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Submitted by email to: electricityconnectionpolicy@cru.ie
Submitted on: 19th March 2024

Re: Consultation on the CRU Large Energy User Connection Policy

Dear Sir/Madam,

Fingleton White welcomes the opportunity to comment on the consultation on the Large Energy User Connection Policy.

Fingleton White provides multidisciplinary engineering services for the energy industry throughout Ireland and the UK. It operates across multiple sectors including gas, bioenergy, hydro, solar, CHP, industrial heat, oil, and water industries.

The Large Energy User Connection Policy by the CRU is essential to regulate the expected demand from Large Energy Users and streamline the requirements to achieve optimal growth and the lowest cost pathway to decarbonisation.

LEUs hold massive untapped opportunities in providing flexibility services to the grid using low carbon technologies. The LEUs can provide the greatest impact at least cost in decarbonising and providing flexibility to the grid, as it is more straight forward to accommodate large scale solutions on larger grid connections than through individual domestic household customers on the low voltage and low-pressure energy distribution systems.

Fingleton White has carried out an independent analysis to determine the grid profile for 2030. We have calculated the following factors for low, median, and high demand scenarios.

This analysis clearly shows that to match wind generation with demand, we need to facilitate flexible demand.

The following is a summary of the analysis. We are available to discuss these findings.

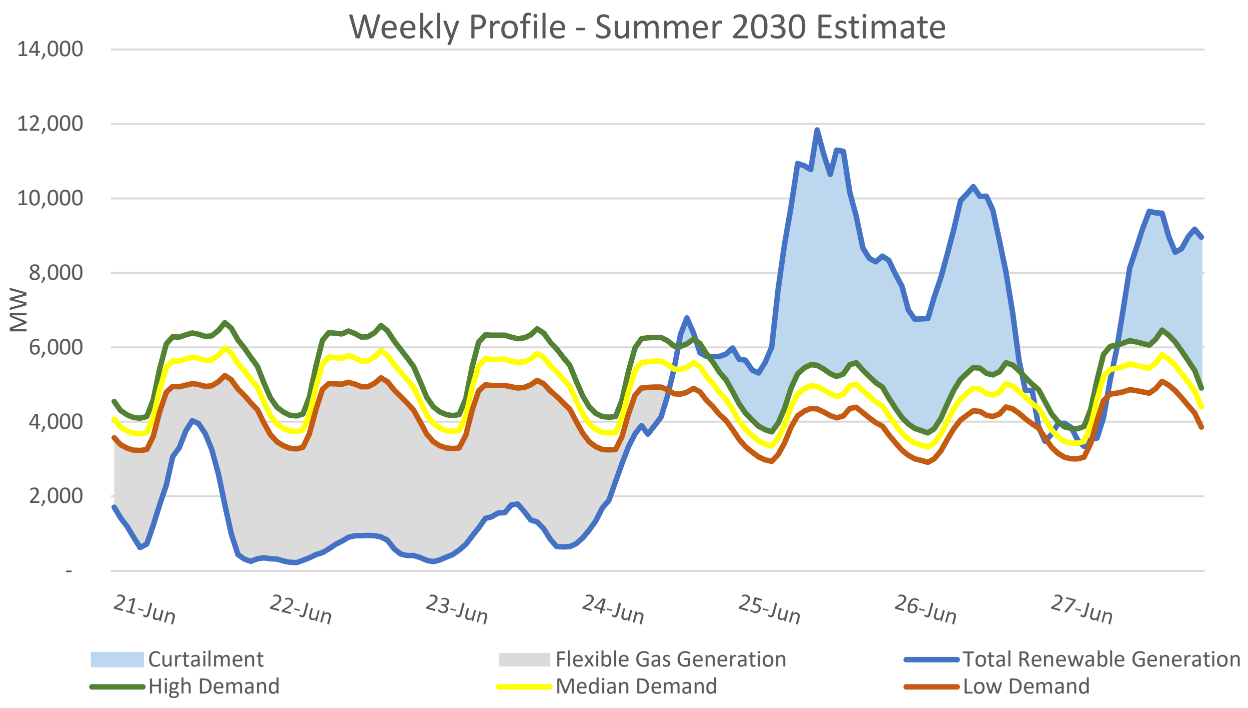

Figure 1: Renewable Generation and System Demand Summer Weekly Profile

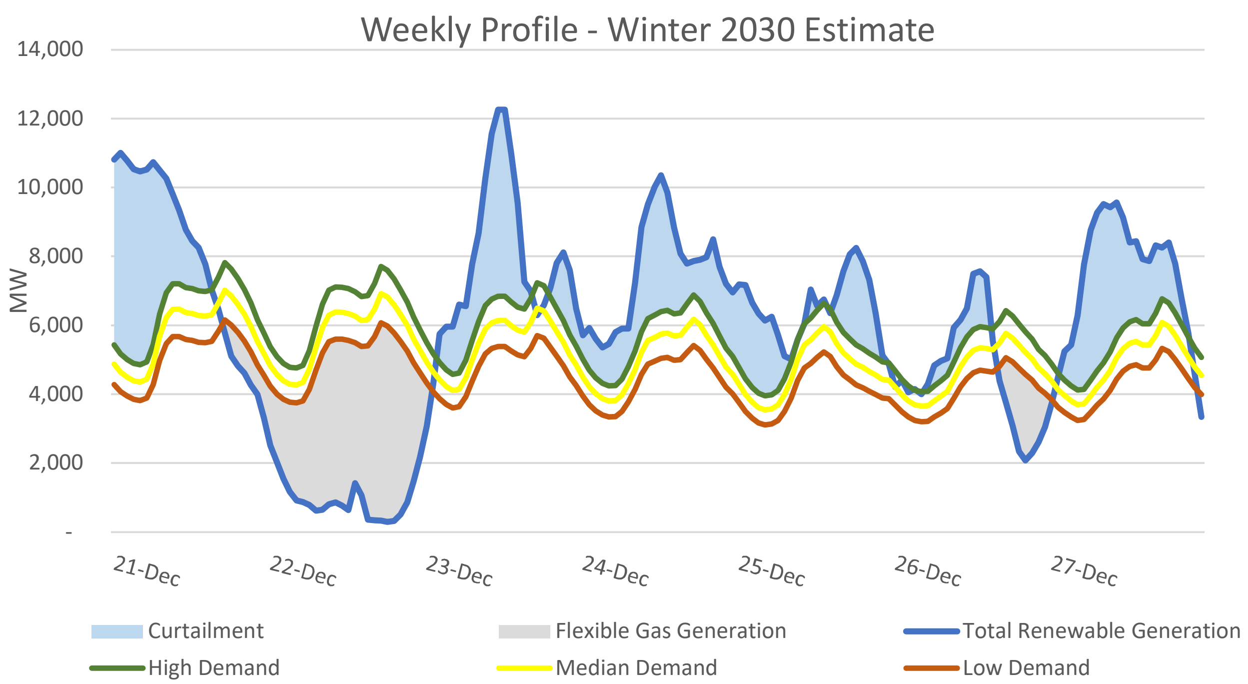

Figure 2: Renewable Generation and System Demand Winter Weekly Profile

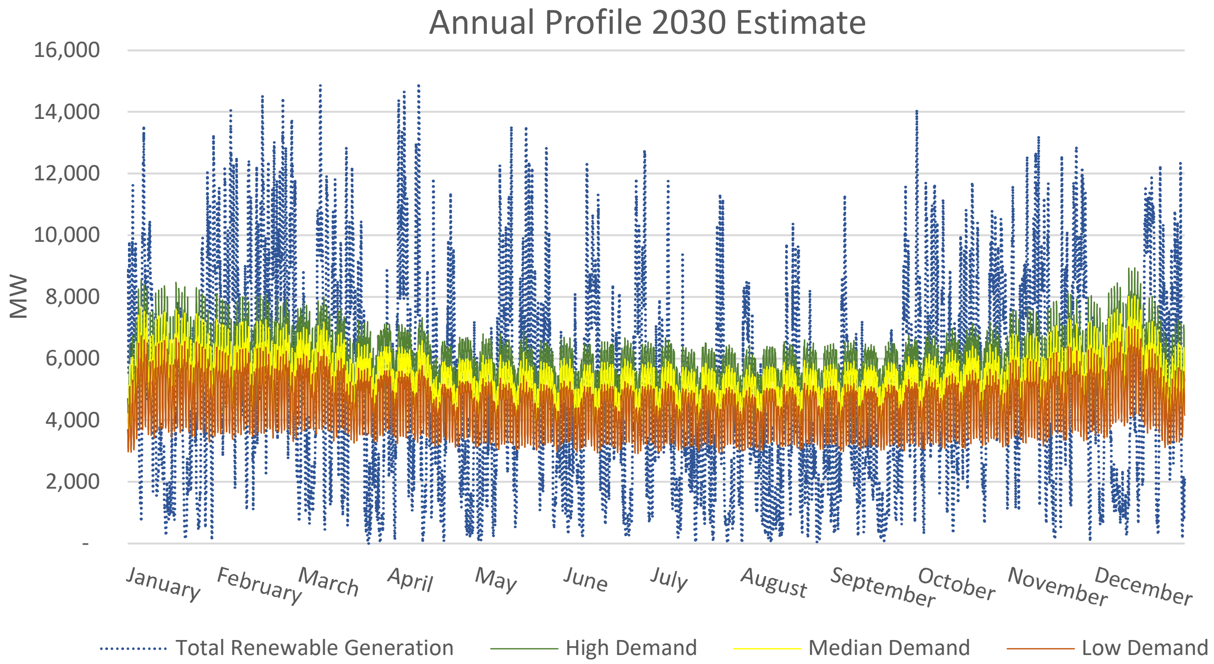

Figure 3: Renewable Generation and System Demand Profile

Table 1: 2030 Electrical Demand

Description	Low Demand		Median Demand		High Demand	
System Demand	39,200	GWh	44,700	GWh	49,800	GWh
Total Renewable Energy Generation	43,300	GWh	43,300	GWh	43,300	GWh
2 GW Battery Systems with 4 GWh capacity (Electricity Supply)	279	GWh	283	GWh	286	GWh
Required Electricity from Flexible Gas Generation[1]	2,563	GWh	4,251	GWh	6,200	GWh
Curtailment[2]	**6,698**	**GWh**	**5,051**	**GWh**	**3,715**	**GWh**
Curtailment (%)	**15.47**	**%**	**11.66**	**%**	**8.58**	**%**
Total Carbon Emissions[3]	**1.2**	**Mt CO_2**	**2.1**	**Mt CO_2**	**3.1**	**Mt CO_2**

[1] Flexible gas is assumed to be a blend of Natural Gas, Hydrogen, and Biomethane.
[2] Curtailment is calculated assuming the SNSP limit at 95% and the availability of demand flexibility of 990 MW from interconnectors (1,650 MW at 60% Derating), 745 MW from DSU, and 500 MW from ESB Flexibility Product Procurement.
[3] Carbon emissions are calculated assuming flexible gas generation.

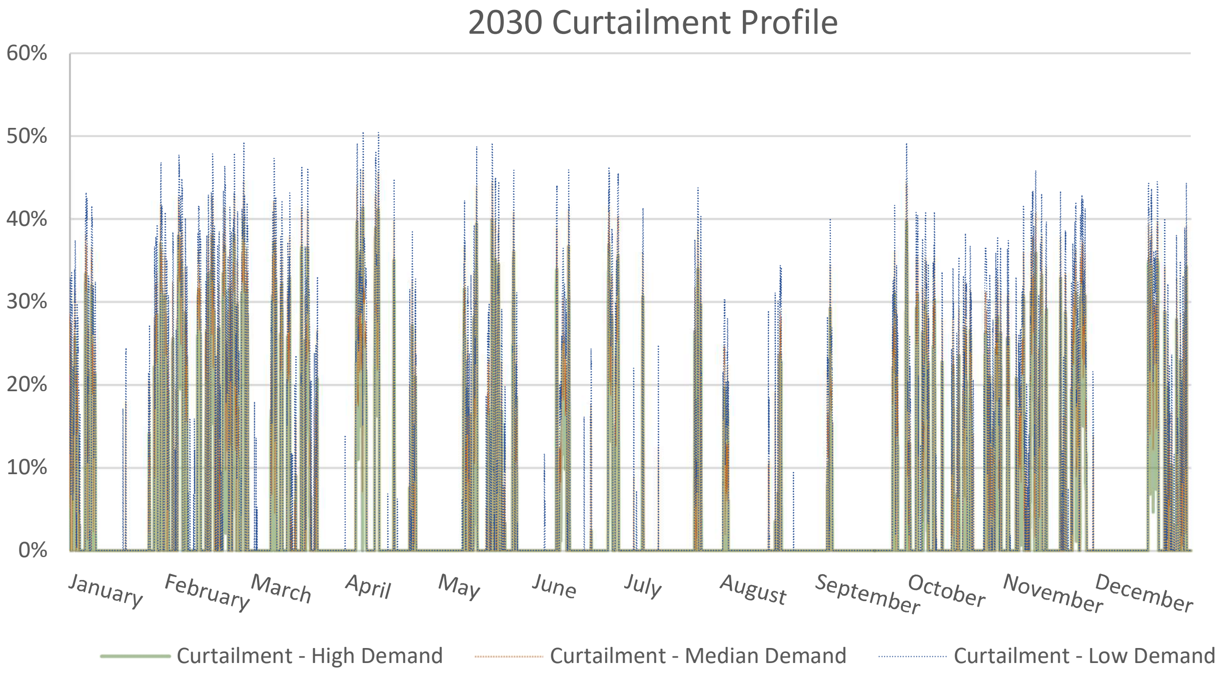

Figure 4: Curtailment Profile

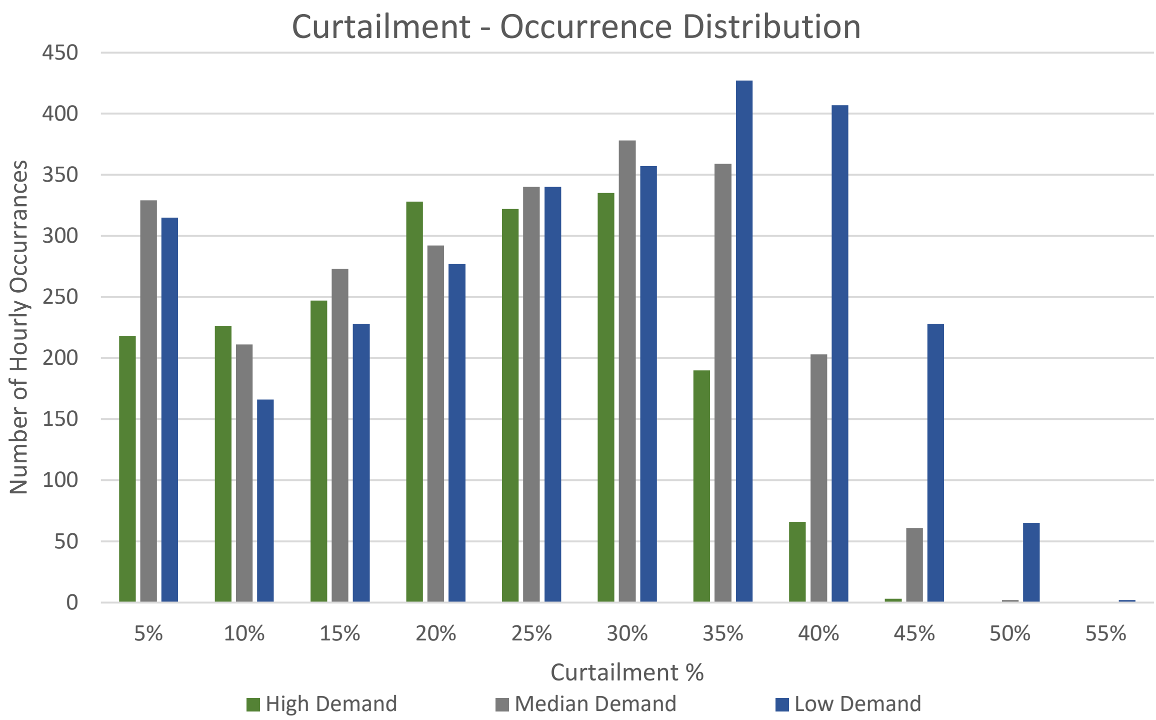

Figure 5: Curtailment Profile Occurrence Distribution

The total renewable energy generation and system demand for low, median, and high profiles shown in Figure 1, Figure 2, and Figure 3 indicate that for the renewable capacity planned to be installed by 2030 the system demand needs to planned in parallel to maximise the utilisation of renewable generation.

The pathways to reduce curtailment for the current estimated demand scenarios include increasing system demand or increasing long duration energy storage. Storage technologies cannot achieve significant reduction in curtailment as there are substantial conversion losses and the capacity requirement for storage is very high. Figure 4 and Figure 5 show the expected curtailment profile for low, median, and high demand scenarios, from this we can observe that the most effective pathway to reduce carbon emissions is to balance the increase in renewable generation with an increase system demand accompanied with demand flexibility, short term storage of renewable energy and flexible generation based in so far as is possible on renewable fuels such as Hydrogen, HVO and Biomethane, while relying on natural gas to provide security of supply in the absence of sufficient renewable fuels.

In the case of the low demand profile, in which the least capacity of LEUs is expected to be installed, we can observe from Figure 3 that the curtailment is highest leading to a very high annual curtailment cost. The annual curtailment cost for the low demand scenario is estimated to be €670 million to be paid for by electricity consumers, whereas for the high demand scenario the annual curtailment cost is estimated to be €370 million. This shows that an annual saving of €300 million can be achieved by accommodating high demand.

To achieve optimal utilisation of renewable assets and economic growth we suggest accommodating the installation of LEUs, as these users can provide greater flexibility to the grid and can act as early adopters of renewable and storage technologies, developing the business ecosystem necessary for large-scale deployment of low carbon technologies provided the value for these services is adequately compensated.

Clarification is required on whether the existing LEUs who are planning to expand due to electrification of heat should be considered under this policy.

The target of achieving net zero requires the responsibility of reducing carbon emissions to be shared among all the participants of an economy. The approach should focus on delivering sustainability as an opportunity rather than as a cost. A priority analysis including cost-benefit assessment should be carried out to identify sectors where most net emissions can be reduced with least impact on the economy. Based on the analysis a pathway is to be determined in which all the entities can contribute rather than burdening the new users to be net zero from the start.

LEUs, growing LEUs, and new LEUs should not be the entities responsible for managing and delivering the transition to net zero. It takes all the stakeholders doing everything possible immediately to achieve Net zero, placing the responsibility on single large energy users will make the task much more difficult, will increase costs for consumers and will reduce the likelihood of success.

The shift in relation to heat and transport from fossil fuels to electricity needs to be accounted for and managed on the whole. This growth in electricity demand from these sectors should be in so far as possible come from renewables backed up by storage and with demand flexibility.

We suggest the CRU to streamline the process of LEU connections to enable them to develop productive assets contributing to demand flexibility, as this case would provide the best utilisation of renewable assets and promote economic development, while limiting the carbon emissions close to the sectorial limits.

RESPONSE

Q1) Comments are invited from interested parties on the categories of LEU in electricity and gas to which this policy should apply (e.g. for electricity is DG10, DTS-T is appropriate, should DG6-DG9 be included, should the definition focus on capacity or usage, should a combination of criteria be applied?).

If the connection policy provides a streamlined process for receiving a new grid connection for a new large energy user or a significant expansion of an existing large energy user site, and it adequately compensates LEUs for any additional services provided to achieve net zero, then it should cover all traditional LEUs along with the larger transmission connections which have become a feature of the energy systems in recent years.

If the LEU connection policy provides barriers to entry or compels one particular cohort to carry excessive share of the costs of the country achieving a net zero economy, without compensating this value add, the applicability of the connection policy is questionable.

Q7) Comments are invited on the approaches used to account for net zero emissions. This could include timestamped GOs or renewable certificates. Please provide reasons and rationale for any views provided.

The use of timestamped GOs or renewable certificates are crucial for accounting the emissions of the grid. By timestamping the GOs an accurate baseline of grid carbon emissions can be established. These GOs can be used in dynamic pricing of the electricity depending on the real time carbon emissions of the grid. This would promote competitive participation of stakeholders in providing flexibility services.

The use of timestamped GOs is important for carbon accounting, but the use of GOs for assessing an LEU connection should not qualify as a mandatory requirement. The timestamped GOs should be used for measuring performance of the grid as a whole rather than an individual connection.

Q8) Should the end target/goal be real time zero emissions? Do respondents have other suggestions as to how this can be demonstrated? Please provide reasons and rationale for any views provided.

The end target/goal of real time net zero emissions is misguided. The proposed requirements are mainly focused on isolating the LEUs and transferring the burden of decarbonising the grid onto those users rather than solving for a holistic solution. The expectation to solve the challenge of variability of renewable resources and grid constraints by an individual LEU is unwarranted, as the solution to variability requires a combination of different load profiles complementing each other to provide flexibility. By imposing unreasonable requirements on LEUs, the grid will be losing the flexibility offered by these users and the challenge of variability would fall upon the end consumers, who have a fixed daily cycle of energy usage.

The LEUs should be encouraged to contribute to the best of their ability towards delivering net zero, but the responsibility of decarbonising the grid should not be the responsibility of new users or users that may wish to increase electrical grid capacity to electrify heat or transport. By imposing onerous requirements on new users, the CRU may inhibit investments towards development of data centres and other LEUs in the manufacturing and processing industries. The CRU regulation should be impartial on assessing connections, as the data centres are also similar to other grid users serving the needs of the local community by providing cloud solutions which are a part of our daily needs for example in online meetings, e-commerce, and various other applications.

If imbalanced requirements are set for new LEU connections, then the CRU may compel stakeholders towards the development of less efficient small scale data centres at 38 kV connections, spread across different locations increasing the grid constraints.

The focus of achieving real time net zero emissions should be on grid scale, by optimally utilising all the available services. We suggest the CRU should assess the new connections based on fit for purpose basis rather than idealistic regulations. The CRU should prioritise development of the market to promote collaboration with LEUs, whereby the LEUs can contribute towards reducing grid constraints as a part of their connection offer. To achieve this the CRU should regulate the system operators to define and publish grid constraints for each locality to identify the gaps and network requirements in terms of scale and time of constraint. By recognising the various service opportunities offered by LEUs and providing appropriate reward mechanisms, the CRU can incentivise LEUs to develop competitive grid services, which the system operators require.

Q15) Should new LEUs be located close to areas of renewable generation and/or storage or within energy parks? Please provide reasons and rationale for any views provided.

The installation of renewable generation or storage in proximity of the LEUs is preferable, but this requirement should not be used as a basis for withholding connection offers. There are many factors influencing the locational requirements such as –

- Availability of renewable resources
- Availability of land
- Availability of access to fibre optical network
- Suitability of local grid
- Availability of Workforce
- Availability of Water Supply
- Availability of Road Network

As all the above listed factors are independent of each other, expecting a site to meet all the requirements is unlikely. By introducing locational requirements, the CRU would be creating barriers inhibiting the additional services which can be provided by the LEUs, for example the LEUs can aid in reducing local grid constraints by installing storage solutions at grid nodes under stress. If there is any benefit in connection costs by locating renewable generation near the site, these additional costs can be passed on to the LEUs in the case of not locating the renewable generation on-site. Implementing an all-inclusive approach would enable the CRU to assess all the available solutions and plan effectively to deliver more efficient projects.

When locational requirements are added on to real-time net zero conditions, the development of LEUs is likely to become unfeasible. We suggest the CRU to establish a middle-ground approach in which all the challenges including both site specific and national grid specific are assessed and optimal solutions are defined.

Q16) What type of measures to facilitate this approach could be introduced to encourage new LEUs to locate close to renewable generation.

The requirement of locating LEUs close to renewable generation does not solve the predicament of grid constraints, as the connection requirement from the renewable generation site to the LEU is independent of the location of LEUs. Considering the case in which renewable generation is located near to the LEUs, the LEUs would still require generation supply from the grid during periods of low renewable generation. The same grid infrastructure would be required to provide security of supply to the LEU and from the renewable generators point of view security of demand. All that has been achieved in this instance is to compromise the location of the LEU.

Q21) Should non-firm LEU connections be introduced? If so, should these non-firm connections be made on an enduring basis? Please provide reasons and rationale for any views provided.

Yes, non-firm LEU connections should be an option introduced on an enduring basis where required along with the provision of converting to a firm connection when grid is suitable to accommodate. This would allow the LEUs to plan their consumption and contribute to the flexibility services. The islanded LEUs should be connected to the grid as soon as practical, by providing non-firm connections to these users the System Operator can access the generation on these sites, which can be used as embedded flexible peaking plants providing valuable services which should be compensated. As lower carbon solutions become available there maybe a drive to make these connections firm and the connection offer should accommodate the lowest cost carbon reduction technologies.

Q28) Comments are invited on the use of renewable generation and storage on-site. Should this be used to match LEUs demand on-site or to provide flexibility services to the system? Please provide reasons and rationale for any views provided.

The focus of renewable generation and storage on-site should be to provide flexibility services to the system, particularly local grid constraints, it should not be to match on site demand and it should not be only renewable generation, the requirements for security of supply needs to be considered at end user level as well as the grid level and in any scenario there will be a minimal amount of fossil fuel required to provide this security of supply during dunkelflaute periods.

The curtailment profile shown in Figure 4 and Figure 5 indicates the requirement for the use of storage technologies in reducing losses due to curtailment. The battery storage solutions these LEUs could offer are very useful in providing high peak short-medium duration flexibility services to the grid, these services can be used to reduce grid constraints on stressed nodes during peak hours. Considering the current expected demand scenarios long duration energy storage solutions are essential to capture most of the curtailed energy. The LEUs can be incentivised to develop these storage technologies to increase utilisation factor of renewable energy as a part of a connection offer. This can be achieved by recognising the carbon savings, attained by increasing renewable integration, provided by the LEUs.

Q29) Should the use of on-site dispatchable generation using only renewable fuels have limited run hours, to reflect limited availability of an indigenous renewable fuel? Please provide reasons for any views provided.

The limitation on the use of onsite generation should be based on dispatches from the grid, rather than availability of renewable fuels in the local market. The interconnectors between France and the UK will not be importing 100% carbon free electricity. The imported electricity will be primarily gas fired power generation, applying restrictions based on national supply of energy is not practical for solving a global issue.

Onsite generation should not be restricted to renewable fuels only. Once it is installed and dispatchable by the system operator, the lowest carbon scenario available can be achieved.

Q30) Do LEUs require back-up generation for operational reasons? If so, what is the typical annual running hours of this back-up generation?

The run hours of back up generation onsite would be ideally zero, provided security of supply comes from the grid. Back up generation is only used when there is an interruption to the supply of energy from the grid.

Q31) What should demand flexibility services provided by new LEUs be used for, system support, decarbonisation or both? Please provide reasons and rationale for any views provided.

The demand flexibility services provided by the new LEUs should be used for both system services and decarbonisation. Currently, the flexibility services offered by LEUs are undervalued, but considering the planned total renewable generation and system demand for 2030 these services are necessary to attain net zero at minimum cost to the end customers.

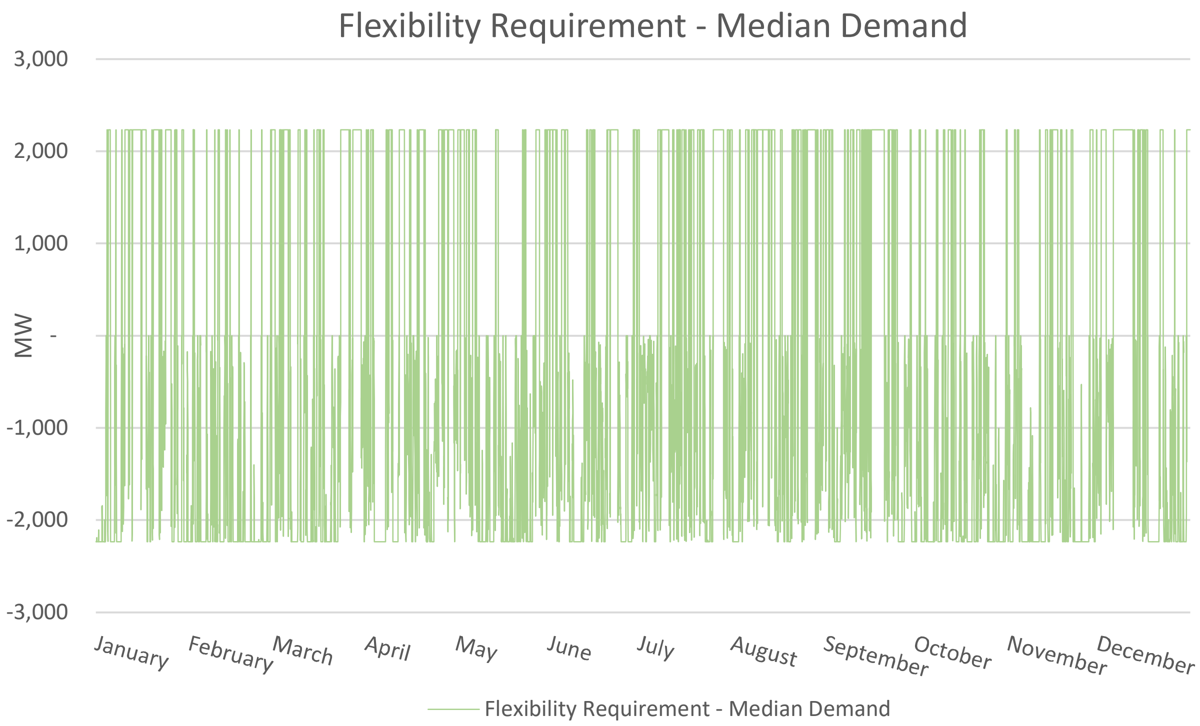

Figure 6: Flexibility Requirement - Median Demand

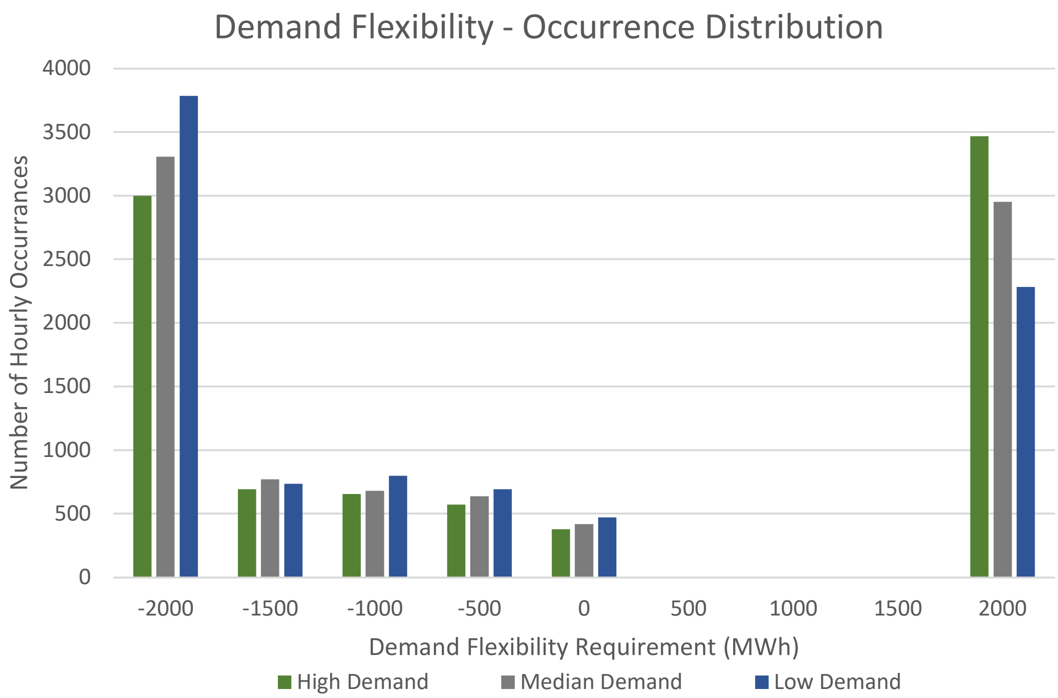

Figure 7: Demand Flexibility - Occurrence Distribution

The Figure 6 and Figure 7 show the variability profile of planned flexibility procurement which includes 990 MW from interconnectors (1,650 MW at 60% Derating), 745 MW from DSU, and 500 MW from ESB Flexibility Product Procurement. The CRU needs to conduct a market analysis to assess the total addressable market available for proposed procurement of flexibility, as the proposed levels of procurement from domestic or commercial customers is very high. The variability profile from Figure 6 indicates fast response switching between demand ramp up and ramp down, and Figure 7 shows that most occurrences of flexibility requirement is at maximum availability of flexibility at both ends. This fast response switching at their peak contracted capacity is unlikely to be provided by domestic or commercial customers 24/7 all year round. The LEUs are essential to maintain energy security of the centralised grid, as they can contribute greatly to this flexibility procurement. The LEUs are better positioned than domestic or commercial customers to plan and schedule their demand according to system requirements.

The cost of flexibility is an important factor the CRU needs to consider in order to achieve large-scale renewable integration onto the grid. The current contracted capacity and costs are shown below -

Service	FFR	POR	SOR	TOR1	TOR2	RRS	RRD	SSRP	SIR	RM1	RM3	RM8
Unit	*MW*	*MW*	*MW*	*MW*	*MW*	*MW*	*MW*	*MVAR*	*MWS2*	*MW*	*MW*	*MW*
DSU	148	169	174	233	225	0	377	0	0	612	47	45
Wind	123	242	257	252	0	0	0	1,484	0	0	0	0
Conventional	375	771	1,167	1,373	1,939	4,484	2,361	5,908	676,114	6,592	7,872	8,459
Battery	463	473	473	473	452	0	8	356	0	0	0	0
Interconnector	200	200	200	200	200	0	0	350	0	0	0	0
AGU	0	0	0	61	74	10	88	0	0	88	88	88
Hybrid	2	2	2	2	2	0	0	0	0	0	0	0
Total	1,311	1,856	2,273	2,594	2,892	4,494	2,834	8,098	676,114	7,293	8,007	8,592

Figure 8: Contacted Volumes of System Services Procured for 2022[4]

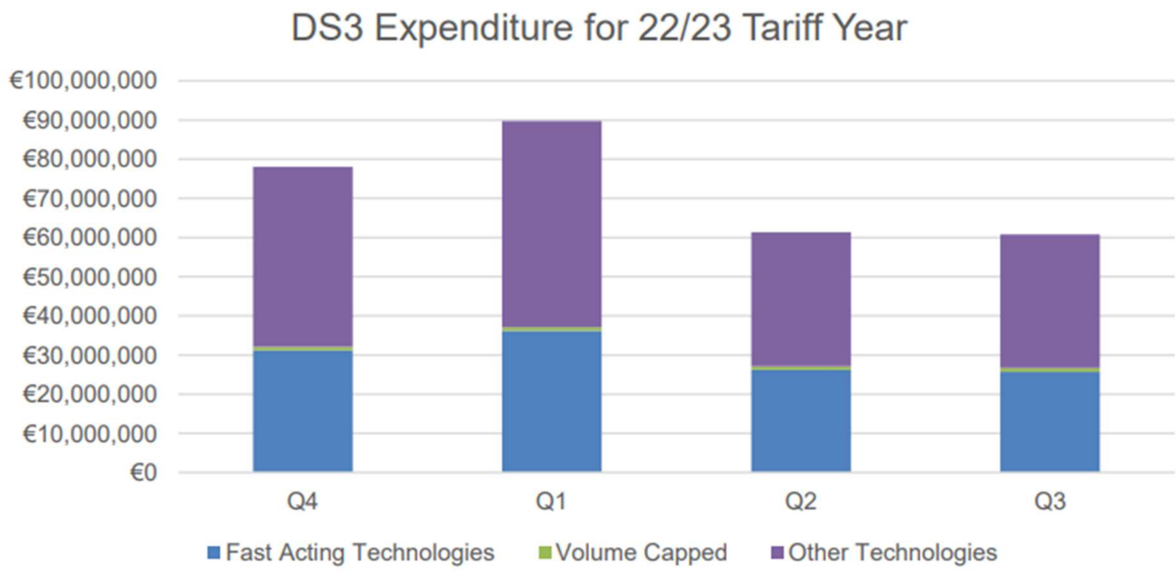

Figure 9: DS3 Expected Expenditure 2022-2023

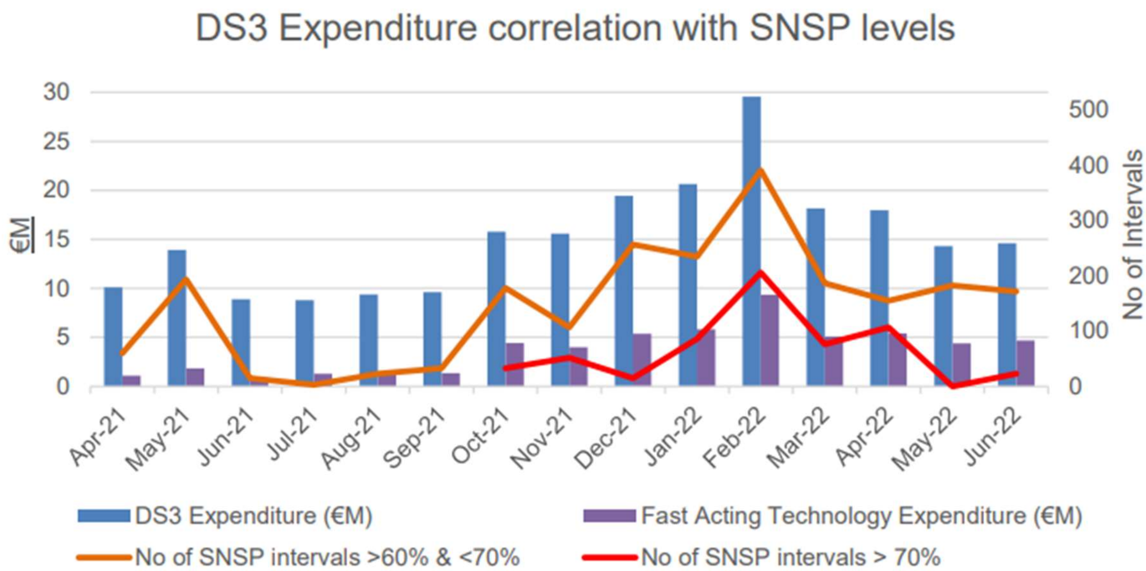

Figure 10: DS3 Expenditure in Correlation with SNSP Levels

[4] https://cms.eirgrid.ie/sites/default/files/publications/DS3-System-Services-Consultation-16-Sept-2022.pdf

The current cost of flexibility from Figure 9 is estimated to be €290 million. This cost is expected to increase significantly in future as to accommodate more renewable energy onto the grid and increase the SNSP limit to the planned 95% substantial capacity of demand flexibility needs to be contracted.

As shown in Figure 10 the cost of flexibility tends to increase with SNSP limit and requirement of fast acting technologies, in 2030 this cost will increase as demand capacity needs fast response switching all year round, shown in Figure 6 and Figure 7. The flexibility services offered by LEUs are crucial to achieve net zero as these LEUs can contribute large amounts of capacity at least cost due to economies of scale and effective utilisation of assets.

The LEUs offer various flexibility services serving both system requirements and decarbonisation by utilising their standby and storage systems. The CRU can assess the local and national grid requirements and accordingly propose a baseline of minimum flexibility services as part of a connection offer. The CRU can incentivise the LEUs to develop additional flexibility services by recognising the importance of these services provided by LEUs and rewarding them accordingly by developing revenue mechanisms or separate capacity market for these users.

Q32) Should demand flexibility services be mandatory or voluntary for new LEUs? Please provide reasons and rationale for any views provided.

The provision of demand flexibility services should be a requirement based on local grid constraints. In the case where there are no local constraints, we suggest the CRU to incentivise the LEUs to develop flexibility services by providing adequate compensation mechanisms for provision of these services. The procurement of demand flexibility should be considered of utmost importance, as Figure 3 indicates that the demand flexibility is the key factor in achieving maximum integration and utilisation of renewable generation. This incentivising approach for procuring demand flexibility would enable the LEUs to tap into utilisation of the excess energy from curtailment and contribute to the decarbonisation of the grid.

Q39) Should provisions to use waste heat from new LEUs in suitable locations to feed district heating or other processes be mandatory or voluntary? Please provide reasons and rationale for any views provided.

The provisions to use waste heat from LEUs for the purpose of district heating or any other process should not be mandatory as a part of the connection offer. If the project is economically viable this waste heat will be captured, and in the case where the project is not economically viable it won't. Regulations should accommodate the ancillary applications but should not mandate it.

Q40) Comments are invited from interested parties on the use of biomethane towards decarbonisation of LEU demand. Do respondents have a view on the volume of indigenous biomethane that can be produced annually? Do respondents have a view on the scalability of using biomethane towards the decarbonisation of LEU demand?

Yes, biomethane should be considered to fuel gas generators on LEU sites via the gas transmission system mixed with natural gas. The biomethane production should not be part of the stipulation for LEU gas connection, the biomethane should be part of a national strategy. This way the percentage ratio of biomethane to natural gas will increase in the countries gas transmission system and the overall reductions in carbon emissions will be greater. The gas generators should be limited to running as back up when other renewables such as wind or solar are not available. The reason is this would lower the countries gas usage and therefore the percentage of biomethane to natural gas would be higher as there always will be other users on the gas network that cannot use alternative fuels.

The Biomethane energy report by Gas Networks Ireland issued in September 2023 indicated that the biomethane potential could be 14.8 TWh per annum by 2030 which represents 26% of the total gas currently transported in Ireland's gas network. This is seen as ambitious given Ireland produced just 41 GWh of biomethane in 2022 and total Irish production of 62 GWh is projected for 2023. The target for biomethane production in Ireland is 5.7 TWh by 2030. Therefore, keeping the gas generators for backup and using other renewable energy for base load on LEU sites would have more of an impact on the annual gas usage and by default scaling up the biomethane production would contribute greatly to the decarbonisation of other gas users. Hence, there should be incentives to encourage the production of large volumes of biomethane outside of the LEU connection process.

The extract from the Biomethane energy report by Gas Networks Ireland issued in September 2023 below shows the biomethane production across Europe in 2021 and this also shows Ireland well behind all other countries in regards to biomethane production. In fact, in 2023 34% of Denmark's gas demand is met by Biomethane and by 2030 the Danish government are aiming for 100% of Denmark's gas demand being meet by Biomethane. Therefore, Denmark's biomethane production shows with the right government policies and incentives there is no reason why Ireland could not aim for the same targets.

Country	GWh
Germany	83,878
UK	26,224
Italy	25,763
France	10,390
Spain	8,329
Denmark	7,277
Czech Republic	6,840
The Netherlands	4,826
Poland	3,407
Belgium	2,965
Sweden	2,265
Switzerland	1,779
Austria	1,622
Ukraine	1,366
Slovakia	1,214
Ireland	487

Figure 11: European Countries Biomethane Generation 2021

Q41) Comments are invited on what running profile should be adopted by onsite gas generation which is being run on a limited supply fuel like biomethane e.g. should it be limited running for back-up and/or flexibility purposes, or baseload (islanded LEU)? If for flexibility services what would be a typical capacity factor?

The running profile for gas generators on LEU sites should be for backup to renewable sources of energy in order to reduce the country's overall gas usage and lower the carbon footprint. The System operators should determine the running profile, and this should be based on the availability of lower cost alternatives such as wind and solar and not based on the availability of biomethane. Primarily the onsite gas generation would run to provide flexibility.

Biomethane fuel combined with natural gas is a secure source of fuel as the supply of feedstock for biomethane is more reliable than wind or solar as there is less control over wind or solar irradiance. Therefore biomethane mixed with natural gas is a secure source of backup power to wind and solar. Retaining gas generation as backup will mean as the percentage of biomethane production increases the carbon footprint will decrease.

Q42) Comments are invited from interested parties on the use of green hydrogen towards decarbonisation of LEU demand and the timelines in which this might be viable. Please provide reasons and rationale for any views provided.

The production of Green Hydrogen is one method of reducing the amount of curtailment of the excess wind generation and therefore make more efficient use of the renewable energy available. This could be 8.6% or 3,715 GWh of wind generation when the higher demand scenario is considered.

LEU's using hydrogen for the generation of electricity would greatly assist towards the decarbonation of LEU demand as they are then reducing their dependency on fossil fuels. One method to achieve this is the hydrogen can be generated and stored elsewhere and then piped to the LEU. Another method to achieve this is the LEU uses electricity from the network being fuelled by hydrogen. This is in line with Irelands hydrogen strategy shown in the extract below where from 2028 onwards hydrogen is expected to be used for power generation. The timeline for this depends on the wind farms coming online to generate the hydrogen. The use of hydrogen for LEU as a fuel source should not be a precedence for LEUs obtaining an electrical connection. The reason why hydrogen as a fuel source should not be a precedence is that LEU should be allowed to use alternative renewable fuel supplies in the situation where there is a shortage of hydrogen and those end users who cannot use alternatives then get priority. LEU should still be required to use battery storage for storing excess renewable energy for short duration.

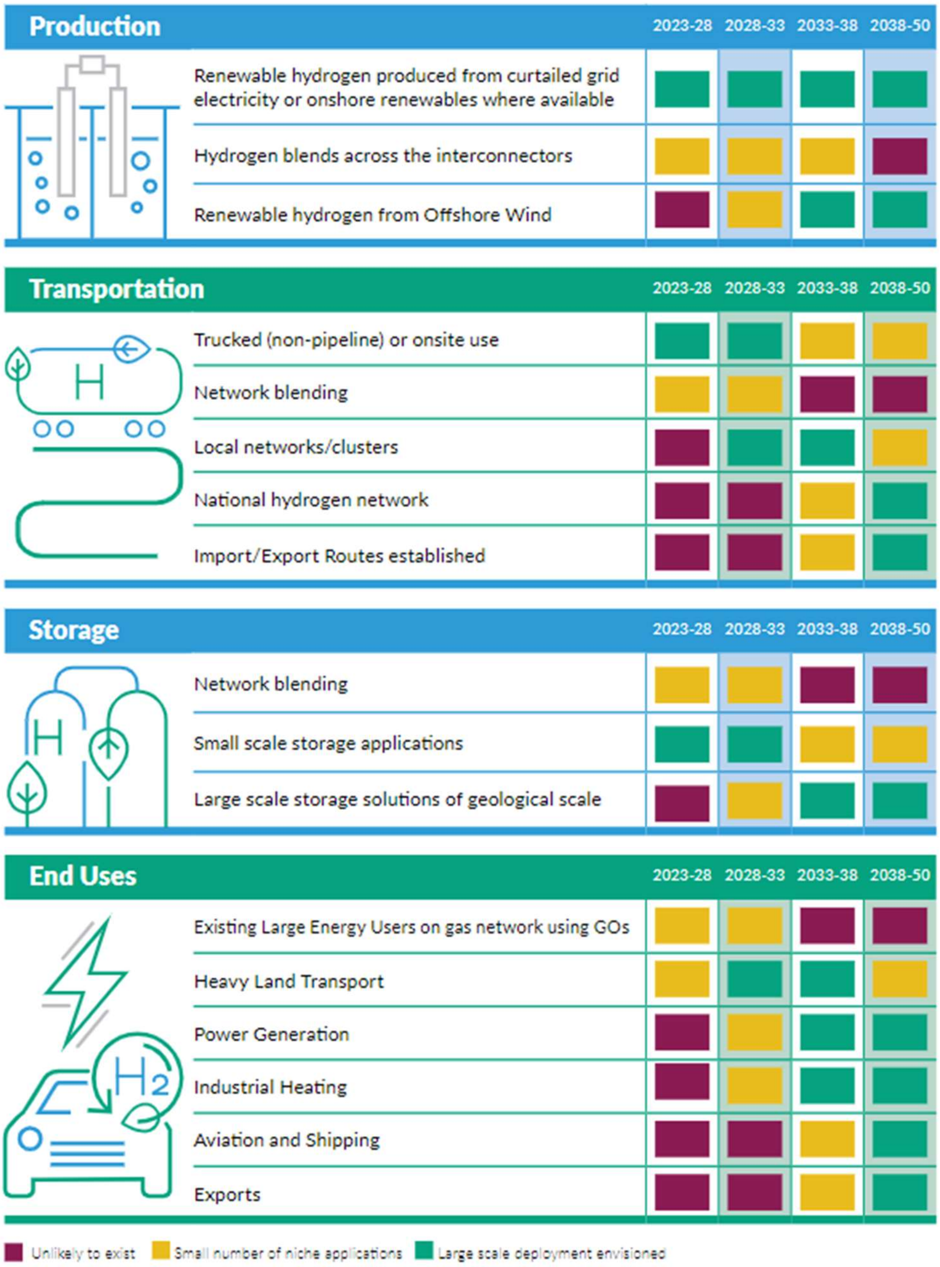

Figure 12: Ireland's Strategic Hydrogen Development Timeline Roadmap

We trust that the CRU will take the above responses into consideration when finalising the Large Energy User Connection Policy and welcome the opportunity to discuss our analysis or any of the above points with you.

Yours Sincerely,

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