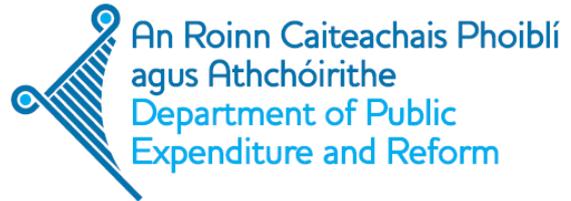




Irish Government Economic & Evaluation Service



Spending Review 2017

Climate Change Related – Research & Funding in Ireland

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This paper has been prepared by IGEES staff in the Department of Public Expenditure & Reform in the context of the Spending Review 2017. The views presented in this paper do not represent the official views of the Minister for Public Expenditure and Reform or the Department of Communications, Climate Action and Environment.

Executive Summary

Climate change research is a key resource for informing policy development in Ireland. It also enables Ireland to contribute to ongoing international efforts in relation to climate change research, observation and analysis. Climate change research is funded across Government and also at EU and international level through a variety of programmes.

For the purposes of this paper, climate change related research is defined as “a way researchers can improve knowledge of environmental effects of climate change and can assist in providing sustainable solutions for stakeholders to effectively manage and reduce the impacts of a changing climate”¹.

The purpose of this paper is to:

- a) Review the level of climate change related research that has been funded in Ireland (between 2010-2015) by three selected funding providers in receipt of exchequer funding²;
- b) Review European Commission funding available for Irish climate change related researchers – FP7³ and Horizon 2020⁴ programmes;
- c) Outline climate change related research priority setting by a number of selected Government Departments; and
- d) Provide recommendations on how linkages between researchers and policy makers can be further enhanced in the climate change research sector.

Three research funding providers in Ireland have been selected for inclusion in this paper as they provide specific funding for climate change related research in Ireland: – the Environmental Protection Agency (EPA), the Sustainable Energy Authority of Ireland (SEAI) and the Department of Agriculture, Food and the Marine (D/AFM). While the paper also notes that the European Commission provides funding to Irish researchers through its research/innovation programmes, for the purposes of this paper only “FP7” and “Horizon 2020” programmes have been selected for inclusion. There are many other funding providers (and programmes) which support climate change related research in Ireland but, while many are noted in this paper, the full list is beyond the scope of this paper.

¹ Definition of Climate Change Related Research (2017). Climate Change Unit. Department of Public Expenditure & Reform.

² Environmental Protection Agency, Sustainable Energy Authority of Ireland, and Department of Agriculture, Food and the Marine

³ FP7 was the European Union’s Research and Innovation funding programme for 2007-2013

⁴ Horizon 2020 is the European Union’s latest research programme, which succeeded FP7 in 2014.

This paper demonstrates that:

- a) Irish researchers are sourcing funding from both Irish and EU funded sources to carry out climate change related research.
- b) €38.2 million in research funding has been provided in total by the EPA, SEAI, and D/AFM for climate change related research in Ireland over the period 2010-2015; and
- c) Irish researchers have been successful in securing climate change research funding at EU level under Horizon 2020's societal challenge research sub-programmes which relate to climate change:
 - Example: Societal Challenge "Climate action, environment, resource efficiency and raw materials" – received €12.9 million⁵ between 2014 - Feb 2017 (equivalent funding programme drawdown under FP7 programme was €18.2 million between 2007 and 2013⁶).
 - Example: Societal Challenge “Secure, Clean and Efficient Energy” – received €31 million under Horizon 2020 between 2014 and April 2017 (equivalent funding programme drawdown under FP7 programme was €19.8 million between 2007 and 2013⁷).

The volume of climate change related research projects being undertaken from the selected funding providers for inclusion in this paper (while also acknowledging other funding provided outside these selected providers), and in the absence of a central database, raises concerns over the level of coordination and possible duplication of work that may currently exist in the climate change research sector in Ireland.

This is of particular concern considering the substantial amount of funding that is currently being invested in climate change related research in Ireland; limited Exchequer resources and the need to demonstrate value for money.

There is a need to ensure increased coordination of climate change research being undertaken in Ireland, whether funded by the Exchequer and/or the European Commission. Policy makers and stakeholders must be fully informed of the level of research being conducted in order to avoid/minimise possible duplication of research and to ensure research priorities across the whole of Government are being met.

⁵ EPA. (2017) Climate Action Sub Programme – Horizon 2020. Funding received between 2014 – Feb 2017. <http://www.epa.ie/mobile/news/name,62137,en.html>

⁶ D/JEI-Summary-Report (2016). Evaluation of Ireland's Participation in FP7 and Horizon 2020. Funding received between 2007-2013. <https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf> (P41).

⁷ D/JEI-Summary-Report (2016). Evaluation of Ireland's Participation in FP7 and Horizon 2020 .Funding received between 2007-2013. <https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf> (P41).

As stated in the National Mitigation Plan “It is important to ensure ongoing coherence between different national and EU funding streams of climate research both to exploit synergies and to avoid duplication. It is also essential to ensure that publicly-funded research is accessible and broadly disseminated and that it is relevant to inform the future development of policy, in particular through alignment with the objectives of the National Mitigation Plans and the National Adaptation Frameworks.”⁸

Without pre-empting the work that will arise from the National Mitigation Plan, this paper makes a number of recommendations aimed at assisting policy makers and stakeholders involved in the climate change area – i.e.:

- A national cross-institutional database should be established whereby climate change related research could be readily accessed. Such a facility could assist policy makers and various stakeholders in accessing climate change related information produced by Irish funded researchers.
- Establishment of an annual climate change related research conference/workshop, which would enhance the coordination between researchers and policy makers.
- Production of a “Research Prioritisation Plan”, which would provide detailed blueprints for actions to be taken by funding Departments/agencies to align the majority of competitive public research funding around priority areas.
- To aid consistency and to increase the likelihood that research makes its way in a timely manner to the relevant policy makers, efforts to disseminate research to policy makers should be coordinated at an appropriate level.

⁸ National Mitigation Plan (July 2017). Department of Communications, Climate Action and Environment. <http://www.dccae.gov.ie/en-ie/climate-action/topics/mitigation-reducing-ireland's-greenhouse-gas-emissions/national-mitigation-plan/Pages/default.aspx>

1. Introduction

This paper was prepared by the Climate Change Unit in the Department of Public Expenditure and Reform in the context of a wider programme of spending review papers.

The importance of climate change research is clearly noted in the National Mitigation Plan, which states that “research, development and innovation will play a key role in achieving Ireland’s transition to a low carbon economy and society” and “Ireland’s climate science research capacity and supporting infrastructure are key resources for informing policy development for both mitigation and adaptation”⁹.

In this context, there is a need to ensure that adequate coordination of climate change related research is being undertaken in Ireland so as to enable policy makers/stakeholders to both utilise this research to its fullest and to identify potential gaps in research.

The structure of this paper is as follows:-

- **Section 2:** Funding provided for climate change related research from selected Exchequer backed funding providers to Irish researchers over the period 2010-2015¹⁰.
- **Section 3:** EU Commission funding for Irish climate change related research – “FP7” & “Horizon 2020” programmes.
- **Section 4:** Climate change research priority setting by selected Government Departments.
- **Section 5:** Recommendations on how linkages between researchers and policy makers can be further enhanced in the climate change research sector in Ireland.
- **Section 6:** Conclusions & Recommendations.

⁹ National Mitigation Plan (July 2017). Department of Communications, Climate Action and Environment. <http://www.dccae.gov.ie/en-ie/climate-action/topics/mitigation-reducing-ireland's-greenhouse-gas-emissions/national-mitigation-plan/Pages/default.aspx>

¹⁰ While also noting the existence of other funding providers of climate change research - **Appendix A**.

2. Selected Funding Providers of Climate Change Related Research in Ireland

This section provides an overview of Irish climate change related research produced by Irish based researchers from funding received from:-

- (a) Environmental Protection Agency;
- (b) Department of Agriculture, Food and the Marine; and
- (c) Sustainable Energy Authority of Ireland.

In **Appendix A** a number of other selected funding providers of climate change research are also noted.

In addition, the section outlines for each of the above funding providers (a)-(c):

- Amount of funding provided for climate change related research between 2010-2015; and
- Programme(s) through which funding was provided.

For the purposes of this paper climate change related research is defined as a “way researchers can improve knowledge of environmental effects of climate change and can assist in providing sustainable solutions for stakeholders to effectively manage & reduce the impacts of a changing climate”¹¹.

2.1 Environmental Protection Agency

The Environmental Protection Agency has provided €16.2m worth of funding to climate change research during the period 2010 to 2015. The EPA has stated that research is targeted to “address the needs of key governmental and non-governmental stakeholders and also encourages the researcher community to engage with these stakeholders” and is built around three pillars; climate, water and sustainability¹². The EPA also state that their Climate Change Research Programme is “directed at addressing specific knowledge gaps of direct relevance to the National Climate Change Strategy”¹³.

¹¹ Definition of Climate Change Related Research (2017). Climate Change Unit. Department of Public Expenditure & Reform.

¹² EPA. About Research. <http://www.epa.ie/mobile/research/abouteparesearch/>

¹³ EPA. Climate Change Research Programme. <http://www.epa.ie/climate/climatechangeresearch/>

The EPA has launched two research strategies encompassing climate change research since 2010:

The “*Climate Change Research Programme (CCRP) 2007-13*” was focused on four thematic areas, as well as earth observations. The programme was guided by a coordination committee hosted by the EPA which included representatives from Government Departments and state agencies that funded or used climate change research. The thematic research areas were¹⁴:

- (i) Greenhouse Gas (GHG) emissions and sinks;
- (ii) Climate change impacts and adaptation;
- (iii) Socio-economic solutions and technologies and
- (iv) Air pollutants/short life climate forcers.

The “*EPA Research Programme 2014–2020*” is comprised of three pillars: Climate, Water and Sustainability. Climate research is funded under four areas¹⁵:

- (i) Carbon Stocks, GHG Emissions, Sinks and Management Options
- (ii) Ireland’s future climate, its impacts and adaptation options
- (iii) Climate Solutions, Transition Management and Opportunities
- (iv) Air science.

2.2 Department of Agriculture, Food and the Marine

The Department of Agriculture, Food and the Marine (D/AFM) operates three competitive research funding programmes through periodic National Research Calls for proposals that include topics relevant to climate change. The three funding programmes in question are:

1. **Food** – Food Institutional Research Measure (FIRM);
2. **Agriculture** – Research Stimulus Fund (RSF); and
3. **Forestry** – Competitive Forestry programme for Research and Development (CoFoRD).

D/AFM also allocates some funding from its three research programmes to support national participation in research projects funded via a number of strategically aligned European Research Area Networks and EU Joint Programme Initiatives that include climate change related thematic areas in their scope.

¹⁴ EPA. Strategy 2014-2020. Page 1.

<https://www.epa.ie/pubs/reports/research/eparesearchstrategy2014-2020/Climate%20-%20EPA%20Research%20Strategy%202014-2020.pdf>

¹⁵ EPA. Climate Change Research. <http://www.epa.ie/researchandeducation/research/researchpillars/climate/>

D/AFM has provided €17.1m worth of funding to climate change related research over the period 2010-2015 covering 25 research projects.

2.3 SEAI – Renewable Energy

The recently published ‘National Strategy and Roadmap for Energy Research in Ireland’¹⁶ sets out an ambitious vision for world class energy-related research in Ireland. The Sustainable Energy Authority of Ireland (SEAI) has a key role to play in delivering on this vision through promoting, coordinating and assisting research, development and demonstration of sustainable energy technologies. This is a central part of SEAI’s remit as set out in the Sustainable Energy Act 2002 (No. 2 of 2002), which is to support solutions to overcome technical and other barriers to market deployment of sustainable energy technologies and to provide an authoritative evidence-base to inform policy making.

SEAI has been operating its Research, Development and Demonstration (RD&D) programme since 2002 and over €25 million has been allocated for feasibility studies, related RD&D and shared-cost demonstration activities. This programme builds research capacity, aligned with Ireland’s and EU priorities, while providing a feeder for researchers to achieve success in Europe. This assists in the delivery of the National Energy Efficiency Action Plan (NEEAP), National Renewable Energy Action Plan (NREAP) and 2015 Energy White Paper. SEAI has provided €4.9m worth of funding to climate change related research under this programme (2010-2015). The budget for the programme was increased to €2m in 2017 and runs on an annual basis which means that the projects are focused on outputs available on a short-term basis.

Projects are funded across four categories in accordance with EU Commission Regulation No. 651/2014. These categories are eligible for different levels of State support as follows:

Experimental Development:	25% of approved itemised eligible costs
Feasibility Studies:	45% of approved itemised eligible costs
Industrial Research:	45% of approved itemised eligible costs
Policy supporting research studies:	100% of approved itemised eligible costs

¹⁶ <http://www.dccae.gov.ie/ga-ie/energy/publications/Pages/default.aspx>

SEAI's RD&D Programme has two distinguishing features:-

- First, there is a strong focus on funding research to enhance and support evidenced-based policy formulation. There are frequent and on-going interactions between SEAI and policy-makers in the Department of Communications, Climate Action and Environment (D/CCAÉ) who are given the opportunity to provide input into the development of the research questions and call according to national policy priorities. The output from SEAI research adds to the evidence base for robust policy development.
- Second, there is a strong focus on supporting market deployment of low carbon technologies targeting technical and other barriers to market uptake. In this regard, projects with a Technology Readiness Levels (TRL) 3-7 are typically supported. Since 2002, SEAI has provided €25 million funding through its RD&D programme (**See Appendix B**).

Marine renewable energy is a priority area under the National Research Prioritisation Programme and SEAI supports this sector through an Ocean Energy Prototype Development Fund. This fund stimulates the development and deployment of ocean energy devices and systems with an emphasis on industry-led projects. Since 2009, SEAI has grant-aided in excess of €14m to over 80 projects. These range from early stage proof of concept tests of novel technologies in laboratory facilities to real sea deployments of pre-commercial devices.

3. European Commission Funding for Irish Researchers – Climate Change

3.1 Climate change research opportunities in “FP7” and “Horizon 2020”

Climate change research is carried out at national level in most EU countries including Ireland. According to the European Commission “what gives added value to EU programmes in this field are: transnational cooperation of best European and non-European centres of excellence; EU-wide experiments; large numbers of case studies in different geographic and socio-economic situations; possibility of large financial dimensions of individual projects; and direct link with EU policy, in a field where the EU acts on behalf of Member States and European leadership in climate change science¹⁷”.

FP7 was the EU’s main instrument for funding research in Europe for the period 2007-2013. With a total EU budget of over €50 billion, FP7 represented a 41% increase in funding from its predecessor FP6¹⁸. FP7 had the overriding aim of contributing to the European Union becoming the world’s leading research area. Ireland performed well against its targets for FP7, with a drawdown of around €625 million, which was more than three times the drawdown realised in FP6 and more than 150% of its original target for FP7¹⁹. It is estimated that between; 15% to 20% of FP7 budget was climate change related²⁰.

Horizon 2020, FP7’s successor, offers Irish researchers valuable opportunities to participate in high quality collaborative research projects with other researchers and institutions across Europe. With a budget of €75 billion²¹ and covering the period 2014 to 2020, Horizon 2020 is the European Union’s largest ever research and innovation programme. Horizon 2020 is the centrepiece of the Innovation Union, one of the seven Flagship Initiatives identified in the Europe 2020 strategy²².

It is expected that at least 60% of the overall Horizon 2020 budget should be related to sustainable development and that climate-related expenditure should exceed 35% of the budget, including mutually compatible measures for improving resource efficiency²³.

One of the three key pillars of Horizon 2020 is tackling “societal challenges” (**Appendix C**).

¹⁷ Presentation. Andrea Tilche. DG Research and Innovation Head of the Unit. Climate change and natural hazards. Slide 4.

<https://ec.europa.eu/jrc/sites/jrcsh/files/andrea-tilche.pdf>

¹⁸ D/JEI-Summary-Report (2016). Evaluation of Ireland’s Participation in FP7 and Horizon 2020.

<https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf> (P5).

¹⁹ D/JEI-Summary-Report (2016). Evaluation of Ireland’s Participation in FP7 and Horizon 2020.

<https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf> (P20).

²⁰ Presentation. Andrea Tilche. DG Research and Innovation Head of the Unit. Climate change and natural hazards. Slide 3.

<https://ec.europa.eu/jrc/sites/jrcsh/files/andrea-tilche.pdf>

²¹ Horizon 2020 Website – Ireland. <http://www.horizon2020.ie/category/news/>

²² D/JEI-Summary-Report (2016). Evaluation of Ireland’s Participation in FP7 and Horizon 2020.

<https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf>. (Page 21).

²³ European Commission. <http://ec.europa.eu/programmes/horizon2020/en/area/environment-climate-action>

The seven societal challenges (listed below), for which multiple agencies have a shared responsibility, mean's Irish researchers can take advantage of the research opportunities this pillar presents.

Seven societal challenges include²⁴:

- Health, demographic change and well-being;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bio-economy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies; and
- Secure societies – protecting freedom and security of Europe and its citizens.

According to the European Commission²⁵ "Climate change research and innovation finds its centre of gravity in Horizon 2020's sub-programme: Climate action, environment, resource efficiency and raw materials". The objective of this sub-programme is to achieve a resource efficient and climate change resilient economy and society, protecting and sustainably managing natural resources and ecosystems and ensuring a sustainable supply and use of raw materials, in order to meet the needs of a growing global population within the sustainable limits of the planet's natural resources and eco-systems.

While the Climate Action sub-programme accounts for just 4% of the total Horizon 2020 budget (€3 billion), the EPA has highlighted the relevance of sustainable development and climate change research across all of the various programmes and sub-programmes of Horizon 2020²⁶.

The following two sections will give a brief comparison of the "FP7" and "Horizon 2020" research /innovation programmes from a climate change research perspective, as well as outlining funding received by Irish climate change researchers, under selected societal challenge pillars of Horizon 2020.

²⁴ European Commission Website. <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>

²⁵ European Commission Website. <http://ec.europa.eu/programmes/horizon2020/en/area/environment-climate-action>

²⁶ EPA Website. <http://www.epa.ie/mobile/news/name,62137,en.html>

3.2 Comparison of Horizon 2020 v “FP7” in relation to climate change research

Some of the key advantages “Horizon 2020” has over “FP7” in relation to climate change research funding include²⁷:

- Relatively larger budget available;
- Emphasis on climate change and energy with a strong emphasis on sustainable energy as societal challenges;
- More focused support to policy; and
- More coordination and cooperation with Member States, in particular through the Climate Joint Programming Initiative (JPI).

The Department of Jobs, Enterprise and Innovation summary report - Evaluation of Ireland’s Participation in FP7 and Horizon 2020. (July 2016)²⁸, outlined Ireland’s Horizon 2020 target income by programme and in comparison with the FP7 breakdown. In relation to societal challenge “Climate action, environment, resource efficiency and raw materials” a target figure of €33 million was indicated in respect of Irish research in the climate action sub-programme. This would be an increase of €14.8 million compared to the FP7 drawdown (FP7 drawdown was €18.2 million) – see Table 1 below.

In relation to societal challenge “Secure, clean, efficient energy”, the report stated a figure of €65 million to be targeted for Irish research in this sub-programme. This would be an increase of €45.1 million compared to the FP7 drawdown (FP7 drawdown was €19.8 million) – see Table 1 below.

²⁷ Presentation. Andrea Tilche. DG Research and Innovation Head of the Unit. Climate change and natural hazards. Slide 18. <https://ec.europa.eu/jrc/sites/jrcsh/files/andrea-tilche.pdf>

²⁸ D/JEI-Summary-Report (2016). Evaluation of Ireland’s Participation in FP7 and Horizon 2020. <https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf>

Table 1: Allocation of Ireland’s Horizon 2020 (H2020) target income by programme and in comparison with FP7 drawdown. (D/JEI summary Report 2016, Page 41)

Areas	H2020 Target	FP7 drawdown	Target – FP7	Target – H2020 versus FP7
	€Ks	€Ks	€Ks	% change
I Excellent Science	401,000	178,860	222,140	224%
European Research Council	100,000	50,467	49,533	198%
Future & Emerging Technologies	25,000	--	--	--
Marie Curie Actions	246,000	112,713	133,287	218%
Research Infrastructures	30,000	15,680	14,320	191%
II Industrial Leadership	254,000	220,196	33,804	115%
LEIT	198,000	184,540	13,460	107%
Access to Risk Finance	--	--	--	--
Innovation in SMEs	56,000	35,656	20,344	157%
III Societal Challenges	331,000	215,221	115,779	154%
Health, demographic change etc.	72,000	77,960	-5,960	92%
Food security, etc.	76,000	40,869	35,131	186%
Secure, clean, efficient Energy	65,000	19,842	45,158	328%
Smart, green & integrated Transport	44,000	16,063	27,937	274%
Climate action, resource efficiency, etc.	33,000	18,210	14,790	181%
Inclusive Societies	21,000	5,641	15,359	372%
Secure Societies	20,000	28,015	-8,015	71%
IV Widening participation	10,000	--	--	--
V Science for and with society	6,000	8,239	-2,239	73%
EIT	8,000	--	--	--
JRC Non-nuclear direct actions	--	382	--	--
Total	1,010,000	614,277	395,723	164%

Source: Technopolis

Note on Table 1: The D/JEI summary report states that “it is understood the targets were set in discussion with the research base and reflect the community’s views on the size of the research base and the extent to which its engagement with the Framework Programme might be expanded. They also reflect certain structural factors, they do not include a view of any competing priorities or alternative funding opportunities (e.g. agri-food businesses focusing on development opportunities financed through other national schemes or even national drawdown from other EU schemes, like CAP). Our analysis suggests there are several areas of national strength where Ireland could look to target greater participation across the life of Horizon 2020”.

3.3 Funding received by Irish climate change researchers under Horizon 2020 – Societal Challenges

According to the Department of Jobs, Enterprise and Innovation summary report (July 2016)²⁹, “Ireland has performed well in all three Horizon 2020 pillars (**Appendix C**), albeit it has been a little more active in the “Excellent Science” (164 projects, €102.7M) and “Societal Challenges” pillars (177 projects, €95.7M) compared to the Industrial Leadership pillar (117 projects, €70.7M,) as of March 2016”.

Looking more specifically at climate action, the EPA has stated that Irish researchers have secured competitive funding of €12.9 million from the “Climate Action, Environment, Resource Efficiency and Raw Materials” (Climate Action) sub-programme of Horizon 2020 as of February 2017. Under this sub-programme, 41 researchers working on a variety of climate-related projects in Ireland have been successful in their applications to receive funding for their work³⁰.

Between 2014 and February 2017, 200 applicants from Ireland submitted a total of 144 proposals seeking EU research funding from the Climate Action Horizon 2020 sub-programme. Projects ranging from “European Research Area for Climate Services”, “Adaptive Management of Barriers in European Rivers” and “Transformations to Sustainability” have received funding³¹.

It should also be noted that climate change research is also being undertaken in other societal challenges. Irish research institutions and industry have consistently won funding for energy-related research under the EU Horizon 2020 programme “Secure, Clean and Efficient Energy” with over €31 million in funding secured between 2014-April 2017³². Climate change research also occurs across other pillars in Horizon 2020.

²⁹ Evaluation of Ireland’s Participation in FP7 and Horizon 2020 – DJEI Summary Report. July 2016.

<https://www.djei.ie/en/Publications/Publication-files/Evaluation-of-Participation-in-FP7-and-Horizon-2020-DJEI-Summary-Report.pdf>

³⁰ EPA.(2017). <http://www.epa.ie/mobile/news/name,62137,en.html>

³¹ Cordis Website: http://cordis.europa.eu/projects/home_en.html

³² Figure Supplied by SEAI. “Secure, Clean and Efficient Energy” – Societal Challenge.

4 Climate change related research priority setting by selected Government Departments

Government Departments will play a significant role in the national objective to achieve a cost effective emissions reduction pathway and will be responsible for ensuring, with key stakeholders, that their sectors can effectively withstand the likely future impacts of climate change. In order to assist in this objective, research priority setting will be vital.

Three Government Departments have been selected for inclusion in this paper and a brief outline of their climate change related research priority setting process has been outlined.

4.1 Department of Agriculture, Food, and the Marine (D/AFM)

D/AFM's Climate Change division works closely with D/AFM's Research and Codex division in the development of priority areas for research in climate change. Both divisions also work closely with the EPA in this regard to ensure coordination and coherence in funding any new initiatives. D/AFM's Climate Change division is also a member of the Technical Research and Modelling Group (TRAM) group referred to later in this report.

A number of high level policy documents give strategic direction and aid prioritisation of climate change research topics across D/AFM's three research funding programmes – FIRM, RSF and CoFoRD, which are run by the Research and Codex division.

These topics include sustainable production, carbon sequestration, green technology, farming management interventions, greenhouse gas emission reduction, and climate change and food security. The most relevant strategic policy documents that inform decisions for D/AFM's support of climate change research funding are listed below:

(a) Food Wise 2025

- Food Wise 2025 is a ten year, industry-led, strategy which sets ambitious targets for the sustainable development of the agri-food sector, and is part of a series of rolling ten year strategies for the sector, replacing the previous strategy; the Food Harvest 2020.
- Food Wise 2025 strategy provides a strong mandate for continued research funding support for the agri-food sector and includes a number of key enabling actions to support a research led approach to inform the sector in mitigating and adapting to the impacts of climate change.

(b) National Research Prioritisation Exercise (NRPE)

- Under the NRPE the need for climate change research in D/AFM's three research funding programmes, emerged particularly under the heading "Sustainable Food Production and Processing" (which aligns to all of RSF, and parts of CoFoRD and FIRM funding programmes).

(c) Strategic Research Agendas: SHARP and FORI

- Subsequent to the publication of the NRPE, in 2014/15 D/AFM led the multi-funder Working Group that developed the Strategic Research and Innovation Agenda Sustainable Healthy Agri-Food Research Plan (SHARP) for the NRPE priority areas *Sustainable Food Production and Processing* and *Food for Health*.
- Climate change research features prominently in one of nine high level research themes in SHARP; 'Sustainable Management of Nature Resources, Climate change and Trans-boundary Gases' (Page 36).
- Similarly, Forest Research Ireland (FORI), the strategic agenda for forestry research, developed by a Working Group of the COFORD Council – D/AFM's forest industry stakeholder advisory committee –has seven high level research themes one of which is; Climate change: Impact, Adoption and Mitigation (Page 38).
- Both SHARP and FORI now serve to guide the research investment decisions of all Irish funders in the agri-food and forestry area, and most notably the content of topics areas targeted for funding under D/AFM's three research programmes from Call 2015 onwards.
- In addition EU level Strategic Research Agenda's inform D/AFM Climate Change Funding – most notably the Strategic Research Agenda of the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE – JPI)

(d) ERA-NET Calls and Climate Change Funding

- ERA-NET Cofunds are a key tool used by D/AFM to enable Irish research participation and collaboration in CLIMATE CHANGE thematic areas
- Most recent ERA-NETS supported by D/AFM that have particular reference to climate change thematic areas are ERA-GAS (ERA-NET for Monitoring & Mitigation of Greenhouse Gases from Agri- and Silvi-culture), and the ERA-NET SUSAN (ERA-NET for Sustainable Animal Production). While expenditure by D/AFM on these ERA-NETS is outside of the scope period of this analysis, the decision by D/AFM to pledge a combined c. €1.5 million to facilitate Irish participation for both Calls was taken in 2015. Expenditure on successful Irish partnered project funded through these mechanism is anticipated in Q2/Q3 2017.

- The ERA-GAS ERANET, which was an initiative of the FACCE -JPI, is notable for its strong Irish participation in leadership roles with Teagasc the coordinating partner of ERA-Gas and D/AFM managing the evaluation of proposals.

(e) FACCE -JPI and the Global Research Alliance (GRA)

- The Joint Programming Initiative on Agriculture, Food Security and Climate change (FACCE - JPI) brings together 22 countries that are committed to building an integrated European Research Area addressing the interconnected challenges of sustainable agriculture, food security and impacts of climate change. D/AFM is a member of the Governing Board of the FACCE-JPI.
- The Global Research Alliance on Agricultural Greenhouse Gases was launched in December 2009 and now has 47 member countries from all regions of the world, including Ireland. The Alliance is focused on research, development and extension of technologies and practices that will help deliver ways to grow more food (and more climate-resilient food systems) without growing greenhouse gas emissions. D/AFM has a representative on the GRA governing council.
- FACCE-JPI and the GRA aim to enhance information exchange, cooperation, programme alignment and mutual learning of best practices in research programming. Within the GRA, there are three groups, the Croplands Research Group, the Livestock Research Group and the Integrative Research Group, all of which have Irish representatives participating.

(f) National FACCE-JPI/GRA Steering Group

D/AFM chairs a national steering group which provides a forum to help guide Ireland's involvement in the FACCE JPI and the GRA. This group assists in identifying climate change research priorities relevant to the FACCE-JPI including participation in relevant Co-fund ERA-Nets under the Horizon 2020 programme thus ensuring that national research priorities identified in the relevant national strategic research agendas align well with the strategic research agenda of FACCE-JPI.

4.2 Department of Communications, Climate Action and Environment (D/CCAEE)

The section below summarises programme/agencies that are under the remit of D/CCAEE.

(a) Technical Research and Modelling Group (TRAM)

TRAM is a high level technical group, reporting to the Senior Officials' Group to the Cabinet Committee on Infrastructure, Environment and Climate Action, is actively engaged in identifying cost-efficient and achievable measures that are reasonable for Ireland to take in terms of bridging the gap

to achieving 2020 targets under the Effort Sharing Decision³³. The Group is also tasked with the identification of a cost-efficient and fair contribution for Ireland to make to overall EU 2030 climate ambition, with particular reference to the identification of a trajectory from now to 2030. The group is comprised of experts from a cross-section of relevant Government Departments and State Agencies as well as representation from academic institutions.

TRAM so far has assisted the Government in developing the draft National Mitigation Plan (NMP), and also in informing negotiations with the European Commission relating to Member State targets for distributing the EU 2030 30% target reduction (compared to 2005 level) in non-ETS GHG emissions.

(b) Environmental Protection Agency

EPA Research is targeted to address the needs of key governmental and non-governmental stakeholders and also encourages the researcher community to engage with these stakeholders.

Since 1994, the EPA has funded research that has increased national understanding of the environment, the challenges it faces and responses to these. The EPA has also developed high quality research capacity and has supported innovation that is internationally respected.

In 2014, the 2014-2020 EPA Research Strategy was launched, which builds on existing strengths and experience across a very broad range of activities in support of environmental policy development and implementation.

(c) Sustainable Energy Authority of Ireland

Since 2002, SEAI's RD&D programme supports sustainable energy technologies across academic and industry-based research and recent projects include innovative solar, energy storage and bioenergy technology developments. SEAI also supports the development of marine energy through an Ocean Energy Prototype Development Fund.

In relation to EU research activities, SEAI acts as National Delegate for energy-related research under Horizon 2020. In addition, SEAI coordinates Irish researcher participation in International Energy Agency (IEA) Technology Collaboration Programmes. These are independent, international groups comprising over 6,000 experts from IEA member countries. Irish researchers are active in a range of

³³ The Effort Sharing Decision establishes binding annual greenhouse gas emission targets for EU Member States for the period 2013–2020. These targets concern emissions from most sectors not included in the EU Emissions Trading System (EU ETS), such as transport, buildings, agriculture and waste.

groups related to wind energy, energy technology systems analysis, bioenergy, energy in buildings, smart grids, ocean energy and hybrid and electric vehicles. This is another important route to allow Irish researchers to build research capacity, develop collaborative networks and links with international researchers as well as further enhancing Ireland's reputation for global research excellence in energy.

4.3 Department of Transport, Tourism and Sport (D/TTAS)

The Climate Change Unit of D/TTAS is supported in analytically reviewing on an ongoing basis emerging evidence primarily by the Department's Economic and Financial Evaluation Unit. Further analysis and research is sourced from the academic sector, as well as state agencies such as the SEAI.

Both departmental and agency analytical/evaluation capacity are under review and the need to scale up capacity is being considered to meet the substantial technical demands of monitoring and managing sector performance, evolution and planning. A better understanding of the challenges and opportunities associated with decarbonising and building transport infrastructure and services resilience is developing within the sector. D/TTAS is supportive of and actively engaged with a number of national EPA-funded research projects:

a) Transport Ireland

The Transport Ireland project aims to build a TRANSPORT_Ireland model and analyse mitigation options for transport GHG emissions in the short term (pre 2020), medium term (pre 2030) and long term (up to 2050). The project is being led by researchers in UCC and seeks to identify pressures and solutions for the transport sector in Ireland and develop robust evidence to inform policy making.

b) Greening Transport

The Greening Transport project being led by TCD aims to merge the technical evaluation of the emissions from transport, and the improvements in their calculation, with the behavioural changes needed to realise these reductions in emissions. The work packages for the project have been designed to tackle the technical emissions and transportation modelling, as well as the application of behavioural constraints to these models, to provide details of what emission reductions are possible based upon the current research.

c) CIVIC

The CIVIC project being led by NUIG aims to increase existing knowledge relating to the vulnerability of Irish infrastructure to climate change, including assembly of a geospatial inventory of Ireland's critical infrastructure.

This first project step will include infrastructure across four sectors; transport, energy, water and telecommunications.

The second project step involves a high-level assessment of climate change impacts and adaptation strategies for Ireland's critical infrastructure to be conducted on a sector specific level and will consider spatial variability using the GIS inventory, established in the first project step. This assessment will help to inform climate change adaptation policy.

Furthermore, at the international level, D/TTAS is contributing funding to the International Transport Forum "Decarbonising Transport" project. The International Transport Forum (ITF), an OECD constituent organisation, acts as a platform for discussion and research of policy issues across all transport modes. The 4 year "Decarbonising Transport" project is being co-funded by member states and member transport companies to establish a comprehensive energy and transport activity modelling framework, analysis and feedback of carbon reduction efforts and a pooling of expert knowledge.

5. Enhancing linkages between the research needs of government policy makers and Irish funded researchers

Policy advisers, decision makers (e.g. Departments; Government) and academics can have different expectations of research, collaboration and timelines, as well as different views on what is important in the research. Policy makers will require timely, relevant and robust research data so as to inform their advices to Ministers/Government, whereas academics may focus on topics/themes in terms of the wider academic/research communities and/or operate to differing timelines than those required from the process and needs of policy formulation. In other words, there can be a “gap” in expectations.

This paper recommends that, given the multiplicity of funding programmes that are in existence, more coordination is needed across the whole of Government and various stakeholders to ensure that the climate change research needs of policy makers are consistently met into the future.

In response to the large investment in climate change related research funding worldwide, numerous methods have been used to try to bridge the gap that exists between research and policy. Globally, this includes actions by the scientific communities via research councils, e.g. World Climate Research Programmes, and framing bodies such as Future Earth. The Intergovernmental Panel on Climate Change (IPCC) in particular plays a key role in providing high level policy advice to governments based on assessment of scientific knowledge which it publishes in large scale assessment reports every 5-7 years. In addition to this, the IPCC also publishes shorter special reports³⁴ which are focused on specific topics which are provided over a 2-3 year period. However, it is also recognised that even the IPCC process which been a major driver of policy development has limitations and is reaching practical limits in addressing emerging demands and requirements. The IPCC process has remained substantially unchanged since its establishment in 1988 while there has been an exponential increase in the material published on climate change creating capacity challenges and the timelines for new international processes are more demanding.

There is much to be gained by developing sustained communication between researchers and subsequent end users, such as Government/policy makers.

Potential mechanisms to bridge this gap would be to develop systems that link researchers with relevant policy makers through, **(i)** partnership arrangements and/or **(ii)** knowledge exchange trials - both of which are briefly discussed below.

³⁴ As per D/AFM in May 2017: “Also technical reports prepared, currently special report on Agriculture is in preparation, with scoping meeting held in Dublin during Feb 2017”.

Partnership Arrangements - can operate throughout the research process from the early stage of problem identification to latter stages involving application of findings. An example of a partnership arrangement is the 'Bridging the Gap' (BtG) project³⁵, which operates in the School of International Service, Washington D.C.. Having acknowledged the divide that exists between research and policy the founders of this project have attempted to enable interaction between policy makers and academic researchers. Their website indicates that the function of the programme is to prepare academics to pursue policy-relevant research while engaging policy makers in the work of the academics researching international relations, political science, public policy, law and related fields. In addition, professional development and networking opportunities are provided for researchers who are interested in pursuing policy-relevant research.

Knowledge Exchange Trials - Knowledge exchange can seek to address the current knowledge exchange and engagement gap between and within the academic and policy user community. In the UK, "Knowledge Exchange Trials" (KET) ³⁶ were held in 2013/14 to bring together academia, policy and practitioners. Chatham House rules were used to facilitate open and interactive discussions surrounding how the KETs could allow for the academic-policy divide to be bridged.

The trials had three objectives:

- a) address the current knowledge exchange and engagement gap between and within the academic and policy user communities,
- b) build capacity for effective onward collaboration, impact and mutual sustainable benefit, and
- c) provide a broader understanding of the barriers to effective knowledge exchange.

The twelve workshops were tailored, demand-led, thematic and held throughout the UK. The emphasis of all the KET workshops was the process of knowledge exchange and improving mutual understanding. Academics welcomed the opportunity to gain an understanding from policy-makers about the policy process, the rich diversity of the policy user community and how the policy environment operates. Policy makers welcomed the opportunity to share the complexities of the policy environment. They also appreciated that academic-policy engagement is a two-way relationship. They welcomed academics raising issues such as rewards structure, culture, timeframes and nuances in research, and value of knowledge exchange for academics.

³⁵ <http://bridgingthegaproject.org/>

³⁶ Knowledge Exchange Trials: Pilot Programme Bridging the Academic-Policy Divide.
<http://eprints.leedsbeckett.ac.uk/2126/6/Knowledge%20Exchange%20Trials%20-%20proposed%20FINAL.pdf>

6. Conclusion/Recommendations

Climate change research is a key resource for informing policy development in Ireland. It also enables Ireland to contribute to ongoing international efforts in relation to climate change research, observation and analysis. Climate change research is funded across Government and also at EU and international level through a variety of programmes.

There is a need to ensure increased coordination of climate change research being undertaken in Ireland, whether funded by the Exchequer and/or the European Commission. Policy makers and stakeholders must be fully informed of the level of research being conducted in order to avoid/minimise possible duplication of research and to ensure research priorities across the whole of Government are being met.

As stated in the National Mitigation Plan “It is important to ensure ongoing coherence between different national and EU funding streams of climate research both to exploit synergies and to avoid duplication. It is also essential to ensure that publicly-funded research is accessible and broadly disseminated and that it is relevant to inform the future development of policy, in particular through alignment with the objectives of the National Mitigation Plans and the National Adaptation Frameworks³⁷”.

In light of the above conclusion, this paper makes a number of recommendations:

Recommendation No. 1: Establishment of a national, cross-institutional database. The database could be categorised into sections based on climate change mitigation and climate change adaptation with sub-sections based on core subject areas within these sections i.e. sustainable agriculture, afforestation, climate projections etc. The question of the most appropriate authority to establish & maintain such a database would need to be considered and agreed (e.g. D/CCAIE as the “lead” Department for climate action; including agencies in this sector (e.g. EPA; SEAI)

Aims:

- To assist policy makers and other related professionals in accessing climate change related information produced in Ireland.; and
- To act as a valuable resource to identify areas where research gaps exist and assist in identifying future areas for research.

³⁷ National Mitigation Plan (July 2017). Department of Communications, Climate Action and Environment. <http://www.dccae.gov.ie/en-ie/climate-action/topics/mitigation-reducing-ireland's-greenhouse-gas-emissions/national-mitigation-plan/Pages/default.aspx>

Recommendation No. 2: The establishment of an annual climate change related research conference/workshop organised by the lead Department or agency in this sector (D/CCAIE, EPA, and SEAI). This could include the formation of workshop(s) with policy makers from various Departments who have a role to play in national and EU climate change policy and may enable the policy and research fields to be brought closer together. These workshops could be comprised of research priority setting exercises which would play an important role in identifying any potential gaps which exist in the research from a policy maker's perspective.

Aim:

- To enhance the coordination between researchers and policy makers.

Recommendation No. 3: Establishing a Research Prioritisation Plan³⁸ detailing priority areas related to climate change (determined by policy makers and researchers conjointly).

It should also be noted that the EPA, in light of its statutory role, has established a National Climate Research Coordination Group. It is proposed that the National Research Coordination Group report annually on its activities and provide an assessment and synthesis of key findings from the research programme and wider related research activities every five years³⁹.

Aims:

- To ensure that funding for research in the climate change related field is targeted towards key areas/where funds can be used most effectively; and
- To provide detailed blueprints for actions to be taken by funding Departments and agencies to re-align the majority of competitive public research funding around priority areas in climate change related research.

³⁸ Similar to D/JEI – Research Prioritisation Action Plan. <https://www.djei.ie/en/Publications/Research-Prioritisation-Action-Plans1.html>

³⁹ National Mitigation Plan (July 2017). Department of Communications, Climate Action and Environment. <http://www.dccae.gov.ie/en-ie/climate-action/topics/mitigation-reducing-ireland's-greenhouse-gas-emissions/national-mitigation-plan/Pages/default.aspx>

Recommendation No. 4. Establish an appropriate system for the coordinated dissemination of research to policy makers. This could, for example, be comprised of a monthly email from a research committee with brief descriptions of the research and its main findings sent to specified recipients (e.g. Secretariat of the TRAM; secretariat of the Climate Change Advisory Council). This could be accompanied by a link to the full report which would include the implications/findings of the research.

Aims:

- To increase the likelihood that research makes its way, in a timely manner, to the relevant policy makers; and
- To inform Recommendation #3 above.

Quality Assurance Process

In addition to the Spending Review Working Group, the author also engaged with the Department of Communications, Climate Action and Environment, the SEAI, the EPA, the Department of Agriculture, Food and the Marine, and the Department of Transport, Tourism and Sport.

Appendix A: Other selected Climate Change Related Funding Providers

Irish Research Council

Established in mid-2012 under the Government's Public Sector Reform Plan, the Irish Research Council is a merger of two former Councils (the Irish Research Council for Humanities and Social Sciences, IRCHSS, and the Irish Research Council for Science, Engineering and Technology, IRCSET). It is an associated agency of the Department of Education and Skills (DES) and operates under the aegis of the Higher Education Authority (HEA). The Research Council has funded numerous climate change research projects since 2010.

Marine Institute:

The Marine Institute provides funding for marine research in a range of areas including the Cullen Fellowship, Ship-time Programme and the Networking and Travel Initiative. The Marine Institute also provide funding for marine research including Project-Based awards such as; applied research projects; demonstration projects; desk/feasibility studies, as well as Research Awards such as strategic research appointments/research capacity/competency building/post-doctoral fellowships, and PhD scholarships. The Marine Institute also provided funding to climate change related research over the period 2010-2015.

Science Foundation Ireland

Science Foundation Ireland (SFI) is the national foundation for investment in scientific and engineering research. SFI invests in academic researchers and research teams who are most likely to generate new knowledge, leading edge technologies and competitive enterprises in the fields of science, technology, engineering and maths (STEM). The foundation has also provided funding to climate change related research over the period 2010-2015.

Teagasc

Teagasc is the coordinator of a consortium of researchers, students and professionals working collaboratively to develop verified strategies to decrease greenhouse gas (GHG) emissions from Irish agriculture⁴⁰. Teagasc are an employer of postgraduate Walsh Fellowship students with some 140 pursuing PhD programmes at any one time. A budget of €3.2 million per annum is committed to the programme with 30 new places made available each year with students receiving a grant of €22,000 per annum⁴¹. A number of students who have pursued a PhD programme under this Fellowship have done so in the climate change research field.

⁴⁰ Some of these activities are also funded through D/AFM projects that are already referenced in the €17.1 headline figure.

⁴¹ <https://www.teagasc.ie/about/research--innovation/postgraduate-fellowships/>

Appendix B: - Example of SEAI funded projects.

SEAI has provided €25 million funding through its RD&D programme since 2002. Recent projects supported include:

- NovoGrid, which has developed an intelligent control system that enables PV solar generators to deliver more energy by minimising thermal impacts on the electrical distribution network.
- NVP Energy which is developing an innovative wastewater treatment technology. Funding was provided to validate NVP Energy's low temperature anaerobic digestion technology at full scale to ensure the technology meets expected treatment levels, as seen in pilot studies.
- South Dublin County Council were funded to develop an 'Energy Masterplan' for Clonburris in Dublin, offering the potential to support cost-competitive low carbon heat and electricity alternatives that can be mirrored by other Councils around Ireland.
- Terrag GeoServ Ltd are developing a hybrid ground source and solar thermal system for the Irish market. Funding was provided to develop the system which will introduce a cost competitive alternative to the Irish ground source heat pump market, with greater long term performance and improved operating costs.
- RR Projects in Offaly were part-funded to deliver a €2.25 million hybrid flywheel-battery project to potentially provide dynamic energy storage to the electricity grid.
- Kingspan Limited were grant-aided to install an innovative 300 kilowatt solar PV system consisting of 1,200 rooftop panels in Castleblayney making it the largest PV rooftop installation in Ireland.
- Bord na Móna were grant aided to cultivate, harvest and evaluate bioenergy crops for various end uses such as biomass briquetting, pelletising and composting.

Appendix C: Pillars and programmes in Horizon 2020



Source: Interim evaluation of Ireland's Participation in Horizon 2020. (2016).

Note: Commissioned by the Department of Jobs, Enterprise and Innovation in Ireland (DJEI) and conducted by Technopolis in the period December 2015-March 2016.

Appendix D:

Recent research funding made available from selected funding providers/programmes for climate change related research in Ireland.

National Funding Providers	Funding Amount (€m)
Environmental Protection Agency	€16.2
Sustainable Energy Authority of Ireland	€4.9
Department of Agriculture, Food & the Marine	€17.1
Total Funding (2010-2015)	€38.2

EU Commission - Horizon 2020 - Irish Drawdown	Funding Amount (€m)
Horizon 2020 - Climate Action (2014-2017*)	€12.9
Horizon 2020 - Secure, Clean Efficient Energy (2014-2017*)	€31.0
Total Funding (2014-2017*)	€43.9

* As of the end of February 2017

** As of the end of April 2017