

Energy Systems Catapult Response to the Ofgem Consultation: *Future arrangements for the electricity System Operator: its role and structure*

Introduction

1. This response is submitted on behalf of the Energy Systems Catapult (ESC). The ESC is an independent company whose remit is to create innovation in UK energy markets and to create business opportunities. The ESC is looking at a “whole systems approach” and is responsible for the delivery of the **Smart Systems and Heat (SSH) Programme** on behalf of the Energy Technologies Institute (ETI).
2. The ESC is working with the UK government and local authorities to deliver the SSH Programme, determining the most effective means of decarbonising the UK’s 27 million homes and contributing to the target of an 80% reduction in the UK’s Greenhouse Gas emissions by 2050. The SSH Programme is developing a cost-effective area-by-area deployment approach. A modelling framework (“*EnergyPath™ Networks*”) has been developed that allows the design of the most cost-effective energy system in a local area, including energy efficiency interventions for the homes in that area. We have worked with Newcastle City Council to develop a Local Energy Plan that seeks to reduce carbon emissions by 90% by 2050. We are also working with Bridgend County Borough Council and the Greater Manchester Authority to develop similar local energy plans. We believe that this approach can lead to a significant reduction in carbon emissions from heat in buildings.
3. Another key element of the SSH programme is the development of a Home Energy Management System (HEMS) which will allow the smart operation of domestic heating and other applications. HEMS will enable innovative new business models and allow the householder to automatically control energy usage and potentially help to balance the energy system. To realise the benefits from HEMS, new energy supply licence arrangements and consumer protection will need to be developed to allow energy service providers to offer levels of comfort rather than merely supplying kWh of energy. Digitalisation may also have a key role, with ICT enabling integration and sophisticated customer interaction through the acquisition and use of data and information.
4. The ESC is also leading the Future Power System Architecture (FPSA) project in collaboration with the Institution of Engineering and Technology (IET). This project seeks to determine the functions that will be required to enable a future, low carbon, power system to operate in the face of transformative change, and hence to enable recommendations to be made that will inform policy and regulatory considerations.
5. If you wish to discuss the contents of this submission, please contact Tony Diccico at: tony.diccico@es.catapult.org.uk

Summary

6. The electricity system is complex and 'always on', and the integration of new functionality will need to be undertaken in a systematic way to ensure compatibility and to avoid destabilisation. This will require concerted and coordinated attention in view of the many timing interdependencies, triggers and tipping points. The rise of intermittent and distributed generation and new loads such as heat pumps and electric vehicles could be inhibited by network constraints or require costly upgrades unless actively managed by intelligent matching of supply, demand and network capabilities.
7. The ESC and IET have carried out a study of international power systems as part of the Future Power System Architecture (FPSA) project¹. This **International Study** looked at the main system level challenges facing the electrical power sectors of Germany, Ireland, the United States of America and South Korea. The study found that the challenges faced by the GB electricity sector are similar to those faced in the other countries reviewed, however none of these countries face the extent of the challenges as the UK. This indicates that the scale of the change anticipated on the GB system is more significant and potentially poses a greater coordination and integration challenge.
8. Much new functionality is concerned with interactions that span the whole system – from smart appliances beyond customers' meters to the largest thermal power stations. This integration runs counter to today's stratification of system architecture that, to a large extent, compartmentalises generation, transmission, distribution and consumers. An effective response will require new organisational and governance capabilities to establish and energise this whole-system approach necessary for transforming GB's power system architecture
9. As the interactions between these markets deepen, some level of coordination will be necessary across electricity, gas, biofuels, petroleum supply and heat networks. We support the increased use of competitive markets to reduce the residual costs of balancing and believe that this can be facilitated through effective incentivisation of the SO. We agree that the SO has a pivotal role in the electricity market and an independent SO should take a more active role in understanding the needs of market participants and shaping the future development of the market arrangements.
10. The ESC broadly agrees with the proposed approach for implementing the proposed changes set out in this consultation, and agrees that the proposed timescale of effecting separation from April 2019 is realistic. The role of the electricity SO will be critical to the future operation of smart energy networks. We agree with Ofgem that there should be effective separation between NGET's SO and TO functions, although we are not convinced at this stage that a fully independent (of NG Group) ISO is required, although this option should be retained if the new arrangements do not deliver the required outcomes.

¹ *Future Power Systems Architecture Project* – A report commissioned by the Department of Energy and Climate Change (2016). www.es.catapult.org.uk/fpsa

Detailed Response to Questions

The role of the System Operator (Chapter 2)

Question 1: What are your views on our proposed objectives for the SO (set out in paragraph 2.1)?

11. The proposed objectives for the SO in paragraph 2.1 can be summarised as:

- Overseeing a safe, resilient and cost-effective electricity system.
- Driving competition and efficiency across all aspects of the system.
- Promoting innovation, flexibility and smart/demand-side solutions.

The ESC believes that these are the key future objectives that the SO must meet and are borne out by the results of a study of international power systems carried out as part of the ESC and IET **Future Power System Architecture (FPSA) project**².

12. This *International Study* looked at the main system level challenges facing the electrical power sectors of Germany, Ireland and the United States (US) (with a high-level desktop study on South Korea). They correlate strongly with those facing the GB system around key changes including:

- Integration of large renewable generation sources (and a corresponding reduction in system inertia).
- The growth in distribution-connected energy resources (distributed generation, electric vehicles, heat pumps, demand side response, energy storage).
- The trend towards microgrids, community energy systems and engaged customers.
- Greater interconnection with neighbouring grids, both AC and DC.

13. Many experts consulted as part of the Study expressed the need for greater system-wide planning and indicated that they believed the scale of changes anticipated represented a real risk to system resilience and reliability if not fully coordinated, the value that Distributed Energy Resources (DERs) can bring is being accepted, policies in the countries reviewed are aimed at promoting and encouraging the adoption of DERs.

14. There is evidence of greater central coordination and planning in the countries examined in the Study to ensure that system security is preserved and the value of DERs is fully realised. In California and New York that greater coordination is coming from the Independent System Operators and Public Service Commissions. In Ireland, it is through an SO/TO led cross industry working group.

15. There are many new functions that are being developed across the sectors that will need to be incorporated, either into existing functions or through developing new ones.

² *Future Power Systems Architecture Project* – A report commissioned by the Department of Energy and Climate Change (2016). www.es.catapult.org.uk/fpsa

Examples include modelling of DERs, interconnection rules and standards, situational awareness, data exchange and common information models.

Question 2: What are your views on our expectations for how the SO should seek to achieve these objectives?

16. In addition to the three objectives listed above, Ofgem has listed four areas where the SO's role needs to evolve to both facilitate and respond to a transforming electricity system. These can be summarised as:
 - Improving the SO's performance as the residual balancer.
 - Playing a greater role in the development of competitive markets.
 - Taking a lead in whole system thinking and actions.
 - Supporting competition in the delivery of new network capacity.
17. We agree that the SO's role needs to evolve in all four of these areas. As the power system becomes increasingly complex, decentralised and more interactive with its customers, anticipating, modelling and managing major events will become more challenging. Recovery from prolonged outages will require much more sophisticated coordination to reintroduce load and reconnect distributed generation and storage.
18. Distribution systems face the greatest challenges in defining and implementing comprehensive distribution management systems. In addition, these will need to integrate with ISO systems, Home Area Networks. Microgrid controllers, SCADA systems and market mechanisms to name a few. While many of these have detailed architecture and defined interfaces, there is an absence of a system of systems overview. This is beginning to be actively discussed, with Pacific Northwest National Laboratory (PNNL) and Electric Power Research Institute (EPRI) both being cited as thought leaders.
19. We agree that the SO should be "*thinking more widely*" about how it can reduce the costs of **balancing** the electricity system. We agree that there should be more transparency of the SO's actions through better information provision, however there must also be safeguards in place to prevent any market participants using this additional information from taking advantage of a dominant position, for instance any generator or demand-side provider located behind a network constraint.
20. We agree that there is scope for improving the procurement of balancing services, whether this is via the Balancing Mechanism or through balancing services contracts. As improved 'smart' technology becomes available, the demand side will have the capability to provide much greater energy balancing.
21. We support the increased use of **competitive markets** to reduce the residual costs of balancing and believe that this can be facilitated through effective incentivisation of the SO. We agree that the SO has a pivotal role in the electricity market and an independent SO should take a more active role in understanding the needs of market participants

and shaping the future development of the market arrangements. An independent SO should work closely with Ofgem and the proposed Consultative Board (a new body proposed in the recent Ofgem consultation: *Industry Code Governance: Initial consultation on implementing the Competition and Markets Authority's recommendations*) to provide strategic direction to the development of the industry codes and market arrangements, whilst allowing market participants to take the lead in proposing changes to these codes and arrangements.

22. The rise of intermittent and distributed generation and new loads such as heat pumps and electric vehicles will require a **whole system** approach to system operation. There needs to be greater coordination between the Transmission Network SO and Distribution Network Operators (DNOs) and (eventually) Distribution System Operators (DSOs). The development of distribution-connected generation and demand could be inhibited by network constraints or require costly upgrades unless actively managed by intelligent matching of supply, demand and network capabilities. As already stated, this 'whole system' approach has been considered by the IET and ESC as part of the FPSA project. We believe that the findings of the FPSA project can be used to facilitate the development of a more coordinated approach between an independent SO and the network owners/operators. We also provided our views on the development of smarter, more flexible energy system in the recent BEIS/Ofgem Call for Evidence: *A Smart, Flexible Energy System*, supporting the the greater use of demand side aggregation and energy storage.

Question 3: Do you agree with our proposals for what licence changes are needed to support these objectives?

23. The ESC supports Ofgem's proposals to change the SO licence to support the delivery of the objectives discussed above. We agree with the approach to determine the right balance between licence obligations and different types of SO incentives – we believe that effective incentivisation of an independent SO will lead to a more efficient electricity network. This incentivisation should take a more principles-based approach than a prescriptive one, to allow the SO to be more proactive in dealing with future challenges, with clear rewards for effective cost management and innovation.

A more independent System Operator (Chapter 3)

Question 1: Do you agree that greater separation between NG's SO functions and the rest of the group is needed?

24. We agree that it is right to separate the SO function from the rest of the NG Group, especially as more network functions are opened to competition. Introducing a separate SO will help to remove the potential conflict of interest between NGET's commercial position and its role as administrator of the CUSC, Grid Code and SO-TO Code (STC) and its role in the delivery of the Electricity Market Reform activities. At this time, we do not believe that it is necessary to create a fully Independent System Operator (ISO), but this option should be retained in case the preferred option does not provide the benefits envisaged.

25. We believe that the effective separation of the SO and TO functions is especially important in the coordination of network investment solutions with other network operators: if the SO were not independent there is a danger that it could favour NGET's transmission business over options for investment solutions on other companies' networks or for non-build solutions.

Question 2: What are your views on the additional separation measures we are proposing?

26. We are broadly in agreement with the measures proposed for separating the licence and transferring assets, dealing with consequential changes such as code modifications, contract novation, funding arrangements, governance and physical separation.

27. We agree with the proposed timescales of effecting the separation by April 2019 – this should allow enough time to novate contracts, allow bilateral contract negotiations between NGET and counterparties and arrange physical separation of NGSO and other NG Group staff.

Question 3: What are your views on our proposed approach for implementing these changes?

28. We agree with the approach outlined in Chapter 3 to implement the required changes to separate the SO. We have a number of comments about the detail of the separation and these are included below.

29. We agree that a separate legal entity within the NG Group ('NGSO') should be formed by transferring the existing SO functions in NGET's existing licence. We also agree that it is not appropriate to re-open NGET's RIIO-T1 price control but believe that the process of allocating of revenues, incentives and outputs between NGSO and NGTO will be difficult. Where costs have been incurred as a direct result of separating the SO and operating NGSO separately from NGTO they should be recoverable as part of the RIIO-T1 settlement.

30. In terms of the governance of industry codes, we expect NGET as the existing SO to engage with industry to ensure a coordinated set of proposed modifications are developed for any consequential changes. We agree that these modifications should be taken forward using the existing code modification procedures. We believe that it is appropriate for NGET's ownership of Elexon to be transferred to NGSO and that the existing separation arrangements between Elexon and the SO should be replicated for the new NGSO.

31. We agree that the new NGSO board should have different members than the NGET board. We do not have a preference as to whether there should be two or three sufficiently independent directors (SIDs) on the NGSO Board, but would expect at least one of the SIDs to have a high degree of knowledge of innovative, smart technologies. We agree that the NGSO Board should establish a Compliance Sub-Committee,

chaired by a SID, to ensure that NGSO decisions are non-discriminatory and that NGSO business separation requirements are complied with.

32. It is important that the new NGSO should take all reasonable endeavours to maintain an investment grade rating to protect consumers and other counterparties from the consequences of it becoming financially distressed. NGSO will require the financial resources to ensure it can cover any cash flow issues arising from shortfalls associated with under-recovery from its system operation activities. We agree that, within the RIIO-T1 period, this support should come from the broader NG Group on a commercial basis.
33. There may be some difficulty in ensuring effective separation if the SO and TO functions within NGET continue to share corporate services such as finance, human resources, legal, information systems, regulation, corporate affairs, procurement & logistics, HR etc. There is obviously a trade-off between ensuring effective separation and the cost of replicating existing services. 'Strategic' shared services i.e. regulation, finance, legal and strategy are key to the operation of the new SO business and will have access to commercially sensitive information that affects future network investment and operation. For this reason, we believe that these strategic services in NGSO business should be separated completely from NGET's TO function. For other 'shared services', these should be provided to NGSO on the same basis that they are provided to other NG Group entities.
34. Given that NGET and NGSO will be operating independently, it is important to avoid any real or perceived conflicts from shared working accommodation between the entities. We agree that they should have separate offices and appropriate restrictions should be in place around employee access to these offices. We are unclear whether this separation can be carried out effectively at the existing Warwick offices or whether the new NGSO staff need to be located at a separate site. We agree that employee transfer between NGSO and NGTO should be restricted but not prohibited. NG Group should take responsibility for ensuring that employees transferring into and out of NGSO have been trained on how to meet their obligations to protect information provided to NGSO in confidence.
35. Restricting access to sensitive information will be a key requirement when NGSO is split from NGTO. NGTO staff should be limited to accessing information on its own assets, and should not be allowed access to information on the wider electricity network. An important criterion for future development of IS systems will be how to ensure effective separation of information and systems between the NGSO and NGTO companies.

Next steps (Chapter 4)

Question 1: What are your thoughts on our proposed approach for implementing the proposed changes set out in this consultation?

36. There is no doubt that the gas and electricity supply industry faces significant change over the next 20 – 30 years as the decarbonisation of electricity generation, heating

and transport gathers pace. These changes will require a more coordinated approach across electricity networks and, also more cross-vector coordination. The role of the electricity SO will be critical to the efficient operation of smart energy networks. We agree with Ofgem that there should be separation between NGET's SO and TO functions, although we are not convinced at this stage that a fully independent (of NG Group) ISO is required, although this option should be retained if the new arrangements do not deliver the required outcomes.

37. We are in broad agreement with the approach for implementing the proposed changes set out in this consultation, and agree that the proposed timescale of separation from April 2019 is realistic.

Question 2: What further evidence should we consider in finalising our impact assessment of the proposals on the SO's roles and level of independence?

38. As indicated above, the IET and ESC have collaborated on the Future Power System Architecture (FPSA) project. This project seeks to determine the functions that will be required to enable a future, low carbon, power system to operate in the face of transformative change, and hence to enable recommendations to be made that will inform policy and regulatory considerations. A key output of the project has been a study of the system level challenges facing the electrical power sectors of Germany, Ireland, the United States and South Korea. We believe that there may be useful evidence from the FPSA project that Ofgem should consider when finalising its impact assessment of the proposals on the SO's roles and level of independence.