more cost-effective tools for assessing health effects specific to humans. This includes in-vitro cell-based tests and computational models for predicting toxicity. Much of this effort falls within the activities of the EU Reference Laboratory for Alternatives to Animal Testing, hosted by the JRC. We also provide support to standardisation and harmonisation of alternative methods towards international regulatory acceptance (e.g. OECD, International cooperation on alternative test methods).



*JRC-developed scientific tools are available to laboratories across and beyond the EU.*



# GLOBAL SAFETY AND SECURITY

*Disasters and crises affect hundreds of millions of people annually and cause significant damage worldwide with the number of resulting casualties and economic losses continuously increasing. The EU addresses these challenges through the EU's Civil Protection Mechanism and the global security dimension of the EU's foreign policy.*

*To support these policies, the Directorate-General Joint Research Centre (JRC) provides scientific expertise and develops innovative technologies and approaches that help the EU and its strategic partners to stay ahead of threats and hazards by improving prevention, preparedness, early warning and response against all types of natural, technological or man-made disasters and crises. In particular, the JRC helps to strengthen the EU's resilience to disasters and crises through research on crisis management technologies, satellite image processing and analysis and Internet surveillance systems. Our activities focus mainly on integrated systems for risk analysis, situational awareness, early warning and collaborative decision-making. We also provide administrative and technical assistance on nuclear safety and security.*

*The JRC works with a wide array of international partners in this area and provides assistance to the European Commission's Directorates-General for humanitarian aid and civil protection, development and cooperation, trade, research and innovation, as well as the Service for Foreign Policy Instruments (FPI) and the European External Action Service (EEAS).*



## Support to the EU's Emergency Response Coordination Centre (ERCC)

JRC-developed systems support the work of the Emergency Response Coordination Centre (ERCC), operated by the Commission's service for humanitarian aid and civil protection. They increase the preparedness and response capacity of the ERCC to natural disasters occurring inside and outside the EU. These systems are also used by the Member States and international organisations such as the United Nations.

One example is the Global Disaster Alert and Coordination System (GDACS) which provides global disaster monitoring and alerts for earthquakes, tsunamis, floods and tropical cyclones. It was developed in close cooperation with ECHO and the UN Office for Coordination of Humanitarian Affairs.

The only worldwide automatic tsunami alert system has been developed, and is operated by the JRC. Based on seismic and hydraulic modelling equipment coupled with communication technologies, it gives information about potential tsunami risks. We are now working with Member States on the consolidation of a European tsunami monitoring/early warning mechanism, which is testing portable devices that can be installed on beaches to warn about a tsunami risk.

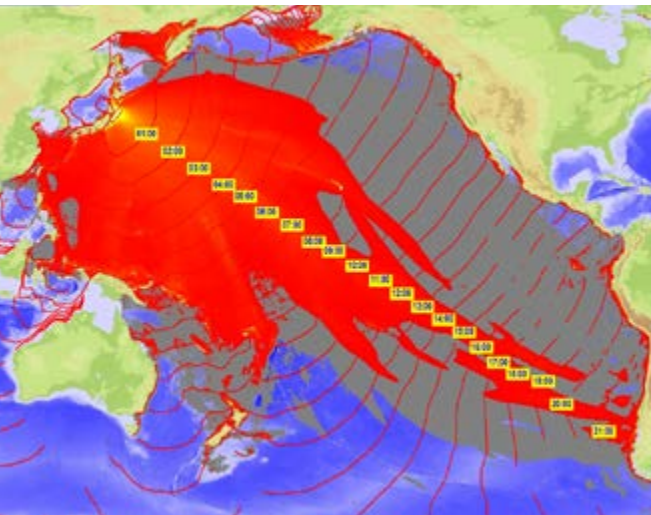


*The JRC joined the Italian civil protection authorities to assess earthquake damage in the field in May 2012.*

Our experts are also actively engaged in enhancing the analytical capability of the ERCC. Based on its own research activities and its hazard monitoring and alert systems, the JRC provides scientific and analytical information to the coordination centre. On a daily basis, situation reports are delivered. They can be complemented with assessments of potential impact. The JRC drafts the ECHO Daily Flash report, which provides updates on conflicts and disasters around the world. It also prepares detailed maps, which are distributed daily to Member States and the public at large through the ERCC portal, also developed by us.

## Disaster Risk Management

Our service also supports EU initiatives on Disaster Risk Management. Natural and man-made hazards continuously threaten populations in Europe and beyond. Managing risks associated with hazards is based on sound policy-making in prevention, preparedness, response, and reconstruction activities. Our efforts focus on improving the scientific evidence base for risk assessment in Europe and worldwide, not only in hazard characterisation, but also in vulnerability and exposure assessment (essential components for risk assessment) and development of guidelines and standards for risk



*JRC tsunami wave propagation model for the Pacific earthquake (March 2011).*

data (including disaster loss data). In particular, the JRC leads a technical working group that includes ECHO, Member States and international partners, which aims to establish European standards and guidelines for recording disaster losses in the EU. The working group is now developing the Union's contributions to coherent technical recommendations for loss reporting requirements in the forthcoming '2015+ Hyogo Framework for Action for Disaster Risk Reduction to Strengthen Resilience'.

### **Conflict prevention – the Kimberley Process**

The JRC supports the EU's efforts to prevent international conflicts by fostering responsible resource management. For instance, it applies its competence in image processing and analysis and in statistics to support the Kimberley Process, an international certification scheme which aims to prevent the flow of conflict diamonds. Algorithms developed by our scientists are used to systematically compare extraction areas for verification of mining activities, with resulting statistics providing evidence for illegal diamond extraction. We have also issued guidelines for matching trade and production data and for data quality.

Together with the United States, the JRC has developed a reference satellite-based method for

monitoring mining activities, which allows identification of active mines and the monitoring of their activity over time through repeated observations.

### **International crisis management – scanning the risk of conflicts**

As a contribution to international crisis management, the JRC supports the European External Action Service (EEAS) in developing the Global Conflict Risk Scan, which provides information on structural risks of political, security, economic, social and environmental dimensions. Our activities include the development and practical use of the methodology, the model, and the web-based platform.

In support of strategic partnerships between the EU and regional organisations, we share expertise on media monitoring and decision support systems for crisis management to help these organisations better anticipate, monitor and prevent conflicts and crises. For instance, we are currently supporting the implementation of the African Union's Continental Early Warning System and the strengthening of early action capabilities of the Organisation of American States, based on the European Media Monitor (EMM), also developed by the JRC, and its collaborative threat and risk analysis systems.



*The European Crisis Management Laboratory acts as a research, development and test facility for ICT focused solutions, integrating devices, applications, and crisis management related information sources to support crisis management needs such as threats analysis, common situation awareness, and collaborative decision making.*



*JRC's nuclear safeguards and forensic laboratory with mass spectrometry equipments.*

### **Nuclear Safety and Security**

The JRC extensively supports the Commission's service for development and cooperation in the field of nuclear safety through the technical implementation of projects under the EU Instrument for Nuclear Safety Cooperation (INSC) with third countries. Our activities are mainly related to "soft" support (i.e. not including equipment) to regulatory authorities and technical support organisations, responsible management of spent fuel and radioactive waste and nuclear safeguards. This support ranges from the development of national/regional project proposals, drafting of terms of reference and technical evaluation of tenders, to quality control of deliverables, technical evaluation of project implementation, and ex-post evaluation of sustainability, including the dissemination of project information and outcomes. The new INSC also includes the support that was previously provided in the frame of the EU Instrument for Pre-Accession Assistance for EU Candidate Countries.

As for nuclear security, the JRC carries out the technical implementation of the EU Chemical, Biological, Radiological and Nuclear (CBRN) Centres of Excellence initiative, funded by the Instrument for Stability (IfS). The aim is to implement a coordinated strategy for mitigation and preparedness against risks related to CBRN material at international, regional and national levels and to boost cooperation. We provide technical support at all stages of this project cycle.

On behalf of the Commission, the JRC also manages the international coordination of nuclear security outreach projects (including security of radioactive sources, detection and response to illicit trafficking and export control) and helps the countries-recipients of IfS support in the analysis of their needs, prioritisation of projects, monitoring of ongoing work and evaluation of the impact of completed projects.



*Evaporation of uranium plutonium large size dried spikes produced by the JRC in support of nuclear safeguards.*

# HEALTH

*Health is of crucial importance for citizens' quality of life and the economy. The Directorate-General Joint Research Centre (JRC) provides scientific and technical support ranging from the implementation of the regulatory framework for medical devices to support to information collection and use on health threats, harmonisation of procedures and promotion of best practices in diagnosis and treatment of diseases, as well as promotion of healthy lifestyles.*

*We support the European Commission's Directorates-General for health and consumers, communications networks, content and technology as well as the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) in public health policy development and implementation.*



## Medical devices including in-vitro diagnostics

Medical devices include a broad range of products from sticking plasters or pregnancy tests to pacemakers and x-ray machines. The regulatory framework is being revised to cover technological progress, and improve harmonisation and transparency throughout the EU (adoption expected end of 2014/early 2015). The JRC will provide scientific, technical and logistical support to the implementation and management of the new legal framework. To improve the safety of medical devices, our experts already today support the Commission's service for health and consumers and the Member States' competent authorities on vigilance issues and post market surveillance.

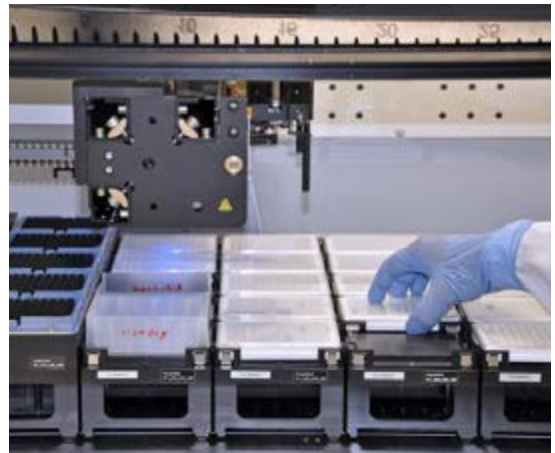
Through the production of reference materials and support to the establishment of guidelines for clinical measurements, we contribute to the standardisation and traceability of results for in-vitro diagnostics, and thus to their reliability and comparability. Over 40 different reference materials are available, including those for tumour markers, markers for infectious diseases and cardiac damage. Our work, through worldwide collaborations, also facilitates international standardisation. We provide advice to the Commission services on the technical implementation of the respective regulatory framework.



*The JRC work supports the early diagnosis and monitoring of major chronic diseases.*

## Improving healthcare and health information in the EU

In support of the Commission's initiative for tackling cancer more effectively, the JRC is developing a European voluntary quality assurance scheme for breast cancer services, in tandem with the revision of the European breast cancer screening guidelines. It is planned to later extend the scheme to cover colorectal and cervical cancers.



*The European Reference Laboratory for Alternatives to Animal Testing is managed by the JRC.*

Based on its nuclear expertise and its facilities for production and handling of radioisotopes, the JRC supports the development and improvement of alpha-immunotherapy of cancer but also infectious diseases.

Health knowledge is another area where stronger European level cooperation towards aggregating robust and comprehensive data at EU level would bring benefits for disease prevention and treatment. Our scientists are developing two harmonised and comprehensive health information systems: the European cancer information system, via the JRC-operated European network of cancer registries, representing over 200 cancer registries in Europe and a European platform on rare diseases, which will provide a central access point for information on rare diseases including access to the more than 600 existing patient registries, and ensure interoperability and harmonisation of collected data to steer EU policy.



### Prevention of diet-related diseases

Diet is a major risk factor for many diseases, but nutrition sciences are complex and this complexity often results in uncertainty and conflicting results. Against this background, the JRC experts provide scientific advice to the Commission and Member States. This includes reviews of state-of-the-art scientific developments and their applicability and relevance for decision making and prevention policies (dietary cancer prevention, food provision in schools, nutrition and healthy ageing), and behavioural sciences approaches e.g. on ways to increase physical activity uptake levels.

### Monitoring cross-border threats to health

The JRC provides essential tools for the early identification of public health threats and their monitoring and assessment. The event-based Medical Information System, MedISys, automatically collects and analyses articles from a wide range of media sources in various languages around the clock. The system is being used to monitor outbreaks of communicable diseases, e.g. the Ebola outbreak in West Africa, avian flu or the E. coli outbreak in 2011. The JRC's early alerting and reporting web-based system combines open source news monitoring technology with collaborative risk assessment and reporting capabilities.

These systems are routinely used by Member States, EU agencies (ECDC, EFSA), and international public health authorities (World Health Organisation, US Centre for Disease Control, Global Health Security Initiative).

MedISys is being continuously improved to serve as a core component of the agencies' daily surveillance and risk assessment processes. Our Europe Media Monitor (EMM), and MedISys technologies can also facilitate efficient collaboration on media monitoring amongst the four EU agencies with responsibilities related to health: European Centre for Disease Prevention and Control, European Food Safety Authority, European Medicines Agency, and European Chemicals Agency.

### Active and healthy ageing

Our actions support the implementation of the European innovation partnership on active and healthy ageing, contributing to the definition of an analytical framework to monitor the related innovation potential of the EU28 as well as analysing the catalytic role of ICT in facilitating a sustainable integration of healthcare and social care for the ageing population.

# HOME AFFAIRS

*The EU can grow economically, culturally and socially only in a stable, lawful and secure environment.*

*The Directorate-General Joint Research Centre (JRC) contributes to a range of home affairs policy goals. Its research, analysis and in-house developed tools support EU policies on border security, including maritime borders, various areas of critical infrastructure protection, and the fight against cyber-crime, as well as the implementation of measures against possible chemical, biological, nuclear and explosive actions. The JRC offers modelling, simulation and response capabilities to enhance the security and resilience of physical infrastructures.*

*This work provides assistance to the European Commission's service for home affairs and the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union (Frontex).*







### Monitoring EU borders

The JRC contributes to the development of solutions for harmonised automated border control, including tools for the assessment of their security and their impact on data protection. For example, we provide evidence needed for reliable application of biometric technologies in border protection (e.g. fingerprint and 3D face recognition).

For the implementation of the EU Maritime Security Strategy, our expertise in maritime surveillance contributes to the policies on the protection of EU maritime borders. It provides technical support, such as common application of surveillance tools for the detection and tracking of small boats, to the development of the European Border Surveillance System (EUROSUR) which aims to reinforce the monitoring of, in particular, Europe's southern maritime borders.

### Protecting critical infrastructures

In support of EU efforts to protect critical infrastructures, including power grids, transport networks, energy production plants and information and communication systems, the JRC coordinates the European Reference Network for Critical Infrastructure Protection (ERNICIP). It also provides technical support for the review of the Directive on European Critical Infrastructures and carries out different research activities, such as assessing the vulnerability of networked infrastructures,

their interdependencies, and in the case of extreme space weather events. We also evaluate the resistance of buildings and transport systems against explosions.

Our activities involve work on the physical protection of critical infrastructures under certain types of intentional threats or accidents, such as explosions, impacts and blast waves, or earthquakes. Vulnerabilities of buildings are identified and classified via proper material modelling, structural mechanics and numerical simulation techniques. To mitigate the effects of earthquakes, our researchers study the structural behaviour of buildings and other infrastructures under earthquake scenarios in the JRC's European Laboratory for Structural Assessment (ELSA). The laboratory develops methodologies to increase the safety of buildings and contributes to the creation of European standards, called Eurocodes, for the construction sector.



*Reaction Wall of the European Laboratory for Structural Assessment at the JRC, Ispra.*

## Enhancing cybersecurity and the fight against cyber-crime

The JRC works on cybersecurity, including that of smart grids. Our Experimental Platform for Internet Contingencies (EPIC) allows researchers to conduct real-time experiments with simulated physical systems tightly coupled with real cyber systems. We develop security-related standards, identify and classify cyber-incidents and develop tools for privacy and data protection. Our work also supports the EU Critical Information Infrastructure Protection (CIIP) Action Plan by contributing to the organisation of pan-European cybersecurity exercises. We also research technical solutions to increase the level of realism of these exercises and develop technical guidelines to help the preparation and implementation of cyber-exercises in a multinational context.

The JRC develops new and improved techniques in the fight against on-line child sexual abuse helping to identify victims and authors of such crimes. It also helps to develop EU mitigation measures against identity theft such as prevention and prosecution techniques for identity cybercrime. Strengthening law enforcement and capabilities to manage crises.

DG JRC's technology for open source monitoring and analysis is a basis for providing technical assistance to the EU Computer Emergency Response Team (CERT) established to counter cyber-attacks against EU institutions, bodies and agencies. It supports building the technical capacity of Europol, Frontex and law enforcement

authorities in the EU Member States in open source intelligence. DG JRC also offers scientific and technical assistance to develop DG HOME's Strategic Analysis and Response (STAR) Capability in crisis management. DG JRC conducts targeted analyses supporting law enforcement and other relevant actors, e.g. on detecting violent radical content on the Internet.

## Strengthening law enforcement and capabilities to manage crises

Our technology for open source monitoring and analysis is a basis for providing technical assistance to the EU Computer Emergency Response Team (CERT) established to counter cyber-attacks against EU institutions, bodies and agencies. It supports building the technical capacity of Europol, Frontex and law enforcement authorities in the EU Member States in open source intelligence. The JRC also offers scientific and technical assistance to develop the Commission's Strategic Analysis and Response (STAR) Capability in crisis management. It conducts targeted analyses supporting law enforcement and other relevant actors, e.g. on detecting violent radical content on the Internet.

## Addressing chemical, biological, radiological and nuclear hazards

In an international security context, preventing and mitigating chemical, biological, radiological and nuclear (CBRN) hazards has become crucial.



Through the EU CBRN action plan, the EU significantly contributes to international efforts to mitigate the associated threats and risks. Our role here lies in conducting radiological and nuclear research, mainly in the areas of detection technologies, forensics, response and training.

As a member of the CBRN advisory group, the JRC gives technical support to the implementation of the plan which is guided by consultation with national authorities and other relevant stakeholders such as the International Atomic Energy Agency (IAEA), Interpol and Europol. In this context, the JRC manages the European Nuclear Training Centre (EUSECTRA) and is responsible for the Illicit Trafficking Radiation Assessment Programme (ITRAP+10).

Our experts are working on a CBRN glossary, contributing to the IAEA illicit trafficking database and supporting its expertise in nuclear forensics. In addition, we offer virtual reality trainings and study performance of portal monitoring under environmental conditions. The JRC also runs a project comparing short-range dispersion models for nuclear security events (such as terrorist attacks), which are needed to provide relevant and reliable information to respond to nuclear emergencies. The JRC is setting up a “security threats detection” laboratory for studies on detection and screening technologies, to be inaugurated in 2015. This

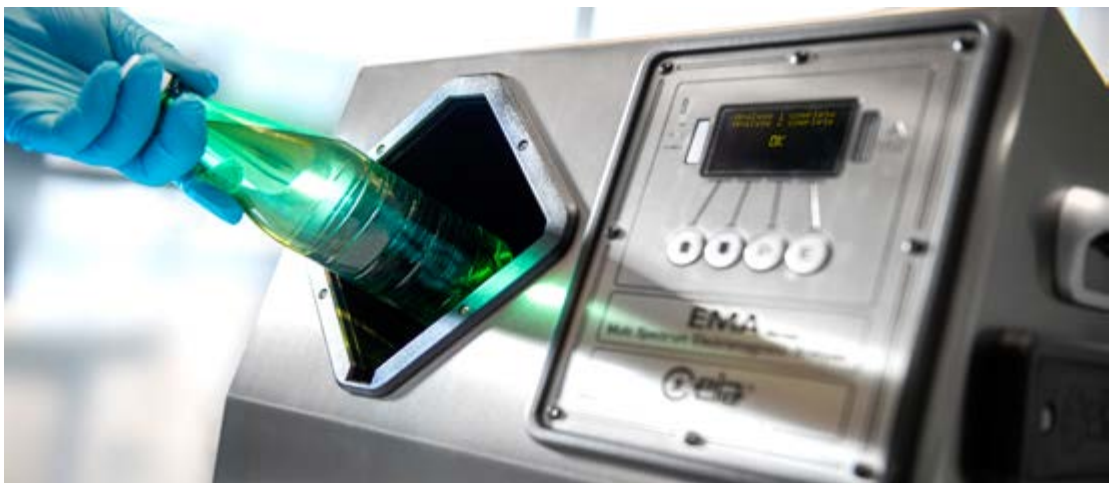


*EUSECTRA training centre.*

laboratory, equipped with screening and first responder detection equipment for aviation security and CBE (chemical, biological, explosive) security threats, will help the Commission to quickly test whether potential and reported threats (of a terrorist incident, for example) are met with appropriate detection capabilities.

### **Aviation security**

The JRC supports Commission activities in developing harmonised EU standards for aviation security and detection of explosives in order to ensure the comparability of results and to provide the basis for an anticipated EU certification procedure of detection systems.



*The JRC laboratory on aviation security is testing aviation security detection technologies e.g. security scanners, X-ray image scanners and cargo scanners.*

# INTERNATIONAL COOPERATION AND ENLARGEMENT

*Science plays an increasing role in international relations, as it is closely linked to the opportunities and challenges of globalisation. Phenomena such as climate change, recurrence of natural disasters and emerging diseases call for global action, based on sound scientific evidence.*

*The Directorate-General Joint Research Centre (JRC) provides strong support to EU external policies in a wide range of areas and works in close collaboration with the European Commission's Directorates-General for development and cooperation, trade, environment, climate action, research and innovation and the European External Action Service (EEAS).*

*In addition to strong bilateral cooperation with the United States of America, Brazil and China, at a global level we collaborate with international organisations, such as the United Nations, the Organisation for Economic Co-operation and Development (OECD), and the World Bank and take part in multilateral initiatives, contributing to providing a scientific evidence base to global issues (e.g. Rio+20, disaster risk reduction).*

*The JRC supports regional integration processes (e.g. African Union), by facilitating common approaches, capacity building and networking to address challenges, such as conflict prevention, maritime piracy, food security, and natural resources management (water, soils, raw materials). We also contribute to the EU enlargement process. To stimulate excellence in research and innovation as a driver of growth and jobs in accession countries, we have set up an Enlargement and Integration programme.*



## Support to interoperability and standardisation

The JRC contributes to standardisation via pre-normative research, working towards harmonised methods, and developing reference measurements and methodologies. Together with the US National Institutes of Science and Technology (NIST) we collaborate on standards and measurements in several areas, ranging from energy and transport, to nanotechnology and healthcare. Such collaboration is relevant in the framework of the Transatlantic Trade and Investment Partnership (TTIP) negotiations, as it will help to build a regulatory level playing field. Our collaboration with the US Department of Energy (DoE) on smart grids and e-vehicles interoperability aims at harmonising test procedures; development and verification of connectivity technologies, communication protocols and standards; as well as identification of gaps where new standards or enabling technologies are needed. This cooperation contributes to the work of the Transatlantic Economic Council and provides tangible deliverables: the first Interoperability Centre was inaugurated in July 2013 at the DoE Argonne National Laboratory in Chicago and the next European Interoperability Centre will be inaugurated at the JRC premises in Ispra, Italy, in 2015.



*The JRC produced the world's first certified nanoparticle reference material based on industry-sourced nanoparticles.*

## Disaster risk reduction

In cooperation with the UN and the World Bank, we work towards improved disaster monitoring, threat analysis and warning systems with societal benefits at a global level. Acting in support of EEAS and the Commission's service for development and



cooperation we provide valuable data analysis in the area of disaster/crisis management, particularly in humanitarian natural disasters, conflict/socio-political threats and global health threats, including post-crisis recovery and reconstruction.

## Nuclear security and non-proliferation

We support the EEAS in the field of nuclear security. In the context of the Nuclear Security Summit the JRC coordinates the EU progress report on activities in the field of nuclear security, to which relevant services of the Commission and the EEAS contribute. During the 2014 Nuclear Security Summit, the JRC, together with EEAS organised the EU High-level Event on "International Cooperation to enhance a worldwide nuclear security culture".

## Countering Chemical, Biological, Radiological, and Nuclear (CBRN) trade

The JRC is a major contributor to the implementation of the EU-CBRN Action plan, to mitigate the risks and increase the control of illegal trade of CBRN materials. Our work covers large areas of security concerns and we work closely with the IAEA on the improvement of the IAEA Illicit Trafficking data base, on screening and eventually benchmarking the existing modelling tools used for the dispersion of radioactivity at urban scale in case of incident. Under the Instrument for Stability we provide technical support to the Commission's service for development and cooperation for the implementation of the CBRN Centres of Excellence initiative and to EEAS for capacity building in nuclear safeguards and security outside the EU member states.



*European Media Monitor (EMM) application on iPad.*

### **International crisis management - scanning the risk of conflicts**

We support the EEAS to develop the Global Conflict Risk Scan, which provides information on structural risks of political, security, economic, social and environmental dimensions. Our activities include the development and practical use of the methodology, the model, and the web-based platform.

Our scientists share their expertise on media monitoring and decision support systems for crisis management to help these organisations better anticipate, monitor and prevent conflicts and crises. For instance, we are currently supporting the implementation of the African Union's continental Early Warning System and the strengthening of early action capabilities of the Organisation of American States, based on our European Media Monitor (EMM) and collaborative threat and risk analysis systems.

### **Responsible resource management**

We support the Commission and the EEAS in the implementation of the Kimberley Process (KP) Certification Scheme, which aims at stopping 'the conflict diamonds' trade and the related abuse of human rights. We contribute to a broad

range of activities, including data processing, statistical analysis of diamond trade and production data for select KP countries, as well as satellite-based analysis of diamond production mines in KP countries under sanction. In 2013, the reference methodology for satellite-based monitoring of alluvial diamond mining in the Ivory Coast, jointly developed by the JRC and the US Geological Survey was endorsed formally by the KP inter-sessional at South Africa as a support tool for the KP Working Group for Monitoring.

### **Enlargement and Integration**

A support scheme for Associated and Neighbourhood Policy countries has been set up by the JRC to share scientific and technologic expertise underpinning European integration. Under this scheme, a significant number of workshops, trainings and activities are organised on a yearly basis, allowing these countries to access our knowledge and expertise in key areas, among which include: nanotechnologies, smart and sustainable energy systems, food safety, crisis and hazard management.

### **EU Strategy for the Danube Region**

The JRC provides scientific support to the EU Strategy for the Danube Region (EUSDR). Through an integrated approach relying on different flagship clusters, together with our partners, we gather essential scientific expertise and data to help decision-makers and other stakeholders of the Danube Region, including in accession (Serbia, Bosnia and Herzegovina, Montenegro) and neighbourhood (Moldova and Ukraine) countries, to identify the policy measures and actions needed for the implementation of the Danube Strategy. Our scientific expertise contributes to several priority areas, among which include: waterways, energy, water quality, environmental risks, knowledge society and competitiveness.

# MARITIME AFFAIRS AND FISHERIES

*Developing the potential of the European maritime economy and securing prosperous coastal communities, sustainable fisheries, a stable supply of seafood and healthy seas requires an integrated approach.*

*The Directorate-General Joint Research Centre (JRC) provides state-of-the-art, multidisciplinary scientific knowledge and innovative solutions for the conception, development and implementation of both integrated maritime and common fisheries policies.*

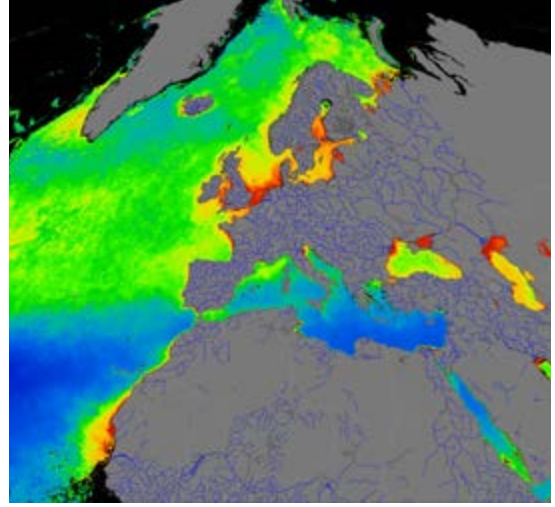
*This involves close working relationships with the European Commission's Directorate-General for maritime affairs and fisheries, other Commission services and the European External Action Service (EEAS).*



## Maritime Policy

JRC activities in this area relate to environment, fisheries, transport, energy, and security, contributing to the EU's Blue Growth strategy. This strategy covers sustainable growth in aquaculture, blue energy, blue biotechnology, coastal tourism, seabed mining and marine knowledge. Our work also serves to identify possibilities for the better integration of maritime contributions into other EU policies, such as fisheries or environment.

One example is between environmental policies, such as the Marine Strategy Framework Directive (which aims to protect marine waters and to achieve a good environmental status of seas) and the sustainable exploitation of the seas and oceans. Our experts provide scientific and technical support for the implementation of the Directive by assessing key environmental indicators of marine and coastal areas. This is done using a unique combination of satellite observations and modelling simulations, plus reference materials for the monitoring of pollutants in the marine environment. This work in turn serves to promote and inform sustainable maritime exploitation.



*Satellite image showing low (blue), moderate (green), high (yellow) and very high (red) Chlorophyll-a concentration.*

The international dimension is also addressed, mainly via the Transatlantic Ocean Research Alliance with the US and Canada. We have a long-standing collaboration with the US National Oceanic and Atmospheric Administration (NOAA). Development policies are supported by assisting the African, Caribbean and Pacific (ACP) countries to manage and protect their coastal and marine ecosystems. In support of the implementation of the EU Maritime Security Strategy, DG JRC develops state-of-the-art concepts and systems for maritime surveillance. Through novel methods and the integration of different surveillance data, we respond to the needs of policy makers over a wide range of maritime-related topics, such as irregular migration/border control, maritime security, fisheries control, anti-piracy, oil pollution and smuggling. Our work includes developing concepts, providing analytical studies, technological advice and system requirements plus undertaking experiments, trials or pilots for validation and verification. Relevant authorities are also informed about new technologies which can address their operational needs.

We also support the implementation of a step by step roadmap to establish the Common Information Sharing Environment (CISE), which aims to have effective data exchange between maritime authorities across many sectors (defence, transport, fisheries, border control, police, environment, and customs) and across borders.

Furthermore, the JRC provides technical support (e.g. common application of surveillance tools for the detection and tracking of small boats) to the European Border Surveillance System





(EUROSUR), which aims to reinforce the monitoring, in particular, of Europe's southern maritime borders. This also includes developing satellite-services and data-use for the Copernicus programme (the European Earth Observation Programme) in the maritime domain. Outside the EU, the JRC has provided tools for maritime authorities in Africa to carry out ocean-basin wide surveillance and build up their own maritime awareness via its PMAR (Piracy, Maritime Awareness and Risks) project. The tools can be used, for example, for counter-piracy and maritime governance. Such international activities are supported by EU development funds and are coordinated with the EEAS and the relevant regional and international organisations.

### Fisheries and Aquaculture

Scientific knowledge and data are indispensable to the Common Fisheries Policy, since policy decisions need robust and sound knowledge about the level of exploitation that fish stocks can sustain, as well as effects of fishing on marine ecosystems. The JRC is a focal point for fisheries data reported by EU Member States.

We support the work of the Scientific, Technical and Economic Committee for Fisheries (STECF),

the Commission's advisory body, with modelling, collection and analysis of fishery data. We also play a key role in the STECF annual evaluations of the economic performance of the fisheries, aquaculture and fish processing industries.

Research focuses on developing innovative approaches, which include fisheries modelling and management strategy evaluation, bio-economic modelling, socio-economic data analysis, as well as fisheries genetics and genomics.

The aim of fisheries modelling is to support fisheries management planning and decision making. The bio-economic modelling aims to bridge biological and economic research in order to develop more sustainable, long-term fisheries management plans and a more economically viable fisheries sector. Socio-economic data analysis involves research on seafood trade, as well as on the spatial distribution of fisheries and aquaculture, to inform policy development on aquaculture (farming finfish, shellfish and aquatic plants) as part of the Common Fisheries Policy reform. Genetics/genomics work is vital for species identification, genetic stock identification and origin assignment and supports the fight against illegal, unreported and unregulated fishing.



# MOBILITY AND TRANSPORT

*Transport policy aims to create the conditions for efficient transport systems capable of coping with increasing demands both for passengers and goods and support the provision of adequate transport infrastructure networks while reducing the adverse impacts of transport activities.*

*The role of science in this ambitious endeavor is essential, given that innovative solutions will be needed to maintain the viability and sustainability of the transport sector as well as to enhance its significant contribution to economic growth. The Directorate-General Joint Research Centre (JRC) provides a range of services including the analysis of policy options and the assessment of their impacts as well as technical support needed to implement policies for the transition to a low-carbon economy (vehicle emission reduction, alternative fuels, electric mobility) and for transport safety technologies.*

*Our research feeds into the work of other European Commission's Directorates-General for transport and mobility, enterprise and industry, energy, climate action, environment, regional policy, home affairs and research and innovation.*

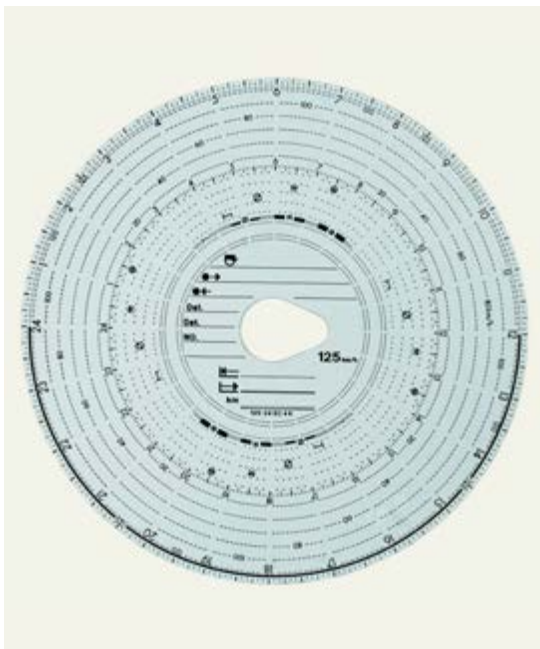


## Impact assessment of transport policies

The JRC supports the Commission service for transport and mobility in the policy-making process with modelling contributions to the development of long-term transport scenarios, such as the impact assessment carried out for the 2011 White Paper. We provide quantitative analysis of, e.g. the external costs of transport (emissions, greenhouse gases, congestion, noise) and their internalisation (e.g. via road charges), and support the development and maintenance of the successive versions of a network model for the EU transport grid (Transtools).

## Transport safety and security

Digital tachographs help enforce professional driving and resting times in road transport. We provide essential services through the European Root Certification Authority, overseeing the overall security of the digital tachograph. At the Laboratory for Interoperability Certification, we also issue certification for type-approving of tachograph equipment. Our experts are preparing technical specifications of new generation smart tachographs expected to reach the market in 2018.



The JRC supports the EU Action Plan for Deployment of Intelligent Transport Systems (ITS) with harmonisation and standardisation work focusing on security and privacy of applications (i.e. professional drivers e-documents, EU-US Harmonisation Task Group on harmonised policies for cooperative ITS Security Implementation).

In order to help national authorities improve accident prevention in public transport, the JRC developed and runs the European Coordination Centre for Accident and Incident Reporting Systems (ECCAIRS). This centre collects data and facilitates the analysis of safety data across the EU. The ECCAIRS information system has been adopted by the International Civil Aviation Organisation in 2004, and is now being used successfully in three transport domains (aviation, maritime and railways) to implement the related EU legislation.

On aviation security, we facilitate mutual recognition of nationally approved or certified equipment by reviewing technical specifications and performance requirements for EU harmonised conformity testing methodologies and standards.

## Supporting the transition to low-carbon transport

Our service contributes to the strategic development of transport technologies (Strategic Transport Technology Plan - STTP) by helping stakeholders to elaborate the first Technology Roadmaps. The JRC's analysis of the state-of-art of transport technologies in the EU and the innovation



*JRC's Vehicle Emissions Laboratory (VELA): emission test on an urban bus.*

capacities of the EU transport sector contributed to the Communication on Research and Innovation for Europe's Future Mobility, which is at the basis of the STTP.

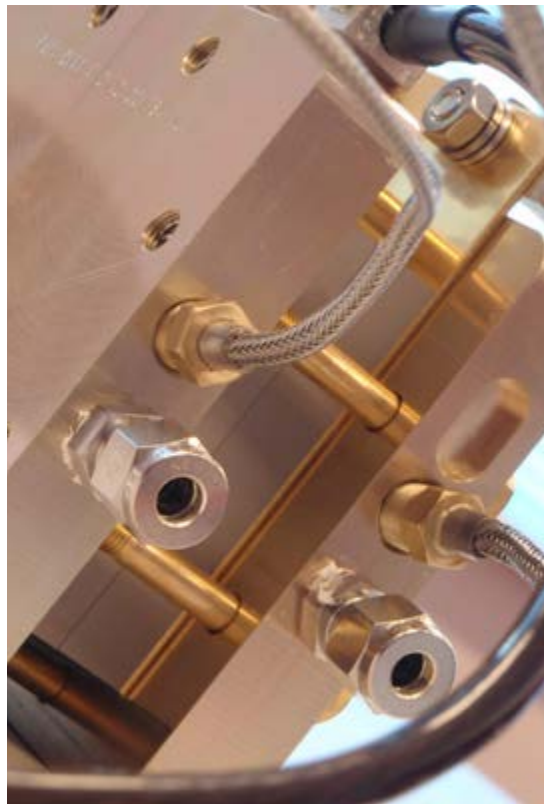
We carry out experimental research on a number of challenges facing the transition to a low carbon transport. This includes analysis of the performance and safety of electric vehicles and their batteries, and pre-normative research on global standards for electric vehicle and smart-grid interoperability, as well as on standards for electric charging and hydrogen refuelling. The work on hydrogen and fuel cell technologies focuses on the harmonisation and validation of test protocols, assessment procedures for performance and safety, and measurement techniques and methodologies as input to regulations and standardisation.

Research on alternative fuels (non-petroleum) is focused on sustainability and techno-economic viability, in particular that of bioenergy/biofuels in the road transport and aviation sectors.

The JRC supports the development and implementation of global and EU technical regulations on vehicle and engine environmental performance and energy efficiency. In our Vehicle Emissions Laboratory (VELA), the scientists assess the pollutant emissions of various engines, from light-duty vehicles to heavy-duty trucks and

buses. They monitor CO<sub>2</sub> emissions from trucks, assess requests for derogation from CO<sub>2</sub> emission limits from passenger cars and light-commercial vehicles, analyse eco-innovation technologies developed by motor manufacturers and develop on-road real-world measurement methodologies to close the gap between laboratory-measurements and the real-world experience.

The JRC produces regular Well-to-Wheels studies (life-cycle analysis) in collaboration with the European Council for Automotive Research & Development and the European oil industries' association. These studies estimate greenhouse gas emissions, energy efficiency, and industrial costs of all automotive fuels and power-train options. This is complemented by the development of an integrated set of models for holistic analysis, investigating spatial distribution and investment needs, impacts on transport, climate and energy policies, and repercussions on the energy system as well as infrastructure requirements.



*A single cell polymer electrolyte fuel cell (PEFC).*

# REGIONAL POLICY

*EU regional policy is a policy for investment in key strategic policy areas. It supports job creation, competitiveness, economic growth, improved quality of life and sustainable development. These investments support the delivery of the Europe 2020 strategy.*

*Much policy emphasis is given to smart specialisation, which is the EU's strategic approach to economic development through targeted support to research and innovation (R&I) and is the basis for European Structural and Investment Fund interventions. European regions are now required to identify the key areas, activities or technological domains where they are more likely to have a competitive advantage and focus their regional policies to promote innovation in these fields.*

*The Directorate-General Joint Research Centre (JRC), with its strong competence in modelling, spatial analysis as well as regional economic analysis, works closely with the European Commission's service for regional policy, as well as with the services for communications networks, content and technology, enterprise and industry, the EU statistical office plus the European Parliament, notably on smart specialisation plus several other aspects of regional policy.*





## Smart Specialisation

The JRC manages the Smart Specialisation Platform to assist Member States and regions in developing, implementing and reviewing their regional research and innovation strategies. These focus on identifying niche areas of competitive strength, solving major societal challenges and incorporating an innovation-driven dimension. The platform also promotes innovation partnerships emphasising greater co-ordination between different societal stakeholders and aligning resources and strategies between private and public actors at different governance levels. This tool is a unique resource for policymakers in regional development developing such strategies, as well as their partners from business, academia and civil society. Providing guidance material and good practice examples; organising information sessions in the regions; providing training; facilitating peer-reviews; supporting access to relevant data; and participating in projects to inform strategy formation and policymaking are among activities linked to the smart specialisation.



*Registered countries and regions in the Smart Specialisation Platform managed by the JRC.*

As an example, in May 2014 the JRC, together with the Commission's service for communications networks, content and technology, produced a digital agenda toolbox giving a comprehensive guide for regional and national authorities to design strategic approaches to digital growth in the broader framework of their innovation activities. The platform has also been used for identifying Key Enabling Technology competencies in the EU's regions.

## Spatial modelling and analysis tools

The Land Use Modelling Platform (LUMP) is used to assess the consequences of policies with direct or indirect territorial impacts and evaluate environmentally friendly options that can contribute to the reduction of social and territorial disparities between regions. RHOMOLO, a dynamic spatial general equilibrium model for assessing the impact of cohesion policy, assesses various aspects of cohesion policy. Simulations provided by the tool have been included in the 5th and 6th cohesion reports. The latest report also makes use of the LUMP to look at the impact of cohesion policy on issues such as accessibility, urbanisation and ecosystem services.

Other work evaluates the financial transfers to regions due to the EU cohesion policy plus other effects of cohesion policy, such as improvements to the transport infrastructure and investments in thematic areas, investment and construction of R&D facilities, health and education facilities, waste and water treatment facilities and urban regeneration. Environmental legislation,



demographic trends and sectors such as agriculture, forestry and energy are also included.

Since 2012, the JRC has also been actively engaged in exploiting its satellite-based methodology and system for human settlement detection and analysis in support of the EU's territorial cohesion policy implementation. The first results are included in the 6th cohesion report (2014) and have contributed to presenting the spatial dimension of the situation and trends in EU regions and territories. Through this work, our scientists have developed a method to reliably identify small and medium-sized human settlements, especially in rural and remote regions, in a harmonised and thereby comparable manner across the EU.

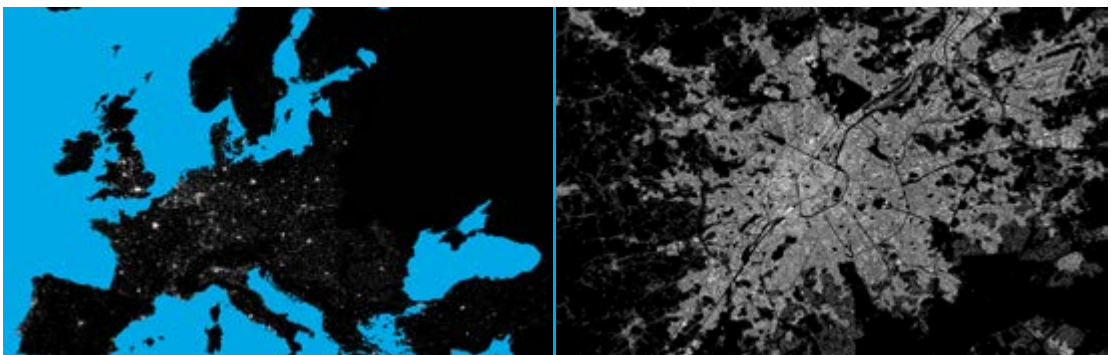
Another activity is improving the accuracy of the European population grid, which provides the backbone for further spatial analysis carried out by the Commission's service for regional policy, relating to local and regional urban rural classification, access to services and vulnerability to natural hazards.

### Scientific support to the Danube strategy

Our service supports the EU Strategy for the Danube Region, a macro-regional strategy encouraging better policy development and, through concrete actions and projects, achieving a more efficient and better-balanced implementation of the EU's overall objectives under Europe 2020. In May 2013, the JRC launched four scientific flagship clusters - water, land and soil, air and bio-energy - complemented by three horizontal activities: the Danube Reference Data and Services Infrastructure, the Danube Innovation Partnership, and Smart Specialisation for the Danube Region.

### More sustainable urban areas

We are developing integrated assessment methodologies at an urban scale to deal with issues related to regional investments in cities, urbanisation, air quality, smart cities, transport, accessibility, urban ecosystem services or urban outlooks. They will allow for example, to link city-level inventories of emissions and reduction measures to their impacts on air quality, ecosystems, health and climate. The JRC will help define wide sustainability criteria for European cities, in the context of economic growth and recovery, with particular emphasis on regional and cohesion policies and the transport/energy/climate package.



*The JRC's Global Human Settlements Layer (GHSL) in-house technology allows for producing maps of built-up areas at an unprecedented fine scale, reporting on the location and surface area of buildings across urban and rural agglomerations. The example shows the map of Europe, with the zoom-in on Brussels.*

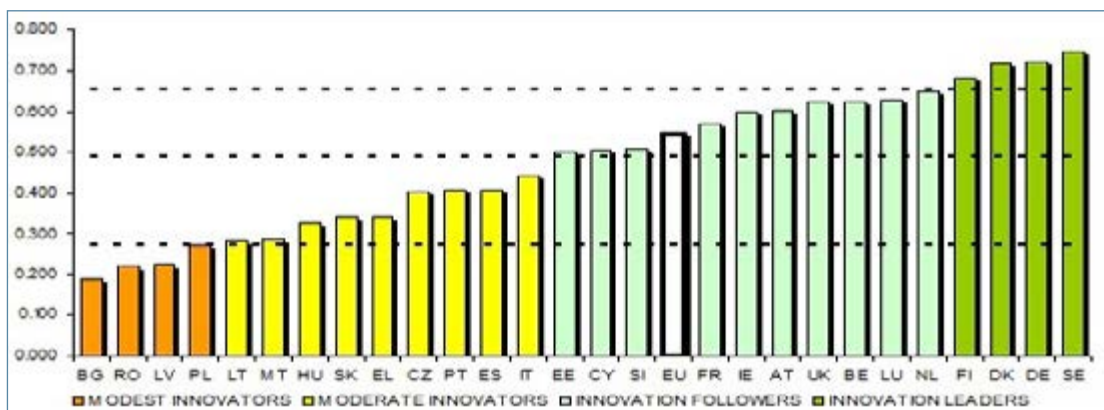
# RESEARCH AND INNOVATION UNDER HORIZON 2020

*Research and Innovation (R&I) policy on European level is implemented through the EU's Framework Programme for Research and Innovation - Horizon 2020.*

*The Directorate-General Joint Research Centre (JRC), as the in-house science service of the Commission, supports research and innovation policy by contributing to the strategic programming of Horizon 2020 in close collaboration with all the "research family" Directorates-General. This is underpinned by providing a range of data and analysis, and by tracking developments in the policy and science of R&I at country or topic level. This serves to inform the European Semester process and the Europe 2020 strategy, especially via the Innovation Union Flagship initiative, and the European Research Area.*







Annual monitoring of progress on innovation is taking place in the framework the Europe 2020 strategy (2013 data).

### Scientific and Technical Support to R&I Policy

The JRC provides scientific and technical support to the Commission’s research and innovation policy. Activities range from foresight and horizon scanning to more specific data and analysis and tracking developments in the policy and science of R&I at country or topic level. Good examples are the Observatory for Research and Innovation (RIO) and the Bioeconomy Observatory:

#### RESEARCH AND INNOVATION OBSERVATORY (RIO)

Set up in 2012, the JRC’s Research and Innovation Observatory provides evidence to support the Commission’s European Semester analysis, and to assess implementation of key policies such as the European Research Area (ERA) and Innovation Union by monitoring national research and innovation systems. Such evidence enables a better understanding of the role of research and innovation in generating growth and jobs - a vital aspect of the Europe 2020 strategy. Data on specific country by country situations is of growing demand, as well as analyses at (sub)national level. Other emerging economic intelligence requirements (e.g. smart specialisation) also call for innovative data gathering and analysis methods.

#### BIOECONOMY OBSERVATORY

The Europe 2020 strategy recognises bioeconomy as a key element for smart, green growth in Europe. We are establishing an observatory as an integrated source of data and information on

progress and impact of the bioeconomy. The aim is to deliver a comprehensive collection of existing data and information regarding research, policy and markets (including biomass availability and biomass uses). This will allow for the development of forward-looking analytical and modelling tools.

### Strategic Programming

The JRC supports the strategic programming exercises of Horizon 2020, starting with the 2016-2017 exercise. This involves identifying the key scientific challenges and bottlenecks for selected thematic areas within each of Horizon 2020 parts of the programme. These assessments, based upon our general expertise and knowledge, are supported by horizon scanning and foresight activities. A pilot project in the field of energy has already been launched. Our assessments are used by the Commission’s research and innovation service to help to define the Horizon 2020 strategic and work programmes.

### Specific Scientific and Technical Support

For selected thematic areas identified in the strategic programming exercise we work together with the Commission’s service for research and innovation for the development of European research and innovation capacity. Joint activities include foresight, knowledge centres and observatories and technology monitoring and assessment.

# TAXATION

*Increased tax policy coordination would help Member States to support smart, sustainable and inclusive growth in the EU. Quantitative analyses of taxation schemes are key for the fiscal consolidation of EU economies. In addition, better taxation coordination among Member States would support the Commission's objective to ensure that tax policy supports wider EU policy objectives.*

*The Directorate-General Joint Research Centre (JRC) supports the work of the Commission in this area mainly by modelling taxation policies and analysing their potential impacts.*

*Our work in this area for the European Commission's service for taxation and customs union is also done in close collaboration with the services for economic affairs, and employment, social affairs and inclusion.*



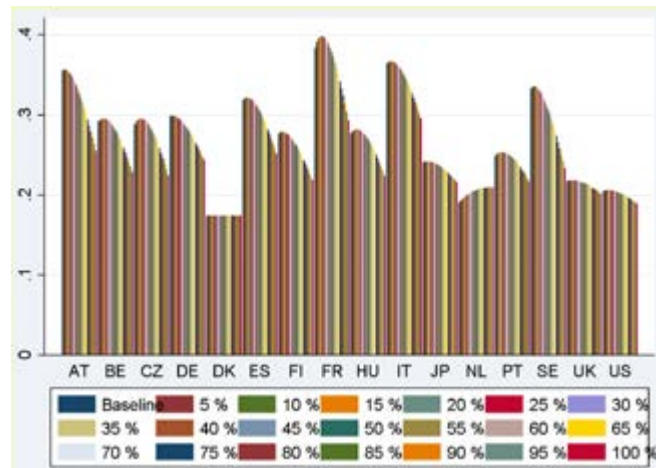
## Modelling taxation policies

As part of its support to Commission policy on improving prudential regulation for EU banks and insurances and addressing financial risk, the JRC has studied the relationship between systemic banking risk and taxation of financial instruments and activities in order to establish the role played by taxation policies in the expansion of the banking sector.

To support the analysis of taxation and employment, our scientists are investigating bringing in house for the Commission the EUROMOD, a multi-country tax-benefit model for the European Union. The key issue is how to make it compatible with other models used by the Commission for the country-specific assessments of the fiscal impact of tax in the framework of the European Semester. The question as to which model is to become the standard in Commission studies on taxation is an important one.

Our analysis supports impact assessments looking at tax shifts in order to find out the best options to lower taxation on labour or to increase fiscal pressure on environment-damaging or natural resource exhaustion activities.

Through the GEM-E3 model (an applied general equilibrium model that covers the interactions between the economy, the energy system and the environment, well suited to evaluate fiscal issues) and the FIDELIO model (Full Interregional Dynamic Econometric Long-term Input-Output),



A recent JRC study looks into the combined impact of capital, labour and energy taxes on the cost of doing business. The graph shows a change in the effective marginal tax rate on total production costs when shifting taxes from labour to energy.

our researchers can, for instance, develop appropriate methodologies and tools to include the “green growth” concept and the competitiveness effect of the green tax reform in the analysis. DG JRC has also studied the trade impacts and economic effects of fiscal policies (QUEST model).

## Behavioural science

The JRC is developing a behavioural science capacity to help Commission services design and conduct behavioural studies. Our scientists are analysing how tax policies influence the behaviour of economic agents (and vice versa) in different EU countries.



# TRADE

*With the goal of securing prosperity, solidarity and security in Europe and the rest of the world, the EU's trade policy aims to drive growth by improving trade conditions for European companies and to foster sustainable development around the world.*

*The Directorate-General Joint Research Centre (JRC) provides scientific expertise in cases where trade disputes may arise or where monitoring of trade rules and obligations occur, while also assisting in the implementation and evaluation of the EU's position in trade negotiations and the impact that international trade has on the EU market, job creation, and the environment. In particular, through feasibility studies on international trade regulations, pre-normative research on international standards, modelling exercises on the impacts of trade, and expert advice in cases of trade disputes especially in the area of food safety, the JRC is helping to ensure that the EU can continue to secure its position as a global trading power.*

*We work with a wide array of international partners in the area of trade and provide scientific support to the European Commission's Directorates-General for trade, enterprise and industry, agriculture and health and consumers.*



## The Transatlantic Trade and Investment Partnership agreement

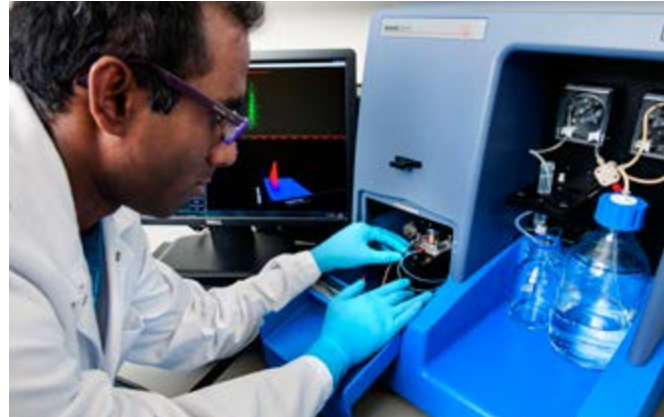
A sizeable share of the overall economic gains expected from the transatlantic trade and investment partnership agreement currently under negotiation between the EU and the United States, will arise from regulatory aspects in reducing the unnecessary costs faced by companies engaged in trans-Atlantic trade. Regulatory transparency fosters trade as it makes information more available and thus facilitates traders in operating their businesses. Since the EU market is more transparent than the US market, current trade negotiations with the US aim to reduce present information asymmetries, which may benefit US firms at the expense of EU firms. It is in this context that the Commission's directorate for trade has asked the JRC together with the service dealing with enterprise and industry to run a feasibility study on the setting-up of an EU-US regulatory database, accessible by exporters and importers on both sides of the Atlantic in order to reduce information barriers.

## International cooperation on product regulation and standardisation

The JRC is involved in various areas of international cooperation, mainly in the area of food chemicals and nanomaterials, which relate to the regulatory component of trade negotiations. Examples are the on-going collaboration with the US Food and Drugs Administration, the US Environmental Protection Agency and US National Institute for Health in the field of alternatives to animal testing, or the collaborations with the US National Institute of Standards and Technologies (NIST) and with the Ministry of Science, Technology and Innovation of Brazil on nanomaterials.

With the Argonne National Laboratories of the US Department of Energy, the JRC is looking into standardisation and harmonisation of electric vehicles, e-vehicle components as well as the interaction of the electric vehicles with the grid. An agreement has been made to establish

twin electric vehicle smart grid interoperability centres both in the US and in the EU, at the JRC's premises.

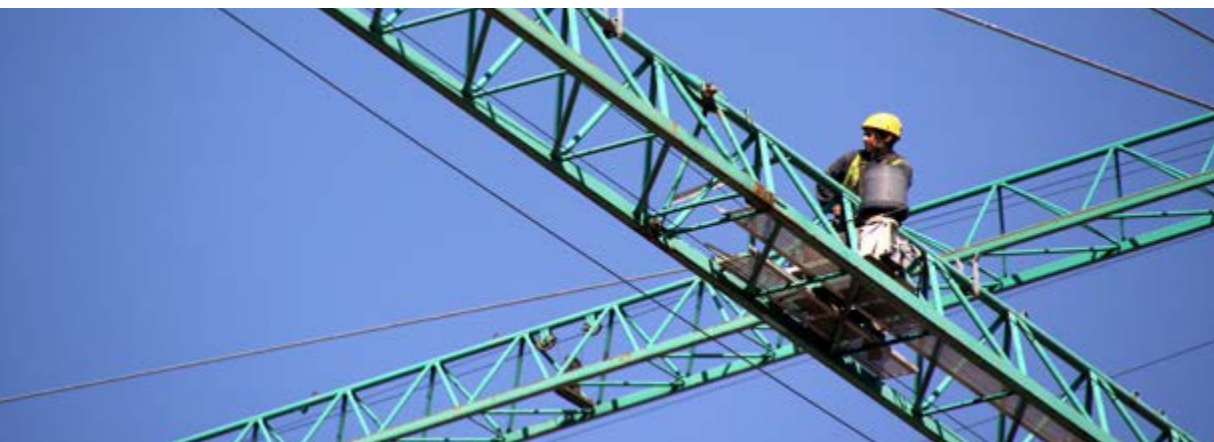


*Measurement of particle size distribution of nanomaterials by a JRC scientist.*

## Socio-economic and environmental impacts of trade

We also support trade policy through modelling and analysing the socio-economic and environmental implications of trade. In particular, our scientists analyse the links between jobs and trade (for the EU and individual Member States), and how external trade and foreign investment flows are linked and affect value chains and employment in the Single Market. Through modelling, they are able to establish the position of industries and countries in terms of their global production, as well as measure the effects of gains and losses from trade due to shifts in the global market and the links between trade, resource use and pollution.





The JRC also helps to improve the quality of European data used in international trade analysis, for instance through the global trade analysis project, whose aim is to create a 'global language' on economic analysis through improvements in quantitative analysis of global economic issues.

In the area of trade in agricultural commodities, we provide market outlooks for the EU agricultural market by monitoring macroeconomic, policy, and weather conditions. The JRC has also been a key player in contributing to the debate on price volatility in the food supply chain and its impact on global agricultural trade.

### **Export controls and trade defence instruments**

Our service provides in-depth expertise on technical issues associated with export controls,

particularly in the area of dual-use items. They represent a significant portion of EU trade and bring together a vast array of companies providing high value-added jobs across a wide range of key sectors of the EU economy. These export controls affect production and trade of typically high-tech, advanced products across a wide-range of civil industries and they are crucial to the EU's drive towards innovation and competitiveness.

We also support the Commission's trade service in maintaining and improving the system to combat distortions and unfair trade practices in international trade. For example, when in 2013, the Commission decided to impose provisional anti-dumping duties on imports of solar panels, cells and wafers from China, the JRC provided data and market analysis, which helped to reach a quick final EC decision in the case.





If you would like to learn more about the activities of the JRC, please contact:

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**Abstract**

This publication provides a comprehensive overview of the JRC's work to support the different EU policy areas. It showcases the JRC's independent and evidence-based scientific and technical support to the development, roll-out and assessment of EU policies. The content is organised in alphabetical order as a dictionary of 23 self-standing chapters – each describing the JRC's work in a specific policy area.





## 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.

**Serving society**  
**Stimulating innovation**  
**Supporting legislation**

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<https://ec.europa.eu/jrc>

