Sectoral Emissions Ceilings

Q4: What do you view as the key actions required to ensure the emission reduction targets set out in the Sectoral Emission Ceilings are met?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Key actions include the prioritisation of research funding into renewable energy/low carbon energy sources such as offshore wind and geothermal energy that have high potential in the Irish context, in combination with increased research into emissions reduction technologies such carbon capture and storage. In addition, research into the materials needed to facilitate the green transition e.g. metals needed for renewable energy technologies is required, especially as Ireland has significant geological potential for a number of key metals that are needed to advance decarbonisation of our energy systems.

Carbon Pricing & Cross-Cutting Policies

Q9: Are there any significant cross-cutting gaps not previously discussed in Climate Action Plan 21 that need to be addressed?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Long-term, consistent, and accurate monitoring and assessment of a wide suite of environmental indicators is essential to support evidence-based decision making in all matters related to climate action. iCRAG supports collaborative, interdisciplinary, cross-institutional initiatives, exemplified by the SFI Research Centres and including the All-Island Climate and Biodiversity Research Network (AICBRN). It would be beneficial to have a coordinating mechanism to identify sources of information, identify gaps, and support FAIR (findable, accessible, interoperable, and reusable) principles across the whole gamut of climate-relevant data sources in Ireland.

iCRAG strongly supports greater integration of subsurface information into all aspects of climate action planning and response. Geological information, including data and modelling, is needed to address rising demand for groundwater, geothermal heating and cooling, sites for storing hydrogen, carbon dioxide, and waste, and the metals required for renewable energy technologies, Planning, mitigation and adaptation actions should be designed to protect the subsurface environment and ensure optimal use of earth resources.

Q10: Are there any other cross-cutting issues that should be considered in the development of the 2023 Climate Action Pan?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Public acceptance is one of the most crucial elements in successfully implementing the Climate Action Plan. Research, training, and outreach in how to best and most effectively engage with individuals, communities, and organisations should be a priority.

Actions to address the climate emergency should include consideration of the full supply chains needed to support those actions. Sectors such as built and architectural heritage, transport infrastructure, electricity and gas networks, flood risk management, water services infrastructure, health, housing retrofit will require substantial amounts of construction materials. Plans to strengthen essential infrastructure, for example, should take a wider look at what additional aggregate and metal supplies will be needed to construct the structures, where those supplies may come from, and how best to select and optimise the supply of these raw materials to achieve national and local goals as well as avoid issues that have occurred in the past with some building materials (e.g., "mica" and "pyrite" issues).

Enterprise, Waste & Circular Economy

Q20: What measures can be taken to accelerate the uptake of carbon-neutral low temperature heating in manufacturing?

[redacted]CRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Currently, of all the heat produced in Ireland, 33% of it is allocated to industrial heating, with heating and cooling accounting for 50-90% of an individual processing plant's entire energy consumption. Reducing this carbon footprint can be accelerated through the introduction of incentives to encourage industrial heat pumps to capture waste heat from secondary processes such as refrigeration and waste-water disposal. Tax incentives aimed at corporate organisations, such as tax credits or deductions could be given for on-site use of renewable energy or renewable energy systems.

Q21: What measures can be taken to decarbonise high temperature heating in industry?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Decarbonising high-temperature heating in industry can be achieved through a pathway of complimentary processes aimed at maintaining current production whilst reducing emissions: 1) switching to zero carbon fuels; 2) utilising zero carbon heat sources where applicable; 3) electrification of heat; and 4) improved heat management. It should be mentioned that financial

investment remains the biggest barrier to this pathway and financial incentives may be required to overcome the barrier.

Switching to zero carbon fuels-In instances where alternative heat sources such as geothermal, solar-thermal or heat pumps are not sufficient to produce the required heat, alternative zero carbon fuels such as hydrogen, ammonia, biofuels and synthetic hydrocarbons (with carbon capture and storage) can be applied. Furthermore, ongoing research and development would be needed to ensure cost competitiveness with traditional fossil fuels.

In instances where carbon is a necessary component in an industrial process, such as steel manufacturing, it is imperative that all CO2 produced is captured for long-term storage in order to remain carbon neutral.

Zero carbon heat sources-Where applicable, high temperature zero-carbon heat technologies should be considered. These include solar thermal and geothermal (which can and should be coupled to industrial heat pumps).

Electrification of heat-Ireland has significant potential to supplement zero carbon heating sources with wind energy. Whilst it is optimal that renewable electricity not be used where a zero carbon heat source is accessible, the availability of electrified heat can fortify heat security. Electrification of heat has the added benefit of being easily adaptable to current infrastructure and can be rapidly applied.

Heat management-The application of the above-mentioned pathway cannot be efficiently implemented without appropriate heat conservation measures to ensure minimal heat loss. In relation to this, polices are needed to ensure waste heat is captured for further use, either in secondary industrial processes (such as drying, washing, etc.) or is funnelled for external use such as agriculture or in district heating.

As such, there exist opportunities to integrate industrial facilities that would allow for compounded heat input and distribution. Further to this, continued research and development should be applied to model and optimise integrated industrial parks.

Q24: What role could Carbon Capture and Storage (CCS) have on industry, and what steps would encourage its deployment?

[redacted], iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

The Climate Action Plan 2021 notes that some sectors can only fully decarbonise with CCS. There are many exciting ideas about how to store captured carbon but many of these options are not yet "shovel-ready". They require additional research, development, and testing to prove that they are economically and environmentally efficient enough to encourage industry to invest in them and wider society to accept them.

To reduce the level of uncertainty and thus the level of risk associated with geological CCS, iCRAG researchers are investigating innovative options for long-term geological storage of CO2 in rocks, soils, and the ocean. Researchers are working to identify sites in offshore sedimentary basins that

would be suitable for CO2 storage, examining ways to rapidly trap CO2 in mineral crystals in basaltic rocks, calculating the capacity of seabed sediments to sequester CO2, investigating CO2 storage in hydrates, looking at ways to link enhanced plant-mediated chemical weathering of rocks to increased oceanic storage of CO2, and quantifying the carbon sequestration potential of soils. Investment in research and development projects such as these will accelerate and diversify the CO2 storage choices available to industry and will help establish the skill sets needed for a new technology sector.

Q25: What other opportunities exist to drive the decarbonisation of the enterprise sector?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Demonstration projects that show new technologies such as geothermal heat in action at scale can assuage investor and consumer concerns about unfamiliar technologies. The cross-border collaborative Geothermal Energy Demonstration Programme under the Peace Plus Programme should be a flagship example of the value of investing in pilot projects.

Q27: Are the measures that can be taken to assist businesses sustain the additional operating costs associated with moving to new low-carbon technology?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

The main financial barrier for businesses intending to use geothermal energy is the up-front capital investment cost, not the operational costs. Financial incentives for geothermal energy should recognise the difference between geothermal and other renewable energy sources.

Q72: What other opportunities exist to support decarbonisation through the acceleration of a transition to the circular economy?

[redacted] CRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

While the economy can never be fully circular there are opportunities throughout the value chain from sourcing materials to their ultimate disposal to reduce the carbon footprint of consumption. As the SFI Research Centre in Applied Geosciences, iCRAG is working to reduce the environmental impact of mineral exploration and production (metals and building materials) and to address issues related to the end-of-life disposal of commodities (including increased recycling), in addition to supporting other components of the circular economy.

Electricity

Q12: What can be done to accelerate/facilitate the delivery/deployment of offshore wind and solar PV in particular, in the context of Climate Action Plan 2021 and the REPowerEU ambition?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Current work is on-going through the Offshore Renewable Energy Development Plan (OREDP) II Data & Scientific Advisory Group in developing a Geographic Information System Model to identify exclusion zones and technical opportunities as part of future offshore renewable energy development. As Ireland looks to move from a developer-led/decentralised to a plan-led/centralised model for offshore development, there is significant scope for Government state-actors to provide critical front-end data that can significantly de-risk and accelerate the deployment of offshore wind in particular, whilst also cognisant of important environmental considerations. We have seen already in the Netherlands the value that Government funded project site descriptions and front-end data can have on cost-reduction of offshore wind development. It is also well demonstrated how early-stage site evaluations can ultimately lead to critical "go/no-go" decisions, avoiding major fiscal implications. In this regard we would strongly encourage the Government to engage across the research and development sector to continue to develop an evidence-based, data-driven approach to such a spatial designation. Furthermore, enhancing the capabilities of the Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) Programme with the provision of geotechnical data (such as cone penetration testing) along with improved geophysical, geological and biological data will greatly enhance understanding of the complex Irish seabed and provide developer confidence in seabed conditions for the deployment of critical ORE infrastructure.

Q18: What financial incentives are needed to increase renewable generation capacity?

a. To incentivise commercial scale production.

b. To incentivise microgeneration.

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Capacity would benefit from increased incentive aimed at improving access to capital, reducing upfront costs, and supporting market growth of variable renewable technologies. This can be partly achieved through tax measures:

1) Personal income tax incentives - Tax credits or deductions are given for purchasing and installing renewable systems and technologies;

2) Corporate tax incentives - Similar to above, tax credits or deductions are given for on-site use of renewable energy or renewable energy systems;

3) Property tax incentives – Incentives aimed at reducing the level of property tax associated with property improvements relative to renewable systems and technologies; and

4) value-added tax incentives – Reduced or removed VAT associated with purchasing of renewable systems or technologies at both personal and corporate level.

Consideration should also be given to tax credits for corporations that support academic research focused on characterisation of the seabed f to enable more rapid development of offshore wind projects.

a. To incentivise commercial scale production.

Production is stimulated by demand. Increasing customer incentives, government purchasing of renewable systems, and funding allocated toward research and development within Ireland would all lead to a cycle of increased demand, improved technologies and decreasing costs. Specifications for public works offer a mechanism for stimulating demand especially in emerging sectors such as district heating.

Resources for research and development should also be allocated toward energy storage to generate confidence from commercial producers. Furthermore, financial insurance schemes could be offered to mitigate risk during construction phases. This is particularly pertinent to geothermal energy operations which bear significant risk during the feasibility stage.

b. To incentivise microgeneration.

In addition to tax incentives mentioned above, capacity generation would benefit from parallel-running financial grants aimed at alleviating upfront costs. The biggest barrier to the current micro-generation support scheme remains the upfront costs, therefore increasing the maximum capital grant could stimulate uptake. As an alternative, a policy of 'rent-to-own' could be proposed, under which renewable systems could be acquired and installed through a fixed term rental agreement through energy suppliers, similar to policies currently proposed in countries such as South Africa, with relative success. Such an agreement would encourage energy provider to adopt a proactive, individual-focused approach, whilst alleviating the upfront capital burden on customers and providing a long-term customer asset.

Agriculture & LULUCF

Q62: What policies and measures would be needed to support farmers diversify their farm activities to include opportunities such as bioenergy, vegetable growth, forestry, organic farming, etc.?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Any policies and measures to support diversified land use should include consideration of potential assets and uses of the subsurface, many of which can be developed in conjunction with other uses of the surface. Valuable assets such as groundwater, geothermal heating and cooling, possible mineral resources, and use of the subsurface for storage of non-petroleum fluids or waste should all be assessed when deciding on optimal land use to achieve climate goals.

Built Environment

Q41: What is the next step for geothermal energy application to the built environment?

[redacted] iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

DECC is developing policies to address this gap and define the regulatory regime for geothermal energy in Ireland. This is urgently needed to support wise development of deep and shallow geothermal resources. Developing policies on district heating is also critical to ensure that both the supply and demand sectors can be developed at the same time with regulatory certainty.
The application of shallow geothermal energy should be accelerated to ease the burden of fossil fuels in heating. As of 2016 (according to 2016 census data), around 73% of all residential dwelling in the Republic of Ireland are located outside of major gas infrastructure (i.e. city centres). These residences rely almost entirely on peat and oil for heating purposes, both of which are rapidly becoming obsolete in Irish legislation. The transition to renewable heat system is fundamental in ensuring heat security and barriers and administrative burdens related to the installation and usage of shallow geothermal heat systems should be minimised.

Though Ireland has geothermal potential the exact areas of such potential remain poorly understood. iCRAG research is focused on identifying such areas. Further research investments in the GSI and research groups such as iCRAG are required to better define the real geothermal potential of the country.

Marine Environment

Q68: What sort of role could Ireland's marine environment (lakes, seas) have in delivering climate mitigation? What are the building blocks that need to be put in place to support the role of the marine environment in climate mitigation (e.g. a regulatory framework, measurement and accounting rules)?

[redacted], iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

There is considerable potential for Ireland's marine environment to contribute to climate mitigation efforts through activities involving Blue carbon, that is the enhancement and/or restoration of natural carbon sinks in lakes, marine transitional zones and coastal regions. In particular, the restoration of kelp forests, seagrass beds and tidal marshes in Ireland would likely have additional environmental, economic and social benefits as well as facilitating the sequestration of carbon. Other potential applications that could be implemented at scale, after passing environmental concerns via appropriate investigation and pilot-scale programs, including alkalinity enhancement in coastal waters to increase CO2 uptake from the atmosphere and wide scale reduction in the release of untreated or partially treated sewerage to the coastal environment which likely result in the release of other GHGs such as N2O and CH4. Other marine based geo-engineering solutions (e.g. nutrient enrichment of coastal seas) are unlikely to be effective in Irish waters and likely have significant detrimental side effects on ecosystems (short term carbon sequestration, increased fluxes of other GHGs and deoxygenation). Fundamental to any mitigation activities in the marine sector is a fit-for-purpose monitoring system for carbon system parameters and GHG emissions, which is designed and able to accurately assess inventories and fluxes in the coastal marine environment and support the regulatory framework and accounting required to deliver climate mitigation policies and targets. Further research is required to adequately characterise the existing situation of carbon storage in Ireland's marine realm and to design and construct sensors to allow long-term monitoring.

Research & Innovation

Q91: Are the required research and innovation programmes and structures in place to support our climate ambitions; including the provision of the evidence needed to underpin policy in a timely manner?

[redacted]iCRAG, the Science Foundation Ireland Research Centre in Applied Geosciences:

Establishing a research and innovation environment that facilitates interdisciplinary approaches to climate action and climate change research is essential. Research programmes that fully fund

climate action research are essential, as many current funding mechanisms, such as SFI Research Centres, require industry co-funding which can be challenging to raise in the context of the climate and biodiversity crises. Working with industry on key challenges in the applied research area is important, in conjunction with significant state investment in fundamental climate change/climate action research. The emergence of north-south funding mechanisms is a welcome development, as taking an all-Island approach to climate action will leader to greater impact. While a broad umbrella climate/biodiversity research centre could be established it would take valuable time to set up. Ensuring active and meaningful interaction among existing research groups in the country could be a more cost and time effective means of quickly and efficiently addressing these urgent issues.