Submission to the Consultation on ESB Networks Demand Flexibility Consultation

Prepared by Codema - Dublin's Energy Agency

February 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 Heat Sector 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.

---

1 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, District Heating and Large-Scale Thermal Storage

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 on "Developing an Electricity Storage Policy Framework for Ireland", which has the potential to be a key initiative for providing a resilient and green electricity system for Ireland while also supporting the decarbonisation of heat which is Ireland worst performing sector in terms of renewable penetration.

Codema is a founding member of the **Irish District Energy Association (IrDEA)**, and some of our response will also be reflected in the IrDEA submission.

Response to Consultation

Codema welcomes the opportunity to make a submission on this consultation. Codema's interest in Demand Side Flexibility stems from our current sector integration research involving electricity generators, district heating with large-scale thermal storage, and the development of cost-optimal decarbonisation pathways for heating, electricity and transport for the Dublin region. Our research and practical experience of developing projects 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 20 years' experience in the climate change and energy sector.

Responses to Consultation Questions

GUIDING PRINCIPLES

Q1. What are stakeholder's views regarding allowing and incentivising the multi-market participation (or revenue stacking) of flexible assets?

How would the allowance of multi-market participation impact the business case of flexible assets? What other barriers to multi-market participation/revenue stacking for flexible assets may still exist, even if allowed by ESB Networks' market arrangements? Does the allowance of multi-market participation introduce delivery risks for distribution level markets for demand flexibility that should be considered?

Codema supports the inclusion and incentivising of multi-market participation/revenue stacking of flexible assets, as this can allow for the inclusion of assets within the district heating sector which can provide highly cost-effective flexibility service to the grid.

Many of the DH networks in Ireland, such as the Tallaght DH network[2], will use electricity to supply low-carbon heat to their customers primarily through the use of heat pumps (using various sources - waste heat, surface water, etc.) but also electric boilers (generally as backup heat supply). These electricity-based systems provide an opportunity for provision of flexibility services as well as other grid services (frequency response etc.). Electricity supply to district heating networks are largely interruptible due to the presence of thermal energy storage (in the form of dedicated thermal storage but also the network itself and the heat retention capacity of the buildings connected) and natural inertia in the heating system. These systems would typically have low-cost, large-scale thermal energy storage that would on average provide 5 hours of maximum heat capacity of the primary heat source (generally in the 3 - 8 hours range depending on the system). For systems using heat pumps the storage levels are generally higher to allow for off-peak electricity use to be maximised (generally 7-8 hours of storage). These heat batteries are charged and discharged on a daily basis but due to their simple design generally do not experience degradation in the same way as assets like battery systems

[2] https://www.codema.ie/projects/local-projects/tallaght-district-heating-scheme

might. Large-scale TES systems generally have a lifespan in excess of 50 years and experience minor degradation in that time whereas batteries have a lifespan in the region of 5-15 years and can experience degradation of 20-40% over that time. **This means that the majority of these systems would be well suited to providing flexibility in excess of the 4 hours per day referenced in this consultation document, without significant degrading over the proposed contract duration of 15 years.**

Large-scale thermal energy storage is among the cheapest forms of energy storage typically has a cost that is 0.65% - 4.4% that of best-case large-scale battery storage in Ireland. Were larger seasonal thermal storage installations, common to countries such as Denmark, to be used by DHC networks in Ireland this would be even more cost efficient at 0.065% of the cost of battery storage[3]. **It is also worth noting that in many cases these large-scale thermal storage assets will already exist to allow DHC networks to utilise lower night-time electricity rates and in this case the capital cost of the storage would only relate to the cost of the controls required to link its operation to signals from the electricity grid operator or market with the necessary response times. This would make these flexible assets even more cost-competitive.**

One of the biggest barriers DH involvement in flexibility markets in Ireland is the **lack of awareness from DH network operators on how to get involved in the flexibility market. As a result continued transparency, open engagement and clarity around how best to get involved in providing these services will be key. Codema are leading an SEAI-funded Research Development and Demonstration (RDD) project this year, which in part focuses on enabling DH operators to provide grid services (through their DH networks and thermal storage assets). Codema would welcome the opportunity to engage further with stakeholders such as ESBN and CRU on this project.**

Q2. What are stakeholders' views regarding the focus on ensuring that procurement of demand flexibility does lead to reductions in system wide carbon emissions?

When assessing 'system-wide' carbon emissions, ESBN should look beyond just the electricity sector as the benefit of district heating is that it will enable electricity to decarbonise the heating sector, which is the worst performing energy sector in terms of renewable share. To capture this, the assessment must look beyond just the electricity sector when quantifying if a 'system-wide' carbon reduction has been achieved.

3 https://www.codema.ie/images/uploads/docs/Poolbeg_Sector_Integration_RDD_Final_Report.pdf

Q3. What are stakeholders' views on the suite of guiding principles outlined above?

Are there additional guiding principles that should be considered? Are there guiding principles that should be removed?

Codema broadly agree with the guiding principles set out in the consultation document. However, further consideration should be given to the following topics for both the guiding principles and award criteria to help develop a merit order for flexible assets.

- Emissions from utilisation of the flexible asset e.g. associated carbon emissions with using the asset - this means that additional revenue streams from providing flexibility services would go to lower carbon technologies rather than supporting technologies that are more polluting.
- Potential environmental impacts/risks -this could also include NOx and particulate matter emissions, fire risk, etc.
- Embodied carbon of the flexible asset & resource efficiency (use of critical minerals, land use, etc.)
- Degradation of the asset over time - over the contract duration or longer if contract extension is considered to be likely

DISTRIBUTION CONNECTED PROPOSITION FOR DEMAND FLEXIBILITY

Q4. What are stakeholders' views regarding how services for demand flexibility will be defined?

It is welcome that a localised approach will be taken to assessing the demand flexibility needs of the system and an open approach will be taken to defining the parameters of any tendering process resulting from locational analysis. Codema urges that within the context of this, district energy systems, including thermal energy storage solutions, be allowed for wherever feasible when tendering parameters are being defined to ensure that this proven, available, and cost-effective storage solution be given the consideration it deserves to form part of Ireland's demand flexibility system.

The case for Thermal Energy Storage (TES)

There is a natural saturation point for any form of storage. It is, therefore, vital to promote the adoption of a variety of options to ensure the most appropriate and efficient use is made of each one across the system. This is particularly the case when it comes to ambitions to move the electricity system to 80% RES-E, as the efficiency profile of storage solutions changes as the RES-E saturation increases. Per Figure 2 below, the greater the saturation of intermittent renewables within the system the greater the need for long-duration storage options. Though

the present consultation is more focused on medium-term storage solutions, the makes sense to build towards a greater level of long-duration storage capacity in the long-run to achieve longer term results.

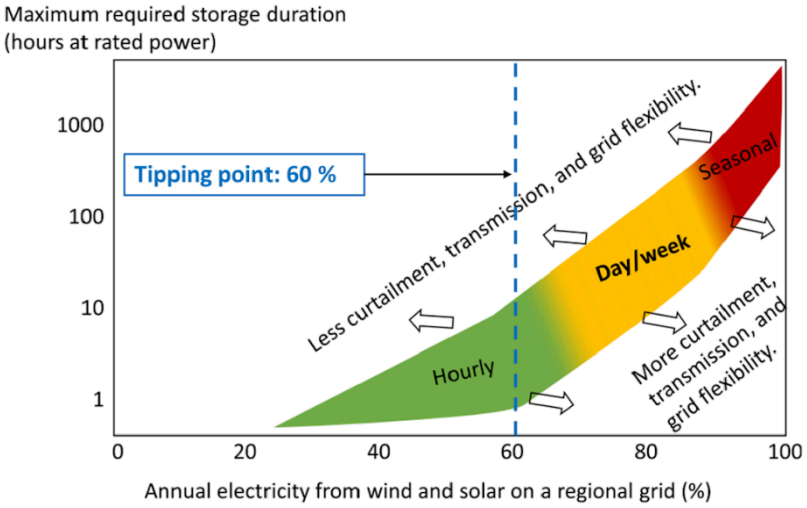


Figure 4: *Y-axis shows maximum duration of electricity storage needed to ensure demand is met at all times (logarithmic scale) versus fraction of annual energy from variable renewable generators (wind and solar) on a regional/local level. The arrows indicate either more restrictive (to the left) or aggressive (to the right) assumptions for curtailment, transmission and grid flexibility. For example in a system where curtailment is minimised (arrow to the left), storage duration required is longer than in the case where more curtailment is allowed (arrow to right). Adapted from ref [7].*

Figure 2. Storage durations for intermittent renewables-led electricity generation systems.

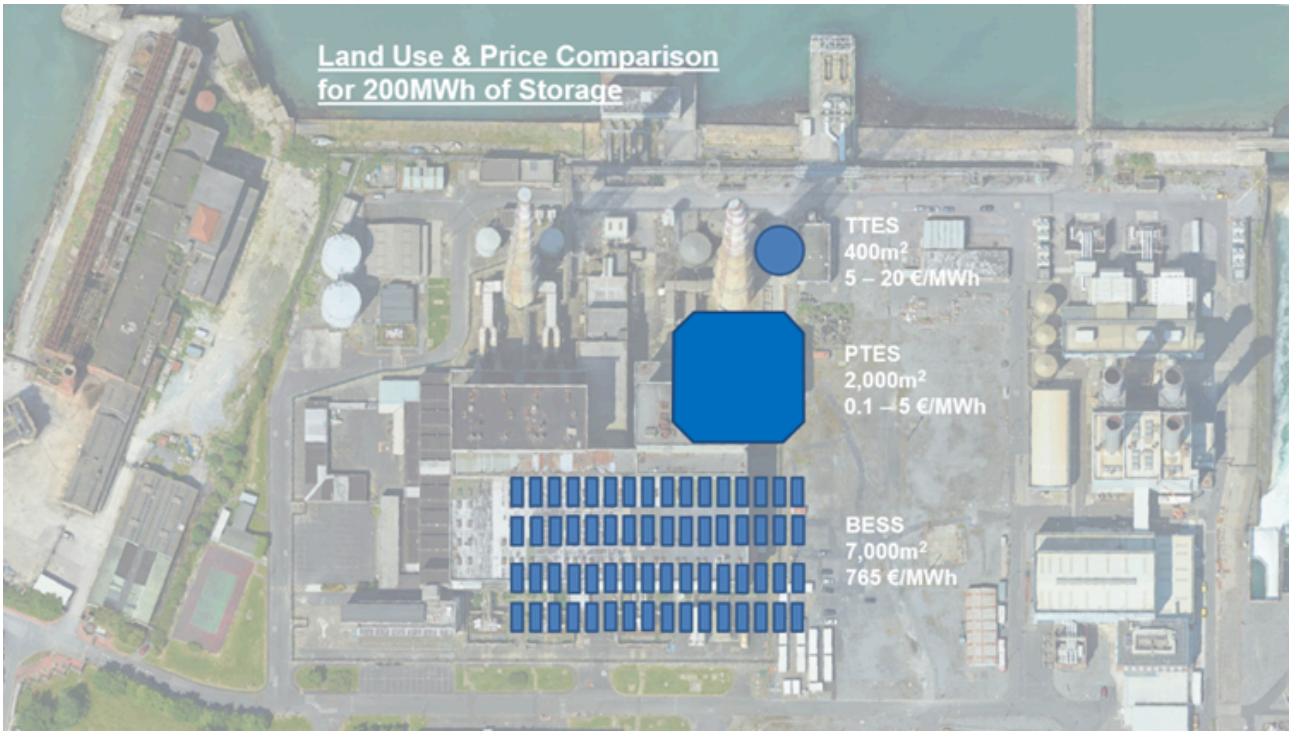
The need for storage across various durations (up to 8 hours) is estimated at 2,475MW or 10.8GWh for a 'Central' scenario (Eirgrid, 2022). However, as it currently stands, most battery storage today is limited to durations of 2 to 4 hours as durations beyond this have proven expensive to deliver. While this works for an energy mix of under 40% RES-E, once we move beyond that point longer duration storage is needed to support the system, which requires storage durations of multiple hours to days. Having reached a share of 38.9% in renewable electricity generation in 2023 (SEAI, 2023), never has there been a more pressing need to identify, procure, develop, and deliver long duration storage capacity to support Ireland's energy system.

While battery technology is evolving and advancing at pace with new batteries beginning to offer longer durations than the more established 2–4-hour range, this technology is neither freely available nor well established. This presents a short to medium term problem for the Irish energy system as it gradually ramps upward to a sustained 80% RES-E saturation in time for the 2030 deadline. Alternative forms of long-duration storage are, therefore, needed to meet the storage needs of a system with an increasingly renewables-led energy mix. TES is an established and tested mix of technology; vitally, it is primed and ready for deployment across the Irish energy system alongside the soon to be scaled up district energy system.

Thermal storage is well placed to address this gap as larger scale, longer-duration TES systems prove to be more cost effective than shorter term and smaller scale alternatives. If, for example,

the Climate Action Plan 2024 targets for District Heating & Cooling are achieved, it could provide 1300MW or 9.1GWh of low-cost large-scale thermal storage to support the electricity grid (between 53% and 84% of the storage capacity required based on the MW and GWh estimates from Eirgrid respectively) by 2030 (Codema, 2023). This is a particularly important function considering the duration limitations on battery storage solutions, which tend to decrease in cost-effectiveness as storage duration is increased. Conversely, TES systems become more cost effective the larger their scale and the longer their duration.

Large-scale thermal energy storage is among the cheapest forms of energy storage typically has a cost that is 0.65% - 4.4% that of best-case large-scale battery storage in Ireland. Were larger seasonal thermal storage installations, common to countries such as Denmark, to be used by DHC networks in Ireland this would be even more cost efficient at 0.065% of the cost of battery storage[4]. It is also worth noting that in many cases these large-scale thermal storage assets will already exist to allow DHC networks to utilise lower night-time electricity rates and in this case the capital cost of the storage would only relate to the cost of the controls required to link its operation to signals from the electricity grid operator or market with the necessary response times.



4 https://www.codema.ie/images/uploads/docs/Poolbeg_Sector_Integration_RDD_Final_Report.pdf

Figure 1: Land use and price comparison between 200mWh of tank thermal energy storage, pit thermal energy storage and battery energy storage system[5].

Curtailment Reduction Potential

Analysis from Codema and Mullan Grid[6] has shown that if the 2030 target for DH (2.7TWh heat demand supplied through DH networks) set out in the Climate Action Plan was to be achieved curtailment reductions of between 70% and 86% could be possible through the utilisation of heat networks and their installed thermal storage. In this scenario backup electric boilers would be utilised to manufacture demand during low electricity demand periods and utilise otherwise curtailed electricity. This would be a 'demand up' operational state which would be different to what is being referenced in this consultation but is something to consider in future flexibility market designs.

Voltage Levels

Voltage levels of 38kV and 110kV are referenced in the document. It would be beneficial to clarify if these are the preferred voltage levels for which flexibility is sought as part of this procurement process? This may exclude aggregated smaller demands. If this is the case it would also be very useful to get an indication of plans for flexibility procurement at other voltage levels, particularly medium voltage levels (10kV, 20kV).

Q5. What do stakeholders consider is a feasible required energisation date?

What is the minimum time required for developers between contract completion and energisation?

If there is a certain amount of flexibility in terms of provision of these services in a given area

Q6. What are stakeholders' views on the carbon emissions limit the CRU should set to ensure that the procurement of demand flexibility results in a reduction in the carbon intensity of the system?

No comment

5 https://www.codema.ie/images/uploads/docs/Poolbeg_Sector_Integration_RDD_Final_Report.pdf

6 https://www.codema.ie/images/uploads/docs/Poolbeg_Sector_Integration_RDD_Final_Report.pdf

Q7. What is the minimum length of time before procurement that potential providers of demand flexibility need to receive a final list of network locations where ESB Networks' will seek to procure demand flexibility?

Most important thing is that location information is shared openly with non-traditional actors to highlight opportunities. Check if there is additional detail on the level of flexible demand being procured beyond CAP23 % levels stated.

PROCUREMENT, PAYMENT & SCHEDULING

Q8. What are stakeholders' views on the proposed floor and share revenue model?

Does this model strike an appropriate balance between the needs of the energy customer and those of the provider of demand flexibility? Does this approach create risks which the CRU and ESB Networks should consider?

Setting a floor price helps safeguard the financial viability of district heating and TES systems, thereby providing stability for investors, which is vital to establishing and maintaining an investment-ready market environment. Similarly, ceiling prices can provide comfort to (potential) consumers by providing assurances that excessive tariff increases will not be introduced. This is important in the interests of consumer protection and consumer sentiment, which is, in fact, an important element of ensuring investment certainty for developers.

Q9. What are stakeholders' views on an appropriate level for the sharing factor?

Please provide quantitative evidence, where available, to support any proposed sharing factor values.

No comment

AVAILABILITY-BASED PAYMENTS

Q10. What are stakeholders' views on the proposal for revenues to come in the form of availability payments, rather than utilisation payments?

Is this approach also an appropriate enduring market solution or are there benefits in moving to an availability and utilisation payment approach in the future? If the approach should be reconsidered in future, what market indicators should be used to determine when a review of payment structure is necessary?

There are both pros and cons to this availability payment approach.
Pros:

- Revenue certainty to bidders - increasing attractiveness to provide flexibility services
- Simplicity of system

Cons:

- May reduce incentive for asset owners to optimise their operations improving whole-energy-system

Q 11. What are stakeholders' views on the proposed approach to penalties for non-delivery?

Does the proposed approach to penalties create any barriers to revenue stacking (outside of times when not required by ESB Networks) that should be considered?

Penalties for non-delivery serve an important purpose in terms of reliable provision of services. However, for DH operators who may initially be less familiar with the workings of the flexibility market this may act as a barrier to involvement. It is therefore essential that what would trigger a penalty for non-delivery is clearly communicated and that open dialogue can be fostered to allay any unnecessary fears or overestimation of potential risks that may be experienced by non-traditional actors in the flexibility markets. Limits on exposure to this risk could also be considered that could reflect a reasonable period of time/cost for alternative flexible demand could be mobilised, to reduce the impact of these penalties as a potential barrier.

Q12. What are stakeholder's views on the indexation of payments for demand flexibility?

Codema agree that any variable costs should reflect any changes in market rates/inflation rates.

SCHEDULING APPROACH

Q13. What are stakeholders' views on the proposed scheduling approach?

The proposed scheduling approach seems reasonable. Codema would welcome any updates on the TSO-DSO Operating Model work once available.

CONTRACT DURATION

Q14. What are stakeholders' views on the appropriate contract length?

What factors which should be considered when determining the appropriate contract length? Does a longer-term contract strike an appropriate balance between the risks placed on the flexible assets and energy customers?

The proposed length of contract will look to balance the provision of secure returns on bidders' investments to encourage bidders' involvement in the flexibility market but also try to not exclude newer projects which may provide more cost-effective flexibility opportunities.

PROCUREMENT APPROACH

Q15. What are stakeholders' views on the relative merits of a most economically advantageous tender process versus an auction process?

Codema would have a preference for multi-criteria tender that best captures wider system benefits. In addition to the criteria outlined in this consultation, the following may also be included as award criteria:

- Emissions from utilisation of the flexible asset e.g. associated carbon emissions with using the asset - this means that additional revenue streams from providing flexibility services would go to lower carbon technologies rather than supporting technologies that are more polluting.
- Potential environmental impacts/risks -this could also include NOx and particulate matter emissions, fire risk, etc.
- Embodied carbon of the flexible asset & resource efficiency (use of critical minerals, land use, etc.)
- Degradation of the asset over time - over the contract duration or longer if recontracting is considered to be likely

Q16. What do stakeholders consider are the metrics and levels of same that would indicate sufficient liquidity to enable a move to a price-based auction?

No comment

Q17. What are stakeholders' views on the proposed aims of the assessment criteria (value for money, deliverability and operability)?

Are these aims sufficiently comprehensive? Are there other high level aims that the CRU and ESB Networks should consider?

In addition to the criteria outlined in this consultation, the following may also be included as award criteria:

- Emissions from utilisation of the flexible asset e.g. associated carbon emissions with using the asset - this means that additional revenue streams from providing flexibility services would go to lower carbon technologies rather than supporting technologies that are more polluting.
- Potential environmental impacts/risks -this could also include NOx and particulate matter emissions, fire risk, etc.
- Embodied carbon of the flexible asset & resource efficiency (use of critical minerals, land use, etc.)
- Degradation of the asset over time - over the contract duration or longer if contract extension is considered to be likely

Q18. What are stakeholders' views on the proposed assessment criteria outlined in the table above?

Are there other criteria which should be considered when evaluating the three key aims? Are the assessment criteria sufficiently clear to stakeholders? Do stakeholders consider that they will be in a position to provide evidence relating to the outlined criteria when responding to the procurement process?

Same as above

Q19. What evidence of a tenderer's ability to deliver to the required energisation date should be required, taking into account the need to balance avoiding speculative tenders that may not deliver while not ruling out early-stage projects that are capable of delivery but require more time?

Covered by deliverability criteria

Q20. What are stakeholders' views on how the aims and assessment criteria should be balanced against one another when ESB Networks are selecting the winning tenders?

No comment

LOCATIONAL BATCHING

Q21. What are stakeholders' views on the proposed locational batching of flexibility procurement?

Is this likely to improve competitive outcomes?

No comment

Q22. Do stakeholders consider there are other approaches that can be used to promote competitive outcomes as the market is developing?

A technology agnostic approach based on the multi-criteria award analysis seems a sensible approach (please also consider additional criteria included in this response).

STAGES IN THE PROCUREMENT PROCESS

Q23. What are stakeholders' views on the proposed phases in the procurement process?

Codema would welcome the inclusion of some form of open dialogue in the stages prior to submitting a tender in order to ensure full understanding of the needs of ESBN to allow for a solution that is best tailored to these needs.

Q 24. What are stakeholder's views on the appropriate timing for each stage?

How long in advance of RFT issuance do stakeholders need to receive the final list of locations where demand flexibility will be procured? How long is needed from the RFT issuing to RFT close?

No comment

For further enquiries regarding this submission, please contact:

John O' Shea, Heat & Electricity Lead (Codema) john.oshea@codema.ie