Energy for generations

Call for Expert Evidence Climate Action Plan 2023

20 September 2022

ESB Generation and Trading

Contents

1. EXECUTIVE SUMMARY

Ireland has a rare opportunity to create a global offshore wind industry given its seabed resource, particularly off our west coast. Our offshore wind potential can be harnessed to create green hydrogen, a clean fuel source which can be stored. The capability to create and store green hydrogen is a critical step in delivering a net zero society – the ability to store clean energy from renewables which can be used when the wind is not blowing, and the sun is not shining. It will also create a domestic and export green hydrogen industry. In seizing this opportunity, it will require a series of concerted actions from the State and wider energy industry both now and progressively over the coming decade.

Offshore wind combined with green hydrogen production can help Ireland in delivering on a wide range of goals, including:

- Reducing carbon emissions
- Strengthening energy security
- Developing dispatchable energy
- Creating high-value employment and supply chain opportunities, and
- Enhancing regional development

We believe that there are four key items that, if acted upon quickly, can position Ireland to deliver 7,000 MW of offshore wind by 2030 while also creating an industry to deliver long-term enduring economic and social benefits to the State.

1. Enable floating offshore wind projects now
2. Utilise the existing grid network as efficiently as possible using hybrid connections
3. Build early supply chain confidence
4. Set up Ireland for hydrogen power generation

Detailed recommendations:

1. Develop a single overall masterplan for the transition to net zero by 2050 of the Irish energy sector (electricity, residential, industry and transport).

2. Set an objective for a net zero electricity system by 2040 to enable an overall net zero energy system by 2050 to be achieved.

3. Prioritise initiatives that progress implementation of this masterplan. Avoid initiatives that could reduce carbon usage in the short-term but end in unviable cul-de-sacs.

4. Accelerate the planned trajectory for the development of Irish renewables, particularly offshore wind. Set targets for renewables development that delivery the 86% journey to net zero required by 2050. Infrastructure or development challenges should be secondary to decarbonisation in setting out the required trajectory. These are challenges to be overcome and shouldn't be allowed to dictate the overall pace of decarbonisation.

5. Enable the development of renewable projects for hydrogen production as well as electricity production.

6. In particular, target the immediate acceleration of offshore wind in the east, south and west coasts, including floating offshore wind making use of hybrid offshore grid connections.

7. Exploit the full potential of existing grid infrastructure. Exploit the full potential of the grid through the use of hybrid connections for all renewable projects.

8. Establish a hydrogen strategy that incorporates promotion of hydrogen production and hydrogen demand

9. Develop multiple seasonal energy storage solutions. Set targets for large scale renewable energy storage, accelerate a licensing process to enable them and establish the commercial incentives to promote them.

10. Stimulate the hydrogen sector with support for initial projects. Establish a hierarchy of use for green hydrogen based on its contribution to decarbonisation

11. Promote enduring demand to compliment hydrogen production through ambitious targets and efficient funding schemes.

12. Explore opportunities to rapidly build scale by developing infrastructure in tandem with our EU partners – building economies of scale and enhancing overall EU energy security

13. Identify and designate specific renewable energy and hydrogen clusters. At a minimum, ESB believes that there should be Dublin, Cork Harbour and Shannon Estuary clusters but others may be viable and/or required.

14. Deliver a market mechanism to replace fossil fuels as back up to renewables in the energy market. Set 2040 as a climate neutral electricity system target on the path to an overall climate neutral economy by 2050.

2. INTRODUCTION

ESB Generation and Trading (ESB GT) welcomes the opportunity provided by DECC to respond to this important Call for Expert Evidence on the Climate Action Plan 2023. The 2021 Climate Action Plan was and is a welcome guide to industry on Government policy to enable the decarbonisation of Ireland's energy supply. Indeed, the pace of change of the global decarbonisation agenda makes periodic revision of the CAP a prudent approach to best adopt current thinking and targets to best deliver a decarbonised economy.

ESB GT is fully committed to the transformation of Ireland's energy supply, becoming a net zero provider of electricity by 2040 as outlined in our Strategic Plan *Driven to Make a Difference*. ESB GT will be producing 63 % of our power from renewable sources by 2030. We will achieve this target by continuing to invest in the electricity sector in Ireland and through the development of new onshore and offshore renewable electricity generation capacity. In addition, we will invest in new technologies that will optimise the ability of the electricity system to supply renewable power to customers. ESB is installing a synchronous condenser at Moneypoint which will be operational in 2022 and will be Ireland's first such carbon free, renewable enabling technology.

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3. ISSUES FOR CONSULTATION

3.1 Sectoral Emission Ceilings

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

No response

What do you view as the main challenges/obstacles to the Sectoral Emission Ceilings being met?

No response

3.2 Carbon Pricing and Cross-Cutting Issues

Are there any unintended barriers within the planning system that should be addressed at national policy level in order to deliver our climate ambitions?

ORESS1 will be the first opportunity to road test the new offshore planning regime. The sooner that Phase One projects can be processed, the sooner any teething issues can be identified and addressed. The early resolution of these type of issues married with a growing supply chain will allow for a far more successful Phase Two development.

Planning permission is not expected to be a requirement to compete in either ORESS1 or ORESS2 auctions and projects that are successful at auction may still fail to secure planning. There are good examples of project attrition related to planning consent or planning decision delays in the past. In the UK, 10 projects totalling almost 12.5GW were expected to pre-qualify for the CfD Allocation Round 4 process for offshore wind projects. Actual qualification early in 2022 confirmed that only 7 of these projects, with an approximate capacity of 8.7GW, met the criteria. The 3 projects which did not qualify for Allocation Round 4 failed on planning grounds (30% attrition). In Ireland, an analysis of Strategic Infrastructure (large scale) onshore wind farm development has demonstrated that of 15 applications between 2013 and 2021, 6 were refused and another had its original approval overturned leading to a planning success rate of circa 53%. It is therefore very important that more than the 5GW target of grid is made available to allow for inevitable project attrition that will occur.

What further opportunities exist within our taxation system, beyond measures already implemented and planned, to promote emissions reductions, either on an economy-wide basis, or in specific sectors?

No response

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

To create a secure, resilient, affordable, decarbonised energy system we will need considerable the build out of floating wind technology, hydrogen production and large-scale energy storage. An integrated energy system approach is required for deep decarbonisation. Floating offshore wind and hydrogen is required for Ireland to reach its own decarbonisation targets but will also present a significant opportunity for export of renewable power to other European nations and beyond. Floating offshore wind and hydrogen is required for Ireland to reach its own decarbonisation targets but will also present a significant opportunity for export of renewable power to other European nations and beyond. This will take a strong concerted effort to streamline processes and align key policies across a number of sectors. Crucial to achieving this will be

- Procuring at least 7,000MW from the two offshore RESS auctions
- Promoting the delivery of floating offshore wind by 2030,
- Utilising the existing grid as efficiently as possible
- Developing supply chain confidence and
- Incentivising the production of green hydrogen to serve domestic and international energy needs

If implemented in the short term, then these steps can be transformational for Ireland.

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

No response

3.3 Electricity

What options are available to increase the penetration of renewable electricity beyond the up to 80% committed to in Climate Action Plan 2023?

1. Set a date for a Net Zero Power System

In transitioning to a net zero economy, many studies are indicating that the electricity sector needs to fully decarbonise before other sectors of the economy, and well before 2050. The 2022 CAP has set ambitious targets to decarbonise the heating and transport sectors by utilising a decarbonised electricity sector to supply low carbon energy into those sectors.

The Government should include in the 2023 CAP an action to map out a transition to a net zero power system and the year this is to be achieved by. ESB GT believes a target to achieve net zero emissions in the electricity sector in 2040 is appropriate. To this end, the 2023 CAP should look beyond 2030 making least regret policy choices to enable a fully decarbonised electricity supply.

This ambitious target for the electricity sector will ensure rapid decarbonisation gains can be made in the heating and transport sectors in the 2020s and into the 2030s through electrification. Barriers to electrification should be removed in the 2020s to allow swift electrification of heat and transport.

Designing a net zero power system in Ireland requires all-island coordination through the Joint Steering Group since the Ireland and Northern Ireland systems are interconnected.

Technology solutions to enable a fully decarbonised electricity sector include:

- West Coast floating offshore wind

- New technologies capable of providing zero carbon electricity system services including synchronous condensers
- Zero carbon dispatchable generation (including green energy storage, renewable hydrogen powered gas turbines or fuel cells)
- Improved management of demand and system flexibility

2023 CAP should include specific actions to enable these technologies and solutions to emerge. The role that some of these technologies can play are addressed separately below.

2. Make the grid work for the electricity sector

EirGrid's Shaping Our Electricity Future (SOEF) SOEF sets a framework for how Eirgrid as TSO responds to the various challenges expected of it. As such it is a critical component of the collective initiatives within Ireland to deliver a climate neutral economy by 2050. This means that the appropriate lens to evaluate SOEF is not how well it serves the electricity system. Instead, SOEF must demonstrate that it is the appropriate framework for Ireland to deliver net zero by 2050 and the additional objectives of energy security, affordability, economic growth and environmental projection. In its current format, ESB GT believes that SOEF fails to meet this and requires fundamental change.

The initial roadmap is not a complete assessment of the available capacity for renewables in Ireland and in particular for onshore wind and offshore wind around the Irish coast. Instead, it is a single view on how a 70% renewable generation target could be met in terms of grid delivery. This constrained view of grid availability gives no room for flexibility and substantially increases the risk of failure, cutting out all other scenarios in the event this view cannot be realised. The realisation of this singular scenario is heavily dependent on the delivery of a series of large-scale grid reinforcements. Based on the track record of delivering these types of projects in Ireland, it is unlikely that all these reinforcements will be completed within the 2030 timeframe. This greatly highlights the need for a more flexible approach to give the highest chance of success in delivering the 2030 targets while planning for net zero electricity by 2040. The assessment in its current form effectively gives no allowance for a plan B to meet our 2030 targets, nor does it consider net zero electricity by 2040.

Backup zero-carbon power generation in a clustered approach is also a viable pathway for this green hydrogen and would further accelerate the delivery of a net-zero economy. We would argue that the power from the 2 GW of additional offshore wind following the recent Government announcements on Sectoral Emissions Ceilings should not be tied to the point of landing for the production of hydrogen but rather is made available to locations best suited to the production of green hydrogen by means of adequate grid connections.

ESB GT defines a hybrid grid connection as using a single grid connection associated with an existing power plant to also connect new assets to the system. Maximising existing infrastructure should be encouraged where possible, and hybrid grid connections have an important role to play in delivering new renewable electricity capacity.

Thermal-offshore wind hybrid connections can maximise the use of existing grid infrastructure, will minimise the need to develop new grid, will minimise the impact of project attrition and will increase competition for the benefit of the consumer. Using hybrid grid connections will ensure that grid capacity in addition to grid reinforcements identified in the SOEF Report can be used to deliver policy on time and at the least cost.

ESB GT believes that offshore wind-thermal hybrid grid connections will be an essential component of connecting new offshore wind projects in time to meet national policy targets. Hybrid grid connections are now facilitated within the RESS process and must be facilitated within the ORESS process. The role offshore wind-thermal hybrid grid connections can play has been referenced by ESB and others in the recent Phase Two Offshore Wind consultation. We cannot envisage any scenario in which 7 GW of offshore wind can be delivered by 2030 without the extensive use of offshore wind hybrid connections.

In addition, ESB GT is strongly of the view that the grid should be developed to enable and facilitate the de-carbonisation of the Irish economy, not just the electricity sector, and not just to the extent that EirGrid believes to be possible. ESB GT believes that building grid infrastructure in anticipation of the development of new renewable and thermal assets would help developers deliver the generation assets necessary to de-carbonise Ireland's electricity sector, and in turn all energy sectors. It would be useful if the current approach to planning of primarily focusing on traditional electricity demand scenarios was replaced by considering the full electrification of transport and production of hydrogen for a zero-carbon economy in all sectors.

The SOEF candidate reinforcements are predominantly to facilitate Phase 1 Offshore projects with the majority of proposed grid development being in Dublin. This needs to be revised as it is probable that there will be significant attrition for example due to the unacceptability of cumulative environmental impacts arising during the consenting process. Offshore wind should and will be developed off the South Coast and the West Coast and EirGrid should not shy away from developing Grid on the south and west coasts. We have learned from experience that development of grid reinforcements takes time and future requirements should be identified and progressed now.

The SOEF Report must be updated in advance of the commencement of the Phase 2 Maritime Area Consent ("MAC") assessment process, to include all available grid capacity, including the grid connection at Moneypoint and along the west coast, to allow all generating technologies the opportunity to secure a MAC and therefore be eligible to compete for a route to market (ORESS) in a non-discriminatory manner.

The SOEF Report's assessment of future available grid capacity must not discriminate against or prevent any technology either onshore or offshore from participating in any route to market. For example, the SOEF Report only includes one west coast offshore wind project and does not include the use of the grid infrastructure at Moneypoint. Floating offshore wind is a mature technology today and cannot be prevented from participating in the ORESS process. Earlier this year for example, Portugal's Environment and Energy Transition minister advised of their plans for a 3-4 GW floating offshore wind auction with projects targeting operation by 2026, while the Global Wind Energy Council identified Ireland as one of five countries that have the potential to accelerate the growth of floating offshore wind. Another excellent example is ScotWind and the CfD Pot in Great Britain which has attracted a lot of interest from developers.

This is important in the context of the Phase 2 Offshore Wind Consultation, which proposes that projects need to be aligned with the capacity volumes and locations identified in the SOEF Report. The Phase 2 MAC process therefore must use the most accurate assessment of all available capacity to ensure non-discriminatory competition for offshore wind capacity regardless of whether the technology is fixed bottom or floating.

We cannot envisage any scenario in which 7 GW of offshore wind can be delivered by 2030 without the extensive use of thermal-offshore wind hybrid connections. It is envisaged in the Climate Action Plan, operates for other technologies but isn't enabled by CRU/Eirgrid for offshore wind.

ESB GT believes that Eirgrid should be open to underground options for generator connections if that is the only way to extend the HV network. In practice this form of connection is often favoured by developers when doing contestable connections as it de-risks the planning and construction risks. Eirgrid's strategy should reflect a greater propensity to underground onshore networks in recognition of the changing socio-economic conditions.

ESB GT believes that the main deficiencies in the current version of the SOEF report are as follows:

- It doesn't provide a pathway for decarbonisation of the Irish economy by 2050. In particular, the roll out of additional renewable generation as foreseen under SOEF doesn't provide sufficient sources of zero carbon primary energy sources to meet targets set for 2030.
- It was not a complete assessment of the available capacity for renewables in Ireland and in particular for onshore wind and offshore wind around the Irish coast. Instead, it is a single view on how a 70% renewable generation target could be met in terms of grid delivery.
- A constrained view of grid availability gives no room for flexibility and substantially increases the risk of failure, cutting out all other scenarios in the event this view cannot be realised.
- It is inappropriate that the report prioritises the avoidance of onshore grid development and the minimisation of transmission infrastructure costs at the expense of Ireland's RES-E targets, carbon budget costs and the minimisation of overall energy system costs.
- The SOEF candidate reinforcements are predominantly to facilitate Phase 1 Offshore projects with the majority of grid development being in Dublin. This needs to be revised as it is probable that there will be significant attrition.

ESB GT's main recommendations in relation to SOEF are as follows:

- SOEF should be focused to connect sufficient renewables to the electricity grid to achieve a Net Zero greenhouse gas emissions target for 2050.

- There should be a more flexible approach to grid development to give the highest chance of success in delivering the 2030 sectoral targets while planning for net zero electricity sector by 2040 as per ESB Strategy.
- The new Climate Action Plan 2021 target of 80% renewable electricity by 2030 must be incorporated into EirGrid's plans
- The recently announced 2 GW of additional offshore wind must be incorporated into EirGrid's plans. We would argue that the power from the 2 GW of additional offshore wind following the recent Government announcements on Sectoral Emissions Ceilings should not be tied to the point of landing for the production of hydrogen but rather is made available to locations best suited to the production of green hydrogen by means of adequate grid connections.
- The SOEF Report should be updated immediately to include all available grid capacity, including the availability of west-coast capacity, to allow all generating technologies to compete for a route to market in a non-discriminatory manner.
- Offshore wind should be developed off the South Coast and West Coast, and EirGrid should not shy away from developing grid in these areas. Experience shows that development of grid reinforcements take time. They should be identified and progressed now to meet the future energy needs of the country beyond 2030.
- Offshore wind hybrid grid connections can maximise the use of existing grid infrastructure, will minimise the need to develop new grid, will minimise the impact of project attrition and will increase competition for the benefit of the consumer. Using hybrid grid connections will ensure that grid capacity in addition to reinforcements identified in the SOEF report can be used to deliver policy on time and at the least cost.
- Future revisions of the SOEF report should fully consider current threats to gas availability in Europe by ensuring that grid development can accommodate and work hand-in-hand with a green hydrogen economy and a zero-carbon electricity system.
- The SOEF report should be revised to include the volumes of renewables and the associated grid reinforcements needed to deliver both 2030 RES-E targets and carbon budgets in Ireland and in Northern Ireland in an economic manner.
- The most economic means to deliver policy is to continue to allow developers of new capacity to connect to the grid in a non-discriminatory manner, i.e., Developer Led.

- Grid reinforcement should be preferentially developed at 220kV and 400kV rather than at 110kV to provide sufficient scale and address projected long-term transmission requirements. Underground networks should be considered if that is the only way to extend the HV network.
- In terms of market design, the SOEF document should be focused primarily on implementing the market design policies that have been determined (or delayed) rather than addressing future market designs. In the past, the development of SEM and I-SEM was led by the Regulatory Authorities and handed over to the system operators, market operators and industry for implementation with all questions of a fundamental design already addressed. ESB GT is concerned with the potential duplication of resources (TSOs and Industry Participants) on future market designs via the SOEF and later via the official Regulatory Authority route. ESB GT believes the SOEF should focus on the current market design issues that are within their remit to progress to the RAs or deliver i.e., CEP Article 12 & 13 implementation, more information on the GTUoS methodology and charging model, Firm Access Methodology, connection agreements timeframe, and linkage of SSFA and LCIS process.

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?

A key component to delivering new renewable generation is for developers to have certainty on the permitting and environmental consents needed to develop infrastructure. This can be achieved by:

1. Enable Offshore Renewables by Providing Certainty of Process for Developers

A modern planning and permitting regime and a certainty over the route-to-market for off-shore wind is needed to ensure timely investment to meet the 2030 target.

The Programme-for Government commits to the enactment of the Marine Planning and Development Bill and the importance of delivering this cannot be over-emphasised. The following steps are required to enable offshore wind in Ireland:

- Complete the National Marine Planning Framework (NMPF)

- Amend the MPDM bill for offshore hybrid projects that can meet 2030 delivery to be included in phase 1 projects
- Enact the Marine Planning and Development Management (MPDM) Bill by the Oireachtas
- Issue Foreshore Licences and exclusivity for the seabed to all 2030 projects
- Finalise Policy decision on offshore grid delivery which allows for hybrid offshore wind units

2. Enable Hybrid Offshore Wind Grid Connections

ESB GT defines **Hybrid Offshore Wind Grid Connections** as using a single grid connection associated with an existing power plant to also connect offshore wind to the system. Hybrid grid connections are necessary to achieve the 2030 renewable electricity targets. Using grid connections in such a manner will:

1. Minimise the need to develop new grid infrastructure, a key component of delivering any renewable generation project
2. Maximise the output from a given grid connection point.

   Thermal stations will operate less and less in the market, particularly as the SNSP rises to > 95 %. An offshore wind farm connected to a thermal station's grid connection will see the output from that connection maximised; wind will supply the system when available, with the thermal plant able to supply the system during periods of low wind.
3. Enable an accelerated connection of offshore wind to the system.

   By utilising hybrid connections, offshore wind projects can be brought to market quicker and in a more cost-effective manner when compared to building a dedicated offshore wind grid electrical connection infrastructure.
4. Co-locating technologies as synchronous condensers with hybrid grid connections can provide inertia and renewable power from the hybrid connection when the thermal generator is not in operation. This will provide a carbon free means to ease constraints on the system.

Delivery of 5 GW or 7 GW of offshore wind 2030 will be virtually impossible without enabling Hybrid Offshore Wind grid connections.

ESB has determined that enabling hybrid connections alone can expedite the connection of 2,000 MW of offshore wind. Add to this the connection of new offshore wind to new grid connections and the 2030 target becomes more achievable.

The following steps will need to be taken to enable hybrid connections and the associated increase in connection of offshore wind:

- Modification of the Trading and Settlement Code (TSC) to enable hybrid connections in the market.
- Modification of the Grid Code to enable hybrid connections in the market.
- Review of RESS eligibility and settlement rules for hybrid units

3. Determine the rules surrounding priority dispatch of renewables

The provisions for priority dispatch and redispatch outlined in Articles 12 and 13 of the EU Regulation on the Internal Market for Electricity, EU (2019/943), have been in effect since January but not yet implemented by the Single Electricity Market Committee. These are important provisions for investors. The 2023 CAP should, for completeness, give weight to their importance by including an action to track their implementation progress.

The implementation steps that should be included in 2023 CAP include:

- Modification of the SEM Trading and Settlement Code reflecting the SEM Committee decisions
- Implement the required changes to market and dispatch systems

a. Publish the Revised Wind Energy Guidelines

Ireland has developed approximately 4,235 MW of onshore wind to date. RESS will see the development of more onshore wind in the 2020s.

In addition, Wind Energy Ireland estimate that 1,400 MW of existing wind generation will see either their support end and/or their planning permission expire by 2030.

The publication of the Wind Energy Development Guidelines is urgently needed to:

a) Provide clarity on the rules for repowering and/or refurbishment of out of support wind

b) Provide clarity to developers of new onshore wind projects

4. Enable Floating Offshore Wind

Ireland has one of the largest areas of territorial waters in Europe. The 2020 Programme for Government identifies a potential of at least 30 GW of floating offshore wind by 2050. Indeed, the actual potential from floating offshore wind off the west coast could be significantly higher than 30 GW as technology continues to evolve over time.

ESB and other industry players are currently developing floating offshore projects off the Irish coast. These projects can be delivered before 2030 and ESB believes floating offshore windfarms will be required in delivering the national target of 7 GW by 2030. This timeframe would also position Ireland strongly to develop local supply chain jobs capabilities as opposed to those job being created elsewhere. The timeframe is realistic but will require significant action now to make that happen.

Floating offshore wind turbines can harness the high wind speeds in the deeper waters off the west coast of Ireland. High load factor west coast floating offshore wind offers a real solution to reduce the impact of intermittent renewables on the system. Developing west coast floating offshore wind will also minimise the need to provide back-up generation capacity to provide cover for low wind periods.

As a technology, floating offshore wind is ready, and ESB is ready to re-purpose Moneypoint to enable west coast offshore wind be developed in Ireland as outlined in our Green Atlantic project.

As part of our Green Atlantic @ Moneypoint vision, we commissioned an independent socio-economic report from BVG Associates on the local and national benefits from floating offshore wind and complementary hydrogen development, and the potential benefits are significant.

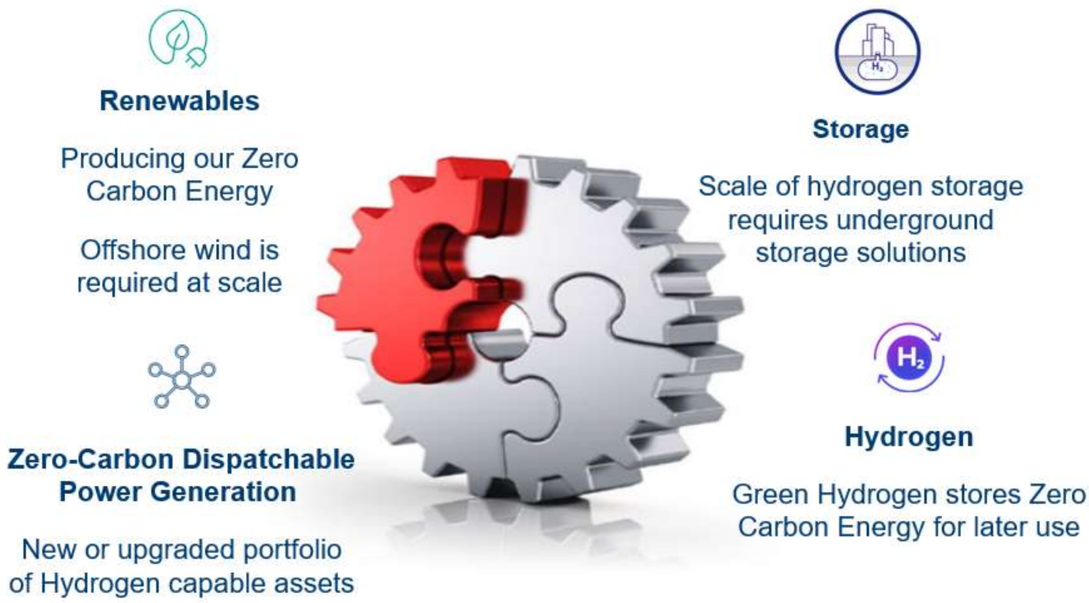
The report concludes that the construction and assembly of a 1,400 MW floating offshore windfarm off the west coast that uses the existing Moneypoint power station site as the construction and assembly hub, combined with a future hydrogen storage facility on site could deliver a direct gross value added (GVA) of more than €1.0bn to the Irish economy over its lifetime the bulk of which will be added locally in the Midwest region. While there would be thousands of jobs created during the construction phase, the analysis also indicates that there would be approximately 450 long term enduring jobs created locally.

What role does renewable gas have in the power generation sector?

A secure, resilient, reliable Net-Zero energy system is not possible without a backup power generation fleet that is fuelled by a zero-carbon fuel, hydrogen which is the perfect renewable fuel.

- Create a new market mechanism for the delivery of a zero-carbon dispatchable generation
- Incentivise existing gas power plant to transition to hydrogen: Capacity market modified to enable existing capacity to invest in hydrogen capability based on additional 10-year capacity guarantee
- PSO to cover zero carbon operation within fossil-based competition
- Promote zero-carbon dispatchable power generation at three Hydrogen Valleys based around Dublin, Cork, Shannon Estuary dedicated to large scale production, storage and use of renewable hydrogen from offshore wind energy
- Set 2040 target date for net zero electricity system, set 2050 for net zero energy system
- Create a new market mechanism for the delivery of a zero-carbon dispatchable generation. Modification of capacity mechanism or replacement to prioritise zero-carbon plant.

The domestic production and storage of green hydrogen could allow Ireland to achieve complete energy independence. This would be a major shift in Ireland's energy security given that 72% of energy was imported in 2020.



However, ESB does not agree with the blending of hydrogen in the gas grid. It is an inefficient, uneconomical use of a scarce, premium, zero carbon fuel. Similarly, the EU Commission reiterates its position that blending hydrogen into the natural gas grid "*requires careful consideration as it diminishes gas quality, can increases overall system costs and the costs of heating for the residential sector, and it is in most applications a less efficient alternative to direct electrification".* Initiatives by gas distributors and governments to add up to 20% green hydrogen to gas grids would be expensive, wasteful, technically complex to achieve and would reduce carbon emissions by a far lower amount than other uses of that hydrogen[1].

What role could carbon, capture and storage have in decarbonising our power sector?

None. We should skip this option and move directly and quickly to green hydrogen. CCS brings certain risks to the decarbonisation of many sectors, and in particular that of the electricity sector. Inherent in the use of CCS in the electricity sector is the continued use of fossil fuels which should really be an anathema to anyone who supports the decarbonisation of all sectors. Continued use of fossil fuels, albeit with

[1] https://www.iee.fraunhofer.de/content/dam/iee/energiesystemtechnik/en/documents/Studies-Reports/FINAL_FraunhoferIEE_ShortStudy_H2_Blending_EU_ECF_Jan22.pdf

the capture and storage of carbon emissions, brings with it the unavoidable and considerable GHG emissions associated with the production and transport of fossil fuels. CCS may have a role in de-carbonising heavy industries such as cement.

What other opportunities exist to support the decarbonisation of the electricity sector?

No response.

What measures might be taken to improve the resilience of the electricity system to the impacts of climate change?

The most common environmental limitation is flooding. Hence operators conduct extensive dam safety work. Contingency plans are in place for a broad spectrum of dam safety risks.

High temperatures can lead to malfunctioning of the cooling systems, eventually leading to shut down of the systems. High temperature can also affect the correct functioning of electrical systems.

Risk management, including weather hazards, is primarily addressed by means of policies, procedures and emergency plans which aim to prepare personnel for the management of the critical events that may occur and to ensure the restoration of systems quickly and safely.

Operators of hydro plants use specific tools for forecasting extreme events in order to prepare for the management of flood events.

All renewable energy sources are dependent on weather and climate, and it can be therefore assumed that they will be affected if there is a change. However, changes are unlikely to have a significant negative impact on the generating capacity. Operating limitations on wind turbines will vary to some extent depending on the turbine design. The most important environmental parameters for wind power generators are icing and changing wind conditions. Extreme wind gusts can damage the blades and affect the stability of the tower. Extreme precipitation and flooding can cause high water levels and landslides which can damage roadways and impede access to the plant. High temperatures can limit the production of wind turbines due to overheating of cooling systems. Wildfires can damage wind turbine generators and limit access to the plant.

The design phase of wind power plants considers potential impacts caused by climate change and adaptation measures are implemented to improve the resilience of the project. In the operation phase, the risk management is implemented by means of policies, procedures and emergency plans.

Resilience and security of electricity supply to customers is a key requirement today and will remain a key requirement of a decarbonised electricity sector. The resilience and security of the electricity sector becomes even more important as electrification of heat and transport gains traction.

Back up generation cannot rely on unabated gas generation indefinitely, and alternative, low carbon capacity solutions are needed.

ESB GT considers the following should be included in CAP 2023:

1. Complete the Security of Supply Review and consult with industry on solutions

ESB GT acknowledges that DECC plans to carry out a review of Ireland's gas and electricity security and looks forward to being able to respond to this consultation once opened.

2. **Include Actions to Address Security**

The agreed actions from the Security of Gas and Electricity Supply review undertaken by DECC should be included future revisions of the CAP.

In identifying solutions to security of supply, ESB GT suggests that the review consider short term and long-term low carbon solutions:

- **Look to existing infrastructure solutions**: Retaining Moneypoint as a generator of last resort, only operating when there is an interruption to gas supplies is a short-term security insurance solution to retaining diversity of generation and security of electricity supply in a system dominated by wind and gas
- **Look to new infrastructure solutions**: One key component of ensuring resilience in the electricity system is the encouragement of zero carbon forms of dispatchable generation to emerge. A means to remove barriers to entry of zero and low carbon dispatchable generation that can also provide system resilience have been outlined above, and include creating a pot akin to the O-RESS pot to support low carbon dispatchable generation

The emergence of these low carbon dispatchable generation technologies should dovetail with the carbon budgeting process as a means to incentivise the emergence of these technologies while targeting carbon removal from the system.

Develop new market mechanisms, akin to that established for offshore wind to deliver new low carbon dispatchable generation solutions. A means to remove barriers to entry of zero and low carbon dispatchable generation that can also provide system resilience have been outlined above. These technologies will be needed to enable a transition away from unabated fossil gas generation. Green electricity storage should be incentivised to begin the removal of unabated gas generation from the system.

3. Ireland, Northern Ireland and GB Co-operation

Northern Ireland is preparing an energy strategy to 2050 and has nominated an 80 % renewable electricity target by 2030. The UK is at the forefront of many aspects of the decarbonisation of energy systems. The UK will remain key energy partner for Ireland post Brexit not least because of gas and electricity interconnection. In this context co-operation on policy is prudent.

While we expect that co-operation at Government level will remain in place, we would suggest the establishment of a wider Islands group to discuss important topical matters such as cross border trading or energy system decarbonisation. This would be a useful place for industry, regulators and Governments to share information on a half yearly basis.

4. Regional Cooperation

Ireland can learn from other jurisdictions beyond our immediate energy trading partners. We can also create better communications channels in Ireland so that we can all (Government, regulators, business, etc) operate more effectively internationally. We propose that two new regional cooperation groups be set up by DECC.

5. Hydrogen

Green, renewable hydrogen can be produced by electrolysers consuming electricity during periods of high renewables penetration or by using otherwise curtailed renewable power can decarbonise sectors that are not suitable for electrification.

In addition to consuming renewable power, hydrogen electrolysers can stabilise the grid by providing frequency support and dispatchable demand to compliment intermittent renewables availability.

The rapid development of a domestic hydrogen economy is an important component of achieving climate neutrality by 2050. Decisions taken now will set the trajectory for Ireland's hydrogen economy in the decades ahead.

To this end, we propose that the 2023 CAP should identify actions to stimulate a hydrogen economy for Ireland as follows:

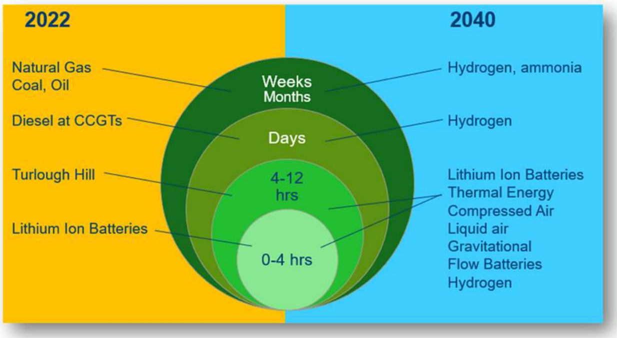
- Ireland should support the production of green hydrogen from renewable electricity sources only.
- A hierarchy of use for green hydrogen should be developed. ESB GT suggests that an appropriate hierarchy of uses for green hydrogen is:
  - Transport: Heavy transport and "Last mile transport" where electrical solutions do not exist
  - Industrial high temperature heat supply where electrical solutions do not exist
  - Chemical feedstock in industry
  - Zero carbon energy storage and direct use for dispatchable power generation (where the hydrogen is produced, stored and used on site).
- In the short term, a scheme to support the use of green hydrogen on a per kg of hydrogen produced basis should be developed to get the hydrogen economy up and running. This scheme should focus on the use of green hydrogen in heavy transport as per the hydrogen use hierarchy and should be designed to make hydrogen use economic relative to the fossil fuel alternative.

  In the longer term, the scheme should be broadened to support use of green hydrogen in other difficult to electrify sectors such as high temperature heating. The carbon content of the electricity mix and a sound guarantees of origin system will be key to qualify this part of the hydrogen production as renewable.

- Ireland should aim to have a hydrogen strategy in place by the end of 2022 and efficient, effective funding mechanisms for hydrogen production, storage and use by end 2023.

What role do you see for electricity storage and demand-side response in providing flexibility to a system comprised of high renewable penetration and in supporting the decarbonisation of the electricity sector?

Renewable energy storage is paramount to delivering a Net-Zero Energy System. The scale of the storage requirement for an integrated energy system powered by renewables ranges from hours to weeks and months and can easily extend to 10's of TWh. We are moving to a "just in time" system. The exit of fossil storage and the transition to a decarbonised system is happening quicker than the development of low carbon dispatchable back up for renewables. Removing carbon emissions from the 20 % of non-RES-E generation after 2030 will be difficult without storing renewable energy to back up the system. The scale of energy to be stored to back up the electricity sector is greater than today's need since interdependency of sectors will increase, e.g., e-heat & e-transport. Currently storage is provided by fossil fuels, pumped storage and lithium-ion batteries. In the future within-day storage solutions will include flywheels, lithium-ion and flow batteries, compressed / liquid air, thermal energy storage, and green hydrogen. These technologies can provide zero carbon system services, help manage curtailment and congestion, provide energy balancing and help maximise grid usage. Longer term storage will be green hydrogen and its derivatives such as ammonia and metal hydrides.



In decarbonising there are other important objectives that Ireland must secure in parallel with delivering a zero-carbon energy system.

- It is important to maintain and enhance the security of supply and the reliability of the energy system.

- Affordability is important to both commercial and residential consumers.
- It is important to maintain economic activity and growth potential.
- There are other environmental objectives such as sustainability and biodiversity.
- Additionally, there is the potential for Ireland to develop a green economy using environmental change to stimulate other economic activity – in short, depending on our initiative, we can become an exporter or an importer of green technology.

Hydrogen will be an essential component of a carbon neutral energy economy in Ireland. It is difficult to envisage a carbon neutral energy system that doesn't incorporate hydrogen as a significant component. The principal contributions of hydrogen will be to:

- Provide seasonal levels of zero carbon energy storage to underpin energy security and continuity of energy supplies. Energy storage needs are likely to be significantly greater in the future energy system due to the intermittency and seasonality of wind and solar resources. Coupled to that electrification of winter heat and other requirements will place greater seasonal variation on the electricity system than we currently experience.
- Decarbonise sectors of the economy that are not suited to electrification. This includes long distance transport, high temperature industrial applications, shipping, and aviation.
- Provide an energy source for dispatchable backup generation to generate electricity when wind and solar resources are inadequate.

Ireland should align with EU policy that green hydrogen is the only long-term viable source of zero carbon hydrogen. In particular, blue hydrogen is not consistent with a climate-neutral energy sector and should not be pursued by Ireland.

Hydrogen and its associated infrastructure are one component of a larger climate neutral energy system. The efficacy of the system to decarbonise is dependent on all necessary infrastructure components being in place at the appropriate times. Therefore, the hydrogen strategy must sit within an overall framework that sets out how Ireland intends to move from 14% to 100% decarbonisation by 2050.

Also, it is important to understand the components of the future energy system and focus now on these sectors. Failure to do this risks investment in sectors or technologies that will not and cannot be part of a zero-carbon energy system.

From an infrastructure perspective, the carbon neutral energy system requires:

- **Sufficient zero-carbon generation sources**. In the Irish context, the minimum requirement exceeds 30 GW – primarily offshore wind with its higher expected load factors. Energy sources in excess of 30 GW are required should Ireland target decarbonisation of marine shipping, aviation, or other sectors.
- **Hydrogen electrolysers – c.15 GW** – most of which are serviced by generation sources dedicated to hydrogen production while others can toggle between the electricity and hydrogen sectors. Hydrogen can provide a store of zero carbon renewable energy of seasonal scale sufficient to ensure security of supply of the energy system. Hydrogen also is essential to decarbonise sectors not amenable to simple electrification. Examples here include heavy and long-distance transport, shipping, aviation, and high temperature industrial applications. Stored hydrogen is essential to power a climate neutral energy sector in response to seasonal supply/demand differences and in response to the periodic unavailability of wind and solar resources – sometimes for extended periods of time.
- **Seasonal energy storage** sufficient to provide the Irish energy system with continuity of supply and strategic security of supply. This is needed to overcome the intermittency of renewable generation sources, seasonal variation in demand/supply and maintain a strategic energy reserve akin to that currently in place at EU level for petroleum products and more latterly, natural gas. ESB estimates that this storage capability will utilise hydrogen or associated carriers and requires 90 days of seasonal storage capacity. For security of supply, this requires multiple underground storage reservoirs utilising depleted gas field and salt caverns.
- **Always available zero carbon generation**, powered by green hydrogen, of sufficient capacity and with sufficient access to green hydrogen to provide production backup to intermittent renewables for the production of electricity. This backup role can be for extended periods of time. August / September 2021 included a 6-week window with limited wind energy production – for example. This zero-carbon fleet is likely to combine both hydrogen compatible gas turbines and hydrogen fuel cells.

Each of these infrastructure sectors requires a policy framework that fosters its development at a pace sufficient for the effective decarbonisation of the overall energy sector. Each sector can be considered as an important pillar within a single overall decarbonisation masterplan. This framework must address promotion of both production and demand. It must ensure that the right economic framework exists for the development of each sector at the right pace. It must align infrastructure development with other decarbonisation initiatives such as public engagement and behaviour change. Finally, it must ensure that the necessary industry safety, operating, and regulatory frameworks are in place where new sectors are being developed.

What are the regulatory challenges for reaching the renewable energy share targets?

- SOEF should be focused to connect sufficient renewables to the electricity grid to achieve a Net Zero greenhouse gas emissions target for 2050.
- There should be a more flexible approach to grid development to give the highest chance of success in delivering the 2030 sectoral targets while planning for net zero electricity sector by 2040 as per ESB Strategy.
- The new Climate Action Plan 2021 target of 80% renewable electricity by 2030 must be incorporated into EirGrid's plans
- The recently announced 2 GW of additional offshore wind must be incorporated into EirGrid's plans. We would argue that the power from the 2 GW of additional offshore wind following the recent Government announcements on Sectoral Emissions Ceilings should not be tied to the point of landing for the production of hydrogen but rather is made available to locations best suited to the production of green hydrogen by means of adequate grid connections.
- The SOEF Report should be updated immediately to include all available grid capacity, including the availability of west-coast capacity, to allow all generating technologies to compete for a route to market in a non-discriminatory manner.
- Offshore wind should be developed off the South Coast and West Coast, and EirGrid should not shy away from developing grid in these areas. Experience shows that development of grid reinforcements take time. They should be identified and progressed now to meet the future energy needs of the country beyond 2030.
- Offshore wind hybrid grid connections can maximise the use of existing grid infrastructure, will minimise the need to develop new grid, will minimise the impact of project attrition and will increase competition for the benefit of the consumer. Using hybrid grid connections will ensure that grid capacity in addition to reinforcements identified in the SOEF report can be used to deliver policy on time and at the least cost.

- Future revisions of the SOEF report should fully consider current threats to gas availability in Europe by ensuring that grid development can accommodate and work hand-in-hand with a green hydrogen economy and a zero-carbon electricity system.
- The SOEF report should be revised to include the volumes of renewables and the associated grid reinforcements needed to deliver both 2030 RES-E targets and carbon budgets in Ireland and in Northern Ireland in an economic manner.
- The most economic means to deliver policy is to continue to allow developers of new capacity to connect to the grid in a non-discriminatory manner, i.e., Developer Led.
- Grid reinforcement should be preferentially developed at 220kV and 400kV rather than at 110kV to provide sufficient scale and address projected long-term transmission requirements. Underground networks should be considered if that is the only way to extend the HV network.
- In terms of market design, the SOEF document should be focused primarily on implementing the market design policies that have been determined (or delayed) rather than addressing future market designs. In the past, the development of SEM and I-SEM was led by the Regulatory Authorities and handed over to the system operators, market operators and industry for implementation with all questions of a fundamental design already addressed. ESB GT is concerned with the potential duplication of resources (TSOs and Industry Participants) on future market designs via the SOEF and later via the official Regulatory Authority route. ESB GT believes the SOEF should focus on the current market design issues that are within their remit to progress to the RAs or deliver i.e., CEP Article 12 & 13 implementation, more information on the GTUoS methodology and charging model, Firm Access Methodology, connection agreements timeframe, and linkage of SSFA and LCIS process.

What financial incentives are needed to increase renewable generation capacity?

No response

To incentivise commercial scale production.

No response

To incentivise microgeneration

No response.

3.4 Enterprise

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

Heat pump technology offers a much more efficient route to de-carbonise the heating sector at both residential and commercial and industrial sectors and latest developments in heat pump technology now deliver output temperatures of up to 160°C. The recent SEAI Heat Study highlighted the important role that Heat Pump technology can play in de-carbonising the heating sector.

Heat pumps are around 300-400% efficient and return 3 to 4 times more heat for every kilowatt (kW) of electricity the heat pump uses. Contrast this with the relatively poor efficiency associated with the production of green hydrogen from electricity and storage losses (c. 55%-60%) and boiler efficiency of c. 90% delivering an overall efficiency of c. 50%. Using renewable energy to generate hydrogen, and then using that for heat, would have a system efficiency of around 50%. Using the same renewable energy via a heat pump would have an average coefficient of performance of 3 or an efficiency of 300%. Heat pumps are not just a bit more efficient; they are about six times more efficient than using green hydrogen for heating and this means that six times more renewable energy capacity would be required to supply heating demand via Green Hydrogen than would be required if this heat demand was delivered via heat pump technology.

The recent SEAI / Element Energy National Heat Study[2] undertook a comprehensive analysis of the potential for Ireland to reduce emissions from the heating sector. Amongst its key finding were that

- Decarbonising the electricity grid is essential to cutting heat-related emissions.

[2] National-Heat-Study-Summary-Report.pdf (seai.ie).

- Net-zero emission pathways with the lowest cumulative emissions use more electric heating technologies. Scenarios focused on a hydrogen gas grid have more cumulative emissions.
- Heat pumps are a prominent technology in all scenarios and in all sectors. Rapid emissions cuts require deploying the technology at scale.
- District heating is a technology that offers additional potential for carbon reduction, is proven and available now.
- A timetable for fossil fuel phase-out in all sectors is needed as soon as possible to meet net zero by 2050.
- Evolving existing policy supports to focus on replacing fossil fuels in buildings can have a more significant and immediate emissions reduction impact than a fabric-first approach.

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

Green hydrogen

What measures can be introduced to reduce to F-Gases in the Enterprise sector?

No response

How can we encourage the diversification away from products with high levels of embodied carbon, such as traditional cement in construction to lower carbon alternatives?

CCS may well have a role in the de-carbonisation of industries such as cement.

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

CCS may well have a role in the de-carbonisation of industries such as cement.

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

No response

What measures should be taken to address the risks that climate change poses for enterprise?

No response

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

No response

3.5 Built Environment

Currently SEAI provides approx. 50% of the grant of retrofit to Landlords, Housing for All commits to introducing a minimum BER for rented properties from 2025 onwards. What further supports can be put in place to address the split incentive when retrofitting rental properties (residential and commercial)?

No response

How can we encourage SMEs to upgrade the energy efficiency of the buildings they own?

No response

What immediate actions can we take to address the skills shortage in the construction sector, to facilitate meeting our annual retrofitting targets?

No response

How can we ensure that necessary skills will be available to support district heating projects?

No response

Housing for All Commits to 100% funding to retrofit 40% of local authority housing stock to B2 by 2030 at a cost of 1.4 billion euro. How can we further support local authorities to help them deliver on social housing retrofit targets?

No response

In addition to the existing financial supports and policy measures, are there any other incentives/assistance needed to help homeowners upgrade the energy efficiency of their homes?

No response

How could the roll-out of district heating be accelerated and what needs to be done to expand its coverage in Ireland?

No response

Are there any specific obstacles in the planning system that is impeding the rollout of district heating and the national retrofit plan? How can we overcome these barriers?

No response

What policy levers are needed to encourage and support the retrofitting of shared properties e.g. apartments?

No response

Further to the existing supports financed by carbon tax revenues, how can we protect those who are currently experiencing fuel poverty and those who are at risk?

No response

What specific measures can be implemented to improve the efficiency of rolling out the National Retrofit Programme?

No response

Further to those technologies identified in previous iterations of the Climate Action Plan, what other additional measures could be used to reach our emission reduction target in this sector?

No response

What specific measures would incentivise a greater rate of oil boiler replacement?

No response

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

No response

3.6 Transport

What obstacles exist in the planning system that may prevent greater modal shift from being achieved? Are there specific measures that can be implemented to avoid further forced car dependency or lock-in of unsustainable practices?

No response

What additional measures should be considered to improve the quality or attractiveness of public transport or active mobility solutions as an alternative to private car use? (e.g. dedicated lanes, secure bike parking, rest areas).

No response

What policies or measures can be considered to further incentivise the use of more sustainable modes of transport for education and leisure-related journeys?

No response

What potential do blended working policies or remote working hubs have to help reduce commuting travel and volume of transport emissions?

No response

Is the level of transformation required of our transport behaviour patterns well understood and what more can be done to demonstrate the benefits of modal shift? How can the overall impact of wider decarbonisation measures be measured most effectively (e.g. capturing wellbeing impacts, health impacts, liveability, permeability, etc.)?

No response

How can EV and other transport grants/supports be more targeted (spatially, demographically) to deliver additional emissions reduction or address distributional impacts in a more equitable manner?

No response

What specific actions can government take to help create a robust second-hand market for electric vehicles?

No response

What specific actions can government take to help accelerate or achieve parity in the total cost of ownership between electric vehicles and ICE vehicles?

No response

What specific policies can assist in reducing the overall volume of ICE vehicle kilometres driven? Is there further scope to effect a change in the composition of the private car fleet to shift the vehicle mix away from higher emitting classes?

No response

What specific measures can be applied in the commercial transport sector to encourage or accelerate a change to EVs or to other zero carbon alternatives?

No response

What potential do digitalization, innovation and efficiency improvements in the commercial sector (including, e.g., establishing logistics hubs) have to deliver emissions abatement? What are the barriers to delivery of each?

No response

How can the climate costs of home delivery services be mitigated? Should there be a surcharge - depending on the mode of delivery, with cargo bikes and EVs exempt. If this was to be considered, how would transparency around this charging be affected?

No response

As a transitionary fuel to help decarbonise the road haulage sector, what obstacles to bioethanol (E10), and 20% biodiesel (B20) by 2030? Is there potential for greater you foresee in raising the blend proportion of biofuels in road transport to 10% ambition?

No response

What expectation or level of public transport service is appropriate in rural communities and what other key measures can support a transition to sustainable modes?

No response

What infrastructure or further measures are required to help improve the safety of rural roads and further incentivise the use of walking and cycling for shorter journeys in rural areas?

No response

What are the key elements of a just transition in transport? Are there certain cohorts that should be given exemptions / insulated from potential increased costs?

No response

What platforms or mechanisms can best facilitate the sharing of data, transport modelling and research findings with policy makers, local authorities, research groups, local communities and the wider public?

No response

What other opportunities exist to support the decarbonisation of the Transport sector?

Green Hydrogen for Transport

Medium and long-haul aviation is going to be impossible to electrify due to fundamental limitations in battery chemistry / physics and green hydrogen will have a key role in development of Synthetic Aviation Fuels alongside other forms of biofuels. For short-haul and light aviation, it may be the case that battery electric aircraft could play an increasing role as battery energy densities increase and costs come down.

In shipping, local ferry with routes up to a few hundred kilometers, are most likely to go electric however green hydrogen will be used for vessels with longer ranges where green hydrogen is used in a fuel cell or just burned in an internal combustion engine which can benefit from the existing marine engine supply chain. Using green hydrogen to create ammonia or methanol may also have a key role to play in de-carbonising the marine sector. Danish shipping giant, Maersk, has ordered eight methanol powered vessels from South Korean shipbuilder Hyundai Heavy Industries.

In road transport, the most energy efficiency de-carbonisation technology is Battery Electric Vehicles (BEV) with an estimated efficiency of over 70%[3]. The efficiency of Hydrogen Fuel Cell Electric Vehicles (FCEV) is estimated to be less than 25% while the efficiency of an Internal Combustion Engine (ICE) is just 13%.

[3] How efficient are Electric Cars Well-to-wheels?? - G. Burch Fisher (burchfisher.com)

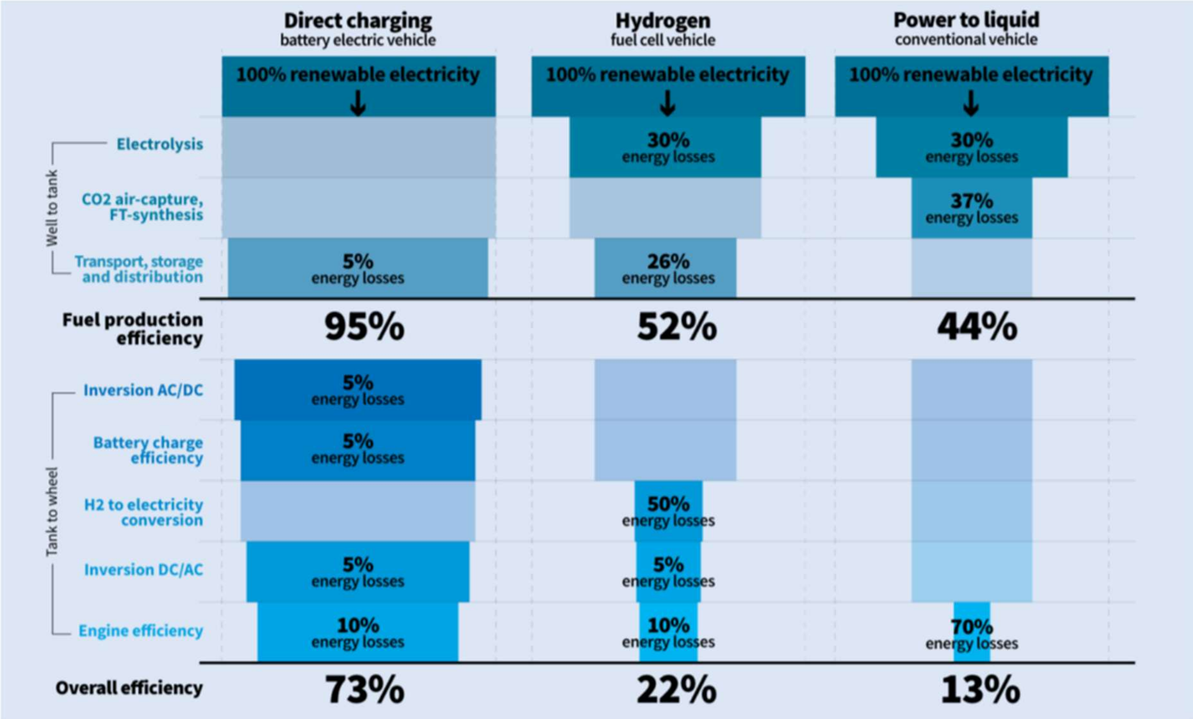


Figure 9: Energy efficiency of different technologies

The reason for the poor efficiency associated with FCEV technology is the fundamental inefficiency of turning electricity into hydrogen, compressing it, storing it, transporting it and then converting it back into power on board a vehicle. Almost three quarters of the input power is wasted in these processes, and this will not change significantly into the future.

Given these technology fundamentals coupled, the rapid development of EV charging infrastructure across Ireland in recent years and the small geographic size of Ireland, it is likely that the majority of cars, light delivery vehicles will be electrified using BEV technology. Hydrogen will have a role for intercity coaches, some train routes and a portion of the heavy good transport fleet.

3.7 Agriculture, Land Use and Forestry

What are the opportunities to increase take-up of measures identified in AgClimatise and encourage adoption of other practices which reduce emissions?

No response

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.?

No response

What can be done to maximise the use of manure and silage as feedstock for biomethane generation in closed digesters and inject into the gas grid to offset natural gas?

While ESB supports the blending of biogas and biomethane into the gas grid as a viable measure to reduce the carbon content of methane, there is no economic, carbon-reduction or sustainability argument to support the injection of green hydrogen into the gas network. Injecting green hydrogen into the natural gas network is simply wasting a precious expensive energy carrier for limited benefit when there are other technologies available that can offer a route to de-carbonisation at much lower cost.

What can be done to increase sequestration through forestry (afforestation, extended rotations, and improved forest management)?

No response

What opportunities are there to rehabilitate our peatlands and wetlands, and what can be done to realise these opportunities?

No response

What measures would support increased sustainable management of grasslands, including those areas on drained organic soils?

No response

What opportunities exist for increased use of cover crops, incorporating straw into tillage and for the application of regenerative agriculture practices? How can farmers be supported to take up these practices?

No response

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)?

No response

What other opportunities exist to support the decarbonisation of the agriculture, land use and marine sectors?

No response

What specific measures can be taken in agriculture, forestry and land use to adapt to climate change?

No response

3.8 Waste and the Circular Economy

What are the main barriers to consumers embracing the Circular Economy, e.g. lack of awareness, increased costs compared to disposable products, lack of access to circular goods and services?

No response

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

No response

3.9 Public Sector Leading by Example

What opportunities exist for the public sector to step up its climate ambition?

No response

What sort of practical changes would you expect the public sector to make in leading and delivering Ireland's climate ambition?

No response

How can the public sector lead wider society to change? In the short-term, medium term, long-term?

No response

What are the biggest barriers (resourcing / tech gaps / funding / policy gaps / etc.) for the public sector in reducing greenhouse gas emissions and how can they be overcome?

No response

What other opportunities exist to support the decarbonisation of the public sector?

No response

What practical steps should the public sector take to adapt to climate change?

No response

What is your vision for the public sector in 2050 in a climate neutral Ireland?

No response

Where can the most optimum investment be made by the public sector in climate action?

No response

What should be prioritised / where should actions be prioritised for the public sector to realise its climate vision?

No response

What would be an appropriate level of ambition/targets/challenge for public sector climate action?

No response

3.10 Just Transition

What types of supporting interventions should be considered by the Government to address the four principles of our Just Transition Framework within individual sectors?

No response

Are there any emerging skills gaps that need to be addressed that haven't already been identified by the Expert Group on Future Skills Needs in its Skills for Zero Carbon report?

No response

What additional targeted supports should be considered to minimise the impact of our climate policies to those on low income or households that are most at risk from fuel poverty (including transport and heating)?

No response

Are there are any emerging areas of vulnerability in specific sectors of the economy as a direct result of the implementation of Ireland's climate action policies?

No response

How should Local Authorities seek to integrate just transition considerations into the preparation of their statutory Climate Action Plans?

No response

What other issues should be considered by the Government to inform just transition policy in the 2023 Climate Action Plan?

No response

Should the proposed Just Transition Commission have any other functions in addition to those described above?

No response

What mixtures of skills and expertise are required on the Just Transition Commission?

No response

3.11 Research and Innovation

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?

1. There is a need for a **Hydrogen Masterplan for Secure Net Zero Energy System** to quantify the volume of hydrogen needed to complement the role of electrification.
    - Renewables
    - Hydrogen production (GW capacity)
    - Energy storage
    - Zero carbon dispatchable generation required for a secure resilient net zero economy
    - Export opportunities and new industries will increase these targets further
    - Need roadmap for interim milestones.
2. Hydrogen is a smaller molecule than the likes of methane, meaning it is even more prone to leakage from pipelines. Recent research[4] has shown that when hydrogen is vented or leaks into the atmosphere, its short-term global warming potential is significantly higher than previously thought. The climate impacts of hydrogen

[4] Hydrogen is also a greenhouse gas, so leaks must be minimised - Energy Post

leakage from pipelines and transport vehicles must be understood before there is large-scale commitment to transporting hydrogen in this way.

3. Safety cases can be explored to determine how best to store, handle and transport hydrogen.
4. Inter-seasonal storage of hydrogen will be required. Important research can be carried out on the suitability of geological storage sites to learn how best to construct, operate, maintain and eventually de-commission these sites.
5. Creative research is required to assist in the development of hydrogen hubs and valleys which will be an integral part of Ireland's hydrogen economy.
6. Port development to support offshore wind and green hydrogen

Have you identified any research and innovation gaps which need to be addressed? If so, how can these gaps best be addressed?

Fertiliser industry

- Explore use of renewable hydrogen for fertiliser - scale/ cost/ subsidy needed/ decarbonisation impact / food security impact / economic benefit.
- Produce for indigenous use and / or export
- What a roadmap for development of this industry could look like for Ireland - locate at hydrogen valleys east, west and south.
- SWOT analysis of Ireland vs other countries. What are the enablers and barriers? Look back at the genesis and demise of the historic fertiliser industry in Ireland – what are the lessons learned?

Ireland's energy storage

- As European electricity markets decarbonise and rely more on weather-dependent intermittent Renewable generation, a new form of resilience will be required to replace fossil fuels, particularly as electricity will play an increasing role in decarbonising Heat and Transport.
- Quantitative analysis of various types of energy storage (fossil) and energy usage (fossil and renewable) across all sectors in Ireland over the last four decades.

- Forecast of energy usage in Ireland as we journey to net zero carbon in 2050 and the energy storage (quantity and technologies, including hydrogen) needed in Ireland to provide the necessary energy security and resilience for a zero-carbon energy system.
- For the long duration storage technologies identified, review technical characteristics, costs, development times, potential for future development and its suitability in the Irish context.

Ireland- a net exporter of energy in the form of molecules and electrons?

- Ireland has a continental scale of renewable resources including onshore wind and offshore wind on east, south and west coast. Renewable energy produced could be multiples of Ireland's peak demand, even when significant parts of the economy have been electrified.
- Can Ireland produce renewable hydrogen for domestic use at a cost that can compete with hydrogen from solar in southern Europe/ Africa/ Middle east/ south America? Consider factors including:
    - Forecast trends in hydrogen production costs (capex plus opex plus energy plus water (may be significant in areas where water supply may be challenging)
    - Transport costs and carbon footprint of transport
    - EU policy on energy security (indigenous energy resources)
    - Geopolitical issues

Total cost of ownership of BEV vs FCEV urban buses for daily routes >300km

- BEV is a much more efficient option than FCEV based on energy requirement per km. Public transport operators recognise that there is a role for both FCEV and BEV in their fleet, particularly for longer routes with daily total in excess of 300km. There is a balance between larger number of efficient BEVs (and drivers) to cover a longer route vs smaller number of less efficient FCEV buses with longer range and fast refuelling time. A quantitative assessment would be valuable to provide evidence on optimal choice of vehicle for different route lengths taking into consideration factors including:

- Capital costs of BEV and FCEV
- Maintenance costs of BEV and FCEV
- Charging times for BEV and refuelling times for FCEV
- Passenger capacity of BEV bus v FCEV bus
- Energy costs / km for BEV, FCEV
- Range BEV, FCEV (taking into consideration any seasonal variations in range during extreme cold weather)
- Replication of BE/ DB current resilience and security of fuel supply (Consider 'beast from the east' or 'storm Ophelia scenario'. Can fuel security be provided with batteries/ is H2 storage needed)

Long term: transport

- Explore use of renewable hydrogen for synthetic fuels- scale / cost / subsidy needed / decarbonisation impact
- What would a roadmap for development of this industry could look like for Ireland - locate at hydrogen valleys east, west, and south to e-fuel aviation and shipping.
- What are the enablers and barriers?
- SWOT analysis of Ireland vs other countries

Are there important areas of research and innovation, where Ireland currently does not have sufficient capability, that need to be developed? If so, what are these areas?

All of the areas noted in the question above.

Is the research and innovation system developing and retaining the skills needed to deliver on our climate ambitions?

No response