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Call for input: The Future of Distributed Flexibility

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Summary

Energy Systems Catapult (ESC) welcomes the opportunity to respond to Ofgem's call for input on 'The Future of Distributed Flexibility'.

ESC was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth. ESC is an independent, not-for-profit centre of excellence that bridges the gap between industry, Government, academia, and research. We take a whole systems view of the energy sector, including in policy design and implementation, helping us to identify and address innovation priorities and market barriers, to decarbonise the energy system at the lowest cost.

We generally agree with Ofgem's view that there is a need to significantly scale up the role of distributed flexibility in the energy system, and that the current landscape is inadequate to do so at sufficient pace and scale. We also share Ofgem's view that data and digital interoperability are highly desirable – regardless of the specific design of a future energy system. However, our view as to what needs to happen to achieve the above outcomes has some nuanced differences to the views presented in Ofgem's call for input.

Our main messages are:

- There is a need to closely align any work on a common digital infrastructure for distributed flexibility with other initiatives that further the digital enabling environment in the energy sector.
- There is a need to more explicitly consider the value of the different Archetypes in the context of the markets that they link, and how the relative costs/benefits of an Archetype may change as market structures change.
- Care needs to be taken when attributing benefits (and costs) to an Archetype or to closely related changes, such as local markets governance.

We discuss each of the above points in further detail below.

1. Consistency across the 'digital commons' landscape

For the purposes of our response, we understand 'digital energy infrastructure' to mean the enabling digital assets, processes or products that enable the archetypes described in the consultation. We define 'digital commons' as digital infrastructure which enables a wide variety of use cases and would be best utilised within and beyond the scope of what is described in this call for input.

Reflecting where we are today and in relation to the current initiatives and their interaction with the proposed archetypes, we are of the opinion that the following needs to happen either in parallel or before building or development of any archetype for flexibility:

- The [Digital Spine Feasibility](#) study concludes, and a decision is made if what is proposed will be taken forward as the standard for transmission of data between market participants (either in a limited or complete way)
 - This includes clarity on how the service is funded, mandated, and operated.
- The [Automatic Asset Registration](#) (AAR) programme is given regulatory certainty and a clear cost recovery mechanism.

Both these projects are key enablers of a flexibility market - AAR more so, through the discoverability and data relating to flexibility assets; though the digital spine may become the key enabler of the transmission of data between market participants. In the absence of certainty over the digital spine, any flexibility archetype will have to develop a similar capability for its own purposes which increases development time, duplicates effort and reduces whole system interoperability.

2. Alignment of digital commons with the sources of value

Currently, the value of flexibility is suppressed due to there being a single national price in the wholesale market that does not reflect local constraints. And value is dispersed across multiple sub-markets (e.g. different balancing services purchased by the ESO; local flexibility procured by DNOs).

The market failures articulated in the call for input, and some of the conclusions made therein, appear to be predicated on the idea that value will continue to be dispersed across multiple markets as is currently the case. This need not be the case and, indeed, ESC strongly advocates for a radical redesign of energy markets that would better reveal the value of flexibility.¹ This, in turn, may affect the relative benefits (and costs) of the different Archetypes.

For example, we have set out a vision that includes locational marginal pricing in the wholesale market (which would incorporate most balancing services) and a move to outcome-based mandates on suppliers, such as a Clean Energy Standard (these would replace disparate pots of funding such as Contracts for Difference for renewables, and the Capacity Market). And it is possible that, at the distribution level, there would be a move to highly dynamic and granular

¹ [ESC, Rethinking Electricity Markets – EMR 2.0: a new phase of innovation-friendly and consumer-focused electricity market design reform](#)

network tariffs, obviating the need for separate procurement of flexibility services by the DNOs.² Such a market landscape would not face the same market failures as articulated in the call for input, and so the appropriate regulatory intervention may also be different.

At the same time, the call for input has focused on electricity flexibility whereas in the longer-term the challenge for markets and for system operators would be how to optimise and resolve conflicts across different vectors (electricity, hydrogen, carbon networks, etc.).

Ofgem should consider how the relative costs and benefits of each of the Archetypes it presented might change under different types of market structures, and whether there is a "transition path" between Archetypes in light of changing market ecosystems.³

3. Consistency with market governance

The call for input appears at times to blur the lines between the digital infrastructure and other closely related changes. This is most notable in the references to "trusted governance" of the Medium and Thick archetypes. The dispute and conflict resolution that is attributed as a benefit of these archetypes appears to us to be a function of the rules and governance of the markets in question, not of the digital infrastructure that connects these markets.

In our response to Ofgem's concurrent consultation on the 'Future of local energy institutions and governance', we expressed support for the proposal to establish a single market facilitator function across local electricity markets. The benefits of such a function would accrue under any of the Archetypes presented in the call for input, as well as under the 'business as usual' counterfactual.

In order to make the most appropriate policy decision on which Archetype to pursue, it is important that Ofgem is able to accurately and distinctly assign costs and benefits to each archetype.

We provide a response to the detailed consultation questions in the annex. We would be happy to further discuss our response further with you.

Sincerely,
Ben Shafran

² For the avoidance of doubt, this is not a position ESC is advocating for, simply an articulation of one possible future.

³ We also note that the call for input makes references to the digital infrastructure enabling 'price discovery'. We would like to better understand what Ofgem means, as it does not appear to be the standard use of the term. 'Price discovery' is typically used to mean the matching of supply to demand – this is something that happens *within* markets, whereas the digital infrastructure in question applies *between* markets.

Annex: Response to detailed consultation questions

1. What do you think distributed flexibility could contribute to the energy system?

The potential role that distributed flexibility could play in the current and future energy system should not be underestimated or stifled. We agree with Ofgem's assertion that for a net zero energy system, flexibility is not optional, it is essential.

The various potential roles for distributed flexibility are also being increasingly well documented. The call for input has highlighted the numerous innovation trials and projects exploring flexibility, with projected benefits cases in the multi-billions. Energy Systems Catapult has previously engaged in multiple trials exploring various aspects of consumer flexibility,³ which have highlighted benefits for consumer experience and contributions to wider system flexibility challenges.⁴

With an increase in adoption of low carbon technologies like heat pumps and battery electric vehicles (BEVs) on the distribution level, the need to have some form of flexibility in the operation of these assets is vital to ensure system stability at both the local and transmission level. There have been studies carried out that have shown the impact mass adoption of BEVs could have on frequency, even though this is a national issue and does not apply locally, developing the capability to flex these assets for use at a national level is prudent.⁵

Increasing the use of flexibility in the operation of the power system can also allow networks to defer physical reinforcements that could save consumers money on energy bills, whilst allowing more efficient operation of local networks - i.e. allowing for increased numbers of generators to connect to a congested network, and using flexibility to manage these loads.

The deployment of this technology is not a singular comprehensive solution to manage the power system but should be developed alongside other solutions, such as smart tariffs, increasing coordination between the FSO and DNOs (in their system operator / DSO function), etc. The development of these solutions should also be managed carefully with learnings made clear, so wider adoption and rollout can be done as efficiently as possible.

Effective optimisation across and between different energy vectors – including electricity, heat, transport, etc. – is also an aspect to consider, and could enhance the ability of distributed flexibility to contribute to the energy system.

2. Will a focus on CER flexibility also help enable other forms of flexibility, especially distributed flexibility?

Given the expected growth over the coming years of CER and their potential to contribute to various forms of system flexibility, it is important to ensure that any solutions developed to unlock flexibility do not leave consumers (and their CER) behind.

Whilst there will be many overlapping qualities between CER and DER (as these two terms have been defined in Ofgem's call for input) in terms of solutions and barriers to unlocking flexibility, this should not be inferred that simply focusing on unlocking CER solutions will by extension unlock the full potential of DER solutions.

⁴ See examples such as in the Flexibly-Responsive Energy Delivery ([FRED](#)) programme; the [No Regrets](#) Renewable Heating Project.

⁵ <https://es.catapult.org.uk/report/resilient-electric-vehicle-charging/>

Energy System Catapult advocates for market reform that adopts an outcomes-based approach to energy policy (as distinct from the current policy focus on supporting specific technologies).⁶ one of the advantages of an outcomes-based approach is that creates the conditions for customer-serving organisations (suppliers, aggregators, etc.) to “internalise” technology choices. This is important in the context of distributed flexibility because different technologies have different level of potential to deliver demand-side flexibility and different potential scales of deployment - BEVs and heat pumps have already demonstrated the impact they can have if used flexibly, as observed, for example in OVO Energy’s V2G trial⁷ and Octopus Energy’s Demand Flexibility trial⁸.

3. Is there a ‘case for change’ and a need for a common vision for distributed flexibility?

We agree that current distribution flexibility market arrangements are not fit for purpose and that more attention is needed to facilitate more efficient arrangements for entry and participation. Ofgem’s call for input is valuable in setting out the need for a vision of whole system outcomes, and the roles that flexibility – including distributed flexibility – could play within that. As we have noted and agreed, there is a great need for various and many forms of flexibility within the future energy system.

While a direction of travel is important for guiding decision making and coordinating the actions of multiple players, an overly specific vision could pose risks of its own. In particular:

- Inevitably, the context and requirements will develop and evolve over time. The timescales within which the vision can be realised are long – perhaps decades – and in that time we can expect significant change – e.g. technological development, behavioural change, wider policy design. An overly specific vision risks missing the opportunities that come with the potential changes.
- If the ‘common vision’ originates from a single organisation (e.g. Ofgem) and is not “owned” by a wider group of stakeholders, then there is heavily reliance on that organisation to continue driving the ‘common vision’. Progress against that vision may well stall if the originating organisation’s priorities change. For example, New York’s “Reforming the Energy Vision” (REV) shows the limitations of a centralised vision when delivery is distributed / the originating organisation may not be able to maintain focus on delivery of that vision. Our research shows that after initial drive following the launch of REV, progress in New York has slowed down and been overtaken by some other US states that took less of a centralised approach.
- Related to this, is the risk that now is not the right time to lock in place a rigid framework. Over the past few years, we have seen rapid development of new innovative products and services in this field. New market platforms – e.g. Piclo’s marketplace for flexibility services – have come to market and others are being developed. Ofgem asserts that now is the time to consolidate the innovation and develop a single framework. This might be true – but more evidence should be provided to demonstrate this, and also to consider if further market development is needed before consolidation takes place. The risk would be to lock-

⁶ <https://es.catapult.org.uk/report/rethinking-electricity-markets-the-case-for-emr-2/>

⁷ <https://www.ovoenergy.com/electric-cars/vehicle-to-grid-charger>

⁸ <https://octopus.energy/press/believe-it-or-watt-octopus-energy-customers-provide-108mw-of-grid-flexibility-in-first-saving-session-equivalent-of-a-gas-power-station/>

in technological standards that do not necessarily provide optimal system solutions, and to lock-out new innovation that could provide better solutions.

Given the above, it could be counterproductive to propose or implement a rigid framework that should be adhered to. However, some standardisation around areas like communication protocols, consumer privacy and security of data would be beneficial. In particular, if the FSO/ESO is to utilise large volumes of CER/DER, communication protocols for these various platforms/mediums should be standardised to ease replicability and scalability.

It is also essential to remember that CER primarily exists to meet consumer needs. As such any common vision for distributed flexibility should articulate a system in which delivery of consumer outcomes (e.g. warm home, mobility needs, etc.) is done in a way that also achieves system co-benefits (low cost, low carbon, secure & reliable supply), but not one where consumers are expected to sacrifice in the interest of system outcomes.

4. What is your vision for how to accelerate the delivery of accessible, coordinated and trusted markets for distributed flexibility?

The market failures articulated in the call for input, and some of the conclusions made therein, appear to be predicated on the idea that value will continue to be dispersed across multiple markets as is currently the case. This need not be the case and, indeed, ESC strongly advocates for a radical redesign of energy markets that would better reveal the value of flexibility. This, in turn, may affect the relative benefits (and costs) of the different Archetypes.

Ultimately, we need to reach and unlock all distributed flexible potential across the system. While some of this can be reached through local / distributed level actions, this will need to be complemented with wholesale market reform that brings more granular locational and temporal pricing signals to consumers and generators.

Ofgem's approach of identifying the barriers to distributed flexibility is sensible overall, but the thinking remains relatively high level. More detailed and quantified analysis will help guide thinking on appropriate solutions to address those barriers. Each archetype should be fully conceptualised to illustrate how they would work and how that depends on the structure (including existence) of different markets / sources of value; what are the technical requirements; what policy and regulatory frameworks should be in place; and how the archetype would actually work.

The different levels of archetypes could be conceptualised in a roadmap, where networks, aggregators/suppliers have a set of guiding principles for the phased implementation of a 'thin' to 'medium' to 'thick' archetype (the sequence need not be from thinner to thicker archetypes, and may indeed flow the other way), with decision milestones along the way to agree on whether each further phase of implementation is needed and if so how. This modular approach and set of guiding principles could allow for smaller flexibility trials to take place with varying budgets to be then built out to a later date.

The guiding principles would also produce a series of recommendations on how supplier/aggregators, DNOs/DSOs and the ESO would coordinate within these varying levels of archetypes.

5. Will certainty of an end vision help accelerate enabling work and make it cohesive?

We would caution against the idea that there can be an “end point” to the role of flexibility, since the context in which flexibility will be deployed will itself change – climate targets may change in light of new scientific learning and/or progress on decarbonisation; the structure of the energy system and the interactions between different vectors will evolve; technological advancements and consumer preferences will dictate what is possible and desirable.

As we note in response to question 3, a vision that comes from a single organisation lives and dies with that organisation’s commitment to that vision.

Instead, we would encourage Ofgem to articulate the importance of flexibility to a range of different future energy systems. This includes cross-vector flexibility, whereas Ofgem’s call for input appears focused on electricity flexibility. There should be a clear set of guidelines on how flexibility could be delivered at varying levels and functionalities. If these guidelines are clear, the roadmap on how to deliver these becomes clearer.

6. When should a common digital energy infrastructure be in place? And therefore, when should development begin?

We are of the opinion that what Ofgem is describing as common digital energy infrastructure (the thin, medium or thick options) should be developed *in parallel or immediately after* existing industry innovation programmes, specifically the Digital Spine and the Automatic Asset Registration programme, have clarity on their regulatory roles (if any) and their remits.

More broadly, development of digital infrastructure has already begun in earnest. Some components, such as the ‘digital spine’ concept are foundational layers of *digital commons* that can potentially enable a wider variety of use cases than flexibility. Other things that could be described as digital commons, such as the discussions Ofgem are having around ‘consumer consent’, the Open Energy project, National Grid’s Virtual Energy System, or the Smart Meter Data Repository are in the processes of scoping/feasibility and have different approaches and cover different aspects of digitalisation of the sector. Given the necessity of flexibility to the future operation of the energy system, where common or foundational infrastructure is identified, there is a strong case for development to begin with the flexibility use case in mind, and then widened over time.

Alternatively, Ofgem and the government can help ensure that other *digital commons* are developed in such a way that the infrastructure can be used or re-purposed with minimal effort by other use cases and without ‘central’ intervention. This would require an open-source first approach that builds the base layer of functionality and enables users to use it how they see fit.

Those digital commons will, however, need an owner of the tool or service, with regulatory certainty and policy direction on how these services interact with licenses, codes, policy and importantly how they are funded and ‘mandated’. The Energy Digitalisation Taskforce recognised⁹ the need for common infrastructure, noting:

‘There are a number of projects across the sector which are already developing shared digital infrastructure using open source software and standards and these are to be applauded. It is now critical to ensure that these point solutions are integrated to deliver a robust, interoperable digital ecosystem which can deliver the decarbonised products and services customers need as part of a

⁹ <https://es.catapult.org.uk/report/delivering-a-digitalised-energy-system/>

coherent digital architecture. Importantly common “connectivity” interfaces are crucial for new innovators to scale businesses nationally and enter the market’

| Data | Asset | Operations |
|--|---|---|
| <ul style="list-style-type: none"> → Energy data catalogue → Data sharing fabric → Network data standards (CIM) | <ul style="list-style-type: none"> → Energy asset register → Auto registration → Flexible asset standards (PAS 1878 & 1879)¹¹ | <ul style="list-style-type: none"> → Digital spine → Carbon monitoring & data |

Reflecting where we are today and in relation to the current initiatives and their interaction with the proposed archetypes, we are of the opinion that the following needs to happen either in parallel or before building or development of any archetype for flexibility:

- The digital spine feasibility concludes, and a decision is made if what is proposed will be taken forward as the standard for transmission of data between market participants (either in a limited or complete way). This includes clarity on how the service is funded, mandated, and operated.
- The Automatic Asset Registration (AAR) programme is given regulatory certainty and a clear cost recovery mechanism.

Both these projects are key enablers of a flexibility market - AAR more so, through the discoverability and data relating to flexibility assets; though the digital spine may become the key enabler of the transmission of data between market participants. In the absence of certainty over the digital spine, any flexibility archetype will have to develop a similar capability for its own purposes which increases development time, duplicates effort and reduces whole system interoperability.

7. What should a common energy digital infrastructure look like, and why? Please consider the archetypes or develop your own proposition.

On balance, and subject to further development of this work, we can see the broad appeal of Archetype 3: Medium and think that the common energy digital infrastructure that is described in the IBM report is a sensible approach for this type of work. As with other initiatives, such as the Virtual Energy System, Digital Spine and Automatic Asset Registration, we would expect the infrastructure to be built out in an open-source first manner, with ‘closed’ software used where only necessary for issues around security, for example.

Whatever is built should avoid specific vendor lock in and recognise the monopolistic nature of its position in the market. The infrastructure developed should prioritise openness of data and approach to reduce the risks associated with what could otherwise be a monolithic IT infrastructure project.

8. What is your view on the desirability and feasibility of the archetypes or your own alternative proposition?

From a technical perspective, our view broadly matches the study conducted by IBM¹⁰. A 'medium' build could be desirable if it can meet the needs of the emergent flexibility market without undermining existing market propositions.

Operationally – the development of the variety of common infrastructure being proposed and scoped by government and Ofgem is rapidly passing the point of innovation-funded attempts to solve individual challenges, and has perhaps already entered the realm of delivery of industry change programmes.

We believe that a very clear industry change programme with senior responsible people from both DESNZ and Ofgem will be required to manage the building, prioritisation and necessary code/licence changes that can facilitate this transformation.

The development of flexibility platforms will not be successful without widespread consumer participation. Success can be measured by the impact of flexibility on the grid in terms of managing the system, saving money on reinforcement and use in national balancing, with success also measurable on how much consumers could save on energy bills as well as the number of consumers actually benefitting.

Consumers will not necessarily be proactive and a broad range of consumers from different socioeconomic backgrounds should be given the opportunity to benefit from such infrastructure.

Information flows, architecture diagrams and stakeholder engagement for whichever archetype is pursued should be enhanced with an effort to develop a staged roadmap.

9. Should a common digital energy infrastructure be new-build, or should it build-out from existing infrastructure?

Please note our other answers. In short, the digital spine could facilitate the data standardisation and transfer mechanism required by the proposed archetypes, and the Automatic Asset Registration programme could function as the mechanism for device discovery and, in theory, also be used to provide data for settlement purposes (when considering CER). Though this would be above and beyond the scope of AAR as it is currently set out.

10. What are the important areas for consideration when designing institutional delivery models for a common digital energy infrastructure?

The Energy Digitalisation Taskforce noted in its governance annex¹¹ an approach to governance for designing, maintaining, and prioritising development of common digital energy infrastructure. In addition to the governance approach set out in this document, the following considerations should be made.

Owners/operators of common digital infrastructure should have the following characteristics:

¹⁰ <https://www.ofgem.gov.uk/sites/default/files/2023-03/IBM%20Report%20-%20Digital%20Design%20Study.pdf>

¹¹ <https://esc-production-2021.s3.eu-west-2.amazonaws.com/2022/01/EDiT-Annex-Digitalisation-Governance-v1.0.pdf>

- Not for profit – The organisation should be free of commercial interest with a mechanism for financial sustainability.
- Be technically capable – The organisation should have the capability to develop technical requirements and maintain the solution(s)
- Collaborative – The organisation should work with stakeholders across the energy sector and beyond to ensure the infrastructure and its governance is robust with broad support.
- Be public good driven – the organisation should prioritise ensuring that its work is for the public's benefit and on their behalf.

In addition, we are of the opinion that any design choices for institutional governance should reflect approaches set out by the Ada Lovelace Institute's paper 'rethinking data'¹² which provides detail for both policymakers and civil society organisations that are very relevant to the decisions that will need to be taken by government and Ofgem in pursuing the development of common digital infrastructure and the associated governance.

ESC undertook work in 2021 for the "Milford Haven: Energy Kingdom" project,¹³ including work on systems architecture. While the project focused on hydrogen, the detailed consideration of development of a flexibility trading platform to lower costs, as well as wider consideration of trading platform design principles, will be relevant for Ofgem's further thinking.

11. What are the important areas for consideration when designing financial delivery models for a common digital energy infrastructure?

Please refer to our 'Automatic Asset Registration Programme' feasibility study,¹⁴ which goes into a high level of detail on how cost recovery can be achieved for that specific programme and has insight on how that can be done in a coherent way for different digital infrastructure development.

¹² <https://www.adalovelaceinstitute.org/report/rethinking-data/>

¹³ <https://es.catapult.org.uk/project/milford-haven-energy-kingdom/>

¹⁴ <https://es.catapult.org.uk/report/automatic-asset-registration-feasibility-study/>