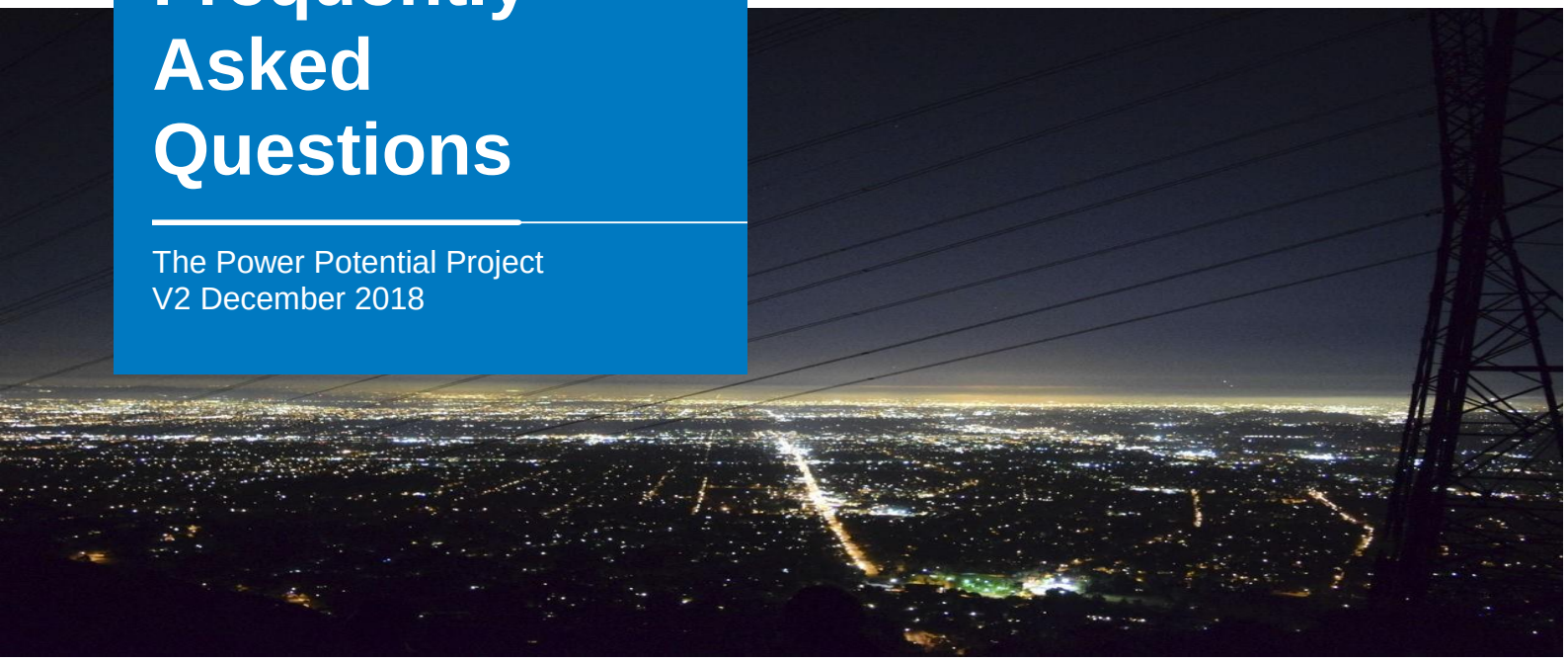
Frequently Asked Questions

The Power Potential Project
V2 December 2018



Email: box.PowerPotential1@nationalgrid.com
Website: www.nationalgrid.com/powerpotential

Introduction

This document has been written for all parties interested in the Power Potential project.

The Power Potential project aims to create technical and commercial solutions to maximise the use of Distributed Energy Resources (DER's) to resolve transmission voltage and thermal constraints within the south-east of England.

We have collated all questions received to date and included them in this document.

For more information on this innovation project, please visit the website to review the requirements for participation and trial participation documentation.

The document is split into technical and commercial questions related to the project.

Power Potential Technical Questions

What is DER effectiveness?

It is a coefficient, taking values between 0 and 1 and it represents the relationship between reactive power produced/absorbed at the DERs Point of Connection (POC) and the amount of it reaching a Grid Supply Point (GSP). This value depends on the distribution network configuration and the DER's position in relation to a particular GSP. Network configuration can change (e.g. due to outages or switching), resulting in DERs being most effective at a different GSP.

Will DERs bid per Grid Supply Point (GSP)?

The control platform for Power Potential (Distributed Energy Resource Management System - DERMS) will assign each of the distributed energy resources to the GSP at which they are most effective. DERs place a bid, which is then allocated to the most effective GSP by the DERMS, based on the distribution network configuration on the day for which bid is placed.

If DERs bid per GSP, could they also support another GSP?

Technically yes, but this is out of the scope of the project. For the purposes of the trials, the design decision was made that each DER will be assigned to a single GSP (where the DER effectiveness is maximum).

Can you clarify what is meant by 'DER on the fringe of the areas shown on the heatmaps would be of interest, especially for larger assets.'

Every site with installed capacity above 1 MW is welcome to participate in the project. If a DER is located on the edge of Power Potential area, its effectiveness to the trials GSPs might be low. However, the size of the asset can fully or partially compensate for low effectiveness. We encourage all DERs interested in the project to contact project team for more detailed information regarding their location in the distribution network and effectiveness.

Where can I find detailed heatmaps of the project area?

Heatmaps can be found in the *Guide to Participating* document in the *DER Market Information* folder on the Power Potential website.

Can the flow battery be used as an alternative to lithium-ion?

All DER technologies are encouraged to participate in the trials if they satisfy the requirements of the service they wish to participate in. There is no preference for any technology type.

What is the deadline for completing and submitting a Technical Characteristics Submission Spreadsheet?

The project is still accepting submissions to participate in the Power Potential trials. DER providers may be able to join the trial at any point during the trial year (2019). For more information about trials, please refer to the *Market Procedure* and *Framework Agreement* documents.

Can you comment on the bid size for wind farms (+/- 32% of the maximum export capacity)?

This capability range is a firm requirement for new DER connections. For existing DERs, the project is looking forward to receiving the plant technical capability information in order to accommodate it in the trials. Please specify this data in the *Technical Characteristics Submission Spreadsheet* indicating your interest in providing one, or both services.

Is droop control needed for synchronous plant?

For synchronous DERs, the response is expected to come from the generator's Automatic Voltage Regulator (AVR) in constant terminal voltage control mode. The AVR would intrinsically provide a droop-like control function at the high-voltage side of the generator step up transformer (without needing to build any function in it). The AVR would only need to control the generator terminal voltage by following a voltage reference set-point issued by the DERMS. The only additional consideration is to have under- and over-excitation limits in place.

Can I use a bespoke controller for the plant?

The plant controller should meet the requirements listed in the *DER Technical Requirements* document, available on the Power Potential website. How it is achieved (by procuring an off-the-shelf solution, upgrading an existing controller, designing a bespoke solution or any other approach) is up to the trial participant.

What is the criteria for being able to use the aggregator interface?

The main criterion is that the response to the control signal from UK Power Networks (and the DERMS) does not get significantly delayed with an additional network interface with an aggregator.

The DER's aggregator is expected to connect to the UK Power Networks IT infrastructure through a secure enterprise connection between the aggregator and UK Power Networks via Wide Area Network (WAN). At the moment, the aggregator interface does not exist as a standard connection in UK Power Networks' communications infrastructure design. As part of the Power Potential project, this interface is being developed to industry standards while engaging with the aggregators. Communications to the aggregator will be either via UK Power Networks Distribution Management System, PowerON, using the DNP3 Protocol, or directly from the DERMS via a web Application Programming Interface (API). Alternatively, an aggregator can interface their DER to UK Power Networks' infrastructure via the substation installation with a hard-wired or Local Area Network (LAN) connection between UK Power Networks' and DER's equipment, both installed within the DER's substation premises. More details on the communication requirements can be found in the *DER Technical Requirements* document available on the Power Potential website.

How are the system operational modes commanded?

Regarding DER's operating mode, section 3.7 in the *DER Technical Requirements* document establishes the expected mode of operation for DERs depending on the services that it is participating in. The interface signals to enable these control options are captured in appendix 6.1 and will be issued by the Power Potential control software (the DERMS).

What does 'arming a DER' mean?

The DERMS instruction for availability will be issued 2 minutes before the contracted period starts. It will arm the DERs in voltage droop control mode for the whole window, using a droop characteristic. In this case, the instruction is issued to change the DER's operating mode from power factor (p.f.) control to voltage droop control and it will consist of a droop slope (gradient) value (likely to be fixed at 4%) and a voltage set-point (which can be adjusted by the DERMS).

How often will the voltage set-point and voltage response gradient be changed?

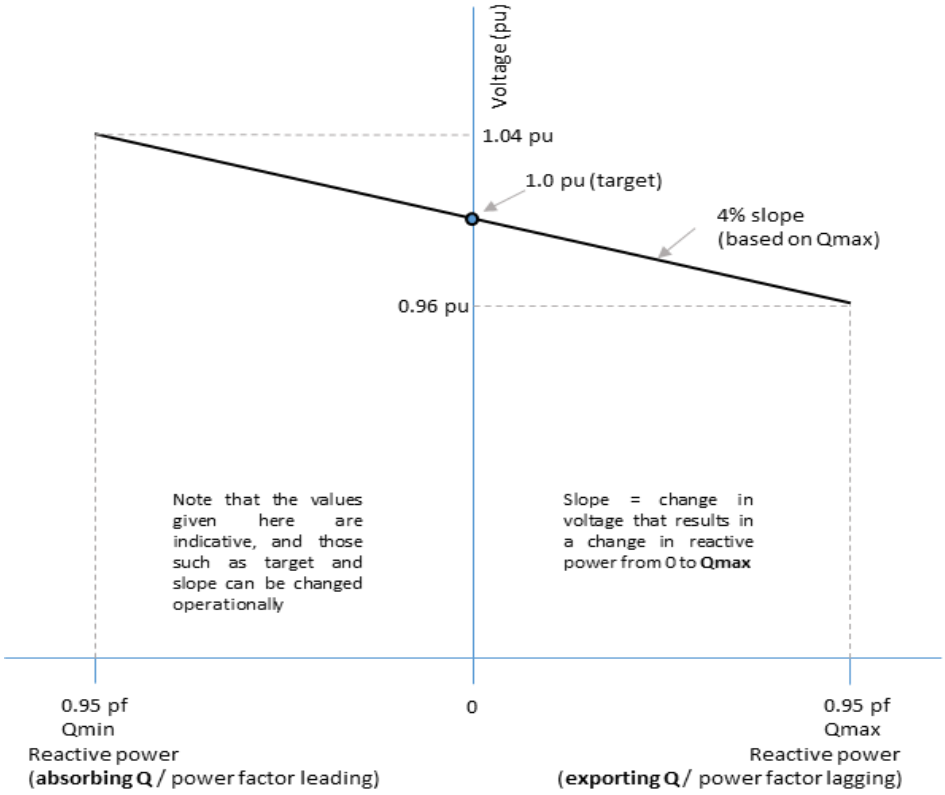
When a DER is armed (put into voltage droop control mode by the DERMS), but not dispatched for utilisation, voltage set-points will be adjusted to maintain the DER's operation at its nominal p.f. level (automatic adjustments due to changes in the DER's active power output or due to grid voltage changes). When a DER is dispatched for utilisation, voltage set-point changes will be driven by National Grid instructions (coming from a control engineer and expected to be in the order of 5 times per night, but can vary depending on the trialled scenarios). Voltage gradient is not expected to change.

Does the 4% gradient mean that Vt + 4% = full Q import and Vt - 4% = full Q export?

A 4% droop gradient means that a 4% voltage deviation causes a 100% change in reactive power output. This corresponds to a change from 0 to Qmax or from 0 to Qmin, with Qmax being defined as the reactive capability corresponding to 0.95 lagging power factor at rated MW power and Qmin as the reactive capability corresponding to 0.95 leading power factor at rated MW power. This is not equivalent to the DER's full reactive power import/export capabilities (although it might be in some cases).

Let's walk through an example; figure 1 (on the next page) shows the voltage droop control of a generator with defined limits of 0.95 power factor leading and lagging capability. In the example, there is a target of 1pu and a slope of 4%. If the point of connection voltage is at 1pu, the generator will operate at unity power factor (0 Mvar) at the point of connection. If the point of connection voltage drops to 0.96pu, the generator will export Mvar equivalent to 0.95 power factor (calculated based on rated MW). If the voltage at the point of connection voltage increases to 1.04pu, then the generation plant will import Mvar equivalent to 0.95 power factor.

Figure 1: Voltage droop control of a generator



Will a faster response speed lead to more utilisation?

It is not expected that faster speed of response would lead to more utilisation under the reactive power service, since DERs are required to meet specific response time requirements to participate in the this service. DERs should can move their operating point and change reactive power output from 0 to 90% of its maximum export capability (full lag) within 2 seconds and from 0 to 90% of its maximum import capability (full lead) within 2 seconds. This condition could be relaxed after evaluating DER's submitted values.

If I operate at full active power output, must I reduce it to provide reactive power?

Each plant has an operational characteristic called a 'PQ-capability curve', within which it operates. The extremes of the curve should capture both the DER's technical limits and the MVA limit set up in your connection agreement. The DER's active power output affects the available reactive power output. It is not the intention of Power Potential to obtain reactive power capability at the expense of reducing active power capability.

What is the project convention for lead and lag DER Mvar output?

In the adopted convention, Q>0 refers to export/inject conditions (lag) while Q<0 refers to import/absorb conditions (lead).

Power Potential Commercial Questions

Could you clarify on the possibility to provide both reactive power response and Firm Frequency Response (FFR)?

The project will not devalue your FFR tender if you are participating in the reactive service of the Power Potential trial. We expect you to submit your DER reactive power capability curve in line with its active capability. We would expect the DER to deliver on the FFR service if called upon and to maximise or optimise their reactive service for the Power Potential service.

How will the requested reactive power instructions be coordinated with active power balancing services currently running at the site? Is there any requirement to prefer one reaction over another?

Reactive power provision in the Power Potential project trials can be provided in conjunction with a National Grid active power service if the existing balancing service is not compromised (i.e. priority is given to the active power service). If the DER plant and control system is designed to produce real power independently of reactive power, then procurement of these two services will be independent. However, if the DER reactive power output is impacted by the real power output, the DER will deliver as much of the reactive power response as possible at the resulting active power operating level.

How will DER be compensated for providing the service during the trial?

Reactive service payments for DERs will include a participation payment, up to £45,000 per site, linked to overall availability in wave 1 of the trials and market revenues (from payments for availability and utilisation during waves 2 and 3).

For DERs who have been successful in the competitive bidding, payments will be made at the level of DER bids and there will be no availability payment for providing active power services.

Will you be rolling power potential out to other network areas soon?

It depends on the success of the trial in this area. We will explore if this is a possibility after the trials have concluded and will share the learnings and outcomes with the industry.

What would be the procurement method for day-ahead auction, pay as bid or pay as clear?

This will be a pay as bid auction.

Where are historic utilisation profiles published?

These are available on the Power Potential website in the *DER Market Information* documents folder.

Can you tell me more about wave 1 and what the participation payment for that wave means?

Wave 1 aims to trial the technical aspects of the Power Potential services. This wave includes a mandatory technical trial, which must be completed before a DER can participate in the optional technical trial. The optional technical trial is split into different time blocks to allow technical trials across the year. DERs involved in the provision of reactive power services in this wave will be remunerated in the form of a participation payment. This is up to £45,000 per site and is linked to overall performance during the wave 1 trial. There will be no additional availability or utilisation payment during this wave.

Can you tell me more about wave 2?

Wave 2 introduces competitive bidding between DERs, with the volumes accepted by National Grid. Although volumes procured will not be used to secure the system. DERs must have completed the mandatory technical trial to participate in wave 2. The process for participation in wave 2 is like wave 1. The key difference is that this wave introduces competition among participants, with each specifying an availability price and a utilisation price.

What other types of generation will we be competing against in wave 3?

There are transmission connected assets in the project's trial region currently providing reactive services as part of their system obligation. DERs will be competing alongside these providers during wave 3. The list of connected assets in the region can be found on the National Grid TEC Register.

What prices can be expected in wave 3?

In wave 3, DERs will be competing with transmission connected assets. DERs will only be procured if combined cost of availability and utilisation is at, or below the cost of the next available transmission solution. Historically for the Power Potential area, the average cost of a transmission solution was around £4/Mvarh. This is the average price paid for this service between January and July 2017 and is only an indication of the historic price of reactive power in the project area. This figure should not be interpreted as a guaranteed price for the Power Potential trials, or possible maximum or minimum payments.

End

If you have a question that has not been answered in this document, please contact the team who will get back to you: box.PowerPotential1@nationalgrid.com