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Response to consultation on frameworks for future systems and network regulation: enabling an energy system for the future

Contact:

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Summary

Energy Systems Catapult (ESC) welcomes the opportunity to respond to Ofgem's consultation on the future of network regulation.

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 welcome Ofgem's openness to different approaches of regulating investment in energy networks in light of the changing policy (i.e. the decarbonisation targets) and institutional (i.e. creation of the Future Systems Operator (FSO)) contexts. We strongly support the notion that economic regulation of network companies should be an enabler of meeting the Net Zero target.

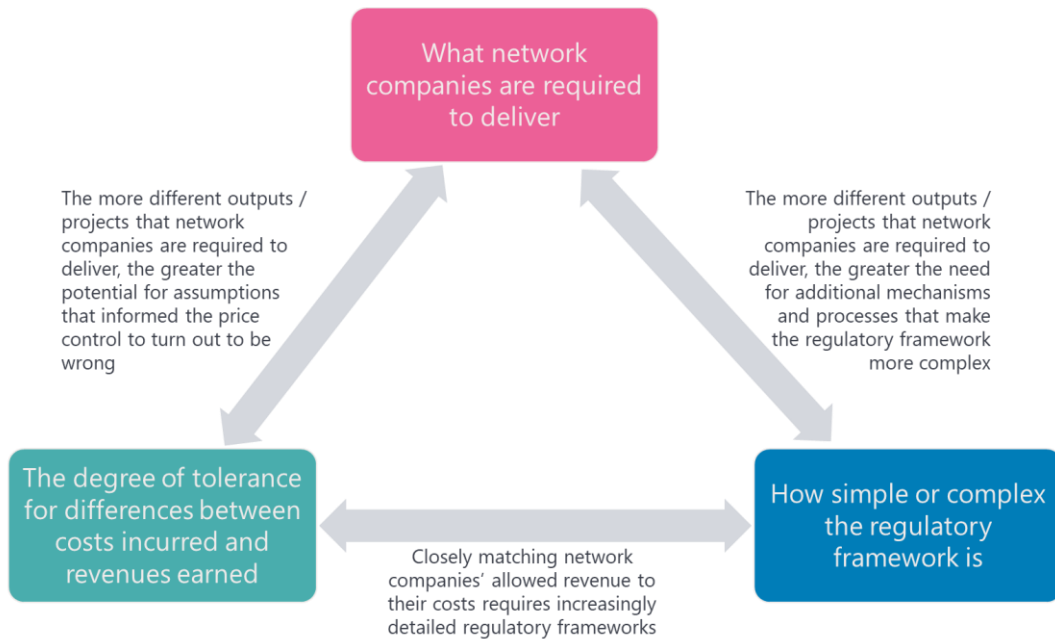
With regard to the proposals made in the consultation paper, our main messages are:

1. Focus on the delivery of overarching outcomes

In broad terms, every price control framework balances a tension between three dimensions:

- "Delivery" – what the regulated network companies are expected or required to deliver.
- "Accuracy" – the extent to which the regulatory framework allows for variance between the actual costs that the regulated network companies incur and the revenues that they are allowed to earn.
- "Simplicity" – how complex the regulatory framework is in terms of mechanisms, processes, etc.

The tension between these three dimensions is illustrated in the figure on the next page.



In the 30+ years of economic regulation in the UK, the “delivery” dimension has only ever grown from one price control to the next – this is also true for other regulated sectors such as water. With the scale of energy infrastructure that is needed to decarbonise electricity by 2035 and the whole economy by 2050, there is every reason to expect that the trend in the “delivery” dimension will continue.

This means that Ofgem’s decisions for future regulatory framework come down to trading off “accuracy” vs “simplicity”. The RIIO-2 frameworks strongly emphasised alignments of costs and revenues, at a cost of increasingly complex regulatory settlements – as acknowledged in Ofgem’s consultation. But, while the consultation explores potentially very different regulatory approaches, it does not address the question of what the right balance should be between seeking “accuracy” and “simplicity”. Without truly reckoning with this trade-off, we are concerned that Ofgem may end up stacking interventions on top of each other regardless of the framework adopted.

ESC has long advocated for policy approaches that focus on the desired outcomes, while allowing the relevant organisations (regulated network companies, in this case) the relative freedom to explore the most effective ways to deliver those outcomes. Such an approach inherently accepts that there may be a degree of variance between allowed revenues and actual costs, but that the resulting innovation and efficiency in delivering the outcomes would more than compensate for this potential disbenefit.

2. Taking a genuine whole-systems approach

The consultation makes welcome references to the need to take a system-wide approach to network planning and regulation. The creation of the FSO and potential regional subsidiaries offers a genuine opportunity to turn such ambition into reality.

However, the regulatory frameworks presented in chapter 4 of the consultation appear to be heading in the opposite direction. They imply multiple organisations being jointly accountable – for example, for planning. These frameworks also appear to propose that planning for business-as-

usual activities would sit with one organisation while planning for reinforcement would sit with other organisation(s). It is difficult to see how such an approach could support whole-systems planning. In fact, this appears to be a recipe for slowing down essential investment to enable the net zero transition, by requiring multiple layers of governance and delivery – each with its own set of disparate incentive structures.

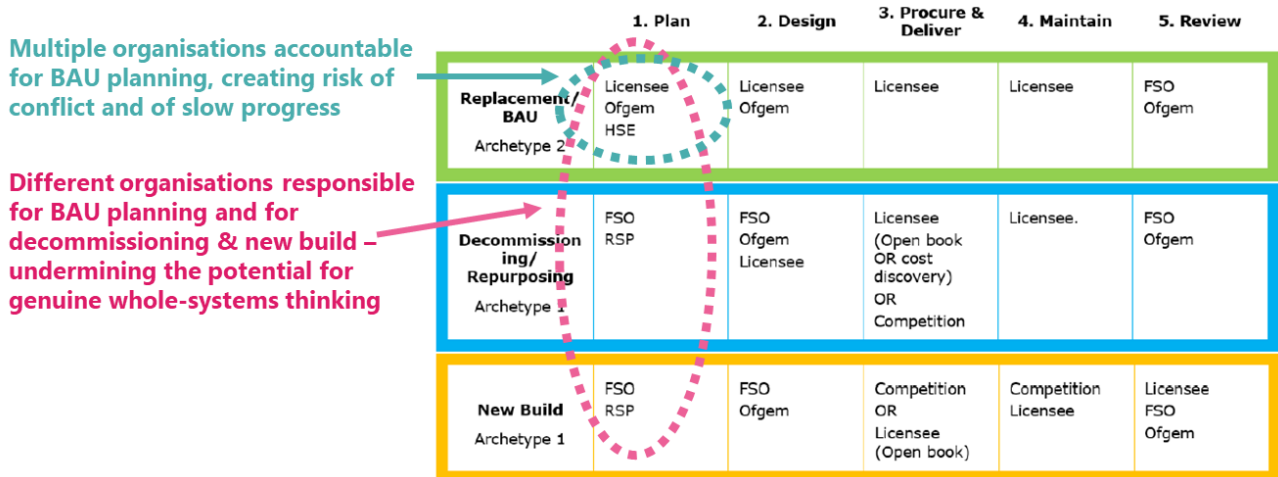


Figure 6. Gas T&D example model (for discussion), organisations are listed within each box in order of responsibility in that area this model

To that end, we think Ofgem also needs to articulate how the activities that are subject to price control (or similar regulatory approaches) interact with other elements of the energy system such as energy markets. For example, ESC strongly advocates for the introduction of locational marginal pricing (LMP) in the wholesale electricity market.¹ Our review of US markets that use LMP has found that the granular price signals in such markets provide an important signal of the locations where network reinforcement is most valuable, in turn reducing the risk of those reinforcements becoming stranded assets.^{2,3}

3. The potential role – and potential limitations of – centralised plans

A cross-vector view is important when developing strategic energy plans (either on a national scale or for a local area in the form of Local Area Energy Plans) - to understand where and when key technologies and supporting network infrastructure will be required. From such a plan, the more detailed network plans can be created. Enabling the right level of detail into network plans will increase the deliverability of those plans in a timely manner.

However, the extent to which Ofgem's regulatory framework could rely on such centralised plans would depend on the quality of the plans. It may take some time before the FSO has developed the capabilities required for its plans to genuinely reflect a whole-systems perspective – accounting for trade-offs and coordination across vectors (electricity, gas, hydrogen, etc.) and between the

¹ <https://es.catapult.org.uk/report/rethinking-electricity-markets-the-case-for-emr-2/>

² <https://es.catapult.org.uk/report/rema-international-learnings-on-investment-support-for-clean-electricity/>

³ We also note that US markets that use LMP are operated by an independent system operator (ISO) or a regional transmission organization (RTO) whose roles are somewhat similar to that envisaged for the FSO.

national and local dimensions. Local plans are also likely to vary quite a bit in their quality, at least initially until standardisation of approach and of data quality are established.

Ofgem's consultation also places a great amount of emphasis on the problem of information asymmetry. This has long been the focal point of regulatory thinking, but we question whether Ofgem's characterisation of this problem is correct. In the context of relatively steady-state conditions, a regulated company holds an informational advantage over the regulator, which it may wish to exploit. However, in a transformational state, as we expect the energy system to undergo in the coming decades, it is unclear whether such an advantage is as material. For example, network companies are unlikely to have an advantage over Ofgem when it comes to fundamental uncertainties such as the future role of hydrogen in domestic heating (and the implications this would have on gas and electricity networks).

All things considered, we would caution against moving to approaches that rely primarily on *ex post* regulation – at least until such time as very high quality centralised planning is in place.

4. Innovation and digitalisation

There is little mention in Ofgem's consultation of the need to incentivise and facilitate innovation as part of the energy transition. As noted above, the proposed fragmentation of regulatory approaches could weaken the incentive for network companies to innovate.

Additionally, we think that Ofgem should consider the role of digital tools and digital infrastructure in providing greater clarity for network companies when they are planning the build out or upgrade of digital services. Digital work, particularly for networks building capabilities, does not match the cadence or development pathways of physical infrastructure investment, so the regulatory approaches that are needed to facilitate investment in digital systems should likewise be different to those used for physical infrastructure.

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

Sincerely,
Ben

Response to detailed consultation questions

Q.1. What should the role of the 'consumer voice' be and through what institutions and processes should it be channelled?

The role of the consumer voice in the net zero transition will be fundamental. Consumer choices will be needed to drive change (including in relation to where and when to use energy, which energy vectors to use and when to invest in low carbon technologies such as heat pumps and EVs). It will also be necessary to maintain consumer confidence in the transition, and so consumers will need to feel they are getting the energy they need at the right price. An increasing focus on consumers is therefore important.

Setting clear expectations around outcomes should help drive up results for consumers – including network infrastructure built in time to connect low carbon generation to demand, costs kept down (including through the use of flexible technologies) and security of supply.

Most consumers are unlikely to want to engage in the detail of network regulation, but will be concerned about the outcomes they deliver. Transparency and clear communication to consumers in relation infrastructure delivery and costs / charging is important to maintain confidence. In the main, we expect consumers' voice to be expressed through the choices they make – e.g. their participation (directly or via an intermediary) in providing flexibility services. To ensure that consumers' choices best align with the desired system outcomes, markets and regulation should best reflect the physical nature of the grid and its energy assets, in order to unlock the most effective signals to encourage behaviour that makes the best use of the grid and energy assets.

Q.2. How detailed could an independent, cross vector view become to determine future plans for periods beyond RIIO-2 and support effective use of the 'Plan and Deliver' model?

A cross vector view is important when developing strategic energy plan (either on a national scale or for a local area in the form of Local Area Energy Plans) - to understand where and when key technologies will be required. From such a plan, the more detailed network plans can be created.

Enabling the right level of detail into network plans will increase the deliverability of those plans in a timely manner. An important consideration, however, is how energy investment plans interact with the development planning and permitting process – historically there has been a disconnect between the approval of regulated funding and the planning permissions for energy networks infrastructure. This disconnect has, and continues to be, a threat to industry's ability to deliver the infrastructure that is required to enable the decarbonisation of the electricity system and, ultimately, of the whole UK economy. It is essential, therefore, that Ofgem considers how the frameworks for network regulation can overcome this disconnect.

Q.3. Under what circumstances would competition, or other procurement models such as open book contracting, have benefits over ex ante incentives as a cost control mechanism?

There is a need to ensure value for consumers and assess projects on a whole system cost. Only considering the capital cost may not lead to the best value for consumers. There is an interaction between capital costs, constraint costs, speed of delivery and how projects are delivered. Expanding the criteria used when considering cost would help to capture the true value to consumers of accelerating network build.

While competition for separable, new investments is conceptually attractive, there is a need to balance that against the reality of delivering such projects. In the context of fierce global

competition for access to supply chains – e.g. cable manufacturers – there is a risk that introducing competition inadvertently slow down infrastructure build by going to the supply chain project by project rather than a programme of projects.

Open book contracting and allowing flexibility in the costs that are passed through to consumers would support the challenges with volatile prices within the supply chain, as currently observed. However, this must be balanced against the weaker incentives that such an approach creates for network companies to innovate – both in terms of technologies deployed and in terms of contracting approaches.

Q.4. What is your view on the options identified for simplification of incentive regulation? What would be the benefits and costs by comparison to the approaches used in RIIO-2?

Q.5. What are the network activities where there would be benefits for a move to an ex post monitoring regime, and what would be the associated costs?

Q.6. What are the benefits and costs of this approach for Electricity Transmission by comparison to an evolution of the approach in RIIO-2, and what are the implementation barriers?

Joint response to Q4, Q5 and Q6:

The extent to which Ofgem’s regulatory framework could rely on centralised plans would depend on the quality of the plan. It may take some time before the FSO has developed the capabilities required for its plans to genuinely reflect a whole-systems perspective – accounting for trade-offs and coordination across vectors (electricity, gas, hydrogen, etc.) and between the national and local dimensions. Local plans are also likely to vary quite a bit in their quality, at least initially.

Additionally, in a transformational state, such as we expect the energy system to undergo in the coming decades, it is unclear that information asymmetry offers network companies as much of an advantage over the regulator as it would in steady-state. For example, network companies are unlikely to have an advantage over Ofgem when it comes to fundamental uncertainties such as what the government will decide about the future role of hydrogen in domestic heating.

All things considered, we would caution against moving to approaches that rely primarily on *ex post* regulation – at least until such time as very high quality centralised planning is in place.

Q.7. What is the potential for Electricity Distribution planning and commissioning to move to an alternative model by the end of RIIO-2, and what might be the benefits and costs of doing so?

Q.8. What is your view on the most effective approach to regulation of Gas Distribution and Transmission beyond RIIO-2? What would be the benefits and costs of moving to a simpler approach to regulation of the ongoing costs of operating and maintaining the network?

Joint response to Q7 and Q8:

Ofgem has separately consulted on the ‘Future of local energy institutions and governance’, in which it proposes the creation of Regional System Planners (RSPs) as local offshoots of the FSO coordinating local energy investments.

As set out in our response to the ‘Future of local energy institutions and governance’ consultation, we think that the value of a strategic planning function relating purely to electricity is perhaps

overstated. In broad terms, the demand for electricity is expected to increase significantly over the coming decades – precisely when, where and by how much is uncertain, but there is little reason to think that an RSP would be able to make significantly more accurate forecasts than the DNOs. Moreover, if the RSP's forecasts / plans are not binding on DNOs nor directly inform Ofgem's price control decisions,⁴ their added value appears limited compared to work Ofgem would be commissioning from consultants under current arrangements.

We think the more valuable strategic functions at a local level are (1) aligning spatial planning and energy infrastructure investment plans (see our response to the 'Future of local energy institutions and governance' for further discussion on this point); and (2) cross-vector decisions, particularly if decisions about local investment in hydrogen, electrification of heat, etc. need to be made in the absence of clear national guidance.

Q.9. Should there be a shorter-term price control in gas distribution and/or gas transmission, and how could this work in practice?

Not answered

Q.10. Would there need to be any changes to maintain a stable and consistent financial framework if we were to make greater use of different regulatory archetypes, and if so, what would those changes need to be?

It is well understood that Ofgem's price control regulations have to balance a number of objectives, and crucial among those are the interests of the consumer against the interests of investors. Private sector investors have a vital role to play now and in the coming decades given the huge volume of new infrastructure that will be required to connect up the system. While stable and predictable regulatory frameworks are favoured by the investment community, it is right that they evolve to ensure that are delivering in line with their ultimate goals and best serving consumers. Where it is concluded that risk / return is too generous, it will be in the interest of consumers to push back and tighten the settlement. Ofgem can help to mitigate negative impacts through transparency in regulatory planning and signalling change in advance to allow investors to amend their business plans.

Q.11. Do you have any views on our proposed analytical approach?

Not answered

Below we provide responses specifically for the topics listed in the consultation regarding 'Digitalisation and its role in unlocking smart regulation'

1. What regulatory mechanisms and tools (eg licence conditions) could support the network companies in moving towards increased digitalisation beyond RIIO-2?

Regulation has a key role to play in the digitalisation of the sector. ESC's paper, Digitalising Licensing in Energy⁵ sets out how licence conditions themselves should be managed. Improvements to the licensing regime can be achieved through adopting a digitalised, risk-based licensing regime where licensees provide regular updates to Ofgem across numerous categories, such as number of customers or volume of energy managed as well as providing data on their compliance with licenses. While the focus of the paper set out the case for heat networks, it is

⁴ Subject to a cost efficiency / consumer interest test.

⁵ <https://es.catapult.org.uk/report/digitalising-licensing-in-energy/>

similarly applicable to energy networks. Particularly where licensing plays such a prominent role in the ways in which costs are managed through the RIIO process.

The approach to network costs, specifically around building digital capability, is another area where regulation can be supportive of the digital transformation. The network price controls are predominantly constructed to serve physical infrastructure costs and BAU activities, with some incentives around innovation. Generally, with the exception of innovation, funding is provisioned based on providing justification papers and up front cost profiles of work undertaken. Digital work, particularly for networks building capabilities do not match the cadence or development pathways of more traditional work. We believe that Ofgem should consider how digital tools and infrastructure are procured and evidenced, to provide greater clarity for network providers when they are planning the build out or upgrade of digital services.

Similarly, some digital infrastructure and enabling technology should be able to be shared or procured by combinations of networks to reduce overall system costs and increase digital interoperability of services. There is no clear mechanism to do this that has led to the development of shared infrastructure as the sector has digitalised in the last few years – beyond government competitions for things like Open Energy, Automatic Asset Registration or the Digital Spine – none of which, to date, have clarity on a pathway to BAU or their 'place' in a regulated ecosystem.

Regulations can also play a role in the development of standards. Data Best Practice guidance is a very good example of work being done, and ESC's consultation response reflects further thinking on this example. Ultimately, the sector needs a coordinating body managing, setting and coordinating standard use and development by critical parties in the energy sector. The Energy networks association Digital and Data steering group is facilitating some of this, Data Best Practice another piece. Our understanding is that a central *industry* body, with sufficient oversight should have the remit to set and direct the use of standards in the sector. The digital spine's implementation and governance may provide a solution as it seeks to solve some of the interoperability challenges inherent in the sector.

2. What can a digital twin do to close the loop between planning and monitoring – what is needed, and what is feasible by when?

It is first quite useful to set out a definition of a digital twin. ESC's work on digital twins have been exploring the use cases in the policy space. Our digital twin demonstrator project⁶ produced two demonstrators to begin to paint a picture of how digital twins could be used to support decision-making within the energy sector. An analytical version for technical users, and the visual element of twinning for non-technical decision-makers, to give the assurance needed that the modelling makes sense. To facilitate this work, we set out a definition of digital twins as follows.

- **Digital Model** – A digital representation of a physical system or object, e.g. a network infrastructure map that uses data from a fixed point in time.
- **Digital Shadow** - A digital model that integrates automated one-way data flow from the physical system or object, e.g. A network infrastructure map that pulls data from the system to dynamically update inventory, asset state and constraints.
- **Digital Twin** - A digital model that integrates two-way data flow between the model and physical object or system. Where making a change to one can change the other for

⁶ <https://es.catapult.org.uk/report/beis-energy-system-digital-twin-demonstrator/>

example a control centre network map, which displays real time system status and enables engineers to control assets to mitigate issues.

Similarly, our paper on “the case for policy use⁷” went into more detail on specific use cases that could be enabled by the deployment of a digital twin using these definitions.

It is our impression that while a Digital twin may be a long term ambition of the sector, a Digital Shadow is likely a more achievable tool for the sector in the nearer term (2-5 years). We are of the opinion that the next price control period should be designed in such a way to utilise a digital shadow as described in the policy use paper in section 4.2 “Benchmarking network price control plans”.

To facilitate this, a few things are needed:

- An overhaul of the way ‘licensing’ is done (See answer to question 1 in this section)
- An update to the data collection methodology for the price controls
- Increased digital skills of policymakers and regulators
- A GB-wide CIM implementation for electricity and gas, and an equivalent for hydrogen network(s).
- A scalable and interoperable solution for sharing data (such as the digital spine)

Many of these elements are in play, but to facilitate a pathway to its use would require a concerted effort by a senior responsible officer within Ofgem. Beyond the alignment of data, standards and processes to use digital twins, their use will also create unknown outcomes or opportunities to efficiently re-allocate resources between gas and electricity networks, and the regulatory structure for price controls should be flexible enough to take advantage of those opportunities where identified.

3. How could a digital twin be utilised to assess the optimal national, and regional, balance between flex and network investment requirements?

Assuming a digital *shadow* is developed in support of the network price controls (primary use case) then secondary use case(s) can be prioritised to develop specific assessments of the optimal balancing between flexibility and network investments. We expect the data that would be required to facilitate this type of analysis would be:

- Cost of infrastructure (*data from networks*)
- Cost of flexibility (*capital costs to install flexibility*)
- Model of the electricity and gas networks (*as well as possibly hydrogen*)
 - Including a model of future states based on proposed building of transmission/generation etc.
- Real operational data of flexible assets (*derived from AAR project possibly*)
- Constraints on the network
- Expected uptake of domestic flexibility (*projection data*)
- Built environment planning data (*new housing estates etc*)

With these datasets, scenarios of consumer uptake can be incorporated into the regulator’s decision making for network cost recovery. Similarly, key infrastructure projects (upgrading transmission lines, etc.) can receive much greater scrutiny/evidence on the needs – enabling

⁷ <https://es.catapult.org.uk/report/digital-twins-the-case-for-policy-use/>

anticipatory investment to occur where, for example, EV utilisation on specific locations of the grid is happening faster than expected.

4. When could we feasibly get a digital system that can monitor real time network conditions and automate future needs at all levels, timescales, and vectors? How can it be delivered and what are its limitations?

As described in the previous answers, a digital shadow may be a more appropriate step in development and use by policymakers. ESC would not expect, for example, for policymakers to have access to a digital twin that can provide feedback to the real world system in real time. These functions very much sit in the scope of the system operator(s) in the energy sector. To automate and monitor the real time network conditions, a key delivery mechanism for the required detail will be resolving access to smart meter data for these purposes for key market participants (namely the energy networks who currently aggregate smart meter data and use it sparingly).

Any development of an operationally capable digital shadow (twin) should have a few characteristics:

- Be vendor/technology agnostic.
 - Avoiding vendor lock in for critical infrastructure is very important to minimise risk/future costs
- Have a common framework for sharing network models and data
 - Some of this work is being undertaken by the VirtualES project by the ESO and another similar overlap may emerge through the digital spine project.
 - Permissions management for access to data and models will be a key issue
 - Governance of standards will equally be of vital importance. Some data assets will underpin critical functions in the energy system, and the reliability
- Gap identification and change management
 - Where data does not exist that could feed the digital shadow (twin), consideration should be given to how that can be procured or developed (for example by bringing new types of requirements for sensors on parts of the network)
 - The twin that is developed will also need to be operationally managed as a critical asset, particularly if policymakers are using it as a tool to assess policy interventions. A framework for how to create scenarios or models and test those will need to be drawn up. Something that could be described as “Digital twin policy development best practice” may be required in the longer term.

Ultimately, the limits of these systems and processes lay with the quality and reliability of the data that underpins them. The industry currently works on well establish data transfer mechanisms with a good level of reliability of that data. Any change will have to be managed to ensure that data can be processed at a greater velocity while retaining (or improving) its quality and reliability. The increase of interdependencies within the data models will have to be carefully managed, as the complexity of the network increases, so will the models within a digital shadow or twin.

5. Could a digital twin model be combined with the Archetype 3 regulatory approach to provide a more flexible approach to network regulation, and if so for which activities and by when?

A digital twin, along with the associated licensing approach as described in the ‘digitalisation of licensing in energy’ paper could play a part in supporting an approach such as that described by Archetype 3. We are not of the opinion that Archetype 3 could be delivered with a digital twin in of

itself, and would require the ways in which license conditions are written and monitored to be fundamentally changed as described by both the archetype and the paper referenced above. Our estimation is that a wide variety of activities could be enabled by this approach, generally set around the use cases explored in the 'case for policy use' paper referenced in answer 3 of this section.

A drawback of this approach may be where the 'benefits' to the GB energy system, as measured by the approach undertaken in Archetype 3, may land in a different patch of the system to the network that needs to build the assets/reinforce etc. Careful consideration should be given to how the benefits are measured and applied, particularly where financial rewards or penalties are considered.

These drawbacks are resolvable, but worth planning for and creating robust frameworks to account for system wide benefits that the network may provide (which does not materially impact their own responsibility for a particular part of the network). The approach of drawing a digital twin approach and the digitalisation of licensing and associated monitoring could be achieved in line with the next price control change or equivalent.