



CORDIS Results Pack on climate neutrality

A thematic collection of innovative EU-funded research results

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Pathways for achieving the European Green Deal objectives



Research and
Innovation

**SECOND
EDITION**

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Editorial

Pathways for achieving the European Green Deal objectives

The European Union is committed to becoming climate-neutral by 2050 to fulfil its commitment to the Paris Agreement. The 14 research projects featured in this CORDIS Results Pack have developed a suite of models and tools that are able to assess the benefits, costs, risks, trade-offs and synergies with other policy objectives of strategies and investments associated with the transition to climate neutrality.

This work provides a solid bedrock on which policymakers, business and society can make informed choices about the best route to ending the reliance on fossil fuels and building a greener, cleaner and more equitable future for Europe.

A climate-neutral Europe means achieving net zero emissions of greenhouse gases such as carbon dioxide and methane. This transition is essential if we want to limit global warming to well below 2°C and avoid catastrophic climate change. It requires a deep transformation across all economic sectors and entire societies. Dramatic reductions in burning fossil fuels, hand in hand with increased investments in green technologies, clean transport, a more efficient and circular industrial base, climate-friendly food systems, and massive upscaling of renewable energy capacity will be at the heart of achieving this goal. Commensurate and maintained societal momentum will need to support this Herculean effort. And of course, finance must be mobilised to enable such transition.

Meeting these objectives demands a raft of legislative and social instruments. The European Green Deal announced by the European Commission in 2019 lays the groundwork for the changes needed. It is a comprehensive road map that details actions to steer Europe towards climate neutrality. The Green Deal also outlines the investments needed and financing tools available, as well as concrete steps on how to ensure a just and inclusive transition that benefits everyone.

The EU's targets are set by the European Climate Target Plan, which identifies the need to reduce greenhouse emissions by 55 % by 2030 to achieve climate neutrality by 2050. To capture political determination and provide directionality, the European Climate Law turns this commitment into a legal obligation and a trigger for the investment needed.

This year, the Commission set out the Fit for 55 package, a set of proposals for implementing this Climate Law. The package identifies legislative opportunities across the transport, energy and housing sectors.

Meanwhile, the Climate Pact brings individual citizens together to share information, debate and act on the climate crisis, placing people at the heart of building a more sustainable Europe.

Horizon 2020 – and its successor Horizon Europe – are crucial for the implementation of these climate policies, and at the same time the wider Sustainable Development Goals. The projects featured in this Pack are drawn from Horizon 2020's dedicated Societal Challenges funding stream.

Embracing the complex interplay between the energy system, the economy and consumer behaviour, the research highlighted in the Pack reveals how policies can best direct the EU towards climate neutrality and how investment can be mobilised.

Coordinated development and climate policies, for wider acceptance and higher impact

It is widely acknowledged that sustainable development and climate action are two ends of the same spectrum. Yet, their complex interplay has yet to materialise in coordinated policy design underpinned by dedicated scientific research. CD-LINKS aimed to bridge this gap with extensive international research and low-carbon pathway development.

The CD-LINKS (Linking Climate and Development Policies – Leveraging International Networks and Knowledge Sharing) project specifically looked at interactions between climate policies and the United Nations Sustainable Development

Goals (SDGs) to highlight the potential co-benefits of coordinated policy-making. From 2015 to 2019, the project team combined research on both issues with a view to strengthening evidence-based policy-making.





Well-designed climate change mitigation policy can lead to significant co-benefits for a range of development priorities, but it can also lead to trade-offs if not managed properly.

“Our work is of critical importance,” says Volker Krey, Deputy Programme Director for Energy at the International Institute for Applied Systems Analysis in Austria. “Well-designed climate change mitigation policy can lead to significant co-benefits for a range of development priorities, but it can also lead to trade-offs if not managed properly.”

To prevent this from happening, the project brought together research groups from within the EU of course, but also from Brazil, China, India, Japan, Russia and the United States. Together they empirically analysed the effects of past and existing policies with a climate or energy focus. They characterised policy designs that adequately account for trade-offs, and developed globally consistent national low-carbon pathways. Finally, they reviewed national action plans and international pledges.

Insightful results

The work led to many accomplishments. These include: a better understanding of the links between climate action goals and SDGs; and the realisation – while studying 17 global energy and climate policies – that policy-makers do not often consider complementary policies to strengthen synergies or alleviate trade-offs. To overcome this problem, the project proposes a new framework based on complementarity, transparency and adaptability to improve multiple-objective policy-making.

The project also provides insightful statistics on current efforts. For example, the team found that currently-implemented domestic climate policies would reduce global greenhouse gas (GHG) emissions by only 5% by 2030. Most countries are not on track to meet their own nationally determined contributions (NDCs), and the global GHG emissions reduction expected from these NDCs will not allow the world to keep global warming to well below 2 °C.

Growing influence

Dissemination was a key part of the project, with the team even informing highly visible international assessments such as the IPCC’s Special Report on Global Warming of 1.5 °C (IPCC SR1.5) and the UNEP emissions gap report.

By his own admission, Krey was even surprised with how far the project resonated amongst stakeholders. “When I was at the approval plenary of the IPCC SR1.5 in which I participated as scientific support for a government delegation, I was approached by a delegate who did not know about my involvement in CD-LINKS. He told me how he thought that research on interactions between ambitious climate policy and broader sustainability objectives from a project called ‘CD-LINKS’ or similar ought to be used to underpin some of the statements that were up for approval,” he explains.

Such encounters might become more frequent as CD-LINKS-related publications keep being released, including one recently published in the prestigious journal ‘Nature Communications’ focusing on what current policies and the NDCs are expected to deliver in terms of emission reductions.

Several interactive online tools have been developed, making the project’s low-carbon development pathways accessible to researchers and policy analysts, while a new Horizon 2020 project called ENGAGE is already building upon the CD-LINKS research.

“My hope is that the project will contribute to strengthening evidence-based policy-making. Obviously, this is a process which will take many years, if not decades, and a single project only contributes to a very limited extent, but shifting the entire policy process in this direction is highly desirable,” Krey concludes.

PROJECT

CD-LINKS – Linking Climate and Development Policies – Leveraging International Networks and Knowledge Sharing

COORDINATED BY

International Institute for Applied Systems Analysis in Austria

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/642147

PROJECT WEBSITE

cd-links.org



To address a global problem, focus on the local impacts

By emphasising those most affected by climate change, EU researchers have found that the true cost is higher than previously estimated. The good news is that by identifying socio-economic tipping points, policymakers have the opportunity to address climate challenges in a more targeted and coordinated manner.

Climate change is much more than an environmental issue. It presents huge social and economic challenges, at the global, regional and local levels. Vulnerability to climate change often lies in a combination of geography, socio-economic status,

and access to services and justice. A careful examination of all these issues is critical if we are to fully understand the real cost of climate change, and develop coherent mitigation and adaption strategies that bring everyone on board.



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"A key difficulty has been matching the global assessments that are needed to drive mitigation actions with more local assessments that are needed to guide adaptation actions," explains COACCH (CO-designing the Assessment of Climate Change costs) project coordinator Francesco Bosello, a senior scientist at the Euro-Mediterranean Centre on Climate Change in Italy. "In particular there is a need to better highlight hotspot regions at risk from climate change, and to provide more useful, targeted indications for policy action."

Identifying the root causes

The COACCH project set out to address this challenge by developing focused assessments of the risks and costs of climate change in Europe. To achieve this, the project team introduced the concept of 'socio-economic tipping points'. "In addition to considering catastrophic events at the global level, we need to talk about events that have huge economic losses locally," says Bosello.



We hope that our results are used by the policymaking community to support long-term climate policy action.

A second key element of the project was the involvement of highly multidisciplinary stakeholder teams. Participants included policymakers at the European, national and regional levels, researchers, financial and insurance organisations, and industrial sectors with a strong interest in climate impacts, such as steel companies. These teams

analysed various climate change case studies from a range of sectors, including agriculture, forestry, energy and infrastructure.

"What is interesting is that we adopted an 'inverted approach' to our analyses," explains Bosello. "This means that we started from local social and economic shocks, such as localised production losses, price increases or job losses. We then worked our way backwards, in order to assess the climatic conditions that led to these shocks."

This approach enabled researchers to identify the root causes of certain local climatic impacts, such as flooded homes or damaged shopping premises.

Improving climate policy

The close involvement of policy, investment, business actors and researchers helped the project team to calculate the actual cost of climate change, and to make recommendations for more

cost-effective, robust and resilient responses. "These new revised estimates of climate change costs take into account both direct and indirect economic impacts, and are significantly higher than in previous modelling," notes Bosello.

The project findings are mostly addressed to policymakers and the research community. The analysis and assessment of 'socio-economic tipping points' will help policymakers to identify where and when these could emerge in the future. "Knowing where climate change impacts can be most damaging can help inform action," he adds.

Financial institutions also stand to benefit through a better perception of climate change risks, with a focus on specific local or sectoral characteristics.

"Another key outcome has been our Climate Change Impact Scenario Explorer," says Bosello. "This open-source web interface allows anyone user-friendly, non-technical access and use of our data, assumptions and results." The project also offers a wider database repository targeted at the research community. Here, researchers can download and explore in depth all of COACCH's results.

"We hope that our results are used by the policymaking community to support long-term climate policy action in the EU," adds Bosello. "We also hope that the wealth of data produced by COACCH can help the research community to improve their models, and lead to more effective mitigation and adaptation policies."

PROJECT

COACCH – CO-designing the Assessment of Climate Change costs

COORDINATED BY

Euro-Mediterranean Centre on Climate Change in Italy

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/776479

PROJECT WEBSITE

coacch.eu



Different pathways for different contexts: A country-driven approach to accelerate climate action

Achieving the ambitions set out in the Paris Agreement is becoming more of a challenge with each day that passes. Far from giving up, the COP21:RIPPLES project suggests a way forward based on an integrated energy system assessment.



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Four years after the Paris Agreement, disillusioned voices have never been so loud. The United States has vowed to pull out and the perceived half-hearted nature of other countries' efforts is

starting to show. There is now abundant evidence that the world is far from being on track to keep the global temperature rise well below 2 °C above pre-industrial levels.

As urgency grows, work under the COP21:RIPPLES (COP21: Results and Implications for Pathways and Policies for Low Emissions European Societies) project has never been so crucial. From 2016 to January 2020, the project team aimed to better understand what separates our current societies from their potential, Paris Agreement-compliant counterparts.

“Our work focused on means to overcome the technology, finance, policy and governance-related barriers to accelerating climate action,” says Marta Torres Gunfaus, Senior Research Fellow at IDDRI and coordinator of the project. “We wanted to provide an integrated assessment of the energy system. The latter is based on the modelling and analysis of physical transformations required to meet the Paris Agreement mitigation goals, the socioeconomic implications of these transformations and the social sciences-based analysis of enabling conditions.”

Going deeper: Not just an EU or global perspective

To stack all the odds in their favour, the project team combined this interdisciplinary analysis with a multilevel approach to research. Rather than focusing strictly on a global or EU perspective, the project team also aimed to understand the national circumstances, policy strategies and transition pathways of individual EU Member States and key non-EU countries.

Such a strategy pays off, as most research findings soon highlighted. “Many of our findings make the case for country-driven approaches at national and local levels. These can effectively engage impacted communities and assess economic and societal transformations with clearly identifiable benefits,” Torres explains. Such approaches could be used, still according to project findings, to improve the EU’s 2030 commitment to ensure politically resilient decarbonisation pathways.

regulation now providing an opportunity for enhanced governance.”

Moving forward

Besides the country-driven approach, the project provides a range of recommendations for future decision-making. These include: favouring the already-mentioned sectoral approach; a multidimensional framework to assess the adequacy of global and country-level responses; early action on and investment in promising technologies; and challenging the financial system to fix its incapacity to deal with common goods and embrace ‘long-termism’. Finally, the project calls for industrial transformation piloted by a transnational steel sector decarbonisation club.

Regarding the changing international context since 2016, Torres says that it only emphasises the need for transdisciplinary and multilevel approaches. “To date, much decarbonisation has been achieved by policy instruments that operate in a largely invisible way for most of society. When their effects in political, social and economic terms (for example in raising consumer prices) become apparent, they may lose legitimacy. To reduce this risk, policymakers seeking to increase the rate of decarbonisation must do so more explicitly and in collaboration with affected communities and sectors. Transdisciplinary and multilevel research can provide a more textured response, embedded in the realities of the different geographies and sectors,” she explains.

Now that the project has ended, Torres expects higher global ambitions to emerge from its recommendations.



Policymakers seeking to increase the rate of decarbonisation must do so more explicitly and in collaboration with affected communities and sectors.

Of course, effective international cooperation is also imperative to meet the Paris Agreement goals, as Torres points out. “Our research shows that a number of gaps and opportunities exist for each of the sectoral systems. National strategies often fail to tap into the enabling potential of international cooperation and discussions. This applies also to the EU and its Member States, with the European Climate Law and existing governance

PROJECT

COP21:RIPPLES – COP21: Results and Implications for Pathways and Policies for Low Emissions European Societies

COORDINATED BY

IDDRI in France

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/730427

PROJECT WEBSITE

cop21ripples.eu

Clearing a path for Europe's decarbonisation

As time passes, potential decarbonisation pathways for businesses and governments get narrower and riskier. The EU-funded DEEDS project marks them out with specific agendas for research, policy recommendations and actions businesses can undertake today. Its results are already influencing the European Green Deal and Horizon Europe calls for proposals.

Tackling climate change is akin to hitting a moving target. When DEEDS (DialoguE on European Decarbonisation Strategies) was launched in October 2017, the Paris Agreement and the European Commission's visions for climate neutrality had only defined what that target was: climate neutrality by 2050. The debate on which means should be used by Member States and businesses to reach it was just heating up across Europe,

and the fear of prohibitive costs and negative social impact has been strong ever since.

In the space of 3 years, DEEDS dealt with these uncertainties by devising six decarbonisation pathways for important economic sectors, with a focus on enabling technology, social innovation, and economic and societal conditions.



The project team created a network of leading scientists and relevant research projects, delivered a Research Agenda and a guide for businesses, and even provided COVID-specific policy briefs. The team also supported the High-Level Panel (HLP) of the European Decarbonisation Pathways Initiative in the creation of its final report.

Known unknowns

"There are two main challenges at hand," explains Adriaan Slob, DEEDS project coordinator and a senior researcher at TNO, an independent research centre in the Netherlands. "Firstly, the idea of a climate-neutral society has yet to be fully embraced. Circumstances in some Member States and fear of the consequences of pro-environmental measures call for better insights into possible technology pathways, their impacts, and the societal conditions for their take-up."

He adds: "Secondly, we know that the design of decarbonisation pathways must deal with many uncertainties. The pathways constantly need to be evaluated and benchmarked against new insights and developments."

The HLP report addresses the first challenge by providing research and innovation recommendations addressing sectors such as energy production, mobility, industry, agriculture, cities, green finance, innovation and lifestyles. While the report provides a total of 68 recommendations divided up by sector, it was followed by workshops involving policymakers, scientists, businesses, industry and civil society.

The policy briefs and business guide are the key outcomes of these workshops. Out of the many ideas put forth in the Research Agenda, Slob finds three to be particularly innovative. "I would say the ones on social innovation, cities, and innovation and finance. These are topics that are normally left out," he says.

In the financial sector for instance, the project team calls for a complete restructuring where investments would be diverted towards low-carbon technologies and processes. They particularly insist on the need for new approaches to overcome what they call the "financial market myopia" or short-sightedness, as well as the need for more predictable and coherent regulatory frameworks.

The role of cities

"Our Research Agenda was written with the Green Deal in mind, to provide concrete input for Horizon Europe calls. Much of what's in the report has been used for the calls that are coming out now," Slob explains.

In addition to this Research Agenda, the project team provides interested businesses with specific recommendations based on their sector. Companies active in the energy, transport, agriculture, forestry, industry and building sectors can use it as a reference to map out their own decarbonisation pathway. Last but not least, the project provides a 'Scenario Explorer' that compiles climate scenarios published across various databases.

With the project now completed, Slob intends to focus on the decarbonisation of cities. "What role can cities play? How should they fill their role in reaching climate-neutral cities? What decision-making processes should be in place? How do we deal with the local innovation ecosystem? These are some of the questions I will be addressing in future work," he concludes.



Our Research Agenda was written with the Green Deal in mind, to provide concrete input for Horizon Europe calls.

PROJECT

DEEDS – DialoguE on European Decarbonisation Strategies

COORDINATED BY

TNO in the Netherlands

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/776646



How social science can help trace new paths out of the climate crisis

One of the key challenges we face today is how society should tackle climate change and mitigate the impacts of global warming. The EU-funded ENGAGE project has gathered key stakeholders to produce a new generation of global and national decarbonisation pathways.



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Policymakers, industry and civil society leaders count on solid data to inform and guide strategies that will deliver on the objectives of the Paris Agreement. To support these decisions, scientists developed long-term global scenarios known as integrated assessment models (IAMs) that combine different strands of knowledge – natural science, engineering and economics.

The ENGAGE (Exploring National and Global Actions to reduce Greenhouse gas Emissions) project is a 4-year programme of research and innovation to develop new decarbonisation pathways that supplement the knowledge traditionally represented in IAMs with cutting-edge insights from social science.

Coordinated by the International Institute for Applied Systems Analysis in Austria, the project boasts 24 partner organisations from 15 different countries across Europe, Asia and South America. By drawing from a wide range of expertise, the resulting pathways will be credible, legitimate, and rooted in concrete policy and industry experience. This will help to reflect the multidimensional feasibility of decarbonisation and identify opportunities to strengthen climate policies.

The pathways, designed to minimise overshoot of temperature targets, will avoid reliance on controversial and unrealised negative emissions technologies, and instead integrate game-changing innovations and conceptually novel approaches to architectures of international climate agreements.

The ENGAGE project, due to run until 2023, has already achieved a string of successes. The first generation of pathways has been developed and presented in five papers which contributed significantly to the IPCC Sixth Assessment Report – Working Group III that will inform the UNFCCC 2023 global stocktake. These contributions will also feed into the design of mid-century strategies for achieving climate neutrality by 2050.

ENGAGE has also developed and is hosting the Sixth Assessment Report Scenario Explorer, a critical resource for the IPCC authors, enabling them to conduct a comprehensive and effective assessment of different pathways.

In addition, the project has developed a visualisation tool for assessing the multidimensional feasibility of climate

mitigation pathways. This framework allows assessing the timing, disruptiveness and scale of feasibility concerns, and identifying trade-offs across different feasibility dimensions.

This framework has already been applied to scenarios in the IPCC SR1.5 database, and formed the backbone of the Second Order Draft of the IPCC AR6 regarding the evaluation of transformation pathways from IAMs.

PROJECT

ENGAGE – Exploring National and Global Actions to reduce Greenhouse gas Emissions

COORDINATED BY

International Institute for Applied Systems Analysis in Austria

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/821471

PROJECT WEBSITE

engage-climate.org



Online tool reveals individuals' role in tackling climate change

Many people are wondering what their lives and jobs will look like in a world with net zero carbon emissions. The EU-funded EUCalc project has built an interactive pathways explorer to reveal how the Paris Agreement objectives will affect us all.

Should we aim to limit global temperature rises to 1.5 °C or 2 °C? Should Europe's share of the burden be calculated per capita or based on actual capability? The 'Transition Pathways Explorer' of EUCalc (EU Calculator: trade-offs and pathways towards sustainable and low-carbon European Societies) asks

these questions and many more to find out exactly how much change is required to reach a selected objective.

Policymakers, business owners, scientists and everyday citizens will be able to access interactive charts and information on



climate neutrality efforts across 60 sectors. They can find out about the global benefit of actions taken in Europe, and compare scenarios where the rest of the world does or does not follow suit. In a first for such tools, the calculations consider emissions of gases other than CO₂ and convert them into CO₂ equivalents in terms of climate impact.

Inspiring action through data

The tool is of great value to stakeholders looking for suitable measures to lower their impact on global warming. If your objective is to decarbonise the agri-food sector, for example, you can look into different dietary patterns and land-use scenarios, consider intensification and extensification options, and clearly identify the pros and cons of every option.

The tool will even estimate trade-offs and co-benefits with other decisions in, say, the energy sector. As project coordinator Juergen Kropp puts it: "This approach helps actors go beyond sectoral views on the problem of global warming."

To make sure that everyone can use its model and tools, the EUCalc team of 13 institutions coordinated by the Potsdam Institute for Climate Impact Research (PIK) in Germany designed them to be of intermediate complexity. Various respondents even provided valuable feedback that may result in further simplification of the interface.

The content is accessible too. "The advantage of the calculator is that it does not consider only technological changes," says Kropp, who acts as deputy chair of Research Domain II 'Climate Resilience' and head of the Working Group 'Urban Transformations' at PIK. "We know that technological progress alone is not sufficient to reach net zero in 2050, so EUCalc systematically considers the role of lifestyle changes in supporting the decarbonisation of Europe."

Citizen efforts

The tool also speaks in terms that citizens can relate to, such as distance travelled each year, number of passengers in a car, hours spent in front of a screen or amount of food wasted. For

those still tempted to marginalise the importance of individual actions, this is a bit of an eye-opener: the tool demonstrates how ambitious changes in lifestyles could result in emissions savings of 60 % by 2050.

The project also provides important food for thought for key sectors responsible for climate change, which Kropp hopes will result in rapid action. As he explains: "The problem is not whether we can approach neutrality, but when we'll do so. We have already approached 1.5 °C+ of global warming, which makes that objective less likely to be met with every day that passes. Grassroot initiatives like Fridays for Future are good for keeping the pressure, but governments should intervene more."

He adds that project findings show the manufacturing sector alone can reduce its greenhouse gas emissions by 90 % with technologies such as hydrogen-based chemical production, low-carbon cement and a renewable energy mix. But as for all other sectors, the clock is ticking.



Technological progress alone is not sufficient to reach net zero in 2050.

PROJECT

EUCalc – EU Calculator: trade-offs and pathways towards sustainable and low-carbon European Societies

COORDINATED BY

Potsdam Institute for Climate Impact Research in Germany

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/730459

PROJECT WEBSITE

tool.european-calculator.eu/intro



Building back better – from COVID to the climate

Europe's road to recovery also needs to lead to a net zero carbon future.

The EU-funded INNOPATHS project offers a detailed look at decarbonisation pathways that promise economic, social and environmental gains.

As Europe recovers from the COVID-19 pandemic, the wide range of low-carbon technologies available or under development suggests that creating decarbonised energy systems is just a matter of investment and political will.

Picking the right technologies for the job, however, is easier said than done. Inspiration may arise from work carried out by the INNOPATHS (Innovation pathways, strategies and policies for the Low-Carbon Transition in Europe) project.

in the form of a suite of online tools for policymakers, industry representatives, scientists and practitioners in the energy sector.

"We devised a Technology Matrix Tool (TMT) containing data from 46 technologies divided in four categories: power, transport, industry and buildings," says Ekins. "In addition to this tool, we created a Decarbonisation Policy Evaluation Tool providing information on regulations, economic instruments and soft instruments, an Energy System Decarbonisation Simulator, and four INNOPATHS scenarios."

Counterintuitive results

Led by Paul Ekins, professor of Resources and Environmental Policy at University College London (UCL), INNOPATHS provides multiple paths to decarbonising the energy system and highlights the economic impact of each choice. This information comes

Taken together, these tools provide invaluable information for decision makers who could otherwise find themselves overwhelmed with the scale of the challenge or unwilling to face political backlash. By comparing INNOPATHS scenarios across three integrated assessment models, the project team showed that all models in all scenarios can enable net zero emissions in 2050.



"Of course, no one can be sure of the impacts of moving towards a zero-carbon energy system. We are dealing with complex connections between changes in the energy system and the economy, and we know that complex systems often respond to interventions in unexpected and sometimes counterintuitive ways," explains Ekins. "However, models can give valuable insights into these possible responses."

Four scenarios to net zero

The first INNOPATHS scenario is called 'New players and systems'. It is a high electrification scenario with a high proportion of new generators and prosumers. The second one, 'Incumbents' renewal', focuses on carbon capture and storage (CCS), and nuclear energy driven by renewed political push. "End-use energy carriers do not substantially change, but the supply side does: solids, liquids and gases are supplied from bioenergy and power-to-x, bioenergy with CCS is widely used, and hydrogen is added to gas networks where switching is easy," Ekins adds.

The third scenario is that of 'Efficiency and sufficiency', with very high levels of efficiency in buildings through high-spec retrofits and heat pumps, transport electrification, and shifts in industrial demand. The fourth and final scenario considers a two-speed Europe, with deployment of negative emissions technologies (BECCS and air capture) in leading regions, and lower and later levels of mitigation in trailing regions.

"Electricity plays a major role in the decarbonisation of all sectors, with solid liquid and gaseous fossil fuels reduced to less than half their 2015 usage," Ekins notes. "Synthetic fuels,

bioliquids and hydrogen are also key to the decarbonisation of heavy industries and in heavy-duty transport." He adds that for 2050, solar and wind are the major sources of electricity in most of the scenarios and models, except where nuclear is emphasised.

Ekins expresses his disappointment that the COVID-19 recovery programmes proposed so far have few decarbonisation elements. The EUCalc scenarios strongly suggest that the full decarbonisation of Europe is not only possible, but also can lead to a prosperous society that is healthier and has a higher overall quality of life than today.

In a two-degree scenario, health co-benefits of decarbonisation even exceed the costs of decarbonisation, which provides food for thought and – hopefully sooner rather than later – for political action.

PROJECT

INNOPATHS – Innovation pathways, strategies and policies for the Low-Carbon Transition in Europe

COORDINATED BY

University College London in the United Kingdom

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/730403

PROJECT WEBSITE

innopath.eu



We know that complex systems often respond to interventions in unexpected and sometimes counterintuitive ways.



Getting Europe on track to a low-carbon future

The destination established by the Paris Agreement is clear: in order to avoid catastrophic climate change, Europe must reach peak emissions as soon as possible and reduce them rapidly thereafter. How we get there is less certain. The EU-funded LOCOMOTION project is developing an advanced integrated assessment model that will guide Europe's transition to a low-carbon society.



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In order to make informed decisions about the most suitable pathways to climate neutrality, stakeholders need a reliable and practical model system that can assess the feasibility, effectiveness, costs and impacts of different policy options.

The LOCOMOTION (Low-carbon society: an enhanced modelling tool for the transition to sustainability) project, coordinated by the University of Valladolid in Spain, builds on the integrated assessment model (IAM) developed

by the Horizon 2020 MEDEAS project. An interdisciplinary consortium of 14 institutions across Europe and Japan are complementing this with data management, policy and scenario assessment, uncertainty measures, and system dynamic modelling of the relevant energy, environmental, economic, social, technological and biophysical variables.

Known as WILIAM, the improved, more transparent model draws from other models such as World6, TIMES, LEAP, GCAM and C-Roads, and boasts an increased level of detail and precision and greater geographical coverage by creating a new worldwide multiregional model with seven global regions and the integration the 27 EU Member States.

LOCOMOTION is further supporting the EU's contribution to major international scientific assessments by reviewing the IPCC Assessment Report 6, publishing its early results in peer-reviewed journals, and participating in the 25th UNFCCC Conference of the Parties.

The project is also enhancing international cooperation by engaging with international experts (including those from the United Nations), and presenting at international fora such as the Integrated Assessment Consortium.

Due to conclude in 2023, the results of the project will be available to scientists and modelling experts as open-source

software in Python with extensive technical documentation. A second interface aimed at non-scientists will offer a user-friendly decision-support tool for policymakers, as well as education and social awareness applications.

PROJECT

**LOCOMOTION – Low-carbon society:
an enhanced modelling tool for the transition
to sustainability**

COORDINATED BY

University of Valladolid in Spain

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/821105

PROJECT WEBSITE

locomotion-h2020.eu



Improved IAMs help plot a course for climate neutrality

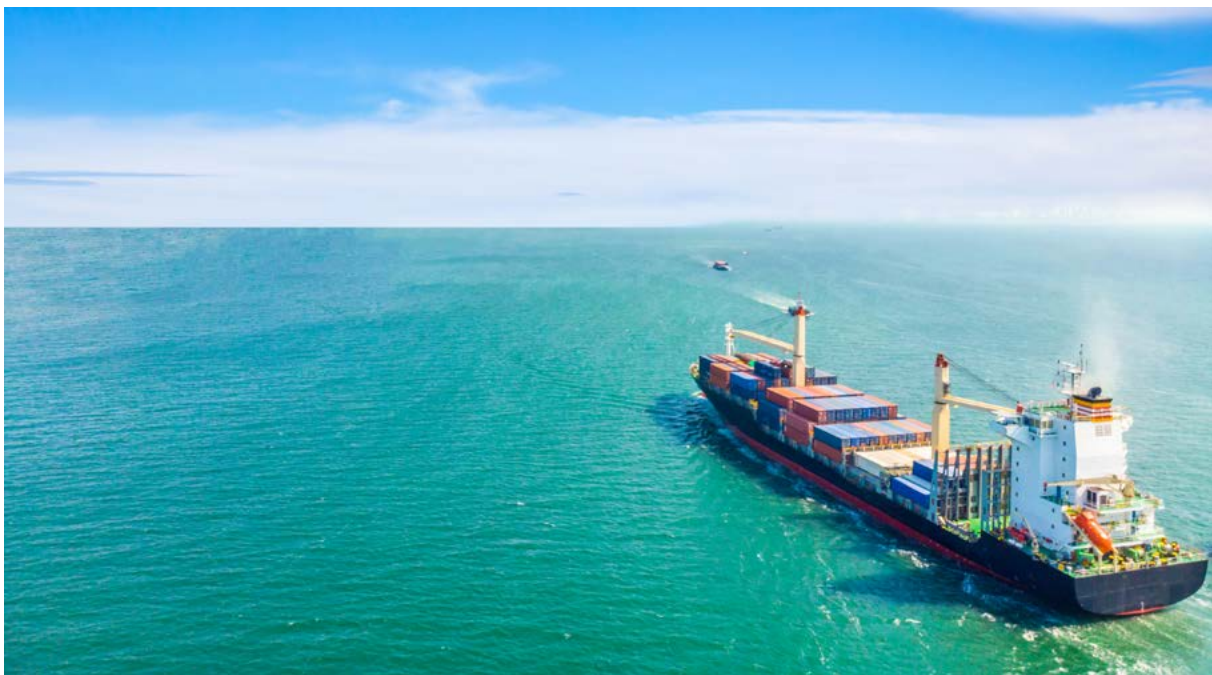
Integrated assessment models combine key elements in energy, economy, land, water and climate into a consistent modelling framework. The EU-funded NAVIGATE project is boosting the capability of integrated assessment models in two key areas, to support the design and evaluation of effective climate policies.

Coordinated by the Potsdam Institute for Climate Impact Research in Germany, the project NAVIGATE (Next generation of AdVanced InteGrated Assessment modelling to support climaTE policy making) brings together leading institutions in the field of integrated assessment modelling and domain experts from 15 partners across Europe, as well as institutions in Brazil and China.

The 4-year project is split into seven distinct work packages. Work began in 2019 with a critical assessment of existing integrated assessment models (IAMs) against new scientific

literature, real-world uncertainties, and the identification of knowledge and methodological gaps.

Work is now underway to complement these existing IAMs with major advances in two important areas. Firstly, NAVIGATE will improve the representation of transformative structural and technological change in the economy and sectors such as industry (including electrification, carbon capture and storage, and carbon capture and utilisation) and land use (such as deep mitigation measures in agriculture and nature-based CO₂ removal).



The project will also factor in the implications of changes in lifestyle and consumption.

Secondly, NAVIGATE will depict how the impacts of climate policies, climate change and the benefits of mitigation and adaptation strategies (in terms of avoided damages and reduced inequality) are distributed geographically and demographically.

These key efforts are set against a backdrop of other enhancements such as methodologies to better assess the robustness of IAM results. The project aims to increase the uptake of IAMs among policymakers by maximising the usability, transparency and legitimacy of these powerful decision-support frameworks.

NAVIGATE is providing new insights into how long-term climate goals can be translated into short-term policy action, and how countries and sectors can work in concert to implement the Paris Agreement.

The project has already contributed significantly to EU climate policy through efforts such as an analysis of COVID-19 impacts, submissions to the UNFCCC Subsidiary Body for Scientific and Technological Advice Research Dialogue 2020, and analyses of climate-neutral 2050 pathways and modelling approaches for the IPCC Sixth Assessment Report.

A stakeholder workshop on the robustness and legitimacy of climate models in 2020 helped to improve the legitimacy and

transparency of IAMs, and numerous papers have been published that contribute to a better understanding of the fundamental properties of global mitigation pathways.

The project also offers new knowledge to support international climate policy processes like the UNFCCC 2023 Global Stocktake.

PROJECT

**NAVIGATE – Next generation of AdVanced
InteGrated Assessment modelling to support
climaTE policy making**

COORDINATED BY

Potsdam Institute for Climate Impact Research
in Germany

FUNDED UNDER

Horizon 2020-ENVIRONMENT

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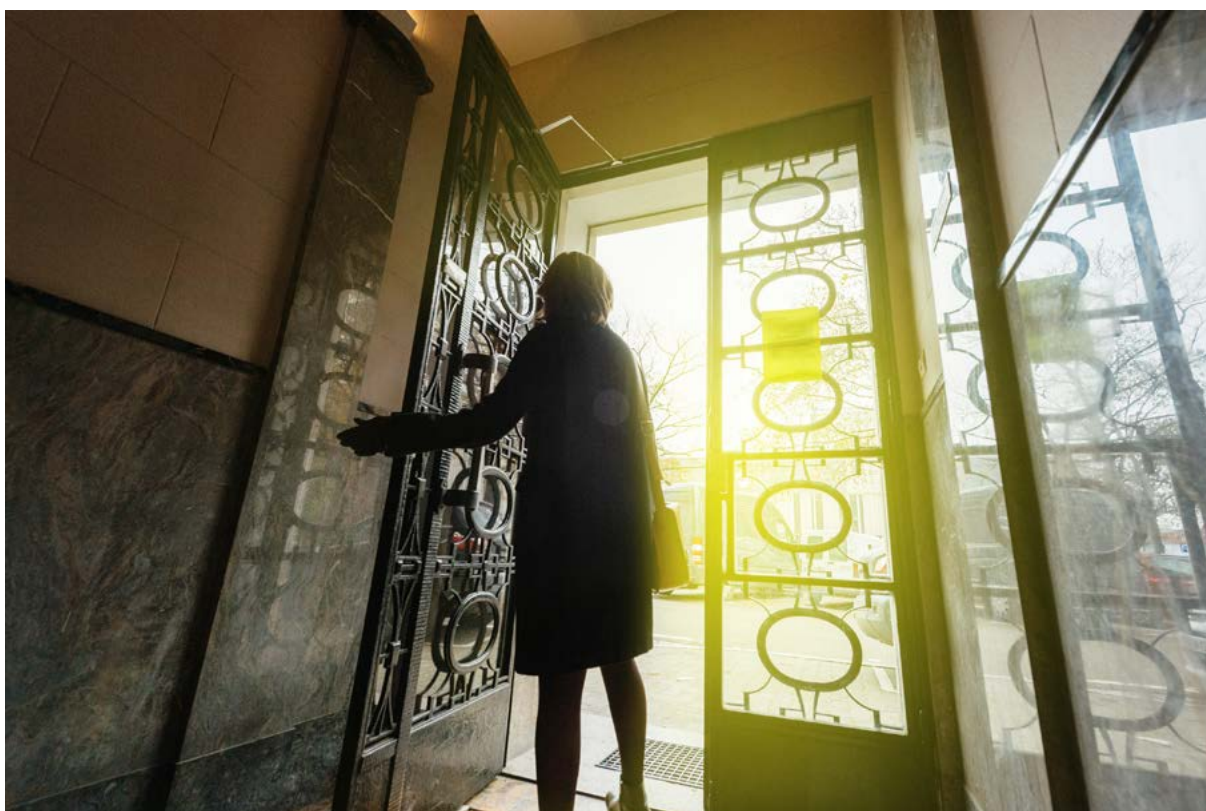
PROJECT WEBSITE

navigate-h2020.eu



A doorway to the future of energy production in the EU

The EU has ambitions to become climate-neutral by 2050. This will require a dramatic shift toward renewable and clean energy sources, as well as drastic economic and social adaptations. The EU-funded Open ENTRANCE project is developing an open-source platform for assessing low-carbon transition pathways.



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In order to meet its climate targets, the EU relies upon accurate energy models that can reveal the most effective pathways to decarbonisation. The Open ENTRANCE (Open ENergy TRansition ANalyses for a low-carbon Economy)

project is accelerating these efforts with a transparent and integrated service for assessing low-carbon transition pathways, developed by a consortium of 14 partners in energy modelling.

Coordinated by Sintef Energi in Norway, the 4-year project aims to deliver a platform that integrates macroeconomic and energy system models, as well as providing economic and human behavioural data relevant to the energy transition.

Open ENTRANCE is building on the capacity of existing carbon transition frameworks by improving the overall quality of the models within the platform and integrating the models so that they improve one another, offer faster and more sensitive analyses, integrate large-scale datasets on human behaviour, and combine detailed bottom-up and top-down approaches.

The project has developed four scenarios for low-carbon energy futures at a pan-European and national level, covering subsequent 1.5 °C and 2.0 °C global temperature increases. These quantitative scenarios were created using a tailor-made extension of the GENeSYS-MOD energy system model, and validated against comparable pathways of the MESSAGix-GLOBIOM integrated assessment model used by the IPCC.

Open ENTRANCE has also developed in-depth case studies about selected topics such as how energy flexibility in households will impact the investment needs at the European level, and how optimal use of energy among communities of actors will impact the overall load profile. Moreover, the project has started macroeconomic analyses to provide new knowledge about the economic consequences of the transition to a low-carbon society.

By offering this research in an open-source system guaranteed to remain available for the next 10 years, the project team

hopes the platform will be reused and further developed by the scientific community, and the collected datasets leveraged in other carbon transition research.

Concluding in 2023, the work will help stakeholders determine macroeconomic consequences of the energy transition, facilitate dialogue between researchers, policymakers and industry, and ultimately identify the best ways to transition to a low-carbon economy.

PROJECT

**Open ENTRANCE – Open ENergy TRansition
Analyses for a low-carbon Economy**

COORDINATED BY

Sintef Energi in Norway

FUNDED UNDER

Horizon 2020-ENERGY

CORDIS FACTSHEET

cordis.europa.eu/project/id/835896

PROJECT WEBSITE

openentrance.eu



Putting stakeholders at the centre of climate policy assessment

The Paris Agreement secured the cooperation of 191 signatories in addressing climate change. However, actions needed for the treaty's implementation require the support of those affected. The EU-funded PARIS REINFORCE project enhances the legitimacy of climate policymaking by introducing an innovative stakeholder inclusion framework.

Coordinated by the National Technical University of Athens in Greece, the 3-year project PARIS REINFORCE (Delivering on the Paris Agreement: A demand-driven, integrated assessment modelling approach) brings together a consortium of 13 institutions across Europe. Together they are building an

open-access and transparent data exchange platform to support the design of climate policies.

In order to address the multiplicity of challenges, PARIS REINFORCE has pioneered innovative integrative processes that couple



modelling tools with well-established methodological frameworks, improving the robustness of modelling outcomes against different types of uncertainties.

The resulting I²AM PARIS framework developed by the project allows for the collection and provision of detailed documentation on integrated assessment, energy system and sectoral models. It supports the design and evaluation of climate policies that are evidence-based, inclusive, realistic and sustainable, and further strengthens them with a robustness analysis toolbox and an innovative stakeholder inclusion framework.

As such, the integrated assessment modelling (IAM)-oriented assessment framework boosts the transparency and legitimacy of transition pathways, and supports the effective implementation of Nationally Determined Contributions, the preparation of future action pledges, the development of 2050 decarbonisation strategies, and the reinforcement of the UNFCCC 2023 Global Stocktake.

Notably, PARIS REINFORCE is working to involve policymakers and other stakeholder groups in all stages of the process, from the formulation of policy questions and the definition of modelling assumptions in a demand-driven approach to the design of I²AM PARIS interfaces and specifications. This

work includes four stakeholder workshops, one EU national forum held in Greece, and three non-EU national workshops in India, Japan and Kenya.

The project concludes in May 2023.

PROJECT

PARIS REINFORCE – Delivering on the Paris Agreement: A demand-driven, integrated assessment modelling approach

COORDINATED BY

National Technical University of Athens in Greece

FUNDED UNDER

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CORDIS FACTSHEET

cordis.europa.eu/project/id/820846

PROJECT WEBSITE

paris-reinforce.eu



How the fictitious city of Notterdam is guiding heavy industry to decarbonisation

Energy-intensive industries need to significantly reduce their emissions if we are to meet our climate commitments. The successes of the EU-funded REINVENT project, which include targeted policy recommendations and an innovative ‘guide from the future’, provide reasons for optimism.



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To keep global warming below 1.5 °C and mitigate against the worst effects of climate change, global carbon emissions need to be reduced to net zero. This will not happen unless entire industries are transformed.

A key problem is that heavy industries, which account for a large proportion of industrial emissions, have been slow to

decarbonise. “Most energy-intensive sectors face the problem that decarbonisation could make their product more expensive,” explains REINVENT (Realising Innovation in Transitions for Decarbonisation) project coordinator Lars Nilsson, a professor of Energy and Environmental Systems at Lund University in Sweden. “They are all also locked into existing assets and infrastructures.”

Industrial processes also tend to be complex and capital-intensive, another reason industrial decarbonisation has often lagged behind other high-emitting sectors such as transport and energy.

Decarbonisation priorities

To address this challenge, the REINVENT project focused on the paper, steel and plastics sectors. Specific processes in each of these sectors were examined, as well as issues such as consumer demand and consumption.

"We took into account links between industries, and brought in economics, geography and political science experts," adds Nilsson. "We asked questions such as: Can we reduce demand? How much can we recycle? And what is a reasonable level of plastics consumption?"

From this extensive fieldwork, the project team identified priorities for industrial decarbonisation. These recommendations, which have been published in a recent policy framework, set out different pathways for each sector.

REINVENT found that the steel industry needs to focus on improving energy and materials efficiency, circularity and new technologies. Plastics, on the other hand, should focus more on reducing or optimising use and production, increasing circularity and making use of chemical recycling. And the paper sector should consider decarbonising production through fuel switching and diversification into biorefineries. "This policy framework is a kind of synthesis of what we want to achieve," says Nilsson.

for achieving these goals should also be identified and prioritised, and the benefits to industry of adopting sustainable technologies highlighted.

Nilsson has noted a shift in attitudes within industry over the past 12 months. "Things have moved fast," he notes. "Since 2020, a number of steel companies have announced plans to decarbonise production, and serious initiatives have been launched." The necessity of net zero emissions is increasingly embraced by industry.

One REINVENT initiative that has proved especially effective at grabbing industry's attention has been a guidebook from the fictitious city of Notterdam, written as if from the year 2045. Drawing on the project's work, the guide paints a picture of how radically reducing our carbon footprint could lead to sustainable living in the future.

"I was nervous at first, as this was really out-of-box thinking, but the guide has been very well received by industry," says Nilsson. "We have held meetings and seminars with companies who are keen to learn more. This is a new way of talking to industry, and for them to think about the future."



*This is a new way of talking
to industry, and for them
to think about the future.*

Breakthroughs such as this have given Nilsson a sense of cautious optimism about the future. "Five years ago I would

have said that climate change is the biggest, most difficult problem facing humanity," he remarks. "Now, I'm more inclined to suggest that mitigating climate change could be a relatively easy fix compared to, say, protecting biodiversity or tackling plastics littering. There are so many possibilities."

Bringing industry on board

The project has also been successful in taking its message to both policymakers and industrial leaders. "REINVENT came along with incredibly good timing," adds Nilsson. "We started in December 2016, when many of these policy issues were emerging, and really got up to speed when work started on the EU Industrial Strategy and Green Deal. In a sense, the project has co-evolved with EU policy."

REINVENT's work is already making an impact. The project team was asked to provide input to the EU Industrial Strategy and engaged in multiple European webinars on industrial decarbonisation, as well as webinars in India and Russia. Nilsson stresses that successful transition policy strategies must be communicated clearly to industry; after all, they need to know what the ultimate objectives are. Suitable technology solutions

PROJECT

**REINVENT – Realising Innovation in Transitions
for Decarbonisation**

COORDINATED BY

Lund University in Sweden

FUNDED UNDER

Horizon 2020-ENVIRONMENT

CORDIS FACTSHEET

cordis.europa.eu/project/id/730053

PROJECT WEBSITE

reinvent-project.eu

Energy transition: helping policymakers think three steps ahead

How do we achieve net zero emissions in Europe while safeguarding a stable and affordable energy supply? By enabling informed decision-making that takes into account all relevant aspects of the energy system.

Putting the EU on track for climate neutrality by 2050 will require accurate tools for testing the possible outcomes of multiple interlinked choices that affect the future energy landscape.

The EU-funded SENTINEL (Sustainable Energy Transitions Laboratory) project is developing a new, modular approach to

energy modelling built with renewable energy systems in mind, to guide key policy decisions for Europe's low-carbon future.

Energy models make projections about energy systems under different scenarios, covering aspects ranging from resource use to greenhouse gas emissions, cost, economic impact and social aspects.





“Policymakers need to know the economic, social and environmental implications of different choices that they face today.”

“Policymakers need to know the economic, social and environmental implications of different choices that they face today,” explains Anthony Patt, professor of Climate Policy at the Swiss Federal Institute of Technology Zürich (ETH Zürich) which coordinates the project.

“We focus on answering these questions not with a single model that is so large and complicated as to be a mysterious black box, but rather by pulling together a set of small, transparent, open-source models and data, that can precisely meet their needs.”

Brussels and beyond

These connected open-source models will bring together data sets covering different locations and spatial scales, to help specific questions users have about the most suitable energy solutions for them.

The project team aims to make these models available for download, with clear instructions on how to use them in combination. SENTINEL also hopes to enable a broader range of analysts to make use of such tools.

Until now, the majority of energy models have been challenging to understand and use, as they were mostly designed for very limited groups of users, says Patt.

The SENTINEL team wants to make it easier for different actors to access and use reliable and transparent models and data sets: “The EU’s energy transition is being guided from Brussels, but also, bottom-up, from Europe’s cities, regions and national capitals,” he notes.

The set of tools Patt and his colleagues are developing is aimed not only at public servants, but also at private companies, such as consulting companies, suppliers and major users of energy.

Informed choices

To lay the groundwork for the new modelling framework, the SENTINEL team has been working with end users on a number of case studies to define their needs and the information gaps they are facing.

“What they value are models that test the outcomes of concrete decisions, at the geographic and temporal scale they are being made, rather than delivering more abstract information. Providing this kind of information is our main challenge,” says Patt.

The online platform hosted by ETH Zürich, which will remain available after the end of the project’s funding period, will serve as a hub for a community of users who will help to continuously improve the tool by sharing feedback and data. The long-term ambition is for SENTINEL to develop into a widely used resource for decades to come.

PROJECT

SENTINEL – Sustainable Energy Transitions Laboratory

COORDINATED BY

Swiss Federal Institute of Technology Zürich
in Switzerland

FUNDED UNDER

Horizon 2020-ENERGY

CORDIS FACTSHEET

cordis.europa.eu/project/id/837089

PROJECT WEBSITE

sentinel.energy



Helping islands fight the rising tide of climate change

An innovative online platform provides island communities with tailored networking opportunities, information and climate adaptation support tools. The resource, a key outcome of the EU-funded SOCLIMPACT project, will help businesses, policymakers and citizens to identify climate-related challenges and take action.



Island populations are especially vulnerable to climate impacts such as rising sea levels, as is already seen in the Maldives in the Indian Ocean and the Marshall Islands in the Pacific. But this is also a European concern: more than 15 million people live on more than 2 000 islands across the EU.

“Climate change presents other problems for islands,” notes SOCLIMPACT project coordinator Carmelo León, from the University of Las Palmas de Gran Canaria (ULPGC) in Spain. “Their modest size can make it difficult to move to renewable energy alternatives, and they often do not have the economies of scale for large infrastructure.”

Assessing island vulnerability

The SOCLIMPACT project set out to better understand the environmental and socio-economic challenges that climate change poses for these communities. Four 'blue economy' sectors were prioritised – coastal and maritime tourism, aquaculture, energy, and maritime transport – across 12 EU islands.

"Island vulnerability is continuously increasing," says León. "We recognised that more detailed modelling and projection tools were needed, to really take into account specific climate tipping points and high-impact events."

Local working groups were established in each of the partner islands. These groups included public authorities and private sector representatives. Climate change impacts across the four blue economy sectors were identified, and integrated socio-economic assessments of expected climate impacts on island communities developed.

Valuable island resource

These project findings have gone into constructing the Regional Exchange Information System (REIS) platform. "This is really the project's legacy," adds project team member Yen Elizabeth Lam, also from the ULPGC. "All the indicators, statistics and socio-economic modelling specific to islands can be found here."

The platform offers three key services. The first is a virtual meeting room for networking, where island policymakers, business leaders and experts can get together to discuss specific issues. Advice can be sought, along with possible partners for future projects.

"The platform also offers an e-library data repository," says Lam. "Here, stakeholders can find all project documentation. We

also provide direct links here to other climate resources, such as the European Climate, Infrastructure and Environment Executive Agency (CINEA)."

Finally, the platform offers tailored adaptation support tools, for both decision makers and economic actors. Users select one of the four key economic areas, and select which island they are interested in.

This generates specific information on climate risks, such as sea-level rises, forest fires and habitat destruction. Information

on the current situation in terms of mitigation plans and strategies is provided. "The data is different for each island, and for each specific problem," remarks Lam. "The aim is to inform, and to inspire climate action."

Although still in the testing phase, both León and Lam are confident that the platform will help to connect islands, and foster targeted climate action. Administered from the TiDES Institute at the ULPGC, the REIS platform is freely open to everyone as a nascent technology centre.

"Here in the Canary Islands, we are trying to merge the platform into the regular services provided by the regional government," explains Lam. The platform is also attracting interest from elsewhere. Crete is using the platform to prepare its climate adaptation strategy, through creating working groups with other regional governments.

"Cyprus has also contacted us," says Lam. "The government is interested in using the platform's networking function to run a public consultation on a climate adaption strategy for tourism."

In the meantime, the platform will continue to be strengthened and improved. "We are currently running a survey of rural tourism firms in the Canary Islands, to find out how useful this resource is, and what actions they feel they can implement," notes Lam. "This will help us to understand how the platform can be useful at multiple levels."



*The aim is to inform,
and to inspire
climate action.*

PROJECT

SOCLIMPACT – DownScaling CLimate imPACTs and decarbonisation pathways in EU islands, and enhancing socioeconomic and non-market evaluation of Climate Change for Europe, for 2050 and beyond

COORDINATED BY

University of Las Palmas de Gran Canaria in Spain

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Birgit BEN YEDDER

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RESEARCH*EU MAGAZINE ISSUE 107

SQUARING THE ARCTIC CIRCLE: PROTECTING AND PRESERVING EARTH'S FAR NORTH

The Arctic is not a frozen wasteland. It is rich in ecological, cultural, and geophysical significance, all of which are under threat. A better scientific understanding of the region's climate, its flora and fauna, and its inhabitants is key to fulfilling the EU's commitment to safeguard the Arctic for the benefit of the entire world.



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