



Energy for
generations

ESB Response: Long Term Strategy on Greenhouse Gas Emissions Reduction

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Introduction

ESB welcomes the opportunity to respond to the Department of Communications, Climate Action and Environment (DCCAE) consultation on a Long-Term Strategy on Greenhouse Gas Emissions Reduction.

When putting together a blueprint for Ireland's emissions reduction strategy, it is instructive to consider what 2050 (with 2050 being the EU reference timeframe) should look like and to work back from there with a set of intermediate targets. This approach greatly reduces the potential for policy options to be chosen which have a positive short-term impact but do not fit with the longer-term strategy.

Achieving an economy wide net zero emissions result within Ireland will be very challenging for many reasons but in particular because of the hard to-decarbonise enteric emissions from the agriculture sector. Achieving net zero within Ireland's boundary without effort sharing will require a significant degree of capture of carbon from the atmosphere through forestry, land management and through technologies like direct air carbon capture and storage. Further analysis is required before setting a net zero target within Ireland's boundaries.

This 2050 consultation should enable the Government to put in train a significant program of work to lay the foundations required to transition to a near zero or net zero society. This can be done by building upon Action '1' in the Climate Action Plan with a significant role for the Climate Change Advisory Council.

In the remainder of this response we have set out answers to the detailed questions applicable to our business.

Responses to Detailed Questions

Pathway to 2050

1. What are the appropriate 2050 targets for Ireland to set in the context of supporting a net zero target at EU level?

Setting an appropriate target for 2050 greenhouse gas reductions for Ireland is crucial for the development of new policy measures in the coming years. Responding to climate change will have wide ranging impacts on our economy and our citizens so it's very important we get the underlying blueprint right.

Agriculture is a key consideration when setting 2050 targets. The consultation states that we will meet net zero within Ireland as opposed to on a regional basis; this is significant and shapes the outline of policy measures that will need to be implemented. A contrasting approach is to rely on effort sharing across EU Member States which might allow certain individual countries to have emissions greater than net zero and for those to be compensated using negative emissions approaches or technologies in other Member States. Until the cost of meeting net zero within national boundaries versus on a regional basis is understood, it is not clear that Ireland has sufficient supporting evidence for a domestic net zero target.

Outside of enteric emissions and in the context of the EU's emerging climate neutrality by 2050 law, Ireland's energy emissions should be targeted for close to zero or negative emissions by 2050 with potential for the power sector to reach this before 2050. This is challenging and requires, rigorous implementation of the Climate Action Plan. Any reduction in ambition or delay of any aspect of the Climate Action Plan will make net zero much more challenging since it will back load decarbonation efforts.

Ireland now has an opportunity to plan for and build a 2050 economy that plays to our strengths and makes us as resilient as possible with energy efficiency and electrification playing key roles.

- Energy efficiency in the built environment should play a key part of our 2050 strategy given its ability to improve the health of citizens, to reduce energy consumption and to provide significant employment.
- Given that Ireland can domestically produce renewable electricity from wind in abundance, this should play a big part of our 2050 economy.

It is not clear that there is sufficient information available to make a decision on setting a net zero 2050 climate target within Ireland versus achieving it on a pan EU basis. However, when developing the ultimate 2050 target, energy efficiency and electrification using indigenous renewable electricity should play a significant role.

2. What advanced technologies, across all sectors, could support a move to net-zero or negative emissions by 2050?

Electricity should play a key role in Ireland's emission reduction strategy for 2050. Ireland has an abundance of wind resources especially offshore wind. This is a key strength and we should play to it in building a resilient and sustainable 2050 economy.

Very high levels of wind generation will see many hours with excess generation relative to demand and so capturing the value of the excess wind will be a key resource to use in decarbonising the wider energy system. It therefore seems intuitive that Ireland should place significant focus on electricity storage (through a wide variety of means) and should seek to make this a National strategic research and development focus. Storage technologies include;

- battery storage at large and small scale and in electric vehicles
- thermal storage in domestic hot water systems and in district heating systems
- storage of hydrogen or ammonia derived from renewable power to gas technologies.

Advanced controllable demand on the power system should also play an important role in the future electricity system. This can provide a balance to the increased variability of renewable electricity sources such as wind and solar.

The ongoing work by EirGrid and ESB Networks to operate the power system with ever higher levels of non-synchronous renewables must continue. This will require a range of new and existing technologies being added to the system to provide inertia and system stability in a system with fewer thermal generation units.

For Ireland to reach a net zero emissions target within Ireland for 2050, then negative emission technologies will be required in addition to the carbon sequestration from land use and forestry. Within the energy sector, biomass with post combustion CCS and direct air capture with storage are the most likely negative emissions technologies based on current evidence¹.

Since greenhouse gas emissions are not bound by national borders there is a wider question as to Ireland involvement in direct air capture and CCS. It may be more efficient for direct air capture to take place near to large carbon sinks such as end of life gas fields. This consideration should feed into the setting of an Ireland net zero target.

3. What financial instruments could complement a decarbonised economy by 2050?

Financing the transition to a low carbon economy raises a number of issues. One key issue is high upfront costs for low carbon investments which are cost effective over a longer time horizon and are often accompanied with co-benefits which are difficult to monetise in the initial investment decision. Retrofitting of buildings is a particularly relevant example of this. We have set out below a number of key financial instruments which will underpin the transition to a low carbon economy.

- Carbon pricing is needed to reflect the externality of climate change in investment and consumption decisions. The EU ETS remains a key plank of industry and power decarbonisation

¹ See European Academies Science Advisory Council (EASAC): Negative emission technologies – What role in meeting the Paris Agreement targets (February 2018).

policy and will continue to be examined by the EU institutions to ensure its fit for purpose for increasing decarbonisation targets. Carbon pricing in the non-ETS sector is also critical. If fossil fuels are appropriately priced to include their associated emissions, this provides a level playing field against low carbon technologies. It is therefore important that the non-ETS carbon tax trajectory in the Climate Action Plan is implemented and its effectiveness monitored.

- An approach is required to channel low cost finance to those seeking to retrofit their homes and businesses. There is significant low-cost money available on international markets, but it is proving difficult to channel these low rates to individual home and business owners. This is something that will be required across three decades as the building stock is upgraded but developing a suitable financial instrument to support retrofit is a key upfront requirement.
- The implementation of the EU's sustainable finance framework is an important part of unlocking financing for low carbon technologies². Confidence within the finance community will be key and the implementation of the EC's action plan on sustainable finance will be important. This action plan will consider the new taxonomy, labels for green financial products and increased transparency.

In summary, to support the transition to a low or zero emissions society, a range of supporting financial instruments will be required to create a level playing field for low carbon technologies and to give confidence to the investor community.

Electricity

4. What is the generation capacity required to move to zero or negative emissions?

As mentioned above, a significant amount of electricity in Ireland in 2050 should be generated from renewables, mainly wind generation (in particular offshore wind). There will still be a requirement for generation capacity to support the system when there is no wind or solar (and potentially interconnection) available. As the electricity system evolves to operate with less and less high inertia plant, then the residual need for dispatchable generation is reduced to fewer and fewer hours per year. There are several technologies available to meet power requirements at these times;

- Gas fired plants with CCS. If Ireland needs an amount of dispatchable generation to support the system and to provide back up when renewables are not available, then gas with CCS provides a solution. Gas with CCS is not a carbon neutral solution and capture rates of up to 90%³ are likely to be economically efficient. CCS allows the use of existing gas pipelines and the storage of primary energy in gas fields. However, gas generation and CCS is not widely implemented to date and requires much investigation. To this end, Ireland needs to form an opinion on CCS and where it fits with the future energy system. We welcome the establishment of an interdepartmental working group on CCS and believe that membership should in expanded to include representation from the electricity industry.
- Power to Gas – given Ireland potential to produce indigenous renewable electricity at scale, there is an option to employ power to gas technologies. With power to gas, electricity is passed through an electrolyser to produce hydrogen. The hydrogen can then be used for a variety of uses including direct combustion, use in a fuel cell or conversion to other forms such as ammonia for longer term stage. In an Irish context, power to gas would utilise excess wind at times wind would otherwise be curtailed or would have dedicated generation capacity commissioned to support it. Power to gas provides a route to zero carbon gas once produced from zero carbon electricity.

² Further information available on the European Commission website [here](#)

³ International Energy Agency – CCUS in Power Tracking Report May 2019.

- Hydrogen from Steam Methane Reforming (SMR) – there is a potential to produce hydrogen from natural gas using SMR with CCS. This process splits natural gas into hydrogen and carbon dioxide. The hydrogen can then be combusted in gas turbines. The SMR and CCS process is not zero carbon with a capture rate of 50-90% possible, deepening on the chosen technology⁴. SMR is an energy intensive process but combined with CCS does offer the opportunity to utilise the storage capabilities currently offered by natural gas.
- Biomass with CCS – Biomass that meets sustainable criteria is deemed to be carbon neutral but biomass does have a significant carbon emission associated with it when it is combusted. Therefore, biomass with CCS removes emissions from the atmosphere (Drax Power Station in Great Britain is currently trialling this technology) . The key enablers here will be a CCS framework and a sustainable biomass supply chain. If possible, the waste heat in the combustion process should be captured to increase the efficiency of the process.
- Direct air capture with carbon storage – another negative emissions option available is to utilise direct air capture with storage. Significant R&D is ongoing with regard to direct air capture and if it can be brought to market at a reasonable price then it may play a role in reducing emissions. In Ireland this might allow the retention of some unabated fossil generators to support the electricity system.

The above sets out a number of technologies that can support the transition to a low, zero or negative carbon electricity system. Ultimately, Ireland needs to give careful consideration to involvement in negative emission technologies unless the technology has associated benefits such as dispatchable electricity production or utilising wind generation that might have otherwise been curtailed. If another member state, closer to a carbon sink can operate negative emission technologies such as direct air capture much cheaper than Ireland then it may not make sense for Ireland to roll out the technology.

5. What resources will help manage intermittency on the grid (e.g. long duration storage, zero-emissions fuel)?

Variable renewable technologies provide a robust route to decarbonising electricity, but their intermittency is something that must be managed. As we transition from our current electricity system, a number of measures need be taken to manage this intermittency.

- Diversification of resources – the key renewable technologies today are onshore wind and hydro power. The average load factors for existing wind generation is around 30% although new onshore wind farms have a load factor closer to 40%. As per the CAP, significant offshore generation will be connected to the grid in the next decades with new offshore technologies having load factors up to 60% depending on wind resources. Solar generation is likely to play a role in the energy mix both at rooftop domestic and large scale. Solar generation has a load factor of 9-10%, mainly provided outside of winter months, which is less than ideal but the output of solar tends to come at times of higher demand which compliments the system. The combination of onshore and offshore wind and solar generation should reduce the intermittency problem compared to what might be envisaged today.
- Short term energy storage – the move to higher permitted levels of System Non Synchronous Penetration (SNSP) will allow the accommodation of higher levels of variable renewables on the system. This will mean that other more valuable dispatchable renewable resources such as hydro and biomass can be directed to times when it's not windy or sunny. This can help address the intermittency by spreading the available renewable resources across a greater number of

⁴ CE Delft – Feasibility study into blue hydrogen. Technical, economic and sustainability analysis (July 2018)

hours. The ability to operate the system with less and less inertia will likely bring forward more battery technology for system support. These batteries will provide hours rather than days storage but will help deal with within day intermittency. Within the 2050 timeframe, there is also significant potential to utilise EVs in electricity storage. This will include dynamic charging, vehicle to grid and repurposing of batteries after cars come to end of life⁵.

- Smart meters and changing demand patterns – some of the intermittency issues we see today are caused by the absence of a price signal for demand. Traditionally, demand has tended to be quite inelastic and generation has needed to flex to meet the demand profile. The rollout of smart meters and more dynamic pricing will allow demand to follow wind generation (expressed through the market price) and in the process mitigating an element of the intermittency problem. To achieve this, it is very important that the charging structures across the market encourage electrification and allow demand to follow wind generation should it choose to do so.
- Virtual Power Plants (VPPs) there will be an increasing role for VPPs as the level of distributed resources (e.g. distributed renewables, batteries, vehicle to grid) on the grid increases. A VPP can aggregate these and provide an active power solution to the electricity network operator. This coordination by the VPP enables the use of resources by the network operators that might not otherwise have been available.

The measures and technologies mentioned above will assist in addressing the intermittency issue. However, even with a seamless implementation of the above there will be times when there is no wind generation and short-term storage is exhausted. This is likely to require the technologies mentioned in the answer to Question 4 above along with electricity interconnection.

6. What should our fuel mix look like by 2050?

The electricity mix in 2050 should be predominantly variable renewables (onshore and offshore wind predominantly) supplemented by interconnection and low, zero or negative emissions depending on the 2050 target. This is supported by [Eurelectric Pathways](#) study from 2018 which was developed by McKinsey. The Pathways Study shows that Europe can reduce energy emission in the EU by 80-90%.

A key consideration in Ireland will be the amount of low or zero carbon dispatchable generation that is required as the load factors of variable renewables increases. This needs to be balanced with the number of days of very low wind generation for which the system needs peak load to be provided for.

Enterprise

7. How can emissions from large industry, e.g. cement and alumina, be reduced, including options beyond fuel substitution?

N/A

8. Should enterprise lead the way in the transformation in the GHG impact of power, transport, buildings, waste and the circular economy? If so, how?

Enterprise can play a significant role in reducing emissions in Ireland. The CAP already envisages increasing enterprise involvement using corporate PPAs to bring forward renewable generation.

⁵ Gazafroudi et al (2019) Decentralised flexibility management for EVs
McKinsey (2019) Second life EV batteries: The newest value pool in energy storage

Enterprise can be engaged by creating a level playing field between renewables and fossil-based solutions (through carbon pricing for example) and by reducing non-financial barriers to rolling out low carbon solutions (e.g. complexity of grant scheme application, permitting etc).

Built Environment

9. How can Ireland retrofit almost all buildings by 2050, including options for heating fuels and what buildings will be most challenging to decarbonise?

Retrofitting the building stock is an opportunity and a challenge. Upgrading our building stock affords us the opportunity of a sustainable future without such reliance on imported fossil fuel and offers the opportunity to live and work in more healthy buildings.

When we look at retrofit costs across a time horizon of 20-30 years the cost benefit analysis improves compared to considering shorter payback periods than might generally be considered. The alternatives to energy efficiency for buildings such as continued fossil fuels or bioenergy-based alternatives are much more expensive since these costs recur every year (and as supported by McKinsey supporting work for the CAP).

Retrofitting the entire building stock over 30 years is entirely achievable but does require State support. The State cannot pay for every retrofit but it can play a critical coordinating role. The key components of a retrofitting strategy are a skilled workforce, building materials, trusted advisors and low-cost finance. These are all within the gift of entities in Ireland to coordinate.

In previous responses, ESB has advocated for a comprehensive working group to be set-up and therefore welcomes the recent establishment of the Retrofit Taskforce. We look forward to having the opportunity to engage with the Taskforce.

The question of heat source for our buildings is a relevant one but it is separate to the question around whether we should retrofit. We are not retrofitting buildings just so as to permit a heat pump to function rather we are retrofitting them to make them more energy efficient, healthier, more comfortable, and more sustainable. The case for energy efficiency through retrofit is a standalone and should be considered as such.

However, where a dwelling has been upgraded to a high standard, the question of heat source then becomes relevant. There is then a strong case to install heat pumps in homes and commercial buildings. Ireland's renewable energy strategy is built around electricity and so having indigenous demand for this electricity compliments this. Heat pump technology is developing all the time and as buildings become smarter we will see heat pumps being able to use power at times of excess wind and therefore optimise the use of the electricity system at peak times⁶.

Regarding bioenergy alternatives, ESB supports the development of biofuels generally within the energy mix in Ireland. However, biofuels, by their very nature are likely to be scarce. ESRI/UCC suggest that there is no bio-based alternative to oil that can be produced at a scale to replace oil⁷. Furthermore, our understanding of SEAI's publication entitled [Sustainability Criteria Options and Impacts for Irish Bioenergy Resources](#) is that the availability of biogas in Ireland is constrained by the RED II sustainability criteria meaning that grass can make up a maximum of 40% of inputs to an

⁶ For example – Delta Energy and Environment. IEA HPT Programme Annex 42: Heat Pumps in Smart Grids.

⁷ ESRI, E4sma, UCC (2013) Technical support on developing low carbon sector roadmaps for Ireland.

anaerobic digester with the rest being from agriculture waste like wet manure. Although no final biogas availability number is published by SEAI, our understanding is that the RED II criteria could potentially limit Ireland's available biogas resource to as low as 3TWh per annum⁸. This represents circa 6% of total gas demand in Ireland in 2017/18 or 13% of non-power demand. This suggests that where decarbonised gas is to feature in heating, energy efficiency is a key requirement to reduce demand.

The above suggests that bioenergy alternatives to fossil fuel for heating are quite limited in their availability. The above further supports the Government's decision to transition away from fossil boilers in new dwellings in the coming years. It also questions the role of fossil fuels more generally in new installations.

Given the potential role for biofuels in a low or zero carbon energy system in 2050, we would welcome a review of the Bioenergy Plan. Such a review could provide certainty for the bioenergy industry by identifying the overall availability of resources and pull together the various bioenergy related actions in the CAP.

10. What is the future of the national gas grid in a net-zero emissions pathway?

The question of future of the national gas grid complex and multifaceted. The short to medium term requirements are without question with gas remaining a key feature of electricity generation, industrial heating and existing gas buildings. Ultimately the long-term future of the gas grid will depend on the following;

- Carbon Capture and Storage – If a CCS industry in Ireland is developed then an enduring “anchor tenant” on the gas transmission system will be secured. To this end, the work of the interdepartmental working group on CCS is timely and the need for final views from the group on the role of CCS in Ireland will be required in the next year or so to allow appropriate policies to be put in place.
- Power to Gas – the conversion of electricity to hydrogen for injection to the gas grid offers the potential to decarbonise some sectors. The round-trip efficiencies of power to gas will be much lower than direct electrification but the gas network offers a mechanism to transport and distribute hydrogen. To this end, further study on the ability to repurpose the gas system for hydrogen will be required.
- Hydrogen from SMR – The production of blue hydrogen offers the potential for the continued use of the gas transmission network if a demand for hydrogen is established in the transition.
- Biomethane – biomethane is likely to feature in the future gas mix in line with SEAI estimates of availability.
- The upcoming EU Gas Decarbonisation Package will be an important consideration in the future of the gas ecosystem across Europe and how it fits with a net zero Europe in 2050.

In summary, the short to medium term requirements of the gas grid will remain while the longer-term role will become clearer as the roles for CCS and power to gas are established.

⁸ We established this number by cross referencing the findings from of the [“Sustainability Criteria Options and Impacts for Irish Bioenergy Resources”](#) report with the earlier findings in the SEAI report [“Assessment of Cost and Benefits of Biogas and Biomethane in Ireland”](#).

11. How do we ensure that building and infrastructure development supports compact urban development, which is regionally balanced and sustainably designed to reduce GHG and enhance sustainable quality of life?

N/A

Transport

12. Do you think modal shift will play a key role in decarbonisation by 2050? If so, what is needed to drive substantial modal shift?

A modal shift must play a role in our transition to a low carbon transport system. If we do not see this modal shift, the roads will need to be reinforced and duplicated at great cost to the public purse while at the same time we will endure crippling congestion costs. To this end, Ireland must place a significant focus on transitioning to greater use of public transport, shared mobility and of new transport forms like e-scooters and e-bikes.

New forms of electromobility like e-scooters and e-bikes compliment the evolving electricity system with high levels of variable renewables by providing a demand source at times of high wind overnight etc.

13. What should transport in our cities and rural areas look like by 2050?

N/A

14. What are the most cost-effective solutions for reducing emissions from heavy duty and long-distance vehicles?

As with many other aspects of the low carbon transition, energy efficiency will play a significant role in decarbonising transport. To this end, the use of the rail network should be maximised particularly in the context of our two rail connected ports. Moving from road to rail for heavy transport allows significant energy efficiency by replacing a one truck, one trailer approach on road to a one engine to many trailer approach with rail.

The decarbonisation pathway for heavy transport will likely be dictated to a significant extent by the offerings of vehicle manufacturers. The Irish market is not big enough to create a new supply chain of its own so it is likely that we will be a technology taker and follow the lead from bigger markets.

- Once energy efficiency has been maximised, the use of direct electrification should be maximised. For example, city and shorter commuter bus transport should be electrified. This has many benefits including zero local emissions and representing a great complimentary technology to a high variable renewable electricity system.
- Indirect electrification through hydrogen production offers a route to decarbonise heavier transport. Given its significantly lower round trip efficiency than direct electrification, hydrogen will only be used where direct electrification is not feasible due to battery size but it does have real potential. The hydrogen transport market is still emerging and so Ireland should maintain a close watching brief on international developments.
- Biofuel availability will likely be scarce but may play a very important role in decarbonising construction and agriculture vehicles.

- Bio-CNG offers a route to decarbonise parts of the heavy-duty transport fleet. However, this will ultimately come down to how the scarce biomethane resource is allocated.

15. How can Ireland, as a small island economy, reduce emissions from aviation and navigation, including demand reduction and stimulating supply of sustainable fuels?

N/A

Agriculture, Forestry and Landscape

16. *How do we secure viable family farms across our regions in an environment profoundly changed by the focus of climate change?*

N/A

17. *How can the methods of evaluating agriculture and land use give more credit for the relative carbon efficiency of food production in different countries, and the potential large contribution from land use management and afforestation?*

N/A

18. *What type of nature-based solutions, including land use, land use change and management, could support emissions reduction and what is the associated emissions reduction potential of such solutions?*

N/A

19. *What is the emissions reduction potential from GHG-efficient food production, including future production scenarios?*

N/A

20. *Where can Ireland show global leadership in GHG-efficiency, e.g. developing 'next horizon' technologies?*

N/A

Waste and the Circular Economy

21. *What circular and bio-economy initiatives could support emissions reduction out to 2050?*

Ireland should incentivise the circular economy by reducing waste at every opportunity. Within energy, where possible and practicable, waste heat should be utilised in district heating for example. There are already examples of this emerging with waste heat from the Covanta waste to energy facility in Dublin and from a data centre in Tallaght being leveraged for district heating networks that have secured support from the Climate Action Fund. Efforts should be taken to see these schemes to fruition and to learn from the projects.

District heating is ultimately complimentary to a high renewable electricity system where excess electricity can be converted to thermal energy and storage additions can be incorporated. Across a 30-year time horizon, Ireland has an opportunity to see district heating in a good proportion of new buildings particularly higher rise buildings in urban centres. The recent consultation on developing a Policy Framework for the Development of District Heating in Ireland is welcome in this regard.

22. *How should Ireland target reduction in food waste?*

N/A

23. How important will the development of the bioeconomy, biomass, biofuels, biomethane become in displacing fossil fuels and transforming farm opportunities and land use?

Ireland has potential in the development of a bioeconomy but the scale of this depends on the ambitions reserved for traditional agriculture. Ireland could produce sufficient biofuels to fuel parts of the heavy transport sectors and could produce biomass for electricity and heat production. Ultimately the choice of policy instruments is important so as not to unduly encourage an unsustainable change of land use or other unintended consequences.

Just Transition

24. What are the most important issues for the Government to consider in developing a long term strategy to 2050 in order to ensure a just transition?

Ireland has a 30-year time horizon to deliver an economy that best suits our citizens. A just transition can be enabled across this time frame through initiatives such as multi decade retrofit programs and decentralisation of parts of the economy away from the major cities. We have time now to get this 30-year plan right and we should take every opportunity to do so.

25. What should the primary focus of adaptation policy be for 2050?

While we should put plans in place to transition to a low carbon society by 2050, adaption to climate change will be a key part of the transition. There is already a National Adaption Framework (NAF) in place in Ireland. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The NAF was developed under the Climate Action and Low Carbon Development Act 2015. The NAF has a series of adaption plans for different sectors either developed or under development. This NAF process should be sufficient to deal with climate adaption.

26. Are there any other comments or observations that you wish to make?

As mentioned above, time should be taken now to identify our vision of a decarbonised society in 2050 and to work back from there to put the appropriate foundations in place. Reaching a decarbonised 2050 requires the implementation of the Climate Action Plan in letter and in spirit and as part of that we can see an integral role for the Climate Change Advisory Council.

In the UK, the Climate Change Committee has and continues to play an integral role in supporting government in their decarbonisation strategy. The CCC has published numerous reports on decarbonising different sectors and has drawn in evidence from industry and academia. The Climate Change Advisory Council can play an important role in Ireland.