Inquiry into carbon reduction in Wales: evidence session on energy production
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Energy Network Association submission to National Assembly of Wales Sustainability Committee

Connecting Renewable Energy

1. Introduction

In order to meet the 2020 targets for renewable energy, there is an inescapable requirement to reinforce the electricity transmission and distribution networks across GB. Critical to the success in building this electricity infrastructure is an effective planning framework and full Government support for the significant investment involved.

The Transmission Access review (TAR) process, initiated by Ofgem and DECC, is presently focussed on measures that will help improve the utilisation of existing transmission assets. Although this is clearly very important, it must be recognised that this is only part of the solution. Only a small minority of new renewable generation capacity can be connected by improved access with the vast majority requiring new network infrastructure.

2. Connecting Distributed Generation

Distributed Generation (DG) relates to the wide range of generation technologies that are not directly connected to the electricity transmission network. Such generators vary significantly in size and range; from domestic photo-voltaic and micro-combined heat and power systems connected to low-voltage distribution networks to several hundred MW wind farms connected to higher voltage distribution networks.

Although there are some exceptions, in England and Wales projects generating less than 100MW are likely to connect to distribution networks. However, these distribution networks were originally designed to as “passive” supply networks that accept energy from the electricity transmission system to supply end customers. As DG continues to grow, distribution networks will become more “active” and it is also expected that the trend towards “clustering” will become even more marked. This clustering of generation can present a challenge for distribution companies, especially in areas abundant with renewable resources, as these tend to be in rural locations typically with a relatively weak local network. As the number of such connections increases, network issues will become even more critical. This is particularly the case in mid Wales.

The UK's electricity networks have been designed to deliver energy via high voltage and low voltage systems, with a 'top down' direction of power flows. Increasing levels of DG in distribution networks pose certain operational and control challenges for traditionally designed and operated distribution networks. The key technical issues being power flow management, voltage control and fault level management. These challenges tend to be different in rural and urban settings; in urban areas the issue is predominantly fault level, whilst in rural areas voltage management and load flow tend to be the main issues.

CONNECTING DISTRIBUTED GENERATION IN WALES

Significant network infrastructure investment is required to unlock the wind resource in Wales. To date, SP Manweb has received 15 connection applications totalling almost 900MW for mid Wales, of which approximately 490MW have accepted. The existing mid Wales distribution network is sufficient to supply local customers but not to accept new generation capacity. Although the Welsh Assembly has identified four strategic search areas within the TAN8 document in mid Wales, unfortunately the area is sparse in terms of transmission (grid) and distribution infrastructure.[1]

The proposed infrastructure and the connections associated with generation in mid Wales has been made possible by the cooperative approach taken by developers, National Grid and SP Manweb, and the support of Ofgem and the Welsh Assembly Government. The process is still at an early stage. For the proposal to materialise into construction, this cooperation must be extended to planners, consultees and communities to secure what will be very challenging consents.

It should be noted that SP Manweb are also beginning to see applications for connection in north Wales.

Provision of Distribution Infrastructure

Another important issue is that the network funding arrangements for distributed generation. While the DG incentive put in place by the Ofgem could be effective in ensuring that effective localised infrastructure is put in place, it does not fund the deep reinforcement required in resource rich, infrastructure sparse areas. The current incentive arrangements should be augmented with a mechanism that takes a holistic view of likely network requirements in the medium to long-term to change DG from being a bolt-on extra to an integral part of the way distribution companies develop their networks.

3. Connecting Generation to Low Voltage Distribution Networks

[1] This currently includes 400kV overhead line infrastructure, and a new grid substation. In terms of distribution infrastructure, around 150km of low profile, wood pole 132kV overhead line is required.

There is considerable potential for significant penetration of generation on to low voltage distribution networks, from domestic micro-generation to small commercial units. The distribution companies have recognised that the impact of these technologies on low voltage distribution networks is potentially significant if larger penetrations are to occur in the future. As the current volume of micro-generation connected to distribution networks is relatively small, the impact on networks has not been a significant issue to date. However, a scenario that could create a real challenge for distribution companies is where there is a high penetration of domestic micro-generation and the existing networks are not designed for the potential bi-directional power flow.

There are recognised engineering solutions to all these technical issues and the industry has significantly broadened its toolkit over recent years through work sponsored by the government and Ofgem, through working groups, government technology programmes, and Ofgem's Innovation Funding Incentive (IFI) and Registered Power Zones (RPZ) initiatives. Continued work to increase the ability to effectively connect DG relies upon these support and extension of these mechanisms.

Finally, it should also be noted that as DG connects, it will displace local demand and ultimately result in 'export' onto the transmission system. This in turn could have implications for the requirement for transmission grid infrastructure.

The distribution companies have done much over the last five years to facilitate connection of DG. The companies have also been re-examining traditional operating practices and looking for innovative technological and technical solutions to provide more cost-effective, efficient connection and operation of distributed generation. Such as the development of new technical solutions in the areas of voltage control and power flow management, coordinated constraint management, dynamic circuit ratings, energy storage technologies, intelligent voltage control and microgrids.

4. Offshore

The potential offshore renewable resource in the UK is extensive, The Crown Estates Round 1 and Round 2 development total 8GW, with the potential of a further 25GW from Round 3. However, the regulatory and funding framework is still being developed. The current arrangements and proposed structure of incentives present an 'asymmetry' of risk which will increase the exposure of the offshore transmission owner. In order to attract offshore investment, the regulatory regime must be clear, fair, offer a balanced risk profile and provide sufficient certainty to attract efficient investment. The regime in its current form does not meet these criteria.

5. Supply Constraints

A fundamental issue for both wind farm developers and network builders is acquiring network assets (e.g. turbines, transformers) from suppliers/manufacturers in reasonable timescales. For example, over the last two years the period from order to delivery of large transformers has stretched

from 9 months to 22 months. This delay reflects the worldwide demand for renewable generation assets and grid infrastructure, which is unlikely to be mitigated by the present 'credit crunch'.

THE TRANSMISSION NETWORK IN WALES

In the UK National Grid holds a licence to transmit electricity under the Electricity Act 1989 and our high voltage transmission network provides electricity supplies from generating stations to local distribution companies such as Western Power Distribution (in South Wales) and Scottish Power Energy Networks (in North Wales).

The transmission network is a highly efficient way of moving power across Great Britain. Losses from the National Grid transmission system average 1.5%.

System Operator of the Great Britain transmission system

As the System Operator for the transmission network across Great Britain, our role includes residual balancing of supply and demand, co-ordinating outages with users of our system and facilitating the operation of the electricity market.

Gas transmission and distribution in Great Britain

National Grid also operates the gas transmission system in the UK, transporting gas from importation terminals to major energy users and the gas distribution network which supplies homes and businesses.

In addition, we operate the 0800 111 999 National Gas Emergency number in the UK on behalf of all the gas networks and transporters – including Wales and the West Utilities.

Community engagement

We take our role in society very seriously and Warm Wales – Cymru Gynnes CBC is an independent community interest company operating on a 'not for profit ' basis set up by National Grid in 2004 to assist housing providers in Wales tackle the misery of fuel poverty. Its schemes provide significant assistance to social housing providers to help achieve the Welsh Housing Quality Standard. Through its operations Warm Wales has secured more than £22 million for investment in fuel poverty schemes and created and secured over 70 new jobs for local people.

Through its schemes, Warm Wales has:

- Assessed the energy needs of over 65,000 homes in Neath Port Talbot and Wrexham
- Invested over £14 million in local homes and installed over 23,000 free loft and cavity wall insulation measures;
- Installed over 1200 new or improved energy efficient gas central heating systems;
- Secured over £2.5 million in new or additional benefit payments for local residents; and identified a further £3 million for householders

Under the proposed Planning Bill National Grid plans to engage with communities at earlier stages than on previous projects.

Electricity in Wales

1. Total electricity demand in Wales is approximately 4.08GW and demand is expected to slowly rise over the next seven years at an average of 1.25 % a year.

However demand growth going forward will be affected by increased energy efficiency, the impact of high fuel prices and the severity of the economic downturn.

2. At present generation capacity in Wales is 7.7GW of conventional, nuclear and pump storage capacity. We estimate new generation connecting will add:

    - 4 GW of Gas fired power stations
    - 0.5 GW of Interconnections
    - 0.35 GW of Bio-fuel
    - 2.24GW of wind

So by 2016, our forecasts suggest that generation connected to the transmission system in Wales could total 14.8GW.

Map of National Grid's electricity transmission system in Wales

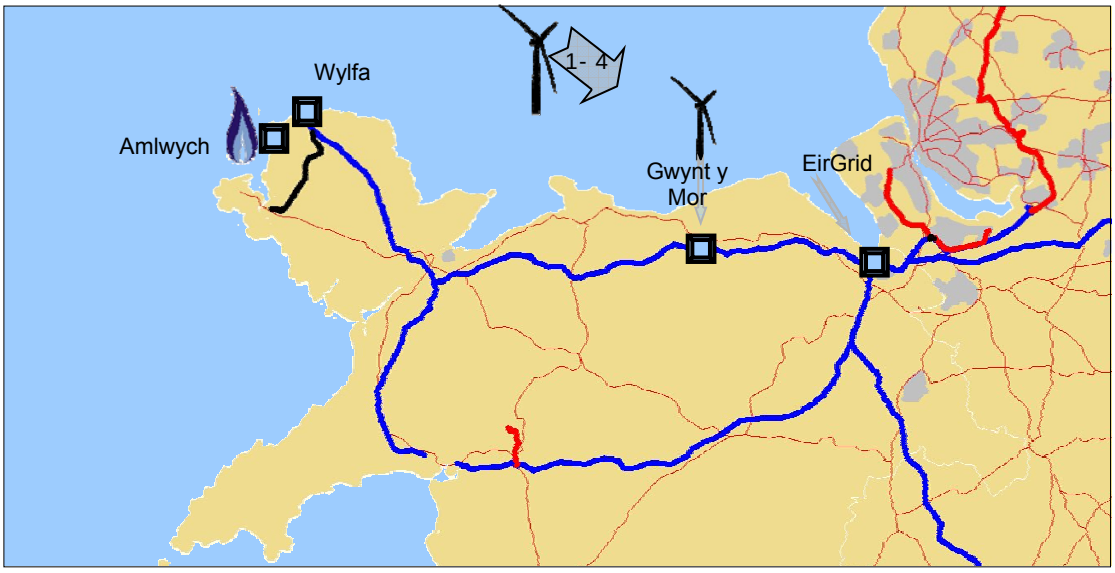
Blue lines represent the National Grid 400kV system and the red lines represent the 275kV system. Squares represent our substations.

Transmission projects that have applied to connect to National Grid in Wales

3. A number of developers have made connection applications to National Grid for capacity. We have offered the following grid capacity:

North Wales

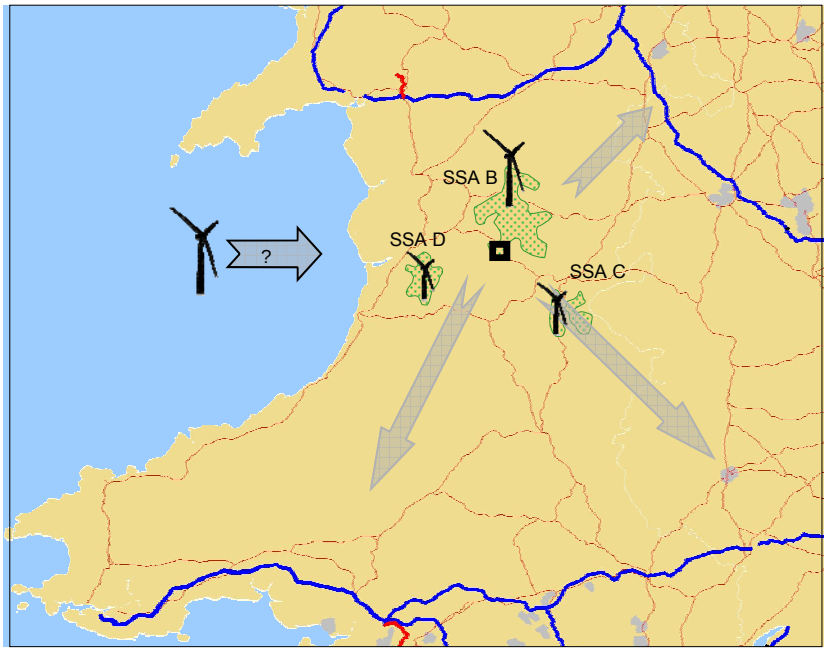
Npower Renewables	Gwynt Y Mor Offshore Wind Farm 735MW
EirGrid Interconnector	High Voltage DC link to the National Grid system at Deeside 500MW
Canatxx	Amlwych Combined Cycle Gas Turbine 250MW
Wylfa	Nuclear 1670 MW



Blue lines represent the National Grid 400kV system and the red lines represent the 275kV system.

Mid Wales

Npower Renewables	Carnedd Wen Wind Farm 191 MW
Renewable Energy Systems	Llanbrynmair South Wind Farm 110 MW



Blue lines represent the National Grid 400kV system and the red lines represent the 275kV system.

South Wales

Prenergy Power Limited	Port Talbot Wood Chip Power Station 350 MW
RWE	Pembroke 2GW
Rhigos	299 MW
Severn Power	Uskmouth 850 MW

Blue lines represent the National Grid 400kV system and the red lines represent the 275kV system.

How National Grid determines its charges

4. National Grid's charges that feed through to end users' bills are designed to be non-discriminatory and cost reflective, and are set by applying methodologies regulated by Ofgem.

5. The total revenue National Grid collects through its charges is restricted by the allowed revenue set by Ofgem as part of five-year price controls. The transmission businesses in gas and electricity along with gas distribution and regulated metering business are all subject to separate price control reviews. The consultation period for changing the price control typically lasts for two years. The process involves not only just licence holders, but also consumer interest groups, market participants, major energy consumers and any other interested parties.

6. In electricity transmission, the high level regulatory framework is set out in National Grid's transmission licence. This includes prices controls and incentives schemes for our Transmission Owner and Systems Operator functions. Revenues remunerating transmission assets are regulated through a price control running until 31 March 2012.

7. The transmission licence also details National Grid's annual system operation incentives to efficiently balance the system in real time. Annual charges for market participants are determined by applying a Charging Methodology[2]. This is published, together with the resulting charges, in a number of Charging Statements. Changes to the Charging Methodology can be made following consultation with market participants and must improve cost reflectivity and promote competition. Any changes are subject to an Ofgem veto, and Ofgem can conduct a Regulatory Impact Assessment, if necessary, before making any decision.
8. In gas transmission, National Grid's regulatory framework is set out in our gas transporter licence. National Grid is subject to a five year Transmission Owner (TO) price control for gas transmission activities that currently runs to 31 March 2012. The TO price control sets a maximum allowed revenue which covers assets and related expenditure. We are also subject to a System Operator (SO) price control which covers operating costs and mechanisms to fund the additional provision of transportation capacity for new connections to the system. In addition the SO activity is subject to a number of financial incentive schemes of varying durations aimed at driving efficiencies in the overall costs of system operation and market operation.

9. Any potential change to the gas transmission charging methodology has to be consulted on with the gas shippers through the Joint Office of Gas Transporters[3]. All the staff for this office are seconded from the different gas transporters involved. The role of this office is to provide an even handed service to all parties to the Network Code and the wider gas industry by publicly providing information and acting as a forum for discussing modifications of the commercial regimes. A report on the consultation highlighting representations made and any consequential

[2] National Grid, Electricity Charging. http://www.nationalgrid.com/uk/Electricity/Charges/
[3] Joint Office of Gas Transporters home Page. http://www.gasgovernance.com

change proposals has to be provided to Ofgem which has the power to veto any proposed change

National Grid transmission charges as proportion of domestic customer bills

10. National Grid's transmission charges are a small component of the end users bills and we have made considerable steps in reducing the costs these charges seek to recover.

11. Gas transmission charges levied by National Grid account for about £20 (2 - 3%) of an average consumer gas bill of approximately £720p.a.

12. The electricity transmission charges which recover the costs of the Scottish transmission companies as well as National Grid Electricity Transmission account for about £20 (4 - 5%) of an average electricity bill costing approximately £450 p.a.