

# Flexible Plug and Play

**Funding mechanism:** LCNF Tier 2

**Funding amount:** LCNF: £6.7m  
UK Power Networks: £2m  
Partners: £1m  
Overall: £9.7m

**Status:** Live  
Start date: January 2012  
End date: December 2014



## Project concept/overview/challenge

Flexible Plug and Play (FPP) is a three year innovation project that has trialled new technologies and commercial arrangements in order to connect distributed generation (DG), such as wind or solar power, to constrained areas of the electricity distribution network.

It has successfully delivered greater flexibility to accommodate DG connections cheaper and faster than previously possible, as well as enabling conventionally unviable DG schemes to become feasible.

Key objectives have included:

- Development of 'flexible' connection agreements for DG developers.
- Installation of smart technologies (Dynamic Line Rating, Active Voltage Control, Remote Terminal Units enabled with IEC 61850 and an Active Network Management system) to maximise the use of the existing electricity network and allow real-time management of network constraints.
- Installation of the first ever Quadrature-booster on the 33kV distribution network. This is a mature technology that is currently used on the transmission network, but has been trialled on the 33kV distribution network to control active power flow on parallel lines.

## Stakeholder benefits

- Providing a cheaper and faster alternative to connect DG to constrained parts of the network.
- Enabling a platform for the integration of low carbon technologies onto the network.
- Making more efficient use of the existing network capacity, resulting in higher asset utilisation, less disruption from engineering works and lower emissions. With innovative new safeguards in place, the existing network can be safely operated closer to its capacity.
- Simplifying technical solutions that DG project investors can incorporate into their business models.

- Increasing the cyber security of the network by introducing technology to ensure the data is not shared on the public network.
- Sharing our learnings with other distribution network operators (DNO).
- Developing new skills and capabilities which will help make low carbon networks and smart grids across Great Britain a reality.
- Ensuring that the new technologies and commercial arrangements we have developed will be integrated into our business by the middle of 2015.

## What we have done/delivered

### Our customers

- Significant engagement with DG developers who have suitable projects in the geographical area in which the trial has been taking place in order that they can take advantage of the Flexible Plug and Play connection offer and benefit from the novel solutions that have been developed.

### Commercial Arrangements

- Thirty-two 'flexible' connection offers have been made to customers.
- Eleven customers have accepted these 'flexible' connection offers.
- Connections have begun to 'go live' using the new smart technologies.

### Smart technologies

- New telecommunications platform has been installed and successfully tested to allow the smart devices used in the project to 'talk' to each other using the data protocol IEC 61850.
- The first Quadrature-booster in the world to operate at 33kV has been installed and is working to successfully control active power on parallel lines.
- New smart control and monitoring technologies have been installed and are now working to maximise the use of the network.

### Sharing Knowledge

- Five learning reports have been produced with 3 more to be published at the end of 2014 (available at [ukpowernetworks.co.uk/innovation](http://ukpowernetworks.co.uk/innovation)).



- Four learning events have been held. These were filmed and are available to watch at [ukpowernetworks.co.uk/innovation](http://ukpowernetworks.co.uk/innovation)



### Findings

#### Customer engagement

- Transparency and engagement with customers has helped to develop the 'flexible' connection agreements.
- Explaining the curtailment arrangements of the 'flexible' connections requires a specific skill set to ensure the right level of customer service.

#### Commercial arrangements

- Customers are comfortable with expected curtailment levels resulting in a 3-5% reduction in expected annual output with some customers willing to accept a curtailment estimate of over 9%.

#### Telecommunications platform

- Communications solutions can be flexibly deployed within relatively short timescales.
- New understanding as to how to implement open standards such as IEC 61850 over wireless networks.

#### Quadrature-booster

- Important learning around the design, installation and protection arrangements required for a 33kV Quadrature-booster (first in the world).

#### Technical architecture and solution

- Valuable experience in the use of open standards, such as IEC 61850, for the overall integration of Active Network Management and smart technologies.

#### Commissioning of flexible connections

- Standardised communications protocols should be used for interfacing with the generator's control system.
- Bench testing of all interfaces should be carried out prior to final commissioning and connection to the generator's control unit.

#### Next steps

- **Customers:** We will continue to engage and sign up more distributed generation developers to the Flexible Plug and Play project.
- **Business integration:** This trial has been so successful, UK Power Networks has committed to the Flexible Plug and Play connection offer becoming a standard business service for our distributed generation customers before the summer of 2015.
- **Knowledge Dissemination:** We will continue to share the knowledge and learning we have gained from this project through learning events, academic papers, learning reports, industry forums and presentations at external conferences.

### Partners

