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Distributed Generation: Opportunities for Distribution Network Operators, Wider Society and Generators

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Different studies have evaluated the impact produced by the integration of more distributed generation (DG); however the distribution of these benefits across the different parties is still a work in progress. Through this study we examine the distribution of these benefits, who benefits the most and to what extent. A cost-benefit analysis is conducted for this purpose.

We evaluate this in a specific constrained area operated by UK Power Networks. The aim of this paper is to evaluate the opportunities across the parties (e.g. DNOs, generators and wider society) when connecting more DG within a distribution network. This study quantifies the most relevant benefits from facilitating earlier and greater quantities of DG by examining the difference between smart connection arrangements (where DG is offered a cheaper but interruptible connection) and conventional connection arrangements (where a 100% export guarantee exists) in the face of network constraints.

The analysis is focused on a constrained area of the March Grid (in the East of England) operated by UK Power Networks. This area has been selected (due to increasing DG) by the DNO to be the trial area of the Flexible Plug and Play project. Benefits include DG incentives and the profits for connecting DG units (including embedded benefits). In addition, the paper introduces a *smart connection incentive* (to be paid by the generators to the DNO) in order to encourage quicker and cheaper connections.

The paper provides a brief explanation of the regulatory framework associated with DG in Great Britain, focussing on market structure and ownership, incentives and types of connection charges. It evaluates the impact that DG produces on distribution networks and wider society, and analyses the most relevant technical, regulatory and commercial challenges and opportunities for DNOs. We describe the methodology for quantifying the benefits and show the results applicable to our case study area (Flexible Plug and Play trial).

One of the main contributions of this paper is the use of real data in terms of the cost of network investment and electricity delivered for each generator across different connection scenarios (for the amount of DG capacity). Different kinds of benefits have been identified and allocated across the parties. We find that electricity generator benefits exhibit the highest proportion of the total benefits. This means that generators are those that benefit the most when the smart connection option is selected.

Our results suggest that the introduction of a *smart connection incentive* payable by distributed generators to DNOs may help to allocate more efficiently the distribution of the benefits from connecting more DG capacity. This incentive payment is calculated as a per MW DG capacity one-off charge. We suggest how this charge might be calculated and show what effect it would have on the distribution of overall benefits. The *smart connection incentive* we propose may also contribute to the reduction of network upgrade or reinforcement costs which usually are borne by customers.

Overall, this study shows the existence of potential monetary benefits to DNOs (with a focus on UK Power Networks) due to the implementation of DG under a new (smarter) business as usual DG connection regime. In addition, this study has quantified the benefits that the FPP trial or similar projects may transfer to wider society. The methodology proposed in this paper for the estimation of benefits can be broadly applicable in similar contexts. Our analysis forms part of the calculation of the full NPV to a DNO of connecting more DG.

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