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Finding the Optimal Approach for Allocating and Realising Distribution System Capacity: *Deciding between Interruptible Connections and Firm DG Connections*

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The aim of this paper is to evaluate the different approaches that distribution network operators (DNOs) exercise for releasing capacity and connecting more distributed generation (DG) in a cost effective way; by opting for interruptible connections, firm connections or a combination of both. Specific case studies are analysed with a focus on UK Power Networks' recent proposal for connecting more DG under the FPP trial, in order to identify the best practice and evaluate its applicability across DNOs taking into consideration the regulatory and market context. The UK Power Network' case study refers to a specific constrained area of the March Grid with a particular network configuration.

We focus on the benefits that DG customers could have for exporting capacity under a set of specific scenarios, and perform a cost benefit analysis (CBA) of those scenarios. To put into context, the study also presents a comprehensive review of the different types of connections (non-firm or firm), current and future regulation relevant to DG and the current initiatives (trials and business as usual) from DNOs that allow interruptible connections (non-firm).

Regarding the types of connections, the study shows that in general the offer of non-firm connections is of growing importance across DNOs because these allow cheaper and quicker connections of DG to the distribution grid by sacrificing the export of full generation capacity. On the other hand, firm connections allow the export of full generation capacity, guaranteeing future capacity requirements and allowing greater energy revenue for individual DG projects. However, firm connection means higher connection costs (especially in case of reinforcement) than under the non-firm connection option.

The study also explores the regulatory framework relevant to DG in terms of connection costs and system charges, incentives schemes and the main outputs from the new price control RIIO-ED1 applicable in the context of DG regulation.

Among these outputs are those related to connection costs (the removal of the DG incentive, the option of an ex-ante allowance for efficient investment and the inclusion of actual expenditure on network reinforcement in the load related expenditure reopener), innovation (time-limited innovation stimulus) and level of service (incentive on connections engagement for major connection customers). The aim of the new model is to find the right balance across parties by providing strong incentives to DNOs in order to meet investment and innovation challenges.

In addition, the study indicates that the offer of interruptible connections that involve the use of smart solutions (technical and commercially) is still at the initial stage across DNOs. Apart from specific trials which are mainly funded under the Low Carbon Network Fund (LCNF) or the Innovation Funding Initiative (IFI) (such as the case of Orkney ANM Project), there is no clear evidence of the terms and conditions for this kind of connection being offered on a business as usual basis. Similar to UK Power Networks, other DNOs are in the process of determining the most convenient approach applicable in a situation of network capacity constraint.

In terms of the CBA, the results are presented for four different scenarios with specific assumptions and assess the costs and benefits for the smart connection option (non-firm) and the reinforcement option (firm connection). Among the assumptions made are those related to curtailment, capacity quota, connection costs (where reinforcement costs covered by wind generators), demand, network upgrade in medium term and generation mix. We also examine a dynamic scenario that assumes a bringing forward of installed capacity in the medium term due to accelerated network reinforcement. We consider the scenarios with and without embedded benefits (i.e. the benefits arising from substituting DG for transmission system connected generation, arising for example from saving total system losses).
Results from the CBA suggest that in general small generators would prefer the reinforcement option (firm connection) with full non-firm capacity quota (with or without embedded benefits). Under this approach the reinforcement costs are shared across a greater number of generators (especially larger generators) thus the share of costs allocated to small generators is lower. An opposite effect is observed in large generators. For generators with a nameplate capacity higher than 5 MW the smart connection option would be more profitable due to the avoidance of reinforcement costs, in both cases including of excluding embedded benefits.

When comparing with the Business as Usual (BAU) connection option, the study shows that total savings for the selecting the smart connection options are always larger than those under the reinforcement option, due to the avoidance of reinforcement costs. The value for accelerating the connection of additional capacity by one year has also been estimated with a positive NPV (including or excluding embedded benefits). The study also shows that suppliers are those with the largest proportion of embedded benefits and generators with the lowest. This should give scope for generators to negotiate cheaper connection costs.

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