DTI Centre for Distributed Generation and

Sustainable Electrical Energy

Electricity Distribution Price Control Review:

Response to Second OFGEM Consultation

DTI Centre for Distributed Generation and

Sustainable Electrical Energy

February 2004

Scope

This response primarily covers issues associated the Innovation Funding Incentive and Registered Power Zones, including the initiative for Regulatory Impact Assessment for Distributed Generation, IFI and RPZs.

The need for R&D

We are extremely enthusiastic about Ofgem's IFI and RPZ initiatives particularly because the RPI-X form of regulation has not encouraged R&D activity, other than work that would deliver direct benefits to DNOs in the short term. This has had some adverse effects on, primarily industrial, but also on academic research capacity in the UK[1]. On the other hand, DNOs are facing significant challenges, particularly in the medium to long term, that clearly need R&D and an incentive framework to DNOs to engage in R&D is critical. For illustrative purposes, we highlight three key areas that need R&D:

(i) Given the age profile of the network infrastructure, considerable R&D effort is needed to improve understanding of the fundamental properties of various components of the existing asset and its present and future performance;

(ii) Investigations and development of alternative cost effective network replacement and development policies is of strategic importance (it is not clear, for example, that

[1] Given the present status of the UK R&D community, this incentive framework must recognise the requirement to build up capacity in the DNOs to commission and manage R&D prudently (and also contribute to R&D itself) and also to re-build R&D capacity among the providers. It is critically important to build long-term R&D capacity and significant fraction of the IFI funds should be devoted to this. We would be concerned if a considerable proportion of these funds were spent on short-term contracts.

the current "like for like" replacement approach and the incremental network reinforcement concept will be cost effective in the long run);

(iii) The anticipated large-scale penetration of distributed generation, ranging from very large installations to domestic CHP, is imposing massive challenges to DNOs and is likely to radically change the network operation and design philosophies. One of the key R&D questions in this area is the cost effective integration of this generation in the operation of the system.

The above topics cannot be considered in isolation, as clearly, distributed generation, will play a significant part in the future development of distribution network infrastructures.

Outline proposals for deployment and management of IFI and RPZs

We consider that one of the key issues associated with the proposed incentive framework will be to identify how the resources will be allocated and the maximum benefits extracted. We are concerned about the coordination and management of IFI and RPZs as this is not specifically addressed in the consultation.

Our proposal is to devote considerable initial effort to create a Technology Road Map (TRM) for the future distribution system. Such a mechanism would specify the areas of research and development that are critical for achieving the objectives of efficient network operation and cost effective investment programmes that will deliver open access and adequate service quality to all network customers in both short and long term.

We are concerned that although all interested parties could agree on the technical objectives of various research themes it will be very difficult to come to mutually satisfactorily agreements regarding Intellectual Property Rights (IPR) and exploitation issues. The mechanism of a TRM would lead to consensus on technical challenges, outcomes and benefits while leaving open the issues of consortia membership, share of IPR and commercial exploitation, which is very important for the delivery of necessary R&D.

One of the key objectives of the TRM would be to provide seamless chain of innovation from research to deployment. Such a TRM should include a review of the state of the art, the results expected, outline the specific research challenges that must be overcome, demonstration programmes and specification of benefits to customers. Consider for example, that one of the areas of R&D in the Technology Road Map considers the question of life extension of 11kV paper insulated cables. A number of manufactures presently offer effective partial discharge measurement systems. However, the interpretation of the results remains uncertain and research is required to understand their significance and include them in the asset management decision-making process. Following from this research, field tests and demonstration will be necessary. Benefits of this activity would be better use of existing assets and reduced number of interruptions. This example, together with a case of advanced active management concept, is presented in the Table 1 for illustrative purposes of a TRM approach.

Table 1. Example of R&D areas (projects) within an agreed Technology Road Map for the Future Distribution Network

Objective	**State of the art**	**Research challenge**	**Demonstration**	**Benefits to customers**
Life extension of 11kV paper insulated cables	Manufactures offer effective partial discharge (PD) measurement systems	Improve interpretation of results and decision making	Demonstrate findings using field tests	- Better use of existing assets and -Improved service quality
Advanced management of active distribution network	Basic active management techniques well understood and some pilot schemes installed	Development of advanced distribution state estimation and control scheduling techniques	Development of laboratory and filed tests	Increased network control, cost effective connections, improved service quality

An additional advantage of this approach is that once the road map has been agreed, than the management of IFI (and perhaps RPZ) funds can be fully decentralised and will not require micro management. Companies will be free to determine their own priorities and chose elements of the road map they wish to pursue. This would also allow the research providers to create their own consortia with their own IPR arrangements, with the possibility of attracting significant additional industrial funding (these will be absolutely necessary for the delivery of commercial grade equipment and solution).

It is important to recognise that there is a considerable risks associated with a very high investment required to produce commercial grade equipment. This may prevent open sharing of best practice. Clearly, deployment of new technology will require investment by manufacturers very much in excess of Ofgem funds. It is therefore only reasonable that manufacturers obtain commercial advantage of their own investment. Hence IFI and RPZs incentive schemes must be managed carefully so that early research and perhaps some demonstrations are publicly funded and all results transparent. However, the development and field trials is likely to be predominantly privately funded with results being confidential.

The concept of Technology Road Map has been successfully used in the USA in many areas, including application to distributed generation by Department of Energy.

Developing the Regulatory Impact Assessment for Distributed Generation, IFI and RPZs

We fully support Ofgem's decision to develop Regulatory Impact Assessments for all significant new policies introduced as the price control review progresses. In principle, we agree with the relevance of the set of questions listed in the consolation document that need to be answered in developing full RIAs for distributed generation, IFI and RPZs. We wish to point out, however, that the benefits of the proposed incentive framework are likely to expand significantly beyond the distribution network, and these should also be included in the RIA process.

We offer our views to some of the specific questions for developing the RIAs

What would be the impact of each of the:

distributed generation incentive;

IFI; and

RPZ mechanisms

on the volume (or capacity) of distributed generation connecting to the distribution networks?

It must be recognised that the volume of DG coming forward to connection is likely to continue to be driven by a number of other major factors. For example CHP development is critically dependant on the relative price of electricity and gas while renewable development critically depends on the ROC mechanism and the planning permission process. However, all the proposed incentive will of course act to remove barriers to deployment of DG.

Although we very much support RPZs to encourage the DNO to demonstrate potentially lower cost we wish to point out that the solutions are likely to be more complex and challenging. We are therefore concerned that RPZ mechanism provides only a single reward for an innovation that is likely to cause higher on going cost and hence may not be considered to be attractive. Furthermore, the incentive based on MW connected is likely to disadvantage smaller installations. We also believe that some of the existing generation schemes could be considered as candidates for RPZs. For example, a novel form of management of the operation of an existing generator could postpone network reinforcement.

The IFI and RPZ mechanisms should build up seamless chain of innovation from research to deployment. This should insure overall lower network cost to the benefit of both load customers and generators as well as providing greater access.

Would be the impact of each of the proposed incentive schemes on the costs of connecting distributed generation in the period to 2010 and in the longer term – both in *terms of £/kW and total system costs? How would you expect new technological developments to reduce the £/kW cost of connecting distributed generation over that period?*

At the present moment, we do not have quantitative information available to directly respond to these questions, although the Centre for Distribute Generation and Sustainable Electrical Energy will be developing tools for assessing the costs and benefits of large-scale penetration of distributed generation and will made its results available.

To date, most attention has been paid to the immediate technical issues of connecting and operating generation on a distribution system and most countries have developed standards and practices to deal with these. In general, the approach adopted has been to ensure that any distributed generation does not reduce quality of supply offered to other customers. No real attempt has been made to consider how the overall performance of a distribution system with a significant penetration of distributed generation may be optimised.

We have carried out a number of research projects considering the development and design of alternative active management schemes and the quantification of benefits that can be derived from changing the operation philosophy of distribution networks from passive to active. The key objective of this work was to design network control strategies of an active distribution system that would enhance the ability of the existing network to accommodate additional distributed generation. We have demonstrated that coordinated voltage control strategies, for example, are likely to enable a considerable amount of distributed generation to be connected. Our studies indicate a 3-fold increase in the capacity of distributed generation that can be connected to 11kV and 2-fould to 33kV networks[2].

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[2] Integration of operation of embedded generation and distribution networks, K/EL/00262/REP, URN 02/1145, UMIST, 2002.

To what extent does the connection of distributed generation require new R&D by the DNOs?

Significant part of new generation capacity (about 14GW) is likely to be connected to distribution networks, i.e. at voltages of 132 kV and below. However, under the present conditions DNOs anticipate that they can integrate only a much more limited capacity of generation without a major reinforcement[3]. Continuing the present “fit and forget” approach will limit the connection of DG, and will require significant primary plant. Furthermore, continuing with the existing operating philosophy the system benefits will not be possible to extract. This is most unlikely to lead to cost effective solutions. There is an obvious need for the electricity supply industry, power companies, manufacturers, consultants and academic institutions, to come forward with innovative solutions as to how this Distributed Generation is to be installed and integrated within the power system in a cost effective manner. There is a developing appreciation of the scale of this task and the recognition that the resources necessary to address it will need to be mobilised and coordinated across industrial, R&D and academic sectors.

We believe that the proposed OFGEM incentive framework will be critical for facilitating a cost effective integration of distributed generation in distribution networks.

What would be required to do to administer each of the proposed incentive schemes and what would be each of the associated costs?

We would anticipate that up to 10% of the funds available should be allocated to project definition, project management and effective monitoring and dissemination. Reducing the management cost of R&D to very low levels will not result in prudent use of resources.

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[3] R J Fairbairn, D Maunder, P Kenyn (PB Power) “A Distribution Network Review, ETSU K/EL/00188/REP, 1999.

What would be the impacts of changes in the volume of distributed generation on

- *quality and security of electricity supply; and*
- *losses?*

Will distributed generation provide benefits in these areas, and if so, can they be quantified?

We believe that an effective integration of DG should increase quality and security of supply, given that reduced number of failures in the network will lead to interruptions due to the presence of local generation. There may be, however, situations that introduced changes in network operation, driven by the wish to connect distributed generation at low cost, may adversely affect service quality, particularly in the short term. On the other hand, some form of distributed generation will be able to offer security related services at the national level.

The impact on looses depends critically on the future development of DG. Local generation, and in particular micro generation, should reduce losses, while remote renewables are likely to increase losses. These impacts cannot be quantified without anticipating future development of DG.

It may be important to understand if there will be any interactions (positive or negative) between IIP, the loss incentive mechanism and the proposed DG incentive framework specifically for each of the DNOs.

The impact of the distributed generation on security and reliability of supply and on losses profile will be location and technology specific and quantitative assessments could be conducted for various alternative development scenarios. Some work in this area will be conducted by the Centre for Distributed Generation and Sustainable Electrical Energy and the results of this work will be made available.

How much of the increased volume in distributed generation would be of environment friendly types (eg renewables)? By how much would this be expected to replace electricity from non-renewable sources? Would such generation contribute to the reduction of emission levels and, if so, how should these benefits be quantified?

At present the main development of DG is from renewables supported by the ROC scheme. Conventional CHP continues to face financial difficulties and micro CHP is not yet deployed widely.

Renewable resources and other forms of distributed generation will displace corresponding amounts of energy produced by large conventional plant. However, new generation technologies, particularly intermittent, may not be able to replace fully the capacity and flexibility of conventional generating plant. Some preliminary work carried out recently[4] suggests that capacity value of wind generation is in the order of 20%.

[4] System Cost of Additional Renewables (SCAR), ILEX/UMIST, October 2002