

CLIMATE CHANGE, ENERGY AND THE ENVIRONMENT

GREEN HYDROGEN IN IRELAND

Socio-Economic and Collaborative
Prospects with Germany

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Green hydrogen not only offers a unique chance for Ireland and Germany to apply social market economic principles, it promotes social justice in the European energy transition.



As Ireland is still in the early stages of developing green hydrogen, its excellent offshore wind resources offer a realistic opportunity for green hydrogen export to Germany in the medium to long term. This puts the Irish-German bilateral relationship on a promising new footing.



The German and Irish governments could accelerate Ireland's green hydrogen sector through innovative offtake agreements, providing financial stability and market certainty for both countries and thereby strengthening resilience in the European Union.

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1. INTRODUCTION

Green hydrogen is set to play a pivotal role in Europe’s transition to a green economy, especially in decarbonizing sectors that are difficult to electrify. Under various EU policies such as the European Green Deal and Repower EU, green hydrogen is essential for reducing reliance on fossil fuels and supporting Europe’s leadership in carbon-neutral industrial systems. The urgency of this transition has been underscored by the need to reduce dependence on Russian natural gas following recent geopolitical tensions. While the EU will inevitably need to import a significant amount of green hydrogen, building substantial production capacities within Europe and its neighbouring regions is equally critical. This strategy not only enhances energy resilience by lowering import dependencies but also fosters a robust market for European technology and innovation in the burgeoning hydrogen sector.

In this context, Ireland with its abundant renewable energy resource could play an important role as a potential hub for green hydrogen production and export via pipeline through the proposed pan European Hydrogen Backbone. Ireland has committed to such a future through legislation and policy including the Climate Action and Low-Carbon Development (Amendment) Act 2021, the National Hydrogen Strategy, and Ireland’s Future Framework for Offshore Renewable Energy. Ireland’s plans to export hydrogen will be enabled by the development of offshore wind which is gathering pace with recent offshore renewable energy support schemes, designated marine area plans and supporting policies. However, acceleration of Ireland’s entire renewable energy agenda is needed to achieve the national objective of Net Zero by 2050, let alone supporting export of green hydrogen to aid European efforts.

This paper explores what sort of partnership between Ireland and Germany could accelerate the green hydrogen sector in Ireland with a view to exporting this clean energy vector. It provides an overview of the existing climate and energy

policy in Ireland, current energy mix and offshore renewable energy potential before describing the significant opportunity that Ireland’s green hydrogen sector presents for social cohesion and feminist climate justice. It describes the existing commitment between Ireland and Germany on green hydrogen collaboration and advocates for this to be strengthened and enhanced. That partnership approach can benefit both Ireland and Germany not only in securing a clean energy future but also to advance social justice and strengthen a social market economy.

2. CLIMATE AND ENERGY POLICY IN IRELAND

To understand Ireland’s climate and energy policy, it is useful to understand the countries greenhouse gas emissions which were estimated at 60.76MT of CO₂ equivalent in 2023, a reduction of 1.9 percent from the previous year with majority of emissions from agriculture, energy and transport. (Environmental Protection Agency, 2023)

Ireland’s Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021) provides for a national climate objective, which commits to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy including a 51 percent reduction in such emissions by 2030. To achieve that, the government adopted carbon budgets and sectoral emissions ceilings i. e. maximum limits on greenhouse gas emissions for each sector of the Irish economy to the middle and end of this decade and shown below to highlight the comparatively high level of emissions allocated to agriculture in Ireland which results in lower levels for other sectors, notably electricity, transport and industry.

The actions to achieve these emissions reductions are listed in Ireland’s Climate Action Plan, the third update of which – Climate Action Plan 2024 (Government of Ireland, 2023) –

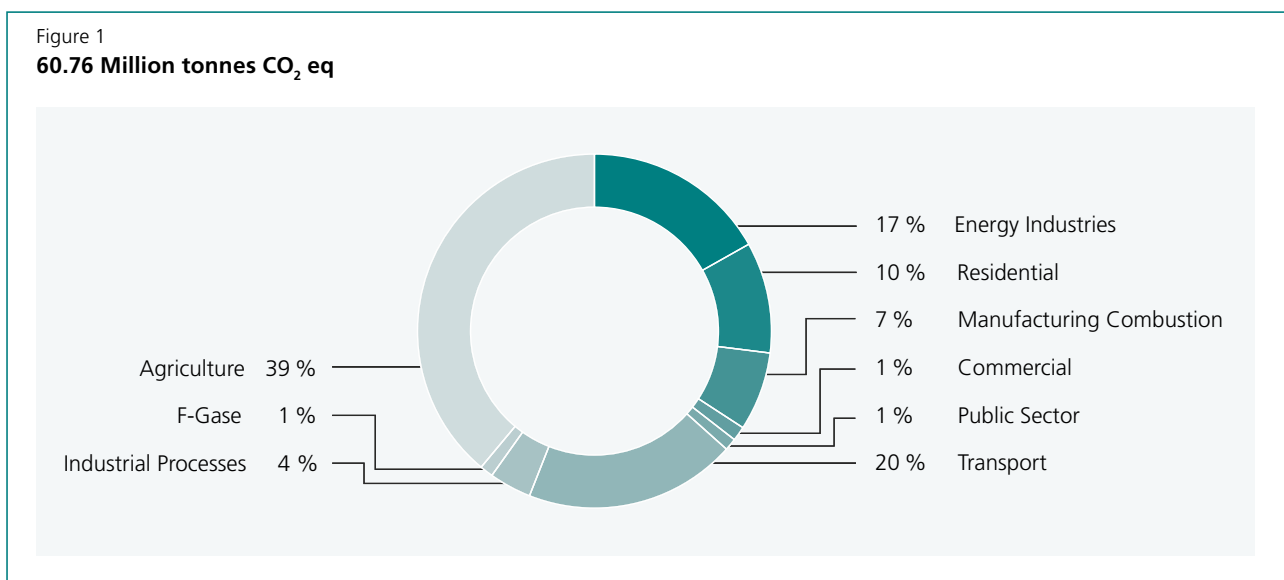
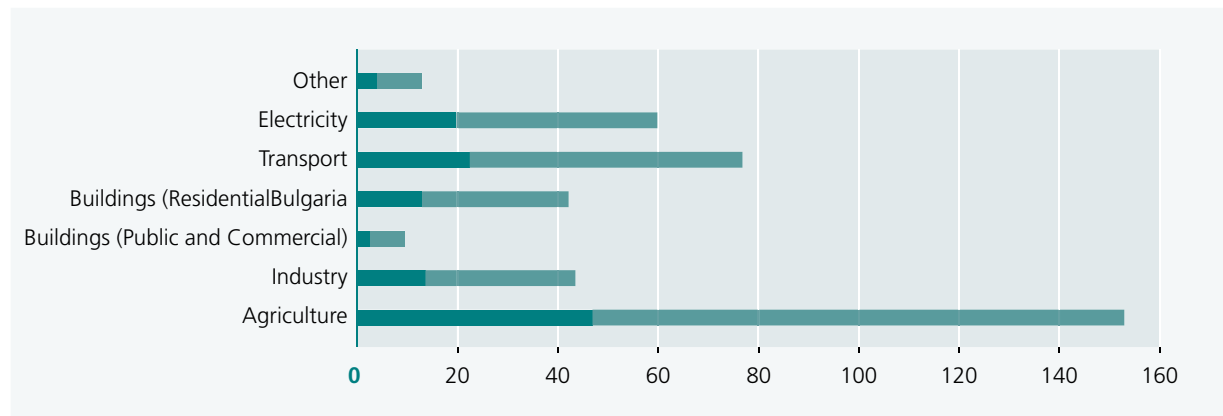


Figure 2

First Sectoral Ceilings 2021-2025 and Usage Million tonnes CO₂ eq

was published in December 2023. As Ireland's hydrogen is focused on production using renewable electricity, the following key targets are important

- For onshore wind, the target is 6 GW by 2025 increasing to 9 GW to 2030
- For solar, the target is up to 5GW by 2025 increasing to 8 GW by 2030
- For offshore wind, the target is at least 5 GW by 2030

Cumulatively, Ireland proposes 11 GW of renewable energy production by 2025 (circa 6.752 MWh per capita for Ireland), increasing to 22 GW by 2030 (13.49 MW per capita for Ireland). This equate to about 100 percent and 200 percent of existing electricity demand in Ireland (according to the International Energy Agency, Ireland's electricity consumption is 6.193 MWh/capita (IEA, 2023). While electrification will lead to increased consumption, it is envisaged that surplus renewable electricity will be available for Ireland's hydrogen sector.

CAP2024 proposes an increase in hydrogen ambition for Ireland in line with the National Hydrogen Strategy. It proposes green hydrogen production from renewable electricity surplus generation by 2030 coupled with long duration hydrogen storage and electricity generation from green hydrogen as a back up to intermittent renewables and production of hydrogen from 2 GW of offshore wind between 2031 & 2035.

Ireland's National Hydrogen Strategy was published on 12th July 2023 (DECC, 2023) and sets out that Ireland will focus its efforts on the scale up and production of renewable »green« hydrogen as it supports both decarbonisation and energy security given Ireland's vast indigenous renewable resources. The main drivers for green hydrogen in Ireland are to

- Provide a solution to hard to decarbonise sectors where electrification is not feasible, or cost-effective. Enhancing Ireland's energy security, through the

development of an indigenous zero carbon renewable fuel which can act as an alternative to the 77 percent of the country's energy system which today relies on fossil fuel imports.

- Developing industrial opportunities, through the potential development of export markets for green hydrogen and other areas such as Sustainable Aviation Fuels

The Strategy outlines how Ireland's hydrogen economy will develop and scale up as details below. In relation to production

- Renewable hydrogen produced from curtailed grid electricity or onshore renewables where available is expected from 2023 onwards
- Hydrogen blends across the interconnectors are expected to play a limited role from 2023 to 2038
- Initial production of renewable hydrogen from offshore wind is expected between 2028 and 2033 with large scale deployment from 2033 onwards

With regards to transport for domestic use or export

- Trucked (non-pipeline) or onsite use is expected to play a significant role from 2023 to 2033 with a limited role expected after that
- Network blending will play a limited role from 2023 to 2033 (relevant to storage also)
- Local Networks/Clusters will play a limited role from 2028 to 2038
- A National Hydrogen Network is expected to play a limited role from 2033 to 2038 with large scale deployment from 2038 to 2050.
- Import and Export routes are likely to be established in a limited way from 2033 to 38 with large scale deployment after that.

For storage,

- Network blending will play a limited role from 2023

- to 2033 (relevant to transportation also)
- Small scale applications expected to play a significant role from 2023 to 2033 but more limited after that
- Large scale storage solution – geological scale are expected to begin with limited application from 2028 to 2033 increasing significantly after that to 2050

End use applications will be for

- Existing large energy users on the gas network using guarantees of origin in a limited way from 2023 to 2033 only
- Heavy land transport in a limited way from 2023 to 2028 with large scale deployment after that until it peaks in 2033 to 2038
- Power generation in a limited way from 2028 to 2033 with large scale deployment after that
- Industrial Heating in a limited way from 2028 to 2033 followed by large scale deployment
- Aviation and shipping in a limited way from 2033 to 2038 followed by large scale deployment
- Exports are expected to begin in a limited way from 2033 to 2038 followed by large scale deployment from then

3. IRELAND'S TOTAL ENERGY SUPPLY

Ireland's interest in green hydrogen is driven by its potential to decarbonise economies including hard to decarbonise sectors where electrification is not feasible or cost effective; enhance energy security through development of indigenous zero carbon renewable fuel and to develop industrial opportunities. To understand the role for green hydrogen in Ireland, and the potential for export of surplus energy, it is helpful to consider the current types and origins of Ireland's energy supply as well as the potential for offshore wind.

Today, Ireland's net energy imports in 2022 accounted for 86.6 percent of total energy supply (IEA, 2023). Ireland's total energy supply is shown below, with fossil fuels accounting for 86.4 percent of total energy supply.

Ireland will need new energy carriers in the form of bioenergy or hydrogen for heavy transport and high-grade heat in industry (EPA, 2023). The EPA sees green hydrogen as a future energy choice required to help Ireland get to net zero emissions, and to balance a grid based on variable renewable electricity technologies. Hydrogen is frequently seen as playing a role in the long-term decarbonisation of energy systems (Hanley, 2018).

4. IRELAND'S OFFSHORE RENEWABLE ENERGY

Ireland has one of the best offshore wind regimes in the world. With an exclusive economic area at sea equal to 7 times its landmass and a shallow continental shelf, it is economically viable, using fixed bottom wind turbines and floating offshore wind turbines (FOWT), to generate up to 80 GW of electricity from offshore wind. That is enough to meet Ireland's energy needs with a surplus to export meaning the overall offshore renewable energy (ORE) sector will be worth €38 Billion by 2050 (BVG Associates, 2024). To support the creation of this sector, the Department of Enterprise, Trade and Employment have established an offshore wind energy industrialisation strategy entitled »Powering Prosperity« which focuses on how to support Irish companies so that they can participate in the domestic and international supply chain for the ORE sector.

To support Ireland's targeting of 37 GW by 2050 to support clean, affordable energy and green growth a Future Framework Policy for Offshore Renewable Energy was developed by the Offshore Wind Delivery Taskforce, outlines strategic actions and principles, emphasizing economic opportunities, community returns, and environmental protection (DECC, 2024). The policy includes a roadmap and 29 key actions to develop a long-term, plan-led approach to offshore wind and emphasizes economic opportunities, aiming to attract investment and maximize financial returns to the state and local communities.

Figure 3
Total energy supply, Ireland, 2022



Source: International Energy Agency. Licence: CC BY 4.0 .

Such financial mechanisms include community ownership and revenue sharing, with current efforts centred on seabed levies and Community Benefit Funds (CBF). Seabed levies, mandated by MARA (MARA, 2024) under the MAP Act (Government of Ireland, 2024), apply at €20,000 per km² annually during development, shifting to 2 percent of gross revenue in the operational phase. Additionally, developers contribute at least €2 per MWh to the CBF, used for local infrastructure and community programs, with potential significant economic impacts. Future policies may refine these contributions and ensure equitable distribution.

5. GAS TRANSPORT IN IRELAND

Gas Networks Ireland is the state-owned company with responsibility for the operation and maintenance of Ireland's €2.8bn, 14,725 km national gas network, securely supplying more than 30 percent of Ireland's total energy, including 40 percent of all heating and almost 50 percent of the country's electricity generation.

Gas Networks Ireland anticipates that regional hydrogen demand clusters will develop in the early 2030s (Cork, Shannon, Dublin). Gas Networks Ireland will play a pivotal role in securing energy system resilience through long duration storage and/or the import and export of green hydrogen through the repurposing of one of the interconnectors with the UK. Gas Networks Ireland's distribution pipes will be capable of transporting pure hydrogen via repurposing parts of the network; the costs of repurposing natural gas pipes to transport pure hydrogen is around 10–15 percent of the cost of construction of new hydrogen networks. Their current focus is getting the existing gas network ready to accept blends of hydrogen and natural gas from the interconnector with the UK. In parallel, from 2023–2030, GNI will support the development of hydrogen clusters. From 2030 to 2035, they expect to develop hydrogen networks to link to these clusters to enable decarbonisation of gas dependent customers not in proximity to clusters. From 2035, one of the two existing gas connectors will be repurposed to enable green hydrogen export/import. While the physical connection from Ireland to Europe will be via a pipeline through the UK, this is part of the wider European Hydrogen backbone and allows for export from Ireland to European Union countries including Germany.

The European Hydrogen Backbone initiative is focussed on planning for the future development of a hydrogen market. Five large-scale hydrogen pipeline corridors are envisaged. These new corridors will initially connect domestic local hydrogen supply and demand in Europe before expanding and connecting European regions amongst each other, and then connecting neighbouring regions with hydrogen export potential. The planned Hydrogen Backbone network will largely be based on repurposing existing natural gas infrastructure. It is anticipated that by 2040, Ireland could be connected to the new European Hydrogen Backbone via a repurposed subsea pipeline to the Moffat Interconnector in Scotland.

6. CURRENT HYDROGEN PROJECTS IN IRELAND

BORD NA MONA - MOUNT LUCAS (Bord na Mona, 2024)

Bord na Móna are transforming approximately 3,000 ha of land in counties Offaly, Westmeath, and Meath into the first Bord na Móna Eco Energy Park. This sustainable development will co-locate a range of low to zero carbon energy generation assets with industrial-scale high demand energy users. The concept is designed to enhance Ireland's security of energy supply, supporting the delivery of several of the State's climate, renewable energy, and enterprise objectives. The Park will generate sufficient renewable energy to power several sectors that play an important role in Ireland's social and economic development, such as, Manufacturing, Pharmaceutical, Agrifood, ICT, Transport, Green Hydrogen derived E-Fuels and Logistics.

ENERGIA, LONG MOUNTAIN (Energia, 2024)

Energia Group is producing renewable hydrogen from wind energy at their Long Mountain Wind Farm in County Antrim. Wind energy is converted into hydrogen using an 1MW electrolyser. The hydrogen is compressed on site and transported to Belfast, where it is used to power double-decker fuel cell buses. The Long Mountain pilot project was part-funded by Interreg Northwest Europe as part of GenComm, an EU programme generating energy secure communities through smart renewable hydrogen.

ESB AGHADA

Electricity Supply Board (ESB) has secured approval for the construction of a hydrogen production facility in Aghada, Co Cork. This initiative marks a pivotal step in the ESB's broader vision to establish a »hydrogen lighthouse around Ireland.« The proposed hydrogen production facility, situated on a 0.56-hectare site within the ESB Aghada generation facility, encompasses a range of infrastructure. This includes a megawatt electrolyser, a water purification unit housed in a 40-foot container, and a stack with a height of 7.7 m above ground level. The development will also feature transformers, ground units, storage containers, compressors, and various other amenities essential for hydrogen production. The primary goal of this project is to demonstrate the production of green hydrogen using renewable energy sources. This small-scale generation project is designed to operate for five years, serving as a blueprint for the ESB's ambitious plans to establish a »hydrogen lighthouse« that displays Ireland's commitment to sustainable and innovative energy solutions.

ESB - GREEN ATLANTIC @MONEY POINT

This is a multi-billion Euro programme of significant investments on the County Clare site over the next decade, a range of renewable technologies will be deployed over the

next decade with the capacity to power 1.6 million homes. It will also become a site for the production and storage of Hydrogen, cited as the clean replacement fuel of the future which will power our buses and other heavy vehicles through our cities, contributing also to the decline in transport related CO₂ gases.

ESB - KESTREL ENERGY STORAGE PROJECT

This project is focussed on delivering large scale energy security of supply for Ireland which in turn will support the expansion of renewable energy production (wind and solar) and facilitate the development of an indigenous green hydrogen sector in Ireland in the years ahead. dCarbonX (an associate company to Snam, Europe's largest energy infrastructure operator) are partnering with ESB and Bord Gáis Energy who operate significant electrical generation capacity at their onshore Aghada and Whitegate gas-fired power stations in Cork. The integration of essential large-scale storage will support the transition of these stations to net zero emissions in the future.

GH2 - GALWAY

This hydrogen hub, known as ›GH2‹, will be used for research and development. A clean, zero-carbon fuel, green hydrogen will be produced from renewable energy and used for power generation, heavy goods vehicles in the transport sector and to help decarbonise a wide range of industries such as pharmaceuticals, electronics, and cement manufacturing. The production and supply of clean, green, hydrogen fuel for public and private vehicles. GH2 is a consortium consisting of seven members – NUI Galway, the Port of Galway, CIÉ Group and Bus Éireann, Aran Islands Ferries, Lasta Mara Teo, Aer Arann Islands and SSE Renewables. The hydrogen valley recognises the ecosystems that link hydrogen, research, production, distribution, and transport for end users as well as the challenges facing all those associated with this project.

GNI - CELTIC HYDROGEN CLUSTER

Announced in November 2023, this is being developed by Gas Networks Ireland, Irving Oil, Simply Blue Group, Port of Cork Company Ltd., ESB and Bord Gáis Energy.

INDAVER - DULEEK

Indaver has an existing Energy from Waste facility in Duleek in Meath to manage and treat non-recyclable waste since 2011. They recover materials from this waste and supply the energy generated to the national grid, creating further value from waste that would otherwise be landfilled, with a vision to further develop the decarbonisation benefits of this facility through the production of hydrogen fuel from the energy generated. Planning permission has been secured for a 10MWe Hydrogen Generation Unit (HGU).

MANNOK CEMENT - FERMANAGH

The diverse building products manufacturer located in Fermanagh is one of two companies in Northern Ireland to secure funding in a £240 million UK Government Green Energy Scheme. The funding will support Mannok as the company works towards net zero by 2050. The first phase of the programme, which the funding will support, is the generation of onsite green hydrogen (H₂), created using renewable energy, to replace the use of diesel in over 70 percent of the company's 150 heavy-goods truck fleet.

MERCURY RENEWABLES - CARROWLEAGH (Mercury Renewables, 2024)

Mercury Renewables is applying for planning permission for the construction and operation of a 13-turbine wind farm and associated site development works in Co. Mayo and a hydrogen electrolyzer plant and associated site development works in Co. Sligo. This Strategic Infrastructure Development project was submitted directly to An Bord Pleanála during July 2023.

7. CHALLENGES FACING IRELAND'S GREEN HYDROGEN SECTOR

The National Hydrogen Strategy is a positive step towards the development of hydrogen as a key pillar of a secure net zero economy which will complement Ireland's vast renewable energy resources. Given the early stage that the sector finds itself, key public and private stakeholders are refraining from making statements or predictions about costs, timelines and volumes of green hydrogen that will be available for export. The energy sector is focused on what needs to be achieved in the short to medium term to produce and export hydrogen in the medium to long term. The enabling works for green hydrogen production is a subset of the wider need for Ireland's overall energy transition and includes port infrastructure for offshore wind projects, build of the electricity grid and creation of dedicated hydrogen pipelines.

Additionally, there are challenges to overcome to make hydrogen a viable and competitive option in the energy market. Ireland can look at best practices and lessons learned from other countries that have advanced their hydrogen agendas and supported their hydrogen industries. For example, Germany, France, The Netherlands, and UK have all adopted national hydrogen strategies underpinned by concrete targets, measures, and funding mechanisms for scaling up hydrogen production and consumption. These include

- A funding scheme to bridge the cost gap between fossil fuels and low-carbon alternatives such as hydrogen;
- Incentives for investment in large infrastructural projects such as hydrogen clusters, leveraging EU schemes that can facilitate access to public funding and state aid, as well as foster cross-border

- collaboration and innovation; and
- Commercial frameworks and supports that incentivise existing and new thermal power plants to transition away from fossil fuels.
- Education and Workforce Development Programs: Develop training and educational programs to build a skilled workforce for hydrogen production, distribution, and maintenance.
- Regulatory and Policy Support for Market Creation: Introduce regulations to foster a hydrogen market, setting usage standards in transportation and industries, and mandating hydrogen

8. GREEN HYDROGEN AND SOCIAL JUSTICE

RENEWABLE ENERGY SKILLS GAP

Ireland's energy transition will require a tripling of full-time equivalent employees working in this sector to 9000 by 2030 (Expert Group on Future Skills Needs, 2021). This is at a time when Ireland is at full employment (Central Statistics Office, 2023) with many employers are experiencing difficulty in attracting and retaining staff. Given the large-scale nature of the infrastructure proposed, ORE companies will seek to fill many technical positions for which there is limited supply due in part, to lack of diversity in the sector. There is a wider societal problem in that 39 percent of women and 40 percent from lower socioeconomic groups view engineering as a career not suitable for people like them (Engineers Ireland, 2024) and a recent survey showing 52 percent of respondents did not know what training or skills they might need to join the sector (Bradley, 2024).

PUBLIC SUPPORT FOR CLIMATE POLICY

A large majority (79 percent) of Irish People say that climate change should be either a »very high« or »high« priority for Government (EPA, 2023). Opposition to climate policies does not appear to be reflective of climate denial, underlying concerns, or suspicions around climate change, rather it is related to local issues and concerns. However, there remains a sense that people in other countries and in the future will be more impacted than Irish people in the here and now. As such, the success of Ireland's green hydrogen sector will require additional drivers that complement climate action to ensure social licence. This is encapsulated in Ireland Offshore wind Industrial Strategy. It aims to build a successful, vibrant and impactful offshore wind energy industry in Ireland, ensuring that the sector creates as much value as possible for Ireland and maximises the economic benefits associated with government ambitions to deliver its 2030, 2040, and 2050 offshore wind targets. (DETE, 2024)

INTERSECTIONAL FEMINIST CLIMATE JUSTICE PERSPECTIVE

The vision for feminist climate justice is a of a world in which everyone can enjoy the full range of human rights,

free from discrimination, and flourish on a planter that is healthy and sustainable (UN Women, 2023). In 2023, the National Women's Council (NWC) and Community Work Ireland (CWI) Feminist communities for Climate Justic Project (FCCJ) carried out a baseline review to establish the current position of Irish environmental and climate policy and its impact on women and marginalised communities in Ireland. It describes climate injustice as »another layer to the injustices already experienced by people who may be economically, socially and politically marginalised, thus perpetuating and exacerbating existing inequalities and marginalisation« (NWC/CWI, 2024). It finds that Irelands approach to just transition policy is narrow in scope and does not adequately address the multi dimensions of climate justice as it focuses heavily on how transitioning from a carbon intensive economy to a carbon neutral economy impacts male-dominated industries without acknowledging existing gender-related inequalities within such industries.

Armed with this knowledge it is important that Ireland's green hydrogen economy takes account of existing gaps and international best practice to ensure this new sector creates an opportunity to fairly include women and marginalised groups in responding to climate justice and in climate policy decision making, in line with both the UN Women recommendations and the Nordic Council of Ministers' explicit commitment to feminist climate justice action for example. Participation based on diversity and inclusion, and the production of knowledge to inform and progress gender proofing and gender mainstreaming are crucial policy actions and could significantly progress intersectional feminist climate justice in Ireland from its current almost absent baseline.

9. IRELAND AND GERMANY

Green Hydrogen will play a key role in ensuring the transformation to a climate-neutral economy for Europe. Germany is a net importer of energy and will remain so for the foreseeable future. The country's hydrogen strategy estimates that by 2030 only 20 percent – 30 percent of hydrogen will be produced domestically. Green hydrogen demand in the EU and Germany is projected to exceed domestic production capacities. In 2050, Germany is likely to consume an estimated 400 to 800 TWh of hydrogen and synthesis products (Agora Energiewende and Wuppertal Insititute, 2021). This amounts to two to four times the current renewable energy generation in Germany, which stood at 254 TWh in 2022 (Office of the Working Group on Renewable Energy Statistics (AGEE-Stat) at the Federal Environment Agency, 2023).

Due to its huge wind capacities, Ireland has great potential to produce renewable electricity, which in the long term will exceed its own requirements and Ireland's hydrogen strategy includes targeted government support for export of products from wind energy. Ireland's green hydrogen will play a role in decarbonising hard to abate sectors such as transport and dispatchable electricity generation, however there is limited heavy industry demand for hydrogen.

As such, there is a natural fit for Ireland and Germany to collaborate on green hydrogen.

JOINT DECLARATION OF INTENT

A Joint Declaration of Intent on cooperation in the field of green hydrogen was signed on 31 May 2023 between the Ireland’s Minister for the Environment, Climate and Communications, Eamon Ryan, and the German Federal Research Ministry (DECC, 2023). It formalised cooperation in respect of green hydrogen between Ireland and Germany enable it to grow in the coming years. The Joint Declaration of Intent emphasises the willingness of both states to initiate their cooperation on research and development in the fields of production, storage, transport, and use of green hydrogen including its derivatives. The key points of the Declaration are:

- To explore the establishment of a joint pilot project on a potential Green Hydrogen cross-border value chain in Ireland and Germany
- To cooperate with other European countries within the Strategic Research and Innovation Agenda on Green Hydrogen
- To carry out the cooperative activities subject to the availability of funds.

Between May 2023 and April 2024, the Department of Environment, Climate and Communications (DECC) and the German Federal Research have met typically on a bi-monthly basis to progress these ambitions. (Government of Ireland, 2024). A short list of potential candidate projects which could meet the objects of this agreement are being developed. DECC are planning to establish an early hydrogen innovation fund as set out in Action #2 of the National Hydrogen Strategy and it is envisioned that this fund could be used to support a joint pilot project in line with the ambitions of the Declaration of Intent.

OPPORTUNITIES FOR COLLABORATION

German industry has emphasized sustainability, positioning hydrogen as a key component in decarbonizing various sectors. Central to this initiative, Germany has developed innovative, adaptable solutions for the effective production, transport, and utilization of green hydrogen. German companies are eager to collaborate with Irish counterparts, sharing expertise, products, and solutions to address challenges in Ireland’s local communities and industries. Additionally, Germany’s significant investments in wind energy technologies have bolstered its capacity to scale up green hydrogen production, potentially accelerating wind generation development in Ireland.

Crucial technology partnerships between German and Irish industries aim to align efforts in the hydrogen sector. These partnerships are vital for unlocking hydrogen export opportunities for Ireland, requiring clear communication about Germany’s long-term demand and offtake capacity for Irish-produced green hydrogen. A well-defined market route and comprehensive pricing strategies will provide

Irish developers with the confidence to invest in hydrogen infrastructure, knowing there is sustained demand from a key EU partner.

In the short term, reassuring Irish developers about Germany’s interest in green hydrogen is crucial, as is informing German off takers about Ireland’s potential supply. Regular discussions and ongoing exchanges between German and Irish partners are essential. Over the medium term, purchase obligations and commitments will be necessary to build confidence and facilitate effective project development. Ultimately, fostering strong relationships and enabling bilateral exchange is key to developing a sustainable and long-standing hydrogen partnership between Germany and Ireland.

To truly leverage the enormous potential of Irish green hydrogen for Germany’s industry, it is essential to rapidly link Ireland’s capabilities with Germany’s need for green hydrogen to achieve carbon neutrality by 2045. This requires a clear and transparent political framework in Ireland, which is supported by innovative projects like those at the maritime regulatory authority, and a mutual understanding of the financial and infrastructural investments needed, such as in offshore wind parks and pipeline networks. This bilateral cooperation can accelerate the EU’s energy transition, enhancing European energy security and contributing to the overall goal of producing significant quantities of green hydrogen within the EU by 2030.

10. CONCLUSIONS

- Ireland is committed to the creation of a green hydrogen economy.
- Renewable hydrogen produced from curtailed grid electricity or onshore renewables will be available for local use during this decade with 2 GW of green hydrogen production from offshore wind between 2030 and 2045. As such, Ireland’s Offshore Renewable Energy industry is key to the creation of Ireland’s green hydrogen economy.
- Ireland’s integrated policies are aligned for the export of green hydrogen in the 2030s. The National Hydrogen Strategy lists export as a small number of niche applications between 2033 and 2038 and large-scale deployment between 2038 and 2050; Gas Networks Ireland proposed the repurposing of an existing gas interconnect to enable green hydrogen export between 2035 and 2040.
- Use the existing gas network to transport hydrogen in line with EHB initiative will decrease costs and avoid stranded assets resulting in a more just transition and allow optimisation and full potential of renewable electricity generation.
- To ensure social licence and protect citizens, it is im-

portant that renewable energy is progressed through an economic lens as well as a climate action one. Ireland's powering prosperity doc is key to this and value for money should be at the heart of decision making.

- While existing government policy does not sufficiently address the intersection between gender equity and climate action, the green hydrogen sector offers opportunity to embed diversity of decision making in new sector.
- Strategic Partnerships Enhance Market Opportunities: The collaboration between Ireland and Germany can serve as a model for developing a robust hydrogen market, leveraging German demand and Irish supply. Such strategic partnerships are crucial for Ireland to position itself as a leading exporter of green hydrogen, tapping into existing and emerging markets within the EU and beyond.
- Investment in Infrastructure is Critical for Scalability: For Ireland to meet its green hydrogen production goals and export ambitions, significant investment in infrastructure is essential. This includes the development of offshore wind farms, enhancement of port facilities, and expansion of pipeline networks. These investments will not only support the scale-up of hydrogen production but also ensure the long-term sustainability and economic viability of Ireland's green hydrogen sector.

11. RECOMMENDATIONS

11.1 Addressing skills gap can be a springboard for a just transition.

By addressing the skills gaps in the Offshore Renewable Energy sector in a way that embeds gender equity and socio-economic balance, Ireland can not only achieve its ambitious climate targets, but it can change social justice for generations to come. As the Green Hydrogen economic opportunity is a new sector, it gives a chance to embed female climate justice in a way that was previously neglected (NWC/CWI, 2024). To achieve this, the Department of Trade, Enterprise, and Employment should engage with the Federal Ministry for Economic Affairs and Climate Action funded Women in Green Hydrogen organisation. This network of passionate women working in the green hydrogen sector are increasing the visibility and amplifying the voices of women working in green hydrogen. (WiGH, 2024). In addition, the recommendations outlined by Wind Energy Ireland in their recent skills report (WEI, 2024) should be actioned without delay, namely established a skills development fund, build industry and market confidence, ensure offshore specialisms are covered in public education and private training providers, and advertise offshore wind as an attractive industry. Moreover, such action should be cognizant of gender specific data available in reports such as the 2023 Survey of Female Students Attitudes to STEM

(I Wish, 2024) and to engineering (Engineers Ireland, 2024) Suggested actions include

JOINT VOCATIONAL TRAINING AND CERTIFICATION PROGRAMS

Establish joint vocational training centres in both Germany and Ireland dedicated to training a diverse workforce for the green hydrogen industry. By offering scholarships or incentives for underrepresented groups, including women, these programs aim to fill the skills gap while promoting gender equality and social inclusion in a burgeoning sector.

BILATERAL RESEARCH INITIATIVES WITH DIVERSE LEADERSHIP

Initiate bilateral research programs funded by both governments, which mandate diverse leadership and focus on projects that integrate gender and socio-economic considerations. Such initiatives not only promote inclusive research practices but also ensure that the advancements in green hydrogen technologies are accessible and beneficial to a wider array of communities.

CROSS-CULTURAL INNOVATION HUBS

Set up cross-cultural innovation hubs in Ireland and Germany to foster collaboration among entrepreneurs from diverse backgrounds, focusing specifically on developing green hydrogen applications tailored to community needs. These hubs are designed to be incubators for socio-economic development and empowerment, particularly encouraging participation from women entrepreneurs and promoting economic equality.

PUBLIC AWARENESS AND ENGAGEMENT CAMPAIGNS

Launch comprehensive public engagement campaigns in both countries to educate the populace about the benefits of green hydrogen and promote STEM education among young women and socio-economically disadvantaged youths. By boosting awareness and interest in sustainable technologies from an early age, these campaigns aim to cultivate a diverse talent pipeline and ensure broad public support for green initiatives.

GENDER-FOCUSED IMPACT INVESTMENT FUNDS

Create impact investment funds that prioritize investments in startups and companies within the green hydrogen sector that are either led by women or demonstrate a strong commitment to socio-economic impact. This strategy not only provides essential funding but also incentivizes companies to embed gender equality and socio-economic development into their core business strategies, fostering a more inclusive and equitable industry.

11.2 Ensuring value for money in renewable energy projects protects citizens.

Given the costs associated with critical energy infrastructure, it is important that value for money is achieved by the Irish Government. For example, National electricity grid operator EirGrid will have to finance about €5 billion worth of infrastructure needed to get the electricity generated offshore to customers, including green hydrogen producers (CRU, 2024). At a time when 71 percent of Irish consumers are using less fuel in their homes (Ipsos B&A, 2024) the increase to customers through their public service levy or network charge will be keenly felt and as such value for money must be achieved. Repurposing Gas Network Ireland's distribution pipes to transport pure hydrogen is estimated to save 85–90 percent the cost of construction of new hydrogen networks for example.

Public private partnerships are a method of procuring public services and infrastructure by combining the best of the public and private sectors with an emphasis on value for money and delivering quality public services. A key benefit of Public-Private Partnerships (PPPs) highlighted by experts is their ability to fast-track infrastructure development during economic downturns or budget constraints. By funding projects off-balance sheet, PPPs allow for multiple large-scale initiatives to progress simultaneously, despite fiscal limitations. They enable the spreading of capital costs over an extended period. Additionally, PPPs capitalize on the private sector's innovation, management skills, and efficiencies. They also strategically allocate risks, link payments to sustained performance and maintenance standards, and ensure the asset is returned in good condition with a guaranteed residual life at the contract's conclusion. (DPER, 2018).

Given the timeframe associated with offshore renewable energy projects and the cyclical nature of economies, this could protect end customers while also providing the stability the emerging sector needs to achieve Climate Action Plan targets. Further actions to reduce financial risks for government are outlined below.

FINANCIAL INSTRUMENTS AND MODELS

By diversifying and securing funding through various channels and safeguards, financial exposure and risk can be addressed making projects more appealing to both investors and governments. Consideration should be given to

- Green Bonds and Climate Bonds – these attract investment by assuring that funds are used for sustainable projects, effectively lowering the cost of capital, and broadening the investor base;
- Hybrid Financing Models – combining different types of financing (grants, loans, equity) diversifies funding sources and reduces reliance on any single source, thus spreading the risk; and
- Escrow accounts and Reserve Funds – to provide a financial buffer to manage revenue flows and unforeseen costs to enhance the financial stability of projects.

RISK MANAGEMENT AND MITIGATION

By mitigating various risks around financial, operational, and regulatory risks, projects can increase stability, reliability and adherence to outcomes making these projects more secure from a financial perspective such as

- Guarantees and insurance mechanisms to reduce the perceived risk for investors and lenders to make projects more financially viable.
- Performance based contracts, whereby payments are linked to performance and ensuring private entities meet their obligations which in turn reduces operational and performance risks.
- Regulatory frameworks where clear regulations decrease policy related uncertainties which can significantly impact long term infrastructure investments.

VALUE OPTIMIZATION AND STAKEHOLDER ENGAGEMENT

To ensure the value and sustainability of projects, it is important to address the qualitative aspects to ensure projects meet their long-term goals and maintain public support. This can be enabled through.

- Stakeholder engagement plans ensuring early and continuous engagement to foresee and manage social and environmental risks, which can affect project timelines and costs;
- Technological agnosticism in contract will allow for future technological updates without renegotiation meaning contracts can adapt to innovations in this fast-moving sector which enhances the projects long term value; and
- Value for money frameworks will ensure that PPPs offer better value than traditional public procurement through comprehensive cost assessments to help justify and sustain investment.

11.3 Build on 2023 Declaration of Intent for ongoing collaboration.

Ireland has vast potential for renewable energy, especially offshore wind generated electricity, which exceeds its own need and could provide a valuable export opportunity through production of green hydrogen. Germany has advanced engineering and technological capabilities as well as a future need for importation of green hydrogen. Both countries are looking to reduce their dependence on imported fossil fuels, with green hydrogen provided a clean alternative. Collaboration with Germany across the value chain would allow Ireland to pool resources, share risks and benefits, and enhance energy security. Joint ventures between Ireland and Germany could help both countries achieve their ambitious decarbonisation goals in sectors such as heavy industry and transport. It also allows for economic opportunities, policy and regulation harmonization

and export opportunities. A green hydrogen partnership could acceleration innovation, reduce costs through shared investment, create a resilient green hydrogen supply chain to support both countries and the broader European Union. Such a joint venture should take cognizance of the following.

EQUITY IN TECHNOLOGY AND KNOWLEDGE TRANSFER:

Given the emphasis on German expertise in sustainability and hydrogen technologies, joint ventures should explicitly include frameworks for equitable technology and knowledge transfer so that the Irish companies and workforce can access and co-develop technologies alongside German partners. They could highlight training exchanges or joint research initiatives that foster a bilateral upskilling of the workforce in both countries, particularly focusing on inclusive opportunities for underrepresented groups in the tech sector.

LOCALIZED INVESTMENT PLANS:

Such joint ventures should outline a strategic plan where investments are not only concentrated in infrastructure but also in developing the local economies of both Ireland and Germany. For instance, the construction of hydrogen facilities could prioritize local supply chain. Furthermore, part of the revenue generated could fund community projects, such as improving local educational facilities or developing public amenities that improve quality of life, ensuring that the benefits of foreign investment are tangibly felt by local communities.

CLEAR, FAIR TRADE AND PRICING AGREEMENTS:

Joint ventures could describe the establishment of transparent and fair-trade agreements that define clear pricing strategies and market routes for the hydrogen produced. This could include long-term purchase commitments that provide stable and predictable revenue streams for Irish hydrogen producers, ensuring that the economic benefits are sustained and equitable. These agreements should be crafted to avoid exploitative conditions and ensure mutual benefits for both parties.

STAKEHOLDER AND COMMUNITY ENGAGEMENT FRAMEWORKS:

Any agreement should emphasize a continuous and structured engagement process with stakeholders, including local communities, industry experts, and regulatory bodies to ensure that any project addresses local concerns, incorporates community feedback, and is aligned with local and national socio-economic goals.

SUSTAINABILITY AND ENVIRONMENTAL EQUITY MEASURES:

Agreements should incorporate specific sustainability measures that ensure environmental benefits are equitably shared.

This might involve setting up environmental monitoring stations jointly managed by Irish and German teams to continuously assess the impact of hydrogen production and use. Initiatives could also include community-based projects that focus on enhancing local biodiversity, promoting environmental education, and ensuring that green hydrogen production contributes positively to local ecosystems.

In 2023, a strong first step was made through the signing of the Declaration of Intent between Ireland's Minister for the Environment, Climate and Communications, Eamon Ryan, and the German Federal Research Ministry, it is important for the proposed actions to be progressed at pace.

WORKS CITED

- Agora Energiewende and Wuppertal Insititute** (2021): s.l.: s.n.
- Bord na Mona** (2024): Bord na mona Energy Park. [Online] Available at: <https://bnmenergypark.ie/> [Accessed 13 05 2024].
- Bradley, K.** (2024): How to attract people into working on climate, San Francisco: Work in Climate.
- Central Statistics Office** (2023): Labour Force Survey Quarter 4 2023, Cork: Central Statistics Office.
- Cork Chamber** (2023): Quarterly Economic Treands Survey. [Online] Available at: <https://www.corkchamber.ie/quarterly-economic-trends/> [Accessed 26 03 2024].
- CRU** (2024): Price Review Six Strategy Paper, Dublin: Commission for Regulation of Utilities.
- DECC** (2023): Department of the Environment, Climate and Communication: National Hydrogen Strategy. [Online] Available at: <https://www.gov.ie/pdf/?file=https://assets.gov.ie/263248/f982c10f-eca6-4092-a305-90000e5213ed.pdf#page=null> [Accessed 23 04 2024].
- (2023): Joint Declaration of Intent on cooperation in the field of green hydrogen between Ireland and Germany. [Online] Available at: <https://www.gov.ie/en/publication/29fa0-joint-declaration-of-intent-on-cooperation-in-the-field-of-green-hydrogen-between-ireland-and-germany/> [Accessed 23 04 2024].
- (2024): Future Framework for Offshore Renewable Energy. [Online] Available at: <https://www.gov.ie/en/publication/0566b-future-framework-for-offshore-renewable-energy/> [Accessed 10 05 2024].
- DETE** (2024): Powering Prosperity - Ireland's Offshore Wind Industrial Strategy, Dublin: Department of Trade, Enterprise and Employment.
- DPER** (2018): Report of the Inter-Departmental/Agency Group on Public Private Partnerships, Dublin: Department of Public Expenditure and Reform.
- EHB** (2024): The European Hydrogen Backbone (EHB) initiative. [Online] Available at: <https://www.ehb.eu/> [Accessed 26 04 2024].
- Energia** (2024): Green Hydrogen Production and potential. [Online] Available at: <https://energiagroup.com/renewables/green-hydrogen/> [Accessed 13 05 2024].
- Engineers Ireland** (2024): Women significantly less likely than men to view engineering as a career. [Online] Available at: <https://www.engineersireland.ie/News/women-significantly-less-likely-than-men-to-view-engineering-as-a-suitable-career-stem-forum-hears> [Accessed 29 03 2024].
- Environmental Protection Agency** (2023): Ireland's Provisional Greenhouse Gas Emissions 1990- 2022, Dublin: s.n.
- EPA** (2023): Climate Change in the Irish Mind: Wave 1: Insight Reports No.1 & 2, Dublin: EPA.
- (2023): Ireland's Climate Chagne Assessment, Wexford: EPA.
- European Commission** (2022): European Hydrogen Bank. [Online] Available at: https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen/european-hydrogen-bank_en [Accessed 09 05 2024].
- Expert Group on Future Skills Needs** (2021): Skills for Zero Carbon – The Demand for Renewable Energy, Residential Retrofit and Electrical Vehicle Deployment Skills to 2030, Dublin: Department of Enterprise, Trade and Employment.
- Government of Ireland** (2021): Ireland's Climate Action and Low Carbon Development (Amendment) Act 2021. Dublin: Government of Ireland.
- (2023): Climate Action Plan 2024, Dublin: s.n.
- (2024): Maritime Area Planning Act 2021. [Online] Available at: <https://www.irishstatutebook.ie/eli/2021/act/50/enacted/en/print.html> [Accessed 10 05 2024].
- (2024): Renewable Energy Generation Dail Eireann Debate. [Online] Available at: https://www.oireachtas.ie/en/debates/question/2024-04-30/165/#pq_165 [Accessed 09 05 2024].
- Hanley, E. e. a.** (2018): The role of hydrogen in low carbon energy futures – a review of existing perspectives. Renewable Sustainable Energy Review, pp. 3027-3045.
- I Wish** (2024): 2023 Survey of Female Students Attitudes to STEM, Dublin: I Wish.
- IEA** (2023): International Energy Agency. [Online] Available at: <https://www.iea.org/countries/ireland/electricity#how-is-electricity-used-in-ireland> [Accessed 10 06 2024].
- Ipsos B&A** (2024): Sign of the Times Survey, Dublin: The Irish Times. MARA, 2024. Maritime Area Regulatory Authority. [Online] Available at: <https://www.maritimeregulator.ie/> [Accessed 10 05 2024].
- Mercury Renewables** (2024): Firlough Wind Farm Planning. [Online] Available at: <https://firloughwindfarmplanning.com/> [Accessed 10 05 2024].
- NWC/CWI** (2024): Feminist Climate Justice Report, Dublin: s.n.
- Office of the Working Group on Renewable Energy Statistics** (AGEE-Stat) at the Federal Environment Agency (2023): Renewable Energy in Germany 2022 Data on the development in 2022, s.l.: Federal Environment Agency.
- Rabiee, A. e. a.** (2021): Technical barriers for harnessing green hydrogen: a power system perspective. Renewable Energy, Volume 163, pp. 1580-1587.
- UN Women** (2023): Progress of the World's Women – conceptualizing feminist climate justice, s.l.: UN Women.
- WEI** (2024): Building our Potential: Ireland's Offshore Wnd Skills and Talent Needs, Dublin: Wind Energy Ireland.
- WiGH** (2024): Wom in Green Hydrogen. [Online] Available at: <https://women-in-green-hydrogen.net/> [Accessed 28 04 2024].

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GREEN HYDROGEN IN IRELAND

Socio-Economic and Collaborative Prospects with Germany



Ireland aims to achieve a climate-neutral economy by 2050, with a 51 percent reduction in greenhouse gas emissions by 2030, guided by the Climate Action Plan and the National Hydrogen Strategy, creating new green jobs and economic opportunities.



The National Hydrogen Strategy outlines the development of green hydrogen from renewable electricity, with production scaling up significantly from 2033 onwards, ensuring a reliable and sustainable energy supply for Germany.



A Joint Declaration of Intent between Ireland and Germany, signed in May 2023, formalizes cooperation on green hydrogen, focusing on mutual benefits in research, development, production, storage, transport, and use of green hydrogen.



Emphasizing gender equity and socio-economic balance in the green hydrogen sector is crucial, advocating for inclusive decision-making and workforce development, ensuring that all segments of society benefit from this transition.



Collaborations between Irish and German industries are essential for developing a robust hydrogen market. Clear communication about long-term demand and pricing strategies will help Irish developers invest confidently, securing a stable energy supply for German industries.



Recommendations include establishing joint vocational training centers, bilateral research initiatives, and gender-focused impact investment funds to promote inclusive and sustainable development, ensuring that the green hydrogen sector benefits all workers.

Further information on the topic can be found here:
ireland.fes.de