



Joint Research Centre

Annual Report
2021

Table of Contents

Foreword by Commissioner Mariya Gabriel	3
Observations from the Board of Governors	4
Editorial by the Director-General	5
COVID-19	11
Strategic foresight and resilience	15
New European Bauhaus	19
Support to EU political priorities	23
A European Green Deal	24
A Europe fit for the digital age	28
An economy that works for people	30
A stronger Europe in the World	34
Promoting our European way of life	38
A new push for European democracy	40
Key facts and figures	44

Foreword by Commissioner Mariya Gabriel

For many Europeans, 2021 was a year of challenges – millions of us were directly affected by the pandemic or had families, friends or colleagues who struggled with the disease and its impact on our lives and societies. During the summer, climate-induced disasters such as droughts and floods wreaked havoc with unprecedented frequency and severity. Then energy prices started to soar, affecting many people just as winter approached. These challenges serve to bring us together as Europeans as we strengthen our resilience. In an impressive display of community spirit, the European Commission, EU countries, regions and municipalities have joined efforts with industry, citizens and the scientific community, to anticipate problems and identify possible solutions in a fast and efficient way. I truly believe that one of the main strengths of European policymaking is that we pool our efforts, and we take an evidence-informed approach.

Operating at the interface between science and policymaking, the JRC has had a busier year than ever, making major contributions to each of the six political priorities of the European Commission, as shown in this Annual Report. In fact, the JRC is indispensable for European policymaking, underpinning almost every policy initiative or legislation with high quality, independent scientific advice. Therefore, it warmed my heart to see that in the 2021 Eurobarometer survey, 86% of Europeans confirmed that the overall influence of science on policies is positive. In a time of competing claims around evidence, Europeans' belief in the role of publicly funded science remains solid.

Although this report is by no means exhaustive, I hope the examples will give you a flavour of what the JRC is doing, the breadth of JRC expertise, and the impact of its work on EU policies to impact society positively. The JRC approaches the wide variety of aspects linked to a specific challenge in an integrated manner, bringing together different scientific disciplines in an effective and coherent way instead of looking at each aspect in isolation. As you will see in the report, this is particularly apparent in the range of activities the JRC has undertaken to deal with the multifaceted challenges linked to COVID-19 and on the European Green Deal. Here, the JRC has undertaken key activities ranging from impact assessments, identifying future scenarios and developing testing methods, to mapping and modelling.

Let me also highlight the launch of two new initiatives in 2021 – the European Commission's Knowledge Centre on Cancer and the New European Bauhaus. Both are led by the JRC, in collaboration with other Commission services and with the collaboration of many partners from different sectors across Europe. I would like to thank JRC colleagues for their extraordinary commitment and many valuable achievements in 2021, and I would like to thank the many friends and partners of the JRC for all their support throughout the year. Looking ahead, 2022 already seems likely to set us further challenges as a European Union and as individual Europeans. However, I look forward to the JRC's continued support to the European Commission's political priorities and to fruitful cooperation with our many partners, as we stay united behind our science, serving the EU project as best we can.



Mariya Gabriel
European Commissioner for Innovation, Research,
Culture, Education and Youth

Observations from the Board of Governors

2021 has been a year when science has supported policymaking more than ever. Although the pandemic is not yet over, it has also been a year of hope – hope in recovery and building a more resilient future.

The Board welcomes the European Commission's response to the COVID-19 crisis, both in trying to minimise the public health threat and deliver on the vaccines, while investing in economic recovery through the Next Generation EU instrument. The Board compliments the work of JRC's scientists in supporting the Commission to tackle the pandemic, and in assessing Member States' recovery and resilience plans.

The challenges we have been facing have made it even more important to invest in research and knowledge. The Board encourages the JRC to continue its valuable work in providing science for policy and leading the way in the EU's research and innovation.

The Board welcomes the entry into force of Horizon Europe and the Euratom Regulation. While expressing its regret at the significant budget cut for the Euratom programme, the Board extends its support to the JRC senior management in their endeavours to absorb the cuts over the years and across directorates. Through the work of its Ad hoc Groups, the Board remains closely involved in the process of drafting the revised JRC nuclear strategy and directly supports the process of the JRC's organisational transformation.

The Board welcomes the adoption of the JRC Work Programme 2021-2022, which clearly supports the Commission's priorities and the implementation of Horizon Europe and the Euratom programme.

The Board supports the development of a more strategic approach for the JRC's participation in Indirect Actions, which should ensure synergies and optimal use of research results for policymaking. The Board equally supports the JRC's prominent role in the EU missions in Horizon Europe.

The Board emphasises the continuous work done by the JRC in support of the Commission's priorities and the JRC's significant contribution to important legislative files in 2021, including the first delegated act of the EU taxonomy for sustainable activities, the Fit for 55 package and the EU Strategy to tackle Organised Crime.

The Board signals the importance of the work of the JRC in nuclear decommissioning, in synergy with national programmes of European countries, and in international cooperation, with the successful signature of the EU-India agreement on peaceful uses of nuclear energy.

The Board compliments the work done under the New European Bauhaus initiative, highlighting its importance in creating a greener and more sustainable future.

The Board welcomes the second [Strategic Foresight Report](#), focused on shaping and securing the EU's open strategic autonomy by 2040 and beyond, with the JRC being at the centre of this evidence-based participatory policymaking process.

The Board welcomes the launch of [knowledge centres on cancer](#) and [Earth observation](#), as well as the competence centre on participatory and [deliberative democracy](#), and encourages the JRC in its efforts to centralise knowledge.

The Board strongly supports the JRC's efforts to strengthen interinstitutional relations, as well as its outreach work and encourages even stronger contribution and presence.

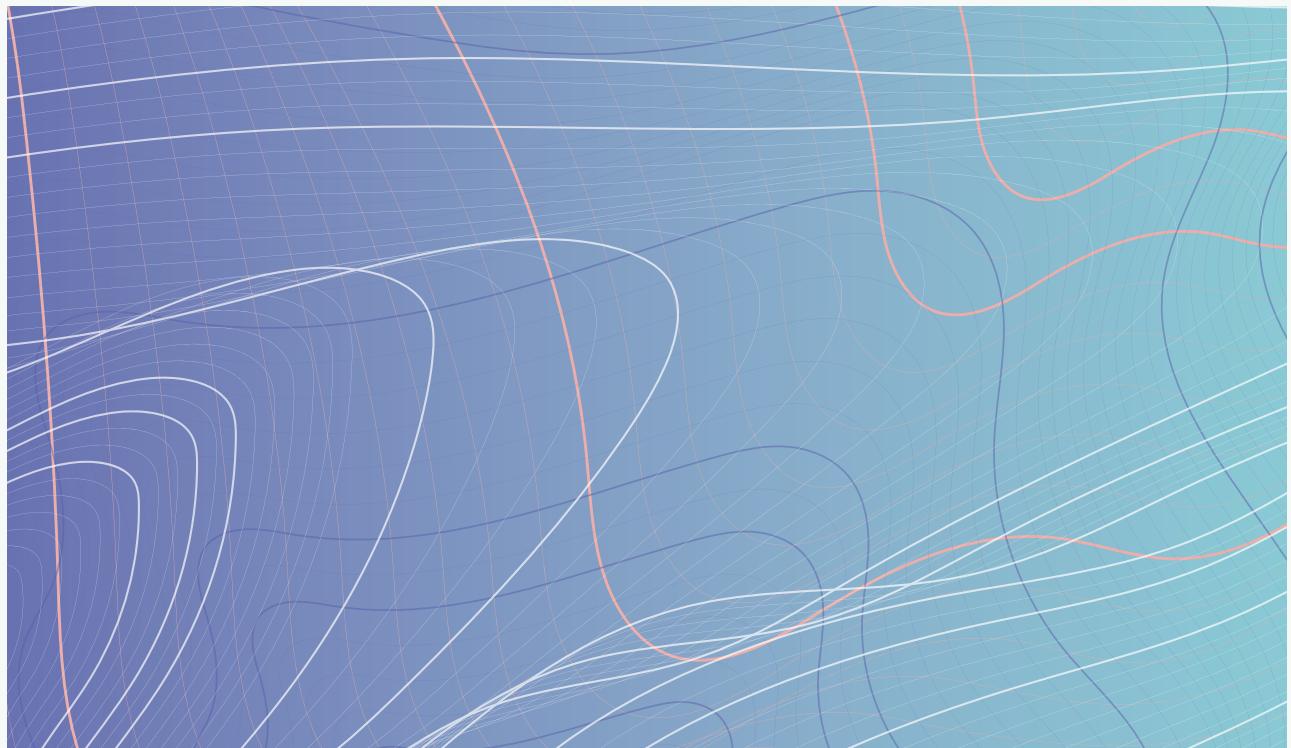
The Board welcomes the JRC's role in the development and implementation of the Commission's 'Global Approach to Research and Innovation' - and the active cooperation with international partners.

The Board acknowledges the JRC's engagement with the Western Balkans, supporting transformation agendas, as well as its support to the Transatlantic Partnership, including through the Implementing Arrangement with the US National Institute for Standards and Technology.

The Board endorses this Annual Report and reiterates its appreciation for the work of the JRC in 2021. The Board looks forward to providing continued guidance and support in 2022.

Editorial by the Director-General

Stephen Quest



Welcome to the [2021 Annual Report](#) of the Joint Research Centre, the science and knowledge service of the European Commission, whose mission is to support EU policies with independent scientific evidence throughout the whole policy cycle.

As Europe started to emerge from the worst extremes of the Covid-19 pandemic last year, we at the JRC continued our support for EU policies across the board: from the [twin transitions](#) (green and digital), to extensive support to the [Recovery and Resilience Facility](#) actions to boost Europe's economy; informing the discussions on Europe's strategic autonomy in the world; and helping to shape public health policy.

2021 was also a year of change for the JRC. We entered into a new multiannual financial framework and embarked upon three new programmes: the new Horizon Europe and Euratom programmes; the nuclear decommissioning and waste management programme; and the new JRC work programme 2021-2022. On top of this, we initiated the preparation of a new nuclear strategy for the JRC, laying the basis for our work in the nuclear area for the coming decades.

We did all of this by creating and managing high quality, fit-for-purpose scientific knowledge in support of evidence-informed policy. In addition, we learned valuable lessons from the way Europe responded to the Covid-19 crisis and how we at the JRC played our part in that. The pandemic was also a stress test of science for policy, highlighting the indispensable role that science plays in helping us manage complex policy problems. Examples in this report demonstrate not only our capacity to mobilise rapidly, but also the wide scope of our support, including the release of a new test method for the Omicron variant in December 2021, near real-time assessments of the economic situation, and of the impact on education and children's on-line safety.

Our capacity to respond rapidly is built on a track record of providing evidence-based knowledge over the years and of pushing for evidence-informed policymaking

both inside and outside the Commission, throughout the policy cycle. Scientific work takes time to plan, to conduct, and to deliver results, whether contributing to a new standard in energy efficiency, assessing artificial intelligence techniques in robotics for children, or investigating how values and identities shape the political landscape.

The experience of Covid-19 also highlighted that, in a crisis, it is essential to communicate and explain the evolving nature of knowledge and the uncertainty around research-based claims. It required an agile response from our scientists and has increased dialogue between EU and Member State levels on the critical importance of scientific knowledge for effective policy and decision-making to strengthen resilience in the face of complex crises. We will build on this momentum in the coming years.

A core plank of JRC expertise lies in our capacity to anticipate future policy needs and developments. We took on a strengthened role in the field of strategic foresight where our 2021 report on strategic autonomy identified ten key areas in which the EU can strengthen its capacity and freedom to act. Prior work in the field of population and demography resulted in the launch of the *Atlas of Demography*, a freely accessible, interactive platform, providing quick access to a wealth of demographic data and knowledge at EU, regional and municipal levels.

Much of our work also involves connecting the dots across policy areas. A prime example is the co-designing and implementing the [New European Bauhaus](#). A truly cross-cutting movement, integrating the [Green Deal](#) with education, industry, art, inclusion, regional and many other aspects of our policies, it has also drawn on our competences in citizen engagement with a particular emphasis on inclusiveness and co-creation. Many other examples can be also found in our work on the [European Green Deal](#) and all other [EU Priorities](#) as the JRC has interdisciplinary teams integrating knowledge from data collection, modelling in impact assessments, expert analysis and forecasts.

Furthermore, recognising the pace and extent of disruptive change in our broader environment, we set ourselves the challenge to reset, re-imagine and re-energise the JRC for the future to further strengthen our role at the service of the European project. While the JRC's role will remain the provision of independent, evidence-based knowledge and science supporting EU policies, by strengthening our partnerships inside and outside the Commission, we can help provide answers and solutions to the complex and inter-linked challenges faced by our society. We want to build on our strengths, using our convening power to add stakeholder value and deliver better integrated EU policymaking.

The Annual Report 2021 summarises our progress and also tracks how we are delivering against these ambitions, in order to provide real value for our stakeholders. JRC engagement in 2021 helped underline the importance of ensuring that policy is backed by scientific evidence. The activities and achievements highlighted illustrate that the JRC is taking important steps to help our stakeholders strengthen the role of anticipation and integration in policymaking, to help achieve greater impact for EU policies.



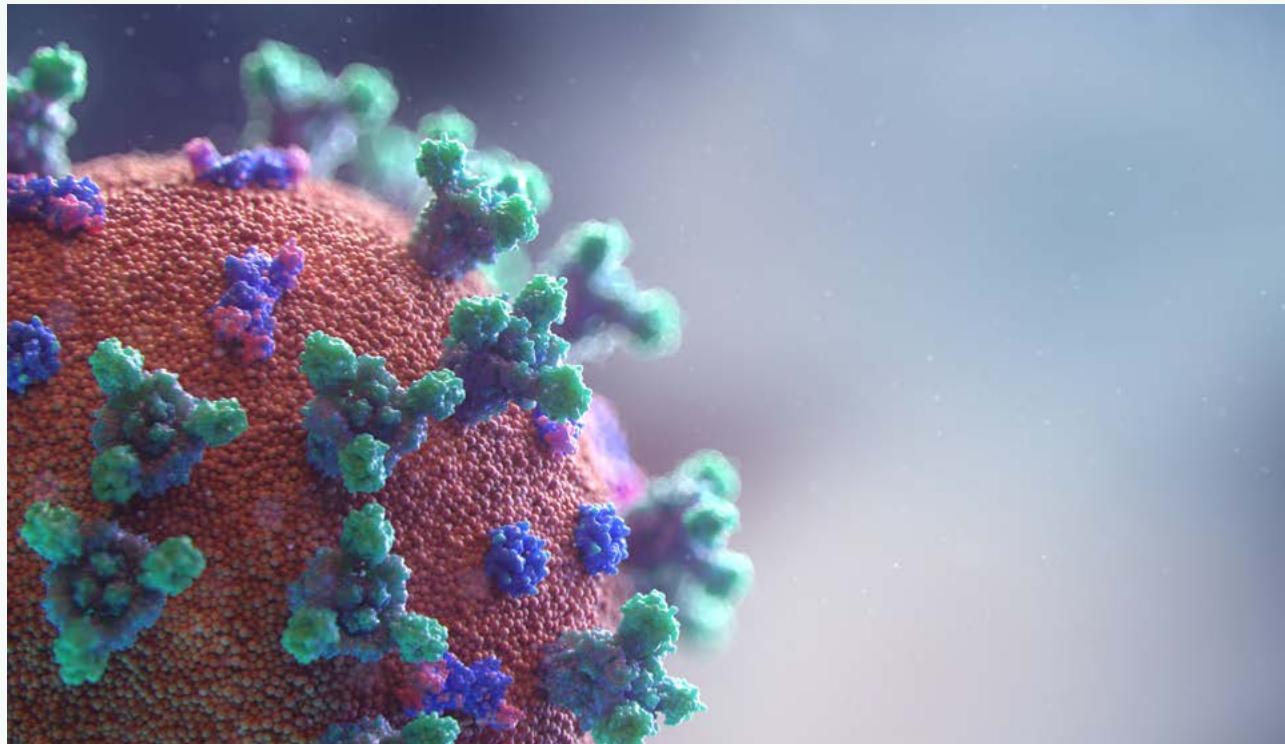
Stephen Quest
Director-General of the Joint Research Centre

COVID-19

Throughout 2021, COVID-19 continued to impact our lives and, in many ways, it was a year in which we continued to adapt to the presence of the virus in our lives. As we gradually emerge to what will hopefully be a post-pandemic society, it is easy to forget the scientific and societal challenges that we faced during the year. It has been a year of vaccine roll-outs, new variants, digital vaccine certificates, coupled with the effects on our economy and society as a whole. If the pandemic has demonstrated the complexity of managing a coherent and effective policy response, it has equally highlighted the essential underpinning role of science for policy. Working hand-in-hand with colleagues within the Commission, Member States and internationally, at the JRC we focused our efforts on providing pragmatic, timely, evidence-based support across a range of areas. Beyond expertise, the fact that the JRC is a ‘trusted partner’ played an important role. With decades of experience in the development of reference methods and materials, in contributing to standards and common protocols, and in partnering with organisations, we were able to mobilise and mount an agile response. As recently as December, the JRC developed and published a cheap and reliable method to detect the Omicron variant in a matter of weeks.

Examples outlined here illustrate the breadth of JRC’s knowledge and support across the policy spectrum, whether helping the European Medicines Agency and Member States to predict consumption of medical supplies to helping to ensure recognition and integrity of the EU Digital COVID Certificate. In collaboration with DG Environment and the World Health Organisation, we have created a collaborative platform to connect wastewater-based surveillance of the virus and its variants in the EU Member States.

With the economy hit hard by the pandemic, we have monitored the repercussions of the COVID-19 crisis, contributing to the Commission’s 2021 Winter and Spring Economic Forecasts and providing real-time assessment of the economic situation.



Rapid development of an Omicron-specific detection method

Omicron is the most prominent SARS-CoV-2 variant of concern, characterised by its high transmissibility and its frequent mutations. Heavily mutated variants like Omicron may even slip through the usual detection net and lead to 'false negative' results. Throughout 2021, we continuously monitored SARS-CoV-2 evolutions to identify potential issues with detection methods. This involved analysing the viral genomic sequences in real-time to determine if current detection methods were still effective.

In December 2021, our scientists rapidly developed and confirmed *in silico* a new detection method, specific to Omicron. It enables any laboratory operating standard PCR technology to quickly identify the Omicron variant, without expensive and time-consuming sequencing. We have published the method as open access, and it has already been viewed and used by thousands of scientists.

Epidemiological monitoring

The JRC developed the Scenario Analysis Toolbox to support the European Medicine Agency, the European Centre for Disease Prevention and Control, and Member States in determining scenarios for their predictions of consumption of medical items (vaccines, antivirals, etc.). Following its launch in early 2021, it received more than 1000 requests for calculations a month on average, with interest increasing at the end of the year due to Omicron.

Our daily COVID-19 Factsheets containing the latest data and reviews of scientific papers were broadly read by policymaker colleagues in the Secretariat-General and other Commission Services.

Development of a new ‘double antibody’ to prevent and treat COVID-19

The JRC, in collaboration with different partners, developed a second-generation ‘double antibody’ that is effective in neutralising the SARS-CoV-2 virus and some of its variants. The antibody-based immunotherapy supports the patient’s own immune system in being more targeted towards specific proteins of the virus, thereby preventing its proliferation. It has applications in both the prevention and treatment of COVID-19.

In their development work, JRC scientists used state-of-the art laboratories to develop and apply analytical methods for measuring purity, stability, binding and biocompatibility of this bispecific antibody.

Assessing the impact of COVID-19 measures

Beyond pharmaceutical interventions, such as vaccines or therapeutics, countries introduced many other measures to fight COVID-19, including physical distancing, mask wearing and quarantines. But what are the real impacts of these measures? The Response Measure Database developed by the JRC in collaboration with ECDC is a unique evidence base to identify the effectiveness of the response measures to the pandemic in the various countries. It has been presented at different conferences across Europe for wider outreach.

Digital COVID Certificate

2021 also marked the year in which European citizens became familiar with the EU Digital COVID Certificate. All EU countries recognise this tool, which allows citizens to move from one country to another. Our role here was to help define the underlying trust model, which is essential for the trustworthiness of the certificates, by confirming their authenticity, validity, and integrity. In addition, the COVID-19 In Vitro Diagnostic Devices and Test Methods Database played a key role in proving that the rapid antigen tests used are part of the common list approved by the Commission’s Health Security Committee.

Impact of fiscal policies in EU countries on households during COVID-19

Fiscal policies of EU countries at the onset of the pandemic helped to cushion the impact of the crisis on household income, avoiding major social disruptions. Based on the EUROMOD model, our analysis found that most countries experienced a large drop in market incomes during 2020, with poorer households hit hardest. But it also found that the tax-benefit systems absorbed a significant share of the COVID-19 shock on market incomes and were able to offset its regressive nature in most countries. Short-term work schemes, widely implemented or revised to compensate for the reduction in economic activity, played a major role in this process.

As a consequence, income inequality and the risk of being below the poverty line in 2020 were only marginally affected by the pandemic. This analysis has been widely used: from the EC assessments of the national recovery and resilience plans of Member States, to the flagship Employment and Social Developments in Europe (ESDE) Report or the Quarterly Review of the Euro Area (QREA).

Monitoring effects on cultural and tourism sectors

The JRC collected the data and relevant analyses, delivering the report 'European Cultural and Creative Cities in COVID-19 times: Jobs at risk and the policy response'. The report assesses the potential effects of the pandemic based on pre-COVID evidence from the Cultural and Creative Cities Monitor, highlights best practices and policies, and makes recommendations for future policies and funding programmes. Both the European Parliament and the Council of Europe used the findings to feed into their work on the cultural and creative sectors. The JRC's [Cultural Gems app](#) was highlighted among the 'EU tools to facilitate the re-opening' in the Commission Communication on this issue.

As a major employer and contributor to the EU's economy, the tourism sector was also hard hit by the health crisis, dropping by 95% in some EU regions. To support tourism, we worked with DG GROW to develop a novel EU Tourism Dashboard. The Tourism Dashboard is aimed at supporting the green and digital transitions of the tourism sector towards higher resilience and sustainability.

Wastewater surveillance

Wastewater surveillance to track SARS-CoV-2 / COVID-19 has emerged as a cheap and reliable early warning tool. We provided scientific support to the European Commission's Recommendation adopted in March 2021 on monitoring COVID-19 and its variants in wastewaters in the EU. We also developed a sentinel system with DG ENV and WHO to better understand the spread of the virus. Together with the European Centre for Disease Control (ECDC), we worked on criteria to reliably identify SARS-CoV-2 variants in wastewater. An EU Guidance for Practitioners is under development.

Online sentiment analysis

How have EU citizens coped with the pandemic? The JRC performed online sentiment analysis during the pandemic on topics such as vaccination, tourism, online education, COVID-19 restrictions, and acceptance of the Digital COVID Certificate. The work gives insights into Europeans' attitudes towards these issues, which can better inform policymaking.

Impact of COVID-19 on education and children's online safety and well-being

In response to what was undoubtedly one of the biggest upheavals in the history of education and school, we published a qualitative and quantitative study called 'Kids' Digital Lives during COVID Times'. It addresses the impacts of the forced digital transition due to lockdown on children's [online safety](#), [privacy](#), as well as [education and well-being](#), gathering data from 26 partner organisations in 14 countries across Europe. This work fed into the new EU Strategy on the Rights of the Child, the Council recommendation for Blended Learning and, in light of its global relevance, also a policy brief for the G20 in Milan.

JRC findings on COVID-19 and its consequences on learning outcomes and inequalities informed the Commission's initiative on Pathways to School Success. We provided insights on European trajectories of learning loss and inequalities during COVID-19 in the framework of DG Education and Culture (DG EAC)'s inclusion policies. Using recent cross-national education data, merged with other school-related pandemic indicators and sophisticated modelling techniques, the results forecast in which European countries COVID-19-induced learning losses are likely to be worse.

Strategic foresight and resilience

How can policymakers prepare, anticipate and adapt to changes, to proactively shape future policies so they effectively meet the EU's political priorities? At a time when the future appears increasingly uncertain, reflection and evaluation around public policy relies more and more on foresight – a method of analysis that seeks not to forecast, but to anticipate the future in order to prepare for it.

Our Competence Centre on Foresight was created to strengthen strategic foresight and anticipation capacities in EU policymaking and supports Vice-President Šefčovič in his mandate. Strategic foresight helps anticipate trends, risks, and emerging issues, as well as their potential implications and associated opportunities. These insights can be used for strategic planning and increased preparedness in policymaking, in the initial policy design, in policy implementation, when involving stakeholders, and while developing innovative knowledge. At the JRC, we are uniquely placed to integrate cross-cutting expertise in foresight techniques and scientific knowledge across a range of disciplines, with the capacity to engage with stakeholders in furnishing such support.

A strong focus of our work in 2021 was on the preparation of the Commission's annual foresight report 'European Strategic Autonomy towards 2040 and beyond'. Four scenarios were constructed with the help of over 100 stakeholders to present a different future for Europe. Examining geopolitics, technology, the economy, environment, and society, the report highlights ways in which the EU can start to benefit from positive developments and transform risks into potential for positive transformation. Unsurprisingly, other foresight exercises undertaken throughout the year support the digital and green transitions on the future of green jobs, the development of scenarios for European rural areas and on the bio-economy. Finally, an acknowledgement of the importance of foresight in policy was its inclusion in the Better Regulation Toolbox, where foresight is recommended to be used for impact assessments and evaluations.

“...we are stepping up efforts to simplify EU legislation and reduce its burden, while making better use of strategic foresight and supporting sustainability and digitalisation.”

Maroš Šefčovič
Vice-President for
Interinstitutional Relations
and Foresight



Securing the EU's strategic autonomy towards 2040

The COVID-19 pandemic demonstrated how interrelated the global economy is and how quickly shortages to supply chains can arise. To get an overview of future challenges and opportunities, the JRC conducted a multidisciplinary, participatory foresight study on the EU's open strategic autonomy towards 2040 in five areas: geopolitics, technology, economy, environment, and society.

Our study showed that to overcome the decline in democracy, perceived worldwide, as well as increased polarisation in society, our systems need to embrace participatory and inclusive governance. This requires the co-design and co-creation of policy solutions and services with citizens to enhance trust and legitimacy at all levels of governance. Likewise, reinforcing the international role of the euro could enhance the stability and resilience of

the financial system and increase the EU's economic sovereignty. Furthermore, the green transition offers an opportunity for the EU to become a leader in emerging green technology sectors.

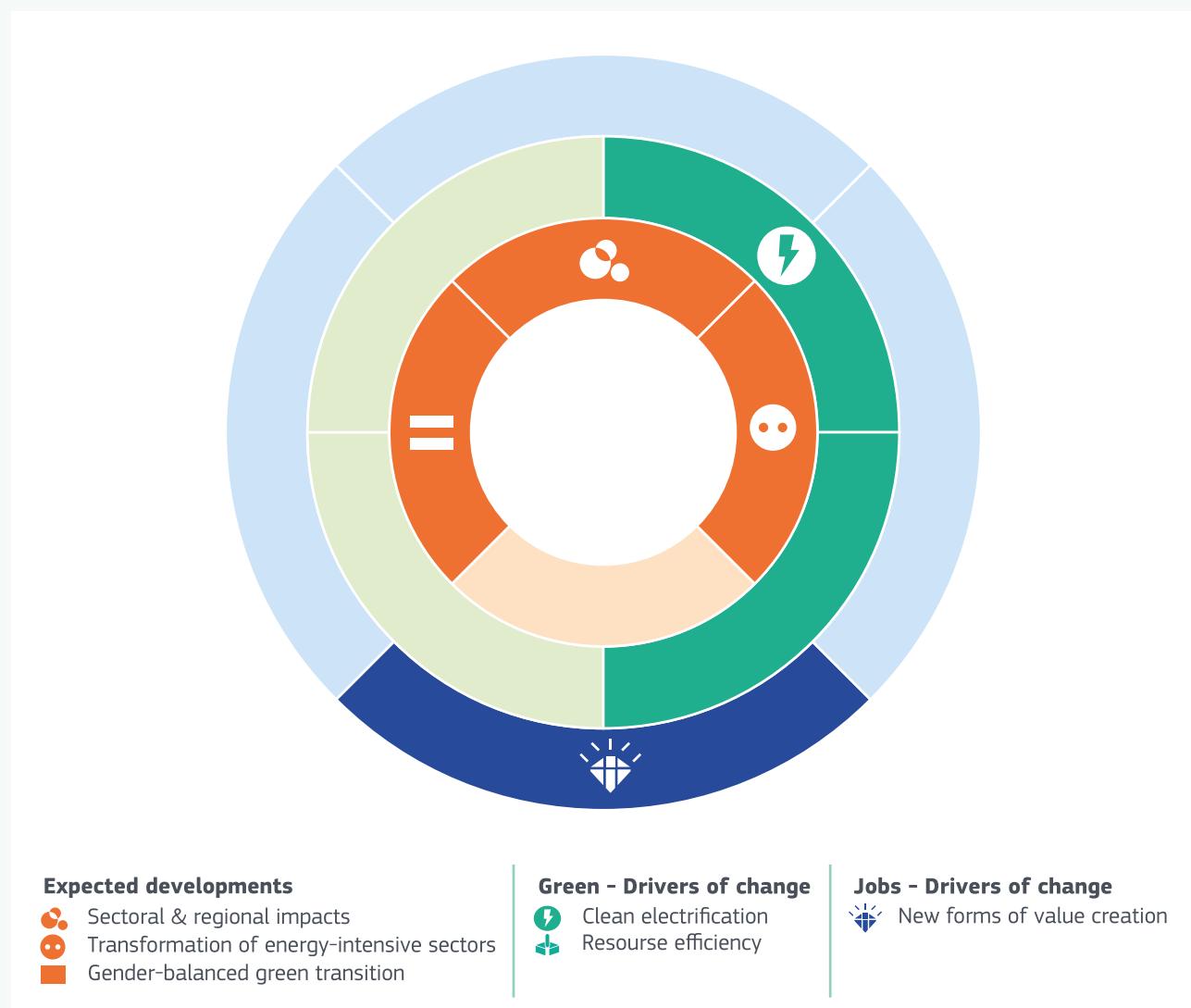
At the same time there are threats to European science, technology and innovation systems that could be disrupted by increasing geopolitical competition in the years ahead, so there is a need to safeguard these systems to maintain momentum. One opportunity could be to strengthen strategic alliances and alignment with like-minded countries and international organisations.

The future of jobs is green!

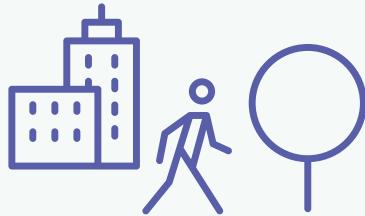
This foresight study addresses how the green transition might impact European labour markets in the medium-to long term, and how jobs will change. It provides examples of changing job roles and completely new jobs that could emerge as part of this process.

Specifically, the study concludes that the 'Fit for 55' policy could lead to a net increase of almost 900 000 jobs by 2030, compared to business-as-usual. To fully deliver, women's increased participation in technical education and jobs is however a prerequisite. It should also be noted that some of the green jobs do not even exist yet, so a pro-active approach has to be taken

in terms of education possibilities. For example, a future job could be a tidal energy producer who is in charge of installing micro-hydropower devices and dynamic braking resistors that help prevent damage and protect against excess power generated by strong currents. People are increasingly interested in work that enables them to contribute to a sustainable future. However, this needs to be accompanied by a stronger shift in values and behaviour through sustainability awareness if we want a sustainable future.



Tidal energy producer: Future job based on expected developments and key drivers of change.



EU rural areas – What will happen over the next 20 years?

For decades, the trend has been for a net movement of people, especially those of working age, away from the countryside towards cities, but will that hold true now that many have discovered teleworking, alongside high housing prices in large cities? To address these questions and many more, we undertook a foresight study on the future of EU rural areas, based on a participatory process involving a diverse set of stakeholders and carried out in collaboration with the European Network for Rural Development. On the basis of the study, four possible future scenarios were developed, describing potential pathways for rural areas towards 2040:

- ▶ ‘Rurbanites’: People move to rural areas looking for better quality of life. Declining social cohesion, competition and limited coordination between different governance levels lead to fragmentation.
- ▶ ‘Rural renewal’: The coordination of the ‘green transition’ is one of the overarching aims of the governance systems, complemented by people moving to rural areas in search of sustainable ways of living.
- ▶ ‘Rural connections’: As population numbers and economic activity decline in rural areas, people concentrate around rural hubs. A rural strategy manages the transition.
- ▶ ‘Rural specialisation’: Most people have moved to urban centres. The consolidation of land has led to large-scale, automated facilities and vast land parcels for forestry, wilderness, and recreation parks.

The scenarios will help policymakers in Member States, rural municipalities, regions and at EU level to further reflect on important elements for a long-term vision for rural areas in Europe, including the need for future demographic change management and land use management in larger regional contexts. They also stress the central role of digital infrastructure and services for rural areas.

Shaping our future bio-economy

This [foresight report](#), produced in collaboration with DG Research and Innovation and an ad-hoc network of specialists from policy, civil society, industry and academia, outlines four alternative scenarios for the EU bio-economy by 2050. Each scenario describes the world, Europe, and the bio-economy in 2050, but with political and policy variations, and considers the contributions to the objectives of the EU Bio-economy Strategy and to selected United Nations Sustainable Development Goals.

One scenario aligns closely with the objectives of the [Commission’s Bio-economy Strategy](#) and is characterised by a fundamental societal change towards sustainable consumption, supported by a consistent and coherent set of policies. The bio-economy transition described in the scenario leads to positive effects, not only on the environment but also on rural employment, with a reduction in the gap between rural and urban areas.



Resilience Dashboards

On 29 November 2021, the European Commission launched an interactive website to navigate the resilience dashboards, a set of indicators and information on resilience in Member States and non-EU countries. The dashboards provide a holistic picture that spans four dimensions: social and economic, green, digital, and geopolitical. They will further help EU countries to assess their vulnerabilities and capacities when it comes to navigating the green and digital transitions, facing challenges, and coping with potential shocks.

The dashboards were first announced in the [Commission’s 2020 Strategic Foresight Report](#), focused on resilience as a new compass for EU policymaking. They were developed in a collaborative process led by the JRC, involving other Commission Services, Member States and relevant stakeholders.

New European Bauhaus

The New European Bauhaus (NEB) expresses the EU's ambition of creating beautiful, sustainable, and inclusive places, products and ways of living, aiming to connect the European Green Deal with the spaces in which we live and the way we would like to live together, respecting the planet and preserving nature. It promotes a new lifestyle where sustainability matches style, thus accelerating the green transition in various sectors of our economy.

The goal is to contribute simultaneously to the realisation of all three values to develop creative solutions that best meet the needs of people, while increasing efficiency at a lower total cost. The green transition brings many challenges, and the New European Bauhaus aims to offer solutions and transformation – from the global level to the level of neighbourhoods, cities, and villages.

From its inception, when first entrusted to the JRC, the principles of inclusiveness and co-creation have been embedded in the development of the initiative. The NEB is about bridging silos in every aspect of the way we live and do things, including EU policies and funding possibilities, where synergies between initiatives are naturally intertwined. Above all, the NEB is an innovative and participatory project, which builds on our experience at the JRC in citizen engagement and innovation.

Involving everyone, encouraging concrete actions, and finding solutions together, along with policies and different funding models, because it is this that will make a difference. It is this inclusion that ensures that no one is left behind and that the most creative solutions are born out of collective innovation.

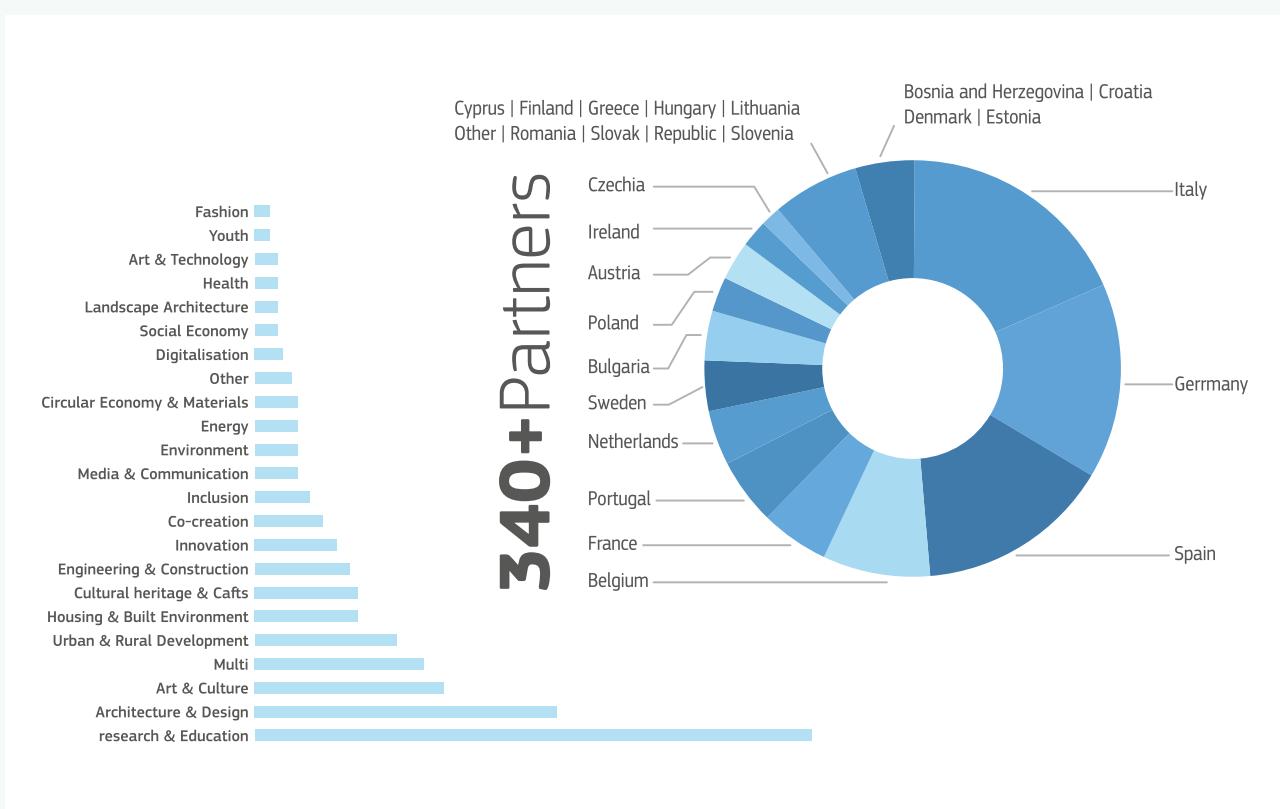
At the JRC, in addition to our experience in co-creation, the project presented an opportunity to pilot novel approaches in our efforts to reach beyond the 'usual suspects'. It also drew on our ability to convene and our status as a trusted partner, both within and outside the Commission, where we work right across the policy spectrum. Our capacity to co-create and integrate helped make this novel NEB journey from fledgling concept to a design phase, establishing a high-level round table while involving a truly diverse group of partners, through to the launch of the NEB Prize, one of 2021's success stories, and the adoption of the Communication on the NEB.

An innovative co-design process



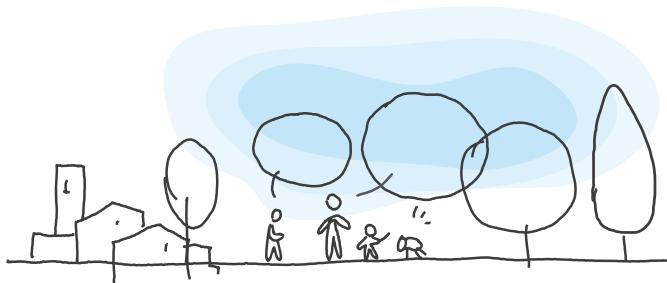
The NEB was created with an innovative co-design phase, engaging on values, calling for experiences rather than expert opinions. As a result, more than 200 contributions – ‘stories’ – were collected, including stories from the ground in the design phase. In shaping the process at the JRC, we paid special attention to inclusiveness and the creation of a community. We based our engagement and communication on what people wanted the New European Bauhaus to be, and in the process recruited a vast and heterogeneous group of partners. The New European Bauhaus Prize, which was co-organised with DG REGIO, was launched to collect concrete illustrations of the concept through inspiring examples, attracting more than 2 000 applications for this first edition. The prize ceremony focused on the community and the people behind the projects.

A diverse community of partners



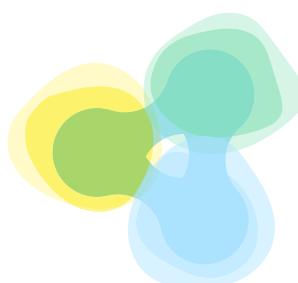
With the same perspective, the visual identity was created in an unorthodox way, to reflect the various phases of the project. We developed a visual narrative in stages:

Simple drawings to illustrate the ‘design’ phase



New European Bauhaus
beautiful | sustainable | together

A new visual identity with a logo to support the delivery



New European Bauhaus
beautiful | sustainable | together

We have also created and curated a wide media presence:



Instagram



Twitter



Website



Newsletter



Pinterest

15.5k Followers
33k Interactions
27k Video views

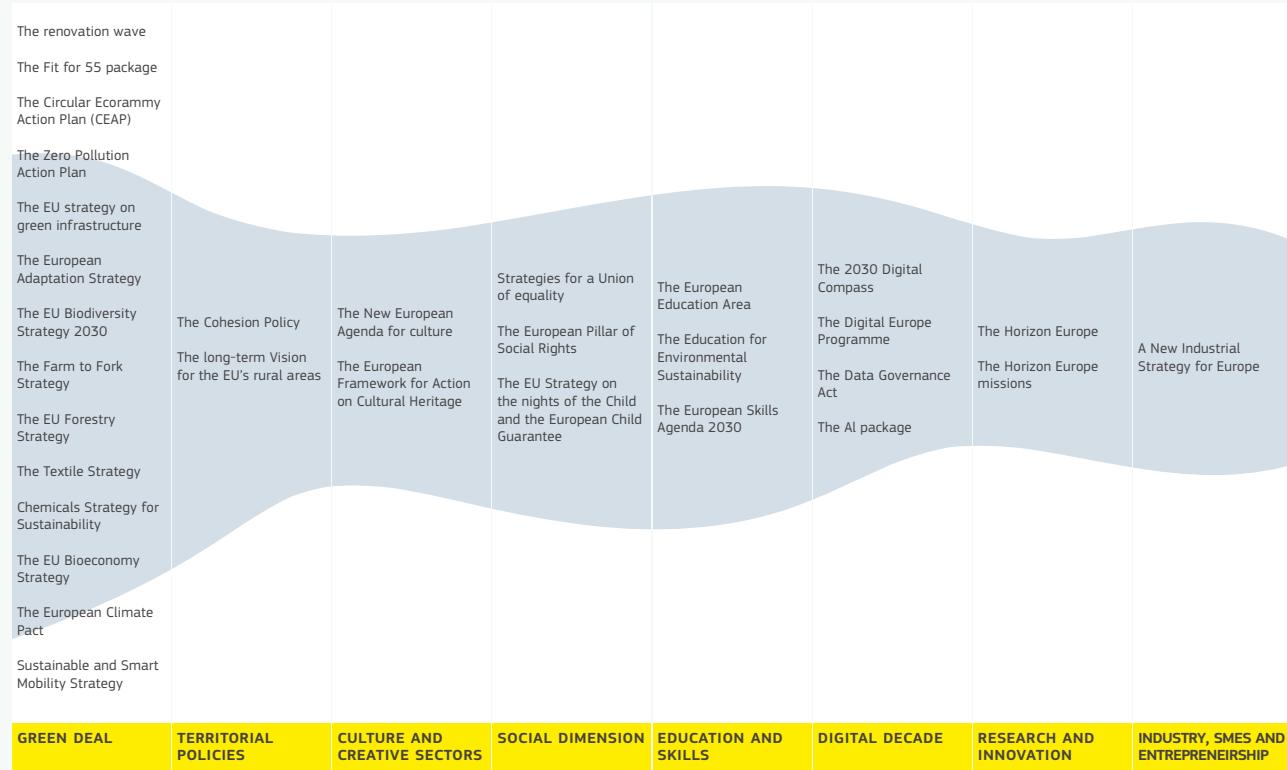
12k Mentions
25k Engagements

450k Visits
950k Page views

24k Subscribers

99 Pins

The NEB is also a co-creation project inside the Commission, a transversal initiative with a large footprint across many policy fields:



NEB calls for proposals were created across many different EU programmes and cross-DG cooperation is needed for the delivery of the initiative. For example, DG REGIO is the co-organiser of the NEB Prize and DG RTD is the co-organiser of the NEB Festival. We have also seen the emergence of thematic NEB cooperation across DGs, for example in territorial and urban dimensions and citizen participation. This is important, as the NEB has the capacity to connect many parts of the EU agenda in a very concrete way for citizens and become the crossroads of programmes, initiatives, strategies and institutions.

What's coming next: towards the NEBLab

The NEBLab will be a space for experimenting with new co-creation processes under the coordination of the JRC. The NEBLab will also help to structure and support place-based and context-specific activities emerging from the NEB Community. The NEBLab will therefore include activities stemming from an EC-led agenda as well as activities stemming

from a partner-led agenda. The activities in the NEBLab will be supported by the new community of Friends of the New European Bauhaus (e.g. local authorities and businesses), hosting activities in their different contexts and providing finance or other forms of support.

The NEBLab will not provide funding but will support the maturing of activities proposed by a group of partners through mentoring and will facilitate connections with potentially interested parties (Commission services, existing projects, regional or local authorities, businesses, experts, etc.). Mature projects meeting certain requirements will be publicly communicated as NEBLab projects.

The NEBLab ‘rules of the game’ – the modus operandi – were based on the initial input of the community of partners in a series of co-creation meetings, each involving more than 100 individuals.

Support to EU political priorities

EU priorities seek to anticipate and respond to the challenges and opportunities of our complex world and, more than ever before, require a strong evidence and knowledge base to underpin them. Throughout the year, the JRC used its multi-disciplinary expertise and analytical capability to help assess where best to make investments, shape regulations and join the dots between different policy areas. Spanning the policy spectrum, the examples illustrated are a selection of ‘snapshots’ of where we helped to make a tangible difference in 2021. In doing this, we focused on our core strengths of anticipation and integration in policymaking, to help EU policies achieve greater impact.

A European Green Deal

On 14 July 2021 the European Commission adopted the Fit for 55 package of proposals to enable the EU to deliver on the European Green Deal and the associated 2030 climate and energy targets while, at the same time, strengthening the EU's competitiveness and resilience.

As a reflection of the multifaceted and interlinked nature of Fit for 55's ambitions, the JRC is applying the full breadth of its expertise in the energy-climate-environment nexus, taking an integrated approach in our scientific support. In doing so we accelerate the Green Deal transformation, and provide the scientific underpinning to build consensus and belief in the Green Deal in Europe – and beyond.

As you will see from the examples on the next pages, we are supporting the Fit for 55 package as a whole. For instance, we map clean energy opportunities, compare the relative energy efficiency of various types of production and identify scenarios for the future, to allow policymakers to make informed choices. To monitor progress on the Green Deal, we have proposed a series of indicators that make it easy for policymakers to see where progress is on track, and where more efforts are still needed. We also predict the impact of new policy initiatives with sophisticated modelling and assist EU policymakers with impact assessments and toolboxes.

AN INTEGRATED APPROACH TO RENOVATING BUILDINGS FOR ENERGY EFFICIENCY AND SAFETY

A significant part of Europe's energy consumption is linked to the heating and cooling of our buildings, but much of it is wasted, not least because eight out of ten buildings in Europe were constructed before 1990. In 2021, on the basis of data from more than 100 million buildings in Europe, the JRC undertook several projects on energy renovation of existing buildings that analysed retrofit technologies, compared intervention scenarios, assessed methodologies and renovation costs, and located vulnerable regions and inhabitants.

A study of barriers to energy efficiency investments complemented the analysis. As a result, the JRC produced a [set of guidelines](#) for the integrated renovation of buildings for energy efficiency and seismic safety. The new JRC guidelines help authorities with the practical implementation of strategies like the Renovation Wave, New European Bauhaus and Recovery and Resilience Plans, for the benefit of millions of Europeans, while stimulating major investments to modernise buildings in an energy-efficient, safe and sustainable way.

REDUCING EMISSIONS – THE CASE OF METHANE

To achieve climate neutrality by 2050 we need to transition away from fossil fuels, in a rapid but carefully thought-through manner. Reliable data and information are crucial for policymakers to manage this paradigm shift smoothly. In support of draft EU legislation and a global partnership to cut methane emissions announced during COP26, we have calculated that methane reduction consistent with the Paris Agreement could lead to 70 000-130 000 fewer annual premature deaths globally, and 6 000 to 11 000 in the EU alone, towards 2050. We also made proposals for how to improve the reporting framework, how to reduce the methane emissions linked to flaring, and on health and ecosystem benefits of reduced global methane concentrations. The JRC also ensures coherence with the Renewable Energy Directive by estimating methane leakage values.

MAKING THE GREEN DEAL FAIR AND SOCIALLY ACCEPTABLE

In connection with the revision of the Energy Taxation Directive and the Carbon Border Adjustment Mechanism in 2021, the JRC provided evidence on the expected effects on households of various reform options linked to the two initiatives. The [JRC analysis](#) concluded that the impact of various policy options on household budgets was generally insignificant or slightly regressive, but that tax rebates via lump-sum transfers to households can mitigate or entirely reverse any negative impact. These findings formed part of the impact assessments for the Fit for 55 package.

When energy prices started to go through the roof in late 2021, and many Europeans were struggling to heat their homes, the JRC, in support of the Commission's Communication on Energy Prices, provided the impact assessment for a new toolbox. Policymakers in the EU and Member States can consult it to address the immediate impact of current price increases, and strengthen resilience against future shocks.

THE PATH TOWARDS A RENEWABLE FUTURE

With the update of the EU's Industrial Strategy, the JRC and the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, set up the [Energy and Industry Geography Lab](#). The Lab offers a user-friendly online tool for companies, energy infrastructure planners and policymakers on where to find clean energy, whether the necessary infrastructure is in place, and how much land is available for installing renewable energies. This map-based interface enables online data management, visualisation and analysis, hosts socio-economic information, and offers forward-looking capabilities.

As part of the Commission's [Strategic Action Plan on Batteries](#), the JRC assessed whether the European Battery Innovation project met innovativeness requirements in order to be eligible for state aid. The JRC analysis of 56 project portfolios helped the Commission to approve EUR 2.9 billion of public funding by 12 Member States for a second Important Project of Common European Interest (IPCEI) to support research and innovation in all segments of the battery value chain.



ASSESSING NUCLEAR ENERGY FOR THE TAXONOMY REGULATION

Following the political agreement on the Taxonomy Regulation the JRC was asked specifically to perform a technical assessment of whether or not nuclear energy could be included in the EU taxonomy of environmentally sustainable activities, with a special focus on the 'do no significant harm' (DNSH) criteria of Regulation (EU) 2020/852. The [JRC report](#) assesses radiological and non-radiological environmental and human health impacts linked to the various life cycle phases of nuclear energy, and addresses DNSH aspects of radioactive waste management. It also includes a comprehensive description of the relevant nuclear and environmental legal and regulatory frameworks at EU and international level. The report has been reviewed by the Group of Experts on radiation protection and waste management under Article 31 of the Euratom Treaty, as well as the Scientific Committee on Health, Environmental and Emerging Risks on environmental impacts, contributing to the Commission's decision-making.

SUPPORTING AN INTEGRATED FARM-TO-FORK APPROACH

[Sustainable agricultural production and consumption](#), also known as an integrated 'farm-to-fork' approach, is a key element of the Green Deal and meeting the UN's Sustainable Development Goals. On the production side, the JRC has reviewed more than 15 types of farming practice for their impact on the environment and climate. The European Commission is using the results of the analysis to assess the climate and environmental performance of Common Agricultural Policy (CAP) plans of Member States.

Equally important, on the consumption side, the JRC identified a set of indicators to evaluate consumption footprints, which helps monitor the progress of the Circular Economy Action Plan, the Zero Pollution Action Plan, the Farm to Fork Strategy, and the EU Biodiversity Strategy for 2030. We also developed a harmonised methodology to estimate how much food is wasted, and refined the EU Bio-economy Monitoring System to include the [JRC food waste indicators](#).

TACKLING FOOD FRAUD

In 2021 the JRC conducted the [largest ever investigation into the authenticity of herbs and spices](#) on the European market in support of the Commission's coordinated control plan. The results are based on about 10 000 analyses from 1 900 samples, originating from 21 EU Member States plus Switzerland and Norway, and revealed that 17 % of the herbs and spices had most likely been adulterated. Oregano in particular was affected, with half of the samples having been adulterated, mostly with olive leaves, although pepper, cumin, curcuma, saffron and paprika, and chili were also often adulterated.

Wine fraud is another problem area, costing the EU wine sector an estimated EUR 1.3 billion a year, with about 1.7 million counterfeit alcoholic beverages seized in Europe in 2021. The JRC has developed a new quality control tool to verify the authenticity of wines, in the form of a new [Certified Reference Material](#) that allows control laboratories to check whether claims declared on the label are accurate regarding the wine's vintage and geographical origin, or whether there has been undeclared sugar addition or dilution with water.

EDUCATION FOR CLIMATE COALITION AND GREENCOMP FRAMEWORK

Together with the Directorate General for Education and Culture, we established a [Coalition](#) that brings together pupils, students, teachers and education actors to support the changes needed for a climate-neutral society. Supporting both the European Education Area and the European Green Deal, the Coalition focuses on the development of green skills, teacher training, promoting behavioural change, linking education and science, and collective awareness-raising. In 2021 the co-design phase of the project kicked off with a community mapping and analysis exercise, followed by the official launch of the [community platform](#) in November.

Also, [GreenComp, the European Sustainability Competence Framework](#), was developed. This identifies a set of sustainability competences to help learners develop knowledge, skills, and attitudes that promote ways to think, plan and act with empathy, responsibility, and care for our planet and for public health. It comprises four interrelated competence areas: embodying sustainability values, embracing complexity in sustainability, envisioning sustainable futures, and acting for sustainability.

STUDY ON METHODS TO MEASURE MICROPLASTICS IN WATER

The zero pollution action plan sets a target to decrease pollution and improve water quality by reducing microplastics released into the environment by 30% by 2030. However, commonly accepted routine methods to measure microplastics pollution are not yet in place.

In this context, the JRC published the [results of its inter-laboratory comparison study](#), launched in 2020, to investigate the state of the art of methods currently applied to measure microplastics in water. With almost a hundred participating laboratories in the EU and across the globe, it is the biggest study so far in this field.

A Europe fit for the digital age

More than ever, digital technologies are imperative for working, learning, entertaining, socialising, shopping, and accessing everything from health services to culture. The ambition behind European digital sovereignty is to develop policies that enable citizens and business to lead a human-centric, sustainable and more prosperous digital future. At the same time, the EU needs carefully to assess and address any strategic weaknesses, vulnerabilities, and high-risk dependencies that put the attainment of these ambitions at risk. The European vision for 2030 is a digital society where no one is left behind and where there is leadership in ethical artificial intelligence.

The strategy also recognises that these strong ambitions can only be met if the EU overcomes strategic vulnerabilities and dependencies. One such example is our work on the 2021 Raw Materials Scoreboard, which, together with resilience, foresight and sustainability analyses, provided input to the EU's policy efforts at a time when global supply chains to the EU continue to be severely disrupted.

There are reasons to be positive. A report produced by our AI Watch, which monitors and analyses AI policies across 60 countries in the world, showed that the EU has a higher concentration of activities in autonomous robotics and AI services than most countries. This suggests that the EU is well positioned to maintain its global leadership and harness the potential of robotics to increase economic competitiveness, sustainability and strategic autonomy.

The results achieved in 2021 were obtained by working in close partnership with national and international organisations and with other Commission services.

EUROPE SET TO TAKE LEADING ROLE ON ARTIFICIAL INTELLIGENCE ON THE GLOBAL STAGE

The JRC's [AI Watch](#), which monitors artificial intelligence developments and impact for Europe, published the 2021 edition of its [Report on National Strategies](#) in tandem with an OECD report on the state of implementation of AI principles. Both reports drew on a joint database of about 650 AI policies and strategies from over 60 countries and the EU. Recommendations include strengthening AI education and skills, supporting research and innovation, creating a regulatory framework for ethical and legal issues, and establishing strong data ecosystems and ICT infrastructures.

A JRC study on the [EU's strengths in the 'AI in health' domain](#) suggested that the EU could set the benchmark for global standards in terms of safety, trustworthiness, transparency and liability.

An [analysis of the global AI landscape](#) also showed that the EU has a higher concentration of activities in autonomous robotics and AI services than most countries. Meanwhile, an [analysis of 2020 EU AI investment](#) estimated that by 2025 AI investments will reach EUR 22.4 billion, surpassing the EU target by over 10%.

NEW COMMISSION KNOWLEDGE CENTRE ON EARTH OBSERVATION FOR BETTER POLICIES

Satellites provide a wealth of data, products and services on our atmosphere, marine environment and land, but uptake of such data in policies remains a challenge. The Knowledge Centre on Earth Observation (KCEO) was launched in 2021 so that fit-for-purpose products and services can address EU policy needs in a tailored way, supporting the green and digital transitions and a Stronger Europe in the World, by integrating knowledge sources from Earth Observation and geospatial programmes. It is a key component of our support to the European Union Space Programme (Copernicus) and includes contributions to reports and briefings, with guidance on how to ensure that it continues to evolve in ways that are responsive to EU policy. The aim is to gain overarching insight on best practices and novel science to propose new policy-tailored services.

Underpinning this work is a continued focus on international standards for measurements from space to enable the acquisition of and access to Earth Observation data.

NECESSITY FOR RESILIENT AND SUSTAINABLE RAW MATERIAL SUPPLIES TO THE EU

Raw materials are key enablers of the twin green and digital transition. Recent supply shortages of semiconductors and materials like manganese, along with high import reliance on rare earth elements, show the necessity for resilient and sustainable supplies to the EU. Our foresight analyses show that increased demand and competition are likely for materials required to achieve digitalisation and low carbon ambitions.

Undertaken in close collaboration with the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, the 3rd edition of the [Raw Materials Scoreboard](#) presents an in-depth analysis of Europe's raw material supply chains, trade flows, their competitiveness, EU dependencies, as well as their sustainability. Together with resilience, foresight and sustainability analyses this Scoreboard provides input to the EU's policy efforts at a time when global supply chains to the EU face severe disruption, due to the pandemic, increasing supply shortages and a recent surge in energy prices around the world.

An economy that works for people

The EU's unique social market economy allows economies to grow and to reduce poverty and inequality, recognising that individuals and businesses in the EU can only thrive if the economy works for them. In particular, Next Generation EU is a more than EUR 800 billion temporary recovery instrument to help repair the immediate economic and social impact brought about by the COVID-19 pandemic.

To finance the green recovery, the Commission intends to raise 30% of Next Generation EU (up to EUR 250 billion) through green bonds, making the EU one of the biggest green bond issuers globally and reinforcing the EU's policy and market leadership in sustainable finance. The July 2021 proposal for a European Green Bond Standard (EU GBS) is a crucial step in the effort to help scale up green and climate finance. Our research at the JRC shows that investors have a 'taste for green', but want firms to be transparent, and tend to go green when there are policy and economic signals pointing in that direction.

Throughout the year, we have continued to furnish evidence-based analysis integrating data and knowledge. One such example is a statistical pocket guide, which we publish with DG Trade to estimate the number of jobs directly linked to export activity. Our latest results indicate that there has been a substantial increase in such jobs since the beginning of this century. Much of what the JRC is doing in the area also examines the impact of policy measures, such as our analysis of fiscal measures introduced during the COVID-19 pandemic. Our work also has a focus on inclusion and fairness, as demonstrated for example by the analysis of narrowing the gender pay gap. A strong component underpinning all of this is the knowledge gained through statistical analysis and modelling. We have also looked more broadly beyond economic incentives in a new report examining poverty and mindsets, where we argue that material improvements also need to be accompanied by measures to improve both resilience and aspirations. And while not described here, our ongoing work on standards across the policy spectrum is an invisible driver for innovation and the economy.

EU EXPORT-LINKED JOBS INCREASED BY 75% IN TWO DECADES

In support of trade policy, we developed a new methodology to estimate the number of jobs linked to export activities, including those indirect jobs linked to suppliers of inputs to exporters throughout the whole economy. Moreover, the number of jobs can be broken down by countries, industries, gender, skill level and age groups. The JRC and the Directorate General for Trade regularly jointly publish a statistical pocketbook, which features the results of these estimates, together with technical notes, conference papers and academic journal articles.

As announced in connection with the Council Foreign Affairs Meeting in November the [latest report](#) notably showed that over 38 million jobs in the EU are supported by EU exports, 11 million more than a decade ago.

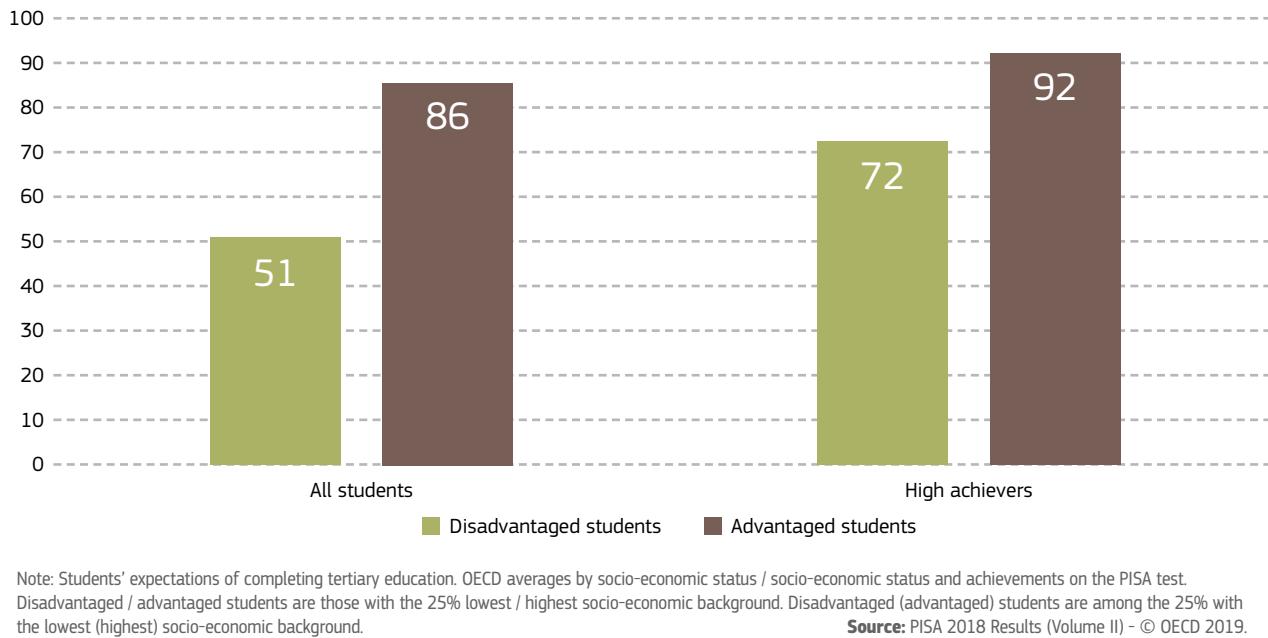
FINANCING THE GREEN RECOVERY

A key element of the European Green Deal, the EU Taxonomy, is a robust, science-based tool for companies and investors to support sustainable investment. We have strongly supported its development, from conception of the framework and methodology to the technical screening criteria in the first Delegated Acts on climate objectives, adopted last year.

In support of the proposal for a European Green Bond Standard (EU GBS), we produced [scientific evidence](#) on the merits and limits of green bonds, success factors, and [financing potential](#) for the Green Deal targets, showing that the enhanced transparency and credibility brought about by the EU GBS are crucial for further market development. We have also supported the development of the Platform on Sustainable Finance and the [EC Strategy for financing the transition to a sustainable economy](#). Our [research](#) has helped assess the financial and economic impacts of climate change and make the financial system more resilient to climate-related risks while showing that investors have [a taste for green](#) and want firms to be transparent.



JRC experts identified a 'greenness and transparency factor' in stock prices.



Percentage of students who want to complete higher education in the OECD countries. By socio-economic background and school performance.

TACKLING MINDSETS TO OVERCOME POVERTY

The [JRC report on Poverty and Mindsets](#) brings together in one place multi-disciplinary findings on how poverty and exclusion affect aspirations, self-confidence, and decision-making. To help people who suffer from prolonged marginalisation, it is not enough just to tackle material conditions. Overcoming poverty also means supporting resilience, the capacity to aspire, and taking decisions that help realise aspirations.

The report contributes to the reflection on addressing poverty in a comprehensive way, and achieving the right to aspire for all, supporting the principles of the European Pillar of Social Rights. It is particularly relevant to – and has already fed into – stakeholders' discussions on the implementation of the European Child Guarantee, national strategies for Roma inclusion, and anti-poverty strategies. A follow-up initiative will look into best practices and success factors for multidimensional coaching in support of the socio-economic advancement of people in poverty.

SUPPORTING PAY TRANSPARENCY MEASURES

In March 2021 the Commission presented a [proposal](#) on pay transparency to ensure that women and men in the EU get equal pay for equal work. As a result of these measures, the Impact Assessment estimates a reduction of the gender pay gap of three percentage points.

Our analysis of the main foreseeable socio-economic consequences played a key role in supporting the initiative. One of the main benefits expected from reducing the gender pay gap is that increased women's earnings would trigger a drop of the at-risk-of-poverty rate, mainly for single-parent households, often composed of women raising their children alone. A reduction of the gender pay gap is also expected to generate extra government revenues as the income tax base broadens.



EFFICIENCY AND FAIRNESS OF TAX-BENEFIT SYSTEMS

The JRC conducted research on fiscal policies through a series of studies that focus their analyses on simulations and modelling. The thematic studies aim to shed light on specific research questions related to EU Member States' tax and benefit systems, deepening our understanding of relevant efficiency and fairness issues of these systems. They also extend and improve the modelling tools currently being used to be able to reply to ever-changing policy needs. The most important studies have fed into flagship publications of policy DGs and included the tax treatment of pensions (used in the [Pension Adequacy report](#)) and early estimates on income and poverty used by Eurostat in their [Flash estimates](#).

The JRC also provided extensive support on proposals and discussions for modernising corporate tax systems, including the growing digitalisation of economic activity, tax avoidance mechanisms and tax loopholes, and favouring a more level playing field for small compared to large companies.

INTEGRATING GLOBAL ACCOUNTS FOR ECONOMIC MODELLING

In collaboration with Eurostat, the JRC designed, developed and launched a new tool to produce official statistics in the form of a database (FIGARO) that enables economic modellers, policymakers, and other interested stakeholders across the EU to analyse the effects of globalisation. By relating national accounts data of countries with international trade statistics, the applications include evaluations of global value chains, strategic vulnerabilities, carbon footprints, female employment linked to export activities, as well as the socio-economic impacts of European funds. Some of the latest uses of the database by the JRC are the Spring and Autumn Economic Forecasts in 2021 and the Winter Economic Forecast in 2022 by the Directorate-General for Economics and Financial Affairs (DG ECFIN). This work has been recognised by the OECD and the United Nations Statistics Division, among others.

A stronger Europe in the World

A strong, fair and open trade agenda makes Europe an attractive place for business while ensuring the highest standards of climate, environmental and labour protection. Such responsible engagement also means that the EU invests in partnerships with neighbouring countries, and alliances with third countries, multilateral and regional organisations.

Much of our role throughout 2021 was to offer strong support for climate policy, and in particular climate diplomacy, where we worked to underpin actions to shape international cooperation on climate change. This encompassed our presence at the 26th UN Conference on Climate Change (COP26) in the autumn and our contribution as lead authors to the Intergovernmental Panel on Climate Change assessments of drivers of climate change. Never has this been so pertinent, as our results demonstrated that climate change is becoming more noticeable each year, with 2021 being the second worst year for wildfires recorded to date.

Science and knowledge play a crucial role in anticipating future conflict and risk, and the JRC's data, tools and networks support policymakers at all levels to make Europe more resilient. Consolidation of our position as a knowledge broker led to JRC being recognised as responsible for the science pillar of the Union Civil Protection Knowledge Network. It is a clear example of the way our efforts to integrate and share knowledge also help to anticipate future risk.

Beyond climate change and civil protection, we contributed to the update of the Dual-Use Regulation, which has been expanded to encompass more global threats, from the spread of weapons of mass destruction to emerging new technologies and the protection of civil rights. Our work here consolidated a decade of such support to the Directorate-General for Trade. No less important, we also continued our strong commitment to training on nuclear safeguards and security through the delivery of online and hybrid courses.

INTEGRATING SUSTAINABLE DEVELOPMENT GOALS ACROSS COMMISSION POLICIES

The JRC used text mining and natural language processing technology to map policy initiatives with SDGs and their targets, making it possible to track the ways in which the European Commission is furthering its commitment to implement SDGs in all policies. This policy-mapping tool, available on the [Knowledge base for the Sustainable Development Goals \(KnowSDGs\)](#) web platform, is designed to help policymakers to identify the SDGs that may potentially be impacted or linked to their policy.

In collaboration with the Directorate-General for International Partnerships (DG INTPA), the JRC also created an automated web version of the tool, the SDG Mapper, which provides the results automatically and in real time. Any user can analyse any kind of document with respect to SDGs, simply by accessing the tool, uploading the document and discovering which goals and targets it addresses. The Commission's Secretariat General has included both tools in the Better Regulation Guidelines and Toolbox as key enablers to help policymakers mainstream SDGs and facilitate their assessment in policies.

REINFORCING INTERNATIONAL COOPERATION ON CLIMATE CHANGE

Throughout 2021, the JRC supported the Commission's actions to shape international cooperation on climate change. At COP26 we (co-)organised 11 side events, launched new tools and presented several reports on a wide range of climate-related activities. As lead authors, JRC scientists contributed to the [Sixth Assessment Report](#) of the Intergovernmental Panel on Climate Change (IPCC), with assessments on climate change drivers, the construction of regional climate information and contributions to several other chapters.

JRC's [2021 Global Energy and Climate Outlook](#) took stock of updates in nationally determined contributions and, for the first time, assessed how recently announced, long-term strategies by major world economies will affect the global effort for the low-carbon transition. Other important JRC activities included an updated [report on EDGAR](#) (Emissions Database for Global Atmospheric Research), a new report on [the use of solid fossil fuels in the Western Balkans and Ukraine](#), and activities in support of the new EU Arctic policy.



JRC contribution to COP26 and climate action.



CLIMATE MIGRATION: FOCUSING ON LOCAL ADAPTATION SOLUTIONS

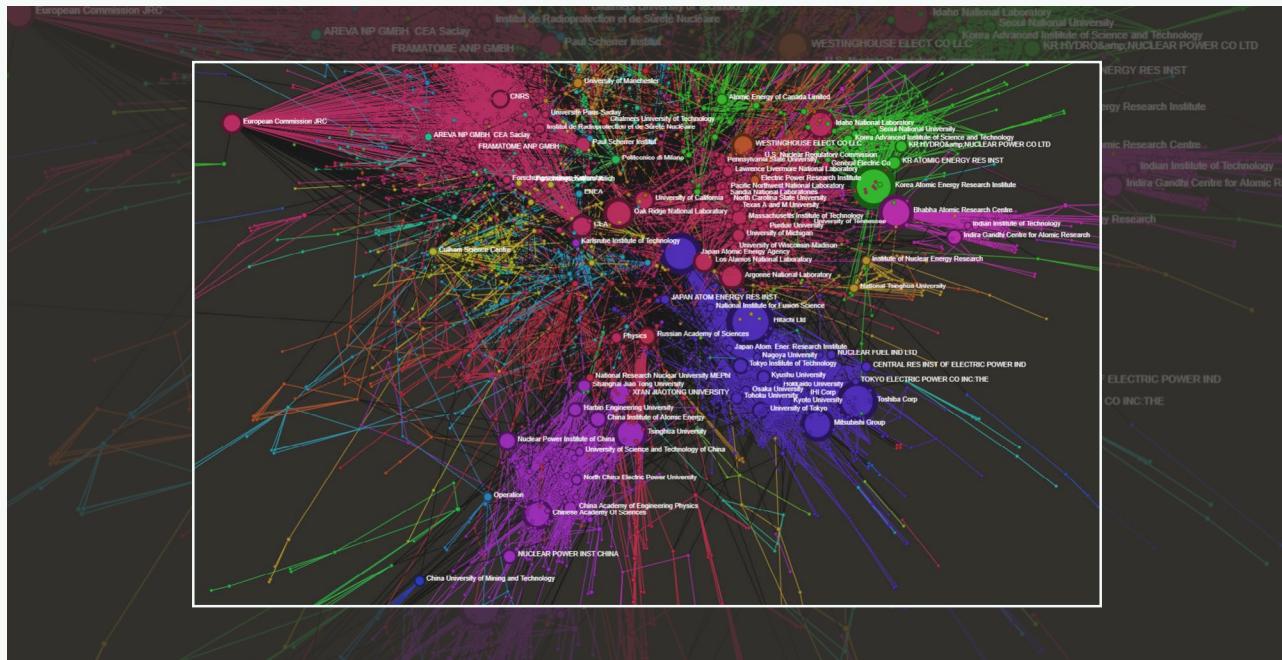
Climate change will have a profound impact on population dynamics, but research shows that reality is more complex than the alarmist narratives predicting mass climate migration. To understand the extent to which climate change is a driver for migration, JRC scientists analysed past trends, future population projections and the possible links between extreme weather and net migration (the difference between the number of immigrants and the number of emigrants in the same region). There was evidence of such links in some African regions (e.g. parts of the Sahel), but these linkages were not systematic across the African continent.

The report emphasised that migration processes are complex, responding to determinants that are structural, institutional and personal. It highlighted the need to shift the debate from the threat of migration triggered by climate change to the humanitarian impact in the most vulnerable regions and the need to find adaptation measures to protect the lives of displaced populations.

LEADING THE SCIENCE PILLAR OF THE UNION CIVIL PROTECTION KNOWLEDGE NETWORK

In 2021, in recognition of our role as knowledge broker, the JRC was mandated to lead the Science pillar of the Union Civil Protection Knowledge Network. This builds on five years of success of our Knowledge Centre on Disaster Risk Management.

This year we showed that 2021 was the second worst year for wildfires on record, with our data showing that climate change is more noticeable every year. For example, our scientists called for global action for better resilience to droughts, as co-lead of a flagship UN report that argues for proactive and innovative approaches to drought risk management. We also launched a revolutionary tool for monitoring floods worldwide. The tool, which can process all data received by the Sentinel-1 satellites, is part of the Copernicus Emergency Management Service.



TIM DU snapshot. Screen grab from TIM Dual-Use: organisations involved in nuclear dual-use research, 1996-2020.

GOING DIGITAL FOR TRAINING IN NUCLEAR SAFEGUARDS AND SECURITY

How to raise awareness and build competences in nuclear security during the pandemic? The JRC's training activities in nuclear safeguards and security focused on two novel pathways. [Hybrid training at EUSECTRA](#) combined laboratory exercises carried out by JRC staff with transmission to remote participants. The trainees were able to interact in real time with JRC staff to guide their laboratory analyses and to interpret the results jointly. The pilot course took place in 2021 for a national radioprotection service in the EU with trainees located at four different sites.

The [ESARDA nuclear safeguards course](#) this year went fully digital and the 19th edition was more successful than ever, with 150 participants from all over the world. For this online edition, considerable efforts were made to convert the entire content, including exercises and visits to the nuclear laboratories at our Ispra site, into a virtual format. These virtual tours of the safeguards facilities allowed participants to have a closer look at nuclear safeguards equipment and instruments from their remote locations.

MODERN EXPORT CONTROLS TO FIGHT AGAINST GLOBAL THREATS

Dual-use goods can have both civil and military applications and so cannot be freely exchanged. In EU Member States, thousands of dual-use items, including nuclear, chemical and biological materials, electronic components, mechanical systems, sensors, or telecommunication equipment, are listed under the EU dual-use export control list.

Building on a decade of JRC support to DG TRADE in this area, we contributed substantially to the [2021 recast of the dual-use regulation](#), which is now addressing more global threats, from the spread of weapons of mass destruction to the emergence of new technologies and the protection of civil rights. In collaboration with the University of Liège, our Competence Centre on Text Mining and Analysis developed the [TIM Dual-Use tool](#) to track possible dual-use relevance of research and innovation results. We also published a new edition of our [Export Control Handbook for Chemicals](#).

Promoting our European way of life

Values of solidarity, equality and fairness are at the heart of the Commission priority, ‘Promoting our European way of life’. It is about feeling safe and secure, about supporting the most vulnerable in our society and championing inclusion. It is about finding common solutions to shared challenges and equipping people with the skills they need and investing in their health and wellbeing. It is about building stronger, more cohesive and more resilient European societies.

The JRC is behind a number of activities that contribute to making this priority a reality. On the health side, our Knowledge Centre on Cancer, launched in 2021, is playing a key role in supporting Europe’s Beating Cancer Plan and the Horizon Europe Mission on Cancer. We also provide evidence-based guidance to reduce the burden of non-communicable diseases by hosting the European Commission’s Health Promotion and Disease Prevention Knowledge Gateway and evaluating best practices in EU Member States.

The JRC is developing artificial intelligence techniques for data and information analysis applied to safeguards and nuclear forensics. Scientists are testing results in JRC laboratories and at European nuclear facilities. Additionally, our facilities for nuclear fuel and materials research were used to generate improved irradiation targets for radioisotope production to support nuclear medicine applications.

COMMISSION GEARS UP ACTIONS TO FIGHT CANCER

In June 2021, the European Commission launched the [Knowledge Centre on Cancer](#). Resourced and operated by the JRC, this marked the first Flagship Action delivered under Europe's Beating Cancer Plan.

The Knowledge Centre maps the latest evidence on cancer, provides healthcare guidelines and quality assurance schemes, and monitors and projects trends in cancer incidence and mortality across the EU, leveraging a united EU approach to tackling cancer.

As a first deliverable, the [European Guidelines and Quality Assurance Scheme for Breast Cancer Screening, Diagnosis and Care](#) were released, offering women, healthcare providers and policymakers clear and independent guidance on the complete healthcare pathway for breast cancer. The JRC-led European Cancer Information System also launched a [new tool](#) with indicators on the extent and types of cancers affecting children (aged 0-19) in Europe. Furthermore, our EU Reference Laboratory for alternatives to animal testing added a [new knowledge base](#) of 542 models used in the immuno-oncology field.

USING AI TO SUPPORT NUCLEAR SAFEGUARDS AND NUCLEAR FORENSICS

A few years ago, the JRC started applying AI techniques to nuclear safeguards, as part of the support provided to Euratom and the International Atomic Energy Agency (IAEA) nuclear inspectorates. More recently, our scientists have applied AI to the [indoor localisation of safeguards inspectors](#) in deep geological repositories and to identify significant events through the automatic analysis of large sets of surveillance images. We have also tested augmented reality equipment for nuclear inspectors and algorithm accelerators for better modelling and simulation tools, both using AI. In the field of [nuclear forensics](#), AI methods are used for the evaluation of spectral information in order to help identify the origin of nuclear material found out of regulatory control.

HOW LONELY ARE EUROPEANS?

Our report, [Loneliness in the EU: Insights from surveys and online media data](#), is the first step of a broader project in support of Vice President Dubravka Šuica's priorities, building on a collaboration between the JRC, the Directorate-General for Employment, and the European Parliament. It explores how the pandemic has magnified the problem of loneliness for Europeans of all ages, but particularly for young adults.

Containing the first ever EU-wide analysis of online media coverage of loneliness, the study shows that reporting on loneliness also doubled during the pandemic and that there is increased awareness of the phenomenon in several Member States, as well as initiatives to tackle it. Next steps will include new, EU-wide collection of data on loneliness and the establishment of a web platform to monitor loneliness over time and across Europe.

IMPROVING RADIOISOTOPE PRODUCTION FOR HEALTH APPLICATIONS

As part of our Open Access to Research Infrastructures programme, scientists from the University of Padua and the National Institute for Nuclear Physics (INFN, Italy) were hosted at our nuclear facilities in Karlsruhe, Germany. This allowed them to develop novel, optimised irradiation targets at accelerators for radioisotope production for medical applications and basic studies in nuclear physics.

For instance, they used graphene for the first time as a source of carbon to make uranium carbide targets. Graphene has significant effects on target properties, with a remarkable increase in thermal conductivity. This can lead to a higher production yield of radioisotopes for health applications, such as the alpha emitter Ac-225 used for targeted alpha therapy. Published jointly by the JRC, the University of Padua and the INFN in *Nature Scientific Reports*, the results of this [high-level scientific research](#) help to improve applications of direct benefit to European citizens, as well as fostering further collaboration within the European scientific community.

A new push for European democracy

Countries all around the world are facing tremendous challenges, such as how to adapt to climate change or recover from the effects of COVID-19. While democracies are well suited to resolve such challenges, democracy is increasingly under an onslaught of disinformation and misinformation, which is eroding trust in institutions and the fabric of society. Recent years have also seen high levels of polarisation, a decrease in willingness to compromise, and sometimes outright attacks on democracy. On top of traditional economic conflicts, cultural values and identity issues have become just as important for politics today.

Meanwhile, we are in a period of profound demographic change, which is also shaping the future of Europe and must be taken into account in order to build a more resilient, sustainable and fair Union.

Throughout the year, the JRC has demonstrated a capacity to anticipate and address these issues, creating and curating knowledge and tools in support of related policies. Our *Atlas of Demography* is one such example. Launched in 2021 and continuously updated, it is providing demographic insights to help inform the development and implementation of policies closer to citizens' needs.

Recognising that the EU needs new tools to understand the new fault line between cultural values, our report on *Values and Identities* contains relevant insights for policymakers, including a dedicated toolbox section. Such work is also complemented by the Competence Centre for Participative and Deliberative Democracy, which we inaugurated last year. This has been set up to support European Commission initiatives to involve citizens more effectively in the co-design and co-implementation of policies that are fit for purpose – designed, implemented and evaluated with citizens, for citizens. Finally, our experts in the field of data and text mining have researched and analysed the phenomenon of online disinformation and produced tools to help media analysts and fact checkers to detect and manage disinformation, particularly in the field of COVID-19.

MONITORING AND ANTICIPATING DEMOGRAPHIC CHANGE

In 2021, our Knowledge Centre on Migration and Demography (KCMD) supported Commission Vice President Dubravka Šuica in her mission to bring demographic analysis to the heart of EU policymaking and to increase demographic resilience in the EU. [The Demographic Landscape of EU Territories report](#), published in February 2021, details the territorial diversities of ageing across the EU, outlining the main drivers behind it and exploring their interrelations. It revealed a diverse picture of population growth, decline and ageing in Europe, and warned that the gap between regions of population growth and population decline is set to widen in the coming decades.

Launched in April 2021, our [Atlas of Demography](#) is a new interactive tool that enables policymakers and citizens to observe, monitor and anticipate demographic challenges. It informs several policy areas, including health, labour, education, access to services and amenities, territorial and cohesion policies, with timely, robust, comparable demographic data, right down to the level of a single municipality.

VALUES AND IDENTITIES: A POLICYMAKER'S GUIDE

Values are said to be the dominating forces in life and identities represent who we are and to whom we belong. Both shape the political landscape in democracies and have gained in importance in recent decades. But how should policymakers navigate this new societal and political landscape? Our report [Values and Identities – a policymaker's guide](#), intended for policymakers and decision makers, is the first of its kind to bring together interdisciplinary insights from the social and behavioural sciences on values and identities in the political process.

The report contains important insights to support policymakers in adapting their work to the challenges of our time, including a dedicated toolbox section, which is aimed at helping to systematically think through policy issues through the lens of values and identities. Both the report and the toolbox are complemented by findings from a dedicated Eurobarometer on values and identities commissioned for this purpose.





COMPETENCE CENTRE ON PARTICIPATORY AND DELIBERATIVE DEMOCRACY

As part of the Commission's commitment to strengthen the links between people, countries and institutions in Europe, the JRC launched a new [Competence Centre on Participatory and Deliberative Democracy \(CC-DEMOS\)](#) to provide the tools, resources, research and methodologies to build capacity and best practice among EU institutions, Member States, and research and policy organisations.

This Competence Centre aims to support mainstream citizen engagement across the policy cycle. This includes guidance on how to plan and design citizen engagement activities, as well as a financial instrument to help services contracting them. Throughout 2021, policy areas supported included European Missions, the Pollinators initiative, the Arctic Joint Initiative, the Climate Pact, the Cancer Initiative, and is gradually moving to other policy areas.

DIRECTIVE ON POLITICAL ADVERTISING

The Commission's 2021 initiative on the transparency of political advertising aims to promote high standards of transparency in political campaigning and free and fair elections at the EU level, strengthen the resilience of democratic processes in the EU, and combat disinformation and other interference in elections. The JRC supported the Directorate-General for Justice and Consumers (DG JUST) at each stage of the policy process, resulting in a final regulatory proposal that reflects many of the recommendations outlined in the [JRC report on Technology and Democracy](#).

Through our provision of extensive summaries of academic literature and expert insights, colleagues from DG JUST established an in-depth understanding of the complex behavioural implications of legislating in this area. This has been directly translated into the proposed regulation, providing far greater consumer protection.

COUNTERING MISINFORMATION NARRATIVES AND DISINFORMATION EFFORTS

Our JRC Disinfo team researched and analysed the phenomenon of online disinformation and produced tools to help media analysts and fact checkers to detect and manage disinformation. In 2021 the work focused on misinformation related to COVID-19, due to its potential impact on the vaccination campaign across Member States. The work contributed to regular newsletters highlighting current misinformation, and to long-term analysis of key misinformation narratives. The Disinfo team also collaborated closely with the World Health Organisation, enriching the Epidemic Intelligence from Open Source (EIOS) system, itself based on JRC technology, with AI tools for the automated detection of COVID-19 misinformation.

MAKING SENSE THROUGH TEXT MINING AND ANALYSIS

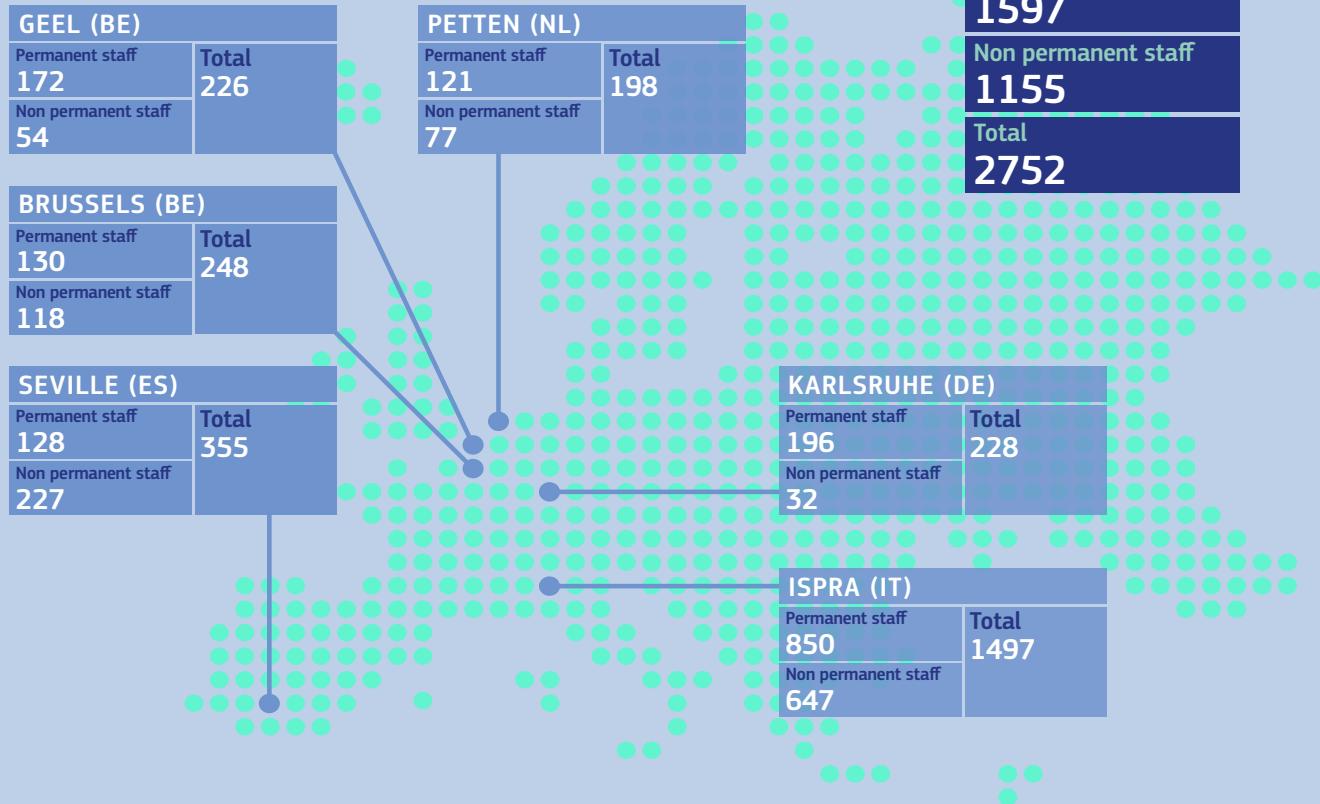
The JRC's Competence Centre on Text Mining and Analysis (CC-TMA) extracts useful information from unstructured text, coping with high volume, multiple languages and ensuring timeliness of information in a proper format and in a variety of contexts. It has become a recognised focal point of expertise in this growing field as evidenced by over 300 participants across the Commission in a dedicated event on text mining.

Notable achievements in 2021 included the development of tools to allow multilingual semantic search and to discover text with similar meanings in different languages. Interactive dashboards using these techniques helped analysts to make sense of the online contributions to the Conference on the Future of Europe and ensured that key ideas from the online platform fed discussions in the citizens' panels. Other applications through the year included text mining in the field of risk assessment, the delivery of policy briefs as media sentiment analyses, and developing a 'values detector' in social and political discourse.

Key facts and figures

(AS OF 31 DECEMBER 2021)

The total number of active staff working at the JRC on 31 December 2021 was 2752.



EQUAL OPPORTUNITIES

By the end of 2021, women represented 40 % of the JRC's active staff* and 35 % of its administrator** function group. The JRC is making a continuous effort to meet Commission targets for female staff holding management positions.

Positions (% female)	2019	2020	2021
Senior management	50 %	27 %	30 %
Middle management	28 %	26 %	29 %
Non-management administrators (AD)	35 %	35 %	36 %

* 'active staff': Officials, temporary agents, contact agents, JRC grant holders and seconded national experts.

** 'administrators function group': officials and temporary agents in function group 'administrator' and contract agents in function group IV.

JRC CONTRACTUAL INCOME

The value of contracts signed by the JRC in 2021 amounted to EUR 131.4 million. The table below shows the split of the contracts signed by 31 December 2021. These activities complement the tasks outlined in the JRC's work programme and are essential to acquiring and transferring expertise and know-how.

Contracts signed (in million EUR)	2019	2020	2021
Indirect actions (framework programme)	4.2	9.1	2.7
Support to Commission services	68.5	85.9	121.5
Third party work	10.7	7.9	7.2
Total (rounded)	83.4	103.0	131.4

BUDGET

The JRC is funded by the EU's Framework Programme for research and innovation, currently Horizon Europe, and the EURATOM research and training programme. Further income is generated through additional work for Commission services and contract work for third parties.

The JRC's available credits are allocated to staff expenses, means of execution (maintenance of buildings and equipment, commodities, insurance, consumables, etc.) and specific expenses (direct scientific procurements) related to the research and innovation framework programme activities.

The table shows the breakdown of how the 2021 budget was spent (in terms of available commitment appropriations). In addition, EUR 32.7 million was made available for the programme to decommission the JRC nuclear installations, and for EURATOM-related waste management. An additional EUR 14.7 million was received in the form of contributions from countries associated to Horizon Europe.

Outgoing expenditures (in million EUR)	2019	2020	2021
Staff expenses	244.28	249.17	253.24
Means of execution	114.45	115.13	82.64
Operational appropriations (FP) €	50.26	56.66	40.70
Total (rounded)	408.99	420.96	376.58

JRC Annual Report 2021

The JRC's Annual Report gives an account of the activities, accomplishments and resources related to the JRC's work carried out in 2021. As well as an overview of scientific achievements and activities, the report includes corporate initiatives and key facts and figures. The Annual Report features a balanced structure in two parts - the first covers a selected few key areas of activities and the second gives examples of concrete science-for-policy achievements contributing to the Commission priorities - taking the reader through the activities of the year and giving an insight into the strategic dimension of the JRC's work. It documents how the JRC contributes to the Commission's and Members States' efforts to tackle the COVID-19 pandemic; how it anticipates future trends and societal transformations; and how it manages and contributes to the New European Bauhaus initiative. A series of examples is given of what the JRC has achieved in 2021 through the prism of the von der Leyen priorities: a European Green Deal; a Europe fit for the digital age; an economy that works for people; a stronger Europe in the world; promoting our European way of life; a new push for European democracy.

This publication can be found online at:

publications.jrc.ec.europa.eu/repository/handle/JRC128620

Manuscript completed in April 2022

CONTACT INFORMATION

European Commission
Joint Research Centre (JRC)
JRC.02 – Communication
1049 Brussels
Belgium

Antje Followald (Head of Unit)

Antje.COLLOWALD@ec.europa.eu

EU Science Hub

joint-research-centre.ec.europa.eu

JRC128620

Print	ISBN 978-92-76-55198-0	ISSN 0376-5482	doi:10.2760/251335	KJ-AR-22-101-EN-C
-------	------------------------	----------------	--------------------	-------------------

PDF	ISBN 978-92-76-55199-7	ISSN 1684-0917	doi:10.2760/915689	KJ-AR-22-101-EN-N
-----	------------------------	----------------	--------------------	-------------------

Luxembourg: Publications Office of the European Union, 2022
© European Union, 2022



The reuse policy of the European Commission is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except as otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union, 2022, except for the following images:

Page 12 photo by Fusion Medical Animation on Unsplash; page 26 by Clemens van Lay on Unsplash; page 31 jintana, adobe stock 2021; page 33 photo by Mark Timberlake on Unsplash; page 35 photo by William Bossen on Unsplash; page 36 photo by Redcharlie on Unsplash; page 42 photo by Robin Worrall on Unsplash.

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online:
european-union.europa.eu/contact-eu/meet-us_en

On the phone or in writing

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696,
- via the following form: european-union.europa.eu/contact-eu/write-us_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website:
europa.eu

EU publications

You can view or order EU publications at:
op.europa.eu/en/publications

Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre:
european-union.europa.eu/contact-eu/meet-us_en

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex
eur-lex.europa.eu

Open data from the EU

The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

**The European Commission's
science and knowledge service**
Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub

joint-research-centre.ec.europa.eu



@EU_ScienceHub



EU Science Hub - Joint Research Centre



EU Science, Research and Innovation



EU Science Hub



@eu_science



Publications Office
of the European Union

ISBN: 978-92-76-55199-7
doi:10.2760/915689