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Dear Rachel

Open letter consultation on the development of gas and electricity innovation stimuli

UK Power Networks is pleased to respond to the above consultation and provide our views on the specific areas which are of interest to Ofgem at this stage. We have also taken the opportunity to expand on the discussion which took place during the Innovation Stimulus Working Group session on Monday 15 November.

UK Power Networks (and our predecessor, EDF Energy Networks) has a strong track record in innovation. You will be aware of the extent to which we have made use of our IFI allowance since the incentive was introduced. Importantly, many of the innovations we have trialed have already led to significant improvements in network management efficiencies and operational practices while others have informed our views on longer term network strategies. The success of our innovation is a result of:

- careful management and co-ordination of our research and development programme;
- clear alignment of R&D projects with our strategic objectives; and
- strong collaboration with external parties able to bring new ideas to the table for us to jointly develop.

Our project portfolio (as reported annually through our IFI report) comprises a full range of projects ranging from relatively small in-house or single partner projects which will typically deliver early benefits or provide direction for further research, to major collaborative projects that explore longer term challenges, opportunities and solutions.

This focus on well directed research and development and optimised project portfolio management is evidenced in our engagement with the Low Carbon Network Fund in respect both of our Tier 2 proposal ‘Low Carbon London’ and the two Tier 1 projects we have registered to date. We therefore feel that we are well placed to understand what makes for successful innovation, including collaboration with relevant stakeholders and partners (and third parties).

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In answer to Ofgem's specific questions:

What innovation might be required to facilitate a low carbon economy …

In terms of what innovation might be required, Ofgem is right to acknowledge that Britain's gas and (especially) electricity industries are facing a significant challenge to meet the uncertain demands of moving to a low carbon economy and meeting our renewable energy targets while maintaining safe, secure, reliable (and affordable) energy supplies. In the case of electricity distribution networks, the challenges are those arising from, on the one hand, increased levels of micro-generation and DG which will create a need for new approaches to voltage and fault level management and, on the other hand, increased usage of electricity as a result of electrification of heat and transport which will create a need to be able to manage new demand profiles so as not to exceed thermal ratings of plant and equipment.

However, as studies have shown, this simplistic summary does not convey the full range of challenges and uncertainties that DNOs will face. For example, in respect of electric vehicles, not only is the future rate of take up uncertain, the geographic clustering of electric vehicle ownership and the variations in usage (and recharging behaviour) creates a high degree of uncertainty regarding future electricity demand profiles on distribution networks. Similarly in respect of micro-generation, DG and heat pumps - the extent to which the Feed-in Tariff and Renewable Heat Incentive will encourage adoption of these new low carbon applications creates uncertainty, not least in terms of how the combined effects of these technologies will impact daily and seasonal demand profiles.

Moreover, studies indicate that the UK Renewable Energy Policy, which advocates over 30GW of wind generation being connected (largely) to transmission networks by 2020, will also have a significant impact on daily distribution network demand profiles due to price and demand volatility. On the other hand, DNOs' strategies for managing distribution demand profiles, including through commercial innovation such as introducing time-of-use DUoS tariffs and through responsive demand contracts (typically with I&C customers) might also contribute significant benefits both in terms of management of the balancing mechanism and the post-gate closure (i.e. residual) balancing of the national electricity transmission system. The evolution of the 'DNO' role to that of a Distribution System Operator (DSO) might have significant benefits in terms of the overall management of the electricity system.

For electricity transmission, the future pathways are arguably clearer (for example in terms of the impact that DECC's 2050 Pathways Analysis scenarios would have on future electricity transmission infrastructure). In terms of network architecture, there will be increasing emphasis on effective utilisation of existing transmission assets in order to minimise the need for reinforcement and/or the construction of new onshore transmission lines. Accommodating new offshore transmission systems, providing interconnection to major wind farms and/or other parts of Europe, will place further demands on the development of network architecture.

Future gas scenarios are also relevant - for example in terms of:

- introducing biogas to mains gas to reduce the carbon footprint of domestic and I&C gas heating;
- the role that local CHP/CCHP and gas fired centralised generation (the latter possibly combined with CCS) might play as part of the national generation portfolio and regional energy policy;
- the economic and security benefits that might accrue from an efficient and effective increase in storage capacity; and
- the arbitrage opportunities between electricity and gas options.

Details of potential projects which could meet the objective of the innovation stimuli …

In terms of potential projects, all of the above suggests a need for coordinated innovation, particularly between transmission and distribution but also between electricity and gas futures. Extending the principle of a 'low carbon network' incentive to electricity transmission, and to gas transmission and distribution, is therefore logical provided that there is a strong incentive to investigate holistic end-to-end options for (and interdependencies between) low carbon energy production, storage, delivery and usage.

Some DNOs' LCNF Tier 2 year-1 project proposals demonstrate this end-to-end approach. For example, the focus of UK Power Networks' 'Low Carbon London' project is very much towards commercial innovation (a largely untapped opportunity) and exploring how such commercial innovation can be structured to provide end-to-end synergies which optimise not only the electricity distribution network but also the electricity transmission system, the national generation portfolio (in terms of low carbon production) and, by no means least, the actual utilisation of electricity. Such commercial innovation directed towards optimising the utilisation of electricity systems will in turn require more sophisticated information communication technologies and IT systems (including systems that leverage the benefits of smart meter data) and advanced network management systems, including distributed and/or autonomous active network management systems.

In terms of electricity distribution 'hardware' the opportunities are mainly those surrounding electricity (or energy) storage, advanced voltage, power flow and fault level management, self-healing networks and power electronics. A number of these have featured in RPZs or are the subject of current IFI or LCNF projects. However, the focus going forward needs to be towards integrating these technologies at scale in order to emulate future network challenges and the required architecture, and to understand how the overall system can be developed to improve efficiency, avoid excessive investment in capacity, and facilitate a low carbon economy by embracing low carbon energy technologies.

For electricity transmission, examples include deployment of sophisticated power flow optimising technologies such as SVCs and phase shifting transformers (quad boosters) and series capacitors. For long (typically sub-sea mainland-to-mainland) interconnectors the drive will be towards voltage source converter based dc solutions, including multi-terminal systems (i.e. dc systems with multiple converter stations) for interconnecting offshore wind farms with the main interconnected transmission system. While these technologies are not entirely new, their deployment at the scale envisaged is largely unprecedented and not without risk. Some of these technologies will also become increasingly relevant for distribution networks at sub-transmission voltage levels.

Notwithstanding the need for innovation to facilitate a low carbon economy, we must not lose sight of the need for continuous innovation in life extension and increased asset utilisation as a means of maximising the effectiveness of legacy investments. Innovation in diagnostics and metrology (and state estimation) will continue to be important as will the development of techniques for asset degradation and thermal modeling. For example, partial discharge monitoring of paper insulated cables (which, albeit now fully depreciated in regulatory terms, remains a major component of future asset renewal liabilities) has considerable potential in diagnosing condition and imminent failure, and hence targeted repair or replacement. However, the technique requires further development before it can be relied upon as a robust input to decisions in either operational or planning timescales.

For gas transmission and distribution, we would not presume to be able to comment knowledgably on the technical innovation required other than to suggest that it will be driven by the need to both optimise the utilisation, and extend the life of, existing assets which may, under some scenarios, see a decline in volume flows (i.e. under an increasingly electricity oriented energy future) or in some cases an increase in flows where de-centralised gas-fired CHP/CCHP (including district

heating) systems become more common as a consequence of local government and community 'sustainable energy' strategies. The introduction of biogas into mains gas systems will no doubt also require some innovation as will the development of effective storage capacity.

The deployment of commercial innovation might also inform the need to review the boundaries between regulated and non-regulated activities. For example, distribution connected electrical storage offers end-to-end system benefits but only if the inherent flexibility is used to its full extent, including providing ancillary services to the transmission system operator as well as providing local distribution network support and/or perhaps increasing the effective load factor of local wind generation. The same is true of dispatchable DG and responsive demand.

How the annual level of funding should compare to the £64m annual LCNF fund …

In terms of the annual level of funding required, clearly this must reflect the scale of the opportunity. For electricity transmission networks, certain new technologies such as multi-terminal dc systems are likely to require very significant levels of expenditure both in developing and proving the concept, and subsequently in the actual deployment of the proven technology. For electricity distribution networks, while individual projects will generally be smaller in scale, they will generally be greater in range due to the relatively diverse nature of distribution networks (i.e. in terms of voltage levels and urban/rural architectures) and the fact that new low carbon technologies such as micro-generation, heat pumps and electric vehicles will create many variations in daily and seasonal demand patterns on low and medium voltage networks. For both electricity transmission and distribution, we would suggest that the ENSG reports on transmission futures and smart grids provide a useful steer on the scale and types of innovation required for these networks, and the potential cost-benefits if successful innovation is able to displace conventional network investment.

While it is difficult to suggest a definitive level of stimulus funding for each sector we would suggest that, prorated to cover an 8-year price control period, the current combined level of LCNF and IFI allowance (over 5 years) is of the right order of magnitude for both electricity distribution and transmission networks. We would however implore Ofgem not to apply a rigid annual cap but be prepared to flex the fund in light of the quality of projects and competitive bids received. There is an obvious benefit to the industry and customers if innovation can be developed more quickly and hence deliver earlier benefits. In particular, given the envisaged challenges arising from Energy Policy (and potentially as a result of Electricity Market Reform) it will important to accelerate the development and deployment of innovation such that these challenges can be met through more efficient, reliable and cost-effective network management strategies than those based on conventional network investment. It follows that front-loading the innovation stimulus could have significant benefits if that were to result in more comprehensive learning and earlier commercialisation and/or 'productisation' of innovative techniques.

What speculative investment companies should include in their business plans …

In terms of what should be funded through the price control as opposed to being subject to competitive bidding for stimulus funding, this depends to a large extent on the degree to which the risks associated with innovation are reflected in the price control - in particular the assumed cost of capital. While mechanisms such as IFI and the 'non-competitive' Tier 1 of LCNF will continue to be important in 'bringing on' innovative solutions, we do recognise that there is a need to move beyond the RD&D phase to full roll out if the potential benefits are to be embedded and not simply 'remain on the shelf' as interesting pilot studies. UK Power Networks supports in principle the concept of risk sharing whereby we would accept the risk of rolling out innovative technologies (or commercial arrangements), where these offered a more economic (or better value) alternative to

‘conventional’ network solutions, in return for a higher return over the life of the technology or commercial arrangements. This would provide benefits to all parties where the innovations proved reliable and sustainable, but would provide some measure of protection to UK Power Networks’ shareholders should some of those innovations result in partial failure and/or higher than expected costs of implementation or correction. It is our (and others’) experience that no matter how well innovative technologies are tested before ‘business as usual’ implementation, teething troubles or even more serious failures will sometimes occur. Consac cables is one extreme example of where latent defects became apparent only after some companies had invested heavily in the technology, but there have been numerous lower profile failures which have required corrective actions and/or design changes following implementation.

Of course these examples are very much the exception but given the uncertain impact on networks arising from the evolution of new low carbon energy applications - and the extent to which, in the interest of customers, network operators might apply innovative technologies and commercial mechanisms to limit the requirement for conventional network investment - network operators will be facing increased risks in predicting future (8-year price control period) network intervention obligations and expenditure profiles. In this respect, a particular concern would be how learning from projects that are accepted for LCNF funding in the second half of the current price control period will be able to feed into DNOs’ business plans and subsequently their allowances from April 2015.

Given an 8-year price control period, there is a potential risk that the wider benefits from these projects will not begin to be delivered until 2023, at which time the learning will be reflected in DNOs’ business plan submissions for DPCR7. Further thinking therefore needs to be built into the stimulus as to how future learning will be shared; how it will be deployed on a timely basis within a price control period; and how any change of investment strategy informed by such projects would be reconciled with a DNO’s business plan submission. It would therefore seem important to allow companies some flexibility in their business plan submissions to reflect the potential (over an 8-year period) for an innovative trial of a new technology or commercial instrument deployed in the early years of the period to become a proven application and a genuine option to a ‘conventional’ network solution by the end of that period.

It will also be important for companies to have the option to deploy an alternative technology or application (not predicted at the time of their business plan submission) which might have a different life-cycle cost profile but a more economic whole life profile. For example a newly developed solution might have a higher initial capital cost than the technology it displaces (particularly if this includes pre-volume sales start-up costs) resulting in a higher level of investment within the 8-year price control period, but might incur a lower NPV cost over the life of the investment. It follows that a simplistic ex-post benchmarking test based purely on 8-year costs and end-of (8-year) period outputs would not incentivise such innovation.

A further issue to be considered is the impact of the innovation stimulus on the overall incentive framework. As we have commented above, the application of new technologies can sometimes result in unintended network performance issues which can result in financial penalties for the company. So long as the cost of capital is set a rate which captures this increased level of risk then this would be acceptable in principle to UK Power Networks. However, in terms of the returns that a successful network operator might reasonably anticipate, one area that does need further examination is the use of the Return on Regulated Equity (RORE) metric. The mechanics of this metric were not clearly set out at DPCR5. If companies are to accept a higher level of risk as a result of greater innovation, it is vital that the additional return required to compensate for this risk is not negated as a consequence of the overall RORE calibration exercise.

We acknowledge the value of the RIIO framework in establishing the principle that companies must demonstrate that their historic and planned expenditure represents good value for money when

considered over the long term. We accept that the onus is on companies to provide the necessary information for Ofgem to assess the long term efficiency of their plans. However, there is also an onus on Ofgem as they move to translate the principles of RIIO into practical price control mechanisms that these mechanisms can cope with increased complexity. Not to do so would eventually undermine the incentives for innovation.

Licensing and third party access …

We do not believe there is a need for Ofgem to provide for the option of licensing third parties to undertake innovative trials on commissioned electricity or gas networks. We would in any case foresee a number of difficulties in establishing and implementing such a regime. If an existing licensed network company was unable to actively control and integrate (or mitigate) unproven technologies being deployed on their networks there would be a significant risk of unintended and uncontrollable operational and performance consequences. As a minimum, UK Power Networks would expect full and complete indemnity against such consequences.

In any case, we do not believe there is any substantial evidence to suggest that network operators would not openly embrace good innovation proposed by third parties. By way of example, the initial action in the development of our LCNF Tier 2 year-1 project which culminated in 'Low Carbon London' was for UK Power Networks (then EDF Energy Networks) to issue calls for expressions of interest to a wide range of organisations, many of whom we had not previously engaged in the context of potential partners in innovation. This call resulted in two consecutive days of interviews with prospective partners where we invited them to present their ideas to us (rather than vice versa). It was as a result of this process (followed by several exploratory workshops) that the Low Carbon London collaborative partnership was formed and the project was borne. We believe this (and other DNOs' LCNF Tier 2 projects) provides strong evidence that the most effective way for third parties to engage in innovation is to form collaborative partnerships with network operators where good ideas can be brought together to develop meaningful coordinated innovation that will far better serve customers' interests than ad hoc unrelated trials.

Yours sincerely

Dave Openshaw
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