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Hitachi Energy: Drive toward the electric future

Offshore windmill park in the ocean, aerial view.

Hitachi Energy is advancing a sustainable energy future for all by integrating renewable sources into the next generation of energy systems.

The significance of transportation in sustainable development was first recognised at the 1992 United Nations Earth Summit, with Agenda 21 highlighting its role. The UN General Assembly in 1997 reiterated that transportation would be a key driver in increasing energy demand. Today, it is the largest energy end-user in developed countries and the fastest growing one in developing nations.

The United Nations Framework Convention on Climate Change (UNFCCC) underscores the centrality of the transport sector in achieving the Paris Agreement goals. With transport contributing nearly a quarter of global energy-related greenhouse gas emissions, a figure

expected to rise, its role in climate change cannot be overstated.

The transition to sustainable energy is vital for environmental, economic, and social sustainability. Globally, nations are setting climate targets to address these challenges. For instance, Ireland's Climate Action Plan 2021 aims for 80 per cent renewable electricity and net-zero emissions by 2050.

Electrifying energy, transport, and infrastructure is key to meeting these goals. Renewable energy, including predictable sources like hydropower and geothermal, as well as variable ones like solar and wind, is expected to lead to a carbon-neutral future. However,



Solar power farm aerial view.

maintaining system stability is essential. This involves using existing and emerging technologies, such as battery energy storage systems (BESS), pumped hydro, and renewable hydrogen, to integrate renewables without compromising energy security.

In this context, multi-sourced electricity will become vital, powering everything from transport to industrial processes. Hitachi Energy is playing a pivotal role in this transformation.

In Ireland, the company offers innovative solutions across the electrification value chain to various sectors, including utilities, industry, transport, and infrastructure.

Hitachi Energy enables its customers' success – from clean energy generation to network infrastructure and electrification of end-use sectors.

As renewables replace fossil fuels, Hitachi Energy helps power systems remain resilient and adapt to fast-changing demands, with as little disruption as possible.

Hitachi Energy offers its customers industry-leading expertise spanning the full range of renewable energy project challenges, including:

- financial services;
- consulting services;
- front-end engineering and design (FEED) solutions, development, construction, operations, and maintenance;
- service and digital transformation support; and
- energy and renewable energy certificates, trading, and risk management.

As the energy system undergoes a comprehensive transformation, Hitachi Energy's expertise becomes increasingly crucial. The company aids in integrating renewables into the power grid, ensuring its resilience and adaptability to rapid changes.

Hitachi Energy's offerings include financial and consulting services, FEED, development, construction, operations, maintenance, digital transformation support, and energy trading and risk

management. Its comprehensive approach makes it well-equipped for renewable energy projects.

With over a century of experience in rail and urban transportation, Hitachi Energy continues to innovate in electrification and digitalisation, supporting transport operators in their shift to sustainable options. As urbanisation increases and the push for reduced CO₂ emissions intensifies, the need for sustainable mobility solutions grows. Hitachi Energy's Grid-eMotion®¹ Fleet offers efficient charging solutions for large electric fleets, complemented by digital asset and energy management.

A recent collaboration with Bus Éireann exemplifies this. Hitachi Energy Ireland is electrifying the Roxboro depot, involving the installation of a new medium voltage electricity substation, 24 charging points, and all necessary civil and cabling works. Funded by the National Transport Authority, this project marks a significant step in transforming Ireland's urban bus fleets towards zero tailpipe emissions.

In summary, Hitachi Energy is leading the way to an electric future, offering cutting-edge, secure solutions for integrating renewables and electrifying transport, thereby playing a key role in the global shift towards sustainable energy.

For further information visit
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1. Grid-eMotion® Fleet is an EV fleet charging solution suitably designed to offer the flexibility of connection to the utility grid and ensure compliance with power quality requirements. Chargers are available from 50 to 600kW power, combined in cabinets to facilitate maintenance. Charging points are designed to ensure full interoperability with current and future EV fleets charged in DC via plug or pantograph.



Energy security in an all-Island context

Brian Ó Gallachóir, Associate Vice-President for Sustainability at University College Cork (UCC), assesses whether worrying electricity generation inadequacy necessitates an all-island focus on energy security.

Ó Gallachóir heralds the development of the all-island Single Electricity Market (SEM) as one of the “hidden giants” of greater all-island cooperation, 25 years after the signing of the Good Friday Agreement.

In 1995, the North South Electricity Interconnector was restored after almost 20 years of inaction and since then several significant electricity and gas infrastructure projects have been developed on the island, ranging from the commissioning of the Moyle electricity interconnector to Scotland in 2021 to the approval in 2018 of a second North South Interconnector.

While benefits to consumers have been evident in the delivery of cost reductions per kWh, the all-island market has also been critical to providing timely warnings on supply

risks via generation system adequacy reports.

“These reports significantly helped enable us to look at the challenge of meeting our electricity demands through electricity supply on an all-island basis in an efficient and cheaper way,” explains the Cork-based academic.

“That focus on efficiency leads to emissions reduction relative to what otherwise would have ensued. Similarly, efficiencies also lead to price reductions, relative to if these markets had continued to evolve separately.”

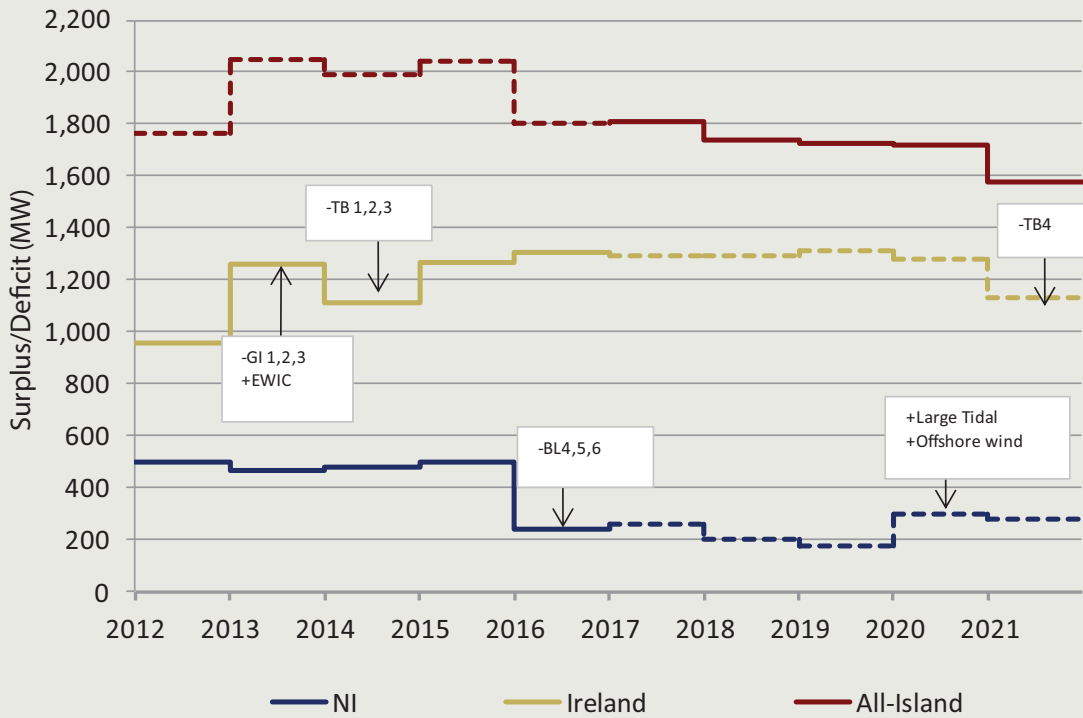
Significant infrastructure developments in the all-island electricity and gas networks have provided a high degree of reliability. *The Generation System Adequacy* report for 2012-2021 (Figure

1) shows large levels of surplus electricity on an all-island basis. However, the report also indicates tight margins for the North from 2016 onwards, providing an impetus to build and plan for the second interconnector.

“The signal at that time was important in terms of flagging what might be important,” says Ó Gallachóir, adding: “Rolling forward to 2017, we saw even starker warnings of the situation, but this time in both jurisdictions. This foresight has been very important in terms of informing the policymakers, the regulators, and the industry of the challenges ahead.”

In the past five years, energy policy developments have been significant. The transition of the SEM to the I-SEM as part of the European electricity market developments in 2018 was

Figure 1: Generation System Adequacy 2012-2021



Source: EirGrid All-Island Generation Capacity Statement 2012-2021

impacted by Brexit and in the last three years there have been strong policy developments relating to supply security, but also in terms of the energy transition to a low carbon future.

Both jurisdictions on the island share a number of ambitions in relation to net zero by 2050, including the target of an 80 per cent renewable energy share of electricity generation by 2030.

Key to achieving this ambition will be the increased focus on interconnection. The Greenlink Interconnector between County Wexford and Pembrokeshire, Wales is currently under construction with a commission date of 2024. The second North South Interconnector continues to face challenges but has a target commissioning date of 2026. Additionally, the Celtic Interconnector linking Ireland to continental Europe via France is set for commission in 2027, while the Lir Interconnector, connecting the North and Scotland, should be active by 2029.

One of the key achievements of the SEM has been the levels of variable, non-synchronous renewable electricity that has been integrated onto the all-

island electricity network, which at times has breached 75 per cent. Ó Gallachóir explains that absorbing such levels of renewable generation on a small power system is “world-leading”, but points out that wind variability does mean there are instances when the share of wind-generated renewable electricity is low.

Security of supply

Highlighting the role of natural gas in providing energy security, the Associate Vice-President of Sustainability at UCC points to a period in early January 2021 of low winds and cold weather where the power system on the island compensated for the low levels of wind with increases in natural gas power.

“The level of flexibility and agility that our system has developed in order to deliver the growing amounts of wind energy that we have on the all-island system is another key feature that is sometimes hidden in our electricity supply mix,” he explains.

“It is important that we can maintain this going forward but it requires significant changes to electricity

markets. There is a need to focus not just on the energy payments associated with the market make-up, but also the system services and capacity payments.”

Highlighting that auctions have not always delivered as much capacity remuneration contracts as required, which requires policymakers to rethink market support for new back-up generation capacity, he adds: “We have the theories in terms of how to support and remunerate for capacity, but unfortunately, we have not sufficiently delivered and this is why we have this short-term adequacy challenge.”

More challenging, Ó Gallachóir suggests, is the fact that many of the capacity remuneration contracts for additional gas-fired power plant which have been awarded, have not delivered on the amount of generation initially pledged that is required to be available at times of low wind speed.

This has led to a situation where in winter 2023/2024, the loss of load expectation is 21 hours. While this is less than the 50 hours recorded in winter 2022/2023, it is still well above

Electricity and gas infrastructure on the island of Ireland

- **1970:** North-South Electricity Interconnector built
- **1975:** North-South Electricity Interconnector retired for 20 years
- **1995:** North-South Electricity Interconnector restored
- **1996:** Scottish Northern Ireland Gas Pipeline (SNIP) commissioned
- **2001:** Moyle electricity interconnector to Scotland commissioned
- **2002:** Second gas pipeline built (Ireland-Scotland)
- **2006:** SNP (South North Gas Pipeline) built
- **2012:** East-west (500 MW) electricity interconnector commissioned
- **2018:** Second North South Interconnector approved
- **2022:** Celtic (Ireland-France) electricity interconnector approved



the guideline of eight hours at most.

Ó Gallachóir explains that blackouts and brownouts have been avoided because of policy decision to extend older power plants that were scheduled to retire, and the procurement of temporary emergency electricity generation, which is more expensive, more carbon intensive, and does not represent a long-term solution to the challenge. Temporary electricity generation is in the main fuelled by natural gas.

Russia's invasion of Ukraine and the subsequent price hikes of imported natural gas shone a focus on Ireland's reliance on fossil fuels to ensure energy security.

Although Ireland was relatively insulated from the physical risk to security of supply because of gas interconnections to Britain and a low Russian dependence, it is an outlier in the absence of gas storage.

Progress is, however, being made. The

Government recently published an Energy Security Strategy, while in the North, the first caverns of the Islandmagee (County Antrim) natural gas storage facility are expected to be operational by 2026.

However, Ó Gallachóir says that in the context of progress of the all-island electricity market, the question has now been raised as to whether storage at an all-island level for gas should be considered.

Concluding, the academic raises some concern that the SEM and the benefits of an all-island approach – not least improved energy security – are underappreciated.

In the context of an ongoing demerger between EirGrid, the national electricity grid operator, and the System Operator for Northern Ireland (SONI), he says: "I would hope that as we move forward, we refocus our efforts on ensuring we look at energy security, not just through the lens of each jurisdiction, but on an all-island basis."

ORESS 2.1: Ireland's south coast

Up to 900MW of renewable electricity is set to be secured in 2025 under a new plan for offshore wind development off Ireland's south coast.

The Government has published an indicative roadmap for the State's next offshore wind auction, which will be named ORESS 2.1.

ORESS 1 took place in May 2023, marking a milestone for the country's offshore wind market, and awarded roughly 3GW of offshore wind generation capacity.

The Government aims to generate 5GW of renewable electricity from offshore by 2030, rising to 20GW by 2040. ORESS 1 awarded licenses to two projects off the east coast (2.6GW) and one off the

west coast (450MW). ORESS 2.1 will take place off Ireland's south coast and will procure up to 900MW of offshore wind.

ORESS 1 secured an average price of €86.05/MWh, one of the lowest prices paid by an emerging offshore wind market in the world.

The publication of the indicative roadmap contributes to the publication by the North Seas Energy Cooperation (NSEC), of which Ireland is a member, of its long-term plans towards the development of offshore wind up to 2040.

All nine NSEC member states put forward their indicative auction timelines for offshore wind auctions to 2030,

including their potential construction window up to 2040.

In 2022, during Ireland's co-presidency, ministers of all nine NSEC member states agreed to reach at least 260GW of offshore wind energy by 2050, which represents more than 85 per cent of the EU-wide ambition of reaching 300GW by 2050. Intermediate targets for NSEC include at least 76GW by 2030 and 193GW by 2040.

Ireland's indicative roadmap sets out a number of steps towards ORESS 2.1, modelled on different scenarios, including whether a draft Designated Maritime Area Plan (DMAP), for marine waters off the south coast, is published before or after summer 2023, and whether any decision is judicially reviewed.

The indicative timeline begins in March 2024, with the potential publication of the draft South Coast DMAP and licenses for generation are expected to be awarded between February and October 2025.

Commenting on the publication, Minister for the Environment, Climate and Communications Eamon Ryan TD, says: "The success of Ireland's first offshore wind auction earlier this year highlighted Ireland's enormous potential in offshore wind. ORESS 2.1 will be another important milestone towards the delivery of our offshore wind ambitions and to reach our climate targets.

"Our ambitions in the area will be further supported by the publication next year of Ireland's Industrial Strategy for Offshore Wind by the Department of Enterprise, Trade and Employment, and the Future Framework for post-2030 Offshore Wind, by the Department of Environment, Climate and Communications."

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European electricity market reform

As the European Union seeks to reform the electricity market, Eurelectric's Savannah Altvater discusses the critical components she believes must underpin market design fit for net zero.

Eurelectric believes that electricity market reform must be underpinned by three critical components in the shape of ensuring consumer choice; diversifying long-term instruments; and delivering manageable financial rules.

Eurelectric is an EU-level trade association representing over 3,500 utilities across 31 countries and is currently involved in lobbying the European co-legislators to help shape reform proposals currently under negotiation.

Reform of the electricity market is the EU's long-term response to the energy crisis experienced in 2022 and amends electricity regulations and directives set out in 2018 and 2019.

Implementation of the Clean Energy Package, finalised in 2019, was severely disrupted by the Covid-19 pandemic and price spikes in the gas market as a result of the Russian invasion of Ukraine. This led to a recognition that not enough implementation of the existing market reform had taken place to protect consumers from volatility in the market.

“Unexpectedly higher bills, supplier failures, and supplier inability to offer competitive fixed contracts left consumers in a tight spot,” explains Altvater.

The EU’s marginal price structure means that the most expensive technology sets the price. Electricity prices tracked gas price spikes and short-term markets were exposed to extreme price fluctuations, particularly for imported fossil fuels.

Altvater explains that the situation exposed the need for liquidity in forward markets to guard against these massive market fluctuations and hedge against spot market fluctuations.

In response to the energy crisis, member states delivered a diversity of emergency measures ranging from clawback mechanisms to price caps. As well as fragmenting the internal market and ultimately increasing prices for the consumer, Altvater believes that these measures breached investors’ confidence and created real disincentives for investment.

“Inframarginal price caps failed to deliver expected revenue in member states and hindered the market,” she explains, highlighting a 53 per cent decrease in the Iberian forward market between 2021 and 2022, as well as a 75 per cent drop in the signing of utility power purchase agreements (PPAs).

Altvater believes that a central component of ensuring market design is fit for the energy transition is increasing consumer choice to shield against excessive volatility.

“Rather than seeking to decouple gas and electricity, a structural reform should provide customers with a better choice of products,” she states.

Giving consumers better access to long-term pricing and supply offers, enabling them to decide on their exposure to spot prices, can be done by removing existing barriers to long-term contracts, promoting the standardisation and transparency of PPAs, and reducing credit risk on those PPAs, Altvater says.

To guard against the privatisation of profits but socialisation of losses, Eurelectric advocates for more stringent financial robustness checks to ensure only reliable retailers remain on the market.

To this end, Altvater says that Eurelectric is opposed to the Commission’s proposal for obligatory hedging requirements to be in place.

“The challenge with obligatory hedging requirements is you can lock in high prices if the hedges are put in at a certain point and suppliers are not able to unfold those hedges in a systematic way. The risk is a shortening of the forward markets because, essentially, what you have is a run on the forward contract markets at the same time to be compliant with these obligations.

“There is a need to strike the right balance between consumer protection and supply regulation in order to preserve competition and we believe that stress tests are a better mechanism than obligations.”

Long-term investment signals

A second key component of market reform raised by Altvater is that long-term investment signals are key for the build-out and mitigating price volatility.

Describing the investment needs for renewable energy across the EU by 2030 as “colossal”, Altvater highlights the need for over 700GW of new capacity, the renewal of existing capacity, build out of storage, and demand response.

“To keep adequate hedging in the forward market we need to enhance liquidity by removing barriers, one of which is the long-term transmission rates. Currently, TSOs only generally offer long-term transmission rights (LTTRs) for a one-year interval and we are asking for an extension to longer timeframes to enhance the liquidity and then consider voluntary market making,” she says.

Altvater believes that Contracts for Difference (CfDs) can serve as a complement to market-based

investments but warns that retroactive changes should be avoided, only applying to new build and deep retrofits of existing power plants where necessary.

Additionally, she says: “We should consider implications on forward markets and public budgets. When we talk about measures to support consumers that come from the State budget, we talk about moving the cost from the energy bill to the tax bill and this is something we also have to take into consideration when it comes to CfDs.

The devil is in the detail when it comes to the design and use of CfDs. They are just one tool in the toolbox and therefore should be voluntary, not mandatory. There is no ‘one-size-fits-all’ CfD and so adequate design and contractual innovation matter.

“Given that a massive use of CfDs would create challenges for investment signals and forward market liquidity, our position is that CfD use should be strategic and sparing.”

Turning to capacity mechanism, Altwater wants to see these become a more integral and integrated part of the market design.

Pointing to the long lead-in time for capacity mechanisms to be approved and then implemented by member states, she says: “We are looking for these to become a permanent part of the market design, so that energy companies know that they can count on this in the long term. Then, of course, we must ensure technological neutrality and include all kinds of energy sources, as well as flexibility.”

In October 2023, the Council reached an agreement on the electricity market design (EMD), enabling the beginning of negotiations with the European Parliament. With European elections scheduled for June 2024, Altwater points out the need for urgency to have the reform finalised, signed, and published no later than April 2024, with implementation likely to take around one year on average for member states to transpose the changes.

Eurelectric’s three pillars for European electricity market reform

1	2	3
Ensure customer choice	Diversify long-term instruments	Manageable financial rules
For more competitive prices and increased price stability.	CfDs, PPAs, capacity mechanisms, and forward hedging all have a role to play to incentivise investment.	Widening the options for non-cash collaterals will ensure the necessary level of liquidity in the forward markets.

Government introduces energy security strategy



A floating natural gas storage facility and increased oil reserves are to be considered in the Government's plan to increase energy security.

Energy Security in Ireland to 2030, the Government's first energy security strategy published in November 2023, outlines national plans to increase energy security, while also delivering on the 2050 commitment of net zero.

Two major areas are highlighted in the report for action; increasing Ireland's resilience in the event of a disruption to natural gas supplies and developing the anticipatory capacity of the energy sector in Ireland.

Central to energy security plans is the progression of existing plans for renewable generation growth, demand-side flexibility, new back-up gas-fired generation, interconnection, and storage. In parallel, the continued electrification of viable sectors will enhance the security of Ireland's future energy supply.

However, also included in the plan is recognition of a need for fossil fuel reserves while the energy system transitions to greater renewable use.

In relation to natural gas, the Government says that while current supplies and infrastructure are adequate to meet demand projections, any future disruption could impact

heavily on energy security. While the longer-term strategy is for the development of indigenous, renewable gas supply and compatible storage, in the medium term, there is a need to introduce a strategic gas emergency reserve.

Stressing that reserves would be used only if a disruption to gas supplies occurs, *Energy Security in Ireland to 2030* says that it is anticipated that floating gas reserve (FSRU) will best meet the needs of the criteria set by government. Gas Networks Ireland has

been tasked with returning a detailed proposal to government for final approval in 2024.

Oil

Ireland has pre-existing commitments to keep strategic oil stocks of at least a 90-day supply, and also be able to release these stocks quickly, effectively, and transparently in the event of major supply disruption. Under the new strategy, the Government has committed to strengthen the supply chain of secondary fuels for gas-fired power.

Alongside a commitment to an assessment of whether further enhancements can be made to strengthen the secondary fuelling capability in Ireland, the strategy says that a study will be taken forward to help understand and resolve the long-term sourcing issues for improved oil security.

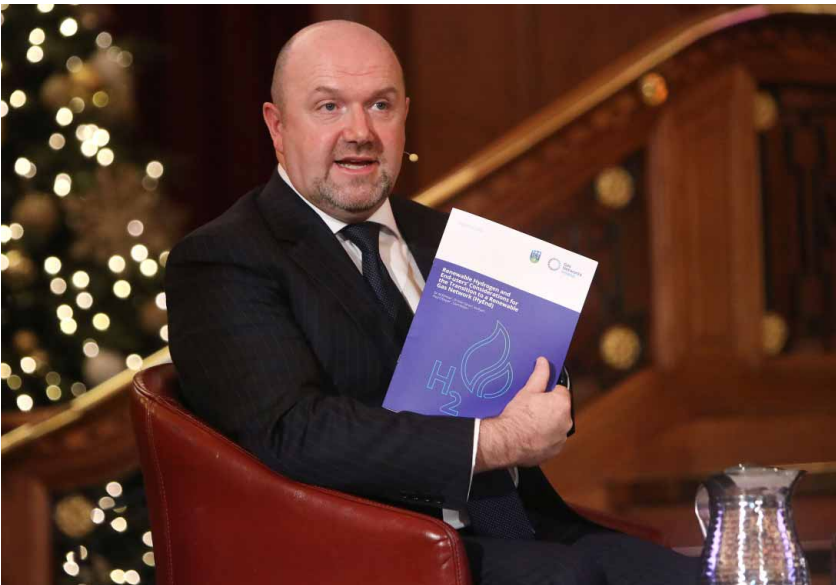
Commenting on the launch of the plan, Minister for the Environment, Climate and Communications, Eamon Ryan TD, says: "By reducing our import dependency through our energy efficiency measures and our investment in a diverse number of renewable energy sources, Ireland will reduce our dependence on imported fossil fuels and dramatically reduce our exposure to energy shocks."

A follow-up to the Energy Security Package will be published in 2030, and every five years thereafter.

Six key pillars of analysis underpin the Energy Security in Ireland to 2030 report:

- The Review of the Energy Security of Ireland's Electricity and Gas Networks, the studies by Cambridge Economic Policy Associates (CEPA) to support this and the over 450 consultation responses to this analysis;
- the Independent Review on the Security of Electricity Supply (the McCarthy Report);
- the conclusion of the National Energy Security Framework (NESF);
- the Climate Action Plan 2023;
- ongoing policy analysis on oil security of supply; and
- the Government of Ireland 'Summit on Energy Independence: Realising the Opportunities for Ireland'.

Researching Ireland's cleaner energy future with green hydrogen



Launching the HyEnd report at the annual Hydrogen Ireland Conference in Belfast, Gas Networks Ireland's Customer and Business Development Director, David Kelly said: "Introducing blends of hydrogen gas into the existing gas network would cause minimal disruption to Irish industry and businesses connected to the gas network as the pipelines are already in the ground and the majority of their infrastructure and equipment is proven to already be hydrogen compatible, as demonstrated through this research."

The EU is predicting that circa 14 per cent of energy consumption across Europe will be from hydrogen by 2050, while it is expected to be between 20 and 35 per cent in the Netherlands, and up to 50 per cent of the total energy demand in the UK. With over 80 per cent of the State's natural gas requirements being met by gas imported from the UK, how ready is Ireland for its hydrogen future?

Preparing Ireland's gas network for hydrogen

In line with the Climate Action Plan (CAP), there is a need to decarbonise the national gas network with renewable gases such as biomethane and hydrogen.

Gas Networks Ireland first introduced domestically produced biomethane onto Ireland's gas network more than two years ago and it is seamlessly replacing natural gas, as well as being fully

compatible with existing appliances and technology.

With one renewable gas – biomethane – successfully being piped through the Irish gas grid, Gas Networks Ireland is preparing for the introduction of the next renewable gas – hydrogen.

Ireland's gas network will be ready for hydrogen

The gas network is Ireland's hydrogen-

compatible infrastructure and reliable energy backbone which will continue to play a central role in the country's future clean energy and hydrogen economies.

The team at Gas Networks Ireland has been working diligently for an extensive period of time on preparing the existing gas network to accept hydrogen and natural gas blends from the UK, as well as preparing for the injection of indigenously produced renewable hydrogen at appropriate locations around Ireland into the gas network.

The cost of repurposing the existing gas network to transport hydrogen is estimated to be a fraction (10 per cent to 35 per cent) of the cost of building new dedicated hydrogen pipelines.

Gas Networks Ireland is confident that the State will be in a position to onboard hydrogen as and when industry partners are ready to produce the renewable gas, as results from the utility's studies indicate that Ireland's gas network will be ready.

Domestic appliances are compatible with up to 20 per cent blends of hydrogen

The operator of the 14,664km national gas network, Gas Networks Ireland, has been working with University College Dublin's Energy Institute (UCDEI) on a research project at its Network Innovation Centre in Citywest, Dublin, to investigate the potential use of hydrogen in Ireland.

Phase one of the research with UCDEI, which was completed in late 2022, focused primarily on domestic appliances, which were tested with a variety of hydrogen blends. The research found that domestic appliances could take up to 20 per cent of hydrogen blended with natural gas without the need for retrofitting, modifications, or additional costs.



Irish industry is ready to take up to 20 per cent blends of hydrogen

Phase two of the research, which concluded in late 2023, involved over 300 of the largest users of networked gas in the country and found that 90 per cent of the end users' equipment is compatible with blends of 20 per cent hydrogen, while the remaining 10 per cent of Irish industry would need further assessment to determine the modifications required.

The results of this research, published in the *Renewable Hydrogen and End-users Considerations for the Transition to a Renewable Gas Network (HyEnd)* report, are significant as they give an indication of how ready Ireland is for blended hydrogen, which is likely to be on the gas network in the UK within several years. Along with findings from Gas Networks Ireland's overall research and hydrogen programme – which aligns with the main takeaways in the Government's National Hydrogen Strategy to get clarity on end users' needs and enable infrastructure – it will form part of the roadmap on integrating renewable hydrogen and decarbonising Ireland's gas network.

Phase three of this research, HyGreenNet, which will focus on the gas distribution network and investigate pressure, safety, and material compatibility, is underway with results expected before the end of 2024.

Aside from this research, Gas Networks Ireland is one of several industry stakeholders funding a €16 million strategic partnership with Irish third-level institutions that will examine how to holistically decarbonise the overall Irish energy sector. Led by UCDEI, NexSys (Next Generation Energy System) is also supported by Science Foundation Ireland (SFI).

Finally, Gas Networks Ireland continues to invest in other strategic hydrogen research partnerships, including one with Ulster University on hydrogen blend safety and with AMBER (SFI Centre for Advanced Materials and BioEngineering Research) on materials compatibility with hydrogen.

W: www.gasnetworks.ie/renewables



Biomethane

Structurally identical to natural gas, biomethane is a carbon neutral renewable gas that can be made from farm and food waste through a process known as anaerobic digestion.

Green hydrogen

Green hydrogen is a carbon free gas that can be made from renewable electricity through a process known as electrolysis and stored until needed, making it an attractive option to decarbonise the Irish and EU energy systems and a strong example of how greater integration between Ireland's gas and electricity networks can support a low-carbon economy.

Government's National Hydrogen Strategy

The report published by the Department of the Environment, Climate and Communications (DECC) during summer 2023 outlines the future role green hydrogen gas – harnessed from offshore wind – and the gas network will play in specific areas of Ireland's energy system the hard to abate sectors such as transport, industrial heating, and power generation. In light of this strategy, Gas Networks Ireland continues to undertake a programme of research and testing to ensure that Ireland's gas transmission network is capable of transporting hydrogen and is compatible with our European neighbours' gas networks.

Low-carbon flexible power: The missing piece of Ireland's net zero jigsaw



SSE Thermal is developing a new power station running on biofuels at its Tarbert site in County Kerry.

As Ireland navigates to net zero, low-carbon flexible thermal will be essential in keeping the lights on, writes Catherine Raw, Managing Director of SSE Thermal.



We are now one month on from the end of COP28, where much of the debate and discussion was focused on the need to phase out unabated fossil fuels. I was privileged to be in SSE's delegation to Dubai and see first-hand the effort being exerted in these crucial climate talks with clear, positive action being taken by countries around the globe.

There is global consensus that renewables will do the heavy lifting when it comes to reaching net zero. That is certainly the case in Ireland, where ambitious climate targets have led to significant success in renewables rollout to date. But while renewables will rightly

form the backbone of the electricity system in Ireland, we cannot ignore the critical role of flexible generation.

Today, flexible power is crucial in keeping the lights on across Ireland when the wind does not blow and the sun does not shine. With increasing intermittency on the system, the importance of flexibility will only grow and at SSE Thermal, we are on a mission to ensure that flexible power is low-carbon in its own right.

In doing so, we can keep the lights on and the electricity grid stable by responding fast and flexibly to system

need, ramping up and down quickly to make sure that demand for electricity is met. That will help with security of supply concerns, something which is particularly acute in Ireland.

Within the last few months, the Government has published its Energy Security Strategy, a welcome step to tackling some of the key challenges the country faces. Within that strategy is clear recognition of the need to decarbonise 'non-renewable' components of the power system coupled with a stated aim of building 2GW of new flexible generation capacity.

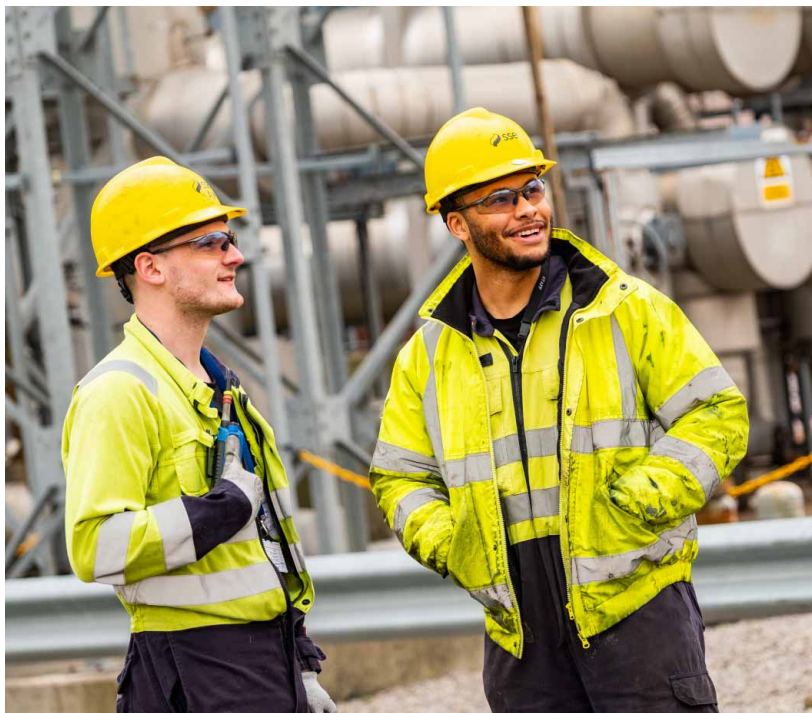
At SSE Thermal, we are proud to own and operate multiple flexible power stations including Great Island in County Wexford which is Ireland's newest and most-efficient gas-fired power station. As a company, we are laser focused on bringing forward the next generation of flexible power stations. In Britain, that has led us to develop new assets which would incorporate carbon capture or hydrogen technology. Ireland, however, is at an earlier stage of its low-carbon journey and that has led us to pursue a different approach.

Specifically, we are developing two power stations which would run on 100 per cent sustainable biofuels. One is being developed at Platin, County Meath for 170MW while the other 350MW plant would be located at our historic Tarbert site in County Kerry. By using hydrotreated vegetable oil (HVO), these new assets will provide a lower carbon alternative to traditional fossil fuels and crucially, both plants would be capable of converting to hydrogen in the future, once appropriate policy mechanisms and infrastructure are in place.

In April 2023, we secured 10-year capacity agreements for both Tarbert and Platin projects, highlighting the role this technology can play in meeting Ireland's acute security of supply challenge and net zero ambition.

While these are important bridging projects, it is key that Ireland moves quickly towards a hydrogen future. That is because 100 per cent hydrogen-fuelled plants would produce zero carbon emissions at the point of combustion, something which would help propel Ireland towards its net zero goals.

That is why the publication of a National Hydrogen Strategy was so encouraging and represented an important milestone in the sector's development. Now, we



"If we are to meet our net zero ambition, we cannot wait until the 2040s to deploy low-carbon flexible power."

need to build on momentum and explore how policy can support the entire value chain from production to storage to offtake, including industry, transport and power generation. In particular, there is a need to actively progress enduring business models to support the emerging hydrogen economy.

We believe Ireland should also consider the potential of carbon capture, something which the Government has begun to explore. We believe carbon capture has a role to play in Ireland, with carbon dioxide emissions from gas power generation being captured and safely stored instead of released into the atmosphere. As a result, we support the early completion of a feasibility study on carbon capture and storage and look forward to sharing our view on how it could be deployed in Ireland, building on our learnings from Britain where we are currently the only company with consent for a power CCS project.

Together, carbon capture and hydrogen can make a major contribution to the Ireland's net zero targets. If we are to meet our net zero ambition, we cannot wait until the 2040s to deploy low-carbon flexible power. We need to move quickly and at the very minimum any new generation plant must be capable of being decarbonised, avoiding carbon lock-in. It is time to seize the low-carbon moment and ensure policies are in place to enable build-out of the next generation of decarbonised flexible thermal generation.

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Reforming electricity markets: A global perspective

Global expert in energy market reform, Todd Bessemer, questions whether the dramatic increase of non-synchronous renewables onto energy systems across the globe requires a greater focus on capacity retention and reliability incentives to ensure an orderly transition to a reduced carbon system.

Bessemer, who was a lead advisor to EirGrid and SONI when the Single Electricity Market was established on the island of Ireland from 2005 to 2007, has advised on energy markets in over 15 countries spanning four continents.

He believes that the ‘soft-landing’ mechanisms utilised in traditional energy markets provide useful lessons management of the dramatic increase of renewables in an orderly manner, rather than the observed trend in some parts of the world of market reform through crisis resolution.

The evolving nature of ‘market reform’

Bessemer explains that the term “market reform” has evolved from the

early days of deregulation. Then, reform centred on the introduction of competition, necessitating changes to industry structures, the introduction of market trading, and changes to related arrangements to support competition. Now, “market reform” is about the changes required to support government policy regarding environmental and resource mix outcomes.

“This still involves changes to market arrangements, and the processes to support these, but now it also involves significant externalities in the form of subsidies and support mechanisms to bring renewables to market, and we have little in the way of structural reform going on,” he explains.

Challenges in the operational timeframe

This evolution is raising significant challenges. Previously, classical generation was considered to provide a market commodity in the form of electrical energy, which could be sold in both real-time and ahead timeframes. Various market-procured and non-market system/ancillary services existed, such as reserves, reactive power, and black-start capability, and a range of assumptions could be made, not least, that demand was mostly passive but predictable. Distribution-level activity could be homogenised and represented as load, and locational challenges were ‘simplified’ from the market, as an issue for the TSO to address. Some “services” were provided implicitly as a bundled part of energy provision, such as dispatchability, rate-of-change of frequency, voltage waveforms, and flexibility.

Outlining a “new world” in relation to energy markets, Bessemer says that the evolving resource mix means that fewer resources are now able to provide those previously implicit services.

“As we get more resources coming onto the system that are both unpredictable in their output and non-synchronous, we are finding fewer resources are left in the system that can provide these services. This was not a problem when there was low non-synchronous penetration, but becomes a substantial issue at higher penetration levels. “We now need to look at how we explicitly incent the provision of these services, and this is a challenge globally, not just in Ireland,” he says. “Market constructs must evolve to properly compensate those providing the key technical attributes required to operate the system.”

The market reform expert says that demand will need to shoulder more of the balancing and system services burden. As a result, distributed energy resources (DER) become a key part of the mix. This also requires that “the ‘where’ and not just the ‘what’ must be better addressed by the market”.

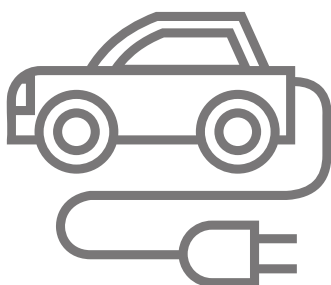
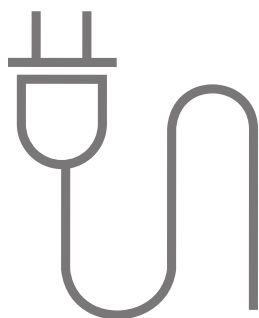
The need for product review and maintenance

Bessemer believes that all of these factors are driving a need for an active culture of product review and maintenance amongst spot markets, explaining that futures markets have long had the concept of ‘product maintenance’; an active review of and modifications to product specifications as the market evolves.

Bessemer notes three key market design principles to guide this evolution. Quoting Larry Ruff, he says that “a market should be as simple as possible, but no simpler”. The market should keep as much activity in the primary energy market as possible; and markets should incent the attributes desired, not specific technologies.

The reality of how this is playing out in current markets globally is that while a range of new system services are being defined in various markets, such as fast-frequency response and firming products, they are happening outside the energy market. “The number of providers for those products is often small which creates liquidity issues and potential market power problems,” says Bessemer. “On top of that, they are often services where you have a monopsony buyer in the form of a TSO versus a plurality of demand. Is it a true market when you have only one buyer?”

Changes are being made to incent for more dynamic performance in markets. In Australia and the competitive markets of the US, five-minute settlement has been mandated to address ramping problems. More granular pricing is occurring worldwide, and flexibility markets are emerging in Europe, though there seem to be a range of definitions for the scope and products of these.



The energy markets expert explored one potentially interesting implication of more active demand-side participation – that it could create explicit cross-market price linkages between power systems, even if no interconnection exists. “Consider disparate regions that are electrically remote from each other. Now consider that these are connected by global data connections. We know that we have less controllable generation, so that is going to force demand to more often be the flexible part of the balancing equation and, increasingly, demand will become the marginal price setter.

“In many of the markets I am involved in, we are seeing that, increasingly, data centre load is particularly displaceable across geographic regions. Data centres tell us that their energy costs are typically higher than their data costs. It is likely then that the price in one region will guide whether to displace processing load to another. “In time, this may create an explicit cross-market price linkage, where load displaces from the east coast of the US to Europe or Asia, or vice versa. If that is the marginal resource, then we are actually going to see linkages between prices, even though there is no electrical interconnection between these markets.”

Challenges in the investment timeframe

Turning to the challenges facing market reform in the investment timeframe, Bessemer says that ‘new’ locations of renewables are driving a lot of non-market costs, particularly on the transmission side. Associated with this is an increase in transmission queues, with TSOs coming under increasing pressure to accelerate the connection process, and prioritise projects that may have joined the queue later but are likely to be ‘shovel ready’ sooner.

Bessemer points to the creation of competitive renewable energy zones as a potential solution to the geographic challenge, which has enabled TSOs in some regions to batch up projects.

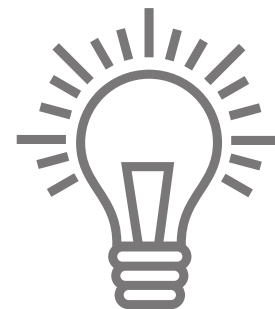
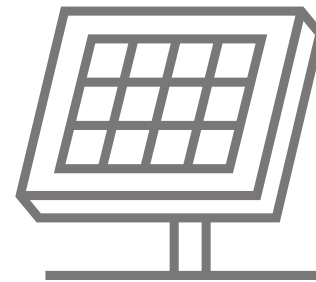
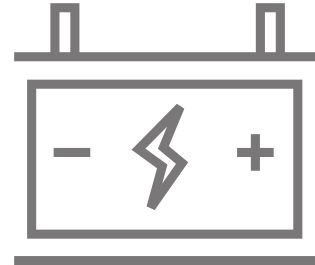
A further challenge discussed by Bessemer is that renewables subsidies are often not well coordinated with system security needs. Most renewables still require subsidies – in the form of portfolio standards/RECs, emissions permits, tax credits – to be ‘investable’. These subsidies create significant economic externalities, which suppress energy and capacity prices. This has sent a lot of traditional generation tumbling out of the system earlier than planned or desired due to loss of revenue, inducing scarcity, and others to cut back on maintenance, impacting reliability. For example, recent data from the AEMO’s 2023 Electricity Statement of Opportunities showed that every state in Australia is now projected to breach the reliability standard in the next few years unless serious corrective action is taken.

Where is the transition in ‘The Transition’?

However, corrective actions tend to be reactive rather than proactive and, as countries around the world move to delay planned retirements of some traditional generation in the name of security of supply, Bessemer poses the question: “Where is the transition in ‘The Transition’?”

“When we first set up electricity markets, we put a lot of thought into making sure that we had a ‘soft landing’. We recognised that participants may not fully understand these things initially, and so we put in place mechanisms like vesting contracts and phased retail competition to ensure that no one lost their shirt on day one.

“However, it appears that much of this thinking is lacking in the energy transition. As we move to ever higher levels of non-synchronous renewables, where are the incentives to retain capacity, and incent the reliability attributes needed, until a point of stability has been reached? Where is the soft landing?” he concludes.



ENERGY IN TRANSPORT FORUM 2024

Thursday 8 February • Dunboyne Castle Hotel, County Meath

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Energy Ireland is organising the Energy in Transport Forum which is taking place on Thursday 8 February 2024 in Dunboyne Castle, County Meath. Energy Ireland has held energy in transport events on an ad hoc basis over the years. The 2024 Forum will focus on energy aspects of transport – although we sometimes touch on this in both Energy Ireland and Transport Ireland conferences we want to cover the issues in more depth.



Speakers include:



Caoimhín Ó Ciarúain
Department of Transport



Julia Poliscanova
Transport and Environment



Shane McDonagh
International Energy Agency



Philip Hannon
Liquid Gas Ireland



Jim Meade
Iarnród Éireann



Shane Malone
Byrne Ó Cléirigh



Mattias Goldmann
Goldmann Green



Neil Walker
Ibec



Fionn Rogan
MaREI, University College Cork



Ken Rooney
Dublin Port Company

Key issues examined include:

- ✓ Renewable energy use in transport in Ireland
- ✓ Accelerating electricity vehicle take-up
- ✓ Developing the e-mobility supply chain in Europe
- ✓ Decarbonising the Irish rail network: electrification, batteries and hydrogen
- ✓ Biofuels in Ireland's future energy mix
- ✓ Fossil-independent transport: lessons from Sweden
- ✓ The use of hydrogen in transport
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Exhibition opportunities

This is an excellent way for organisations to showcase their expertise and raise their profile with a key audience of senior decision makers. For further information on how your organisation can benefit, contact +353 (0)1 661 3755 or email jillian.wallace@energyireland.ie.



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+353 (0)1 661 3755