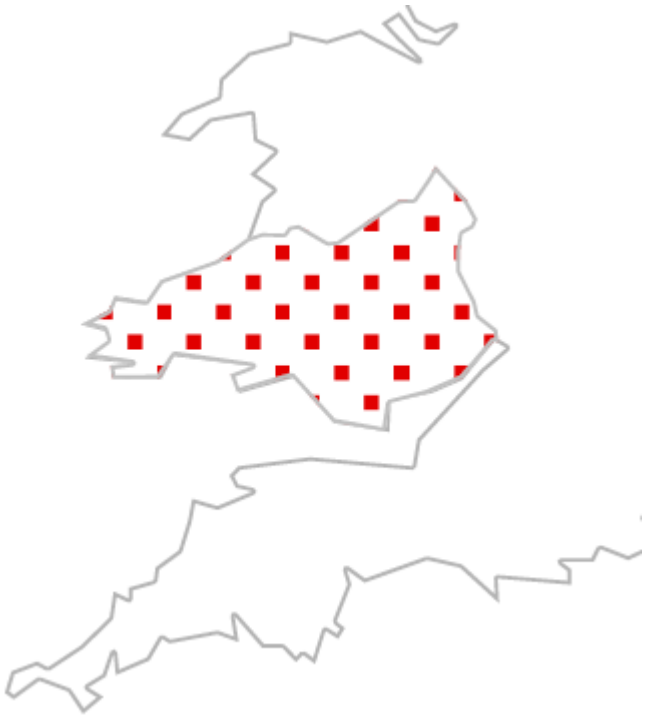
Cynulliad Cenedlaethol Cymru Pwyllgor Amgylchedd a Chynaliadwyedd	National Assembly for Wales Environment and Sustainability Committee
Dyfodol Ynni Craffach i Gymru?	Smarter energy future for Wales?
Gwybodaeth ychwanegol a ddaeth i law yn ystod yr ymchwiliad	Additional information received during the inquiry
Western Power Distribution (Saesneg yn unig)	Western Power Distribution

Cynulliad Cenedlaethol Cymru
National Assembly for Wales

Western Power Distribution holds the licence for the distribution network in South Wales. The geographic area covered is shown below:



Our response to the questions raised prior to the Environment and Sustainability Committee hearing: A Smarter Energy Future for Wales? Are below.

1. Where are the current constraints on the grid transmission and distribution network in Wales?

Distribution network issues

A map of S Wales showing the strategic circuits and which have issues associated with them is separately attached. This is also available from our website at:

https://www.westernpower.co.uk/Connections/Generation/Generation-Capacity-Map/Distributed-generation-EHV-constraint-maps.aspx

Key Limitations on WPD's South Wales networks:

- Mid Wales 66kV ring – solution either 3rd 66kV circuit or better solution new 132kV circuit into Brecon area plus network reorganisation work.
- Pembrokeshire 132kV circuits & 33kV circuits.
- Swansea North 132kV circuits (Rhos – Lampeter, Carmarthen –Llanelli, Swansea North – Ammanford – Travellers Rest – Hirwaun)
- 132kV & 33kV circuit reinforcement in Cardiff East – Aberthaw area.
- Maesteg and Llynfi valley new 66kV circuit.

- Upper Boat 33kV switchgear restrictions.

Most existing 33kV circuits across South Wales are already at a level where further generation is not possible without major reinforcement, or an alternative connection method e.g. new 33kV circuit back to a major substation.

These constraints are after taking into account both the already connected generation and also those that have accepted a connection offer but have yet to progress to connection (generally referred to as committed generation). The volume of committed generation is significant as shown in the following table:

Generation Type	Western Power Distribution - South Wales Generator Connections (MVA)			Total (MVA)
	Connected	Committed	Offered	
Photovoltaic	384.0	1,306.5	615.7	2,306.1
Wind	153.1	692.7	111.3	957.1
LandfillGas, Sewage Gas, Biogas, Waste Incineratior	41.1	26.3	3.2	70.5
CHP	1.9	15.5	5.6	23.0
Biomass & Energy Crops	1.5	71.9	76.0	149.3
Hydro, Tidal & Wave Power	16.4	16.4	0.5	33.2
Other Generation	635.0	461.3	372.0	1,468.3
Total	1,232.9	2,590.5	1,184.2	5,007.6

These need to be considered

There is likely to be some of this committed generation that does not proceed and hence use their allocated capacity. To help identify generation in this position we include 'milestones' in our connection offers which include a requirement to obtain planning consent, start and complete construction of the generation project within defined timescales. This allows us to free up capacity to allocate to other proceeding projects.

National Grid network issues

The interface between distribution networks and transmission networks is managed via a nationally regulated Connection and Use of System Code. This Code includes a 'Statement of Works' (SoW) process where the distributor informs National Grid of generation that is seeking connection and National Grid identifies any issues, and potential work needed on their network. Costs for these works are then established under a Modification Application process. A recent statement of work request by us to National Grid identified the following issues in S Wales:

1. *System Wide Specific Generator Requirement*

NG have requested that generation connecting has a Power Factor range capability of 0.95 lead/lag, with a specific requirement for non-Photovoltaic (PV) to operate at 0.95 lead and PV to operate at 0.98 lead. This requirement is associated with maintaining control of voltage on the 400kV and 275kV National Grid network which can otherwise rise above equipment rating levels.

2. *Specific Grid Supply Point (Grid Supply Points are the point of connection between Distributors and National Grid) - SGT Thermal Capacity*

• Pembroke - Generation included in the request results in overloads of 50MVA. There is some headroom for earlier connections but a Modification Application is now required.

• Based on the diversity of DG in this group National Grid are unlikely to invest in additional super grid capacity.

• Pyle – Generation included results in an overload of 90MVA. NG think that a replacement of 180MVA SGT1 with a 240MVA may be an economic solution. Modification Application required.

• Swansea North – More generation is seeking to connect than can be accommodated under even intact network conditions. There is some scope for some to connect but a Modification Application is now required.

• Upperboat 33kV – Generation included in the request results in overloads of 15MVA. A Modification Application is now required.

3. *Wider Network System Studies*

While there are potentially wider network issues, National Grid believe this can be managed. However, they require a Modification Application to ensure costs are managed in the most economical manner.

4. *Fault Levels*

The fault levels at all GSPs, with the exception of Uskmouth, were found to be within the rating of the relevant circuit breakers.

• Fault levels at Uskmouth 275kV are already at nominal rating pre-connection of any generation in this SoW. There is no headroom to connect any further DG in the Uskmouth GSP without management of generation infeed. National Grid will require Modification Application for this GSP in order to develop a process for management of fault levels in the area.

5. *Dynamic Voltage Stability*

Changes to the position of generation in the TEC register (a register maintained by National Grid of all Transmission connected generation) in response to legislation and economics are likely. Depending on this outcome, it is therefore possible that a detailed stability assessment of this part of the network will be required.

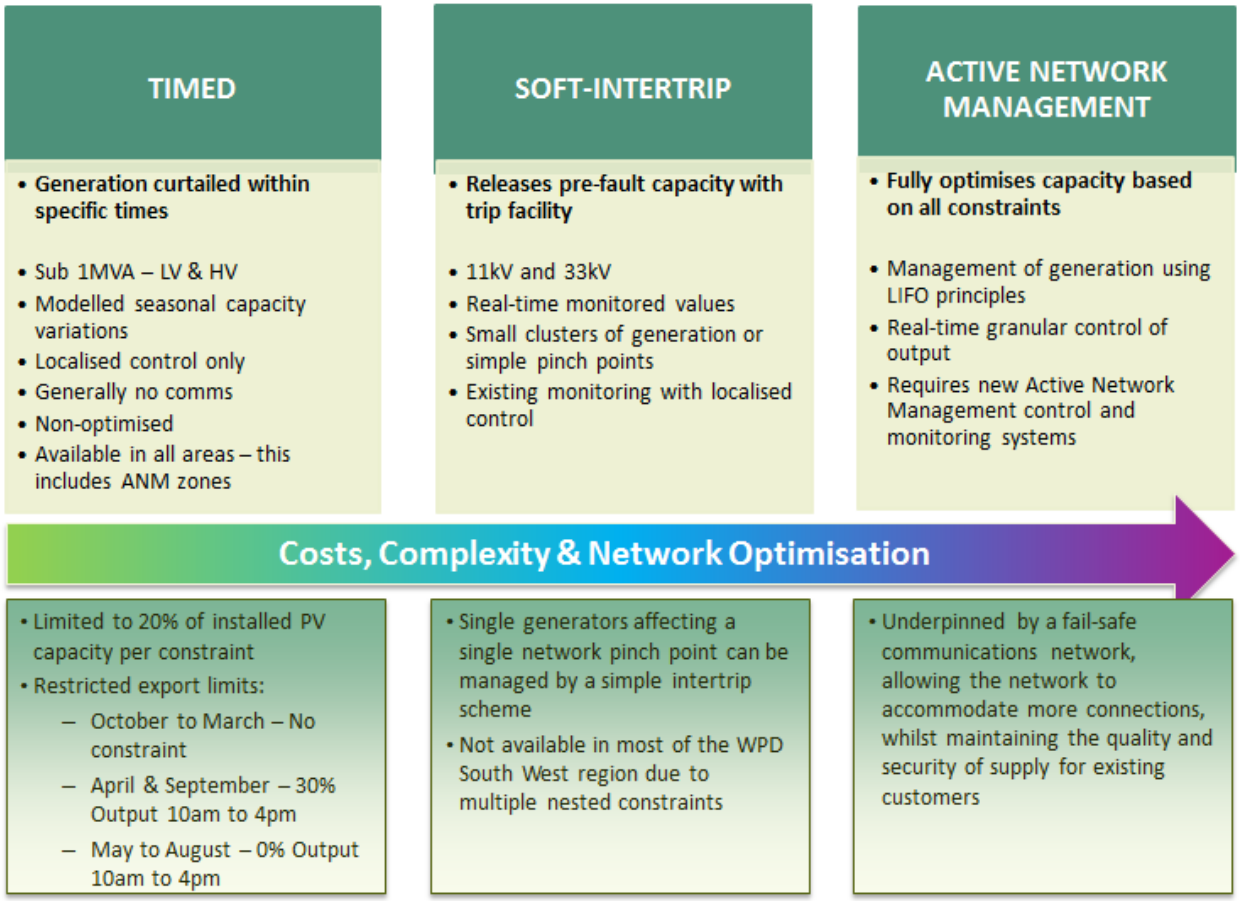
2. Where are the opportunities to exploit spare grid capacity through local generation and the development of energy parks?

Community Energy projects are often seeking to co-located generation with the local community demand. The support offered to community energy projects by WPD includes:

- Website resources including constraint maps, a capacity register and further information on the connections process are available on our website
- A specific guide to Connecting Community Energy available on our website
- Series of workshops specifically tailored for community energy schemes on how get a connection. Presentations from these events are available on our website. Further events to be held in autumn 2015 and first quarter of 2016
- Quarterly surgeries are run at WPD depots to give potential connectees an opportunity to have early discussions with an engineer to discuss on a one-to-one basis their requirements and the connection process. More information is available on our website
- Community representation on the WPD Customer Connection Steering Group

Overall. the impact of generation and demand on the network is due to the net effect of the combination of both. Hence the addition of generation that supplies existing demand can lead to the need to reinforce the upstream network as it effectively removes demand which was already helping to absorb existing generation. The co-location of both new demand and generation, where the generation output matches the demand usage has little impact on the network - to date such developments have been rare as the economics of most generation lead to either near continuous operation or for its use as a 'peak' service or emergency backup. The addition of storage can add significant flexibility, however whilst costs of storage are reducing they are not yet at a level to make storage economic in the vast majority of cases.

As most renewable generation does not have a continuous output the changing pattern of demand and generation during the day can be used to provide 'smart' connections to the network. These connection arrangement (termed 'alternative connections' by us) are available to assist lower cost connections that do not require reinforcement of the network. Alternative offers available are summarised in the following table:



The roll out program for the more advanced ANM solution is shown below (also available from our website):

GSP Group	Active BSP Group	Quoting from	Building during
Bicker fen	Skegness	Active	Active
Grendon	Corby Northampton	Active April 2016	April 2015 April 2017
Bridgwater	Bridgwater Street	Active	November 2015 November 2015
West Burton	Horncastle	April 2015	April 2016
Indian Queens	Truro	November 2015	November 2016
Swansea North	Swansea Pembroke	November 2016 November 2016	November 2017 November 2017

3. On average how long do grid connections for local renewable energy projects in Wales take to complete? How do costs compare with elsewhere in the UK and further afield?

Where reinforcement works are required, the times are very specific to the reinforcement works required. In addition where third party land is involved time is required to agree consents/access. It is therefore difficult to be specific on times for connections.

However, assuming no reinforcement is required, and consents are straight forward, then from full/initial payment and confirmation to progress the connection, typical connection times would be:-

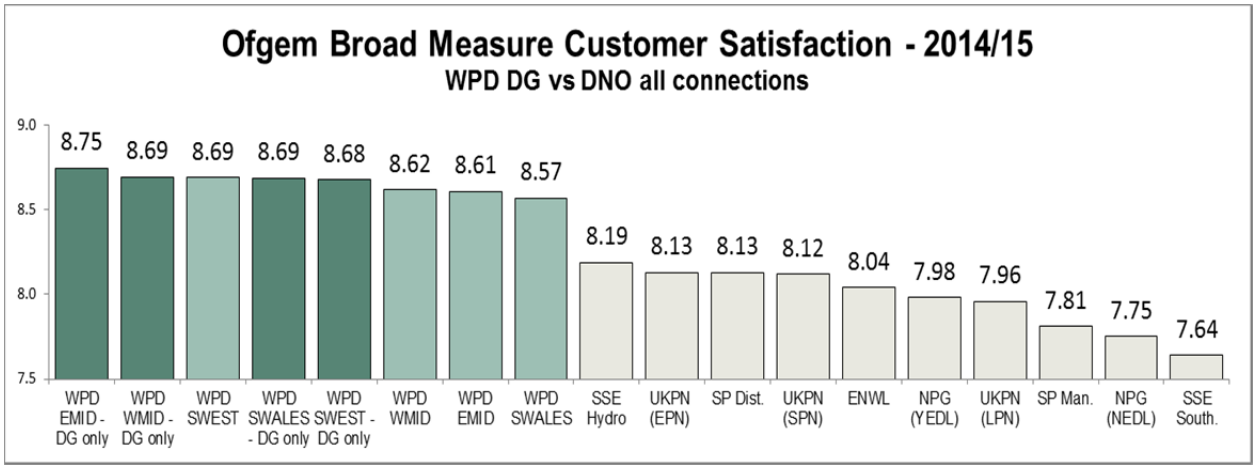
Low Voltage Connections work only - 4 to 8 weeks

Low Voltage Connections with some High Voltage works – 8 to 12 weeks

High Voltage Connections work only – 16 to 26 weeks

Extra High Voltage Connections work – 10 to 18 months (summer system access)

In terms of comparison to elsewhere in the UK, we do not have sufficient data about other DNOs to make the comparison, however we do carry out an annual satisfaction survey for DG customers including questions on both timeliness and cost. The results of this survey for 14/15 compared to a monthly survey of customer satisfaction of all connections carried out by our Regulator is below



We do not have any international comparison data. Previous historic benchmarking has proved problematic due to the differing ownership and regulatory structures.

4. What is the scope for reducing the need for grid enhancement through the local supply and siting of energy generation (plus storage)?

See response to question 2. above.

5. Smart grids – how do we encourage their development to deal with more local renewable energy supply?

Many of the elements of a smart grid either have or are being developed as part of our future networks activities. These include active network management (described above), integration of storage into network operation, demand side response trials, enhanced system monitoring, improvements in our communications solutions, dynamic asset ratings together with commercial arrangements needed to support many of these activities.

Overall national system demand and generation needs to be kept in balance on a real time basis. At present, the 'system operator' which deals with this balancing is National Grid. The actions that they take to achieve balance includes contracting with demand and generation embedded within distribution networks as well as the management via the balancing market of generation connected to the National Grid.

Going forward there are a number of drivers for DNOs to also becoming Distribution System Operators (DSOs) that take a more active role in balancing networks at a local level. These are:

- The commercial interaction between DG connected under a ANM scheme and other connected generation
- The EU Network Codes allow the Transmission System Operator to define (subject to approval by Ofgem) the envelope of reactive power flow at the boundary between DNOs and National Grid - this can probably be best achieved by control of distributed generation.
- the contracting for Demand Side Response and use of any future storage solution can be more cost effective than reinforcement
- As the amount of National Grid connected centrally dispatched generation reduces and is replaced by distributed generation, National Grid will need DNOs to forecast and control the power flows at the boundary between the two systems

Where DG is connected via an ANM scheme, they get the benefit of a faster and lower cost connection but have to accept the risk of being constrained off when there is insufficient network capacity. Whilst the expected level of constraint can be estimated based on historic information, changes to the pattern of demand and future changes to the network present an uncapped risk in terms of the degree of constraint they may see in future. Concerns have been raised by generator representatives that there needs to be a cap on the level of constraint or compensation payments made during times of constraint.

Such an arrangement would give an economic signal for the right time to undertake system reinforcement as the level of constraint payment would show when it is more economic to make an investment in further capacity. Such an arrangement will need assistance from our regulator to establish the framework we can operate in.

6. What can be done to ensure the promotion and development of smart grids?

Distributors and Transmission companies already undertake a number of projects to develop new techniques and understand how to better integrate new generation under the Network Innovation Allowance and Network Innovation Competition introduced by Ofgem.

The progress and results of these projects are widely disseminated and developments resulting in new intellectual property rights are available for all to use. We integrate learning from these projects into our business operations when we can see benefits in doing so.

7. What executive and legislative powers over the grid operation and regulation are needed to take forward this agenda?

Our existing licence encourages innovation via the Network Innovation Allowance and Network Innovation Competition together with a 'totex' approach to regulation which encourages the adoption of lower cost options. Whilst it does not prevent us from becoming a Distribution System Operator there are benefits in a common framework being applied to all DNOs and this would be best achieved via regulation or development of a Code overseen by the Regulator.

Specific areas that would need to be covered include:

- information flows between parties (DSO, TSO, Suppliers, Aggregators, generators etc.)

- market operation in terms of priority over who has access to flexibility generation, demand or storage.
- methods of determining any constraint payments (e.g. administered, bid process etc.)

The lack of a national framework is likely to result in a more fragmented process being developed and different frameworks being developed by different DNOs that will in the longer term need to be pulled together.

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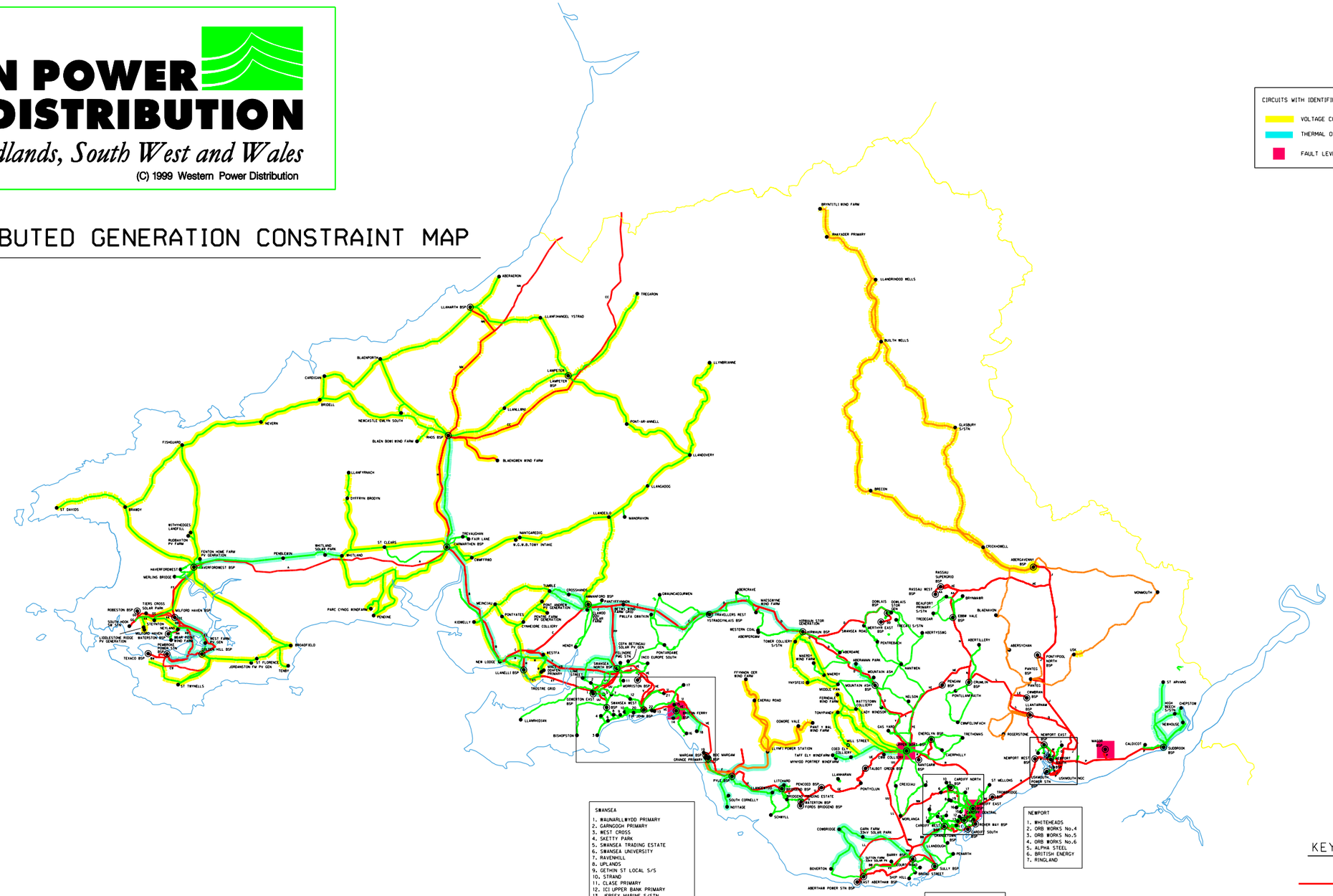
SOUTH WALES DISTRIBUTED GENERATION CONSTRAINT MAP



SCALE:- N.T.S.

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Nigel Turvey

Design & Development Manager, Western Power Distribution

Nigel Turvey has a BSc and Diploma in Electrical Engineering from Southampton University and is a Fellow of the Institution of Engineering and Technology. He joined SWEB (distribution part of which became WPD) on graduation, in 1985, starting as a System Development Engineer and as part of the privatisation team he worked on the development of use of system tariffs.

Following various Engineering and Commercial roles, Nigel now leads a department that develops engineering and commercial policy, designs the higher voltage networks and connections to that network, sets use of system tariffs and also maintains the overhead and underground map records. He is a member of a number of national groups developing technical, commercial and regulatory aspects of smart grids. During regulatory price reviews he has led on investment planning, innovation and smart grid strategies. He also had a major role in the acquisition and integration of both South Wales and more recently the Midlands distribution networks into WPD.

Nigel is a member of the Distribution Code Review Panel and the Power Academy Executive.