Submission to the CRU Large Energy User Connection Consultation

Prepared by Codema - Dublin’s Energy Agency

March 2024

Background

Codema is Dublin's Energy Agency is a not-for-profit company limited by guarantee and was founded in 1997. We are the energy agency to the four Local Authorities in Dublin, and our mission is to accelerate Dublin's low-carbon transition through innovative, local-level energy and climate change research, planning, engagement and project delivery, in order to mitigate the effects of climate change and improve the lives of citizens. We are the Dublin Local Authority's one-stop-shop for developing pathways and projects to achieve their carbon reduction and climate targets. Examples of Codema's work include energy masterplanning, district heating system analysis, energy performance contracting, management of European projects, energy saving behavioral campaigns and detailed energy reviews. Codema is well networked in Europe and has been very successful in bringing European projects to Dublin with a local implementation for the Local Authorities.

Context

Codema's Experience in Developing Debarbonisaion Pathway Analysis and Spatial Energy Planning

Codema are Ireland's leading experts in the area of spatial energy master-planning. As part of our work on the Dublin Region Energy Masterplan[1] (DREM) we have assessed cost-optimal, technically feasible decarbonisation pathways for the heat, electricity and transport sectors in Dublin to 2030 and 2050. The masterplan addresses all energy sectors of electricity, heat and transport, and the interaction between these sectors from a spatial perspective as well as from a technology perspective.

The analysis is at a granular spatial level called the 'small area' level . This project also identifies and supports the use of low-carbon sources indigenous to Dublin, develops and harnesses new local level energy policy practices, and strengthens Ireland's integrated energy system modelling capabilities.

The pathways developed as part of the masterplan are based on detailed local-level, spatially driven energy scenario modelling, which has not been carried out before for any county in Ireland. This innovative local-level energy planning methodology builds upon leading international-class energy research in the area, and findings from the DREM have already been directly applied and demonstrated by the Dublin Local Authorities.

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https://www.codema.ie/projects/local-projects/dublin-region-energy-master-plan#:~:text=The%20Dublin%20Region%20Energy%20Master,targets%20to%202030%20and%202050.

This work presents a set of clear, evidence-based pathways, which will enable the Dublin region to create effective, long-term energy policy in areas such as spatial planning, land-use, and public infrastructure. In addition to this the work also presents a geographic analysis of the current situation for energy use, along with additional spatial data layers to facilitate contextual analysis . The results of the DREM will allow local authorities to effectively create evidence-based policies and actions to affect CO2 emissions county-wide, by using the local authority's powers in spatial planning, land-use, planning policy and public infrastructure.

Codema's Experience in Sector Integration

Codema is Ireland's leading expert in Energy Planning, District Heating and the role Large-scale Thermal Storage in delivering a cost-effective integrated renewable energy system for Ireland. We have built the evidence-base to support the roll-out of DH in Dublin, developing the first heat demand and heat source maps in Ireland, based on European best practice methodologies. We have identified potential projects across Dublin and, working with Local Authority project champions, have **brought projects from idea to reality; from pre-feasibility, techno-economic analysis, business case through to securing funding, procurement, contracting and delivery**. We are the Dublin Local Authority's one-stop-shop for the roll-out of DH projects. Codema therefore very much welcome this opportunity to make a submission to this consultation, which has the potential to be a key policy for providing a resilient and green energy system for Ireland while also supporting the decarbonisation of heat which is Ireland's worst performing sector in terms of renewable penetration.

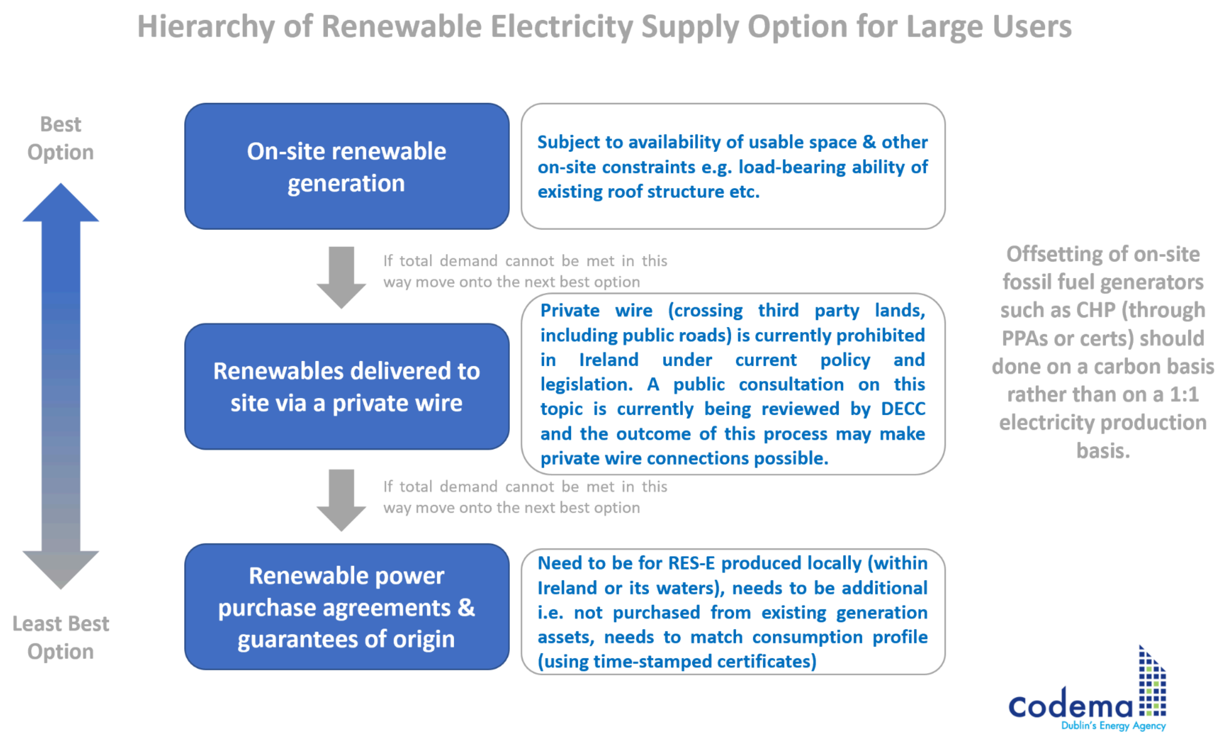
Response to Consultation

Codema welcomes the opportunity to make a submission on this consultation. Codema's interest in this consultation stems from our work on the development of cost-optimal decarbonisation pathways for heating, electricity and transport for the Dublin region. Our research and practical experience of developing projects (particularly those which utilise waste heat) allows us to advise on cross-sectoral local-level low-carbon policies which aim to reduce energy, fossil fuel use and associated costs & emissions. We have more than 25 years' experience in the climate change and energy sector.

General Comments

1. Hierarchy of Renewable Supply Options

The use of renewable generation on-site should be prioritised as much as possible. The image below indicates the hierarchy of renewable energy production for large energy users. A combination of these methods can be used to achieve 100% renewable electricity targets by LEUs.



Land banking practices may also allow some additional opportunities for on-site/near-site production of renewables which may be more limited when only looking at land area that is currently developed.

2. Firm/Non-Firm Connections

Non-firm connections allow the operator to dictate the renewable proportion of the energy supply whereas a firm grid connection places the responsibility on the national grid operator. A firm grid connection ensures that our energy supply transitions to net zero in line with national policy. Non-firm grid connections place large portions of our energy demand outside the remit of grid operators and reduce Ireland's ability to control its energy transition.

3. Economic Impact of LEUs vs RES-E

It should be noted that LEUs such as Data Centres are a core part of Ireland's economy and enterprise strategy but their growth should be scaled in line with our ability to supply renewable energy.

4. Waste Heat Utilisation is Supported through Policy at EU, National and Local Level

Waste heat utilisation is supported at both an EU and a national level through a number of different policy documents, these include:

- EU Energy Efficiency Directive[2]
    - Data centres with total rated energy input exceeding 1 MW are required to utilise the waste heat or other waste heat recovery applications unless they can show that it is not technically or economically feasible.
    - Industrial sites with annual average energy input exceeding 8 MW need to perform an installation-level cost benefit analysis to assess the utilisation of waste heat either on site or off site (e.g. through a district energy network)
    - Wastewater treatment plants and LNG facilities with annual average energy input exceeding 7MW need to perform an installation-level cost benefit analysis to assess the utilisation of waste heat either on site or off site (e.g. through a district energy network)
    - Member States shall aim to remove barriers for the utilisation of waste heat.
- EU Renewable Energy Directive[3]
    - Treats waste heat on a par with renewables
- EU Energy System Integration Strategy[4]
    - Talks about DHC ability to provide flexibility to electricity grid, circular economy & waste heat, strengthen requirement to connect, accelerate investment in DH
- Climate Action Plan 2024[5]
    - Mandating that industrial facilities supply waste heat to district heating where the total rated energy input is at least 1 MW
- DECC DH Steering Group Report[6]
    - Prioritise decarbonisation of heating by promoting renewable heat and waste sources for district heating, in line with the definition of efficient district heating set out in the Energy Efficiency Directive
    - Maximise development of local opportunities for renewable and waste heat supply

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[2] EU Energy Efficiency Directive PDF

[3] https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

[4] https://energy.ec.europa.eu/topics/energy-systems-integration/eu-strategy-energy-system-integration_en

[5] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

[6] https://www.gov.ie/pdf/?file=https://assets.gov.ie/265549/487f6e25-427d-4ba3-acc8-d3b5e6272b46.pdf#page=null

- Certain waste heat applications (data centre + Heat pump and Waste-to-Energy Plant) have also been incorporated into DEAP/NEAP[7] with more use cases being added in due course

Waste heat utilisation is also supported at a local level. The provision of waste heat (installing heat recovery and pipes to bring this heat to the boundary of an industrial site or to a DH Energy Centre) is already a planning requirement in a number of local authority areas. South Dublin County Council for example, requires that any new or expanding industrial or commercial site whose primary activities produce waste heat are required to submit a waste heat report with their planning application. This report includes information on the quantity and temperature of waste heat and where relevant the phasing of when this waste heat will be available. This also requires that heat recovery equipment be installed to bring that waste heat to the boundary of the site or to the DH Energy Centre in areas where a DH network is either planned or existing.

5. Biomethane as an Option for LEUs

Ireland's target of up to 5.7 TWh of biomethane by 2030 is ambitious given Ireland produced just 41 GWh of biomethane in 2022. Due to the scale of LEUs, in some cases a single LEU could use more than 50% of this 2030 target for biomethane, highlighting that indigenous biomethane as a solution for LEU's is not a scalable solution across the LEU sector. This is before you consider the absolute limit on biofuel resources calculated in the SEAI report on Sustainable Bioenergy calculates that the by-products and wastes from households, businesses, agriculture, and forestry could provide about 6.5 TWh of fuel. Based on current national herd forecasts, biomethane production from a grass silage/slurry mix, could deliver 2.7 TWh of biomethane (increasing to 3.7TWh if other food wastes and pig slurry could be used). This sets out a natural limit on indigenous biomethane production.

It is therefore key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

In terms of enforcement perhaps financial penalties in the form of additional commercial rates could be used as a means to encourage compliance. Fines or prohibition of activities are also powers which the CRU holds for certain activities and could be extended to non-compliance in relation to transitioning to low-carbon energy. These penalties would need to be set out as early

[7] https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/software/neap/District-Heating-factors-for-BER-calculations.pdf

as possible in order to allow for business to incorporate the potential for such penalties into their development plans.

Similar to the electricity system it is likely that much of this biomethane resource will be delivered to LEUs through grid infrastructure. This means that any gas consumed on site would need to be considered to have a carbon intensity that is based on the proportion of renewable gas in the grid as a whole (i.e. majority fossil gas). Renewable gas certificates may be used to offset fossil gas consumption but it is the view of Codema that these would have to adhere to similar principles that renewable electricity certificates adhere to, namely:

- Additionality - certs need to be purchased for new renewable gas production i.e. not using renewable gas which is part of current production capacity
- Should be indigenous to Ireland, where possible - easier to track methane leakage (which has a global warming potential 80 time higher than CO2) when it is within Ireland, greater visibility within national borders to avoid potential double counting, stimulate growth of indigenous production, keep money spent on gas within the country, avoid national emissions associated with methane from slurry, food waste etc. leaking into the atmosphere

It is vitally important that temporary solutions (i.e. LEUs being connected to fossil gas supplies) do not become longer term solutions that result in the lock-in of LEUs to polluting fossil fuel systems. It is therefore key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site and/or administer fines. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

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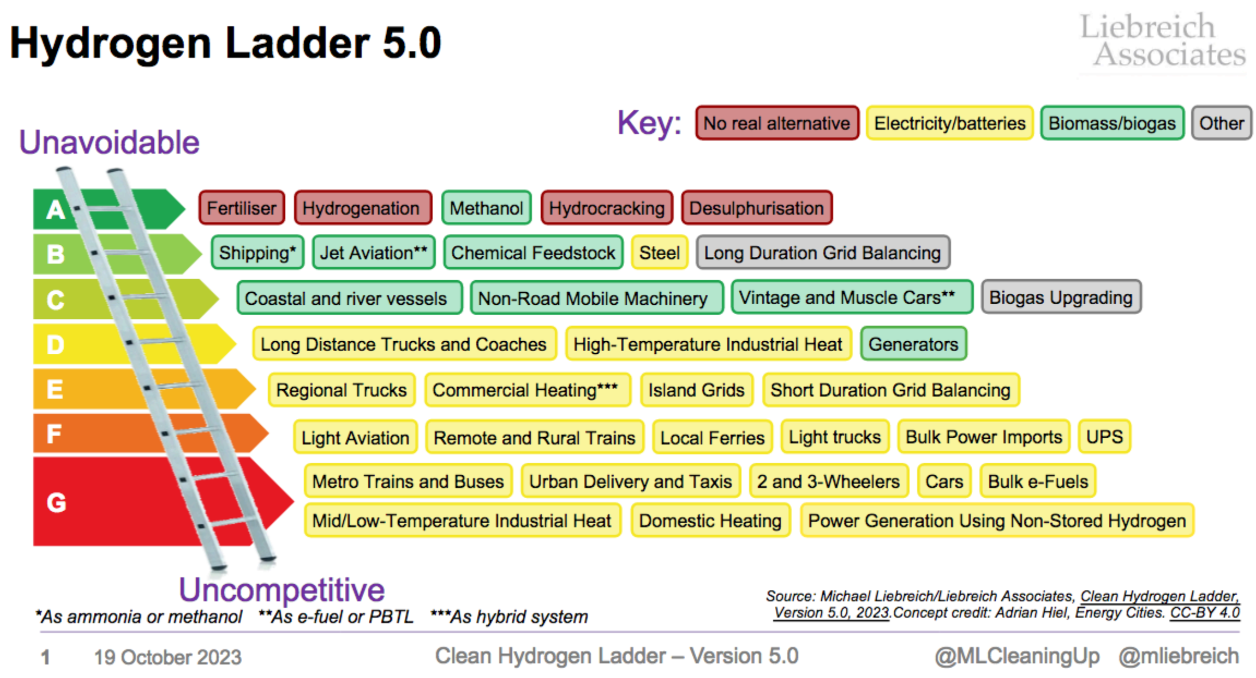
6. Biomethane for On-Site Power Generation

Biomethane however could be used sustainably by LEUs for the purposes of flexibility services for short periods when the electricity grid requires support/balancing. A gas turbine using biomethane would allow a data centre to adjust its demand based on grid requirements, given the fast response time of gas engines to load shifting. This in turn would facilitate greater proportions of variable renewable electricity on the grid from sources like wind and solar. As a backup electricity supply again it would be envisaged that these generators would operate for less than 1500 hours per year in line with definitions set out in the Energy Efficiency Directive. It should be noted that due to the efficiency of these units it is likely that significant quantities of waste heat are also going to be generated. These should also be utilised either on-site or off-site, wherever possible (for heating or for cooling, where possible, through the use of absorption chillers). This reasonably low efficiency for on-site electricity production combined with expected higher prices for renewable gases will also make electricity production in this way more expensive than current methods.

7. Use of Green Hydrogen

The use of green hydrogen should be reserved for hard to abate use cases. The hydrogen ladder below indicates how hydrogen should be used in any energy system. As a high-exergy fuel, hydrogen should not be used in low-exergy applications.



Hydrogen is also an indirect greenhouse gas with a global warming potential GWP of 11 over a 100-year time horizon[8]. On this basis, serious consideration should be taken to establish whether it is a viable decarbonisation strategy for LEUs. A future hydrogen economy would have greenhouse consequences and would not be free from climate permutations. Burning hydrogen can also result in NOx emission up to six times higher than fossil gas boilers and burning

8 https://www.gov.uk/government/publications/atmospheric-implications-of-increased-hydrogen-use

hydrogen-based e-fuels produces similar emissions to fossil-based fuels[9]. The global warming potential (GWP) of NOx is estimated at GWP 30 - 33 for the time horizon of 20 years and is thereby comparable to that of methane. NOx is also a main cause of poor air quality which impacts people's health in dense urban areas. Careful planning for mitigation of these adverse effects, where possible, is required.

There is a need to avoid an emissions lock-in risk or investing in infrastructure that is based on polluting imported fossil fuels for which significant decarbonisation is extremely unlikely to occur in the short or medium term (gas network). Whilst existing infrastructure can accommodate small proportions of H2, the maximum proportion of H2 that can be accommodated without issues by volume is 20%. It is worth noting that the volume percentage differs significantly from the delivered energy proportion due to the difference in energy density between gas and H2 at the same pressure (i.e., in the same pipe). In the case where fossil gas has 20% of H2 blended in, this translates to a 13% reduction in energy capacity of the pipework with H2 only providing 7% of the energy delivered. To increase the proportion of H2 beyond 20%, replacement of pipework, compressors, valves and fittings, boilers, meters, and safety sensors would likely be required.

From analysis conducted by Codema and project partner MullanGrid[10] which investigated the potential for Hydrogen in Dublin. It was found that a viable business model for green hydrogen production from curtailed/wasted electricity depends on the electricity system being very inefficient in using future renewable electricity i.e. long periods of curtailment are required to achieve the required utilisation rates of electrolysers to make the business case for green H2 viable. Modelling of various hydrogen production configurations for a 400 MW capacity electrolyser located at Poolbeg in a 2030-2040 timeline indicate a levelised cost of hydrogen production in the range of €3.8-7.1/kg making it much more expensive than fossil gas. In general the Hydrogen sector suffers from a lot of uncertainty at this point and is not currently a viable option for decarbonisation in the short to medium term.

9 https://www.google.com/url?q=https://www.transportenvironment.org/discover/in-tests-cars-powered-by-e-petrol-pollute-the-air-as-much-as-petrol/

10 https://www.codema.ie/projects/local-projects/integration-of-heat-electricity-and-transport-use-of-curtailed-renewable-en

Category of LEU to which this policy applies

Q.1 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?).

Q.2 Please provide views on whether this proposed policy should apply to capture smaller LEUs in due course, and if so which categories of LEU and on what timeline should this occur. Please provide rationale for any views shared.

The proposed policy could also look to other policies as a method for categorising LEUS. Article 26 of the EU Energy Efficiency Directive[11] for example talks about the following energy input capacities for different sectors which are required to assess waste heat utilisation, something similar could perhaps be used to define LEUs:

- Data centres with total rated energy input exceeding 1MW
- Thermal electricity generation installations with an average annual total energy input exceeding 10 MW
- Industrial sites with annual average energy input exceeding 8MW
- Wastewater treatment plants and LNG facilities with annual average energy input exceeding 7MW

Transition period

Q.3 Comments are invited from interested parties on the proposed use of a transition period/glide path in relation to (i) the changing requirements at time of connection on the transition to zero real time emissions, and (ii) once connected, the changing requirements as the project transitions closer to real time zero e.g. from non-firm connection to firm connection linked to milestones.

[11] EU Energy Efficiency Directive PDF

Whilst the use of a transition period/glide path may look to address current limitations in terms of grid capacity. It is vitally important that temporary solutions do not become longer term solutions that result in the lock-in of LEUs to polluting fossil fuel systems. It is therefore key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

In terms of enforcement perhaps financial penalties in the form of additional commercial rates could be used as a means to encourage compliance. Fines or prohibition of activities are also powers which the CRU holds for certain activities and could be extended to non-compliance in relation to transitioning to low-carbon energy. These penalties would need to be set out as early as possible in order to allow for business to incorporate the potential for such penalties into their development plans.

Allowing connections to fossil fuel infrastructure such as the gas grid may also present a risk to LEUs. As the gas network begins to phase-down its supply then the cost of ongoing maintenance of the network will have to be shared by fewer customers.

If a transitional/ glide path approach is taken to decarbonisation actions, the potential for ownership and management change should be considered. Questions may arise on the bindingness of decarbonisation plans that were created/ agreed by a previous owner or operator. In particular, in the case of colocation data centres as various operators rent space in the same building, complications may arise on the legal obligations of the various stakeholders of the operation to deliver on the original decarbonisation plan if it was agreed by a previous occupier of the building and not their own company.

Q.4 Please provide views on the proposed timing of different options.

Timing would need to align with the sectoral emissions ceilings set out in the time periods set out national carbon budgets. This would need to consider cumulative emissions over the given period.

Q.5 Should optionality be maintained in allowing a menu of different options to perspective LEUs, with the end net zero emissions target becoming more binding as the glide path advances?

It is key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

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Q.6 Comments are invited on how compliance and enforcement with required provisions can be effectively implemented in the operation of a transition period/glide path approach.

See response to Question 3 and 5

Measuring performance

Q.7 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.

Q.8 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 temporal nature of energy consumption is more of an issue for the electricity grid due to current limitations of capacity in certain areas of the country. Renewable electricity certs purchased should, where possible, be time-matched to the onsite demand on an hourly basis rather than an annual basis to ensure the generation more closely matches the actual demand and the real-world impact this has on the electricity system throughout each hour of the year.

Organisation such as EnergyTag[12] are already enabling this kind of operation and companies such as Google are adopting this approach for their data centres[13].

Q.9 Comments are invited on the use of a glide path to implement the basis on which net zero emissions are determined. This could entail starting with measuring net zero performance on an annual basis and moving closer to more real time arrangements in incremental steps.

Q.10 Comments are invited on the use of self-reporting based on best available data/methodology and transitioning to a more robust formal framework over time when it becomes available.

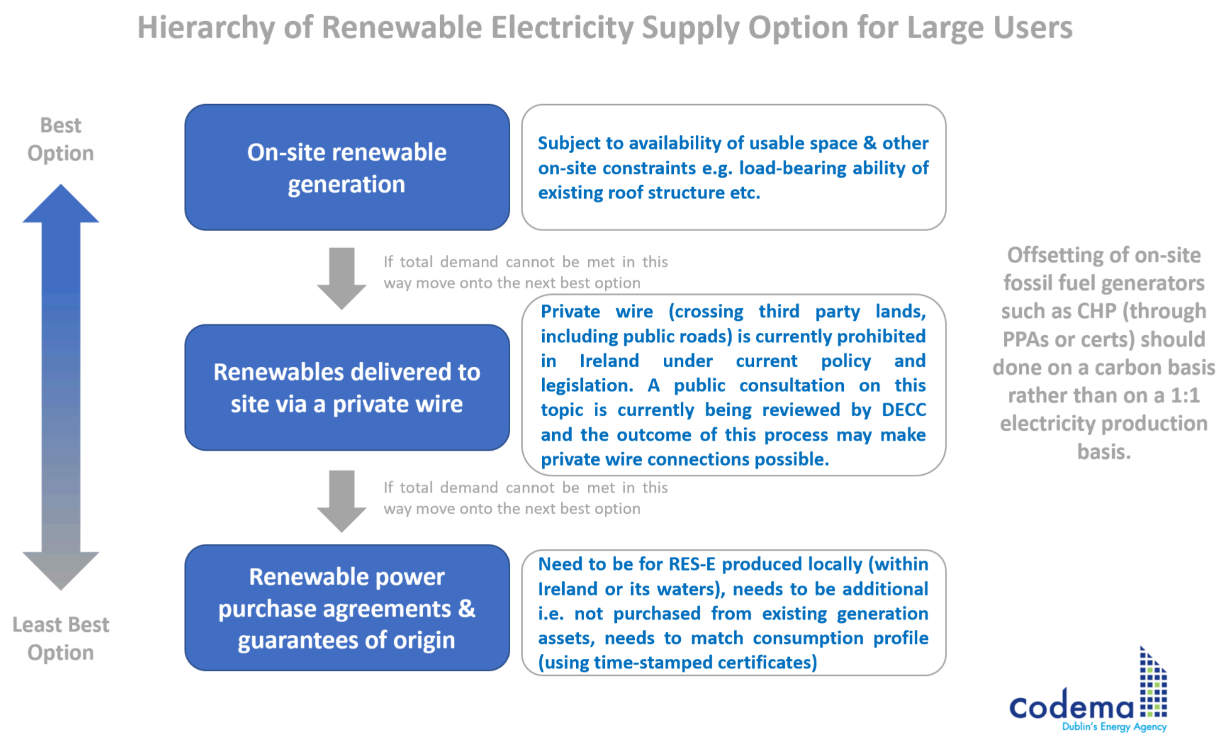
Q.11 Comments are invited on the requirement for indigenous sources of renewable energy e.g. renewable electricity feeding into the Irish system and for gas secure sufficient renewable gas credits feeding into Irish system.

The use of renewable generation on-site should be prioritised as much as possible. The image below indicates the hierarchy of renewable energy production for large energy users. The ultimate goal is for a combination of these methods to be used to achieve 100% renewable electricity targets by LEUs. Where possible the solutions higher up this hierarchy should be used to cover on-site demand. Large Energy Users provide the scale which can make the inclusion of additional capacity to support the grid more cost effective. One of the current barriers to greater local renewable generation is the private wire is currently prohibited but a consultation[14] on this subject is currently under review by the Department of the Environment, Climate and Communications.

[12] https://energytag.org/

[13] https://www.datacenterdynamics.com/en/news/google-to-expand-247-clean-energy-matching-with-flexidao/

[14] https://www.gov.ie/en/consultation/63e1c-private-wires-consultation/



Land banking practices may also allow some additional opportunities for on-site/near-site production of renewables which may be more limited when only looking at land area that is currently developed.

Q.12 Comments are invited on how the storage of renewable energy is captured by any measurement system when this stored renewable energy is used.

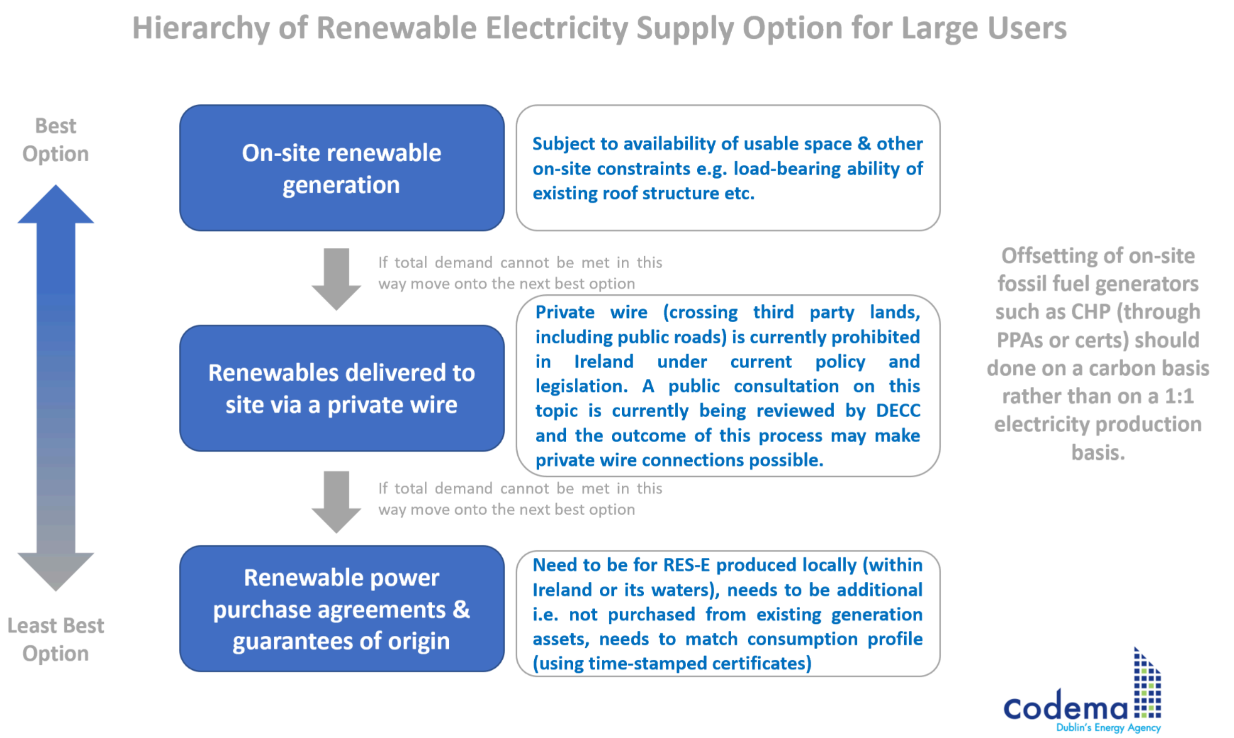
Q.13 Comments are invited on whether the electricity and gas measuring and tracking systems should be integrated to help avoid double counting? If so, how might this be achieved?

Q.14 Comments are invited on who should have responsibility for measuring LEUs emissions and emissions abatement performance?

Location of LEUs

Q.15 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.

Yes, where it is possible co-location of LEUs and renewable energy generation would be a favourable outcome and would facilitate direct line PPAs in the future, if the ongoing review of the Private Wire Regulations results in a change to the regulations that would allow them. This would be a preferable option to the currently widely used virtual CPPAs as it would deliver real time zero emissions.



Undoubtedly, achieving this co-location will present complex challenges. Long-term strategic spatial planning is required to ensure there are sufficient and serviced sites available in close proximity to future large scale renewable energy generation sites.

In addition to colocation with renewable generators it may also be prudent to try to colocate users of renewable gas (i.e. high-exergy applications where low-carbon alternatives are not available) into clusters to reduce the need for additional gas infrastructure.

Q.16 What type of measures to facilitate this approach could be introduced to encourage new LEUs to locate close to renewable generation.

Engagement with the relevant utilities and organisations to ensure that suitable sites surrounding planned renewable energy generation are serviced in advance of energy generation would facilitate a plan-led development approach, rather than the existing, somewhat ad hoc development-led planning of SEU locations. This site servicing would include engagement with Uisce Eireann, Local Authorities, Eirgrid, ESB, fibre optic cable operators, district heating operators etc. In particular, there is potential to co-locate LEUs close to the landing of planned offshore wind developments on the West coast of Ireland. This is also in line with the fundamental principle of the National Planning Framework to achieve "balanced regional development" by directing the wider economic benefits of large industries, such as data centres, to the western and southern regions.

Engagement with Local Authorities during the County Development Plan formation stage would allow for suitable zoning of land to achieve this co-location, as well as for the servicing of sites. Although it is beyond the remit of the CRU, the potential for land speculation regarding rezoning of this land should be considered, particularly the likely potential on land prices and knock-on impact on LEUs planning to co-locate there.

Q.17 Should there be any exemptions to locational requirements for certain LEUs? How could this be assessed? If so what type of connection conditions/requirements might these require?

Q.18 Comments are invited from interested parties on the level of proximity between LEUs and renewable generation? How should this be measured? Should this value apply across the board or be determined on a case-by-case basis?

Q.19 If locational requirements are introduced, there is a need for better integrated planning of the network, generation and demand. What are the roles of the System Operators and enterprise agencies in supporting/facilitating this?

Q.20 If introduced on a mandatory basis in order to recognise that any locational requirements LEU demand may require time to be facilitated, should locational requirements be implemented using a glide path?

Non-firm demand connections

Q.21 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.

Colocation data centres which rent out rack space to third parties are contractually obliged to provide services at all times. The operation of these facilities is therefore primarily based on service reliability over service sustainability i.e. the customer doesn't care how the power is provided as long as it's provided. Non-firm connections allow the operator to dictate the renewable proportion of the energy supply whereas a firm grid connection places the responsibility on the national grid operator. A firm grid connection ensures that our energy supply transitions to net zero in line with national policy. Non-firm grid connections place large portions of our energy demand outside the remit of grid operators and reduce Ireland's ability to control its energy transition. Data Centres are a core part of Ireland's economy and enterprise strategy but their growth should be scaled in line with our ability to supply renewable energy.

Q.22 If non-firm LEU connections are implemented on a temporary/non-enduring basis what should trigger these connections being made firm? Examples could include date(s) specified upfront or linked to certain requirements. Please provide reasons and rationale for any views provided.

Q.23 If non-firm LEU connections are mandatory in certain parts of the system, should there be any exemptions for certain LEUs? If so what type of connection conditions/requirements might these require?

Q.24 Comments are invited regarding the proportion of the LEU demand that would be connected on a non-firm basis. For example, would a non-firm connection apply to 100% of the connection, or would it apply to smaller proportion than this?

Q.25 Comments are invited regarding what measures could be applied to facilitate non-firm LEU connections. If so, should these measures to facilitate recognise the potential locational value of these?

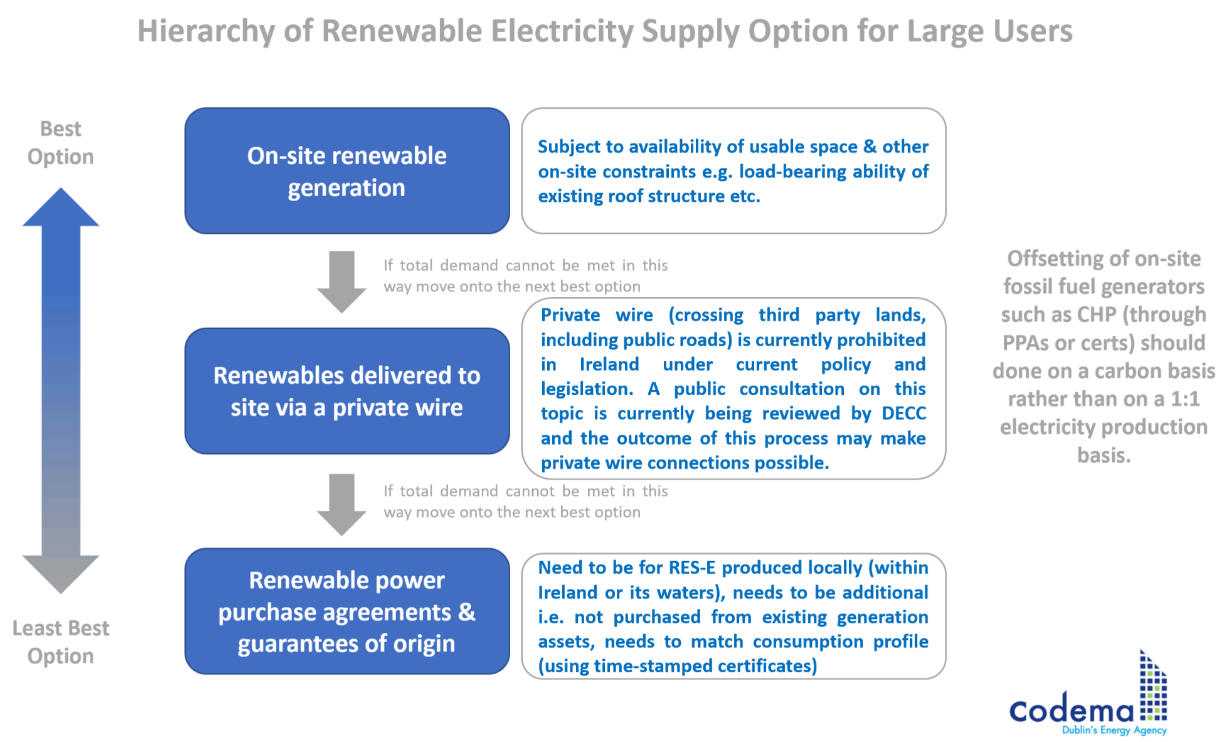
Q.26 How should the SOs deploy this flexibility provided by non-firm demand?

Q.27 Should non-firm/flexible electrical connections be provided to islanded LEUs in order to facilitate flexibility between the electrical and gas systems?

On-site generation and storage

Q.28 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 use of renewable generation on-site should be prioritised as much as possible. The image below indicates the hierarchy of renewable energy production for large energy users. Where possible the solutions higher up this hierarchy should be used to cover on-site demand. Large Energy Users provide the scale which can make the inclusion of additional capacity to support the grid more cost effective.



Land banking practices may also allow some additional opportunities for on-site/near-site production of renewables which may be more limited when only looking at land area that is currently developed.

Q.29 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.

Q.30 Do LEUs require back-up generation for operational reasons? If so, what is the typical annual running hours of this back-up generation?

Demand flexibility

Q.31 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.

Both objectives are key requirements of the energy system going forward and therefore demand flexibility from LEUs should be used for both.

Q.32 Should demand flexibility services be mandatory or voluntary for new LEUs? Please provide reasons and rationale for any views provided?

Q.33 Should LEU connections in certain parts of the network be required to provide demand flexibility services? Is this measure justified?

Q.34 If demand flexibility is voluntary for new LEUs, what type of incentives could be introduced to encourage the adoption of these services?

Q.35 If demand flexibility is mandatory for new LEUs, should there be any exemptions for certain LEUs to having to provide these services? How could this be assessed? On what basis could these exemptions be applied?

Q.36 Should timed/profiled connections be introduced? Please provide reasons and rationale for any views provided.

Energy efficiency

Q.37 Comments are invited from interested parties on the use of waste heat from LEU sites.

Waste heat utilisation is supported at both an EU and a national level through a number of different policy documents, these are listed below. Aside from acting as a low-carbon heat source the utilisation of waste heat also provides free cooling as a by-product for the waste heat producer.

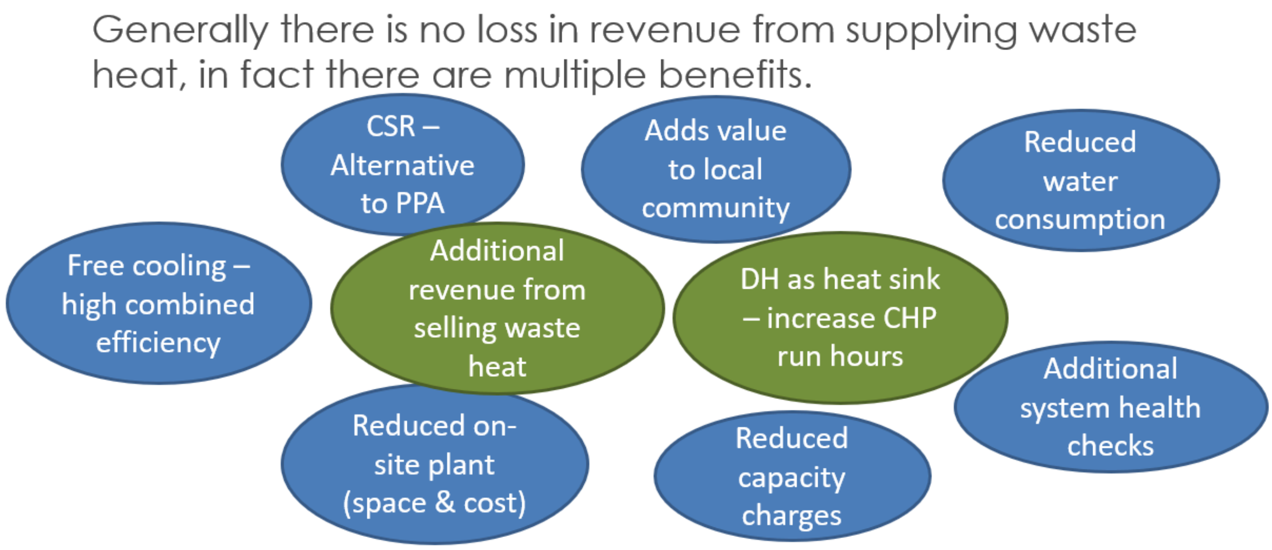


Figure 1: Benefits Possible for Waste Heat Owner when supplying a DH Networks

- The Eu Energy Efficiency Directive:
  - Waste heat from data centres, cogeneration plants, wastewater treatment plants, industrial sites, and LNG terminals
- The EU Renewable Energy Directive:
  - Treats waste heat on a par with renewables
- The EU Energy System Integration Strategy:
  - Ability to provide flexibility to electricity grid, circular economy & waste heat, strengthen requirement to connect, accelerate investment in DH
- The Climate Action Plan 2024:
  - Mandating that industrial facilities supply waste heat to district heating where the total rated energy input is at least 1 MW
- Principles from DECC DH Steering group report led by DECC

    - Prioritise decarbonisation of heating by promoting renewable heat and waste sources for district heating, in line with the definition of efficient district heating set out in the Energy Efficiency Directive
    - Maximise development of local opportunities for renewable and waste heat supply
- Certain waste heat applications (data centre + Heat pump and Waste-to-Energy Plant) have also been incorporated into DEAP/NEAP[15] with more use cases being added in due course
- The use of waste heat also reduces potential environmental impact of heating water bodies, particularly fisheries.

Q.38 Comments are invited on the use of waste heat from LEUs to feed district heating networks or other processes.

The use of waste heat to feed district heating networks or for use on-site where possible should be supported.

The Climate Action Plan 2024[16] states that "industrial facilities supply waste heat to district heating where the total rated energy input is at least 1 MW".

The provision of waste heat (installing heat recovery and pipes to bring this heat to the boundary of an industrial site or to a DH Energy Centre) is already a planning requirement in a number of local authority areas. South Dublin County Council[17] for example, require that any new or expanding industrial or commercial site whose primary activities produce waste heat are required to submit a waste heat report with their planning application. This report includes information on the quantity and temperature of waste heat and where relevant the phasing of when this waste heat will be available. This also requires that heat recovery equipment be installed to bring that waste heat to the boundary of the site or to the DH Energy Centre in areas where a DH network is either planned or existing. The text below outlines in greater detail what is deemed an acceptable development with respect to waste heat recovery and utilisation policy objectives set out in the Development Plan.

It is considered that the proposed development is acceptable subject to the following condition:

15
https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/software/neap/District-Heating-factors-for-BER-calculations.pdf

16
https://www.gov.ie/pdf/?file=https://assets.gov.ie/284675/70922dc5-1480-4c2e-830e-295afd0b5356.pdf#page=null

17 Under Policy E6: Waste Heat Recovery & Utilisation in Chapter 10 of the South Dublin County Development Plan 2022 - 2028

(a) Proposals for waste-heat recovery and ongoing delivery to a local heat-network shall be provided and implemented on site, in conjunction with the commencement and operation of the proposed development Prior to the commencement of development a timeframe for implementation of waste heat proposals shall be submitted for the written agreement of South Dublin County Council.

(b) Such proposals shall include all necessary infrastructure for waste heat recovery from the proposed development, conversion to hot water and delivery through a primary waste heat water circuit to either, the boundaries of the site or to an Energy centre (when constructed as part of local heat network distribution) for connection to heat network. Such proposals shall be submitted for the written agreement of South Dublin County Council.

(c) Where waste heat recovery and utilisation proposals have been explored and, subject to the written agreement of South Dublin County Council, have been deemed to be technically or otherwise unfeasible, details of future proofing of the building fabric, heat recovery and conversion systems and safeguarding of pipework/infrastructure routes up to the site boundaries to facilitate future waste heat connection to a local district heating network, shall be submitted for the written agreement of South Dublin County Council.

This local policy is well aligned with Article 26 of the EU Energy Efficiency Directive[18] which requires:

- Data centres with total rated energy input exceeding 1 MW are required to utilise the waste heat or other waste heat recovery applications unless they can show that it is not technically or economically feasible.
- Industrial sites with annual average energy input exceeding 8 MW need to perform an installation-level cost benefit analysis to assess the utilisation of waste heat either on site or off site (e.g. through a district energy network)
- Wastewater treatment plants and LNG facilities with annual average energy input exceeding 7 MW need to perform an installation-level cost benefit analysis to assess the utilisation of waste heat either on site or off site (e.g. through a district energy network)

The Energy Efficiency Directive also states that Member States shall aim to remove barriers for the utilisation of waste heat.

Q.39 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.

With a new Heat Bill expected in 2024 which may look at designating areas as district heating areas, in which certain building types (perhaps large public and commercial buildings as is

[18] EU Energy Efficiency Directive PDF

being discussed in the UK district heating zoning approach currently[19]) would be mandated to either connect to district heating if one already exists or future-proof their building for connection to future planned networks. With this mandatory connection to DH in place it would be logical that LEUs that produce waste heat in close proximity (within 5km - this distance could be scaled up depending on the temperature of the waste heat available) to these areas are also mandated to support the use of their waste heat. This could be done in the following ways:

- Waste heat owner to conduct analysis of waste heat potential on site (quantity, temperature, availability, timelines, possible challenges to capturing the waste heat) and share this to support local heat planning (which is a requirement under the Energy Efficiency Directive) and to help the development of local district heat networks
- Waste heat owners should be required to take measures to capture this heat and bring it to the boundary of their site or to the DH network energy centre to allow it to supply/decarbonise local homes and businesses in the area.

Commercial rates paid by these waste heat sites could also be used as a mechanism to encourage these activities. These activities could also be supported by the newly formed district heating centre of excellence or other suitably qualified organisations e.g. local energy agencies.

The EU Energy Efficiency Directive supports the use of waste heat either on-site or off-site. stronger language around the use of waste heat from the ICT sector (i.e. data centres). In Germany[20], there are already requirements in place for data centres (of 300kW or more) to recover a percentage of their waste heat. This is referred to as the Energy Reuse Factor. Data centers that start operations on or after July 1, 2026, must be constructed and operated to achieve an ERF of at least 10%; data centers that start operating on or after July 1, 2027, must achieve a projected ERF of 15%; and data centers that start operating after July 1, 2028, must achieve a projected ERF of 20%. The requirements are not to be achieved on an annual average basis until two years after the start of operations.

Gas

Q.40 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?

Ireland's target of up to 5.7 TWh of biomethane by 2030 is ambitious given Ireland produced just 41 GWh of biomethane in 2022. Due to the scale of LEUs, in some cases a single LEU could use more than 50% of this 2030 target for biomethane, highlighting that indigenous biomethane as

[19] See the "Requirements in Zones" section of the Heat Network Zoning Consultation 2023 - https://assets.publishing.service.gov.uk/media/65b3c38c0c75e30012d8012f/heat-network-zoning-consultation-2023.pdf

[20] German Energy Efficiency Act (EnEfG)

a solution for LEU's is not a scalable solution across the LEU sector. This is before you consider the absolute limit on biofuel resources calculated in the SEAI report on Sustainable Bioenergy calculates that the by-products and wastes from households, businesses, agriculture, and forestry could provide about 6.5 TWh of fuel. Based on current national herd forecasts, biomethane production from a grass silage/slurry mix, could deliver 2.7 TWh of biomethane (increasing to 3.7TWh if other food wastes and pig slurry could be used). This sets out a natural limit on indigenous biomethane production.

It is therefore key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

In terms of enforcement perhaps financial penalties in the form of additional commercial rates could be used as a means to encourage compliance. Fines or prohibition of activities are also powers which the CRU holds for certain activities and could be extended to non-compliance in relation to transitioning to low-carbon energy. These penalties would need to be set out as early as possible in order to allow for business to incorporate the potential for such penalties into their development plans.

Similar to the electricity system it is likely that much of this biomethane resource will be delivered to LEUs through grid infrastructure. This means that any gas consumed on site would need to be considered to have a carbon intensity that is based on the proportion of renewable gas in the grid as a whole (i.e. majority fossil gas). Renewable gas certificates may be used to offset fossil gas consumption but it is the view of Codema that these would have to adhere to similar principles that renewable electricity certificates adhere to, namely:

- Additionality - certs need to be purchased for new renewable gas production i.e. not using renewable gas which is part of current production capacity
- Should be indigenous to Ireland, where possible - easier to track methane leakage (which has a global warming potential 80 time higher than CO2) when it is within Ireland, greater visibility within national borders to avoid potential double counting, stimulate growth of indigenous production, keep money spent on gas within the country, avoid national emissions associated with methane from slurry, food waste etc. leaking into the atmosphere
- Unlike electricity the temporal element of grid constraint seems to be less of concern for the gas network compared with the electricity network

As stated in Question 3, It is vitally important that temporary solutions (i.e. LEUs being connected to fossil gas supplies) do not become longer term solutions that result in the lock-in of LEUs to polluting fossil fuel systems. It is therefore key that robust evidence be provided around the ability to quickly transition to renewable supply within a short period that reflects Ireland's need to stay within our sectoral emissions ceilings. An ongoing review process would be required and supporting powers to halt polluting practices on site and/or administer fines. This could be an additional role for the regulator. In terms of monitoring/auditing the progress of the transition on site, new requirements for publishing figures on carbon emissions, power use, water use etc. from the Energy Efficiency Directive and the European Corporate Sustainability Reporting Directive could be leveraged to enable this monitoring.

In terms of enforcement perhaps financial penalties in the form of additional commercial rates could be used as a means to encourage compliance. Fines or prohibition of activities are also powers which the CRU holds for certain activities and could be extended to non-compliance in relation to transitioning to low-carbon energy. These penalties would need to be set out as early as possible in order to allow for business to consider the potential for such penalties in their development plans.

Q.41 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?

It is Codema's view, given the limited availability of renewable gas production, that there are better use cases for high-exergy biomethane in Ireland's energy system than meeting baseload energy demand. A definition of peak-load and back-up electricity generation installation already exists in the EU Energy Efficiency Directive and is defined as an "installation which is planned to operate under 1500 operating hours per year as a rolling average over a period of five years". The scale of the base load demand for large scale data centres is such that if supplied by natural gas it would impact Ireland's ability to adhere to sectoral emission targets. Base load should be met in the first instance by grid supplied electricity, or on-site renewable energy generation if this is not feasible.

This thinking is in line with the IEA[21] which states that "Viewed through the lens of decarbonisation, the optimal uses of biomethane are in end-use sectors where there are fewer low-carbon alternatives, such as high-temperature heating, petrochemical feedstocks, heavy-duty transport and maritime shipping. But there are other motivations that can play into the uses of biomethane, including rural development, energy security (where biomethane is

[21] https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/the-outlook-for-biogas-and-biomethane-to-2040#abstract

used instead of natural gas transported over long distances or imported, or where it is used flexibly to complement electricity from variable wind and solar PV), and urban air quality."

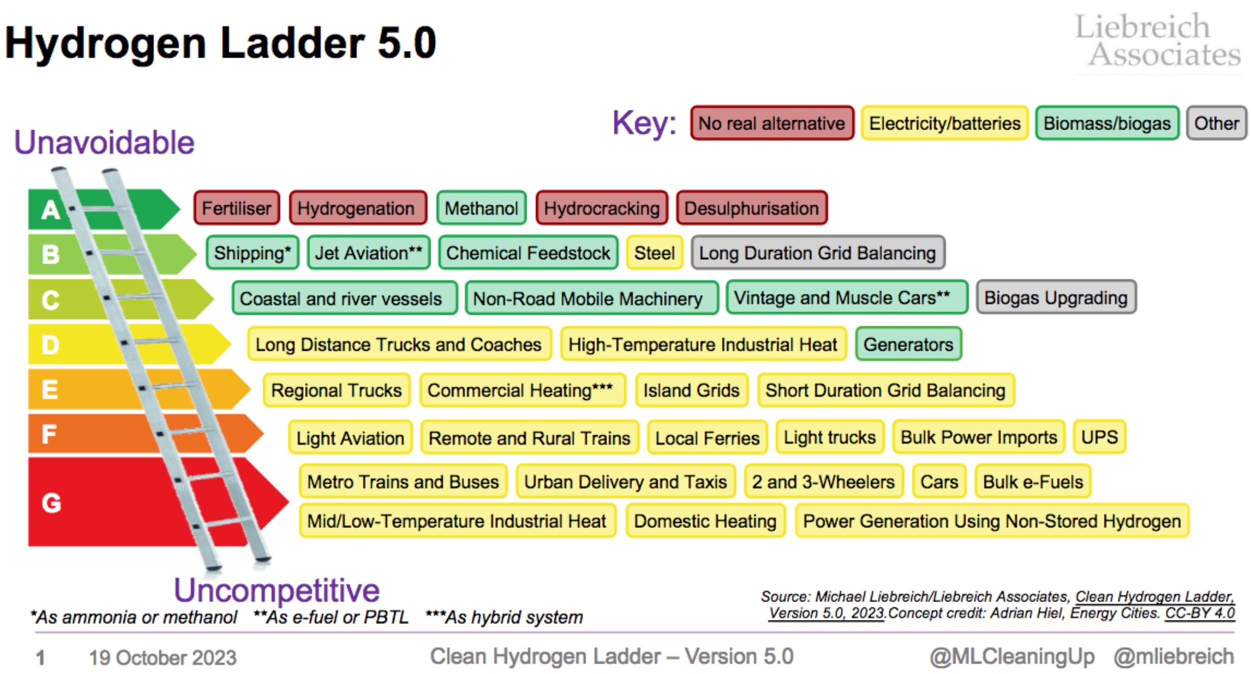
According to the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy "'Islanded' data centre developments, that are not connected to the electricity grid and are powered mainly by on-site fossil fuel generation, would not be in line with national policy. These would run counter to emissions reduction objectives and would not serve the wider efficiency and decarbonisation of our energy system. Growth in 'Islanded' data centres could result in security of supply risk being transferred from electricity to gas supply, which would be a significant challenge given Ireland's reliance on gas importation." Codema wholly agrees with this statement.

Biomethane however could be used sustainably by LEUs for the purposes of flexibility services for short periods when the electricity grid requires support/balancing. A gas turbine using biomethane would allow a data centre to adjust its demand based on grid requirements, given the fast response time of gas engines to load shifting. This in turn would facilitate greater proportions of variable renewable electricity on the grid from sources like wind and solar. As a backup electricity supply again it would be envisaged that these generators would operate for less than 1500 hours per year in line with definitions set out in the Energy Efficiency Directive. It should be noted that due to the efficiency of these units it is likely that significant quantities of waste heat are also going to be generated. These should also be utilised either on-site or off-site, wherever possible (for heating or for cooling, where possible, through the use of absorption chillers). This reasonably low efficiency for on-site electricity production combined with expected higher prices for renewable gases will also make electricity production in this way more expensive than current methods.

Q.42 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.

It is the view of Codema that the use of hydrogen should be reserved for hard to abate use cases. The hydrogen ladder below indicates how hydrogen should be used in any energy system[22]. As a high-exergy fuel, hydrogen should not be used in low-exergy applications.

[22] https://www.liebreich.com/hydrogen-ladder-version-5-0/



Hydrogen is also an indirect greenhouse gas with a global warming potential GWP of 11 over a 100-year time horizon[23]. On this basis, serious consideration should be taken to establish whether it is a viable decarbonisation strategy for LEUs. A future hydrogen economy would have greenhouse consequences and would not be free from climate permutations. Burning hydrogen can also result in NOx emission up to six times higher than fossil gas boilers and burning hydrogen-based e-fuels produces similar emissions to fossil-based fuels[24]. The global warming potential (GWP) of NOx is estimated at GWP 30 - 33 for the time horizon of 20 years and is thereby comparable to that of methane. NOx is also a main cause of poor air quality which impacts people's health in dense urban areas. Careful planning for mitigation of these adverse effects, where possible, is required.

There is a need to avoid an emissions lock-in risk or investing in infrastructure that is based on polluting imported fossil fuels for which significant decarbonisation is extremely unlikely to occur in the short or medium term (gas network). Whilst existing infrastructure can accommodate small proportions of H2, the maximum proportion of H2 that can be accommodated without issues by volume is 20%. It is worth noting that the volume percentage differs significantly from the delivered energy proportion due to the difference in energy density between gas and H2 at the same pressure (i.e., in the same pipe). In the case where fossil gas has 20% of H2 blended in,

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23

https://www.gov.uk/government/publications/atmospheric-implications-of-increased-hydrogen-use

24

https://www.google.com/url?q=https://www.transportenvironment.org/discover/in-tests-cars-powered-by-e-petrol-pollute-the-air-as-much-as-petrol/

this translates to a 13% reduction in energy capacity of the pipework with H2 only providing 7% of the energy delivered. To increase the proportion of H2 beyond 20%, replacement of pipework, compressors, valves and fittings, boilers, meters, and safety sensors would likely be required.

From analysis conducted by Codema and project partner MullanGrid[25] which investigated the potential for Hydrogen in Dublin. It was found that a viable business model for green hydrogen production from curtailed/wasted electricity depends on the electricity system being very inefficient in using future renewable electricity i.e. long periods of curtailment are required to achieve the required utilisation rates of electrolysers to make the business case for green H2 viable. Modelling of various hydrogen production configurations for a 400 MW capacity electrolyser located at Poolbeg in a 2030-2040 timeline indicate a levelised cost of hydrogen production in the range of €3.8-7.1/kg making it much more expensive than fossil gas. In general the Hydrogen sector suffers from a lot of uncertainty at this point and is not currently a viable option for decarbonisation in the short to medium term.

Q.43 Comments are invited from interested parties on the renewable gas certification scheme.

Similar to the electricity system it is likely that much of this biomethane resource will be delivered to LEUs through grid infrastructure. This means that any gas consumed on site would need to be considered to have a carbon intensity that is based on the proportion of renewable gas in the grid as a whole (i.e. majority fossil gas). Renewable gas certificates may be used to offset fossil gas consumption but it is the view of Codema that these would have to adhere to similar principles that renewable electricity certificates adhere to, namely:

- Additionality - certs need to be purchased for new renewable gas production i.e. not using renewable gas which is part of current production capacity
- Should be indigenous where possible - easier to track methane leakage (which has a global warming potential 80 time higher than CO2) when it is within Ireland, greater visibility within national borders to avoid potential double counting, stimulate growth of indigenous production, keep money spent on gas within the country, avoid national emissions associated with methane from slurry, food waste etc. leaking into the atmosphere (methane has a global warming potential that is 80 times greater than CO2) - A body such as ACER may have role to play if imported renewable gas is to be considered
- Unlike electricity the temporal element of grid constraint seems to be less of concern for the gas network compared with the electricity network

25 https://www.codema.ie/projects/local-projects/integration-of-heat-electricity-and-transport-use-of-curtailed-renewable-en

It is also vitally important that the issuing of these renewable gas certificates be performed or closely monitored by an independent body for which there would be no conflict of interests/incentives to assign gas as being renewable when it may not be.

It should be clearly communicated what standards renewable gas producers need to adhere to and what standards purchasers of the gas need to include in their procurement process. Continuity of standards across countries will also be important if the importing of renewable gases will be permitted. These standards may also closely mirror those used as part of the Renewable Heat Obligation scheme[26] so it would be beneficial to have continuity across both if possible.

Q.44 Are there other options for decarbonisation of gas demand that should be considered?

Q.45 Comments are invited on the introduction of non-firm/interruptible gas connections for LEUs (at exit point). Do respondents have a view on whether these non-firm/interruptible connections can help alleviate emissions? Please provide reasons and rationale for any views provided.

Q.46 How can demand flexibility services on the gas system provide a benefit for both system support and decarbonisation?

Assessment criteria

Q.47 Comments are invited from interested parties on maintaining optionality in what provisions an LEU must meet as part of its net zero emissions requirements.

Q.48 Comments are invited on how a new LEUs location may inform what criteria it may need to meet.

[26] https://www.gov.ie/en/publication/7a1f1-renewable-heat-obligation/

Q.49 Comments are invited on how a transition period may inform an evolving net zero target and demand flexibility services that could be provided.

Q.50 Respondents are welcome to suggest alternative approaches in how criteria is selected.

Q.51 Respondents are welcome to suggest any additional approaches for LEUs to help meet net zero requirements not considered in sections above.

Roles of other organisations

Q.52 Comments are invited from interested parties on the roles of other organisations in the different approaches considered in this paper.

See responses to Question 3 and Question 40.

Q.53 Comments are invited on what functions should be carried out by who, in the context of potentially real time net zero emissions for LEUs going forward.

Q.54 Feedback is requested from stakeholders on other mechanisms that may need to be considered for the implementation of SECs and who should be responsible for delivering them.

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