



Rialtas na hÉireann
Government of Ireland

Climate Research Coordination Group Fourth Report on Activities

January 2021–December 2021



This report was prepared by the Environmental Protection Agency on behalf of the Climate Research Coordination Group: August 2022

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Acknowledgements

The Climate Research Coordination Group would like to acknowledge the contributions of the group's members in the preparation of this annual report for 2021 and thank all those who provided the data included in this report.

Disclaimer

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Acronyms and Abbreviations

5YAR	Five-year assessment research
CAP21	2021 Climate Action Plan
CARO	Climate Action Regional Office
CCAC	Climate Change Advisory Council
CRCG	Climate Research Coordination Group
CSO	Central Statistics Office
DAERA-NI	Department of Agriculture, Environment and Rural Affairs – Northern Ireland
DAFM	Department of Agriculture, Food and the Marine
DECC	Department of the Environment, Climate and Communications
DETE	Department of Enterprise, Trade and Employment
DFA	Department of Foreign Affairs
DFHERIS	Department of Further and Higher Education, Research, Innovation and Science
DHLGH	Department of Housing, Local Government and Heritage
DPER	Department of Public Expenditure and Reform
DT	Department of Transport
DTIF	Disruptive Technologies Innovation Fund
EAP	(EU) Environment Action Programme
EI	Enterprise Ireland
EPA	Environmental Protection Agency
ERA-NET	European Research Area Network
ESRI	Economic and Social Research Institute
EU	European Union
GCOS	Global Climate Observing System
GHG	Greenhouse gas
GSI	Geological Survey Ireland
IPCC	Intergovernmental Panel on Climate Change
IRC	Irish Research Council
ISIF	Ireland Strategic Investment Fund

JPI	Joint Programming Initiative
MÉ	Met Éireann
MI	Marine Institute
NAF	National Adaptation Framework
NERCG	National Environmental Research Coordination Group
NESC	National Economic and Social Council
NPWS	National Parks & Wildlife Service
NTMA	National Treasury Management Agency
NUIG	National University of Ireland, Galway
OPR	Office of the Planning Regulator
OPW	Office of Public Works
RD&D	Research, development and demonstration
RD&I	Research, development and innovation
RFO	Research-funding organisation
SEAI	Sustainable Energy Authority of Ireland
SFI	Science Foundation Ireland
SMEs	Small and medium-sized enterprises
UNFCCC	United Nations Framework Convention on Climate Change
NIEA	Northern Ireland Environment Agency
NTA	National Transport Authority
NTMA	National Treasury Management Agency
NUIG	National University of Ireland, Galway
OPR	Office of the Planning Regulator
OPW	Office of Public Works
P2P	Public-to-Public Partnership
RD&D	Research, Development & Demonstration
RPO	Research Performing Organisation
SDG	Sustainable Development Goal
SEAI	Sustainable Energy Authority of Ireland
SFI	Science Foundation Ireland
UNFCCC	United Nations Framework Convention on Climate Change

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Executive Summary



Executive Summary

The Climate Research Coordination Group (CRCG) was established by the Environmental Protection Agency to coordinate climate change-related research in Ireland. This report presents a summary of investments, of progress on strategic goals and related developments during 2021 and of the CRCG’s activities over that period. This (fourth) report covers competitive research funding committed by members of the CRCG, leveraged funding from EU schemes and core research activities carried out by CRCG members themselves over the period 1 January to 31 December 2021.

The CRCG supports and promotes collaboration by research funding organisations and provides a forum for the exchange of information on activities and plans. The objective is to advance shared strategic goals for climate change research, to ensure coherence in climate change research investments in Ireland and to effectively link these to European funding streams, including Horizon Europe and the Joint Programming Initiative (JPI) Climate.

The EPA convenes and chairs CRCG meetings. CRCG membership is open to departmental officials and to representatives of state agencies/bodies and local authorities and to stakeholders who either fund climate change research or use the outputs from it.

This report builds on and updates the material from the first report (June–December 2018)¹, published in May 2019, the second report (January–December 2019)², published in June 2020, and the third report (January–December 2020)³, published in June 2021.

Action 82(i) of the Climate Action Plan 2021 (CAP21) requires that the CRCG provides an annual report on its activities.

Over the course of 2021, the CRCG collated a single submission to the national research classification project run by the Department of Further and Higher Education, Research, Innovation and Science (DFHERIS) for climate research. The CRCG’s submission focused on making the climate-relevant elements up to date, relevant to Ireland and consistent with other sectors, e.g. energy. The collaborative work on the climate codes also made the classification system more appropriate for use by CRCG members to report on their activities in a consistent manner. The CRCG also began examining climate research metrics, which has continued in 2022. This addresses Action 82(v) of CAP21, which requires that the CRCG examines climate research classification and climate research metrics to support the delivery of the new National Research & Innovation Strategy, Impact 2030.

This report is based on the information provided by the members of the group.

This report and other annual reports are complemented by the five-year assessment of climate research activities in Ireland (5YAR), which provides a synthesis of findings and information from funded research. The 5YAR report will be completed in 2023 and addresses Action 82(ix) of CAP21.

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1 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-report.php>
2 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-second-report-on-activities.php>
3 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-third-report-on-activities.php>

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In summary, in 2021:
Significant progress was made in the first 5YAR, which included completion of the award and scoping processes (Action 82 of the CAP21).
New headings for reporting climate research were used in this report (climate research and research of relevance to climate action).
42 new climate research competitive awards were made in 2021, with a total budget commitment of €24.1 million.
20 of the new climate research competitive awards were supported through co-funding from other CRCG members in addition to the principal CRCG member that made each award. The other 22 awards were funded solely through the CRCG member that made the award.
86% of the budget went to projects led by University College Dublin, Teagasc, National University of Ireland Galway and Maynooth University (based on funding for successful projects assigned to the lead partner).
In excess of €8.2 million was allocated to core research activities in 2021, i.e. research activities that are performed in house (e.g. by Teagasc, Met Éireann, etc.).
There were a further 101 new research competitive awards for projects of relevance to climate action, with a total budget commitment of €76.4 million ⁴ .
The Irish climate research community achieved a drawdown of €32.6 million under Horizon 2020/Horizon Europe (47 projects) and €1.7 million from Interreg (one project) ⁵ .
The launch of the second <i>The Status of Ireland's Climate</i> report⁶ , by the EPA, Met Éireann and the Marine Institute, received considerable media attention.
The Royal Irish Academy Climate Conversations series was held online and provided opportunities to hear about the findings from a number of recent climate research reports ⁷ .
The EPA embarked on a new project with Yale University's Program on Climate Change Communication to research the Irish public's attitudes, behaviours, policy preferences and beliefs around climate change ⁸ . The first report from this project, <i>Climate Change in the Irish Mind</i>⁹ , was published in 2021.
In addition, 80 climate research communication events and workshops took place in 2021 involving CRCG members.

4 This includes one award of €28.3 million for phase 2 of iCrag, the Science Foundation Ireland research centre for applied geosciences.

5 Includes projects approved, contracted and started in 2021. Interreg (<https://interreg.eu/>) is one of the key instruments of the EU supporting cooperation across borders through project funding. Its aim is to jointly tackle common challenges and find shared solutions in fields such as health, environment, research, education, transport, sustainable energy and more.

6 <https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php>

7 <https://www.ria.ie/science-committees/climate-change-and-environmental-sciences-committee>

8 <https://www.epa.ie/environment-and-you/climate-change/what-is-epa-doing/ndcayale-work/climate-change-in-the-irish-mind/>

9 <https://www.epa.ie/publications/monitoring--assessment/climate-change/climate-change-in-the-irish-mind.php>

Climate Research Coordination Group

Reporting Period:
January-December 2021

31
Members



9 CRCG
Meetings



42 New climate
research awards
€24.1m



100 awards of
relevance to
Climate action
€48.1m



€34.3m
Climate-relevant EU
funding leveraged

€8.2m
Core research activities



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Section 1

Purpose of the Report



1. Purpose of the Report

The EPA has coordinated climate change research in Ireland since 2008. Since 2017, this has been advanced through the work of the national Climate Research Coordination Group (CRCG). The CRCG annual report on its activities addresses Action 82 of the Climate Action Plan 2021 (CAP21) to “Strengthen our delivery of public funding for basic and applied research to meet climate action objectives”, and specifically sub-Action 82(i) of CAP21. This is the fourth report by the CRCG on its activities and it covers the period January–December 2021. It builds on and updates the first report on the CRCG’s activities for the period June 2017 to December 2018¹⁰ and on previous reports^{11, 12}.

This report provides an inventory of climate change research-related activities and funding from the CRCG members. This report and previous CRCG reports complement the five-year assessment of climate research activities (5YAR) (Action 82 of CAP21), which is designed to provide an assessment and synthesis of the outcomes and findings from funded research.

It therefore primarily provides the following:

- ▶ An overview of the climate change research that has been funded in Ireland by CRCG members over the period January–December 2021. It covers competitive research funding committed by members of the CRCG for research and development performed elsewhere, as well as leveraged funding from EU schemes and core research activities carried out by CRCG members.
- ▶ An outline of the wider funding landscape, which includes European sources. It also includes a summary of relevant international climate change research in which members of Ireland’s research community are active.

This report is based on the information provided by the members of the group. The scientific and policy context for climate change research was outlined in the first report and updated in subsequent reports.

1.1 The Climate Research Coordination Group

Section 71 of the Environmental Protection Agency Act 1992 gives the EPA responsibility for coordinating environmental research in Ireland. The Climate Action Plans and the National Adaptation Framework (NAF) specify the roles of the EPA in coordinating climate research across state-funded bodies.

The EPA has coordinated climate change research in Ireland since 2008. Since 2017, this has been advanced through the work of the national CRCG. In 2021, under the new EPA Research 2030 framework, the CRCG became a sub-group of the National Environmental Research Coordination Group.

The membership of the CRCG (**Table 1**) is open to and encompasses the main national bodies that fund or use the findings of climate change research, as well as key stakeholders. The objective is to coordinate climate change research investments in Ireland. This is achieved through a coherent and well-structured programme that enhances synergies, avoids duplication and enables stakeholder participation.

The CRCG terms of reference are provided in **Appendix 1**.

The Department of Foreign Affairs (DFA) joined the CRCG in 2021 (see Appendix 2).

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10 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-report.php>
11 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-second-report-on-activities.php>
12 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-third-report-on-activities.php>

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Table 1: CRCG membership (as of January 2022)

Organisation ¹³	Acronym/ short name	Website
Central Statistics Office	CSO	www.cso.ie
Climate Action Regional Offices established in four geographical regions: Atlantic Seaboard North Atlantic Seaboard South Dublin Metropolitan Eastern & Midlands	CAROs	http://caro.ie/
Climate Change Advisory Council	CCAC	www.climatecouncil.ie
County and City Management Association	CCMA	www.lgma.ie/en/ccma/
Department of Agriculture, Food and the Marine	DAFM	www.gov.ie/en/organisation/department-of-agriculture-food-and-the-marine/
Department of Enterprise, Trade and Employment	DETE	www.gov.ie/en/organisation/department-of-enterprise-trade-and-employment/
Department of Further and Higher Education, Research, Innovation and Science	DFHERIS	www.gov.ie/en/organisation/department-of-higher-education-innovation-and-science/
Department of Housing, Local Government and Heritage (Met Éireann)	DHLGH (MÉ)	www.met.ie
Department of Housing, Local Government and Heritage (National Parks & Wildlife Service)	DHLGH (NPWS)	www.npws.ie
Department of the Environment, Climate and Communications	DECC	www.gov.ie/en/organisation/department-of-the-environment-climate-and-communications/
Department of the Environment, Climate and Communications (Geological Survey Ireland)	DECC (GSI)	www.gsi.ie
Department of Foreign Affairs	DFA	https://dfa.ie/

¹³ Where relevant, the specific division or business unit within the department is indicated in brackets.



Organisation ¹³	Acronym/ short name	Website
Department of the Taoiseach	DoT	www.gov.ie/en/organisation/department-of-the-taoiseach/
Department of Tourism, Culture Arts, Gaeltacht, Sport and Media	DTCAGSM	www.gov.ie/en/organisation/department-of-tourism-culture-arts-gaeltacht-sport-and-media/
Department of Transport	DT	www.gov.ie/en/organisation/department-of-transport/
Enterprise Ireland	EI	www.enterprise-ireland.com
Environmental Protection Agency	EPA	www.epa.ie
Health Service Executive	HSE	www.hse.ie
Irish Environmental Network	IEN	https://ien.ie
Irish Research Council	IRC	http://research.ie
Irish Water	IW	www.water.ie
Marine Institute	MI	www.marine.ie
National Economic and Social Council	NESC	www.nesc.ie
National Transport Authority	NTA	www.nationaltransport.ie
National Treasury Management Agency	NTMA	www.ntma.ie
Northern Ireland Environment Agency	NIEA	www.daera-ni.gov.uk/northern-ireland-environment-agency
Office of Public Works	OPW	www.opw.ie
Office of the Planning Regulator	OPR	www.opr.ie
Science Foundation Ireland	SFI	www.sfi.ie
Sustainable Energy Authority of Ireland	SEAI	www.seai.ie
Teagasc – Agriculture and Food Development Authority	Teagasc	www.teagasc.ie

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Section 2

2021 Climate Science Policy Framework and Developments



2. 2021 Climate Science Policy Framework and Developments

This section provides an overview of the national, EU and international science policy interface and development that took place in 2021. A key aim of climate change research is to inform and respond to the policy context. International and EU policy and actions on climate change are uniquely informed by research, principally through the work of bodies such as the Intergovernmental Panel on Climate Change (IPCC).

In 2021, the IPCC, as part of its sixth assessment cycle (AR6)¹⁴, published the Working Group I report on the physical science basis¹⁵. In early 2022, the IPCC also published the reports for Working Group II on impacts, adaptation and vulnerability¹⁶ and for Working Group III on mitigation of climate change¹⁷. The synthesis report is due to be published in September 2022. These reports provide the current authoritative scientific understanding of the issues and are central to informing policy responses and actions to address climate change from the global to the local level. They also identify areas for further research.

As a party to the United Nations Framework Convention on Climate Change (UNFCCC), Ireland is committed to the development and provision of support for climate change research and systematic observations (through the Global Climate Observing System, GCOS) of the climate system. Progress in these areas is reported by parties in national communications to the UNFCCC every four years. Ireland will submit its eighth national communication in 2022.

2.1 EU and International Levels

Eighth Environment Action Programme

In December 2021, provisional agreement was reached between the European Parliament and the European Council on the Eighth Environment Action Programme (EAP), which is the EU’s joint programme for implementing the European Green Deal. The 8th EAP anchors the Member States’ and Parliament’s commitment to environmental and climate action until 2030, guided by a long-term vision to 2050 of well-being for all, while staying within the planetary boundaries. The agreed 8th EAP has six priority objectives related to climate neutrality, climate adaptation, circular economy, zero pollution, protecting and restoring biodiversity, and reducing environmental and climate pressures related to production and consumption. In addition, the programme sets out an enabling framework and a monitoring framework to measure progress towards the required systemic change. Following final ratification, it is expected to be published later in 2022.

Climate-related EU legislation

The European Climate Law¹⁸ [Regulation (EU) 2021/1119]¹⁹ was established in 2021. It writes into law the goal set out in the European Green Deal for Europe’s economy and society to become climate neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas (GHG) emissions by at least 55% by 2030, compared with 1990 levels.

14 <https://www.ipcc.ch/>
15 <https://www.ipcc.ch/report/ar6/wg1/>
16 <https://www.ipcc.ch/report/ar6/wg2/>
17 <https://www.ipcc.ch/report/ar6/wg3/>
18 https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en
19 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119&from=EN>

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The European Commission published its “Fit for 55” legislative package in 2021^{20, 21, 22}. This is a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with the climate goals agreed by the Council and the European Parliament. It includes legislative proposals and policy initiatives in the following areas:

- ▶ changes to the existing EU Emissions Trading System (EU ETS);
- ▶ increased ambition in Member States' targets for reducing emissions under the Effort Sharing Regulation from 29% to 40% by 2030 compared with 2005;
- ▶ strengthening the contribution of the land use, land use change and forestry (LULUCF) sector;
- ▶ a review of the Renewable Energy Directive;
- ▶ revision of the current Energy Efficiency Directive;
- ▶ revision of existing legislation to accelerate the deployment of infrastructure for recharging or refuelling vehicles with alternative fuels and to provide an alternative power supply for ships in ports and stationary aircraft;
- ▶ revision of rules on CO₂ emission standards for cars and vans;
- ▶ revision of the Council Directive on the taxation of energy products and electricity;
- ▶ proposal for a carbon border adjustment mechanism (CBAM) to prevent the EU's emission reduction efforts being offset by increasing emissions outside its borders through relocation of production to non-EU countries (where policies applied to fight climate change are less ambitious than those of the EU) or increased imports of carbon-intensive products;
- ▶ sustainable aviation fuels;
- ▶ a proposal on the use of renewable and low-carbon fuels in maritime transport.
- ▶ a proposal for a social climate fund to address the social and distributional impact of the proposed new emissions trading system for buildings and road transport.

The EU Soil Strategy for 2030 was published in 2021²³. It sets out a framework and concrete measures to protect and restore soils and ensure that they are used sustainably. It sets out a vision and objectives to achieve healthy soils by 2050, with concrete actions in place by 2030. It also announces a new law on soil health by 2023 to ensure a level playing field and a high level of environmental and health protection. Healthy soils are essential for achieving climate neutrality.

COP26

The 2021 United Nations Climate Change Conference, more commonly referred to as COP26, was the 26th Conference of the Parties to the UNFCCC, held in Glasgow, Scotland, from 31 October to 13 November 2021. Nations at COP26 adopted the Glasgow Climate Pact²⁴, aiming to accelerate climate action and mobilise increased support during this decade.

The package of decisions made at COP26 includes strengthened efforts to build resilience to climate change, to curb GHG emissions and to provide the necessary finance for both. Developed nations reaffirmed their duty to fulfil their pledge to provide funding of US\$100 billion annually to developing countries. And they collectively agreed to work to reduce the gap between existing emission reduction plans and what is required

20 https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal_en
21 <https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/#:~:text=Fit%20for%2055%20refers%20to%20the%20at%20least,energy%20legislation%20in%20line%20with%20the%202030%20goal>
22 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0550&from=EN>
23 https://environment.ec.europa.eu/strategy/soil-strategy_en
24 <https://ukcop26.org/the-glasgow-climate-pact/>

to reduce emissions, so that the rise in the average global temperature can be limited to 1.5°C. For the first time, nations are called upon to phase down unabated coal power and inefficient subsidies for fossil fuels.

The Glasgow Climate Pact²⁵ strongly reflected the science provided by the IPCC in its special report on warming of 1.5°C and the IPCC AR6 Working Group I report. These show that CO₂ emissions should be reduced by about 45% relative to 2021 levels by 2030 and reach net zero around 2050. Rapid reductions in non-CO₂ GHG emissions are also required.

As part of the package of decisions, parties also completed the Paris Agreement's rulebook, as it relates to market mechanisms and non-market approaches and the transparent reporting of climate actions and support provided or received.

2.2 National Level

In Ireland, the 2020 Programme for Government²⁶ committed Ireland to reducing carbon emissions by 51% by 2030 and becoming a carbon-neutral country by no later than 2050. In 2021, the Oireachtas passed the Climate Action and Low Carbon Development (Amendment) Act 2021²⁷, which for the first time sets out our targets for emission reductions in legislation²⁸. Following government approval, carbon budgets were laid before the Houses of the Oireachtas on 24 February 2022. The carbon budgets were approved by the Houses of the Oireachtas on 6 April 2022 and took effect on that date.

In 2021, the government published CAP21²⁹, which lays out the detailed path to delivering on this ambition sector by sector. However, if Ireland is to achieve this transition, we will need to make changes in our society and economy, including the built environment, energy, transport, waste and agriculture. This will require a collaborative effort by government, business, communities and individuals to deliver new and ambitious policies, technological innovations, and systems and infrastructures.

This will also require changes in individual behaviours, including how we work, heat our homes, travel, produce our food, consume goods and services, and manage our waste.

The National Dialogue on Climate Action will be the primary vehicle through which this ambition will be realised, delivering a systematic means of actively engaging stakeholders and the public with climate action across Ireland and enabling and empowering people at local and national levels.

The Department of the Taoiseach publishes quarterly progress reports on the implementation of climate action plans, with 2021 focusing on the progress of the Interim Climate Actions³⁰. These actions were developed to maintain a focus on implementation across departments while CAP21 was being prepared. All progress reports were approved by government and published online³¹ to maintain accountability and transparency on national climate action progress.

On publication of the CAP21 in November 2021, and its supporting Annex of Actions in December 2021, the Department of the Taoiseach also committed to further streamline the reporting process to distinguish to between key actions that deliver significant abatement of emissions, and supporting actions, to allow greater transparency on progress towards decarbonisation. This approach will be reflected in progress reporting in 2022.

25 <https://ukcop26.org/the-glasgow-climate-pact/>

26 <https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/>

27 <https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/html>

28 The main elements of the relevant bill were included in the third CRCG report (January–December2020): <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-third-report-on-activities.php>. CAP21 is the first of the annual CAPs required under this Act. The annual CAPs are used to drive continued delivery of climate action across all government departments and bodies. CAP21's Annex of Actions has 493 actions, including over 100 that have a research element.

29 <https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/>

30 <https://assets.gov.ie/127955/298d5c71-05d7-4ff9-b3f4-9da61bd17941.pdf>

31 <https://www.gov.ie/en/publication/55fde-climate-action-important-publications/#progress-reports>

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The Climate Action and Low Carbon Development Act, as amended, came into force in September 2021. This led to an expansion in the number of members of the Climate Change Advisory Council (CCAC) to 14, and a broadening of its functions, including in regard to carbon budgets. The CCAC proposed its first carbon budgets programme to the Minister for the Environment, Climate and Communications on 25 October. The CCAC published its annual review of climate policy, progress on the achievement of the national transition objective and progress towards international targets in December 2021. In addition to progress made in the low-carbon transition, both at the national level and across each of the different sectors, the report considers progress towards climate resilience with a focus on progress on adaptation across each of the NAF sectors. The focus of future annual reviews will include reviews of progress against sectoral emission ceilings, which are due to be agreed by government after the carbon budgets are adopted by the Oireachtas.

Many of the actions of Ag Climatise continue to be implemented following its publication in December 2020³². The Department of Agriculture, Food and the Marine intends to update Ag Climatise in the second half of 2022 as the final emissions ceiling under the Climate Act were agreed in late July 2022 for the agricultural sector. Some of the actions of Ag Climatise will need to be updated to reflect the increased ambition set out for the sector under CAP21.

2021 saw developments in other policy areas that are linked to climate action, including:

1. The Land Use Review included in the Programme for Government was launched^{33, 34}.
2. The General Scheme of the Circular Economy Bill 2021 was published³⁵. Under this Bill, the Minister is to publish a circular economy strategy that will set out the government's policy objectives in relation to the circular economy and its development, which will be informed by a number of listed government policies, including the CAP21. The Department of the Environment, Climate and Communications (DECC) also launched Ireland's first Whole of Government Circular Economy Strategy³⁶.
3. Policy statements published included the Draft Policy Statement on Geothermal Energy for a Circular Economy³⁷, the Draft Policy Statement on Mineral Exploration and Mining³⁸, and the Policy Statement – Petroleum Exploration and Production Activities as part of Ireland's Transition to a Low Carbon Economy³⁹.
4. Work commenced on revising the Offshore Renewable Energy Development Plan (ORED P II) to meet Ireland's increased offshore renewable energy ambition, including an increased target of up to 5 gigawatts of offshore wind energy and an increase in the proportion of renewable electricity to up to 80% by 2030 in CAP21⁴⁰.

The second *The Status of Ireland's Climate* report was published in 2021⁴¹ and received considerable media attention. The research, funded by the EPA, Met Éireann and the Marine Institute, provides an update on the first status report published in 2013, incorporating new datasets and analyses as well as reporting ongoing climate observations over the previous seven years.

32 www.gov.ie/en/press-release/a8823-publication-of-ag-climatise-national-climate-air-roadmap-for-the-agriculture-sector/

33 <https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/>

34 "The Government will undertake a national land use review, including farmland, forests, and peatlands, so that optimal land use options inform all relevant government decisions. The review will balance environmental, social, and economic considerations and involve a process of evaluation of the ecological characteristics of the land. It will include consideration of emissions to air and water, carbon sequestration, and climate adaptation challenges. Policy co-benefits, such as rewetting or forest regrowth to mitigate flooding risks in river catchments, will be considered." (Programme for Government, p 67).

35 <https://www.gov.ie/en/publication/89838-circular-economy-bill-2021/>

36 <https://www.gov.ie/en/publication/b542d-whole-of-government-circular-economy-strategy-2022-2023-living-more-using-less/>

37 <https://www.gov.ie/en/press-release/feabb-minister-ryan-publishes-draft-policy-statement-on-geothermal-energy/>

38 <https://www.gov.ie/en/consultation/94c4e-consultation-on-the-draft-policy-statement-on-mineral-exploration-and-mining-in-ireland-and-associated-sea-environmental-report-and-aa-natura-impact-statement/>

39 <https://www.gov.ie/en/publication/c05aa-policy-statement-petroleum-exploration-and-production-activities-as-part-of-irelands-transition-to-a-low-carbon-economy/>

40 <https://www.gov.ie/en/policy-information/7498e-renewable-electricity/#:~:text=The%20ORED%20II%20will%20provide%20an%20evidence%20base,assessment%20of%20other%20maritime%20activities%20and%20marine%20biodiversity.>

41 <https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php>



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Section 3

2021 Developments in National, EU and International Research Funding Strategies



3. 2021 Developments in National, EU and International Research Funding Strategies

It is important for Ireland to have an active research community that is focused on Ireland-specific issues related to climate change and is engaged with European and global research activities. A coherent, well-structured research programme that is designed to address Ireland-specific issues and is linked to EU funding streams is key to enabling this. It is also essential to ensure that publicly funded research is accessible, broadly disseminated and policy relevant. It should take account of the national climate policy and the objectives and actions contained in the climate action plans and the NAF.

3.1 National Context

At the national level, as the climate change challenge is a cross-sectoral issue, Government of Ireland funding for climate research is provided by a variety of different departments and agencies and specific programmes. Collaboration between national, EU and international research programmes and funders also offers the potential to engage in research on transitioning to a low-carbon economy. The main sources of competitive research funding available for climate research in Ireland is listed in **Table 2**. Not all funders provide specific climate research funding.

Table 2: National funding landscape

National organisations	Funding programmes/schemes available/open in 2021	Funding received from
CCAC	Small-scale studies	Government Exchequer – DECC and Climate Action Fund
EI	The Disruptive Technologies Innovation Fund is open to partnerships of Irish SMEs collaborating with other SMEs, multinationals and research institutions and applying industrial research to deliver large-scale disruptive innovation projects that have the potential to significantly alter markets or the way businesses operate. Projects must address one of the six national research priority areas (including energy, climate action and sustainability) and are required to meet specified low-carbon and sustainability criteria.	Government Exchequer – DETE
GSI	Funding for small- to medium-scale research studies, including post-doctoral fellowships. Provides funding and co-funding with the EPA, MI, SEAI, SFI, IRC, Fulbright Commission of Ireland and OPW. Provides funding through Geothermica and ERA-MIN ERA-NETs	Government Exchequer – DECC
DHLGH (MÉ)	Climate services research; post-doctoral fellowships. Multi-annual competitive research call programme TRANSLATE in the area of climate services. Co-funding with IRC for a GOIPG Met Éireann postgraduate scholarship.	Government Exchequer – DHLGH
DHLGH (NPWS)	Funding of small-scale research projects investigating the impact of climate change on biodiversity and ongoing research into the carbon exchange of selected peatland communities. NPWS also provides co-funding with the EPA.	Government Exchequer – DHLGH
DAFM	Competitive research funding programme	Government Exchequer – DAFM
DT	Funds and co-funds projects that look at directly applicable solutions to climate mitigation and adaptation, as well as air quality issues.	Government Exchequer – DT

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EPA	2021 EPA Research Call 2021 EPA Emission Statistics Research Fellowship Call 2021 EPA Research Fellowship Call 2021 Fast-track to Policy Funding Scheme Awards were also made under its strategic partnerships with MI, DAFM, IRC, ESRI and Fulbright Commission Ireland.	Government Exchequer – DECC
IRC	Funds numerous bottom-up research projects (doctoral, post-doctoral and principal investigator led) that may include climate change topics	DFHERIS
MI	Funding awarded under the MI Marine Research Programme in 2021 for blue carbon projects; postgraduate scholarships; post-doctoral fellowships; Ship-time Programme (access to national research vessels RV Celtic Explorer and RV Celtic Voyager); and co-funded actions for marine-related research projects and awards.	DAFM
OPW	Carries out research on flood risk and rivers in relation to fluvial and coastal flood risk management. OPW does not currently have a dedicated research call, but instead commissions research through either a competitive tender process or by grant awards.	DPER
SFI	SFI has numerous funding programmes available to support individual-led and challenge-based research, partnerships with enterprise, international partnerships, and education and public engagement. All may support research related to climate. Programmes include SFI Research Centres, Frontiers for the Future; Research Professorship, Future Research Leaders, Strategic Partnerships and Future Innovator Prize.	DFHERIS
SEAI	The SEAI National Energy RD&D Funding Programme supports innovative energy RD&D projects that contribute to Ireland's transition to a clean and secure energy future.	DECC
Teagasc	Carries out and administers research and knowledge transfer programmes on animals, crops, environment, land use, grassland management, food and rural development. Funds the Teagasc Walsh Scholarship Programme for postgraduate research.	DAFM

DAFM, Department of Agriculture, Food and the Marine; DECC, Department of the Environment, Climate and Communications; DETE, Department of Enterprise, Trade and Employment; DFHERIS, Department of Further and Higher Education, Research, Innovation and Science; DHLGH, Department of Housing, Local Government and Heritage; DPER, Department of Public Expenditure and Reform; DT, Department of Transport; EI, Enterprise Ireland; ERA-MIN; European Research Area Network on Raw Materials; ERA-NET, European Research Area Network, an EU co-funding initiative; ESRI, Economic and Social Research Institute; GOIPG, Government of Ireland Postgraduate Scholarship Programme; GSI, Geological Survey Ireland; IRC, Irish Research Council; MÉ, Met Éireann; MI, Marine Institute; NPWS, National Parks & Wildlife Service; OPW, Office of Public Works; RD&D, research, development and demonstration; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland; SMEs, small and medium-sized enterprises.

The Department of Further and Higher Education, Research, Innovation and Science (DFHERIS) progressed the preparation of the new national research and innovation strategy in 2021 with a public consultation including stakeholders from across Ireland's research and innovation system, and it has since been published (May 2022). The aim of *Impact 2030: Ireland's Research and Innovation Strategy*⁴² is to ensure that Ireland's investment in research and innovation makes as big a difference as possible to as many people as possible. This will be achieved by building a more inclusive and engaged research and innovation system that is recognised

42 <https://www.gov.ie/en/publication/27c78-impact-2030-irelands-new-research-and-innovation-strategy/>

as integral to addressing major economic, societal and environmental issues. The strategy includes a strong focus on ensuring that research and innovation makes a significant contribution to addressing the climate change challenge. To realise the vision of *Impact 2030*, the strategy will foster greater engagement among a wide range of stakeholders including research organisations, the tertiary education system, enterprise, public policymakers, civil society organisations and European partners.

The critical role of research and innovation as an enabler of addressing climate change challenges is a key focus of *Impact 2030: Ireland's Research and Innovation Strategy*.

3.2 EU and International Context

National research investment is the main funding source for climate change research in Ireland. However, researchers from Ireland have been successful in attracting international funding at the EU level. As well as being an important funding source, this enables researchers from Ireland to work with and lead on projects that involve leading international research groups.

Launch of Horizon Europe

The main development in 2021 was the launch of Horizon Europe, which is Europe's main instrument for funding research and development running from 2021–2027 with a budget of about €95 billion (see **Figure 1**).

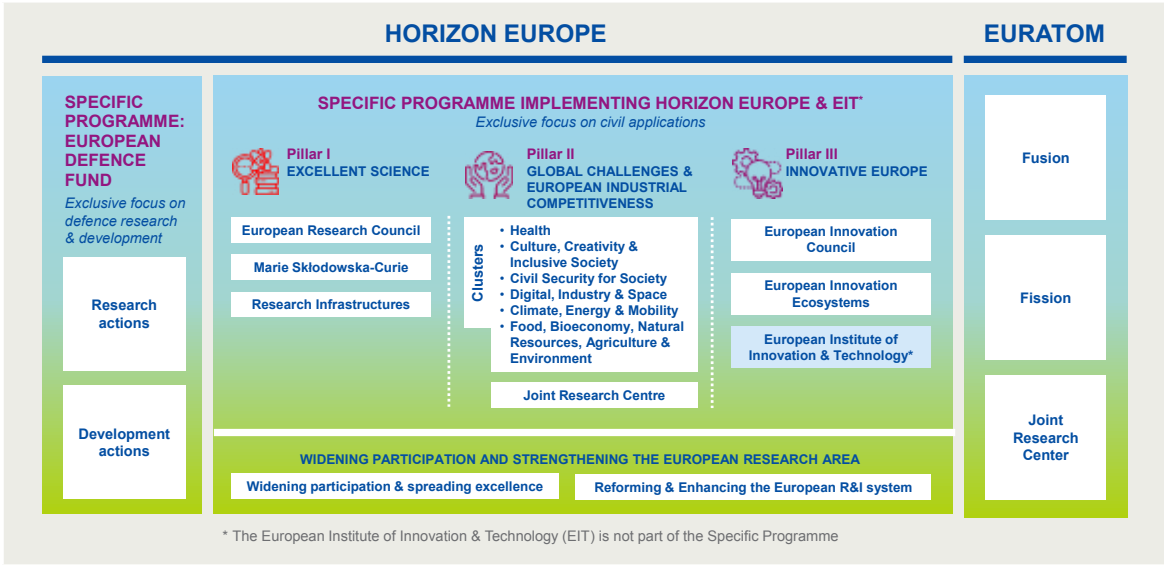


Figure 1. Structure of Horizon Europe.

Under Horizon Europe Pillar II, climate research can be found under most clusters. It is particularly covered under Clusters 5 and 6:

Cluster 5: Climate, energy and mobility

- Destination-1. Climate sciences and responses for the transformation towards climate neutrality
- Destination-2. Cross-sectoral solutions for the climate transition
- Destination-3. Sustainable, secure and competitive energy supply
- Destination-4. Efficient, sustainable and inclusive energy use
- Destination-5. Clean and competitive solutions for all transport modes

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- Destination-6. Safe, resilient transport and smart mobility services for passengers and goods

Cluster 6: Food, bioeconomy, natural resources, agriculture and environment

- Destination-1. Biodiversity and ecosystem services
- Destination-2. Fair, healthy and environmentally-friendly food systems from primary production to consumption
- Destination-3. Circular economy and bioeconomy sectors
- Destination-4. Clean environment and zero pollution
- Destination-5. Land, oceans and water for climate action
- Destination-6. Resilient, inclusive, healthy and green rural, coastal and urban communities
- Destination-7. Innovative governance, environmental observations and digital solutions in support of the European Green Deal

Five missions areas have also been identified, see **Figure 2**. A mission is a portfolio of actions across disciplines intended to achieve a bold, inspirational and measurable goal within a set timeframe, with impact for society and policymaking and with relevance for a significant part of the European population and a wide range of European citizens.

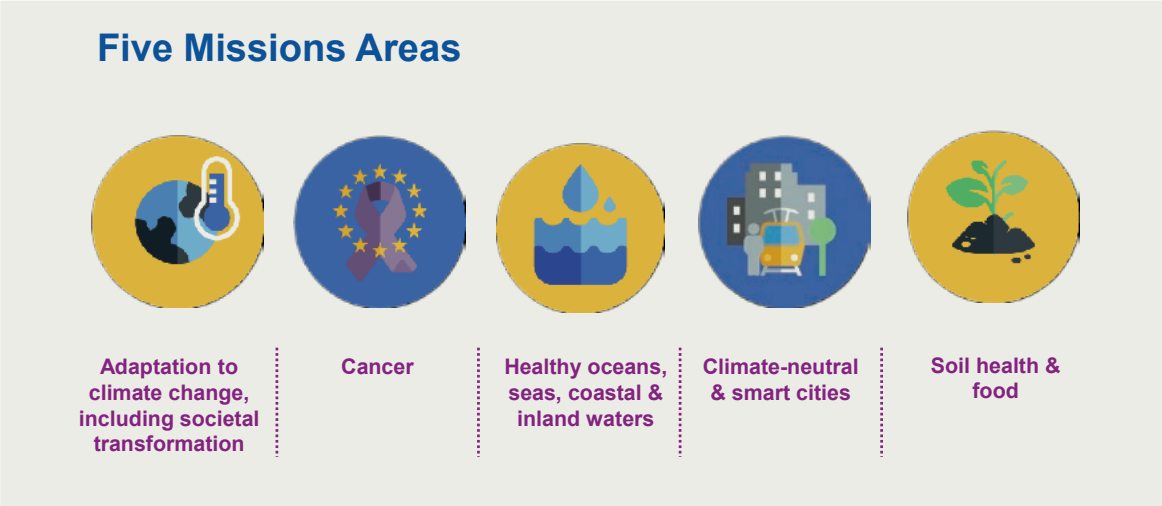


Figure 2. Five Mission Areas of Horizon Europe

3.3 Update on Joint Programming Initiatives

Joint Programming Initiative Climate

Some of the key activities in 2021 for the Joint Programming Initiative (JPI) Climate included:

- Holding the European Climate Change Adaptation (ECCA) conference with the European Commission in June 2021: key messages from this event were presented at UNFCCC COP26.
- Convening the first Climate Neutrality Forum as a hybrid event across the three venues in Oxford, Berlin and Milan: key messages from this event were presented at UNFCCC COP26.
- Launch events for JPI Climate Knowledge Hubs on Climate Neutrality and Climate Resilience were held at UNFCCC COP26.
- Submission of the successful MAGICA proposal to Horizon Europe for a coordination support action (CSA). The EPA and University College Cork are partners in the CSA. This project will allow an upgrading of coordination activities on research and systematic observations. It has links to EU and IPCC activities. This CSA also includes an extensive work package of knowledge transfer (science to policy) activities, for example hosting ECCA 2023 in Ireland, a forum on climate neutrality and knowledge transfer activities related to innovation and infrastructure.

Water Joint Programming Initiative

In 2021, the Water JPI led the submission of the successful proposal for the European Water4All co-funded Horizon Europe Partnership, which was successfully awarded Horizon Europe funding and aims to contribute to the objective of Destination-5 in Cluster 6, “Land, oceans and water for climate action”. The first joint transnational research call on “management of water resources: resilience, adaptation and mitigation to hydroclimatic extreme events and management tools” is expected in 2022.

Joint Programming Initiative Oceans

JPI Oceans launched a new strategy framework 2021–2025⁴³ in 2021, as well as a new joint action on ocean carbon capacities⁴⁴. JPI Oceans and JPI Climate jointly published the governance structure for a new knowledge hub on sea level rise in January 2021⁴⁵.

FACCE Joint Programming Initiative

The four European Research Area Networks (ERA-NETs) SusAn (Sustainable Animal Production Systems), Agriculture, Food Security and Climate Change (FACCE) ERA-GAS (Monitoring and Mitigation of Greenhouse Gases from Agriculture and Silviculture), ICT-AGRI-FOOD (ICT-enabled agri-food systems) and SusCrop (Sustainable Crop Production) coordinated and aligned efforts in areas of mutual interest and established a joint transnational funding initiative in 2021 in the field of agricultural GHG research, focusing on circularity in mixed crop and livestock farming systems with an emphasis on climate change mitigation and adaptation⁴⁶.

The first external research call of the European Joint Programme “EJP Soils – Towards climate-smart sustainable management of agricultural soils” opened for research proposals in 2021. The objective of this call is to “foster holistic agricultural soil management practices which will assist in making a shift to diversify farming to include a variety of sustainable and environmental practices”⁴⁷.

The ERA-NETs SUSFOOD2 (Sustainable Food Production and Consumption) and FOSC (Food Systems and Climate) launched their joint call for proposals on “innovative solutions for resilient, climate-smart and sustainable food systems”⁴⁸.

FACCE JPI also initiated the MACSUR Science–Policy Knowledge Forum to bring science and policy actors together for the strategic design of responses to climate change adaptation and mitigation challenges in the agri-food sector in Europe⁴⁹.

Biodiversa+ European Partnership

The BiodivERsA network led the submission of the successful proposal for the European Biodiversa+ co-funded Horizon Europe Partnership, which was successfully awarded Horizon Europe funding and aims to contribute to the objective of Destination-5 in Cluster 6, “Land, oceans and water for climate action”. The first joint transnational call on “supporting the protection of biodiversity and ecosystems across land and sea” was launched in 2021. Climate change also features strongly in the Biodiversa+ Strategic Research and Innovation Agenda⁵⁰.

43 <https://www.jpi-oceans.eu/en/jpi-oceans-new-strategy-framework-officially-launched>
44 <https://www.jpi-oceans.eu/en/jpi-oceans-launches-new-joint-action-ocean-carbon-capacities>
45 <https://www.jpi-oceans.eu/sites/jpi-oceans.eu/files/managed/Publications%20files/SLR-GovernanceStructure-updated.pdf>
46 <https://www.faccejpi.net/en/FACCEJPI/Four-ERA-NETs-Call-on-Circularity-open-for-submission.htm>
47 <https://www.faccejpi.net/en/FACCEJPI/First-external-call-of-EJP-SOIL-is-open.htm>
48 <https://www.faccejpi.net/en/FACCEJPI/Innovative-solutions-for-food-systems-call-open.htm>
49 <https://www.faccejpi.net/en/FACCEJPI/Actions/Core-Theme-1/Science-Policy-Knowledge-Forum.htm>
50 <https://www.biodiversa.org/1913/download>

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Section 4

2021 Activities of the Climate Research Coordination Group



4. 2021 Activities of the Climate Research Coordination Group

The CRCG acts to coordinate climate change-related research in Ireland. It does so by supporting and promoting collaboration between relevant research-funding organisations (RFOs) and providing a forum for exchange of information on activities and plans. A key objective is to advance shared strategic objectives for climate change research and ensure coherence in climate change research investments in Ireland and effective linking of these to EU funding streams.

The CRCG is focused on the development of research that informs policy and enables actions to address the various challenges that arise from climate change. **Table 3** gives a high-level overview of the progress made in 2021 in meeting the aims and objectives of the terms of reference of the CRCG (see **Appendix 1**).

The activities of the group in the period January–December 2021 are outlined in this section, including new funding commitments, meetings, events and research collaborations. The information provided here is based on the inputs provided by the CRCG members (see **Appendix 3**).

Table 3: Progress made in 2021 in achieving the aims and objectives of the CRCG

Aims and objectives of the CRCG	Progress made in 2021
Facilitate, support and promote coordination, synergies and liaison between relevant cross-sectoral funding organisations – public and private – to reduce the fragmentation and/or duplication of climate research in Ireland	Members of the CRCG progressed the first 5YAR through the granting of three more lead author awards and the hosting of scoping workshops on the four volumes under which the 5YAR will be carried out. Zero and first order drafts are scheduled to be submitted and reviewed in 2022, and the final reports are scheduled to be completed in the first half of 2023. Synergies and liaison among national stakeholders were developed through the addition of the DFA to the CRCG. DFHERIS progressed work on the development of the next national research and innovation strategy (delayed as a result of the Covid-19 pandemic and the restructuring of government departments) and hosted public consultation events. The new strategy, <i>Impact 2030: Ireland's Research and Innovation Strategy</i>, was published in May 2022.
Facilitate an exchange forum between research funders and key stakeholders, providing an interface for funding climate research organisations to facilitate the dissemination, sharing and uptake of relevant scientific outputs to policymakers and decision-makers and the uptake of research outputs for commercialisation	Under EPA Research 2030, the EPA consolidated research coordination into two groups, the NERCG for the coordination of all environmental research (including climate) and the CRCG for the coordination of climate research only. Two CRCG meetings were held in 2021: (i) to review the conclusions and proposed actions in the draft 2020 annual report of the CRCG's activities and (ii) to review progress on the proposed actions included in the 2020 CRCG report. Sub-groups of the CRCG also met to support Action 82(v) of CAP21: - Sub-group 1 met six times to discuss the proposed national research classification system, and a combined CRCG submission to DFHERIS was accordingly submitted to the department. The draft classification system was piloted during the preparation of this report. - Sub-group 2 met once to consider climate research metrics that should be collated. This work is continuing in 2022 and will take into account the new national research and innovation strategy. Two NERCG meetings were held in 2021, which facilitated the sharing of information related to (i) environment and climate research activities for each NERCG/CRCG member, (ii) planned workshops on the outputs of environmental and climate research, (iii) environmental and climate research funding opportunities and (iv) policy developments. It also provided a forum for hearing collectively from national experts.

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Aims and objectives of the CRCG	Progress made in 2021
Identify key research needs and emerging policy needs with the aim of informing the research strategy of Irish funding organisations of climate research	The identification of research needs at the national level will be progressed through the 5YAR (see above) and continued discussion between CRCG members.
Provide a platform for cross-sectoral RFOs to liaise and/or collaborate with European and international activities related to climate research, such as JPIs, technology platforms and LIFE	At CRCG meetings, members were provided with updates on European and international activities related to climate research, including: ▶ JPIs on (i) climate⁵¹, (ii) oceans⁵², (iii) water⁵³, and (iv) agriculture, food security & climate change⁵⁴ and network on biodiversity⁵⁵ ▶ Horizon Europe⁵⁶ ▶ EU LIFE programme⁵⁷

DFA, Department of Foreign Affairs; DFHERIS, Department of Further and Higher Education, Research, Innovation and Science; DT, Department of Transport; JPI, Joint Programming Initiative; NERCG, National Environmental Research Coordination Group.

The most significant highlight in 2021 was progress with the first five-year assessment and synthesis of research (which contributes to Action 82(ix) of CAP21).

4.1 Five-Year Assessment of Research

The 5YAR provides a vehicle to further develop national understanding of climate change and to develop the required analytical capacity and communication structures. It provides an opportunity to integrate and assess a range of climate-related activities in Ireland and link these to EU and international activities. In aiming to provide a shared understanding, based on the best available science, the 5YAR can inform future processes for developing mitigation and adaptation policies, and can be pivotal in informing actions by key bodies in Ireland and activities such as the National Dialogue on Climate Action⁵⁸.

The 5YAR will report under the following four volumes as well as providing an overarching synthesis report (see **Appendix 4** for further details of the contents of the four volumes):

- i. Science: Ireland in a changing world;
- ii. Achieving climate neutrality by 2050;
- iii. Being prepared for Ireland’s future climate;
- iv. Realising the benefits of transition and transformation.

The first 5YAR was advanced in 2021, firstly through the granting of three additional lead author awards (funded by the Sustainable Energy Authority of Ireland (SEAI), Science Foundation Ireland (SFI) and Department of Transport) and secondly through holding scoping workshops for each of the four volumes under which the work is to be carried out.

Table 4 presents the meetings and workshops held to advance the 5YAR.

51 www.jpi-climate.eu/home
52 www.jpi-oceans.eu/
53 www.waterjpi.eu/
54 www.faccejpi.net/en/faccejpi.htm
55 www.biodiversa.org/
56 https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-eu-rop_e_en
57 An EU funding instrument for the environment and climate action: https://cinea.ec.europa.eu/life_en
58 www.gov.ie/en/publication/4bf2c-national-dialogue-on-climate-action-ndca/

Table 4. Meetings and workshops to advance the 5YAR

Event	Date
5YAR Steering Group meeting	25/03/2021
5YAR Volume 1 workshop	16/04/2021
5YAR Volume 3 workshop	28/04/2021
5YAR Volume 2 workshop	31/05/2021
5YAR Steering Group meeting	25/06/2021
5YAR Volume 4 workshop	22/10/2021

Steering groups have been established from the membership of the CRCG to coordinate the work for each volume, including agreeing on the scope. Experts based in state agencies and bodies, and departmental officials, will oversee the writing and review process. The EPA provides management and secretariat support for the process. **Table 5** identifies which stakeholders are in the steering groups for the different volumes of the 5YAR report. Further collaboration in the 5YAR process, such as co-funding of the process, is being examined in 2021.

Table 5: Organisations represented on steering groups for the four 5YAR report volumes

5YAR volume	Steering group
Science: Ireland in a changing world	DECC, DAFM, IW, MI, MÉ, OPW, EPA, SFI
Achieving climate neutrality by 2050	DECC, DAFM, DT, IW, OPR, SEAI, EPA
Being prepared for Ireland's future climate	DECC, DT, DAFM, GSI, IW, MI, MÉ, OPW, CCAC, EPA
Realising the benefits of transition and transformation	DECC, IW, NESC, SEAI, SFI, DT, EPA
Overall/synthesis report	DECC, DAFM, DT, OPW, IW, MI, NESC, SEAI, MÉ, OPR, EPA, SFI, GSI

DAFM, Department of Agriculture, Food and the Marine; DECC, Department of the Environment, Climate and Communications; DT, Department of Transport; GSI, Geological Survey Ireland; IW, Irish Water; MÉ, Met Éireann; NESC, National Economic and Social Council; OPR, Office of the Planning Regulator; OPW, Office of Public Works; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

The annual CRCG reports will link to and be informed by the 5YAR report in a number of ways, for example:

- ▶ It will provide updates on the response of CRCG members, and in particular RFOs, to address the research gaps and needs identified in the 5YAR process.
- ▶ It will report on research activities and projects under the (revised) classifications developed under the 5YAR process, including any apparent trends⁵⁹. However, there will be inevitable interannual variability in research funding, both in total and under each classification, because the different RFOs have different funding cycles (e.g. some are not annual) and focus their funding programmes in different areas.

⁵⁹ This year's CRCG report is the first to provide details on research activities and project awards in line with the thematic volumes developed through the 5YAR process.

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4.2 New 2021 Climate Research Projects and Activities⁶⁰

This year’s report of the CRCG’s activities takes a dual approach to classifying new research projects and activities. In addition to using the previous thematic areas⁶¹, it also classifies the new research projects based on the following themes (which are aligned to the volumes of the 5YAR report):

- Fundamental Science;
- Mitigation;
- Adaptation;
- Opportunities, which is recognised as a theme that cuts across the other three.

In the long term, CRCG reports will use the national research classification system when it has been finalised.

As recommended in previous reports, the reporting structure was also reviewed, and new competitive awards are now reported under the following two broad headings.

- Climate research awards: Awards for climate change research, with climate as primary field of research and that directly address research questions related to climate science, climate change and climate change policy (e.g. analysis of scenarios and pathways to achieve climate neutrality; Ireland’s climate status).
- Awards of relevance to climate action: Awards for other research, with a primary field of research which is not climate (e.g. agriculture, energy, earth sciences, etc.) but that is of relevance to/will generate evidence/ knowledge and/or develop solutions supporting climate action/meeting climate policy objectives, e.g. research on decarbonising energy system.

Due to this change in reporting, data from this report cannot be compared with the data included in previous reports.

New 2021 competitive awards (i.e. funding for research and development performed elsewhere)

This section covers competitive research funding for research and development performed outside the organisation providing the funding.

Based on the information provided, 42 new climate research competitive awards were created during the reporting period, with a total budget commitment of €24.1 million.

Figure 3 illustrates the breakdown of the budget committed to these new climate research competitive awards under the thematic areas used in previous reports (top panel), and under the broad headings used in the 5YAR report (bottom panel).

60 Funded by CRCG members and performed elsewhere.
61 Previous thematic areas: (1) Carbon Stocks, GHG Emissions, Sinks and Management Options; (2) Ireland’s Future Climate, its Impacts, and Adaptation Options; (3) Climate Solutions, Transition Management and Opportunities; (4) Air Science; and (5) Relevant to other areas as well as climate.

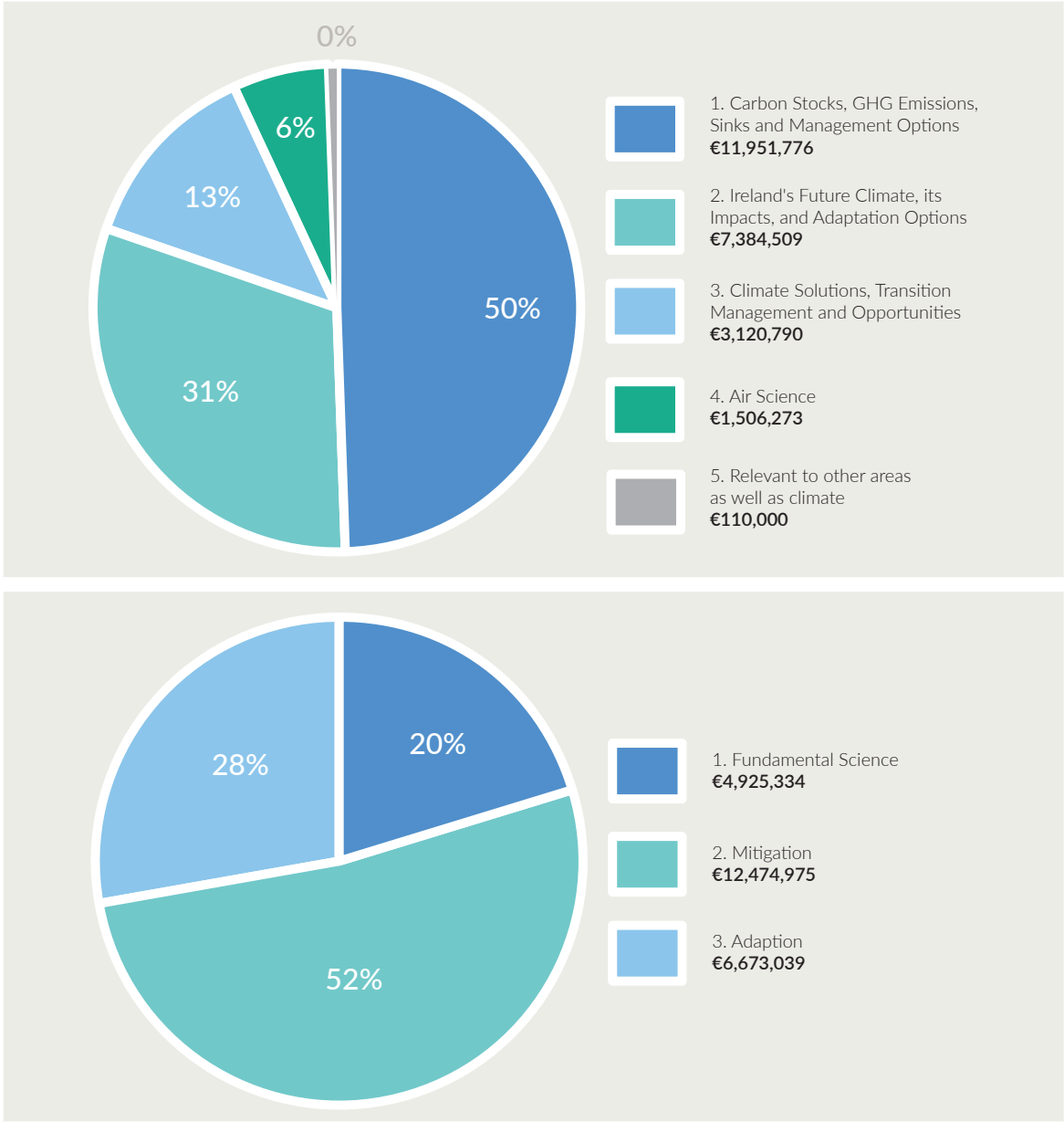


Figure 3: Breakdown of new competitive climate research awards in terms of budget committed (total budget committed €24.1 million) by thematic area used in previous reports (top panel) and by the broad headings used in the 5YAR report (bottom panel).

Figure 3 (bottom panel) indicates that about half of funding for climate research can be classified as addressing the topic of “Mitigation”.

Figure 4 illustrates the breakdown by CRCG member of the budget committed for the new competitive climate research awards during the reporting period.

Awards for research related to the “Opportunities” theme are reported separately as they overlap with projects related to the other themes.

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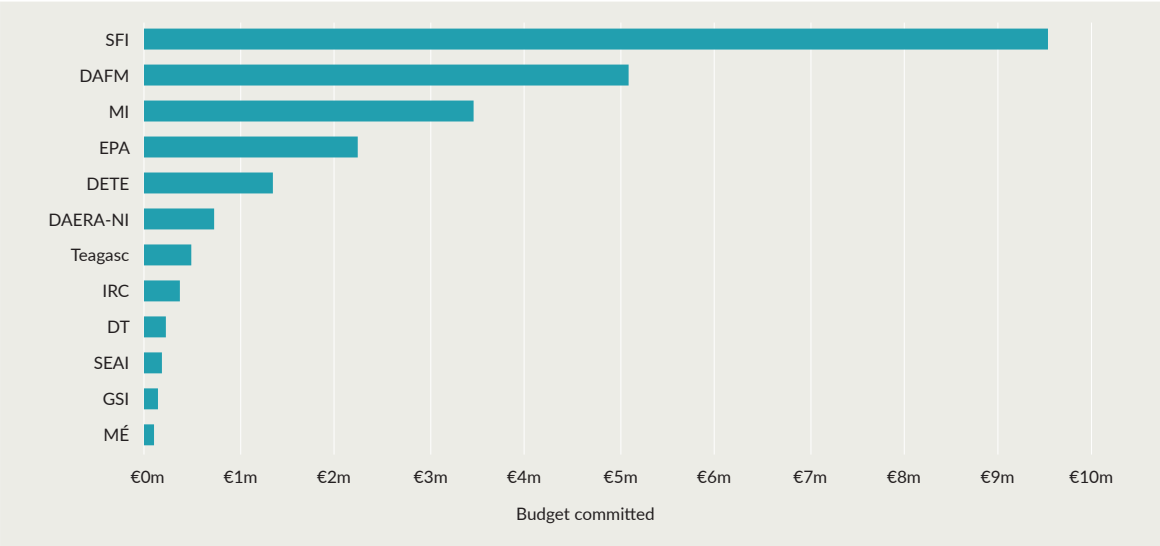


Figure 4: Budget committed by the CRCG members for new competitive climate research awards in 2021.

DAERA-NI, Department of Agriculture, Environment and Rural Affairs – Northern Ireland; DAFM, Department of Agriculture, Food and the Marine; DETE, Department of Enterprise, Trade and Employment; DT, Department of Transport; GSI, Geological Survey Ireland; IRC, Irish Research Council; MÉ, Met Éireann; MI, Marine Institute; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

Table 6 details the funding committed to new competitive climate research awards as reported by the CRCG members. Appendix 5 lists the new competitive climate research awards for 2021.

Table 6: New competitive climate research awards: budget committed in 2021

Organisation	Funding received from	Funding from lead funder (€)	Funding from co-funder (€)	Total funding (€)
SFI	DFHERIS	9,556,811	–	9,556,811
DAFM	Government Exchequer	4,913,395	245,951	5,159,346
MI	DAFM	3,503,786	–	3,503,786
EPA	DECC	1,058,093	1,202,500	2,260,593
DETE	Government Exchequer	1,326,487	–	1,326,487
DAERA-NI	DAERA-NI	–	748,746	748,746
Teagasc	DAFM	234,000	264,000	498,000
IRC	Government Exchequer	369,873	-	369,873
DT	Government Exchequer	–	207,040	207,040
SEAI	DECC	–	180,902	180,902
GSI	Government Exchequer	22,500	129,264	151,764
MÉ	Government Exchequer	–	110,000	110,000

DAERA-NI, Department of Agriculture, Environment and Rural Affairs – Northern Ireland; DAFM, Department of Agriculture, Food and the Marine, DECC, Department of the Environment, Climate and Communications; DETE, Department of Enterprise, Trade and Employment; DFHERIS, Department of Further and higher Education, Research, Innovation and Science; DT, Department of Transport; GSI, Geological Survey Ireland; IRC, Irish Research Council; MÉ, Met Éireann; MI, Marine Institute; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

Figure 5 illustrates the breakdown of the total budget committed in 2021 via competitive new awards for climate research per receiving lead research organisation. The figure shows that University College Dublin was awarded the most funding based on the data provided, getting 28% of the total budget awarded. The top four research-performing organisations (University College Dublin, Teagasc, Maynooth University and National University of Ireland, Galway (NUIG)) were, together, awarded 86% of the total budget committed to new competitive awards in 2021. The data, it should be noted, do not account for funding received by partner organisations, ascribing the full award amount to the lead partner organisation.

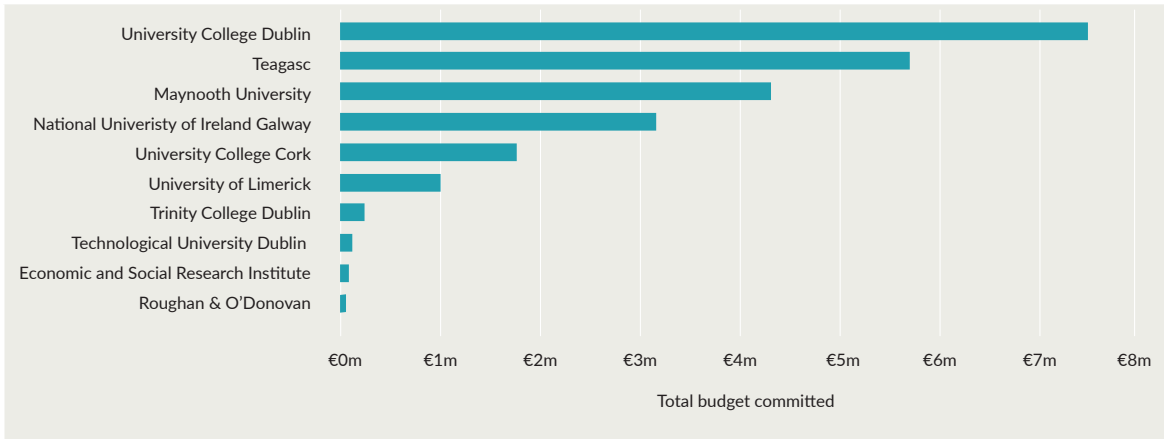


Figure 5: Total budget awarded in 2021 per receiving lead research-performing organisation through competitive new awards for climate research.

Figure 6 presents the distribution of awards by size, which ranged from €11,472 up to €3,144,744, with an average size of €573,175.

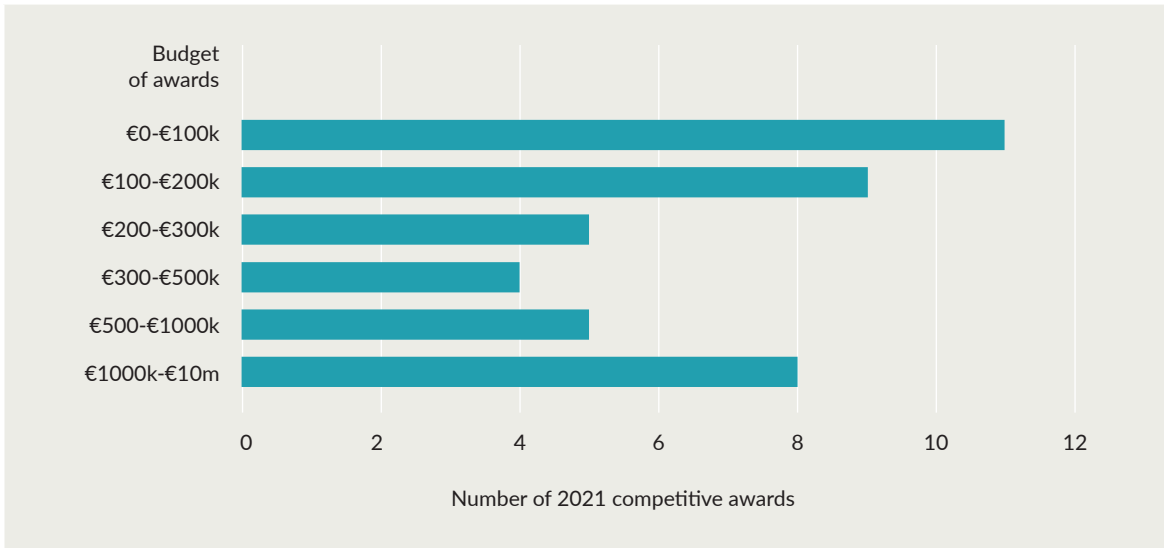


Figure 6: Distribution of 2021 competitive climate research awards by budget size

Co-funding of the 2021 competitive climate research awards

Among the 2021 new competitive climate research awards detailed in the previous section, some were co-funded between members of the CRCG. The NAF calls for better coordination of national climate change research priorities. **Figure 7** illustrates the breakdown of co-funding committed under the thematic areas used in previous reports (top panel), and under the broad headings used in the 5YAR report (bottom panel).

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Based on the information provided, among the 42 new 2021 competitive climate research awards in 2021, 20 (€3.09 million) were identified as being co-funded between members of the CRCG in 2021.

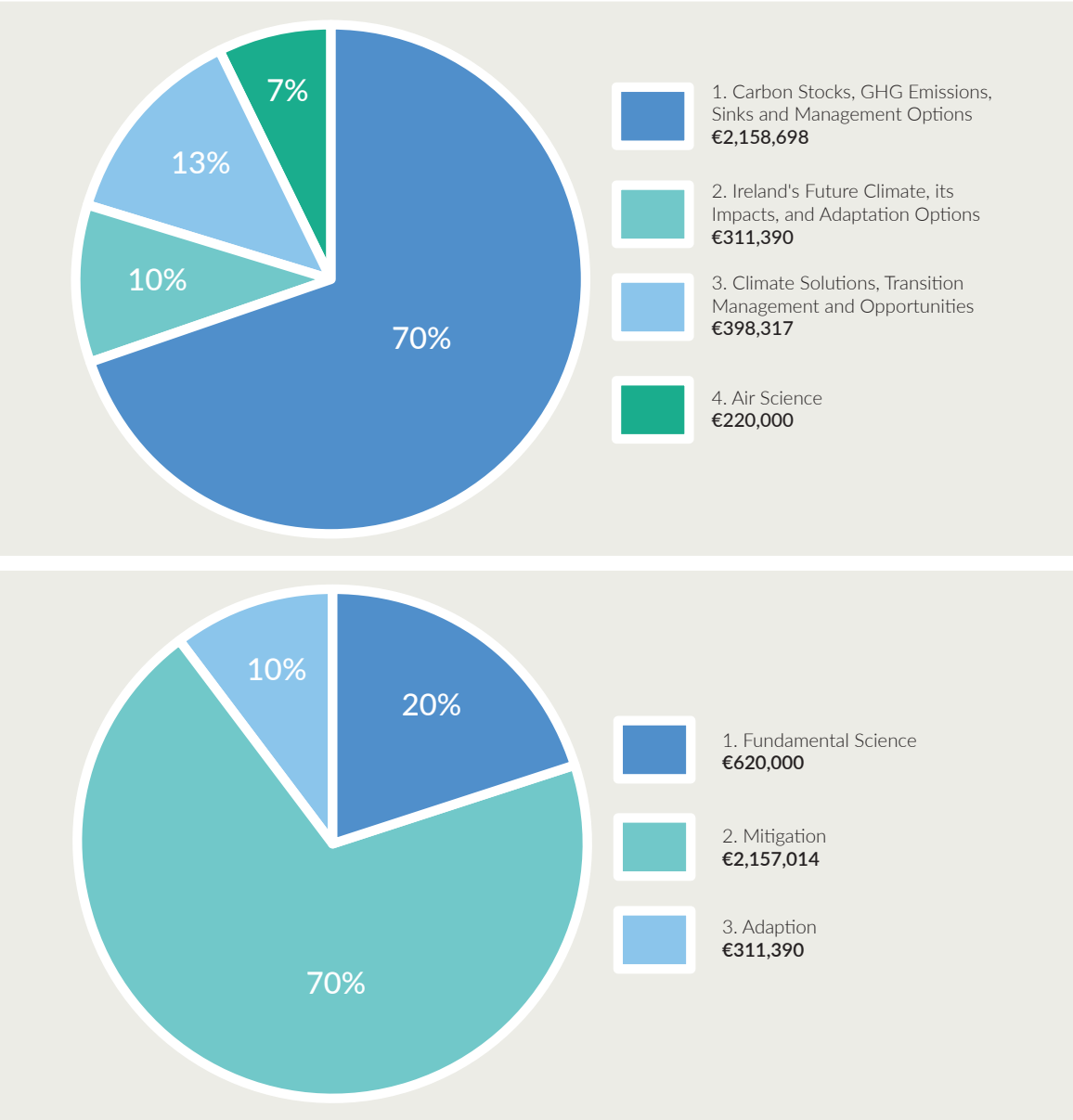


Figure 7: Breakdown of new competitive co-funded climate research awards in terms of budget committed (total budget committed €3.09 million) by the thematic areas used in previous reports (top panel) and by the broad headings used in the 5YAR report (bottom panel).

Other 2021 competitive awards relevant to climate action

In addition to the climate research awards mentioned above, there were a further 101 new research awards (with budget commitments of €76.4 million from CRCG members) for projects of relevance to climate action. This includes the award of €28.3 million for phase 2 of iCrag, the SFI Research Centre in Applied Geosciences⁶².

62 <https://www.icrag-centre.org/research/research-challenges/>

Analysis of the data submitted in the pilot of the national draft classification exercise for the 101 extra research awards identified as of relevance to climate action found that most of these awards related to energy research. This reflects the critical role of decarbonising our energy system in achieving climate neutrality.

The iCRAG centre is Ireland's national geoscience research centre supported by SFI, the European Regional Development Fund, Geological Survey Ireland (GSI) and industry partners. It comprises 150 researchers and eight research institutions and collaborates with more than 60 industry and state policy partners (including GSI). In 2021, iCRAG was awarded €28.3 million for phase 2 of its research activities, which extends to 2026. It undertakes research in three areas:

- 1. Earth resources: sustainable discovery of energy resources and raw materials required for decarbonisation.
- 2. Earth system change: geoscience applied to predicting and mitigating the impacts of climate change.
- 3. Earth science in society: societal aspects of geohazards, Earth system change, and the supply and use of earth resources.

iCRAG hosts (i) a comprehensive suite of analytical and modelling resources and (ii) platform facilities in geophysics, geochemistry and 3D modelling. While iCRAG phase 2 includes significant research activities of relevance to climate action, it also includes research activities that do not fall within the parameters of this report. Thus, it has been excluded from subsequent analyses for clarity⁶³.

Figure 8 illustrates the breakdown by CRCG members of the budget committed for other new competitive awards during the reporting period of relevance to climate action.

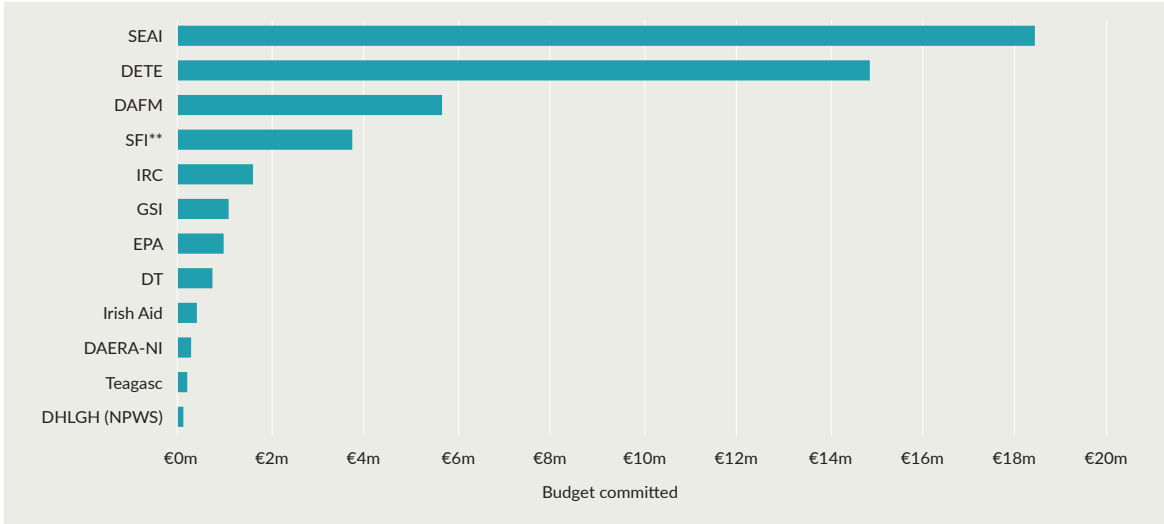


Figure 8: Budget committed by the CRCG members for other new 2021 competitive research awards of relevance to climate action.
SFI**: chart data for SFI excludes the SFI award for phase 2 of iCRAG.

DAERA-NI, Department of Agriculture, Environment and Rural Affairs – Northern Ireland; DAFM, Department of Agriculture, Food and the Marine; DETE, Department of Enterprise, Trade and Employment; DHLGH, Department of Housing, Local Government and Heritage; DT, Department of Transport; GSI, Geological Survey Ireland; IRC, Irish Research Council; NPWS, National Parks & Wildlife Service; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

Table 7 details the funding committed to new competitive research awards related to climate action, as reported by the CRCG members.

63 It is planned that the new research classification system will accommodate multiple classifications for awards of scale such as this, which may permit it to be included in future years.

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Table 7: New competitive research awards of relevance to climate action: budget committed in 2021

Organisation	Funding received from	Funding from lead funder (€)	Funding from co-funder (€)	Total funding (€)
SEAI	DECC	17,700,636	839,286	18,539,922
DETE	Government Exchequer	14,944,014	-	14,944,014
DAFM	Government Exchequer	5,597,351	58,050	5,655,401
SFI**	DFHERIS	3,703,387	-	3,703,387
IRC	Government Exchequer	1,592,751	-	1,592,751
GSI	Government Exchequer	-	1,054,325	1,054,325
EPA	DECC	948,759	55,000	1,003,759
DT	Government Exchequer	-	716,975	716,975
Irish Aid	Government Exchequer	391,000	-	391,000
DAERA-NI	DAERA-NI	-	238,450	238,450
Teagasc	DAFM	192,000	-	192,000
DHLGH (NPWS)	Government Exchequer	70,000	-	70,000

DAERA-NI, Department of Agriculture, Environment and Rural Affairs – Northern Ireland; DAFM, Department of Agriculture, Food and the Marine, DECC, Department of the Environment, Climate and Communications; DETE, Department of Enterprise, Trade and Employment; DFHERIS, Department of Further and higher Education, Research, Innovation and Science; DT, Department of Transport; GSI, Geological Survey Ireland; IRC, Irish Research Council; MÉ, Met Éireann; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

Appendix 6 lists the other 2021 new competitive awards of relevance to climate action.

Sectoral overview

A preliminary sectoral analysis, based on the piloting of the draft national research classification system, was carried out for all 142 research awards collated for this report (excluding iCRAG phase 2). In total, €65.9 million was awarded for energy research, which included €2.8 million related to carbon capture and storage and €1.7 million related to hydrogen and fuels. €2.1 million was awarded for transport-related research (some of which overlaps with energy research). €2.9 million was awarded for research related to agriculture (livestock) and €9.7 million to agriculture (crops and forestry).

A review of all 142 awards (excluding iCRAG phase 2) identified 42 projects that are relevant to the 5YAR “Opportunities” volume with a combined budget commitment of €16 million. Of the 42 awards, 37 relate to the “Mitigation” theme, five to “Adaptation” and one to “Fundamental Science”.

Core research activities (i.e. internally completed research) in 2021

In addition to competitive research awards granted by CRCG members or leveraged from EU and international funding programmes, several CRCG members undertake research activities themselves, i.e. core research activities. These research activities are funded by these organisations and performed in house.

In excess of €8.2 million was committed to core research activities in 2021, i.e. research activities that are funded by an organisation and performed in house.

Teagasc reported in excess of **€4.2 million** dedicated to core research activities in 2021 in relation to:

- ▶ the Signpost Programme to lead climate action by all farmers;
- ▶ the National Farm Survey and sustainability report;
- ▶ incorporating white clover on commercial grassland farms;
- ▶ establishment of white clover and optimisation of nitrogen fertiliser use in pasture-based milk production systems;
- ▶ identifying strategies to improve nitrogen use in grazing dairy systems;
- ▶ developing a blueprint for low or zero nitrogen fertiliser use in low-emission pasture-based dairy farming;
- ▶ phase II of the Heavy Soils Programme to focus on environmental sustainability metrics as well as farm performance metrics;
- ▶ expanding the alternative use and circularity of crops;
- ▶ genetic diversity and resilience of four commercial broadleaved tree species in Ireland;
- ▶ establishing agroforestry sites and collecting baseline data;
- ▶ supporting a sustainable transition away from peat use in mushroom casing;
- ▶ the National Agricultural Soil Carbon Observatory;
- ▶ the consequences of altered plant or soil microbial diversity for nutrient turnover in grasslands;
- ▶ uncovering the biological basis of feed efficiency in cattle through a global omics systems biological analysis;
- ▶ soil ecosystem services and soil threats modelling and mapping;
- ▶ mapping and alleviating soil compaction in a climate change context;
- ▶ modelling and mapping soil biodiversity patterns and functions across Europe;
- ▶ soil organic carbon sequestration potential of agricultural soils in Europe;
- ▶ indicators of successful carbon sequestration and greenhouse gas mitigation by rewetting cultivated peat soils;
- ▶ innovative soil management practices across Europe;
- ▶ stocktaking of agricultural soil quality and ecosystem services indicators and their reference values.

Teagasc also leveraged a further **€712,083** funding from European Commission co-funding through EJP Soils for core research activities.

Met Éireann (MÉ) reported **€2.3 million** dedicated to core research activities in 2021 in areas related to climate change impacts and adaptation. In particular, this included work on climate modelling, climate services, flood forecasting capability building, and national climate monitoring, including the coordination of the Irish GCOS.

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Geological Survey Ireland (GSI) reported **€0.87 million** dedicated to new core research activities in 2021 in relation to:

1. the European Marine Observation and Data Network;
2. the Coastal Erosion Project run by the European Space Agency;
3. the national-scale soil survey of about 40 chemical elements;
4. geological data mapping in support of coastal erosion research;
5. the impact of climate change on groundwater.

The **Marine Institute** (MI) reported up to **€0.29 million** dedicated to core research activities in 2021 in relation to its Ship-time Programme for ocean climate monitoring.

The **National Parks & Wildlife Service** (NPWS) reported **€172,176** dedicated to core research activities in 2021 in relation to a Wicklow Mountains National Park pilot restoration project that will consider the effect of restoration on reducing GHG emissions and the ecohydrological and carbon flux network.

The **Department of Agriculture, Food and the Marine** (DAFM) reported about **€150,000** dedicated to core research activities in 2021 in relation to a research project, RePeat, to acquire a high-quality digital version of the complete series of the Bog Commission Maps and other available peat maps, which will enable the precise identification of agricultural areas on drained carbon-rich soils.

The **National Economic and Social Council** (NESC) reported **€78,528** dedicated to core research activities in 2021 in relation to a research project –Exploring Place-based Opportunities for Policy and Practice in Transition – and two scoping papers:

1. Building Long-term Resilient and Sustainable Development in Cities;
2. Agriculture and Climate Action – Overview of the Science.

The **Office of the Planning Regulator** (OPR) reported **€67,330** dedicated to core research activities in 2021 in relation to:

1. a case study paper on local authority development plans and climate action measures;
2. planning, place-making and the changing spatial relationships between home and workplace, “InPlace”.

The **Department of Transport** (DT) reported **€53,000** dedicated to core research activities in 2021 in relation to phase 2 of its low-emission bus trial and the impacts of aviation taxation in Ireland.

The **Central Statistics Office** (CSO) reported five core research activities in 2021 in relation to:

1. data on environment goods and services;
2. statistics on forest wood removals and wood input purchase;
3. data on plant phenology;
4. four environmental modules of the General Household Survey;
5. environmental concerns
6. visits to nature areas
7. waste & recycling
8. energy use
9. combined analysis of the Census of Population and Building Energy Ratings.

No budget was reported for these activities by the CSO.

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A breakdown of the expenditure on core research activities reported by CRCG members is presented in **Figure 9**.

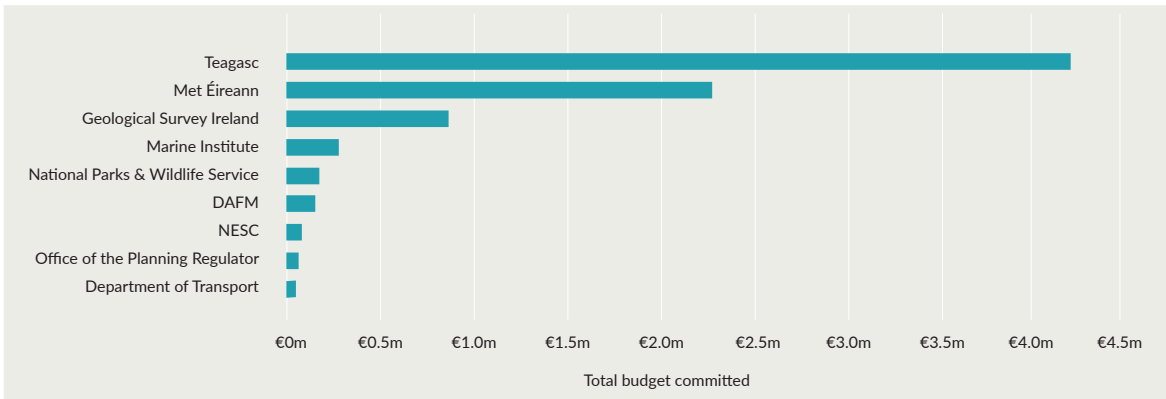


Figure 9: Expenditure on core research activities reported by CRCG members in 2021.

DAFM, Department of Agriculture, Food and the Marine; NESC, National Economic and Social Council.

4.3 2021 Highlights of CRCG Members' Climate-related Activities

This section provides an overview of the climate-related activities of the members of the CRCG during 2021.

Central Statistics Office

In autumn 2021, the CSO undertook a Household Environmental Survey. The survey included four modules (Environmental Concerns; Visits to Nature Areas; Waste and Recycling; Energy Use). In July 2021, the CSO combined the Census of Population with data on Building Energy Ratings to examine which types of households were living in different energy rating categories. During 2021, the CSO took over responsibility for compiling international forestry statistics from the DAFM. As part of this work, the CSO undertook new surveys on forest wood removals and wood input purchases.

The CSO continued work on a climate data rescue project, which involves rescuing detailed daily data for around seven weather stations for the period 1870–1959. In 2021, the CSO made a longitudinal file of quality-checked data available to M^É for further checking against the Phoenix Park series starting in 1829.

Climate Action Regional Offices

The CAROs continued to implement their work programme in 2021, including key deliverables such as the roll-out of a comprehensive training programme on climate action for the local authority sector. While the CAROs are not research-funding offices, they are represented on a variety of research steering groups and are supporting a number of third-level institutions with climate projects through contributory funding and technical assistance. The CAROs are also represented on many of the sectoral climate adaptation implementation groups through the NAF and work closely with local authority climate action teams and other stakeholders in implementing actions in the government's national CAP21 that are relevant to the sector. More information on the CAROs' activities can be accessed online⁶⁴.

Climate Change Advisory Council

The CCAC funds research on specific topics, though both competitive calls and commissioned studies, to support its work.

The CCAC undertook a significant review and analysis of the evidence base supporting the council's proposals for carbon budgets, submitted to government in October 2021. This involved the commissioning of a number

64 www.caro.ie

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of studies and using the existing analytical capacity built through other programmes, most notably within the Marine and Renewable Energy Institute (MaREI)⁶⁵, Teagasc, Dublin City University and the University of Limerick. The Carbon Budgets Technical Report summarises this work and is published on the council’s website along with other supporting documentation.

There was no competitive research call in 2021. The council funded, however, five small-scale studies from various research bodies, with individual awards of up to €7,000 (see **Appendix 10** for research studies funded by the CCAC in 2021). In 2021, the council published the findings of the ReHEAT project⁶⁶ (see **Appendix 10**) and has funded a case study on transport in Ireland for the Organisation for Economic Co-operation and Development (OECD).

Department of Agriculture, Food and the Marine

DAFM supports a competitive research programme containing five strands: (i) thematic research strand; (ii) international outreach strand; (iii) strategic studies strand; (iv) industry strand (research and innovation platform); (v) and coordination/support activities. It also supports Teagasc, BIM (Ireland’s Seafood Development Agency), and the MI through grant-in-aid that supports relevant research programmes linked to climate action, such as the Teagasc Signpost Programme farms. Funding for research under competitive calls led by DAFM supports agri-environmental and climate research on agri-food and forestry systems and, specifically, GHG emissions, ammonia emissions, sustainable strategies and management of food systems, and the effect of land use/land use change.

All funded research projects, that include research undertaken to support climate action, are supported under five Strands of the DAFM Research Programme. A total of €20.1 million funding was announced for the 2021 DAFM National Thematic Research Call for 24 projects. Over €12 million (or 60%) of the total funding will go towards projects on climate and environment. The LAB-MACC project investigates new climate change abatement measures in agriculture. DAFM also supports transnational research through a range of European (Horizon Europe) and international initiatives that focus on sustainable and climate-smart agri-food and forest production systems. In 2021 across three European Research Area Networks, DAFM has provided co-funding commitments of just over €1.9 million to seven successful projects investigating circularity and sustainability with an emphasis on reducing GHG emissions from the agri-food system. Under the first external call of EJP Soils, DAFM has provided funding commitments of €1.44 million to six successful projects investigating the soil management practices that will assist with effective CO₂ sequestration to help reduce GHG emissions.

Department of Enterprise, Trade and Employment

The department continues to manage the €500 million Disruptive Technologies Innovation Fund (DTIF), which is administered by Enterprise Ireland. DTIF was established in 2018 as one of four National Development Plan 2018–2027 funds under Project Ireland 2040. It is aimed at encouraging collaboration and innovation in the development and deployment of disruptive technologies, on a commercial basis, targeted at tackling national and global challenges.

DTIF focuses on the ability of Irish small and medium-sized enterprises (SMEs) to drive disruptive innovation by collaborating on research with other SMEs, multinationals and research institutions. The fund is open to partnerships working on projects that have the potential to significantly alter markets or the way businesses operate. It encourages private co-investment by lowering the risk profile associated with investment in high-risk, high-reward innovations. Projects were required to address one of the six themes under the revised national research priority areas 2018–2023.

The results of the third research call were announced in April 2021. Four of the 27 successful projects addressed the energy, climate action and sustainability research priority area and were allocated funding of €9.92 million over three years. These projects addressed topics such as sustainable crop production, a

65 <https://www.marei.ie/?msclkid=f5c8960bd15a11ec9779729a0759657d>
66 <https://www.climatecouncil.ie/media/climatechangeadvisorycouncil/contentassets/publications/Working%20Paper%20No.%209%20ReHeat.pdf>

new type of sustainable battery, a prototype robotic drilling system and the transformation of the plastics industry. In addition, all other projects were required to demonstrate positive contributions to the low-carbon/sustainability targets in CAP21 or to show that they neither hinder the achievement of Ireland's climate objectives nor have other significant negative environmental impacts.

Department of the Environment, Climate and Communications

The DECC continued to fund the SEAI, GSI and EPA research programmes, which support research through annual calls in a number of areas, and which report separately on their activities. In addition, the department funds some climate research directly with a number of research providers. As the national contact point for the EU LIFE programme, DECC supported the programme in Ireland through stakeholder engagement and information events.

Department of Further and Higher Education, Research, Innovation and Science

Following the establishment of this new department, it took on responsibility for leading the development of a new national research and innovation strategy to succeed Innovation 2020. The development of this whole-of-government strategy is a key commitment in the government's Economic Recovery Plan 2021. Significant progress was made in developing the strategy in 2021. A public consultation on the strategy was held in June and July that year. In total, over 115 submissions were received from a range of stakeholders. In late June, the department held an online stakeholder event at which a wide range of stakeholders from across Ireland's research and innovation system came together to discuss the issues raised in the consultation paper and inform the strategy. The high level of engagement and ambition across the system demonstrates the importance attached to the role that research and innovation can play in driving progress and change on many levels and for many sectors of our economy and society.

Impact 2030: Ireland's Research and Innovation Strategy⁶⁷ was launched in May 2022.

Department of the Taoiseach

Shared Island Unit research programme

The Shared Island Unit in the Department of the Taoiseach is progressing a comprehensive research programme to inform government policy priorities and public discussion on building a shared island and consensus around a shared future. This includes consideration of climate, environmental and biodiversity topics. Key activities in 2021, relevant to the CRCG, include:

- ▶ the launch of a €40 million Shared Island Fund for a new North–South Research Programme (delivered by the Higher Education Authority);
- ▶ the publication and launch of the NESC report Collaboration on Climate and Biodiversity: Shared Island as a Catalyst for Renewed Ambition & Action;
- ▶ the announcement of the Shared Island – Irish Research Council New Foundations awardees, including a project on the circular economy.

Well-being framework

Following the Programme for Government and CAP21, there is significant research ongoing across government to develop a comprehensive well-being framework for Ireland. This aims to create a holistic view of how society is faring, including from environmental standpoints.

The government's first report on a well-being framework for Ireland was published in July 2021, followed by a public conversation in October and a stakeholder event in November. This work will continue in 2022.

Research & Modelling Sub-group

67 <https://www.gov.ie/en/press-release/18f45-minister-harris-launches-impact-2030-irelands-new-research-and-innovation-strategy/>

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The Research & Modelling Sub-group on the Environment and Climate Change met three times in 2021. Key activities included the publication of a memorandum of understanding between departments and the CCAC for enhanced data sharing, the completion of a research and modelling audit and a policy–project matchmaking exercise, and the commencement of a research update series to enhance knowledge transfer from research to policy.

Department of Transport

In 2021, the department continued to provide co-funding to EPA and SEAI research calls. The overarching objectives of research undertaken by DT continues to support its wider commitment to shaping the safe and sustainable development of transport and to supporting economic growth and social progress. Key research priorities for the department included an examination of the potential impact of measures to manage traffic demand in Ireland's five major cities (Five Cities Demand Management Study); the transition of the transport sector to low-emission vehicles and sustainable mobility networks; the climate resilience of the transport infrastructure; the reduction of air pollutant and carbon emissions from land transport, particularly from the heavy-duty sector; and the potential role of sustainable alternative fuels in decarbonising transport. DT also completed the second phase of its low-emission bus trial, which compared the performance of a single-deck hydrogen fuel cell electric bus with the performance of a range of conventional and alternative bus technologies determined by the results of the phase 1 trial, and its results will inform procurement strategies for the national public service obligation fleet.

The department also entered into several new co-funding agreements with the EPA and SEAI to address climate knowledge gaps. This will see an increase in the funding committed by DT in future with the aim of informing policies and pathways to meeting targets for 2030 and 2050.

Enterprise Ireland

The network of national contact points for Horizon Europe led by Enterprise Ireland promotes the Horizon Europe programme to the Irish research and innovation community. National contact points and national delegates represent Irish interests in relation to the development of the various Horizon Europe work programmes. National contact points also assist the research and innovation communities in all aspects of the application process. Enterprise Ireland also provides funding to researchers in academic institutions to develop applications to Horizon Europe.

Enterprise Ireland opened a €10 million Climate Enterprise Action Fund⁶⁸ in 2021 to help companies reduce emissions and embed sustainability in how they work:

- ▶ The fund will support up to 850 companies at an early stage of exploring climate and sustainability to develop a high-level company action plan, which will enable them to measure their carbon footprint and identify projects leading to reduced emissions and greater resource efficiency (e.g. energy, water, materials). The plan will assess the company’s operations, supply chain, market opportunities and challenges through a climate and sustainability lens.
- ▶ The fund will support up to 100 companies at a more advanced stage to develop comprehensive multi-annual business plans with climate change and sustainability actions integrated into the company’s overall strategy.
- ▶ The fund will also support a small number of public–private partnerships working on high-impact feasibility projects that will enhance climate change and sustainability capabilities across Irish enterprise

68 <https://globalambition.ie/climate-enterprise-action-fund/>

Environmental Protection Agency

The EPA launched EPA Research 2030⁶⁹, a new 10-year high-level framework for the EPA's research programming (2021–2030). The new framework has a thematic structure comprising four interconnected hubs: (i) addressing climate change evidence needs; (ii) facilitating a green and circular economy; (iii) delivering a health environment; and (iv) protecting and restoring our natural environment. This brings an integrated and cross-sectoral approach, enabling holistic management and protection of our environment. The scope of EPA-funded research is informed by its relevance to policy and its alignment with the key activities of the EPA. Consideration of the interactions between social, behavioural and economic factors as an integral component of environmental research will lead to enhanced governance and more effective implementation of environmental policies and strategies.

The EPA continued to coordinate environmental research in Ireland and facilitated the activities of the CRCG during 2021, including leading the discussions on the climate-related codes for the national research classification system and on developing metrics for climate research. The EPA coordinated workshops and steering group meetings for the 5YAR.

EPA Research opened its first competitive call under the new framework and granted 12 awards related to climate research in 2021, committing €2 million (and attracting a further €691,000 co-funding). The EPA continued its strategic partnerships with MI, DT, GSI, SEAI, DAFM, Irish Research Council (IRC) and the Fulbright Commission Ireland, supporting a further 9 awards (committing a further €1.3million).

The EPA, along with MÉ and MI, published the report *The Status of Ireland's Climate*, the second such comprehensive analysis of "essential" climate data collected in Ireland.

The EPA published the first report from its **Climate Change in the Irish Mind project**⁷⁰, a study on Irish people's beliefs, attitudes, policy preferences and behaviours regarding climate change. The work was undertaken by the EPA and the Yale University Program on Climate Change Communication in support of the National Dialogue on Climate Action.

Additionally, in 2021 the EPA published:

- ▶ green public procurement guidance for the public sector;
- ▶ GHG emissions projections for the period 2020–2040.
- ▶ Ireland's provisional GHG emissions for 1990–2020.

Geological Survey Ireland

In 2021, GSI continued to support a number of national and international programmes by providing key data and expertise through in-house research activities. These include providing baseline datasets, data products and expertise in the areas of geology, geothermal energy, and marine and coastal change, including flooding and inundation, hydrology and hydrogeology, and landslides resulting from climate change. GSI also funds research in the research-performing organisations and industry partners in these areas. This research is key to understanding not only the past and present Earth systems and how they interact but also how they will be affected by climate change in the future. GSI also works with a number of state partners (e.g. OPW, EPA, Irish Water, MÉ, Climate Ireland, CAROs, MI) and organisations undertaking research.

69 https://www.epa.ie/publications/research/epa-research-2030/EPA-Research-2030-Framework_Final.pdf
70 The Climate Change in the Irish Mind Study (<https://www.epa.ie/environment-and-you/climate-change/what-is-epa-doing/ndcay-ale-work/climate-change-in-the-irish-mind/>) was a nationally representative survey and allows the examination of the challenges of realising behavioural change across different demographics in society and by different sectoral areas. The data were collected and analysed and the first report published in December 2021 (<https://www.epa.ie/publications/monitoring--assessment/climate-change/climate-change-in-the-irish-mind.php>).

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Marine Institute

The following are some of the key highlights for the institute in 2021:

- ▶ €8.6 million is the amount of new research investments awarded under the MI's Marine Research Programme for 2021, including €3.2 million for ship time and €5.4 million for research and innovation actions.
- ▶ €40 million is the total research investment under the National Marine Research & Innovation Strategy from 2017 to 2021, including €14.5 million for ship time and €25.5 million for research projects.
- ▶ A new research programme on blue carbon storage and sequestration was established following the 2021 call, with two awards led by University College Dublin funded for research on carbon storage in seagrass meadows and saltmarshes and in sands and sediments. A total of €2.6 million was awarded, with €2.2 million funding provided by the MI and €0.4 million from the EPA.
- ▶ Three post-doctoral fellowships were awarded in 2021 worth a total of €1.06 million for research on (i) nature-based solutions to achieve climate “resilience” in coastal communities (NUIG), (ii) the use of recycled carbon fibre material for sustainable marine turbines (NUIG) and (iii) sustainable ecotourism built around Ireland's unique shark and ray resources (Trinity College Dublin).
- ▶ In 2020, the Ocean Ecosystems and Climate research call was launched to fund a senior research fellowship in the area of climate impacts on marine ecosystems. Following the evaluation process, NUIG was successful with a total of €0.68 million awarded in 2021 for five years for the CÓIR – Changing Ocean Ireland: Forecasting Biodiversity and Ecosystem Response project.

Met Éireann

In 2021, MÉ's ongoing core climate research activities continued, including climate modelling (e.g. EC-Earth), climate services development [e.g. under the European Research Area for Climate Services (ERA4CS), production of national standard climate maps to support Irish building standards and production of climate monitoring indices and products], flood forecasting capability building [e.g. fluvial (river) flood modelling, pluvial (rainfall) flood modelling and coastal flood monitoring monitoring] and national climate monitoring (including the coordination of the Irish GCOS). MÉ's research call 2021 was launched in support of national climate expertise capacity building with two topics of interest: climate modelling – improving EC-Earth's modelling of the North Atlantic Ocean–Atmosphere system; and model coupling – developing a fully coupled atmosphere–wave–ocean model system for Ireland. In 2021, MÉ continued to further support national capacity building by co-funding the IRC's Government of Ireland Postgraduate Scholarship Programme and continuing to partner with the SFI Centre for Research Training in Foundations of Data Science. Ongoing co-funding partnerships with the EPA and SEAI continued.

National Economic and Social Council

In 2021, the NESC carried out research that deepened and developed previous work on the just transition and climate action, supporting the government's Shared Island initiative and the development of a well-being framework. Published reports included the following: *Perspectives on Micro-generation: Public Participation in the Low Carbon Transition in Ireland*, NESC Research Paper No. 23; *Ireland's Well-Being Framework: Consultation Report*, NESC Council Report No. 155; *Collaboration on Climate and Biodiversity: Shared Island as a Catalyst for Renewed Ambition & Action*, NESC Council Report No. 156; *Overview of Submissions: In response to Shared Island Climate and Biodiversity Consultation*, NESC Background Paper; and *Building Long-Term Resilient and Sustainable Development in Cities*, NESC Research Report No. 22.

National Parks & Wildlife Service

The NPWS is a participant in three new LIFE projects under the 2020 Nature and Biodiversity call for proposals (LIFE on Machair, LIFE Lough Carra and LIFE Insular) and in WaterLANDS under the EU Horizon programme. The NPWS has funded a network officer to facilitate the All Island Climate and Biodiversity

Research Platform. The service is also supporting research into emission factors from peatlands and the factors contributing to peat landslides.

National Treasury Management Agency

The National Treasury Management Agency (NTMA) is a state body with a commercial remit to provide asset and liability management services to government. It has evolved from a single function agency managing the national debt to a manager of a complex portfolio of public assets and liabilities, including the management of the Ireland Strategic Investment Fund (ISIF). The ISIF is a sovereign investment fund with a mandate to invest on a commercial basis to support economic activity and employment in Ireland.

The NTMA is supporting various actions contained in the government's CAP21 and has had in place the NTMA Climate Action Strategy since 2020, which established NTMA-wide actions, including investment. The strategy commits the NTMA to being environmentally sustainable and a net zero emissions organisation by 2030, in advance of the 2050 timeline set by government. The NTMA Board expects the organisation to demonstrably factor climate risk into all its decision-making.

Investing with impact is key to the ISIF's mandate. It is anticipated that the fund will invest €1 billion in climate-related investments over the next five years. The ISIF's climate strategy envisages investments that will put Ireland in a good position to become a net zero economy aligned with the national CAP21. The ISIF has been measuring and monitoring a wide range of climate-related metrics across its portfolios for several years and published its first stand-alone climate report in November 2021⁷¹.

Office of the Planning Regulator

The OPR advanced a number of climate-relevant “strand one” research projects during 2021, in accordance with the OPR’s Planning Research Framework and Strategic Planning Research Programme.

Firstly, the OPR is supporting, by way of a research partnership agreement with the International Centre for Local and Regional Development, the InPlace project (Investigating Place, Planning and Commuting study). This research aims to elucidate the impacts of pre- and post-Covid-19 commuting on people and place. Its findings will have significance for a range of public policies, many of which are within the remit of local authorities, and all of which directly influence local communities, such as health, housing, environment, community development, social policy, transport and spatial planning.

Secondly, entering into partnership with the team at MaREI, the SFI Research Centre for Energy, Climate and Marine coordinated by the Environmental Research Institute at University College Cork, the OPR focused on climate action and the local authority development plan. The resulting case study paper offers insights into the challenges local authorities experience when incorporating climate mitigation into development plans and highlights exemplary aspects of existing development plans that include climate mitigation measures.

Office of Public Works

In 2021, the OPW continued its climate-related activities on flood risk management in three main areas: climate research, capacity building and climate adaptation.

In partnership with the East Midlands CARO, the OPW further progressed climate research to assess the “sensitivity of fluvial peak flows to a changing climate” to inform guidance on the range of allowances for climate change that should be considered in relation to designing flood flows. With regard to coastal flood risk, the OPW has provided funding to study the effects of climate change on sea levels, including astronomical tide levels and storm surges, and on wave climate conditions around the coast of Ireland. Both of these projects are now nearing completion.

71 <https://isif.ie/news/isif-publishes-first-ever-annual-climate-report>

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In terms of capacity building, the OPW continues to support the monitoring of essential climate variables. This is done through the operation of its network of long-term hydrometric gauging stations to support climate research. The OPW has also developed baseline datasets for use in the assessment of climate change effects on river flows. In terms of soil moisture monitoring, the OPW has continued its role as steering group member for the EPA-funded SoMoSAT (Soil Moisture Estimates from Satellite-based Earth Observations project and for the development of ISMON (the Irish Soil Moisture Monitoring Network). The OPW also continues to provide advice and assistance as part of the Steering Groups for Volumes I and III of the 5YAR. In 2021, the OPW supported the CAROs by developing and delivering a training course on flood risk management and climate change comprising eight half-day modules.

The OPW is also progressing a number of projects that are focused on climate adaptation. During 2021, the OPW published the national coastal flood hazard mapping, which provides national-scale coastal flood extent and depth maps, and also the national indicative fluvial mapping, which provides flood mapping for primarily rural areas that were not studied under the CFRAM Catchment Flood Risk Assessment Management Programme. These maps have been produced for the current climate scenario and up to four future scenarios. The OPW has also commenced the review of the preliminary national flood risk assessment and flood maps, which will be informed by the most up-to-date research and projections of climate change, to assess the potential impacts on flooding and flood risk across the country.

Science Foundation Ireland

In 2021, SFI continued to support climate-relevant research through awards across various programmes in its portfolio, including awards in basic research, capacity building, industry-academia collaboration, challenge research awards and public engagement. Research funding calls included the SFI Frontiers for the Future Programme (including co-funding partnerships with GSI and SEAI), SFI Research Infrastructure Programme (including co-funding partnerships with SEAI), SFI RD&I Industry Fellowship Programme (on research, development and innovation), SFI Strategic Partnership Programme, SFI Spokes Programme, SFI Research Professorship Programme and the SFI-IRC Pathways Programme. SFI continued to grow its challenge funding portfolio, awarding prizes under the AI for Societal Good (on artificial intelligence) and Zero Emissions Challenges relevant to climate action, as well as securing funding to run the National Grand Challenges Programme, commencing in 2022, with a focus on the green transition and digital transformation. SFI continued to fund major climate-relevant research initiatives through its research centres and strategic partnerships programmes, including MaREI, BiOrbic⁷², iCRAG and Terrain-AI⁷³. Through its public engagement programmes in 2021, SFI supported some key activities associated with climate action, including National Science Week with the theme “Creating our Future” and a documentary broadcast on RTÉ, “Science to the Rescue”.

Sustainable Energy Authority of Ireland

The SEAI National Energy Research Development and Demonstration (RD&D) Funding Programme invests in innovative energy RD&D projects that contribute to Ireland’s transition to a clean and secure future for energy. Following the 2021 RD&D call, about 50 projects were awarded funding. Co-funding partners included the Department of Transport and GSI. Funded projects covered a wide range of areas including wind energy, offshore renewable energy, hydrogen storage, bioenergy, power systems, efficient buildings, transport, behavioural change, community energy, bioenergy and battery recycling.

The SEAI also led the management and coordination of Irish participation in International Energy Agency activities, hosted the annual National Energy Research and Policy Conference which focused on the theme of decarbonising transport, and maintained the National Energy Research Database, among other activities.

72 BiOrbic is Ireland’s National Bioeconomy Research Centre, pursuing excellence in research, new discovery and innovation for the development of a sustainable, circular bioeconomy (<https://biorbic.com/>).

73 Terrain-AI: climate change project co-funded by SFI and Microsoft Ireland, will focus on improving our understanding of the impact of human activity on land use and how it relates to climate change (<https://terrainai.com/>).

Teagasc

Teagasc continue to fund and conduct research on management practices to reduce agricultural GHG emissions and enhance carbon sequestration. A range of projects were funded by Teagasc through an internal call and postgraduate students (Walsh scholars) recruited through the open competitive call hosted by a range of universities in Ireland and the EU. Nationally significant projects commenced on the evaluation of 3-nitro-oxypropanol (3NOP) to reduce enteric methane emissions, and a new marginal abatement cost curve (MACC) project evaluating a range of new measures to reduce agricultural CO₂ and nitrous oxide emissions and research on the response of tree species to climate change was funded by DAFM. The new Signpost Programme started, a multiannual campaign to lead climate action by all Irish farmers and achieve early progress in reducing gaseous emissions from Irish agriculture. The National Agricultural Soil Carbon Observatory and the agricultural catchments programme began a national soil carbon sequestration programme by establishing eddy covariance towers across farms on mineral and peat soils. The SFI-funded VISTA milk research centre started projects on soil carbon sequestration and enteric methane emissions. The knowledge transfer programme provided training for farmers through the weekly Signpost Series webinars and Teagasc farmer open days on grassland and tillage. Teagasc is also promoting afforestation, tree planting and forest management supporting the achievement of carbon sequestration targets through its advisory, promotion and training initiatives.

4.4 Snapshot of 2021 Joint Research Events

Examples of climate research communication workshops and selected examples of research project briefings and workshops that took place in 2021 are given in **Appendix 9**.

Eighty such events were reported compared with 42 in the CRCG report for 2020. This demonstrates that extensive communication and collaboration took place in 2021. While the increase in events reported may reflect more comprehensive returns, it may also reflect CRCG members' greater familiarity with organising online events, compared with 2020, necessitated by the Covid-19 pandemic.

4.5 Meetings of the Climate Research Coordination Group

In 2021, four research coordination group meetings were organised by the EPA: two were for the combined National Environmental Research Coordination Group (in March and October) and two specifically for the CRCG (in March and September). A further seven meetings of a sub-group of the CRCG were held to examine climate research classification codes and metrics.

CRCG meetings have focused on the 5YAR report, the completion of the third annual CRCG report and progressing the actions included therein, the development of national research programmes, information exchange on activities, updates on current and emerging environmental policy issues, updates on Horizon Europe, coordination of research and leveraging of EU funding and realising the benefits of Europe-wide research.

Additional presentations were given by:

- ▶ Alison Campbell (Knowledge Transfer Ireland) on knowledge transfer in policy-orientated environmental research⁷⁴;
- ▶ Paul Saunders (NTMA) on the Ireland Strategic Investment Fund and its areas of focus on climate change.

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74 <https://www.knowledgetransferireland.com/>

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4.6 Research Publications

This section provides an overview of where to find research reports published in 2021 arising from the funded research projects⁷⁵, as reported by the CRCG members (see **Table 8**).

Table 8: Climate change-related CRCG research publications (2021)

Lead funding organisation	Information source/website/publication link
DAFM	https://www.gov.ie/en/publication/bde7d-research/
GSI	https://www.gsi.ie/en-ie/publications/Pages/default.aspx
EPA	https://www.epa.ie/our-services/research/epa-funded-research/epa-research-publications/
MÉ	https://www.met.ie/science https://www.met.ie/climate/ https://www.met.ie/education
MI	https://www.marine.ie/Home/site-area/publications/marine-institute-open-access-repository
IRC	https://research.ie/funding/ https://research.ie/resources/publications/
NESC	https://www.nesc.ie/publications/
SEAI	https://www.seai.ie/data-and-insights/seai-research/research-database/
Teagasc	https://www.teagasc.ie/publications/
SFI	https://www.sfi.ie https://www.sfi.ie/funding/researcher-database/
CSO	https://www.cso.ie/en/
OPR	https://www.opr.ie/research/ https://www.opr.ie/planning-performance/

CSO, Central Statistics Office; DAFM, Department of Agriculture, Food and the Marine; GSI, Geological Survey Ireland; IRC, Irish Research Council; MÉ, Met Éireann, MI, Marine Institute; NESC, National Economic and Social Council; OPR, Office of the Planning Regulator; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland; SFI, Science Foundation Ireland.

75 Accessible to the public from the CRCG members' websites.



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Section 5

2021 Developments Related to the National Climate Research Infrastructure



5. 2021 Developments Related to the National Climate Research Infrastructure

5.1 Climate Ireland

Climate Ireland is an operational support, funded by the EPA and DECC, for the implementation of the NAF (i.e. Action 7). It provides information, support and capacity building to help organisations, sectors and government to adapt to the consequences of climate change. The service is provided through the Climate Ireland web portal⁷⁶ and through provision of scientific and technical advice, training programmes and workshops, etc. Ownership of and responsibility for overseeing Climate Ireland operations switched to the EPA in January 2021.

Climate Ireland carried out the following activities in 2021:

- ▶ Climate Ireland supported the delivery of Ireland's national reporting requirements under the EU Energy and Governance Regulation.
- ▶ Climate Ireland actively engaged with government departments and local authorities to accelerate the development and implementation of adaptation actions arising from local and sectoral adaptation strategies.
- ▶ Climate Ireland engaged internationally, acting as a national representative on expert panels and contributing information to the European Climate Change Adaptation Platform. In addition, Climate Ireland is engaging with the adaptation science community through the development of peer-reviewed research and the convening of sessions at academic conferences.
- ▶ In collaboration with the CAROs and a dedicated project advisory group, Climate Ireland is developing guidelines for the development of local authority climate action plans as required by the Climate Acts (2015–2021).
- ▶ Climate Ireland is actively supporting the development of capacity for adaptation planning at the local scale through the development of a bespoke semi-quantitative risk assessment methodology for Ireland's local authorities.
- ▶ Climate Ireland has supported the development of the CAROs Local Authority Climate Action Training Programme. As part of this programme Climate Ireland has developed and is delivering the “Climate Action: Raising Awareness” course online through the Climate Ireland Learning Platform. In addition, Climate Ireland has coordinated the development of and is contributing to the delivery of the “Climate Action: Building Capacity” course, which targets climate action teams within the local authorities.
- ▶ The “Climate Action: Raising Awareness” course has been rolled out to 12,458 learners and has achieved an average completion rate of 72%.
- ▶ The “Climate Action: Building Capacity” course has been delivered to 351 climate action team members across Ireland's local authorities.

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- ▶ Climate Ireland's Climate Data Explorer has been updated to include the most up-to-date climate projection data and now contains projected information for 17 variables and provides access to 72 data layers.
- ▶ Climate Ireland's Data Explorer has been significantly improved, with data loading times reduced from 23 seconds to under 1 second.
- ▶ Climate Ireland's Climate Status Tool has been updated to include the most up-to-date information on changes observed in Ireland's climate and to provide access to almost 50 essential climate variables.



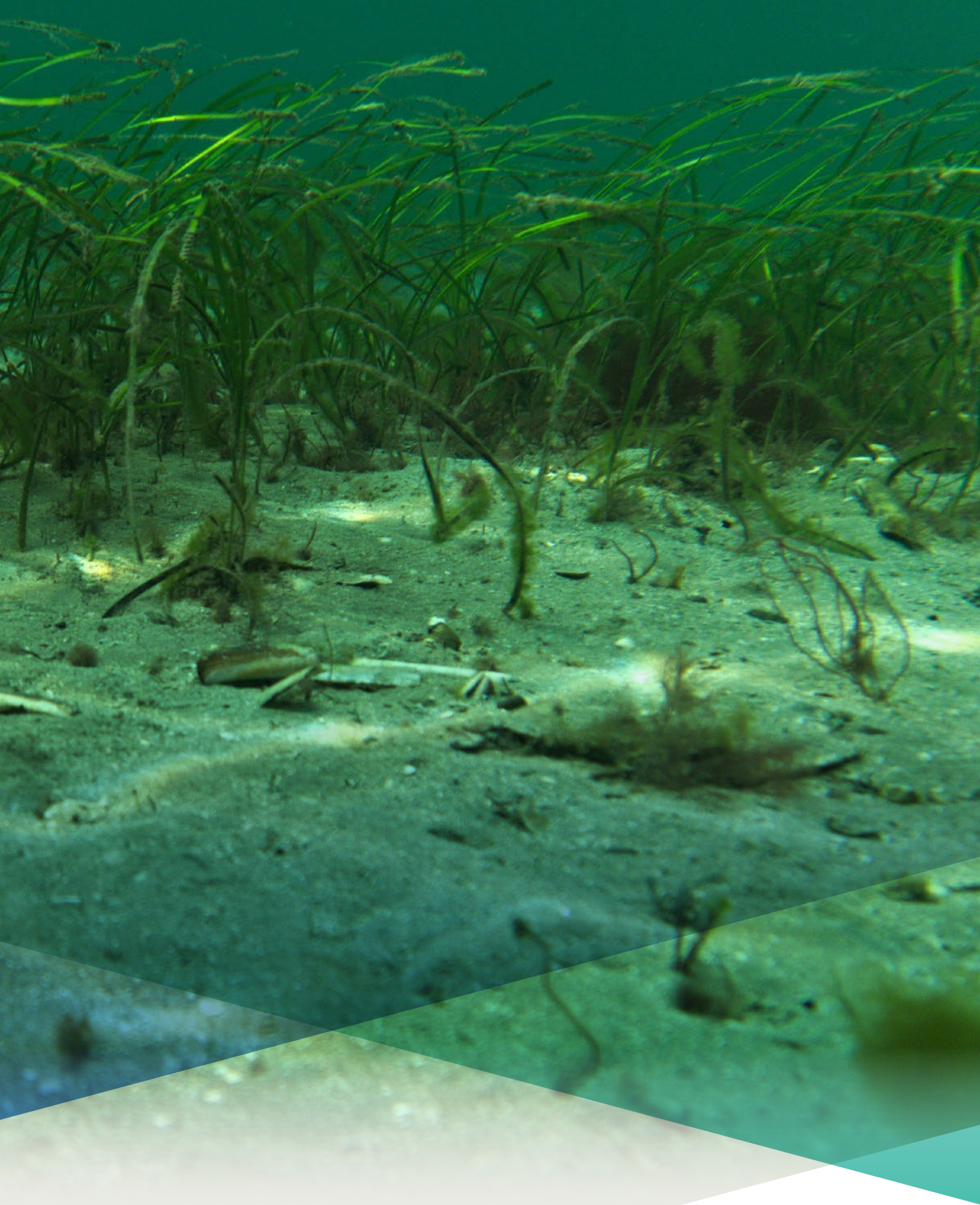
5.2 Atmospheric Composition and Climate Change and AEROSOURCE Networks

The Atmospheric Composition and Climate Change (AC3) and AEROSOURCE networks include Ireland's part of the European Monitoring and Evaluation Programme (EMEP) network⁷⁷. Data from the network are available at data.gov.ie⁷⁸, and EBAS database infrastructure⁷⁹, as are the AEROSOURCE network for chemical speciation of aerosols and the GHG monitoring network (see the second CRCG report⁸⁰ for more details).

5.3 Integrated Carbon Observation System for Ireland (ICOS Ireland)

Measurement of GHGs at atmospheric, ecosystem and oceanic sites in Ireland continued with further developments at the ecosystem sites in particular. These measurements are anticipated to contribute to European analyses under the ICOS programme and increase the basis for engagement with the ICOS European Research Infrastructure Consortium in 2022.

77 <https://emep.int/>
78 <https://data.gov.ie/dataset/emep-the-european-monitoring-and-evaluation-programme-air-quality-monitoring-sites>
79 <http://ebas-data.nilu.no/>
80 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-second-report-on-activities.php>



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Section 6

New 2021 EU Funding Leveraged by Ireland for Climate Change Research Projects



6. New 2021 EU Funding Leveraged by Ireland for Climate Change Research Projects

National research investment is the main funding source for climate change research in Ireland. However, researchers from Ireland have been successful in attracting international funding at the European level. This enables them to work with, lead on and learn from projects that involve multidisciplinary international research groups.

Based on the projects identified by the CRCG members, the Irish research community leveraged €32.6 million (47 projects) of EU funding via Horizon 2020 / Horizon Europe and €1.7 million of funding from Interreg (one project⁸¹) for climate research and other research of relevance to climate action. No new climate-related COST Actions (interdisciplinary research networks) or LIFE projects involving Irish partners were approved in 2021.

Several of the CRCG members, namely DECC, EPA, GSI, MI, NPWS, SEAI, SFI and Teagasc, participated in successful proposals. The list of the 2021 successful climate proposals or other proposals of relevance to climate action with Irish participants is provided in **Appendix 7** for Horizon 2020 / Horizon Europe and in **Appendix 8** for Interreg.

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81 Includes projects approved, contracted and started in 2021.

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Section 7

Summary of Climate Research Coordination Group Activities and Actions



7. Summary of Climate Research Coordination Group Activities and Actions

7.1 Summary of Activities in 2021

This fourth report presents a summary of the CRCG's activities during the 12-month period from **January to December 2021**.

One of the developments expected in 2022 is the publication of the new National Research and Innovation Strategy (postponed from 2021).

In summary, in 2021:

- ▶ **Significant progress was made in the first 5YAR, which included completion of the award and scoping processes** (Action 82 of the CAP21).
- ▶ **New headings for reporting climate research were used in this report (climate research and research of relevance to climate action).**
- ▶ **42 new climate research competitive awards** were made in 2021, with a total budget commitment of **€24.1 million**.
- ▶ **20 of the new climate research competitive awards were supported through co-funding from other CRCG members in addition to the principal CRCG member that made each award.** The other 22 awards were funded solely through the CRCG member that made the award.
- ▶ **86%** of the budget went to projects led by University College Dublin, Teagasc, National University of Ireland Galway and Maynooth University (based on funding for successful projects assigned to the lead partner).
- ▶ **In excess of €8.2 million** was allocated to core research activities in 2021, i.e. research activities that are performed in house (e.g. by Teagasc, Met Éireann, etc.).
- ▶ There were a further 101 new research competitive awards for projects of relevance to climate action, with a total budget commitment of €76.4 million⁸².
- ▶ The Irish climate research community achieved a drawdown of **€32.6 million** under Horizon 2020/Horizon Europe (47 projects) and **€1.7 million** from **Interreg** (one project)⁸³.
- ▶ The launch of the **second *The Status of Ireland Climate* report**⁸⁴, by the EPA, Met Éireann and the Marine Institute, received considerable media attention.
- ▶ The Royal Irish Academy Climate Conversations series was held online and provided opportunities to hear about the findings from a number of recent climate research reports⁸⁵.
- ▶ The EPA embarked on a new project with Yale University's Programme on Climate Change Communication to research the attitudes, behaviours, policy preferences and beliefs of the Irish public around climate change⁸⁶. The first report from this project, ***Climate Change in the Irish Mind***⁸⁷, was published in 2021.
- ▶ In addition, **80** climate research communication events and workshops took place in 2021 involving the CRCG members.

82 This includes one award of €28.3 million for phase 2 of iCRAG, the SFI research centre for applied geosciences.

83 Includes projects approved, contracted and started in 2021.

84 <https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php>

85 <https://www.ria.ie/science-committees/climate-change-and-environmental-sciences-committee>

86 <https://www.epa.ie/environment-and-you/climate-change/what-is-epa-doing/ndcayale-work/climate-change-in-the-irish-mind/>

87 <https://www.epa.ie/publications/monitoring--assessment/climate-change/climate-change-in-the-irish-mind.php>

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Table 9 summarises the CRCG’s activities in 2021 compared with those reported in the first report, which covered June 2017 to December 2018, the second report, which covered January to December 2019, and the third report, which covered January to December 2020. Due to the change in reporting, data from this report cannot be compared with the data included in previous reports and therefore trends analysis should not be carried out.

The review of climate research during the period January–December 2021 indicated an increase in co-funding between the CRCG member organisations. Crucial complementarities exist between the research areas, and the level of co-funding is an important indicator of collaboration.

80 climate research communication events and workshops involving the CRCG members took place in 2021 (compared with 42 in the third report). This is a good indication of extensive communication and collaboration among CRCG members.

Table 9: CRCG activity indicators⁸⁸

Indicator	First annual report	Second annual report	Third annual report	Fourth annual report	Comments
Reporting period	June 2017 to December 2018 (18 months)	January–December 2019 (12 months)	January–December 2020 (12 months)	January–December 2021 (12 months)	Not applicable
Number of new competitive awards	104	72 + MaREI phase 2	84	42 directly relevant to climate change 101 indirectly relevant to action on climate change (includes iCRAG phase 2)	Sections 4.1 and 4.4 identify changes in the research funding landscape for 2021. Greater effort was made to capture all research awards that would have deliverables relevant to climate action and to distinguish between research directly relevant to climate change and research for other purposes but of relevance to climate action.
Budget committed towards new competitive awards	€25 million	€23.1 million + €19.5 million towards the MaREI phase 2 SFI centre	€21 million	€24.1 million on climate research €76.4 million on other research of relevance to climate action (includes €28 million for iCRAG phase 2)	Increased commitments for climate research calls reported for 2021 compared with previous years. Greater effort was made to widen the scope of research awards to include all research that may be of relevance to climate action and not just research specific to climate change.

⁸⁸ Due to the change in reporting, data from this report cannot be compared with the data included in previous reports and therefore trends analysis should not be carried out.

Indicator	First annual report	Second annual report	Third annual report	Fourth annual report	Comments
Collaboration/co-funding among CRCG members	€6 million (19 projects)	€6.8 million (21 projects)	€2.07 million (14 projects)	€3.1 million (20 projects) for climate research awards €3 million (15 projects) for other research awards relevant to climate action	Increased level of co-funding included in 2021 awards may reflect wider scope of research awards. CRCG meetings allow its members to review research gaps, avoid duplication, promote synergies and identify opportunities among funding programmes of CRCG members. This strengthens collaboration, which is reflected in the level of co-funding.
Core research activities	Not reported	c.€3.4 million	c.€4.2 million	€8.2 million	Increased amount of core research activities reported largely due to the engagement of Teagasc in the EJP Soil ⁸⁹ call in 2021, in which Teagasc leveraged a further €712,083 through European Commission co-funding in addition to its own contribution.
Number of CRCG meetings	3	3	4	4	Two NERCG meetings and two CRCG meetings. A further seven meetings were held by a sub-group of CRCG members to examine climate research classification and climate research metrics.
Irish drawdown under Horizon 2020/Horizon Europe	€3 million (14 projects)	€29.8 million (50 projects)	€18.8 million (46 projects)	€32.6 million (47 projects)	Similar number of Horizon 2020/Horizon Europe projects reported but resulting in greater drawdown than reported in 2020.
Irish drawdown under Interreg	Not reported	€15.1 million (11 projects)	€6.9 million (1 project)	€1.7 million (1 project)	A number of assemblies did not have calls in 2021.
Irish drawdown under the LIFE programme	Not reported	€14.9 million (2 projects)	€10.5 million (3 projects)	None reported	No climate LIFE projects were reported for 2021. Irish successes in LIFE funding were in other themes, notably biodiversity.

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89 <https://ejpsoil.eu/about-ejp-soil>

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7.2 2021 Update on Actions and Next Steps

Table 10 summarises the status of actions the CRCG was to progress in 2021 (included in the third CRCG report⁹⁰) and actions planned for the CRCG in 2022.

Table 10: Status of actions proposed for 2021 and actions planned for 2022

Action	2021 Update	Planned for 2022
Synergies between RFO funding strategies and new national research and innovation strategy ⁹¹ (all funders, DFHERIS)	Under way. DFHERIS published the new national research and innovation strategy in May 2022 ⁹² , so this action can be progressed in 2022.	Progress this action - All CRCG members.
Development of an online database for climate research projects	Under way. The establishment of the online database of climate research activities forms part of the redevelopment of the EPA's SAFER database ⁹³ . This redevelopment has been approved and is progressing in 2022.	Progress this action - Led by the EPA with the support of the CRCG members. This project will align with future recommendations from the national research classification system exercise currently being piloted and for which the CRCG provided a combined submission.
Review of thematic structure for reporting research projects/ activities in annual CRCG reports	Under way. The five-year assessment of research process agreed a reporting structure for its assessment and synthesis of climate research. It has been used in reporting research projects/activities in this CRCG report in addition to the thematic areas used in previous reports and the two new broad headings (climate research and awards of relevance to climate action).	Progress this action - All CRCG members. The national research classification system will be used to report projects/activities when it has been finalised by DFHERIS.
Development of climate research metrics	Under way. A sub-group ⁹⁴ of the CRCG started the discussions on suitable climate research metrics.	Progress this action - Led by the EPA with the support of the CRCG members. The development of climate research metrics will align with the national efforts to design research impact indicators led by DFHERIS.
Mapping research projects	Completed. This report captured data under two headings: (i) climate research and (ii) awards of relevance to climate action. A sub-group of the CRCG provided input to a DFHERIS exercise on a national research classification system.	N/A

90 <https://www.epa.ie/publications/research/climate-change/climate-research-coordination-group-third-report-on-activities.php>

91 <https://www.gov.ie/en/publication/27c78-impact-2030-irelands-new-research-and-innovation-strategy/#:~:text=Impact%202030%20has%20five%20pillars%2C%20on%20the%20impact,research%20and%20innovation%20structures%20on%20excellence%20and%20outcomes>

92 <https://www.gov.ie/en/publication/27c78-impact-2030-irelands-new-research-and-innovation-strategy/>

93 SAFER-Data (Secure Archive for Environmental Research Data) is a fully web-based interface to the EPA's Environmental Research Data Archive (<https://eparesearch.epa.ie/safer/>).

94 GSI, ME, EPA, DFHERIS, DECC, SFI, DT, SEAI, Teagasc, DAFM, DoT

Action	2021 Update	Planned for 2022
Invitation to DFA to join the CRCG	Completed.	N/A
Explore and support opportunities for knowledge transfer by improving the interface between policymakers and academia in effecting knowledge transfer and getting the most out of funded research, and by improving knowledge transfer with other stakeholders, e.g. practitioners, farmers and businesses	New action	Progress this action - Led by the EPA with the support of the CRCG members. The ongoing EPA Knowledge Transfer activities led by ERINN Innovation (EPA-Impact) will inform this action.
RFOs to review what changes to their administrative systems are needed to report on actual spending on climate research as opposed to funding committed once a national research classification system is established	New action	Progress this action - All CRCG members.

DFA, Department of Foreign Affairs; DFHERIS, Department of Further and Higher Education, Research, Innovation and Science; RFO, research-funding organisation.

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Section 8

Appendices 1-10



Appendix 1:

Terms of Reference for Climate Research Coordination Group

Purpose

The main purpose of the CRCG is to provide a cross-sectoral, national strategic coordination forum for climate research in Ireland.

Aims and Objectives

The objectives for each research coordination group will be to:

- ▶ facilitate, support and promote coordination, synergies and liaison between relevant cross-sectoral funding organisations, public and private, to reduce the fragmentation and/or duplication of climate research in Ireland;
- ▶ facilitate an exchange forum between research funders and key stakeholders, providing an interface for funding organisations of climate research to facilitate the dissemination, sharing and uptake of relevant scientific outputs to policymakers and decision-makers and the uptake of research outputs for commercialisation;
- ▶ identify key research needs and emerging policy needs with the aim of informing the research strategy of Irish climate RFOs;
- ▶ provide a platform for cross-sectoral RFOs to liaise and/or collaborate with European and international activities related to climate research, such as JPIs, technology platforms and the LIFE programme.

Added Value

Each of the research coordination groups acts as a research forum, coordinated by the EPA (i.e. research coordination groups do not serve as an EPA forum). The added value of membership and participation in the research coordination groups includes:

1. networking, collaboration, consultation, maximised synergies and coordination between the strategic partners throughout the whole research funding cycle to ensure that research programmes are relevant and responsive to current and new emerging policy priorities;
2. provision of a platform to coordinate co-funding opportunities between the strategic partners and thus contribute to maximising the impacts of funding provided across Ireland;
3. promotion and facilitation of increased synergies and reduced risk of duplication;
4. support and facilitation of increased communication and improved visibility and better dissemination of national research strategies;
5. provision of a platform for knowledge transfer of and knowledge exchange on research outputs and uptake for commercialisation.

Composition

The research coordination groups comprise RFOs, the EPA, relevant government departments and other strategic stakeholders. Many environmental issues can have transboundary and/or cross-border impacts. Therefore, the research coordination groups invite contributions from relevant strategic stakeholders across the island of Ireland.

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Meetings

The research coordination group meetings are facilitated by the EPA. Secretariat support will be provided by EPA Research. It is anticipated that the research coordination groups will meet three times per year:

- ▶ meeting 1: combined cross-disciplinary and cross-sectoral meeting for all three research coordination groups chaired by the EPA;
- ▶ meeting 2: May/June;
- ▶ meeting 3: October.

The EPA will circulate the schedule of meetings for the following year in December.

Each research coordination group has the option to rotate the position of the meeting chairperson between the strategic partners and the membership for the second and third meetings, to promote and support partner engagement and inclusiveness.

Each research coordination group may decide to have additional meetings depending on developments within the national/European policy and/or research funding landscape.

Appendix 2:

New Climate Research Coordination Group Member

The CRCG is facilitated by the EPA and includes members from several government departments, local authorities, agencies and other stakeholders whose functional areas are directly or tangentially relevant to furthering Irish climate change research. This appendix provides a brief overview of the member that joined in 2021.

Department of Foreign Affairs

The mission of the Department of Foreign Affairs is to serve the Irish people, promote their values and advance their prosperity and interests abroad and to provide the government with the capabilities, analysis and influence to ensure that Ireland derives the maximum benefit from all areas of its external engagement.

The department's Statement of Strategy focuses on how we implement the commitments assigned to us in the Programme for Government: Our Shared Future and meet international challenges. We have identified five high-level goals to guide our work from 2021 to 2023 in our **Statement of Strategy 2021–2023**⁹⁵.

The preparation of the Statement of Strategy was informed by the core foreign policy statements **The Global Island: Ireland's Foreign Policy for a Changing World**⁹⁶ and **A Better World: Irelands Policy for International Development**⁹⁷ and involved external consultation, including across government and with the Oireachtas, as well as internal consultation with all staff in the department.

95 <https://www.dfa.ie/media/dfa/aboutus/Statement-of-Strategy-2021-2023.pdf>
96 <https://www.dfa.ie/media/dfa/alldfawebitemedia/ourrolesandpolicies/ourwork/global-island/the-global-island-irelands-foreign-policy.pdf>
97 <https://www.dfa.ie/media/irishaid/aboutus/abetterworldirelandspolicyforinternationaldevelopment/A-Better-World-Irelands-Policy-for-International-Development.pdf>

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Appendix 3:

Source of the Data Reported in the 2021 Climate Research Coordination Group Report on Activities

Data	Received from
Competitive national awards	CRCG members (funders)
Core research activities	Teagasc MÉ GSI MI NPWS DAFM NESC OPR DT CSO
Horizon 2020 awards	EI EPA Teagasc SEAI GSI NPWS
LIFE awards	DECC NPWS
Interreg awards	Interreg North-West Europe Southern Regional Assembly
COST Actions	EI
Events and publications	CRCG members

CSO, Central Statistics Office; DAFM, Department of Agriculture, Food, and the Marine; DECC, Department of the Environment, Climate and Communications; DT, Department of Transport; EI, Enterprise Ireland; GSI, Geological Survey Ireland; MÉ, Met Éireann; MI, Marine Institute; NESC, National Economic and Social Council; NPWS, National Parks & Wildlife Service; OPR, Office of the Planning Regulator; SEAI, Sustainable Energy Authority of Ireland; SFI, Science Foundation Ireland.

Appendix 4:

Preliminary Contents of the Four Volumes under the Five-Year Assessment of Research

Volume 1. Science: Ireland in a Changing World (“Fundamental Science”)

Research under this volume builds on the information contained in the IPCC AR6 Working Group I report⁹⁸ and in the special reports on warming of 1.5°C⁹⁹, climate change and land¹⁰⁰, and the ocean and the cryosphere in a changing climate¹⁰¹. It will use relevant information provided at UNFCCC Earth Information days and available from Copernicus¹⁰². It will also highlight fundamental research carried out in Ireland which has contributed to analysis of global change:

- ▶ Global changes and trends in oceans, atmosphere and land systems:
 - i. paleoclimate and observed changes including Ireland-focused analysis;
 - ii. status of Ireland’s climate¹⁰³.
- ▶ Global energy balance and carbon budget:
 - i. global emissions of GHGs and air pollutants and trends;
 - ii. changing the energy balance: including Mace Head analysis;
 - iii. key global cycles: carbon and nitrogen;
 - iv. GHG characteristics, sinks and negative emissions.
- ▶ Future worlds and future Ireland:
 - i. global emission scenarios and climate stabilisations;
 - ii. key projections for oceans, land and atmospheres to 2050, 2100 and beyond;
 - iii. Ireland-specific projections (high, medium and low).
- ▶ Thresholds and tipping points:
 - i. runaway climate change;
 - ii. loss of key glaciers.
- ▶ Areas of concern for Ireland:
 - i. the stability of the North Atlantic Ocean currents.

98 <https://www.ipcc.ch/report/ar6/wg1/>
99 <https://www.ipcc.ch/sr15/>
100 <https://www.ipcc.ch/srccl/>
101 <https://www.ipcc.ch/srocc/>
102 <https://www.copernicus.eu/en>
103 <https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php>

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Volume 2: Achieving Climate Neutrality by 2050 (“Mitigation”)

Research under this volume builds on the information contained in the IPCC AR6 Working Group III report¹⁰⁴ and on material in the special reports on warming of 1.5°C¹⁰⁵ and on climate change and land¹⁰⁶. It includes research done to develop the national inventory report (particularly in agriculture, forestry and other land use) and top-down verification of GHG emissions and removals. It includes research to explore global pathways to 2050 and 2100 and Ireland specific-analysis of these. Research under volume 2 will respond to the following areas:

- ▶ Meeting the Paris Agreement temperature goal (Volume 1):
 - i. global GHG emissions and trends (focus on sectors rather than GHGs);
 - ii. pathways to net zero and balancing GHG emissions and removals;
 - iii. removals and negative emissions.
- ▶ Ireland-specific analysis:
 - i. emissions from Ireland; trends and changes since 1990;
 - ii. moving from default to Ireland-specific emissions analysis:
 - disaggregating emissions from national to local;
 - linking air quality and GHG emissions data;
 - iii. verification systems and tools (ICOS¹⁰⁷ and ACTRIS¹⁰⁸ European research infrastructure):
 - Ireland a platform for verification systems;
 - iv. GHG emission pathways to climate neutrality by 2050 and 2100.
- ▶ Carbon pricing, markets, supports and ambition (Volume 4):
 - i. carbon pricing, the EU ETS and its operation;
 - ii. project-based mechanisms and key supports;
 - iii. actors and enabling;
 - iv. ambition and ambition leaders.
- ▶ Sectoral emissions:
 - i. sectoral analysis and pathways to 2050;
 - ii. mitigation technologies and options;
 - iii. nature-based solutions.
- ▶ Benefits and opportunities of achieving climate neutrality (Volume 4):
 - i. social and economic solutions, services and technologies;
 - ii. health and well-being and environmental quality;
 - iii. ecosystem services and natural capital.
- ▶ Areas of concern for Ireland:
 - i. carbon lock-ins;
 - ii. vulnerability of carbon stocks in soils and biomass.

104 <https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/>
105 <https://www.ipcc.ch/sr15/>
106 <https://www.ipcc.ch/srccl/>
107 <https://www.icos-cp.eu/>
108 <https://www.actris.eu/>

Volume 3: Being Prepared for Ireland’s Future Climate (“Adaptation”)

Research under this volume builds on the information contained in the IPCC AR6 Working Group II report¹⁰⁹ and on material in the AR6 special reports mentioned earlier. Research under this volume aims to identify robust information that can be included on the Climate Ireland portal to advance the NAF process. Research under Volume 3 will respond to the following areas:

- ▶ Impacts of global climate change:
 - i. current impacts and projected impacts at warming of 1.5°C, 2°C and higher temperature increments;
 - ii. Ireland observed impacts and trends;
 - iii. projected impacts.
- ▶ Global sectoral and geographical impacts:
 - i. food production, energy, transport, the built environment, biodiversity, culture and heritage;
 - ii. Ireland sectoral and geographical impacts.
- ▶ Extremes and slow-onset changes:
 - i. storms and sea level rise, ecosystem change and fragmentation;
 - ii. Ireland examples.
- ▶ Vulnerability, exposure and risk assessment:
 - i. infrastructures, population displacement, food systems and supply chains;
 - ii. Ireland examples and exposures.
- ▶ Adaptation options and building resilience:
 - i. risk assessments and adaptation planning;
 - ii. nature-based solutions;
 - iii. Ireland plans and procedures.
- ▶ Benefits and opportunities from planned adaptation (Volume 4):
 - i. social and economic solutions;
 - ii. services and technologies, including observation and early warning systems;
 - iii. health and well-being;
 - iv. environment quality and ecosystem services.
- ▶ Areas of concern for Ireland:
 - i. sea level rise and coastal zones;
 - ii. vulnerability of peatland and terrestrial carbon stocks.

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109 <https://www.ipcc.ch/report/ar6/wg2/>

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Volume 4: Realising the Benefits of Transition and Transformation (“Opportunities”)

Research under this theme links to the sections in volumes 2 and 3 that address opportunities. Volume 4 addresses wider issues of national development and sustainable development, finance and financial flows. Research under this volume aims to identify opportunities and benefits for Ireland in the context of global climate change. Research under theme 4 will respond to the following areas:

- ▶ Envisaging Ireland's economy and society in 2050:
 - i. cities, towns and conurbations (economy, society and environment);
 - ii. energy, transport, communication;
 - iii. food systems;
 - iv. business and commerce;
 - v. rural sustainability (economy, society and environment).
- ▶ Benefits and opportunities of achieving climate neutrality (Volume 2):
 - i. social and economic solutions;
 - ii. services and technologies;
 - iii. health and well-being;
 - iv. environment quality and ecosystem services.
- ▶ Benefits and opportunities of planned adaptation (Volume 3):
 - i. social and economic solutions;
 - ii. services and technologies, including warning systems;
 - iii. health and well-being;
 - iv. environment quality and ecosystem services.
- ▶ Support for action:
 - i. financial systems and flows:
 - micro-level tools available to individuals, households and small business to invest in transformation;
 - macro-level tools to shift investments away from climate-vulnerable or high-carbon options towards consistency with Paris Agreement;
 - ii. decision support tools and systems:
 - green budgeting, pricing carbon, measuring carbon;
 - natural capital accounting;
 - information systems (Climate Ireland);
- ▶ Education, engagement, just transition:
 - i. education system (all levels);
 - ii. process for citizen engagement around the transition;
 - iii. exploration and understanding of the just transition across multiple sectors.

Appendix 5:

New 2021 Climate Research Competitive Awards

Appendix 6:

Other 2021 Competitive Research Awards Related to Climate Action

Appendix 7:

Climate-related Horizon 2020 Projects Awarded in 2021

Appendix 8:

Climate-related Interreg Projects 2021

Appendix 9:

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Appendix 10:

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Appendices 5 to 10 are included in a spreadsheet that can be downloaded from:
<https://www.epa.ie/our-services/research/national-environmental-research-coordination/climate-research-coordination-group/crcg-annual-reports-of-activities/>

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