UNIVERSITY OF CAMBRIDGE | Energy Policy Research Group

Procurement Options for Distributed Generation Resources by Electric Utilities: What Distribution Network Operators can learn from competitive mechanisms

Karim Anaya and Michael Pollitt

EPRG, University of Cambridge

20 January 2013

Contents

1. About the paper

"Procurement Options for Distributed Generation Resources by Electric Utilities: What Distribution Network Operators can learn from competitive mechanisms"

Aim: To evaluate the different mechanisms for the procurement of distributed generation resources by electric utilities, and explore the options for DNOs for the implementation of competitive mechanisms that encourage the connection of more DG customers in a cost-efficient way.

Research question:

What options do DNOs have for connecting more DG customers in a more efficient and competitive environment?

2. Distributed Generation in the UK

a. Definition

Generation units connected to the distribution grid (in the UK up to 132 kV)

b. Types

- Energy sold to suppliers/system operator
- Energy that serves customer load (net metering)

c. Incentives and Subsidies

- Feed in Tariffs – FIT (up to 5 MW)
- Renewable Obligations – RO (over 5 MW)
- Contract for Difference (CfD) FIT: will replace RO in 2017

2. Distributed Generation in the UK

Others

- LCNF (Low Carbon Network Fund)

Provide support to DNOs (up to £500m) for the deployment of trials of new technologies and commercial initiatives

- IFI (Innovation Funding Incentives)

Encourage DNOs to promote research and development activities with a focus on technical development projects

- DG Incentives – recovery mechanism

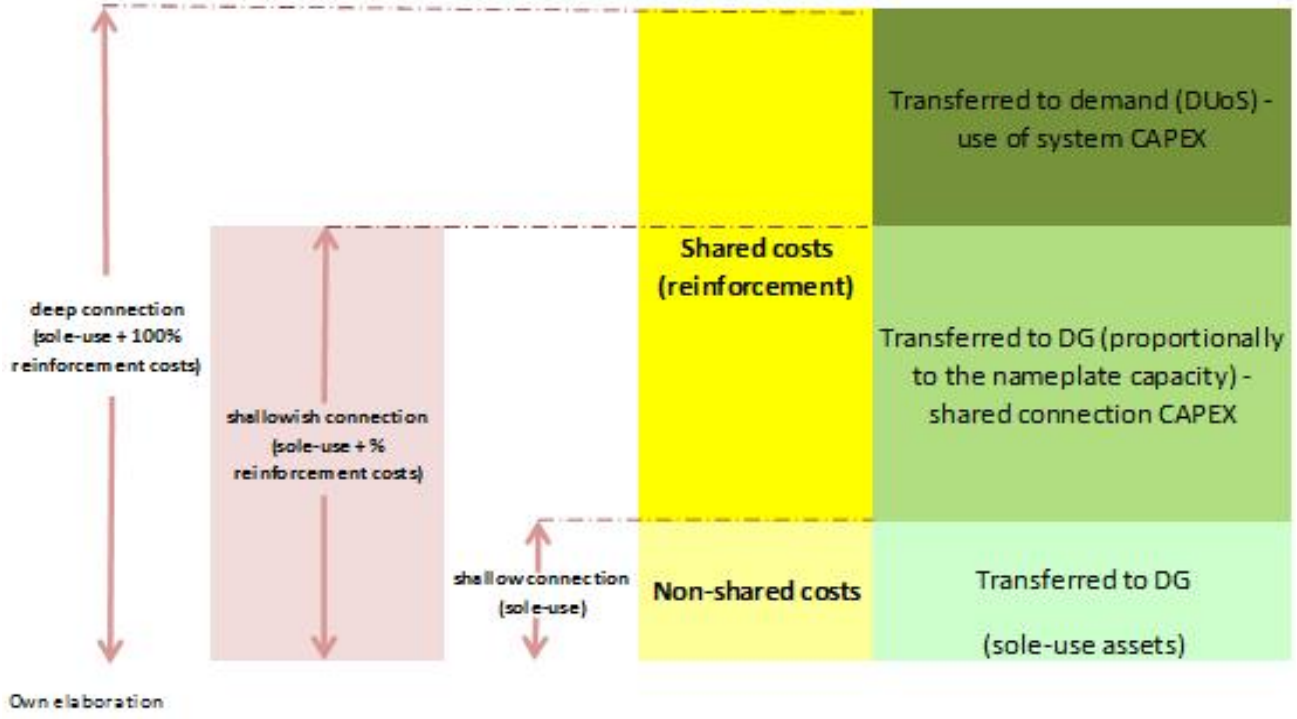
Reduce the risk to DNOs and customers of bad forecast of distributed generation volumes and costs

To be removed next year. No longer required given the package of measures sets in RIIO-ED1

2. Distributed Generation in the UK

d. Connection charges : shallowish connection (sole-use assets + % reinforcement costs)

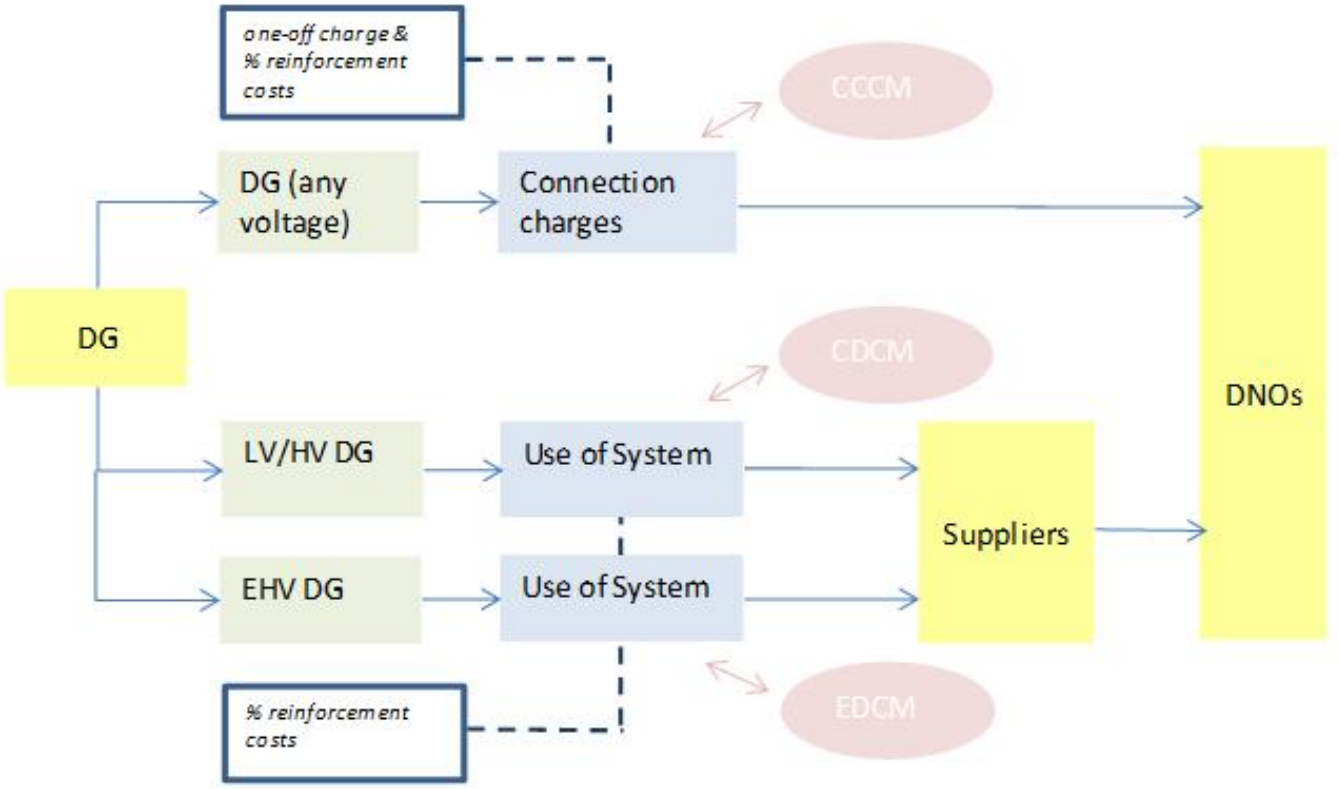
Fig. 1: Types of Connection Charges



2. Distributed Generation in the UK

e. System charges : on-going charges, introduced in 2005

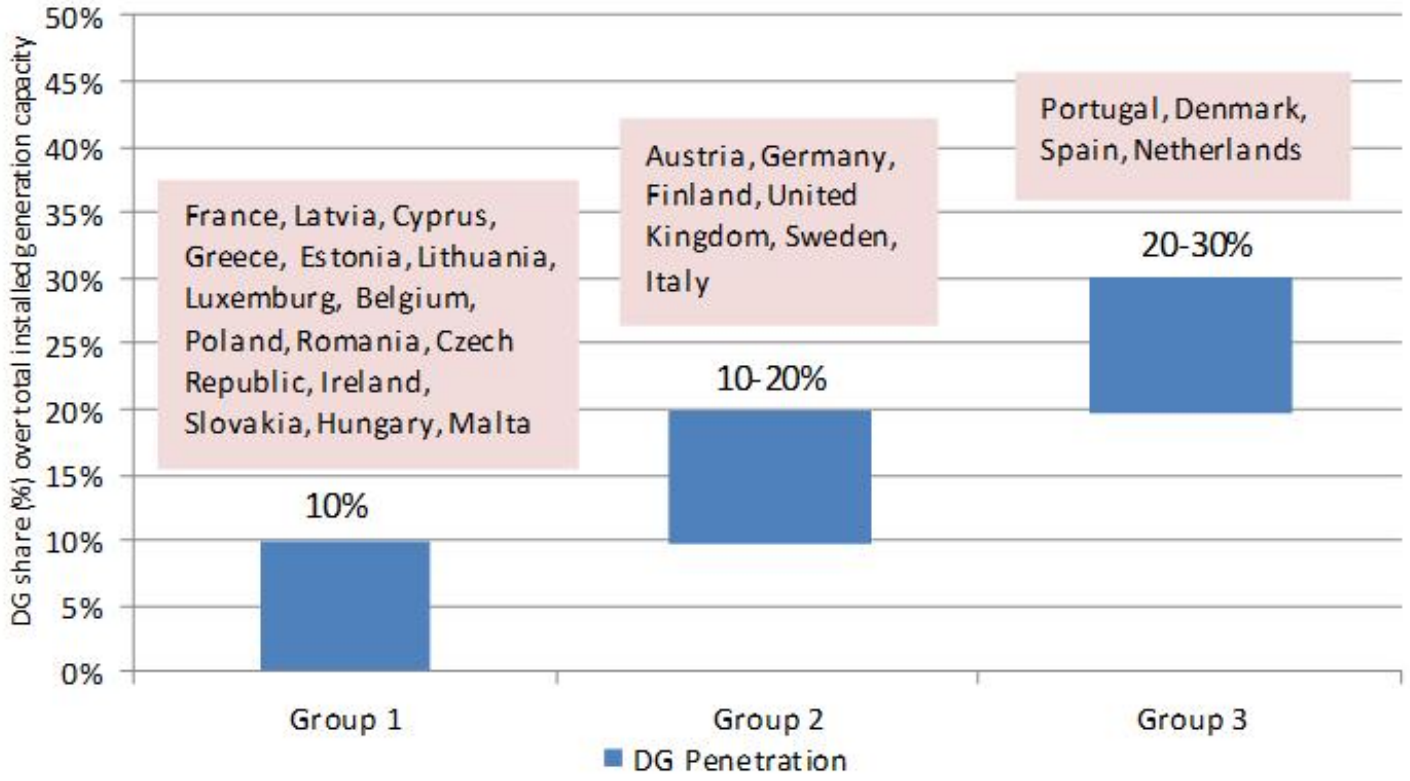
Fig. 2: DG Connection and Use of System Charges



Own elaboration. Source: Connection and distribution charging methodologies from utilities.

2. Distributed Generation in the UK

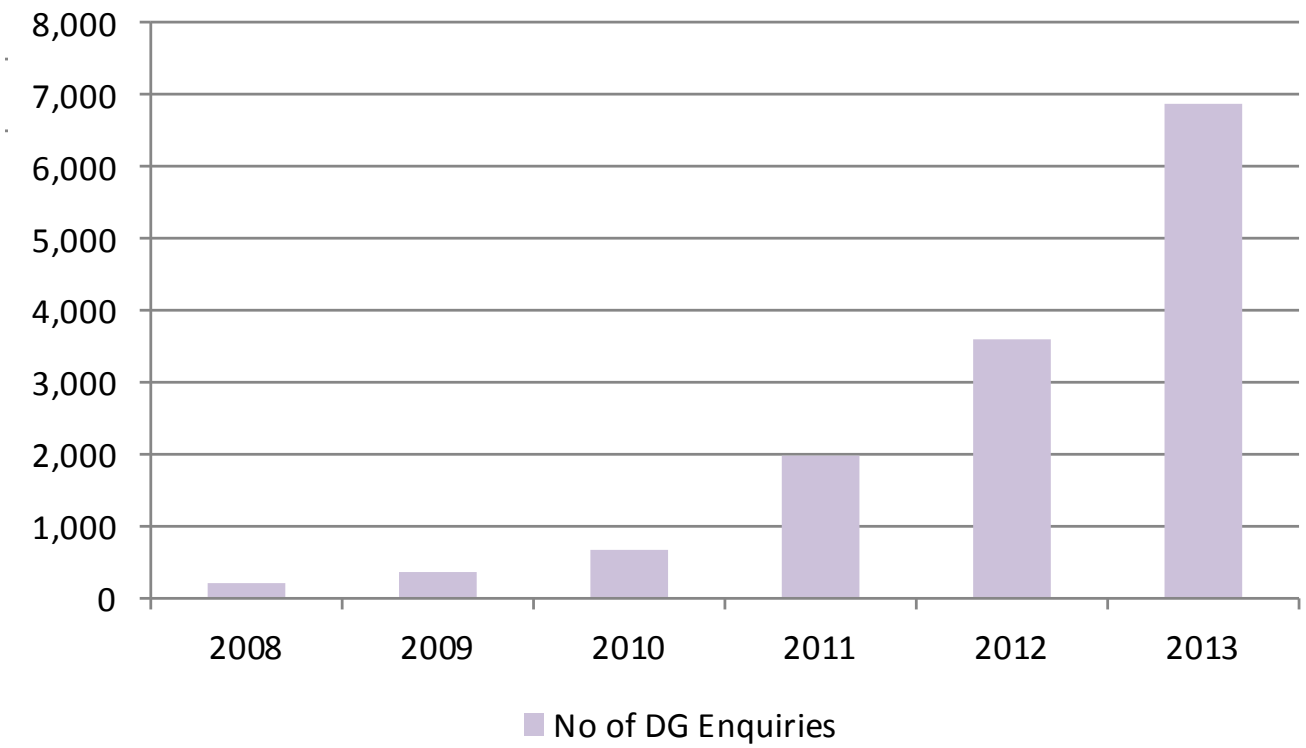
Fig. 3: Penetration of Distributed Generation in EU-27 MS (2008)



Own elaboration. Source Ferreira *et al.* (2010)

2. Distributed Generation in the UK

Fig. 4: No of DG Enquiries period 2008- 2013 (UK Power Networks)



Source: UK Power Networks

Share (2013):

84% solar PV
5% wind

3. Background on Procurement Options

a. Based on the USA experience
b. Description of four methodologies:
- Request for Proposal (RFP)
- Feed-in Tariff (FIT)
- Auctions
- Bilateral Contracts

c. RFP and Auctions:
- Competitive mechanisms, search of most cost-efficient projects, subject to high transaction costs
- RFP: usually with a focus on medium and large projects, evaluation: quantitative and qualitative. RFP is the most popular mechanism (RPS)
- Auctions: usually with a focus on small/medium projects, evaluation: only quantitative. Example: Renewable Auction Mechanism

d. FIT: tariffs are set administratively, adjusted periodically (subject to degression rates), low transaction costs. Restricted to seven states
e. Bilateral contracts: agreement between two parties (buyer and seller), usually the price is not released, low transaction costs, but do not necessary reflect the most cost efficient PPA

4. Case Studies

a. Focus on the USA and on Wholesale DG (export capacity)
b. Based on the large experience that USA has on competitive procurement mechanisms (mandated by the Public Utilities Commissions)
c. States with high Renewable Portfolio Standards (RPS)
d. RFP (3) and Auctions (1)

Table 1: Case Studies

Company name	State	Customers (m)	Service territory (square mile)	Lines (miles)
Southern California Edison	California	4.9	50,000	103,000 (distribution lines) 12,000 (transmission lines)
Public Service Company of Colorado	Colorado	1,4 (electric), 1.3 (natural gas)	32,000	10,000 (distribution lines) 4,000 (transmission lines)
Portland General Electric Company	Oregon	0.8	4,000	25,000 (distribution and transmission lines)
Long Island Power Authority	New York	1.1	1,230	8,950 (overhead), 4,661 (underground)

Sources: PGE (2012a), SCE (2013a), Companies's websites.

4. Case Studies

Table 2: UK Power Networks Figures

UK Power Networks	Regions	Customers (m)	Service territory (square mile)	Lines (miles)
				28,583 (overhead)
	Total	8.1	11,261	85,749 (underground)
				21,126 (overhead)
	East of England	3.5	7,838	38,525 (underground)
				7,456 (overhead)
	South East	2.3	3,166	24,854 (underground)
	London	2.3	257	22,369 (underground)

4. Case Studies

Main Findings

Except from RAM, results from previous competitions are not published

Table 3: Total capacity under RAM

Utility	Total capacity allocated to each IOU (MW)	Capacity (MW) allocated				PPA Executed (capacity and numbers)			
		RAM 1 Nov-11	RAM 2 May-12	RAM 3 Dec-12	RAM 4 Jun-13	RAM 1	RAM 2	RAM 3	Total RAM 1-3
SCE	723.4	65	170.8	230	181	67 (7)	97 (6)	181 (11)	345 (24)
PG&E	420.9	105	147	132	82	63 (4)	120 (7)	115 (6)	298 (17)
SDG&E	154.7	20	45	52	23.4	15 (2)	38 (4)	42 (4)	94 (10)
Total	1,299	190	362.8	414	286.4	145 (13)	255 (17)	338 (21)	737 (51)

Source: CPUC (2013a,b), CPUC website. Own elaboration.

4. Case Studies

Main Findings

a. Product:

- Technologies: renewables with specific restrictions
- Total capacity: variable across utilites (250 MW, 100 MW, 283 MW…)
- Ownership: options to acquire the generation facility by the utility in some cases
- Capacity per project: RAM (3- 20 MW), PSCC and PGE (up to 10 MW), LIPA (2-283 MW, 40 MW biomass..)

b. Contractual terms

- Length of contract: variable between 1 and 25 years
- PPA pro forma: Yes (independent evaluator website), usually one for all products
- Deposits: Development security, performance assurance

4. Case Studies

c. Prices, bidding process and evaluation

- Individual/multiple proposal
- Quantitative and qualitative evaluation. RAM: only quantitative (lowest price)
- Independent evaluator (3/4)
- Bid evaluation fee (US$10,000 /proposal, US$ 100/MW up to US$ 10,000, US$ 5,000 (up to 20MW) or US$ 20,000 (higher than 20 MW)

d. Interconnection/connection and operational issues

- Interconnection/connection to transmission/distribution grid
- Transmission upgrades: reflected in the offer and usually incurred by the utility (or later refund to generator)
- Networks maps (only in RAM)

4. Competitive Mechanisms - Proposals

Rationality:

- Increase in the number of DG connection enquiries (high number of speculative enquiries) (UKPN: 6,879 enquiries in 2013)
- Low connection offer acceptance rate (UKPN: 5.5%)

***Proposal*: Competitive mechanisms for DG connections and PPA**

- A new way to accelerate DG connections in a cost-efficient manner and to manage the DNO queue
- Open to any kind of technology with a specific capacity cap per DNO (e.g based on renewable target) also with a capacity cap per project (e.g. up to 20 MW)
- Options:
  - Option 1: competitive mechanism for only DG connections
    Auction allocates connection on the basis of least cost to the DNO of connecting capacity
  - Option 2: competitive mechanism for DG connection and energy price
    Auction allocates connection and generation rights on the basis of least combined energy and connection costs

4. Competitive Mechanisms - Proposals

Table 4: Summary of Options *(cont..)*

Concept	Option 1	Option 2
Product	Only DG connections All technologies Generator size: From 1 MW to 20 MW Maximum capacity per auction: 200 MW	DG Connections + Energy Price All technologies Generator size: From 1 MW to 20 MW Maximum capacity per auction: 200 MW
Counterparties	Connections: DG and DNO	Connections: Energy supply: DG and DNO DG and supplier/trading party/NGET (preferred option: local supplier)
Evaluation criteria - quantitative (may include reinforcement)	connection cost Least costly connections connect first Weights: No Operational date: no more than 2/3 years Contestable works: Option to ask for different quotes (ICP, IDNO)	connection costs + energy price least costly (connections + energy price) connect first Weights: 50% (connections), 50% (energy price) or 40% (connections) and 60% (price)) Operational date: no more than 2/3 years Contestable works: Option to ask for different quotes (ICP, IDNO)
Evaluation criteria - qualitative	No	No
PPA contract	N/A	Fixed: 10 years

4. Competitive Mechanisms - Proposals

Table 4: Summary of Options

Concept	Both Options
Curtailment	Methods: LIFO/Pro Rata (FPP), no compensation In case of Market-based (compensation schemes/incentives) If generators are part of the BM, they may be compensated in case of curtailment
Number of auctions/year	2
Independent evaluator	Yes
Non-refundable evaluation fee	Based on forecast exported MWh (annual). Maximum fee may apply Online payment
Deposits	Yes (development security, performance assurance)
Submission	Proposal to be submitted online
Online material/requirements	Excel sheet: As reference for estimation of potential revenues Pro Forma Connection Agreement/ Power Purchase Agreement Documentation: Specifications of minimum documentation to be provided by the respondents to the DNO

5. Final Remarks

- The study has shown similar behaviour across utilities in the way in which competitive mechanisms are managed
- The proposed mechanisms (2 options) will help DNOs to deal with the large number of connection applications and the low rate of connection offer acceptance
- The proposed mechanism(s) represent one more option to DG to get connected in a cost-efficient and quick way. There is no need to propose any change to the current regulatory framework (DNO focus on connections and suppliers on the purchase of energy).
- Challenges: high connection and reinforcement costs, high transaction costs (small generators)
- Opportunities: cost-efficient mechanisms that will accelerate DG connections and that will contribute to the offer of lower connection costs (portfolio effect) – simultaneous applications for getting connected (2 per year)
- The feasibility of these mechanisms can be tested through the implementation of trials (LCNF, IFI)

5. Final Remarks

Next step: Evaluate the implementation of one(two) option(s) – online competitive mechanism simulation with EPRG and UK Power Networks:

Experimental Auctions

Research question: What is the trade-off between a competitive environment for DG connections and the business as usual option (first-come first-served)?

Design:

- Reverse English or Dutch Auction
- How it should be built up – “Buy-it-know” or participate in the auction
- Software: Z-Tree (from University of Zurich)
- What is the right size of the sample?
- What are we looking for: (1) lower connection costs, (2) quicker connections or (3) both

The END

Thank you!

Questions and Answers