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Dear Sir / Madam,

### **RIIO-3 Sector Specific Methodology Consultation – Innovation**

As I have written before, research, development, demonstration and deployment to inform innovation in technologies and practices and address risks associated with the energy system's transition to much lower emissions and resilience against climate change are essential activities that, without specific incentives and funds, the existing approach to regulation of privately owned network companies would likely fail to encourage<sup>1</sup>. I therefore welcome Ofgem's continued interest in the encouragement of innovation in the energy networks sector and the opportunity to respond to some questions related to innovation.

#### **OVQ47. Do you have any views on our proposal to retain a flexible allowance, providing evidence for why you think that it should, or should not be, retained?**

Yes, I believe a flexible allowance, similar to the Network Innovation Allowance, should be retained.

I have welcomed the relative flexibility afforded by the NIA and LCNF Tier 1. I believe it has enabled good work. In many projects in my which my colleagues and I have been involved, we have had very positive collaboration leading to useful outcomes, e.g. in development of new analytical methods and learning on grid-forming converters and on optimisation methods that have found use in the Open Balancing Platform launched by the ESO in December 2023. Certainly, we have appreciated the access to 'real world' data, case studies and expertise that collaboration with network licensees has enabled and the opportunity to make our work more impactful.

It has sometimes been difficult to get companies to understand that NIA-funded work – small projects typically addressing medium Technology Readiness Levels (TRLs) (in RIIO-2 of between 2 and 8<sup>2</sup>) – will not provide complete answers fully developed for adoption. Projects that provide positive evidence in favour of the adoption

<sup>1</sup> See, for example, <https://ukerc.ac.uk/news/keith-bell-riio-2-consultation/> and <https://ukerc.ac.uk/publications/ofgem-riio-ed2-consultation-response/>

<sup>2</sup> <https://www.ofgem.gov.uk/publications/riio-2-nia-governance-document-0>

of the ideas that were under development or show that the system is facing significant risks need to be followed up with further work.

Although there are excellent examples to the contrary, a common and longstanding difficulty is that of getting good engagement from individuals 'from the business' who understand the context of the research or development activity, the associated risks and opportunities, and the ways in which it might lead to a change in 'business as usual' practice. Too often, engagement on a project is left to members of an innovation team who are disconnected from the delivery of core services. (It often appears that individuals 'in the business' are given too little time in their 'day jobs' to engage with innovation or research).

As I have argued before, NIA needs to be governed well in order to maximise public benefit<sup>3</sup>. In particular, this needs learning to be published in an accessible and comprehensive way, using best practice from science where the truth of a proposition must be tested via the generation of evidence. As some colleagues and I have proposed before, if innovation projects that, at the outset, promise benefits to energy users, are to be judged, they should be judged in terms of the quality of the evidence generated and access to that evidence<sup>4</sup>.

Reporting of findings from NIA funded projects is still poor with too many projects listed in the ENA's 'Smarter Networks Portal' lacking anything beyond a project initiation report and project closedown report, both of which typically provide only sparse information. There is too little acknowledgement of collaborators' contributions and, in spite of good recent progress by some network licensees, access to data is often difficult. Is this poor performance because company innovation departments don't understand the need and fail to ensure good levels of reporting by themselves, their colleagues and their collaborators, or they don't recognise what good reporting looks like, or they dedicate too little resource to it? An answer to this question is needed in order to provide the correct guidance or training for the network licensees.

In my experience there is still a need for network licensees to properly acknowledge collaborators' interests in the ownership and exploitation of IP generated by an NIA project. (Too many sets of contractual terms seem to be written by company lawyers with little knowledge of how R&D works or the NIA governance arrangements).

**OVQ48. Do you have any views on our proposal to retain a competitive network innovation funding pot, that continues to focus on key challenges facing the energy sector, with phases to de-risk the pot?**

The level of funding made available through the Strategic Innovation Fund (SIF) has been welcome.

A strategic approach might be evident in the set of challenges that have been defined, but it is absent from the delivery mechanism where there is a focus on "lean delivery, sprinters not super tankers" and "failing fast"<sup>5</sup>. As a whole, it is therefore not especially "strategic".

Although the very simple first stage of proposals is intended to enable opportunity for all parties that might have good ideas or useful insights including those that are poorly resourced, it is very difficult for small organisations to resource 2 month 'discovery' projects at short notice. Even with up to £500,000 of funding available for 'alpha' projects, it is very difficult for small organisations to work fast enough to spend the money and do the volume of work it implies in just 6 months in competition with better resourced organisations. Extra funding for the Network Innovation Allowance might be a better, more flexible use of at least some of the money dedicated towards SIF discovery and alpha phases.

What exactly is being sought such that "fast failure" is welcomed? Much has been written about innovation timelines and how to take ideas through the 'valley of death' to commercial viability. Those who seek magic bullets to solve the climate crisis should be aware that technological innovations typically take decades to come

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<sup>3</sup> <https://ukerc.ac.uk/publications/ofgem-riio-ed2-consultation-response/>

<sup>4</sup> D. Frame, K. Bell and S. McArthur, *A Review and Synthesis of the Outcomes from Low Carbon Networks Fund Projects*, UKERC, August 2016, <https://ukerc.ac.uk/publications/a-review-and-synthesis-of-the-outcomes-from-low-carbon-networks-fund-projects/>

<sup>5</sup> <https://www.ukri.org/blog/whats-so-innovative-about-the-strategic-innovation-fund/>

to fruition<sup>6</sup>. Fast failure is presumably an attempt to eliminate weaker ideas before too much effort has been expended on them, but the story of most innovations is one of trial, error and learning. Moreover, tests of potential viability need to be well designed and should not be done in too much of a hurry. “Fast failure” also seems to assume that proposed innovations concern only technologies that can be tested quickly, rather innovation in, for example, business models, regulatory arrangements or consumer engagement that will take time to assess. (No-one should under-estimate how slowly social science investigations proceed).

Although action to enable the energy transition is urgent, this haste seems to work against thoughtful consideration of system risks and opportunities and interactions of initiatives or needs across the system.

There are system issues to be addressed in the energy transition: questions of decision making between options, about keeping options alive and the timing of investment, around societal preferences and impacts, and how to ensure stable operation of complex interactions. All parties affected by the energy system depend on gaining knowledge about the risks and opportunities associated with the system itself. That knowledge is not commodifiable or easily traded in commercial products, but is essential. It will be needed to inform business models, regulatory frameworks and political decisions. The processes to gain the knowledge must be well-defined and use of it well-considered if access to energy is to be reliable and affordable and public support for the transition is to be maintained.

Too much of UK Research and Innovation’s (UKRI’s) programme of funding seems to assume that innovations are commodifiable and that the fruits of R,D&D will only be new commercial products. There is insufficient attention to system issues that might require regulatory action or drive the definitions of services and not be directly commercialisable.

**OVQ49. Do you have any views on how the structure of the price control innovation funding could be adapted to better focus on whole systems problems, and ensure strategic alignment with other public sector initiatives?**

This is a good question.

I feel that a big improvement could be gained through calls for proposals being written in such a way as to emphasise system issues and potential solutions including new analytical methods, business processes, markets and regulatory arrangements including codes and standards. However, at this stage, beyond that, I’m afraid I do not yet have any good ideas on how to structure an innovation programme in order to better address system issues.

**OVQ51. Do you agree there is a need to expand the scope of innovation funding to be more inclusive of third parties?**

Third parties can bring important fresh thinking on challenges and opportunities associated with planning, operation and maintenance of energy networks and the energy system. However, it is important that they have a good understanding of the nature of energy networks, how they are planned and operated today and constraints on their operation, especially around safety and risks to the services that energy networks provide. The constraints include those written into codes and standards although they should not be regarded as written in stone. Where evidence can be mustered to support a case for specific changes to those codes and standards to better facilitate the low carbon transition and serve the interests of network users, changes should be proposed. Innovation projects are important avenues through which such evidence can be obtained.

The best way for third parties to ensure that their ideas will be useful and practical in planning, operation or maintenance of energy networks is likely to be through partnership with a network owner or operator, provided that owner or operator offers engagement with personnel with relevant knowledge, and not just with a project

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<sup>6</sup> Robert Gross, Richard Hanna, Ajay Gambhir, Philip Heptonstall, Jamie Speirs, How long does innovation and commercialisation in the energy sectors take? Historical case studies of the timescale from invention to widespread commercialisation in energy supply and end use technology, *Energy Policy*, Volume 123, 2018, <https://doi.org/10.1016/j.enpol.2018.08.061>

manager, important as their role is. However, there may also be a role for an information hub or incubator to provide access to networks knowledge, use cases and data<sup>7</sup>.

**OVQ55. Do you agree with our proposal to run Future Regulation Sandbox (FRS) trials with an explicit focus on informing changes to the rules governing energy network activities – incentivised through SIF or other price control mechanisms?**

Changes to rules such as the Grid Code and the Engineering Recommendations need to be based on sound evidence. Too often such evidence has been weak (with a failure to commission suitable research to develop it<sup>8</sup>) or has taken too long to develop. On the face of it, the idea of FRS sandbox trials promises to help provided time and effort can be expended on credible proposals.

**OVQ56. What topics could FRS trials usefully focus on and why?**

Particular challenges are posed by growth in the use of ‘inverter based resources’, i.e. HVDC interconnectors and embedded links, wind turbines or solar PV panels connected to the network via power electronic converters. The control of these offers tremendous flexibility but also poses serious risks if inadequately coordinated.

Growing dependency on electricity as heat and transport are electrified and risks associated with climate change against a background of expansion of network capacity suggest a need to review the resilience of electricity supply and, potentially, revise the Security and Quality Standard, Engineering Recommendation P2 and equipment design and ratings standards.

The establishment of “distribution system operators” has been happening slowly with expansion of active management of networks and implementation of ‘flexibility’ markets taking time. The required direction of change is likely to need to be underpinned by well-designed regulatory change.

Packages of market reforms to encourage demand side management, the offering of flexibility services to the ESO and efficient utilisation of energy resources (including storage) and the network should be explored.

**OVQ57. Do you have any feedback on the view that not enough network innovation funded projects have been rolled out, and can you share any evidence you have to support your position?**

Care needs to be exercised when judging how many or how much is “enough”. Trying anything new – as ‘innovation’ implies – entails uncertainty and risk. Some ideas that seem like good ones can turn out to be less good when tested, even when developed further.

What matters is having a portfolio of innovation projects. As my colleagues and I showed in our review of Low Carbon Networks Fund projects in 2016, some will turn out to not deserve to be taken further; others still show promise but the cost-benefit case for further development is unclear<sup>9</sup>. Another set of projects might have proven both viable and potentially useful but the need for deployment has not yet arisen. That leaves potentially only a small subset of ideas that are both effective and cost-effective, and deserve to be adopted forthwith as ‘business as usual’. Given that these ideas can prove extremely valuable – two that come immediately to mind are ‘active network management’ (ANM) and the Open Balancing Platform (OBP) – not many ‘rolled out’ projects would be needed to more than pay for an entire portfolio of innovation projects.

It should also be kept in mind that the road from a nagging thought in the back of someone’s mind to an industry standard product, tool or approach can be long and winding. UKERC research has shown how long some major technologies have taken to come to fruition<sup>10</sup>. My first encounter with ANM was when it was the subject of a PhD student’s research at the time when I became an academic in 2005; only some years later did it become widely

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<sup>7</sup> This is something that I understood was one of the originally intended functions of the Energy Systems Catapult.

<sup>8</sup> In my view, one example was the change to the Security and Quality of Supply Standard in the last few years concerning management of system frequency.

<sup>9</sup> <https://ukerc.ac.uk/publications/a-review-and-synthesis-of-the-outcomes-from-low-carbon-networks-fund-projects/>

<sup>10</sup> <https://ukerc.ac.uk/project/innovation-timelines/>

deployed. The power system analysis engine from which the optimisation framework used in the OBP was developed and demonstrated was developed in an NIA project in 2019-20; the OBP was launched in December 2023.

What would be unacceptable, in my view, would be

- failure to generate good enough evidence in an innovation project to decide whether an idea should be taken forward or not, not through unforeseen barriers to development of the idea or barriers being more difficult to overcome than expected, but through failure to design a project well-suited to the generation of evidence or to disseminate the findings.
- failure to invest the time and effort into further development and 'production grade' implementation of an idea that, including the cost of that development and deployment, has a positive business case.

**OVQ58. What are your views on the design of potential new mechanisms to address this?**

There would ideally be a low cost, minimum bureaucracy way of encouraging the adoption of good practice in the implementation of research and development projects to test innovations and understand what risks there might be in the energy transition, and a culture of innovation across the networks sector. Periodic expert review would be neither zero cost nor zero bureaucracy but might be necessary.

What else might be done to encourage good practice and a culture of innovation? It seems to me that we need people – at least a certain minimum number of them – with training and experience in R&D to be established in positions of influence across the networks sector and in companies and universities with which they work.

I have met many excellent, practical, knowledgeable engineers in energy network businesses with a passion for serving the public. I have met fewer able to articulate a clear vision of how the needs of a quite radical energy system transition can be served, who know how to develop and test that vision, and have the ability to evaluate and develop things they have never seen before. There is need for the sector to attract more people like that. One quite specific way in which that can be done is by the teaching of research skills and provision of space for creativity. A good PhD programme in a supportive environment, with talented students guided by knowledgeable advisors, can do that, especially when it is done in a partnership between universities and industry. This is what a well-structured Centre for Doctoral Training (CDT) in one of the country's leading energy system research groups provides.

Such a CDT requires not only funding but companies' commitment of time, to provide case studies, data and advice on practicalities, and to build relationships. These lead to recruitment of PhD graduates with advanced knowledge and personal attributes – such as an ability to self-start, to identify and solve problems, and communication skills – of great value to industry. I have seen this work well. One example from my experience has been SP Transmission's engagement with the power systems research group at Strathclyde which has led to recruitment of PhD graduates into advanced technical roles that were otherwise proving very difficult to fill.

To date, there have been 3 complete rounds of CDT funding awarded by the Engineering and Physical Sciences Research Council (EPSRC). Applications in a 4<sup>th</sup> round were invited and reviewed in 2023.

A collaboration between the University of Strathclyde and Imperial College London in a CDT on Future Networks and Smart Grids was funded in the 2<sup>nd</sup> round. In its mid-term review, it was rated as very good by EPSRC. A proposal for a successor, broadened to address Energy Systems and adding Newcastle University, was submitted to EPSRC in 2018 and received excellent reviews but was not funded. In the most recent round, a collaboration between Strathclyde, Imperial and University of Manchester for a CDT on the Future Electricity System was submitted to EPSRC with the support of 12 companies including Scottish Power, SSE, National Grid ESO and Siemens Energy, plus the then UK Government Dept. of Business, Energy and Industrial Strategy, the Climate Change Committee, the Scottish Government and the National Infrastructure Commission, but was rejected by EPSRC with no specific reasons given.

I believe the research challenges and need for a pipeline of talent mean that we need a CDT dedicated to the challenges in making the electricity system and our use of energy suited to a net zero world. Innovation funding made available to regulated network companies for the duration of RII0-2, RII0-ED2, RII0-3 and beyond would

allow them to play the critical part in such a CDT – contributions to costs and active engagement with the research and the students – that their role in society demands. Short-termism in regulatory arrangements and excessively narrow framing of the uses to which innovation funding can be put risks such support simply not happening otherwise.

The Electricity Networks Strategic Framework published by BEIS and Ofgem in 2022 says we need £40-110 billion of investment in onshore network plus more for offshore, and 50,000-130,000 more people in the networks sector. A small but crucial subset of people is needed to understand how to innovate, how to test the effectiveness of innovations and mitigate their risks, and how to generate and present evidence. In other words, they need advanced domain knowledge and to know how to conduct scientifically sound research. A survey of supporters of the proposed Strathclyde/Imperial/Manchester CDT mentioned above showed many companies and key stakeholders recognising that need.

My understanding is that EPSRC's most recent round of CDT funding failed to support any Centres dedicated to the energy system or the electricity system. The critical and growing role of electricity in modern society demands a stream of talent capable of understanding the technical and societal challenges in the energy transition and leading solutions to them. It would be in energy users' and network customers' best interests if innovation funding governed by Ofgem and UK Research and Innovation (UKRI) could be put to use not just to test ideas but also to develop people capable of coming up with ideas, testing them and changing the culture of the whole sector.

If there anything in the above that you like to discuss, please do not hesitate to contact me.

Yours faithfully,

A handwritten signature in black ink, reading "Keith Bell". The signature is written in a cursive, flowing style.

Prof Keith Bell