Response to Distribution Price Control Review 2nd Consultation 171/03

EA Technology

Introduction

EA Technology welcomes the proposed IFI and RPZ incentive mechanisms as an economically efficient instrument to overcome barriers to the development of lower cost solutions for the connection of distributed generation and for operating networks with embedded generation. However, the connection of distributed generation is only one of a number of threats that could increase costs of owning and operating distribution networks, or could reduce the performance of distribution networks and the performance of DNOs into the future. Other threats include an ageing asset base, tighter Health and Safety legislation, environmental pressures and loss of expertise and skilled staff.

It is our understanding that the IFI is not restricted to distributed generation, but is also intended to incentivise DNOs to invest in innovation to improve capital and operational efficiency more generally. The potential benefits to customers of innovation in managing the ageing asset base can potentially deliver significantly greater benefits to customers than innovation in connection of distributed generation and therefore we also welcome the wider scope of the IFI. For example, from our work on electricity network assets, we estimate that the value of R&D to develop a full understanding of end of life of existing network assets could have a present value of up to £2Billion in safe deferral of replacement of assets. However the risk of pursuing such a policy without first developing the understanding could be catastrophically high, with power outages such as those experienced in London and Birmingham recently, becoming more common.

DNOs will not receive direct benefits from the IFI. Benefits to DNOs will accrue from RPZ incentives for innovative approaches that are demonstrated in RPZs, both for outputs from the IFI and for approaches that are sourced outside of the IFI. However the main benefit to DNOs from the IFI and RPZs will occur if and when outputs are widely implemented, enabling DNO's to realise efficiency savings and retain the benefits of out-performance for an agreed period.

Generators will ultimately benefit from the IFI and from RPZs in terms of reduced cost of connection and from a reduction in constraints to connecting to existing networks which will otherwise increase as the currently available headroom for generator connections is taken up by early generation connections.

Benefits for other connected customers which would accrue from the IFI and RPZ incentives will include:

- a reduced risk of degraded quality of supply resulting from the connection of DG. This will result from a greater understanding and hence better, more economically

- efficient solutions for facilitating the connection of generation to existing networks, reducing network risk and from a greater diversity of generation, reducing reliance on a small number of primary energy sources.
- lower electricity costs in the future, as the reduced costs of connection feed through into the end-use cost of electricity.
- greater capital and operational efficiency of DNOs, which will feed through into lower end-use cost of electricity.
- improved network performance.

EA Technology has drawn up a list of areas where DNOs would benefit from innovation. Whilst it is not appropriate to present this list in this high level response, nevertheless EA Technology is happy to discuss these further with Ofgem, DNOs and other interested parties.

The goal of RPZ as currently formulated is clear – to encourage DNOs to become the first user of innovative techniques to connect generation and / or operate a demonstration segment of network incorporating generation to enable all stakeholders to gain experience of the benefits and difficulties of using such innovative techniques. Providing that details in the incentive can be agreed at a level which will actually incentivise DNOs, RPZ's would overcome the natural reticence of a DNO to become the first user of an unproven technology for facilitating connection of distributed generation. It would also incentivise DNOs to expend a higher cost for demonstration of a technology than perhaps would be the cost of an alternative, well-proven technology.

However, the IFI would deliver a number of innovative technologies, processes and alternatives for management and operation of the distribution network that are not associated with the economically efficient connection of distributed generation. If the argument for the need for RPZ is sound (and we believe that it is), then it is necessary for Ofgem to consider either widening the scope of the RPZ incentive or introducing a similar incentive in the future, for demonstration of non-DG related innovation on the network.

Projects will need to be completed in the IFI and produce outputs that will require demonstration on the network, before large scale roll-out is undertaken and benefits are seen by customers. There will therefore be a lag between commencement of the IFI and the need for an incentive mechanism to stimulate demonstration of the IFI outputs.

Consequently we do not feel that it is appropriate at this time to widen the scope of the RPZ until IFI outputs are being produced. However we hope that as part of the planned review of IFI and RPZ in the next price control period, Ofgem will consider a appropriate instrument to incentivise DNOs to demonstrate outputs from IFI projects that are not directly related to Distributed Generation.

The impact of RPI-X price control on Innovation

The RPI-X form of price control, together with incentives to maintain and improve network performance and customer service has been successful in incentivising DNOs to invest and operate the network in an efficient manner, as is evidenced by the

reduction in costs and improvement in output measures over the period since privatisation of the electricity industry. However, it has caused a real decline in innovation by DNOs as they are incentivised to meet shorter term goals.

The combination of RPI-X plus short term network performance targets including IIP measures, increasingly incentivises DNOs to be low risk businesses or at least to manage risk over short timescales against well defined regulatory and financial targets. This may be the cause of the fall in equity betas since the last price control review. Skilful management of risk in the short term does not imply optimum management of risk in the medium to long term. Indeed it can be argued that too tight a focus on optimising short term risk can profoundly increase long term risk. The Asset Risk Management project gave some comfort that companies are not ignoring medium to long term risk in the interests of reducing costs while meeting targets in the short term, however there was found to be room for improvement in fairly basic things.

There is no indication that DNOs are motivated to invest in measures to reduce costs and improve performance over a longer timescale by being innovative in their approach, unless there is also demonstrable improvement, from these measures, in reduced costs or output measures within the current price control period.
The five year cycle of price control can produce a disincentive for DNOs to invest, toward the end of a regulatory period, in measures that will reduce costs in that period, since this will be taken into account at the next price review and the DNO will only receive benefit from this investment over a short period compared to the price control period. Ofgem's intention to allow companies to retain the benefit of out-performance for a five year period, rather than up to the next price review, is welcomed as this is likely to cause such investment to be less "lumpy" and to promote a sustained drive for improved efficiency by DNOs.

Whilst this proposed measure will correct the disincentive to invest towards the end of a price control period where returns are measurable within timescales of one or two years, it will not address investments which will produce returns that are measurable over periods longer than 5 years, unless there are well established rules, agreed with Ofgem, for companies to capitalise that investment. It is unlikely that such rules could be established for measures that are not well established and well understood. Therefore it is unlikely that investment in development of innovative measures that are unproven will be allowed to be capitalised. Consequently, the proposed rolling opex adjustment proposed by Ofgem will not incentivise DNOs to achieve efficiency savings in the medium to longer term, by developing and implementing unproven, innovative solutions. The proposed IFI and RPZ incentives will assist in producing efficiency savings in the medium to longer term.

Reductions in allowable operational expenditure from previous price reviews has had a direct and demonstrable reduction in R&D spend by DNOs, because R&D expenditure in one regulatory period is judged by DNOs as unlikely to provide direct benefit in terms of either improved performance or reduced costs during that regulatory period. Current estimates of R&D expenditure across all DNOs are around £1M per annum. The reduction in opex at the last review had the effect of reducing R&D expenditure by DNOs by around £1M. Since this reduction is similar to the total current expenditure there is a real possibility that R&D expenditure will virtually

cease if Ofgem requires a similar reduction in opex at the next price review but does not put in place an incentive for innovation.

Impact of proposed incentives on the amount of distributed generation connecting to distribution networks

Currently the installation of generation which requires connection to the distribution network is driven by a number of factors which are unrelated to distribution networks. The cost of a connection is currently not the major issue in determining whether a generation scheme goes ahead. Therefore the impact of DG incentives, RPZ and IFI on the volume of generator connections is likely to be marginal over the next price review period. However, the impact is likely to be significant after 2010, when the capacity of networks to accommodate generation using conventional approaches is significantly reduced as generation connected during the next price review period takes up the available capacity. Indeed there is at least one DNO that is not considering new applications for generator connection, because using conventional approaches, the available network capacity will be taken by existing applications.

In addition the market is likely to change as developments in generation occur and confidence grows in technologies that are currently relatively unproven. There is likely to be a significant increase in CHP, both domestic and small commercial scale, small scale wind etc. all of which will bring challenges. Incentives that persuade DNOs to explore more efficient ways of connecting new generation technologies and of operating networks which incorporate significant numbers of generators will assist in minimising the costs and risks of future changes in the market for generation.

Additional expected costs & benefits of the incentive framework to Distributed Generators

Innovations in connecting and operating the network to facilitate connection of Distributed Generation are unlikely to feed through in large volumes during the next price review period. It therefore would not be appropriate to levy the cost of the IFI on generators. It is more appropriate to divide the cost of IFI across load customers, because the goal of the IFI is to deliver benefits to customers that would not be achieved were the IFI not to be implemented. There is a relatively low change over time in the numbers of load customers. Load customers will continue to require the distribution network (even if they produce a proportion of the electricity they consume) and therefore a large majority of load customers who cover the cost of the IFI, will receive material benefit from the outputs of the IFI. The cost of the IFI would increase load customers' bills by around 0.013%.

It is more likely that solutions that are demonstrated in RPZs early in the next price review period will be rolled out towards the end of that period, delivering benefit to both generators and DNOs. Ultimately, through operation of a competitive market in generation, and by regulatory action on allowable income of DNOs, this will result in lower electricity costs to load customers.

The cost of first use of a technology is invariably higher than the cost of use of the technology when it is in common use. This is because the capital cost of innovative equipment is significantly higher for first use than when it is fully developed, cost engineering has been undertaken and there are economies of scale in production. It is

also because first use requires higher operational costs for monitoring and evaluation, and because new practices have to be developed. These issues may increase the cost of first use as high as a factor of ten over the ultimate cost of common usage. If the additional cost of an RPZ is borne solely by generators that connect within that RPZ, then individual generators are likely to experience significantly higher connection costs within an RPZ than outside of an RPZ. This would be a significant disincentive to the demonstration of innovation. If the additional cost of RPZs is to be borne by generators, then it would be equitable to divide this cost among all generators connecting to the network. Assuming DNO estimates of 100,000MW of distributed generation connecting over the next price review period, this would add around £0.35 / kW (35 pence per kW) to the cost of connection during the next price review period.

Alternatively, because the aim of an RPZ is to maximise benefit in the future, it could be argued that this will ultimately result in lower electricity costs to load customers and that therefore the additional cost of RPZs should be divided among load customers. If this approach was adopted, the RPZ incentive would increase load customers' bills by around 0.006%.

In addition to reduced costs of connection that are dealt with elsewhere in this response, benefits to generators will include greater standardisation of solutions and better knowledge by generators of solutions to be applied by DNOs. This will result in less confusion and more definite, quicker, and efficient responses to connection applications. This will have a direct impact in terms of both increased efficiency and reduced design and commissioning costs for generators and in reduced time between planning and commissioning of new generation.

Impact of the proposed incentives on R&D & network innovation

If the IFI was introduced at levels suggested in the consultation document then there would be a significant increase in R&D and network innovation funded by DNOs.

The IFI would provide DNOs with an incentive to invest in R&D that may not produce direct benefit in the regulatory period that the investment was made, but could deliver significant benefits over a longer timeframe.

It is clearly difficult to enumerate benefits that would be expected from innovations that have not yet been defined developed, demonstrated and tested, however it is useful to consider the benefits that are accruing now from innovation that has been undertaken in the past within the Strategic Technology Programme (STP) that is operated by EA Technology for DNOs. There are a number of outputs from this programme that have produced benefits to DNOs and to customers. Whilst it is not appropriate to list all of these here it is worth considering one example. R&D investment by DNOs of £130,000 into methods for locating LV faults resulted in the development of a technique and a prototype instrument for locating faults in LV networks by recognising the characteristic gases that are given off by the fault and held in the ground in the vicinity of the fault. EA Technology has subsequently invested in the development of a commercial instrument based on this work, known as the CableSniffer. There is a typical saving of £750 / LV fault for faults located by the CableSniffer in avoiding unnecessary digging of holes. The potential saving across the UK from full deployment of this instrument is around £50 million annually.

Experience shows that the time saved in locating faults can save around 25% in CMLs from LV faults.

It is clear that innovation can provide significant benefits for a relatively low investment cost. However the timescale from investment to achieving benefit in this case is around seven years. During this period, DNOs stopped supporting projects within the STP which had timescales of three years and carried a significant technical risk, as a direct consequence of the last distribution price review. Under the current regulatory regime the R&D work that led to the CableSniffer would not have been undertaken. Small innovative companies find it hard to fund this type of development from financial markets because the risk is high and difficult to enumerate, the timescales are long and the majority of benefits accrue to DNOs.

Not every innovative project delivers this level of benefit. However, based upon the proposed level of investment in IFI compared with that invested in STP over the period that R&D work was carried out on the CableSniffer, then we would estimate that IFI might deliver around £500 million annual savings or equivalent benefits.

Provided that the incentive level is set appropriately then RPZs will provide an impetus for DNOs to try technology and approaches to connection and operation of distributed generation that are relatively unproven. However there is likely to be a reticence in DNOs to move from conventional approaches, even in limited scope in an RPZ, unless some mechanism is put in place to protect the DNO from penalties from poor network performance if the measure is unsuccessful or to reward the DNO for accepting the risk.

Impact on Connection costs

It is difficult to provide firm costed benefits which will arise from the implementation of innovations that have not yet been developed, demonstrated and tested. However it is possible to infer benefits from experience of using devices that are well proven outside of the UK but have only recently been used in the UK. A specific example is the use of automatic voltage regulating devices on an 11kV feeder to facilitate connection of wind generation.

In this example there was a request by a generator to connect 1.9MVA of generation capacity. There was an 11kV line available with sufficient thermal capacity to handle the power flow but connecting this capacity would have caused statutory voltage limits to be exceeded. The conventional approach would have been to build a new circuit and connect at 33kV. By using an automatic voltage regulating device in the 11kV circuit the generation was connected at a cost for assets employed by the DNO of around £50 / kW (one twentieth the cost of reinforcement). It is unlikely that a financial case could have been made for the wind generation capacity if only conventional reinforcement had been considered.

It is noted that DNO estimates of cost of connecting Distributed Generation range from £35 / kW to £220 / kW with a mean of around £90 / kW. (These costs include "Sole use" assets in addition to "Shared" and "Strategic" assets.) The lower estimates tend to apply where there is available capacity and there are no specific network limitations such as the voltage control problem discussed above. Since innovative solutions are expected to be deployed to overcome specific network limitations it is

reasonable to expect that the cost of connection, using innovative techniques to address a specific network limitation, will tend to reduce costs towards lower values in this range. A saving of the order of around £40 / kW might be expected. It is interesting to note that the example discussed above reduced connection costs from well above the maximum in the range of expected costs, reported by DNOs in the DG-BPQ, to slightly above the minimum of the range.

Estimates of additional capacity over the next price control period includes 8,500MW of renewable capacity and 5,500 MW of CHP to meet the governments targets and around 10,000MW from DNO estimates. A significant amount of this capacity will be satisfied by large grid connected installations, or will connect to the distribution network at 132kV. Assuming that around 10% of new capacity would benefit from innovative solutions and the reduction in cost of the order discussed above, then a saving of the order of £40,000,000 over the next review period might be expected from innovative solutions arising from demonstration in RPZ and development through IFI. However a much larger financial benefit would accrue between 2010 and 2020 as network capacity comes under more pressure and levels of microCHP grow to the point where LV networks and the generation and load connected to them need to be actively managed.

Requirement for new R&D by DNOs for connection of DG

The current design and operation of distribution networks is largely based on existing standards and practices based on industry guidance documents. These network standards and practices are still based on understanding developed when distribution networks were required to transfer power from a small number of central supply connections to a large number of load connections. Although engineering recommendations have been produced for connecting distributed generation, these have been produced to ensure that the generation does not adversely affect the existing network. R&D is required to inform the development of standards and recommendations that have at their core bi-directional power flow.

The current regulatory framework tends to drive DNOs to be wary of any change to current designs and practices where there is a possibility that the change could have a negative impact on network performance. Innovative technologies and operational practices which potentially can reduce the cost of connecting DG are by their nature unproven. Their impact on the network is by definition unknown. They also do not conform to existing standards and practices. Their use on a network needs the DNO to have specialist knowledge which has become scarce as the DNOs have come under regulatory pressure to reduce costs. Consequently DNOs tend to be conservative in their approach to new generator connections.

R&D is therefore not only required in the development of new devices and approaches to connecting DG and for managing networks but also in assessment of the impact of these new devices and approaches on existing network designs and network assets. The purpose of this R&D is to increase knowledge and understanding and to communicate this in a way that can increase the confidence of DNOs in applying more innovative approaches to connecting DG. This will underpin revision of design and operational policies, procedures and practices.

Administration of the schemes and associated costs

The IFI can be largely administered by R&D providers providing it is clear what constitutes allowable projects within the IFI and management guidelines are developed. From experience of operating collaborative development programmes we would anticipate that costs to providers of administering the scheme would be around 5% to 10% of the total costs. Activities carried out by or on behalf of Ofgem would be limited to periodic audit in a similar manner and at similar costs to the Asset Risk Management audit. It may be appropriate for this to form part of the Asset Risk Management audit.

We believe that there are significant benefits in DNOs coordinating their R&D activities through Collaborative Innovation Programmes (CIP). These benefits include:

- Avoids duplication
- Reduced cost per DNO
- Shared Risk
- Achieving a critical mass in both direction / coordination of the programme and in project / portfolio size
- Outputs available to all DNOs under previously agreed commercial terms – reduced time to implementation by avoiding commercial negotiations over specific outputs
- Clear that DNOs are not inappropriately spending IFI funds
- Activities will be of general applicability and not specific to a particular DNO (or they would not be supported by sufficient DNOs to progress with the programme)
- Avoids possible criticism that one DNO's customers fund innovation while benefits can be enjoyed by all customers
- Avoids IPR issues acting as a barrier to general applicability of solutions

We propose the following activities are necessary to set up Collaborative Innovation Programmes

(1) DNOs agree with Ofgem the criteria that will define innovation projects within the IFI for allowable expenditure.
(2) A Working Party is set up with representatives from DNOs, R&D providers and other interested parties to develop an industry good practice guide to management of innovation. Ofgem would be invited to attend.
(3) Candidate organisations wishing to participate in a CIP funded from IFI must demonstrate against the criteria in the above guide that they operate according to its recommendations.
(4) Any and all expenditure by DNOs through these CIPs is allowable expenditure under IFI up to any cap set by Ofgem.
(5) The aims and objectives of each CIP will be public information.
(6) An annual high level report is expected to be required by Ofgem and will be produced for each CIP which will detail how the Programme has progressed towards achieving its published aims and objectives. This report will be a public document.

(7) The CIP expenditure will not require detailed breakdown by the participating company within its annual Innovation Report. The participating company's annual Innovation Report will however make reference to the annual CIP report.
(8) Ofgem to selectively audit CIPs periodically to confirm that expenditure has been spent appropriately.
(9) Detailed information generated by a Project in a CIP would be confidential to the participants. There may be commercial agreements that lead to demonstration and adoption of the outputs from the Programme outside participating companies.
(10) Information deriving from Projects in a CIP will be made publicly available if outputs are not taken to commercial implementation within an agreed period of time, to ensure economically efficient dissemination of information where there is no commercial imperative.
(11) DNOs are free to fund innovative Projects outside of CIPs; however these Programmes will be subject to auditing by Ofgem on an individual Programme basis.

It is suggested that a CIP would have the following characteristics:

(1) IPR produced by the CIP is held in Trust by the operator of the scheme.
(2) IPR produced by the CIP is available on a royalty free basis to funding participants of the Programme.
(3) A pre-defined proportion of income stemming from exploitation of IPR outside of participating companies is returned to the Trust to be utilised within the Programme.
(4) Participating companies collectively determine which projects to progress within the Scheme.
(5) Works with universities and manufacturers where they can provide additional relevant expertise and other benefits.
(6) Funds innovative projects, driving both technology and processes forward to better meet the challenges of an evolving electricity distribution network.
(7) Has clearly defined and documented policies and processes including management and exploitation of IPR produced by the Programme.
(8) Has clearly defined and documented management procedures.
(9) Has commercial contract terms and conditions that are acceptable to all UK DNOs.
(10) Has a modular structure. Participating companies select the modules they wish to sponsor.
(11) Is directly controlled by the participating companies via module steering groups, made up of representatives of each participating company, which define and agree the scope and objectives of the module and select and review projects to meet the defined scope & objectives of the module.

Impact of Changes in the volume of distributed generation of Quality & Security of electricity supply

Small volumes of DG, where connected generator capacity is small compared to the thermal capacity of the circuit, will have a negligible effect on quality and security of the network provided that:

a) Network impedance is not significantly decreased by the generation, such that in the event of faults, the current carrying capacity of network assets is not exceeded
b) There is sufficient load close to the generation, or the network impedance is sufficiently low to carry the power to loads more distant from the generation without raising voltage above statutory limits.

There will be a small reduction in losses, provided the generation does not require or produce reactive power. If however the generation causes an increase in reactive power carried on the network, then losses will increase.

Large volumes of DG are likely to have a beneficial impact on security, provided that:

a) There is a sufficiently large diversity of generation to prevent common external factors (eg no wind) removing a large proportion of DG simultaneously
b) Current "Loss of Mains" protection is improved to prevent DG tripping off for trivial network disturbances
c) Standards (including current safety standards) are changed to enable generators to "ride through" loss of supply from higher voltage parts of the network.

Large volumes of DG will have a negative impact on quality of supply unless either

a) There is significant investment in the network (of the order of the higher range of DNOs estimates for the future connection costs for DG)

or

b) There is investment in development and demonstration of innovative solutions for connection, control and management of network and generation

to mitigate the effect of connection of generation on Voltage, Fault Level, Power Flow and Stability of the network.