THE ROLE OF DISTRIBUTION NETWORK OPERATOR IN PROMOTING COST-EFFECTIVE DISTRIBUTED GENERATION: LESSONS FROM THE UNITED STATES FOR EUROPE

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ABSTRACT

This paper explores the different competitive mechanisms applied by electric utilities from the US in promoting cost-effective Distribution Generation (DG) resources and the challenges that they face due to the increase in DG connections. Cases studies from California, Oregon, Colorado and New York are discussed. The case studies refer to two kinds of competitive mechanisms: Request for Proposals (RFP) and auctions (Renewable Auction Mechanism). The study proposes an auction design with a focus on the UK context and examines the role of energy regulators in auction mechanisms. We think that the experience cited in the four case studies can be replicated by the Distribution System Operators (DSOs) from Europe; however unbundling rules established in the EC third package need to be taken into consideration.

INTRODUCTION

The integration of distributed generation in the electricity grid is challenging Distribution System Operators (DSOs or Distribution Network Operators (DNOs) in UK) in the search of innovative ways to connect them in a cost-efficient way. DSOs play an important role in their integration and are required to look for different procurement mechanisms in agreement with their needs and regulatory environment. In Europe, DSOs are subject to specific unbundling rules based on the Directive 2009/72/EC-Electricity Directive). The Directive requires the separation of the vertically integrated energy firms, this means from those activities not related to distribution such as generation, transmission and supply. DSOs with less than 100,000 are excluded from the Directive.

In the UK, DNOs are dealing with the substantial increase in DG connection applications and low rates of acceptance of connection offers. Potential DG customers that apply for connections are required to be considered on a first-come first-served basis. National policies do not allow the implementation of competitive mechanisms by DNOs, for the integration of DG within the distribution grid.

This study explores different experiences of decentralised competitive mechanisms in the US that promote the connection of renewable capacity with a focus on distributed generation. A proposal for an auction design elements is provided applicable to electricity distribution utilities from the UK.

COMPETITIVE MECHANIMS FOR THE PROCUREMENT OF GENERATION RESOURCES IN THE US

Four case studies from the US have been analysed. This involves the evaluation of competitive procurement methods used by different electric utilities that operate in California, Colorado, Oregon and New York. Some figures regarding these electric utilities are shown in Table 1.

Table 1: Electric Utilities' Characteristics

Company	State	Customers (million)	Lines (miles)
Southern California Edison (SCE)	California	4.9	103,000 dist. 12,000 trans.
Public Service Company of Colorado (PSCo)	Colorado	1.4 electric 1.3natural gas	10,000 dist. 4,000 trans.
Portland General Electric (PGE)	Oregon	0.8	25,000 dist. & trans.
Long Island Power Authority (LIPA)	New York	1.1	8,850 overhead. 4,661 underground

Source: Companies' websites.

Our selection is based on the extensive experience that the US has in the procurement of renewable and non-renewable energy sources conducting by electric utilities (decentralised auctions). The four states are among the ones with the highest rates for their RPS. The initiatives allow competition between technologies within the same category (i.e. wind versus solar PV) and between

different technologies (i.e. non-renewable versus renewable). In addition, one of the initiatives is a simplified market- based procurement mechanism (RAM), while the other three relate to the well-known RFP approach. For further details about additional methods see NREL (2011).

RFP, the main regulatory instrument that promotes generation of electricity from renewable sources in the US, involves a more complex evaluation process. This process is subject to qualitative and quantitative evaluation criteria and requires - in many cases - the use of computer modelling for identifying the most cost-efficient portfolio. In addition, RFP may refer to a specific renewable energy resource or a combination of both renewable and non-renewable energy resources. RFP is also associated with the procurement of renewable generation for large-scale generators. Three out of four electric utilities use the RFP approach. RAM is only applicable in California and similar to the other three cases, the mechanism has been approved by the Public Utility Commission. RAM is mainly focused on small and medium scale-generators and the selection of bids is mainly driven by price alone. In both cases the bid price (non-negotiable) includes not only the product price but also any additional costs such as transmission upgrade costs (if required), O&M, ancillary services. This encourages the selection and implementation of the least expensive projects in terms of tariffs and connection costs. A comparison of the different competitive mechanisms applied by the four electric utilities is made in Table 2.

Table 2: Competitive Mechanisms – Comparison Table

Auction name	Firm	Cap. total (MW)	Cap. per project (MW)	Length of contract (years)
RAM	SCE (CA)	1,330	Mar-20	5,10,20
2013 all solicitation	PSoC (CO)	719	Up to 10	1 to 25
2012 renewable energy resources	PGE (OR)	101	Up to 10	10-20+
RFP for 280 MW of renewable capacity and energy	LIPA (NY)	283	2-283	20

Sources: CPUC (2010), LIPA (2013), PG&E (2014), PSoC (2013), PGE (2012), SCE (2014), SDGE (2014).

In addition, the solicitations require the appointment of an independent evaluator by the electric utility (for managing the bid solicitation), deposits (development security and performance assurance) and bid evaluation fees (variable depending on installed capacity or a fixed amount per proposal submitted). In terms of valuable information for potential DG customers, all solicitations require the publication of the Power Purchase Agreement (which helps to accelerate the evaluation of the different offers). In addition, and only under the RAM approach, interactive maps with relevant information about the status of the distribution network are also available online.

APPLYING COMPETITIVE CONNECTION ARRANGEMENTS IN EUROPE

RFP and RAM represent two different well-developed competitive mechanisms that allow the selection of the most cost-efficient energy projects. For instance, in RAM it has been shown that the average bid price from consecutive auctions has decreased over time. These two schemes also represent well-documented decentralised competitive mechanisms carried out by electric utilities. Even though, these have been applied by vertically-integrated electric firms, we think that a similar auction design can be put in place by the DSOs from Europe taking into consideration the EC third package. DSOs with more than 100,000 customers (CEER, 2013) are not allowed to purchase electricity. However, this fact does not prevent these DSOs from implementing similar competitive mechanisms. One way is to allow DSOs to allocate only connection capacity, where the cost of connection is bid. The other way is by conducting a competitive mechanism in association with a local supplier where the bid price will include not only the connection costs but also the purchase of energy by a third party supplier (which could be a licensed electricity supplier or a national government energy procurement authority). Thus, the difference between our case studies and this specific case is the nature of the counterparty to the contract (three instead of two). For vertically integrated DSOs with less than 100,000 customers, of which there are around 2,347 (CEER, 2013), a similar approach to RAM can be followed, which represents the most straightforward approach. Countries where the unbundling rule has already been transposed into national law (11 out of 24, as of July 2012), may represent suitable places for the application of decentralised auction mechanisms. The implementation of competitive mechanisms is also in line with the aim of the EC third package, especially in keeping prices as low as possible.

Competitive mechanisms, not only help with the selection of the most cost-efficient projects and depending on their periodicity (i.e. just two auctions every year), might also help the DSOs to manage the increase in the number of DG connection enquiries and related issues (i.e. large number of speculative connections and low rate of connection offer acceptance). For instance in Great Britain DNOs are required to connect DG facilities on a first-come first-serve basis and to facilitate competition in supply by allowing licensed suppliers to use their distribution network for the transport of energy from the

transmission system (or DG) to customers. UK Power Networks, the largest DNO in Great Britain, indicates that the number of DG connection enquiries has increased significantly, from 208 in 2008 to 6,879 in 2013. Most part of enquiries refers to photovoltaic technology (87.8%) followed by wind (6.2%). Another GB DNO, Northern Powergrid (NPG), has also shown a large increase in the number of enquiries, from 1,300 in 2010 to 5,300 in 2012 (NPG, 2012). This demonstrates the challenge that DNOs are facing in providing quotes within the timelines set in the Guarantee Standards of Practice (GSoP). UK Power Networks is also the DNO with the lowest rate of acceptance of DG connections, 5.5% and 7% in 2012 and 2013 respectively. Scottish Power has a rate above 80% and Scottish and Southern Energy a rate of 40% (OFGEM, 2012). In other European countries, similar behavior would be expected, especially in those countries where renewable energy sources have priority connection to the grid system. Among these countries are Germany, Italy, Portugal, Belgium and Spain (RES LEGAL).

A proposal for a competitive mechanism for connection under unbundling

Another option to accelerate lower cost connection in Europe, in the context of the third package, is to simply have an auction for connection to the DSO network. This takes existing subsidy regimes for renewable generation as given (e.g. the presence of a national FIT). An auction process is then used to allocate the available capacity for connection of new DG at a particular POC. Each DG bids a maximum willingness to pay per MW of connected capacity, subject to a minimum value which covers the cost of connection. Scarce connection capacity can be allocated on the basis of the highest firm bids for connection at each POC. An example of such a competitive mechanism design elements applicable to the UK context is shown in Table 3.

In relation to the product, the process is open to any kind of technology (renewable or non-renewable). There is no specific requirement in terms of the generator size. This mainly will depend on the available capacity at each POC, pre-determined site, to be specified by the DNO. Regarding the counterparties, they would be the DNO and the DG customers and a connection agreement would be required. If the energy price is also included in the bid price, a third party (e.g. suppliers, trading party, system operator) would be required because DNOs are not allowed to purchase energy from generators and a PPA would be also necessary (ELEXON, 2013). In terms of the evaluation and selection criteria, and in agreement with the case studies analysed, we also recommend a set of pre-qualification criteria (without scoring) in order to select those generators with the highest chance of actually connecting. In the presence of network constraints, generators may be subject to the reduction of their generation output (curtailment). There are different curtailment methods (called Principle of Access), among there are LIFO, Pro Rata and Market-Based (Anaya and Pollitt, 2014). If a market-based approach is selected, compensation or any other incentive to generators should be defined in the connection agreement.

Table 3: Competitive Mechanism Auction Design (UK)

Concept	Competitive Mechanism
Product	Only DG connections All technologies (renewable/non-renewable) Generation size: subject to the capacity estimated at each Point of Connection (POC)
Counterparty	DG and DNO
Selection criteria	Pre-qualification criteria and connection cost (£/MW) Highest offers (connect now) or bids are the ones selected first Operational date: no more than 2/3 years
Curtailment	Methods: LIFO/Pro Rata, no compensation In case of Market-Based (compensation schemes)
Number of auctions/year	2
Independent evaluator	Yes
Evaluation fee	Yes (£/MW) with option of refund to those that bid at least once (but are no winners). Online payment.
Deposits	Yes (development security, performance assurance)
Submissions	Proposal to be submitted online
Online material	Spreadsheets: as reference for estimation of potential revenues. Pro Forma Connection Agreement Interactive network connection map with potential POCs

1/ LIFO (last-in first-out: the last on the list is the first to be curtailed), Pro rata (curtailment is equally allocated among all generators), Market-based (generators compete to be curtailed by offering a price based on market mechanism).

Similar to the RAM scheme, we would suggest carrying out 2 auctions per year and also give preference to those projects that are able to connect within the two or three years of the connection agreement. The appointment of an independent evaluator provides more transparency to the bidding process, equal treatment among bidders, sets standard evaluation criteria, and provides equal access to relevant information and documents (online). We think the experience of SCE, PSCo and PGE suggests an

independent evaluator is a good idea. The collection of bid evaluation fees would reduce speculative DG connection proposals. We suggest a payment based on the nameplate capacity (£/MW) with the possibility of refund if generators place winning bids. Deposits (for development security and performance assurance) should also be required to increase the chance of selecting the DG customers that can meet their obligations to generate as set out in the connection agreement. The absence of penalties was one of the major problems of the previous renewable auction regime in the UK (under the Non Fossil Fuel Obligations) (Pollitt, 2010). We also encourage online submissions and the provision of relevant information (spreadsheets, pro-forma contracts, interactive maps) that may facilitate the proposal submissions and evaluations.

Even though the example given is in relation to the UK electricity market, we believe that a similar approach can be replicated by other DSOs from Europe taking into consideration the third package rules. In terms of the auction methods, from the cases studies, a sealed non-negotiable bid is the method selected in the majority of cases with the option of negotiation in only one case. However, Del Rio and Linares (2014) suggest that for renewable auctions a hybrid approach composed of descending-clock phase (price discovery) followed by sealed-bid (for preventing collusion) is the most desirable. The advantages and disadvantages of these or additional methods are considered elsewhere. For further details about the different auction methods see Klemperer (1999).

CONCLUSIONS

Public Utilities Commissions in the US (which enforce the state-level regulation at distribution and transmission level) play an important role in the development of different competitive or non- competitive approaches that electric utilities have implemented to achieve the RPS targets for each state. We have observed similar behavior across electric utilities (private and public) in the way in which competitive competitions such as RFP or auctions (e.g. RAM) are being managed.

Similar to the Public Utilities Commissions from the US, energy regulators in Europe would be very involved in the design of the new competitive mechanisms discussed in this paper. They already regulate national auction regimes and could readily oversee more decentralised competitive strategies that allow DSOs to manage more efficiently the increase of DG connections taking into account the EU third package rules.

Acknowledgments

The authors wish to acknowledge the financial support of UK Power Networks via the Low Carbon Networks Fund's Flexible Plug and Play Project. In addition, the authors are very grateful to Southern California Edison, Public Service Company of Colorado and Accion Group for their valuable clarifications and data provision. The views expressed herein are those of the authors and do not necessarily reflect the views of the EPRG or any other organisation that is involved in the Flexible Plug and Play Low Carbon Networks (FPP) project.

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