



Flexible Plug and Play

Sotiris Georgiopoulos

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Flexible Plug and Play

- Introduction of FPP
- The technical solution
- Commercial arrangements
- Customer engagement
- Thoughts on rollout

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Overview

Objective: Cheaper and faster connection of DG to constrained parts of the network by trialing smart grid technologies and smart commercial agreements

Duration: 3 years: January 2012 - December 2014

Project Value: £9.7 million (6.7m funding from LCN Fund)

Partners and Suppliers:

ALSTOM

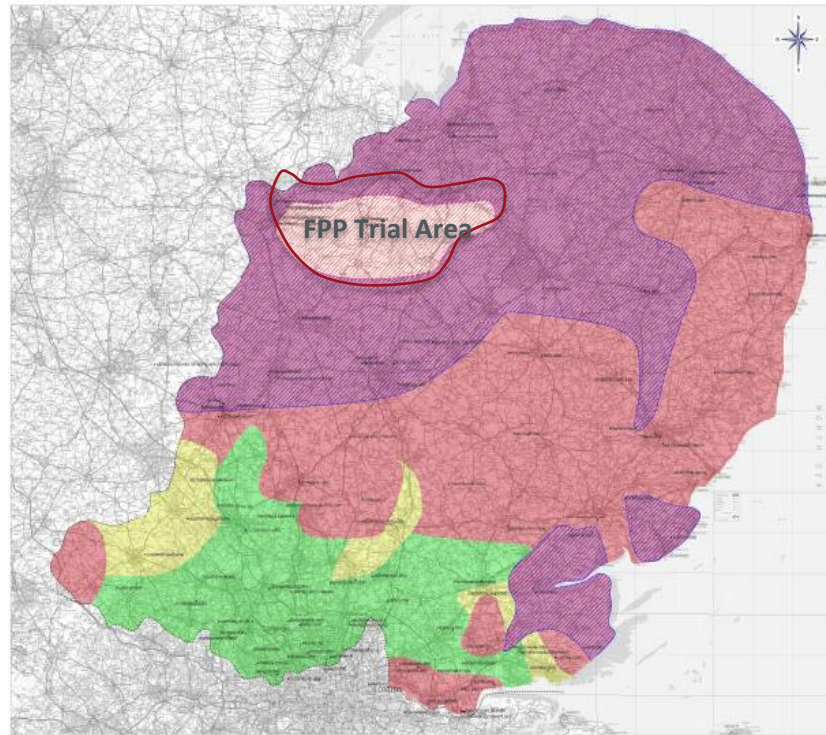
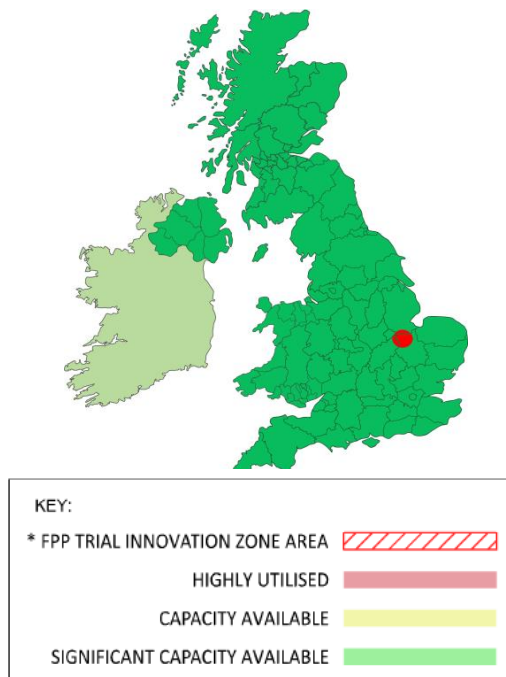


**Imperial College
London**



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Trial area



Location: Cambridgeshire

Surface: ~ 700km²

Network: 33kV and 11kV Network (2 Grid, 10 Primary substation sites)

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What have we achieved

What we have achieved

Interviewed 20
DG developers
Engaged with
50+

Trialling 2
principles LIFO
and Pro-Rata
Capacity Quota

36 offers made
12 offers accepted
34.88MW enabled
£ 25m savings

Analysis of
investment options
in DG dominated
networks

Commissioned
RF Wireless
Comms Network

Smart devices
commissioned:
DLR, AVC, ANM,
Protection across
12 sites

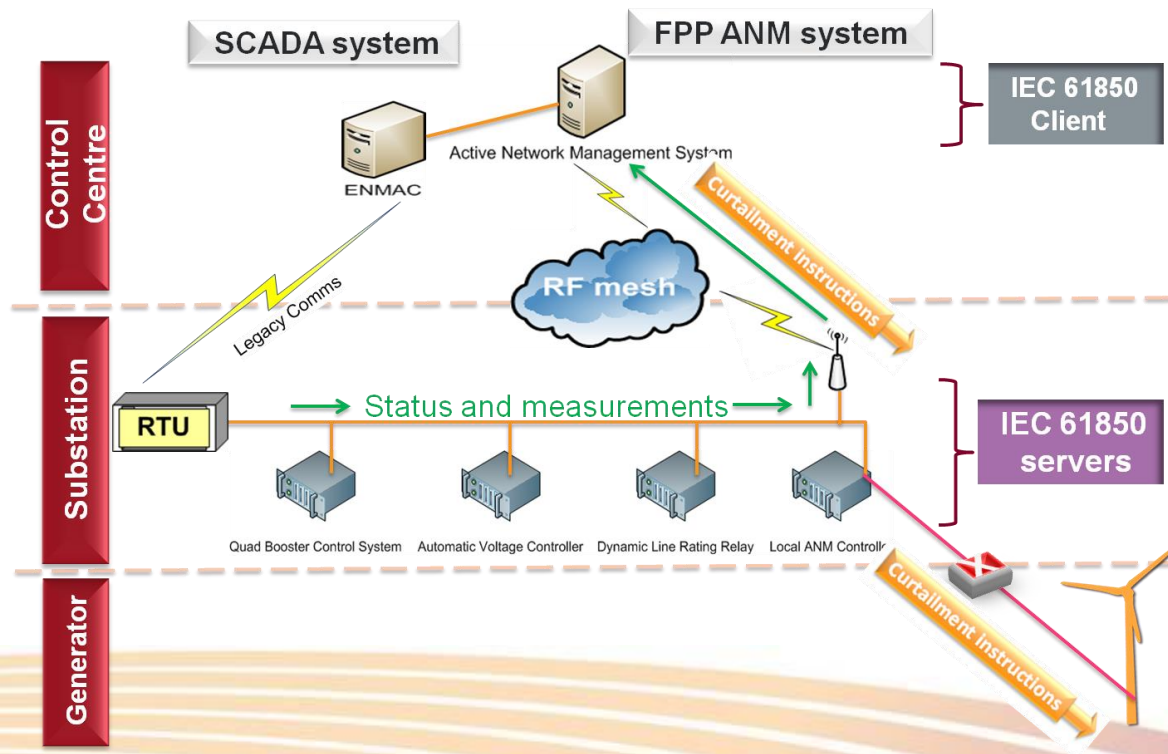
Installed and
commissioned first
QB at 33kV

Using IEC61850
for system
integration

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Technical solution components

- ANM refers to the software application that monitors the network in real time and sends signals to generators to reduce output to maintain the network within operational limits.

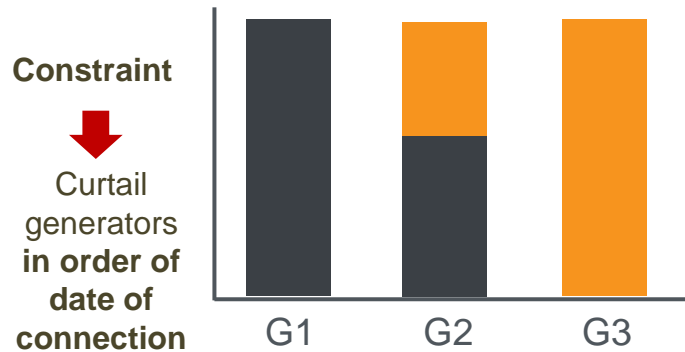


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Principles of Access trialled

- Mechanism for allocating curtailment between generators
- Pro-rata is applicable only to global constraints (i.e. reverse power across Grids/GSPs)

☐ LAST IN FIRST OUT



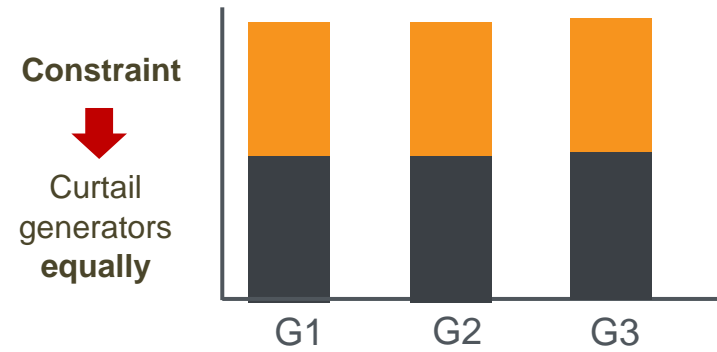
Connected

1st

2nd

3rd

☐ PRO – RATA



Connected

1st

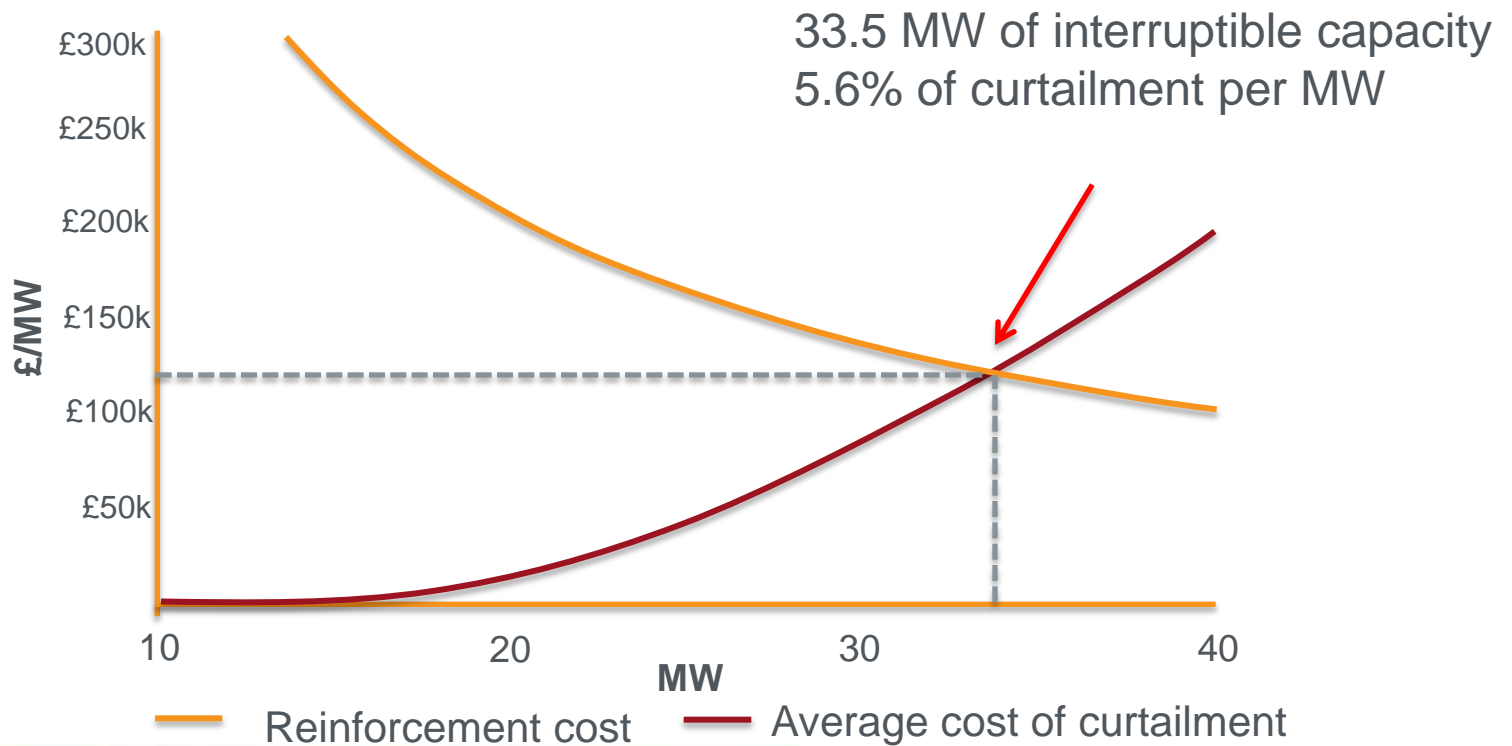
2nd

3rd

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Commercial arrangements – March Grid quota

- Determining available interruptible capacity – March Grid



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FPP Connection offer

- Available since March 2013 across the trial area
- LIFO and Pro-rata based on the Capacity Quota
- Based on existing legal templates

FPP Briefing Document	CONNECTION AGREEMENT Terms & Conditions	Connection Offer £	Curtailement Estimate
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Curtailement estimate

- Baseline provided based on historical demand and generation data for the area and UKPN assumptions
- Iterations following Customer's review
- If in a Queue, the curtailment estimate becomes now the interactive element

	Assumptions
<input type="radio"/>	Network Configuration
<input type="radio"/>	Demand Growth
<input type="radio"/>	Micro-generation growth
<input type="radio"/>	Capacity factor for generation connected
<input type="radio"/>	Number of constraints
<input type="radio"/>	Generation mix
<input type="radio"/>	Principles of access

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Customer engagement



- First customer (G's Fresh, 0.25MW, PV) on the network since June 2014.
- Another 2-3 projects are due to connect using FPP before the end of 2014.
- Certain projects have shown that they are willing to accept curtailment levels of up to 9.64% - higher than the project initially envisioned.
- Customers continue to request FPP offers, despite curtailment levels rising to around 20% for the last in the queue at March Grid.
- Total savings for customers approx. £25m.

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So, what if we were to do this across 40 FPP areas?

- ANM technology – demonstrated mainly at lower complexity EHV/HV semi-radial networks. Further development is required to develop scalability and accommodate HV/LV and complex networks in fully automated manner.
- Smart devices – QB, DLR, Protection (essential learning) – AVC, 61850 (valuable learning)
- Communications technology – a mix of existing and new communications solutions are required and these can work, investment is required though. The key is finding an optimal balance between the smart grid requirements and cost-effectiveness.
- Principles of Access – both solutions will be complex at scale, further thinking and development is required.
- Constraint estimates – as these currently stand, might be a barrier for full uptake.
- Reinforcement – currently the missing link, regulatory structuring required.
- Connection offers and agreements – extensive work has taken place, new terms have been introduced and these are well understood. “Constrained Connection” concept well understood.
- Ongoing system and customer management – a new challenge for Distribution Network Operators

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Concluding thoughts

- Significant progress over the last three years and V1 roll out underway
- The introduction of flexible connections impacts the DNO operations across its business (number of resources required, type of skills, systems, processes and technologies required to deliver).
- The roll out will be gradual to ensure that it is a managed process that does not expose the DNO or the customers at risk and will be based on the evolution of a technical and commercial road map and aligned with the Innovation Strategy.
- There will be additional costs incurred both for the further development of these solutions and their operational delivery from demonstration to transition to BAU and their full roll out.
- Benefit allocation should be considered, currently most financial benefit accrues to DG customers.
- There could be a benefit to DNOs by being able to “pool” the reinforcement and carry it out in a controlled manner provided suitable triggers are in place. How this mechanism works will be key on the evolution of constraint management.
- Flexible connections is at the core of the DSO evolution as it has the potential to lead to large scale active management of networks and new market arrangements.

Thank you