



DG Forum: Innovating DG connections

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- Electricity North West
- What drives the cost to connect Distributed Generation?
- Innovating for Distributed Generation connecting at high voltage
- Innovating for Distributed Generation connecting at low voltage

Connecting the North West

We're not a big multinational we serve only the North West

We distribute electricity to approximately 5 million people at 2.4 million domestic and industrial locations consuming 25 terawatt hours of electricity annually

£9bn of Network Assets

- 58 000km of cable
- 15 grid supply points
- 96 bulk supply substations
- 363 primary substations
- 34 000 transforming points



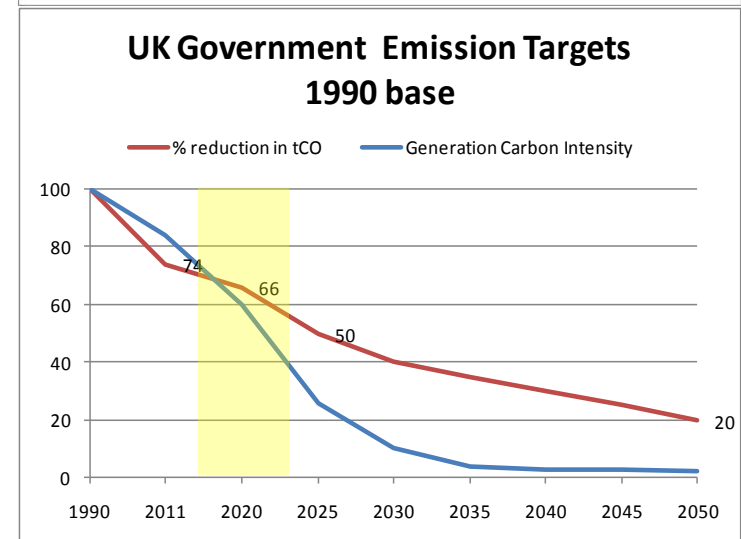
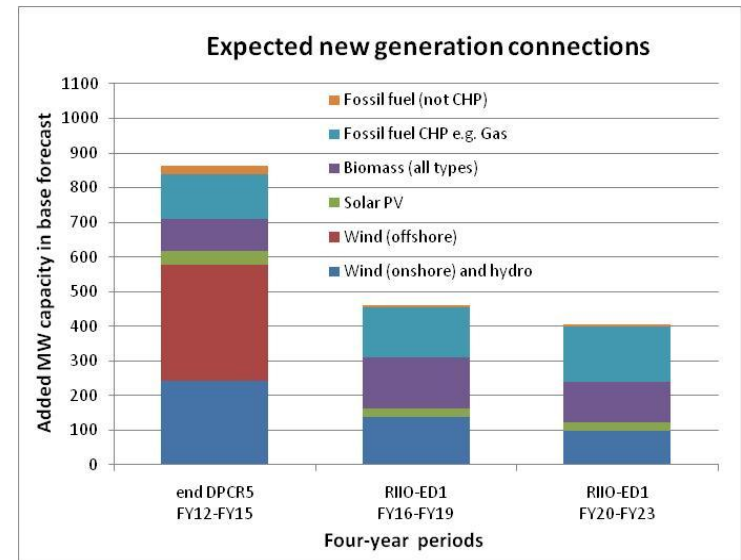
➤ DG is core to our business

➤ Connections Activity

- DPCR4 480 MW
- DPCR5 870 MW
- ED1 850 MW
- Total 2.2GW > 50% of our demand

➤ This is being driven by UK emission targets

- Red line – demand decarbonisation
- Blue line – generation decarbonisation
- ED1 will see a significant increase in DG on already congested networks



What drives cost to connect DG?

Voltage Level	Thermal constraints	Voltage constraints	Fault Level constraints	Harmonics constraints	Desired outcome
EHV	Generally security of supply issue	Can be managed by setting agreed operational parameters	Investment solution	Investment or managed output at margins	Flexible connections to minimise non safety related investments
HV	Not normally an issue	Voltage rise under extreme conditions	Investment solution	Not normally an issue	Voltage managed connections
LV	Not normally an issue	Voltage rise worst in electric heat areas	No issue	Little evidence of any issues	Improve voltage regulation on the LV main

- For small to medium scale onshore DG, voltage control and fault level account for the majority of costs
- As DG levels rise harmonic and thermal challenges must be overcome

Enhancing the capacity available from existing networks offers the lowest cost

- Where is the capacity ?

We developed some initial “heat maps”

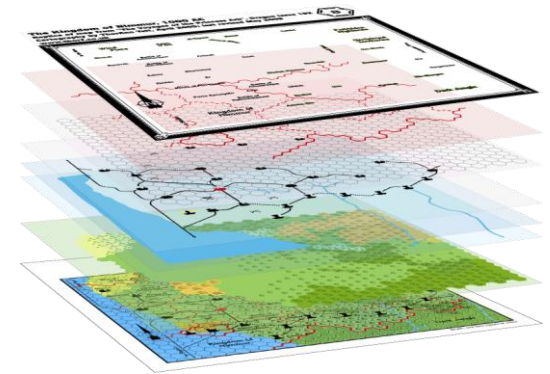
New development statement mapping wind, planning consent and capacity

- All or nothing ?

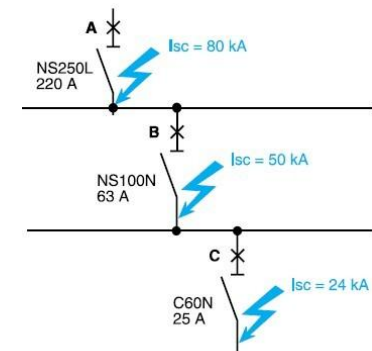
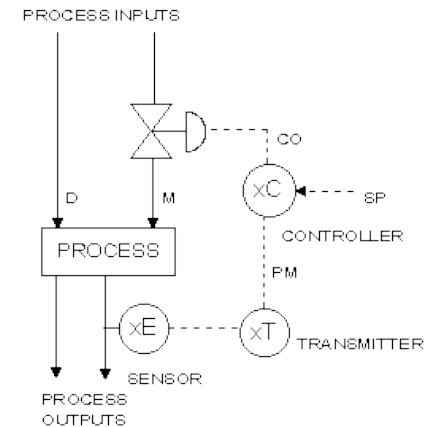
The formal application process can inhibit discussion on options around connection cost drivers as we have guaranteed standards applied to them

We now provide enhanced DG developers services to allow discussion and choice.

We now offer a wider portfolio of commercial offers: non managed, managed, parameter driven



- How can Smart Grid techniques be used to maximise energy output ?
 - Electricity North West Smart Voltage solution trials
 - Our C₂C Project uses meshed HV networks
 - Developing voltage managed output
- How can we manage Fault Level to avoid replacement of expensive HV switchgear ?
 - Upgrade units rather than replace all
 - Developing alternative protection options
 - Utilising Fault Current Limiters or other smart solutions



- ▣ How can multiple PV connections be facilitated?
 - We developed a “connect and manage” approach
 - We don’t assume the worst
 - Smart joints used to measure feeder voltages
 - We intervene only when proven problems

- ▣ We have connected 35MW of domestic PV without reinforcement



- DG does provide a challenge but I believe we are playing our part in meeting that challenge

- For larger developers, our focus is
 - To seek to provide you more information and options up front
 - To use technical and commercial innovation to seek to offer you a connection offer without any reinforcement

- For smaller developers, our focus is
 - To allow you to connect with minimum intervention from us