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Flexible Electrification Connections

Introduction

The electrification of the heat and transport sectors have immense potential and cannot be seen as simply adding to electricity demand. Policy on its development must emphasise the overall advantages of electrification, such as in regard to the flexible demand it can offer for system operators. A further advantage is as a key technology to help decarbonise the energy sector. Renewable electricity, twinned with electrification of heat and transport, should be viewed as the leading vector to allow Ireland to meet its carbon reduction goals. We must look at the policy framework broadly to see how we can encourage greater electrification so that this technology can provide its wider gains to sectors heavily reliant on fossil fuels and extend gains also to the electricity market more widely.

Ireland Electrified is a trade association promoting the electrification of heat, domestic and industrial, as well as transport. This transition to electric heat and transport represents a cleaner, more secure energy source and can provide many benefits to the electricity grid. We advocate for decarbonising our economy in sectors currently heavily reliant on largely imported fossil fuels with greater electrification from renewable energy sources, meaning increased energy security and a more sustainable energy source for householders, businesses, transport and large industry.

There are Climate Action Plan (CAP) targets for electrification across domestic and commercial heat (including very high temperature heat), as well as electrification in the transport sector. These targets are welcome, though the focus is on 2030. Developing further a roadmap to achieving zero carbon energy in heat and transport would be beneficial for the expansion of electrification and would be something Ireland Electrified would support. In order to meet these CAP targets and to gain from the many advantages that greater electrification can provide to the electricity grid, there must be a specific policy framework developed that will encourage and sustain electrification. There have been extensive studies conducted by SEAI¹ on heat demand with 46,000 GWh of heat as the current requirement, much of which can electrify, and there are also studies on the technology available in electric heat.² With EV's, their numbers are predicted to increase over the coming years and "energy market analysts suggest that mass market adoption of EVs for cars and vans is probable".³ So across heat and transport the right policies can help facilitate this projected large growth.

¹ <https://www.seai.ie/data-and-insights/national-heat-study/heating-and-cooling-in-ir/>

² SEAI, National Heat Study, Heating and cooling in Ireland today
[seai.ie/publications/Heating-and-Cooling-in-Ireland-Today.pdf](https://www.seai.ie/publications/Heating-and-Cooling-in-Ireland-Today.pdf)

³ Electric Vehicle Policy Pathway Working Group Report 2021



A Flexible Electrification Connection

Eirgrid⁴ is predicting 35% dispatch down of Ireland's wind and solar assets in 2030 in the business-as-usual case. At the same time fossil fuels will be imported to satisfy Ireland's heating and transport needs. By empowering flexible consumption, the heat and transport sectors can become enablers of renewable integration and reduce the cost on society of achieving government targets.

Providing a flexible connection option to those electrifying heat or transport, that can be flexible in their demand, gives system operators additional tools to manage the grid. This in turn would allow quicker grid access and make electrification even more the economic option for the displacement of fossil fuels. It also optimises the use of the existing transmission and distribution grid infrastructure and reduces the immediate capacity of new grid infrastructure required, thus reducing the cost on society. There are overall broad advantages for the demand user of electric heat and transport, not least a low cost decarbonisation route, and advantages to System Operators such as 1) allowing the shifting of demand to periods of high renewable generation and lower costs⁵, 2) provision of zero carbon grid frequency regulation services, 3) a mitigation tool against dispatch down of renewable electricity, 4) reduced the immediate need for new grid infrastructure 5) facilitating sustainable decarbonisation of our wider economy powered by our renewable assets.

Time and location may be further factors in considering the application of a flexible connection to a specific demand unit. In that projects could be prioritised based on proximity to renewable generation and willingness to provide flexibility services

Flexible supply will also help develop the coupling of electricity, heat and transport sectors, that can contribute to both renewable energy integration and decarbonisation.⁶ Further to this, flexible heat pumps as an example, could significantly lower the costs for integrating renewables and reducing carbon emissions.⁷ Heat pumps, e-boilers, thermal storage and EV's are technologies available now that can help shift demand and integrate renewables more. Ireland has already seen a first of its kind 25MW electric boiler installed with the sole purpose

⁴ https://consult.eirgrid.ie/en/system/files/flipbook_pdf/LDES%20Call%20for%20Evidence%20EirGrid.pdf

⁵ Grid-edge technology - Exploring the flexibility potential of a heat pump and thermal energy storage system Christoph Schellenberg, Laurentiu Dimache, and John Lohan, Galway-Mayo Institute of Technology, Department of Mechanical and Industrial Engineering, Galway, Ireland.
https://www.e3s-conferences.org/articles/e3sconf/pdf/2019/37/e3sconf_clima2019_06002.pdf

⁶ Power-to-heat for renewable energy integration: A review of technologies, modeling approaches, and flexibility potentials Andreas Bloessab, Wolf-Peter Schillb, Alexander Zerrahnb, Applied Energy, 2018.
<https://d-nb.info/1221668390/34>

⁷ Benefits of flexibility from smart electrified transportation and heating in the future UK electricity system

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to displace onsite fossil fuels use with renewable electricity which would otherwise have been dispatched down⁸.

As of yet there are no specific policies in place with the CRU, DSO or TSO in terms of a connection measure for industrial heat pumps, electric boilers or electric transport that acknowledges their potential dynamic applications for the grid. Though the possibilities for electrification in Ireland are immense. The ERSI have stated that *“Heat pumps in conjunction with thermal energy storage provide system wide flexibility services such as load shifting, peak shaving, and demand side management, thereby ensuring increased utilisation of excess renewable energy during off-peak periods.”*⁹ ‘Project Shift’, conducted in Britain, explored different market mechanisms to facilitate smart charging in a way that moved EV demand away from peak. Across all market mechanisms trialled, smart charging successfully shifted EV charging away from the evening peak period.¹⁰ However, it is acknowledged and welcomed that work on developing these new policies have commenced. The speed and resources applied to successfully develop and implement these policies is on the critical path for Ireland being able to maximise the benefits of electrification.

Northern Ireland Electricity Networks (NIEN) and Flexible Connections

NIEN launched a ‘Call for Evidence for Flexible Connections’.¹¹ This looks at possible changes to connections policy away from the current regime, which is a single figure for Maximum Import Capacity (MIC). The consultation states *“we know many of our customers do not need to import or export at the same level continuously. For example: a factory might have higher demand in daytime working hours; a transport hub might charge public transportation overnight; a renewable generator might only generate when the weather is suitable.”* The aim therefore is to offer more flexibility in connections policy. This consultation outlines how certain kinds of customers, with predictable patterns of demand or generation, or the ability to control patterns of use, could benefit from flexible connections such as transport charging (overnight) or industrial users with the ability to manage patterns of demand. Consideration must now be given for a consultation like this to be put forward by ESBN.

Grid Connection

The current policy on grid connections is framed without regard to the possible dynamic application of electrification. However, there are some specific policy conditions being developed for large energy users grid connections.¹² Also the CRU have published a consultation on Energy Demand Strategy.¹³ This review sets out areas of focus such as the

⁸ <https://decarbonisation.ie/>

⁹ ERSI Working Paper No. 627 June 2019

¹⁰ Project Shift Final Report May 2022:

https://d1oyzg0jo3ox9g.cloudfront.net/app/uploads/2023/10/UKPN_Project-Shift_2022_Web-PDF-v2.pdf

¹¹ <https://www.nienetworks.co.uk/documents/regulatory-documents/flexible-connections.aspx>

¹² Eirgrid Data Centre Connection Offer Process and Policy July 2020.

¹³ <https://www.cru.ie/publications/27532/>

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increase in demand flexibility, so that customers are incentivised to use electricity at time of high renewable generation. This also has a consultation on Large Energy Users which looks at how large new energy demand users connecting to the electricity network are low or zero carbon, or provide significant demand flexibility at the point of connection. “*This is in response to recent developments such as the Government publication of the Sectoral Emissions Ceilings*”.¹⁴ The overall demand strategy should consider the role of electrification in this policy going forward and in turn what measures can be created to foster growth.

A more flexible approach on connection policy can be applied by System Operators in regard to MIC connections to help accommodate greater electrification. ESBN have said heat pump technology is developing all the time and will play a significant role in the decarbonisation of industrial heat demand in Ireland¹⁵. Heat pumps are well established technology for decades throughout the EU and can supply a substantial part of future industrial heat. This and other electrification technologies can be facilitated with the correct changes to the policy framework such as providing a flexible grid connection access which will speed up connections. Industrial electrification of heat and largescale electrification of transport could provide a means of establishing a source of flexible demand for system operators and changes in the policy will aid in its expansion. ESBN are seeking 20-30% of flexible demand by 2030¹⁶. Electrification can help toward providing this but the right policies on access must be put in place with grid access for electrification being more dynamic in approach allowing for a flexible connection if requested.

Electrification – Flexible Connection Option

What can be put in place is a connection option for demand users moving to electrification of heat and transport to choose a Firm, Non-Firm or partially Non-Firm electricity connection for their supply. This option can suit the specific needs of the particular demand user which is electrifying. In recognition of the provision of this capacity using the existing infrastructure, this could allow the new non-firm electric heat or transport unit have a reduced connection charge and reduced ongoing network charges. This policy will facilitate more electrification and many countries have adopted different measures to incentivise and encourage electrification, such as a heat pump tariff in Sweden.¹⁷ Maximising the use of existing grid infrastructure could reduce waiting times by up to ten-years compared to the work and

¹⁴ https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/CRU202357_Review_of_Large_Energ_Users_Connection_Policy_Call_for_Evidence_Per.pdf

¹⁵ https://esb.ie/docs/default-source/leading-lights/industrial-heat-pumps-insights-paper.pdf?sfvrsn=270c3311_7

¹⁶ ESBN, Scenarios for 15-20% Flexible System Demand, NATIONAL NETWORK, LOCAL CONNECTIONS PROGRAMME

¹⁷ International Comparisons of Heating, Cooling and Heat Decarbonisation Policies, Report prepared for The Department for Business, Energy and Industrial Strategy (BEIS), Imperial College London, Final report November

2017 https://assets.publishing.service.gov.uk/media/5acf7bdde5274a76be66c1d4/050218_International_Comparisons_Study_MainReport_CLEAN.pdf

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planning requirements to deliver firm MIC. This would also provide the System Operators with a much-needed flexible demand. An electric heat flexible connection could provide the System Operators with the ability to dispatch down or up power to a demand user for a specified period of time. For example, part of a demand users MIC will be firm and part of the MIC will be non-firm. This will ultimately require a policy to be developed on the parameters and regulatory obligations and protections in place to manage the allocation of non-firm capacity and the dispatch of users with this new flexible connection.

EU Electricity Market Reform

The EU objective is to become climate neutral by 2050, with an intermediate target of a 55% net reduction of greenhouse-gas emissions compared to 1990 levels by 2030. The European Green Deal¹⁸ laid down the strategy to achieve this objective, reinforced in the Fit for 55 package¹⁹ which was turned into a legal obligation by European Regulation²⁰. The production and use of energy accounts for more than 75% of the EU's greenhouse-gas emissions, and decarbonising the EU's energy system is therefore critical to reach these climate objectives. The Commission has proposed to reform the EU's electricity market design to accelerate a surge in renewables and the phase-out of gas, make consumer bills less dependent on volatile fossil fuel prices, better protect consumers from future price spikes and potential market manipulation, and make the EU's industry clean and more competitive.

Flexibility needs to be increased greatly – in some cases exponentially so – when the share of variable renewable generation in the electricity system is above 74% of total installed capacity. This is the case in Ireland more so than any other EU country, as we strive to make best use of the valuable resources at our disposal for a zero-carbon economy, while constrained by some geographical realities 1) an island with only a few interconnectors and only DC interconnection 2) few natural hydro storage facilities.

Flexible electrification and energy storage²¹ can play a crucial role in the current and future energy system. They can help decarbonise the economy and increase the efficiency and security of energy supply by providing flexibility, stability and reliability. They can also: (i) lower electricity prices during peak times; (ii) reduce price fluctuations; and (iii) empower consumers to adapt their energy consumption to prices and their needs. The diversity of electrification and energy-storage technologies makes them suitable for many applications. And it is important to fully exploit the added value they can bring to the energy system and

¹⁸ COM/2019/640 final, https://ec.europa.eu/info/publications/communication-european-green-deal_en. On the top of climate neutrality, European Green Deal aims at halt biodiversity loss, reduce and eliminate pollution, and decouple economic growth from resource use through circular economy approaches.

¹⁹ COM(2021) 550 final

²⁰ Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality, <http://data.europa.eu/eli/reg/2021/1119/oj>.

²¹ https://energy.ec.europa.eu/publications/staff-working-document-energy-storage-underpinning-decarbonised-and-secure-eu-energy-system_en

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its users, together with other flexibility tools and energy-efficiency measures, while taking into account their environmental impact.

The current application of market charges, coupled with the network tariffs, can act to discourage flexible electrification. These legacy charges, applied to electricity but not to fossil fuels, are acting to compound the reliance on imported fossil fuels for the long term. The current charging structures create a perverse economic incentive, in that, it is cheaper to import natural gas for a heating application than to consume indigenous electricity, even when that electricity has a €0/MWh wholesale price. We propose that dynamic charges are needed for the future which incentivise consumption in hours of high renewable penetration (high SNSP levels)

Energy Security of Supply

In 2022 the Irish government launched a review of the security of energy supply of Ireland's electricity and natural gas systems²². Ireland's energy system is going through a period of transformational change and, as we transition to a net-zero emissions future, we must ensure the pathway of decarbonisation is underpinned by affordability and security in how we access and use energy in our everyday lives. Having a reliable source of energy is vital for consumers to have confidence in the transition to a net zero emissions future. As our energy systems evolve and increasing volumes of our energy comes from renewable sources, we must ensure that we maintain security of energy supply.

100% of oil and 71% of natural gas burned in Ireland was imported in 2021. Ireland's dependency on gas imports is increasing as our supply of indigenous gas from the Corrib Gas Field declines. At the same time as Ireland is importing these fossil fuels we are also forced to waste our indigenous zero carbon fuel. Dispatch down of Irish wind turbines maximised in 2020 with 12.1% wastage²³. This equated to 1,948GWh²⁴ according to Eirgrid & SONI, (a further figure of 1.3 TWh has also been reported for 2022.)²⁵ If used for example to displace natural gas in a 99% efficient e-boiler this would have saved 393,418 tonne of CO₂ using SEAI conversion of 204 g CO₂/kWh²⁶. This means a reduced cost on Irish society and improving our security of supply. This was when Ireland had 4.3GW of wind capacity, the wastage could be 35% in 2030 according to Eirgrid²⁷ if policy is not reformed when we have quadrupled our renewable generation capacity to 22GW. But we can utilise this ingenious clean electricity with greater electrification.

²² <https://www.gov.ie/en/consultation/dbe14-review-of-the-security-of-energy-supply-of-irelands-electricity-and-natural-gas-systems/>

²³ <https://www.eirgridgroup.com/site-files/library/EirGrid/Wind-DD-Historical-July-2023.png>

²⁴ <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.eirgridgroup.com%2Fsite-files%2Flibrary%2FEirGrid%2FDDE-Summary-Report-July-2023.xlsx&wdOrigin=BROWSELINK>

²⁵ <https://kpmg.com/ie/en/home/insights/2023/11/long-duration-energy-storage-esg.html>

²⁶ <https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/>

²⁷ <https://www.eirgridgroup.com/site-files/library/EirGrid/LDES-Call-for-Evidence-EirGrid.pdf>

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Conclusion

The current policy framework in Ireland creates un-necessary disincentives to the adoption of Demand Response and the broad advantages of electrification. These barriers should be removed.²⁸ Policies that encourage growth and enable expansion, even within a constrained grid, could be developed for electrification to unlock the wide benefits it can provide. Electrification from renewable sources will lower emissions in key sectors heavily reliant on fossil fuels. It can help the management of the grid with existing technologies such as heat pumps, e-boilers, EVs or via thermal storage and can help utilise more of the indigenous renewable electricity being generated. Electrification provides System Operator benefits as electric technologies can operate flexibly and even more so when combined with thermal or electrical storage for example.²⁹ Dynamic network and market charges could also act to remove the financial incentive for the heat and transport sectors to remain burning fossil fuels. A new 'Flexible' grid connection should be developed in a timely manner. It would help to deliver Government CAP targets and accelerate the expansion of much needed electric heat and transport. It could be provided at minimal/no cost and accelerate access to the grid for electrification and would in turn reduce costs for connection.



²⁸ <https://etipwind.eu/files/reports/Flagship/fit-for-55/ETIPWind-Flagship-report-Fit-for-55-set-for-2050.pdf>

²⁹ <https://www.energynetworks.org/newsroom/a-flexible-future-for-heat-pumps>