

# GRID CONSTRAINTS IN THE SOUTH WEST: OPTIONS FOR CONNECTION



REGEN SW

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**Disclaimer: Information and data contained within this guide are correct as of time of print**

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## 1 INTRODUCTION

The rapid growth of distributed renewable energy in the past five years, particularly solar photovoltaics, has caused extensive constraints on the grid network.

The south west of England is particularly affected by these constraints due to the volume of distributed energy projects connecting to the network.

In March 2015 a pinch point in the network led to Western Power Distribution (WPD) implementing long delays for anyone looking to connect energy generation projects to the distributed energy grid network in the south west.

There are two National Grid lines and one Western Power Distribution (WPD) line that carry power into (and increasingly out of) the south west. The 132 kV WPD line that runs from Bridgwater Grid Supply Point (GSP) to Seabank GSP (in the Bristol docks area), known as the 'F' route, has reached capacity. As a consequence a delay of 3-6 years is included in new connection offers for all generation projects seeking to connect to the grid requiring works at High Voltage (HV)

level i.e. above 6.6kV or 11kV. This restriction applies to the entire WPD south west region below Bristol and Bath.

The work National Grid is undertaking to connect the Hinkley C nuclear power plant offers a potential solution, as it would involve the WPD 'F' Route being replaced by a National Grid line with a higher capacity. However, this work remains subject to considerable uncertainty.

The 'F' route constraint is, however, not the only issue for the distribution network in the south west. A map of other constrained areas can be found on the WPD website [here](#) or in Figure 2 below.

Therefore resolving the 'F' route constraint alone would have limited impact in freeing up capacity on the grid network.

This document sets out to provide a briefing for businesses in the south west of England looking to connect energy generation projects to the grid, including what can still be connected and alternative connection options available.

## 2 WHAT PROJECTS CAN CONTINUE TO CONNECT?

Despite the current constraints there is potential for energy generation projects to continue to connect at present. These projects fall under the following categories:

### **Existing offers**

Projects with existing offers to connect to the grid will not be affected, as long as they comply with the conditions of their grid offer.

### **Low Voltage (LV) schemes**

Connections to the Low Voltage (LV) network are not affected by the 'F' route constraint. Individual domestic and many commercial rooftop solar projects will therefore, still be able to continue to connect unless there are specific local constraints.

### **On-site use/private wire**

In simple terms if a project does not export power to the grid then there is no problem with constraints on the grid. Projects that use all their power on-site, or through a private wire connection to an energy user, are not affected by constraints on the grid. However, restrictions to energy export due to fault levels will still apply. Regen SW runs a project to match generation projects with energy users, called the [Renewable Energy Grid Collaboration Service \(REGCS\)](#), which uses our GIS capability to identify opportunities. An early success of this approach can be seen between South West Water and Wadebridge Renewable Energy Network in Cornwall for a 100 kV community owned solar project supplying a South West Water treatment works.

### **Export Limiting Connections**

An export limitation scheme measures the 'Apparent Power' at the exit point of the installation, and then uses this information to either restrict generation output and/or balance the customer demand in order to prevent the 'Agreed Export Capacity' from the installation being exceeded.

Export limiting schemes are suitable for all capacities and voltage levels to reduce a generator's contribution to thermal or voltage limits on the distribution network. However, restrictions to energy export due to fault levels will still apply.

Export limiting schemes allow network operators to continue to maintain the security of supply to existing customers whilst also enabling new generation to connect onto the network. The risk to the security of supply of existing customers is managed by ensuring compliance with technical requirements and by placing limits on the generation capacity installed, which reduces both the likelihood and impact of equipment failure.

### 3 WHEN AND WHERE MAY MORE CAPACITY BECOME AVAILABLE?

#### 'Queue' Management

One area where there is potential to release capacity is the management of the 'queue' of grid offers that have been accepted. Grid connection applications are treated on a 'first come, first served basis', where applications and offers are dealt with in the form of a queue to maintain a fair system for customers. Across the WPD licence areas (south west, east and west midlands and south Wales) approximately 6GW of renewable energy Distributed Generation (DG) has connected to the grid but a further 9GW of offers to connect have been accepted. It is likely that a significant proportion of these are for projects that will not go ahead due to other issues such as planning. These projects are effectively using up capacity that could be used for other projects that could connect. However, under the 'queue' system it is difficult for WPD to

regain this capacity until the grid offer has been rescinded by the customer. To manage this process WPD set in place a number of milestones for customers with grid offers to meet, to ensure that progress towards connection is being made. Should it become clear from these milestones not being met and notwithstanding regular discussion with the customer regarding extenuating circumstances, failed grid offers are regained, with the capacity that becomes available being recycled to the next customer in the 'queue'.

For businesses looking to connect to the grid it is advised that applications are made as soon as possible, in order to enter the grid queue and therefore be positioned for any spare capacity as it becomes available. Grid offers from the DNO will indicate if there are any constraints in the area you are wishing to connect and will suggest Alternative Connection types, if applicable.

### 4 WHAT ARE THE ALTERNATIVE OPTIONS?

#### Alternative connections<sup>1</sup>

Western Power Distribution (WPD) is rolling out a range of 'alternative connections' which use better information on the grid to manage constraints across their networks, allowing new customers to connect but enabling WPD to switch off customers when there are constraints. The advantages of these alternative

approaches for businesses looking to connect to the grid are that they enable projects to continue to connect. However, each 'alternative' connection will only be suitable in certain circumstances and although they can provide an alternative way to connect to the grid, they all limit the output to the grid in some way. The lack of confirmed output can therefore affect

the commercial viability of generation projects and so this needs careful assessment. Projects seeking to connect energy generation to the grid should contact WPD for alternative connection opportunities as well as standard connections. These 'alternative connections' are summarised below:

### **Timed connections**

Some networks have predictable load and generation patterns which enable WPD to determine when the limitations will occur. Connections are given an operating schedule which define the times and levels of capacity available to them. The method of curtailment, i.e. when a generator cannot export energy to the grid, can either be provided by WPD or developed by the customer and submitted for approval.

This alternative connection is suitable for capacities under 1MVA and does not require remote communications. On-going enforcement of the curtailment will be collected from standard metering flows.

In the south west timed connections mainly restrict export to the grid during the day between April and October so are not suitable for large Photovoltaic projects, or other energy generation projects that export large amounts of energy during this period.

### **Soft-Intertrip**

Some networks are constrained due to a single upstream 'asset', i.e. another generator or network equipment on the same grid line, requiring reinforcement. Or there may be a single grid 'limit' being infringed under certain conditions. Through monitoring, further capacity can be released when these limits or assets are within normal operating parameters. When there is no further capacity available, the connection will be curtailed to a predefined limit, which may be zero.

This alternative connection is suitable for all capacities and voltage levels, although due to the coarse method of curtailment, there will be a maximum number of participants allowable per area. In practice the grid constraints in the south west are so extensive that soft-intertrip is rarely a viable option.

### **Active Network Management (ANM)**

In areas where there are multiple complex constraints affecting a number of customers over a long time period, full active network management (ANM) systems are starting to be implemented. ANM areas are not available across all of the south west area and are currently being rolled out across the region. You will need to contact WPD for a list of current ANM areas. Distributed control systems continually monitor all the limits of

<sup>1</sup><http://www.westernpower.co.uk/Connections/Generation/Alternative-Connections/Types-of-Alternative-Connection.aspx>

the network and then allocate the maximum amount of capacity to customers in that area based on the date their connection was accepted.

This 'Last In, First Out' (LIFO) hierarchy prioritises the oldest connections when issuing capacity, but it is scalable.

Figure 1: Western Power Distribution 'Alternative Connections' options<sup>2</sup>

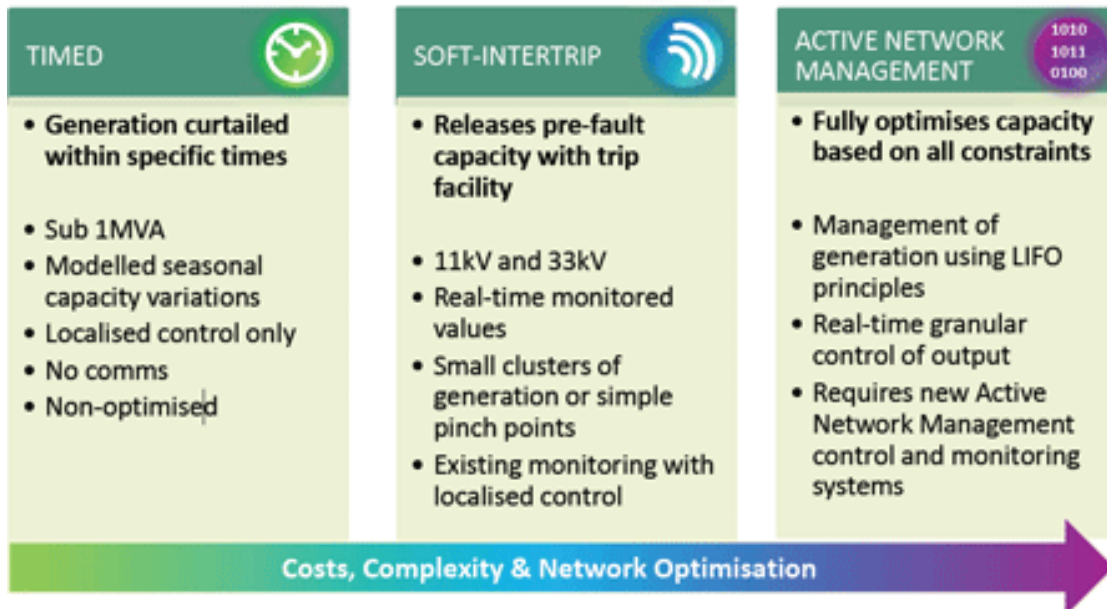
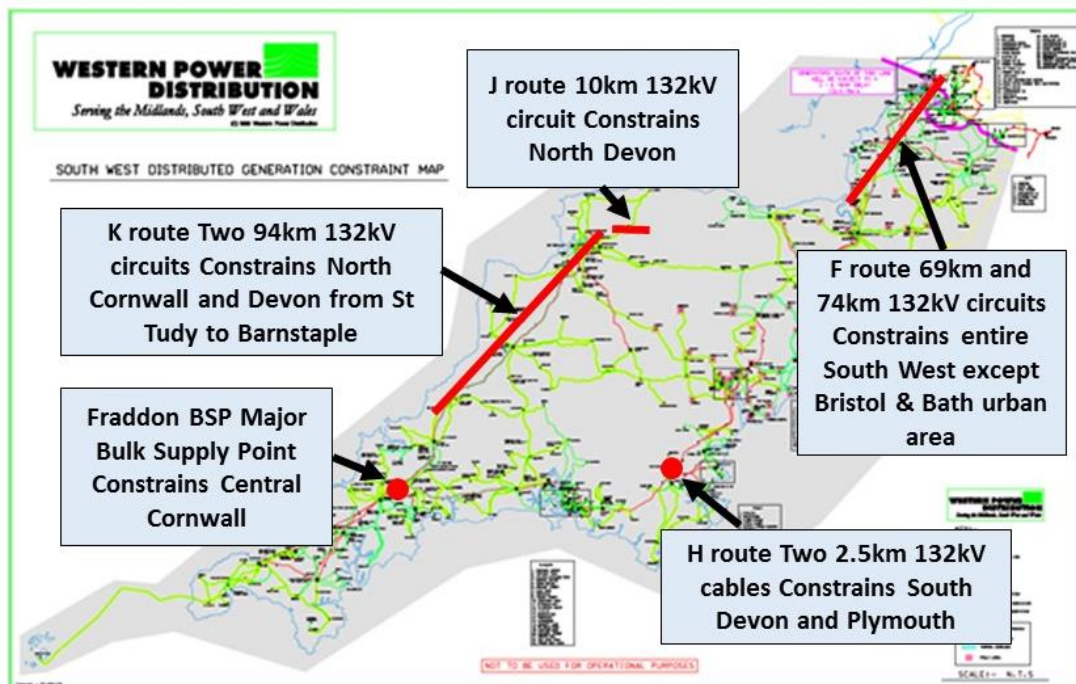


Figure 2: Western Power Distribution south west licence area grid constraints<sup>3</sup>



<sup>2</sup><http://www.westernpower.co.uk/Connections/Generation/Alternative-Connections/Types-of-Alternative-Connection.aspx>

<sup>3</sup><http://www.westernpower.co.uk/docs/connections/Generation/Generation-capacity-map/Distributed-Generation-EHV-Constraint-Maps/South-West-Thermal-Map.aspx>

## Smarter approaches

There are a range of smarter ways of maximising the capacity on the network. Alternative Network Connections as described previously are one innovative approach that is becoming part of 'business as usual'. Innovation projects can be funded under the Network Innovation Allowance and an extensive number of projects are underway. Public bodies

can consider if they could become partners in these projects.

Energy storage is a critical technology to maximise the value of variable and distributed power generation. Storage technologies and their commercial viability are developing rapidly.

However, they are not a silver bullet.

## 5 FACTORS AFFECTING GRID CONNECTIONS

There are a number of factors that can affect the capacity, cost or timescales for a grid connection. These are summarised below:

- **The distance from your generator location to the point of connection to the existing network.**
- **If reinforcement of the upstream network (including higher voltages) is required.**
- **If legal permissions are required for the connection.**
- **The availability and suitability of the connection route between the existing network and your generator location.**
- **If the local network is a single phase overhead line.**
- **If there is a need to install a transformer and/or controlling substation between the generation 'asset' and the network.**
- **Any existing technical limitations of the network**

## 6 CONCLUSIONS AND NEXT STEPS

The switch to more local distributed energy is a major change in the way we generate and use energy and will require a very different grid in the future than that of our traditional system. There will not be one solution to grid constraints but a range of approaches. To achieve progress will require public sector stakeholders and businesses to engage, as well as Ofgem and DNOs. In terms of practical advice for businesses considering connecting to the Distributed Energy Network, it is advised that applications are made as

soon as possible in order to enter the grid queue and therefore take advantage of capacity as it becomes available. Grid offers from the DNO will indicate if there are any constraints in the area you are wishing to connect and will suggest Alternative Connections, if applicable, as outlined earlier in the document. The acceptance of these terms will then be dependent on the specific financial modelling of the connected installation. A flow chart of the application process is set out [here](#).

## 7 DISTRICT NETWORK OPERATOR CONTACT DETAILS

### Telephone

Western Power Distribution - South West: 0845 601 2989

### Email

[wpdnewsupplies@westernpower.co.uk](mailto:wpdnewsupplies@westernpower.co.uk)

### Website

[www.westernpower.co.uk](http://www.westernpower.co.uk)

### Disclaimer

This briefing paper provides a general guide to issues to consider when seeking connection to the grid where there are constraints; it is not intended to provide professional advice. Companies are advised to seek specialist grid expertise with regard to their projects.



## 8 GLOSSARY

### **Active Network Management (ANM)**

The use of distributed control systems to continually monitor all the limits on the network, along with systems that enable the correct level of generation to meet demand.

### **Adoption Agreement**

An agreement which sets out the terms and conditions for the DNO to adopt assets which have been constructed by an ICP.

### **Connection offer**

A formal offer from the DNO containing terms, conditions and charges for the DNO to make the connection. Issued either to you or the ICP where applicable.

### **Connection Agreement**

An agreement between you and the DNO detailing terms and conditions for connecting to and remaining connected to the DNO's network.

### **Contestable**

Work that is open to competition and can be conducted by Independent Connection Providers (ICPs).

### **Curtailement**

A temporary reduction in electricity generation imposed on the generator.

### **Distribution network**

A system of electricity lines and equipment that connects the

transmission system and distributed generation to end users. In England and Wales the distribution systems are the lines with a voltage less than or equal to 132 kV.

### **Distribution network operator (DNO)**

The DNO owns, operates and maintains a distribution network and is responsible for confirming requirements for the connection of distributed generation to that network.

### **Distributed generation (DG)**

A generating scheme that is connected to the distribution network.

### **Engineering recommendations (EREC)**

The technical standards developed by the Energy Network Association.

### **Fault level**

The highest electric current that can exist in a particular electrical system under short-circuit condition

### **Harmonics**

Distortions to a current or voltage wave shape. Harmonic frequencies in the power grid are a frequent cause of power quality problems.

### **Independent Connection Provider (ICP)**

Companies that have the necessary accreditation to provide new connections in competition with the

DNOs. See the see the [Lloyds Register website](#) for a list

### **Interactive connection applications**

When two or more applications for connection are made that make use of the same part of the existing or committed network, or otherwise have a material operational effect on that network

### **Non-contestable**

Work that must be carried out by us and is not open to competition.

### **Ofgem**

The Office of Gas and Electricity Markets. A non-ministerial government department and an independent National Regulatory Authority, recognised by EU Directives

### **Power quality**

The quality of the voltage, which determines the fitness of electrical power to consumer devices.

### **Registered data**

The final confirmed parameters of the generation equipment, including the location, export and import requirements supplier meter operator.

### **Reinforcement**

Increasing the electrical capacity of those parts of the network that are affected by the introduction of new generation or demand.

### **Reverse power flow**

The flow of energy in the opposite direction from end users in the network.

### **Small-Scale Embedded Generation (SSEG)**

Defined in EREC G83 as “A Generating Unit together with any associated interface equipment that can be used independently, rated up to and including 16A per phase, single or multi-phase 230/400V AC and designed to operate in parallel with a public low voltage Distribution System”. I.e. up to 3.68 kW on a single-phase supply and 11.04 kW on a three-phase supply.

### **System voltage**

The voltage at which the network is operated.

### **Thermal rating**

The current carrying capacity of the cable determined by the heating effect caused by electrical losses.

### **Transmission network**

A system of electricity lines and equipment that connects power stations and substations. In England and Wales the transmission system is rated above 132 kV.

### **Voltage unbalance, fluctuation or flicker**

Deviations in system voltage.

**LV – Low Voltage**

Less than 1 kV networks, i.e. 230/400 V.

**HV – High Voltage**

Networks operating between 1 kV and 22 kV, i.e. 6.6 kV or 11 kV.

**EHV – Extra High Voltage**

Networks operating above 22 kV, i.e. 33 kV, 66 kV or 132 kV.

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