Encouraging Innovation in Regulated Utilities

A cross-engineering sector response to HM Treasury’s consultation on Encouraging innovation in regulated utilities on behalf of the following organisations:

The Institution of Engineering and Technology
Royal Academy of Engineering
Institute of Water
CIBSE
Institute of Chemical Engineers

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Summary

- The utilities sectors will be impacted by major societal challenges over the coming decades. As the boundaries between what are considered the traditional sectors become more blurred, innovation and technological breakthroughs will increasingly straddle multiple sectors, not just within a single regulator (e.g. WiFi and 5G), but across the regulated utilities (e.g. smart energy management, smart metering and electric and autonomous transport).

- Regulators generally embrace an approach of "evidence based" regulation. It has the merit of providing stability. But evidence can only come from the past and innovation, particularly in technology, informs and makes the future. As digital technologies, such as AI and machine learning, become more widespread, it will be important that regulators have sufficient understanding of these technologies, and the use and reliability of the data that underpins them. Regulators must ensure that they are used to deliver value to customers and do not, for example, put customers’ personal data, or the stability of the system at risk.

- Increasing interdependence between sectors will require a shift. The responses from the engineering community at the IET have demonstrated 5 key themes which directly need to be addressed to encourage innovation, which will be highlighted throughout the responses to the consultation questions below.

1) **A longer-term, strategic approach:** The utilities sectors need a long-term vision of future design, operation and, crucially, customer engagement that can be used to guide frameworks for investment that will ensure co-ordinated and efficient evolution. It is essential that this includes a link to long term strategic policy aims, such as those set out in the Industrial Strategy, that are not just inward facing, but placed within a wider international context.

2) **Cross-sectoral/multi-vector and whole systems thinking:** It must be acknowledged that communications, energy and water jointly represent a system of systems, with increasing inter-dependencies and reliance on each other. Some of the greatest potential benefits from innovation are likely to cross boundaries between regulators and between regulated and unregulated activity. Taking a whole systems approach should stimulate cross-industry ideas for new and better services before considering whether regulatory changes would facilitate the best ideas.

3) **Clarity and stability:** Creating a regulatory and policy environment that gives industry clarity and stability is key to providing an environment that facilitates innovation and private investment in research and development.

4) **Accountability and transparency:** Greater openness and transparency breeds trust among all parties enabling innovators and investors to have greater visibility and trust, and allowing policy adjustments to be made without creating shocks that damage confidence.

5) **Greater opportunities for the skills and insights of professional engineers in policy formulation:** A greater contribution of engineering insight, alongside other professional disciplines such as the social sciences with greater customer interaction expected, could accelerate solutions and de-risk new policy implementation. In an increasingly complex sector, the sufficiency of engineering skills is a pertinent consideration at both policy and operational levels of regulatory bodies.
We feel strongly that the role of Transport is severely lacking in consideration in this consultation. As already discussed, the increasing interdependence between sectors is evident and if, as we are advocating, a longer-term, more strategic approach to innovation is needed, the transport sector must be integrated into this thinking now.

This response focuses on the market regulators Ofgem, Ofwat and Ofcom. It should be noted that, in the deployment of national infrastructure and its related technology, safety, security and environmental regulators such as HSE, ONR and the Environment Agency also play a significant role.

Understanding the barriers and opportunities for greater innovation

1. **What barriers, if any, are there to the development and implementation of innovative technologies and methods in the utilities sectors?**

1.1. All utilities will need to continue to provide a secure, reliable services while contributing to meeting the UK’s climate change commitments; this will impact particularly heavily on the energy sector while concurrently the communications sector will play an increasingly important role with moves towards a more data-driven and interconnected economy and society. To meet these key societal challenges these sectors will need to look significantly different in 10-20 years’ time from how they do now. It is also evident that these sectors will become increasingly interdependent, for example through the development of connected electric vehicles, and smart energy management.

1.2. The focus on 5-8 year regulatory review periods does not correlate with longer-term policy targets, such as the Clean Growth Strategy, which have longer-term strategic targets. It is relatively easy to address replacement of short life assets such as vehicles and IT (hardware and software). It is far more difficult to deal with long term assets which may have book lives ranging from 20 - 100 years or more and where premature retirement would be financially damaging to the utility. The absence of suitable strategic planning mechanisms linked to wider government policy is a current barrier. For example, it would be beneficial for regulators’ innovation policies to be joined up with the priorities mentioned in the Industrial Strategy, most notably the 2.4% research and development growth challenge Efficiency savings arising from research and innovation have to be passed back to customers (i.e. via price reductions) which has meant that all such research has had to deliver positive cost benefits within 5 years. Thus innovations which have a longer payback period have been rejected by utilities.

1.3. Internationally, the perception is that regulators are able to join up policy, regulation and innovation more coherently. It is important to consider that the environment, within which the regulators work, especially within communications, is becoming more international, so needs to be considered in the context of wider regulatory frameworks, not just a focus on UK or even regional basis. Whatever the outcome of the Brexit negotiations, foreign investment in the UK will continue, particularly on infrastructure projects, so it is essential that regulators learn from others. Independent regulation with rigid boundaries will constrain system of systems innovation. This raises the question of whether the regulators and their relevant government departments should be working more closely together on innovation and investment matters.
1.4. **A lack of holistic thinking** within and across regulators is a potentially serious barrier to more agile responses and the scaled roll-out of successful innovations. It must be acknowledged that communications, energy and water jointly represent a system of systems, with increasing interdependencies and reliance on each other. The changing nature of the sectors needs to be addressed comprehensively as part of policy development. It is now becoming urgent to recognise that new functionalities (such as smart systems and data-enabled services) may no longer reside within the tightly defined licence segments established at privatisation\(^1\). **There are barriers to whole system integrated solutions that now need to be resolved.** To stress, this is not by any means a call for a single regulator, but rather a call for greater strategic collaboration between the different regulatory bodies, and to provide. They should be given the vires and incentives for the sector regulators, for example, to collaborate, especially on strategic investment plans that could affect both Ofgem and Ofcom.

1.5. There is a need for an **adaptive regulatory environment** that both responds to and allows for the rapidly-shifting requirements of the sector and its customers’ needs to be balanced by providing as certain an environment as possible for innovators and investors. Technological R&D and innovation is inherently risky and longer-term. Many technologies can take 10-15 years to travel from an idea to implementation in the market. Therefore, providing as much **clarity and certainty as possible in the regulatory environment is key to providing an environment that facilitates private investment in R&D**, which may not see a return on investment for several years. To encourage innovation, it is important for there to be a safe environment where developer and regulator can work together to assess the benefits of new technology prior to its deployment at scale. Regulatory sandboxes are an example of such an approach.

1.6. Open and transparent processes can help to promote innovation, particularly in the reporting and monitoring of progress to provide greater certainty for investors, particularly if there is a move to longer review periods. It has also been noted that there needs to be **greater transparency** in the mechanisms of how regulators work with innovation bodies such as UKRI and Innovate UK.

2. **What are the best way(s) for utility regulators to further promote innovation in their sectors, while ensuring the interests of consumers (present and future) are protected?**

2.1. To address the challenge of having an adaptive regulatory/policy environment while also providing sufficient certainty for utility equipment suppliers and their investors when undertaking R&D, we suggest exploring the **use of ‘rolling windows’ as part of longer-term plans**. These might be 5 or 10 year periods, the most distant ones have only outline policy guidance and are recognised to be more subject to change; while the closer periods are, wherever possible, assigned greater certainty. As time rolls forward the windows can be revised, the longer-term ones adjusted, and the closer ones 'locked down'. This would provide a measure of transparency for all parties, enable investors to have greater visibility, and for policy adjustments to be made without creating shocks that damage confidence.

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\(^1\) In electricity, emerging new functionality and its whole system characteristics have been assessed and reported by the IET/Energy Systems Catapult under the Future Power Systems Architecture Project (FPSA). [https://www.theiet.org/fpsa](https://www.theiet.org/fpsa)
2.2. With further regards to openness and transparency, a suggestion would be that annual reporting (such as Ofgem’s CMR 2018 or ICMR 2017) contains explicit sections on innovation and change seen over the last year. We feel that through publishing this information it would encourage innovation to be monitored, as well as being a useful tool for regulators should they have a statutory duty to promote innovation.

2.3. A comprehensive UK wide, cross-sectoral approach, rather than geographical splits, can enable regulators to show thought leadership towards innovation, investment and additional strategically important issues such as resilience. The National Infrastructure Commission\textsuperscript{2} is currently undertaking a study on how resilience can be assessed and improved, including through better design and application of new technologies, and it is essential that the issue of resilience be encouraged throughout the innovation process. Innovation in the regulated utilities has a significant potential to be a vehicle for promoting greater resilience or conversely, reduce resilience if it is poorly considered.

3. What barriers, if any, are there to innovative sector specific and cross sector business models?

3.1. As referred to in comment 1.4., a lack of holistic thinking is a potentially serious barrier to more agile responses and the scaled roll-out of successful innovations. The regulatory frameworks for these future utility systems may need to look significantly different to current models of regulation. However, innovation in technology and in business models will be absolutely fundamental to reaching these future visions, and this needs to be assimilated in the thinking for future regulatory frameworks. The findings from this consultation and from the NIC review\textsuperscript{3} should be considered holistically, to ensure that regulators are informed of a long-term view of the sector, its new technologies and business models. Without this it is unlikely that regulation will support industry to deliver the services that meet the needs of customers and society in the longer-term.

3.2. There are positive steps being taken by some regulators to considering the future, long-term needs of the system. Ofgem’s regulatory sandbox is facilitating the trial of new business models in the energy sector, and consideration will need to be given as to how this can evolve to support new business models in practice, as highlighted in Ofgem’s insight document\textsuperscript{4}. The new Ofgem-Energy Systems Catapult Future Services Lab project\textsuperscript{5}, funded by the Regulators’ Pioneer Fund, should be valuable here. There are however limitations to effective outcomes that need to be addressed. One current limitation, highlighted in Ofgem’s insights from regulatory sandbox document, is that trial projects primarily still have to operate within existing regulatory boundaries.

\textsuperscript{2} https://www.nic.org.uk/news/new-regulation-study-to-help-find-the-right-conditions-for-future-infrastructure-innovation/
\textsuperscript{3} https://www.nic.org.uk/news/new-regulation-study-to-help-find-the-right-conditions-for-future-infrastructure-innovation/
3.3. In the coming years there will be a need for regulators to work more closely together on how to facilitate innovation in the utilities sectors. One of the aims of the Regulators’ Pioneer Fund was to ‘be collaborative and bring together multiple bodies to address ‘cross-cutting’ issues that affect several regulators’ but few of the awarded projects involve more than one regulator. The new Regulators’ Innovation Network should explore the potential for cross sector-working.

3.4. In addition to the level of innovation activity, regulators already play a significant but indirect role in determining the focus of innovation within their sectors. For example, if a utility sector is strongly incentivised on the reliability of the service they provide this will steer innovation efforts towards this goal; whereas if the utility is incentivised strongly on environmental impact, companies will focus innovation investment in these areas. An associated consideration is that of the problem of ‘externalities’ where potential innovation by utility companies could deliver real societal benefits, but these benefits are either beyond their remit (so excluded by regulatory rules), or provide no direct returns to the utility company (so cannot form a business case for action). Examples of externalities for power network companies might be improving customer energy efficiency, reducing carbon content, or making data available to third parties for smart service applications.

3.5. Regulators should review the extent of their indirect influencing role, and ensure regulation shapes investment in technology and business service choices in a way that meets the future requirements of the sector and customer needs. It would be helpful to review regulatory requirements that may be excluding innovative developments that would be promising from a societal perspective, simply because they fall outside traditional boundaries of jurisdiction. More flexible thinking could help address the problem of externalities in a light touch way.

Policy and implementation

4. How have utility regulators most successfully encouraged innovation in their sectors?

4.1. Innovation has generally resided within the traditional Incentive Regulation envelope. While successful innovation to meet new regulatory outputs (output innovation) is rewarded by passing the cost of the innovation into the regulatory asset base, where it earns a return for the duration of its useful life, innovation aimed at reducing cost (efficiency innovation) receives a different treatment. Utility companies can keep the benefit of efficiency gains for 5 years and then the gains are transferred into the theoretical cost base, reducing the charges levied on customers. Regulators have not found it necessary to be specific about where efficiencies should be sought, preferring to leave that decision to individual Utility Companies. This limits the financial viability of such schemes, and may deny customers lower charges based on potential schemes with a longer pay-back period.

4.2. Ofgem - We note the following factors as having contributed to Ofgem’s programme in promoting innovation activities in the electricity and gas sectors. Ofgem:

https://apply-for-innovation-funding.service.gov.uk/competition/199/overview
recognises that innovation requires special treatment and that basic 'RPI-X' regulatory mechanisms (which work well in other areas of business activity) are in themselves insufficient to encourage and reward innovation owing to the particular circumstances of regulated companies.

- has considered innovation in a comprehensive way and integrated it as part of their RIIO model; for example, in addition to innovation incentives, energy network companies have the option to submit innovation strategies, to consult with their stakeholders, and form partnerships with external parties for delivering larger (NIC) projects.

- does not direct innovation topics or methods under either incentive mechanism but has either guidelines or filtering/evaluation processes to ensure that projects are well conceived and relevant to meeting the objectives of the network companies.

4.3. We believe that Ofgem's work has valuable learning points to offer and should be shared to prevent duplication of efforts across the sectors. Ofgem's incentive arrangements are not perfect and improvements should be encouraged. We would particularly highlight the need for *whole system* engagement in order to deliver the optimised utility services of the future. While Ofgem have taken commendable steps to incentivise innovation within the regulated monopoly infrastructure companies, their approach to change the regulatory framework as it applies to users of that infrastructure does little to encourage new investment or innovation.

4.4. **Ofcom** - particularly in its role as the UK's regulatory manager of radio spectrum, Ofcom has stronger international links and dependencies than the other utility regulators. Innovation in the communications space is often critically dependant on timely access to spectrum of the appropriate nature and quality. This in turn is often dependant on **Ofcom's international leadership** on spectrum allocation, sharing and standards, alongside that from industry. They should be incentivised by Government/DCMS to ensure that its international contributions are fully resourced, both in terms of number and quality of engagements, plus its strategic awareness of potential innovation demands. They should also encourage innovation by new and existing players by appropriate allocation of resources, for example as advocated by the IET 5GFF group.

4.5. **Ofwat** - Recent years have seen Ofwat adopt a more proactive approach to innovation promotion, for example through their SPARKS initiative. Incentives to invest in longer-term investment programmes beyond a single Asset Management Plan (AMP) cycle have arguably expanded the innovation landscape to allow the sector to genuinely engage with issues of resilience and long-term affordability. As the regulatory regime has been flexed to accommodate unanticipated weaknesses in regulatory ambitions, so increasing opportunities have arisen for innovation. The dynamic between regulation, business risk, and innovation within the regulated utilities is distinctive as compared to that in non-regulated sectors.

5. What additional tools and expertise, if any, do utility regulators need to respond to technological change and promote innovation in their industries?

5.1. As referred to in question 1, the innovation policies of the sectors covered by regulators need to be clearer and much more joined up with the challenges that exist within the sectors today. For example, cost reduction, improved security and resilience and the requirement for data exchanges for better innovation and transformation should be priorities for utilities regulators.
While ideas of Anticipatory Regulation have found some fertile ground amongst the UK regulatory community there remain a number of areas where progress is either weak or untried. Improved competencies and tool sets around virtual competition, horizon scanning and foresight, wider use of testbeds and sandboxes, and more joined up regulation might all pay dividends in this context.

5.2. Digital technologies (AI and machine learning) will become increasingly important across all sectors including regulated utilities. It will be important that regulators have sufficient understanding of these technologies, and the use of data that underpins them, to ensure that they are used to deliver value to customers and do not put customers’ personal data, or stability of the system at risk. One aspect of the expertise required will be an understanding of cybersafety. We would highlight the Royal Academy of Engineering’s Cyber safety and resilience report published earlier this year that recommended government should focus resources on strengthening cybersafety expertise in regulators, using part of the budget for the UK’s cybersecurity programme. This should consider how regulators can ensure standards and regulations address cyber safety and resilience as part of their duties.

5.3. Using the energy sector as an example, as the underlying technical character of the electricity networks is changing, notably requiring new functionalities that span traditional industry supply chain segments, and involve developments on the customer side of the meter including new parties and services at the grid edge and in local communities. This has been examined and reported in detail by the Future Power System Architecture project (FPSA), led by The IET and the Energy Systems Catapult, which has highlighted the significant challenge it creates for change control mechanisms. This is key because the slow working of these industry governance arrangements acts as a serious brake on scaling up and wide area roll-out of successful innovation (in contrast to initial proof of concept projects which are less hampered). FPSA has explored the mechanisms used in other complex sectors to achieve agility and responsiveness; these findings have been published and described as ‘Enabling Frameworks’. There may be helpful learning points here for sectors beyond electricity.

5.4. We advise that innovation projects alone will not deliver the outcomes that government seeks; innovation must be accompanied by the capability for scaling up and mass deployment. However, mechanisms for implementing change are currently deficient, having been put together at privatisation for a quite different power system context. We are pleased to see that BEIS and Ofgem have recently established a full review of Codes and Governance and we would encourage those interested in promoting innovation to engage with this work and ensure that much more agile and responsive mechanisms are developed and introduced. This is a non-trivial task and will require imaginative thinking and determination to overcome deeply ingrained sector inertia.

Regulators’ statutory duties

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8 [https://es.catapult.org.uk/publications/fast-track-to-britains-future-power-system/](https://es.catapult.org.uk/publications/fast-track-to-britains-future-power-system/)
6. **To what extent would a statutory duty to promote innovation help regulators focus further on encouraging greater development and adoption of innovation in their sectors?**

6.1. To an extent, regulators already promote innovation as this is a key way that regulated companies can reduce costs and better serve their customers, especially in sectors undergoing transformative change. Significant benefits (in terms of successful and cost-effective innovation) could be accelerated though, if **innovation incentives are developed as a specific aspect of the regulatory framework**. It may be noted that Ofgem did not simply ‘bolt on’ these incentives to the traditional RPI-X model, but re-thought the whole process to create the RIIO model in which innovation is an integrated part.

6.2. However, the emphasis of all regulators is often on competition policy, market share and pricing. Innovation duties need to be elevated within each regulator as there are real trade-offs with these other duties which affect UK competitiveness, attraction of inward investment and productivity and international thought leadership. An example of this is Ofcom’s work on Spectrum policy and standards. Measures taken and proposed should be benchmarked against initiatives by regulators around the world and appropriate lessons learned.

6.3. It would be valuable if a change to statutory duties in regard to innovation accompanied steps to improve policy stability. Innovation activities, especially in smaller companies, can be deterred significantly by policy uncertainty. In the energy sector, recent examples of this have been the Retail Market Review and the Price Cap. Self-evidently it is problematic to bring forward evidence for initiatives that ‘didn't happen’ but our feedback from commercial organisations supports this observation. To mitigate the tension that arises between the need for policy development and the potential for deterring innovation, we believe there are opportunities for improved outcomes by adopting the more strategic, longer-term planning and rolling windows.

7. **What other measures might support an innovation duty in helping regulators to focus on encouraging innovation in their sectors?**

7.1. In particular we would advise that:

- Innovation **incentives are far more likely to be successful than mandated requirements**
- **A situation where the regulator sets the innovation agenda should be avoided**

Both of these options are likely to produce poor outcomes and have unintended consequences. Innovation is a serious challenge often involving shifting long established inertia and company cultures in an established organisation or from a new entrant trying to disrupt the status quo. There must be recognition that there are different kinds of companies, with differing agendas, trying to innovate within regulated industries. There has to be local ownership of innovation agendas and where this is not the case, there are many examples where innovation projects either fail to deliver, or are apparently successful but are soon decommissioned and forgotten.

7.2. The “Incentive Regulation” model should provide incentives to outperform the regulatory settlement, and to define other measures it is necessary to try to determine why the current model is failing. We suggest that this is because “Financial Engineering” is providing far greater returns at very low risk and technical innovation can never match such returns in either financial value or timescale. Unless issues of Financial Engineering are addressed it is likely that
Innovation, whether incentivised or not will remain a poor relation within utility companies. Innovation incentives are likely to be more successful than mandated requirements, but, it will be difficult to provide suitable incentives to take on risk until the current problems with Financial Engineering are resolved.

7.3. We advise **consideration of the adequacy of engineering/technology professional skills in regulatory bodies**. We note that regulators employ many engineers, but very few operate at policy-setting level. Engineers are commonly recruited because they are skilled analysts, but this is an activity within regulatory organisations, not at the top. Experienced professionals bring not only technical skills, but importantly insights and judgments that can be key at times of transformational change and increasing complexity in the utilities sector. As an example, Ofgem used to have a Technical Director who reported to the Chief Executive, and it was during this period that Ofgem identified the short-falling in innovation activities by the regulated companies and established its landmark innovation incentive programmes.

7.4. Caution should be exercised in drawing parallels between regulated and unregulated sectors in regard to innovation. A key difference is that unregulated companies will develop a portfolio of innovation projects: some will fail, some will be marginally successful, and some will be outstanding and deliver exceptional returns. Regulators should be encouraged to **develop and refine regulatory arrangements that support innovation in the specialised business context in which regulated companies operate**. The balancing factor here is that regulators should be encouraged to **resist pursuing optimality if this creates disproportionate complexity and bureaucracy**. Anecdotal evidence suggests that Ofgem’s helpful incentive arrangements would have even greater take-up if the mechanisms were not so burdensome.