

POWER POTENTIAL: DISTRIBUTED ENERGY RESOURCES (DER) TECHNICAL SPECIFICATIONS GUIDANCE FOR PROVISION OF REACTIVE AND ACTIVE POWER SERVICES

**For use with the Power Potential DER Technical Characteristics
Submission Spreadsheet**

**Please complete and return the DER Technical Characteristics
Submission Spreadsheet by the 26th of February 2018**

Issued on 26th of January 2018

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Introduction

This guidance document advises how to populate the DER Technical Characteristics Submission Spreadsheet for participation in the Power Potential project. This documentation is available on National Grid's website:

www.nationalgrid.com/powerpotential

Terminology and interpretation

In this document, the terms **DER**, **participant** and **plant** are used interchangeably.

Power Potential overview

The Power Potential innovation project is aimed to develop technical and commercial solutions to maximise the use of DER to resolve transmission voltage and thermal constraints. The project is focused in the South-East area of England and there are four Grid Supply Points (GSP) in scope for the project: Bolney, Ninfield, Sellindge and Canterbury North.

GUIDANCE NOTES FOR COMPLETION OF THE POWER POTENTIAL DER TECHNICAL CHARACTERISTICS SUBMISSION SPREADSHEET

1. Overview

The address and contact details section must be completed by all DER participants.

Company Name	Please insert your company name
Name of Contact	Please insert the name of your colleague that has regular contact with UK Power Networks
Job Title	Please insert the job title of the contact listed above
Email Address	Please insert the email address of the contact listed above
Full Mailing Address	Please insert the registered office address of the company
Phone Number	Please insert a telephone number for the contact listed above

The following information should be completed by all DER participants. Please provide as much information as possible, where appropriate.

Please evidence your capability (experience) of providing similar services as requested in the Expression of Interest (Eoi)	If relevant, please indicate participation in similar programs (e.g. other response programmes, portfolio management, operation).
When can you start providing the service, and at what times of the day?	Please indicate any limitation to service provision (reactive power and/or active power) during the day.
Dependencies on other flexibility/ancillary services (e.g. STOR, Triad, FFR)	Please indicate if the plant is currently providing any other grid services. This information is needed to avoid conflict of services.
Is there any additional work required to enable your participation (e.g. installing new equipment)?	Please indicate any expected work/upgrades in your plant to participate in the Power Potential trial.
Please provide a summary of your offer and, if possible, include an indication of cost with assumptions as necessary	Please summarise how your plant will deliver the service and your thoughts on the commercial proposition.

2. Conditions for participation

Two different services can be provided by DER (connected to UK Power Network's distribution grid) through Power Potential: **Reactive Power** and **Active Power** service.

- **Reactive Power service**

In the Reactive Power service, non-synchronous DER would be instructed at their point of connection using voltage droop* control in order to produce/absorb reactive power (Mvars). Synchronous DER would be instructed using a voltage target set-point to adjust the generator terminal voltage in order to produce/absorb reactive power (Mvars). This production/absorption of reactive power would allow more effective control of the voltage in the transmission system.

Reactive Power service participants are expected to be online (armed) in the operating status indicated above when participating in the Reactive Power service. This will allow DER to automatically deliver changes in reactive power in response to system voltage changes.

In addition, the DER plant should be capable of moving the operating point 90% of the possible change from full lead (importing reactive power) to full lag (exporting reactive power) within 2 seconds.

**Voltage droop control: the reactive power exported by the DER is controlled based on a voltage target and a reactive power slope, also known as voltage droop control. Therefore, a change between the measured voltage and the desired voltage target at the DER point of connection will translate in a reactive power injection from the DER proportional to this voltage difference.*

- **Active Power service**

In the Active Power service, DER (both synchronous and non-synchronous) would be instructed to an active power (MW) set-point. This service is expected to help improve the management of system thermal constraints.

Active Power service participants are expected to declare a minimum running time of half an hour (i.e. to declare a capability that can be maintained for half an hour).

Note that these instructions are defined at the DER point of connection (POC) with UK Power Networks.

Please respond to statements 1 to 5 (Yes/No) in the submission spreadsheet to indicate your interest in providing one, or both of these services and whether you can meet their specific high-level conditions. Please provide additional information where relevant.

2.1. Specific conditions for participation in the Reactive Power service

Only for Non-Synchronous DER

To be completed by non-synchronous DER participants only. Specific conditions for participation of non-synchronous DER in Reactive Power service are detailed in this section.

Please respond to points 6 to 9 in the submission spreadsheet to participate in the Reactive Power service. Please specify if any of these conditions are not met.

Only for Synchronous DER

To be completed by synchronous DER participants only. Specific conditions for participation of synchronous DER in the Reactive Power service are detailed in this section.

Please respond to points 10 to 13 in the submission spreadsheet to participate in the Reactive Power service. Please specify if any of these conditions are not met.

2.2 Specific conditions for participation in the Active Power service

To be completed both by synchronous and non-synchronous DER participants. Specific conditions for participation of DER (synchronous and non-synchronous) in the Active Power service are detailed in this section.

Please respond to points 14 to 16 in the submission spreadsheet to participate in the Active Power service. Please specify if any of these conditions are not met.

3. DER site specific details

3.1. General DER technical characteristics

Please complete this section in the submission spreadsheet in order to participate in the Power Potential project trial (for Active Power and/or Reactive Power service). General DER technical characteristics are covered in this section.

Network location	Please insert the name of the plant point of connection to UK Power Network's distribution grid.
Type of customer	Please insert the DER type of customer (e.g. commercial load) and indicate the DER technology type.
Import MPAN	Please insert your asset import MPAN (Meter Point Administration Number) connection number.
Export MPAN	Please insert your asset export MPAN (Meter Point Administration Number) connection number.

Connection status	Please insert your current connection status (energised or not energised). If the plant is not energised, please specify the expected connection date.
Provide site P/Q capability characteristics	Please insert the power capability chart of the plant at the point of connection (x-axis: reactive power, y-axis: active power). This should also be completed in the tabular form (as specified in the next section).
Monitoring and control capability	<p>Please indicate your monitoring and control capability by replying to the following two questions:</p> <ul style="list-style-type: none">• Can the plant respond to a dispatch instruction via IP-based communications?• Is DER Interface available to RTU - DNP3 over TCP/IP using CAT5e or Fibre? <p>Note that communication for control purposes would be via UK Power Networks' RTU system (electronic dispatch).</p>
Provide a control point contact phone number, with operational response capability	Please insert the telephone number of a contact person (i.e. control point) with capability to control the plant operational response.
Existing metering/monitoring capability and resolution (e.g. minute by minute resolution, MW/Mvar)	Please indicate the existing metering capabilities of the plant (capability to record and store active power, reactive power and voltage measurements). Please indicate the measurement units and time resolution (granularity) of these metered values (e.g. minute-by-minute). Please indicate data for metering and/or operational metering.
Typical generation/demand profile for typical operational scenarios	Please insert the plant typical generation profile for relevant typical operational scenarios (e.g. winter, summer, triad avoidance, etc.). Please provide data/charts, if available.
The maximum and minimum time for which you will allow the service to be utilised in a single utilisation. Indicate any other restrictions to utilisation and reasons for those restrictions	Please indicate the maximum and minimum time (in minutes) for which you will allow the service to be utilised in a single utilisation. Specify this separately for the Active Power service and the Reactive Power service. Please specify any other restrictions to utilisation and reasons for those (e.g. environmental reasons, investors restrictions, etc.).

3.2. **Reactive Power service: Service-specific DER technical characteristics**

Please complete this section in the submission spreadsheet in order to participate in the Reactive Power service. Specific DER technical characteristics to participate in the Reactive Power service are covered in this section.

Installed reactive power capacity (Mvar)

Please insert the plant rated reactive power capacity in Mvar units.

Lead time from UKPN's instruction reception to DER instruction order

Please insert the lead time (in seconds) from the time of receipt of a Reactive Power service instruction to DER instruction order. Instruction for the Reactive Power service is a voltage reference set-point.

Lead time from DER instruction to voltage set-point change

Please insert the lead time (in seconds) from the time of DER instruction order to voltage set-point change (i.e. time to react to the instruction). It is expected that any change in voltage target set-point received electronically should be acted on **within 2 seconds**.

Lead time to change from PF/Reactive power control to Voltage control

Please insert the lead time (in seconds) to sweep between power factor control and voltage droop control (for non-synchronous DER). Please insert the lead time (in seconds) to sweep between power factor control target voltage control (for synchronous DER). It is expected that any change in operating mode received electronically should be acted on **within 10 seconds**.

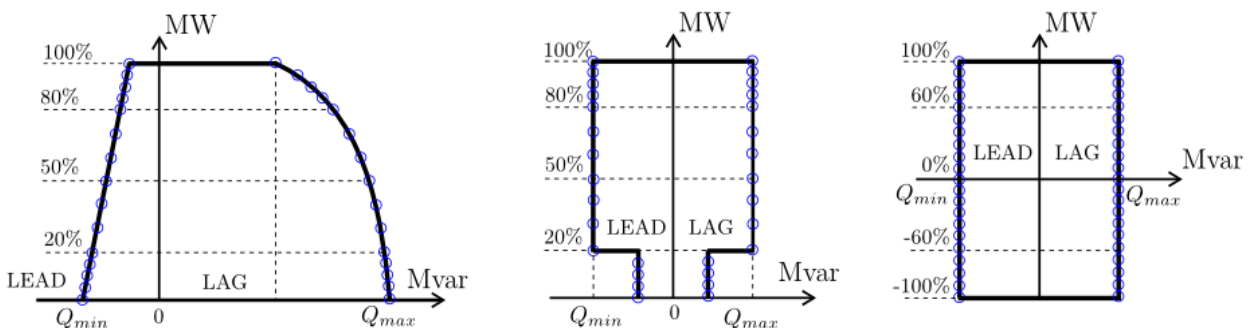
Is the site able to provide reactive power at zero active power output?

Please indicate if the plant is able to provide reactive power when no active power is being produced (i.e. plant is capable of providing reactive power at night).

Non-Synchronous DER: Please insert the PQ capability chart **at the POC** in the submission spreadsheet in order to participate in the Reactive Power service.

Synchronous DER: Please insert the PQ capability chart **at the generator terminals** in the submission spreadsheet in order to participate in the Reactive Power service.

Please provide data in tabular form for the specified points and refer to the examples below when providing performance charts. If the capability chart is dependant of voltage, please provide this information for the three following voltage values: 0.94 p.u., 1.0 p.u. and 1.06 p.u.



Note that in the adopted convention, $Q > 0$ refers to export conditions (lag) while $Q < 0$ refers to import conditions (lead).

For new connections, to participate in the Reactive Power service, a capability equivalent to 32% of the maximum export capacity (in MW) is required to be delivered or absorbed at the point of connection (i.e. capability to provide 0.95 power factor lagging or leading at the generator terminals).

Only for Non-Synchronous DER

To be completed by **non-synchronous DER only**. Specific non-synchronous DER technical characteristics to participate in the Reactive Power service are covered in this section.

Time taken by automatic voltage droop control to change reactive power from 0 to 90% of maximum export (s) given a sufficiently large change in system voltage

Please insert the time (with units) for the voltage droop control system to deliver a change in reactive power (export - lag, $Q > 0$) between the specified values.

Time taken by automatic voltage droop control to change reactive power from 0 to 90% of maximum import(s) given a sufficiently large change in system voltage

Please insert the time (with units) for the voltage droop control system to deliver a change in reactive power (import - lead, $Q < 0$) between the specified values.

Only for Synchronous DER

Specific synchronous DER technical characteristics to participate in the Reactive Power service are covered in this section. **To be completed by synchronous DER only**.

Excitation system details

Please respond to the following three questions regarding the synchronous DER generator excitation system (AVR):

- Is it static/brushless exciter?
- Is it capable of constant terminal voltage control?
- Which is the range of voltage set-point?

Generator step-up transformer

Please insert the following details regarding the synchronous DER generator step-up transformer: rated MVA capacity, rated voltage levels (kV), positive sequence impedance(per unit), tap changer range (+%, -% on MVA) and tap change step size (% on MVA)

3.3 Active Power service: Service-specific DER technical characteristics

Please complete this section in the submission spreadsheet in order to participate in the Active Power service. Specific DER technical characteristics to participate in the Active Power service are covered in this section.

Installed active power capacity (MW)

Please insert the plant rated active power capacity in MW units.

Lead time from UKPN's instruction reception to DER instruction order

Please insert the lead time (in seconds) from the time of receipt of an Active Power service instruction to DER instruction order. Instruction for the Active Power service is an active power set-point.

Lead time from DER instruction to ramp-up/ramp/ramp-down start

Please insert the lead time (in seconds) from the time of DER instruction order to ramp-up/ramp/ramp-down start change (i.e. time to react to the instruction).

Maximum response duration (utilisation time) for MW response (mins)

Please insert the maximum time (in minutes) for which you will allow to utilise the Active Power service in any single continuous utilisation.

Recovery time (from end of delivery to when next available to deliver)	Please insert the maximum time (in minutes) it takes to make the Active Power service available again after it has been utilised.
Maximum active power (P) export	Please insert the plant maximum active power export in in MW units.
Maximum active power (P) import	Please insert the plant maximum active power import in in MW units.
Minimum active power (P) export	Please insert the plant minimum active power export in in MW units.
Minimum active power (P) import	Please insert the plant minimum active power export in in MW units.
Ramp Up Rate (MW/s)	Please insert the rate in MW/s at which the plant will change load in response to an instruction to start providing Active Power service.
Ramp Down Rate (MW/s)	Please insert the rate in MW/s at which the plant will change load in response to a cease to start providing Active Power service.
Range of continuous ramping (MW)	Please insert the range in MW for which the plant can continuously ramp up and down.

3.4 Technology-specific DER technical characteristics

Please complete this section in the submission spreadsheet if the DER technology type falls in one of the specified categories in order to participate in the Power Potential trial (for Active and/or Reactive Power service).

DER: Storage

Capacity (MWh) Please indicate the storage nominal capacity in MWh units.

DER: Wind Farm

Cut in wind speed (mph) Please insert the wind farm cut in wind speed in mph (miles per hour) units.

Cut out wind speed (mph) Please insert the wind farm cut out wind speed in mph.

Saturation wind speed (mph) Please insert the wind farm saturation wind speed in mph.

DER: PV Solar

Reference irradiation (W/m²) Please insert the PV solar plant reference irradiation in W/m² units.

Reference cell temperature (°C) Please insert the PV solar plant reference cell temperature in °C (Celsius degrees) units.

Other cell module data Please insert any other relevant plant data. For example, the PV solar plant number of modules and cells, the modules open circuit voltage, the modules short circuit current, the modules maximum power, etc.

FURTHER INFORMATION / FEEDBACK

For any further enquiries, please contact us at box.PowerPotential1@nationalgrid.com and one of the project team will be in touch with you.