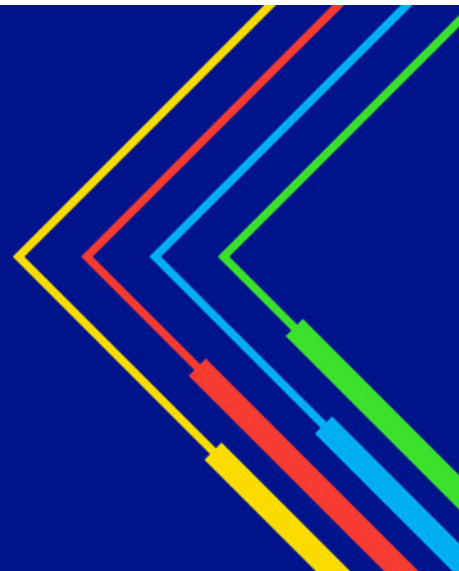


National Grid response to draft National Development Framework consultation



At National Grid, we believe that our nation should have a clean, reliable energy system to help tackle climate change, improve the quality of the air we breathe and to power growth and prosperity in our economy for future generations.

We welcome the opportunity to contribute to the draft National Development Framework consultation and support Welsh Government's ambition to take urgent action in carbon emissions and deliver a competitive, resilient and sustainable decarbonised society. In responding to this consultation, we set out how we can support Welsh Government to achieve this ambition and the key role electricity transmission has in facilitating the transition to a decarbonised Wales.

Executive Summary

- We are pleased to respond to this consultation and commend Welsh Government's commitment to develop a strategic planning framework which will drive clean renewable energy solutions to reach net zero.
- We are committed to enabling the transition to net zero in the most efficient way and for the benefit of consumers in Wales and the rest of the UK.
- Over a number of years, we have worked closely with Welsh Government and are keen to forge an ongoing partnership to enable Welsh Government to achieve its ambitious climate targets through transformational engineering solutions.
- We support Welsh Government's commitment to encourage the uptake of low emission vehicles. Indeed, with the right investment, the UK could become a world low-carbon leader in areas such as transport. National Grid believes that targeted strategic investment to deliver a high-powered electric vehicle (EV) charging network, could see the UK become a world-leader in EVs. However, for this to be a reality, future-proofed electricity network infrastructure will need to be place in the early 2020s.
- In our response, we have detailed the critical role the transmission network plays in facilitating renewable energy development. We detail how potential transmission solutions could connect the energy that is generated to the places where it is used. We are keen to work with Welsh Government and local communities to develop these solutions and would welcome further engagement on our suggestions.

Understanding National Grid

This response represents the views of National Grid Electricity Transmission (NGET). NGET owns the high voltage electricity transmission network in England and Wales. The network covers some 7,212km of overhead line and 2,820km of underground cable. We connect sources of electricity generation to the network and transport it onwards to the distribution system, so electricity can reach homes and businesses.

As a business, we are regulated by Ofgem and we have recently published our latest draft business plan for the next RIIO price control period (2021-2026), which can be found [here](#)

<https://investors.nationalgrid.com/riio-2>. In building this plan we have extensively engaged with our customers to understand their needs and have fed these into our plan. The final version of the plan will be issued on the 9th December 2019.

Question 1: NDF Outcomes (chapter 3)

NGET supports NDF outcome 11: 'A Wales where people live in places which are decarbonised'. We agree that the challenges of climate change demand urgent action on carbon emissions and the planning system must help Wales lead the way in promoting and delivering a competitive, sustainable, decarbonised society.

In view of the scale of the challenge, a clear, coordinated and aligned energy and planning policy context is needed to encourage the right innovation and investment. As part of this, it is important to have a planning system that facilitates the development of energy infrastructure in a timely, economical and responsible manner.

Question 5: Low Emission Vehicles (policy 7)

NGET supports Welsh Government's ambition to increase the use of ultra low emissions vehicles. We consider, that with the right conditions, the UK could become a global leader in electric vehicles (EVs). For this to be a reality, it is important that the charging infrastructure that EVs rely on is planned and in place in the early 2020s.

We welcome Welsh Government's commitment to work with stakeholders to plan for and implement the roll out of electric vehicle charging infrastructure, including a network of rapid charging points. We support this vision and would be pleased to work with Welsh Government on developing the strategy for electric charging infrastructure identified in policy 7.

NGET is already working to enable the consumer to switch to electric vehicles by providing solutions for drivers' charging needs. The lack of infrastructure is the most serious deterrent to over half of UK drivers who are worried about travelling long distances in EVs. The availability of charging infrastructure could significantly delay the speed of EV adoption and materially impact the ability to achieve decarbonisation targets.

It is clear that EV owners will charge their vehicles in numerous ways at various locations. The majority of charging will take place at home, work or destinations such as shopping centres. However, for those longer distance journeys where the distance exceeds the range of the car, ultra-rapid charging will be critical for users. It is important that the charging infrastructure installed is relevant to the time spent at each location. We have studied the UK's strategic road network and identified 54 sites where an upgraded electricity network connection, suitable for vehicle volumes in 2030s when we will have 36m vehicles on the road would allow 99% of drivers in England and Wales to be within 50 miles of an ultra-rapid charging station. This would allow drivers to fully charge their car in minutes.

Targeted investment from Government will help stimulate the market to deliver ultra-rapid charge points. There is a need for intervention to enable the market mature quicker than it otherwise would. If the market matures, the utilisation risk will reduce and make it more commercially viable for private investment to deliver ultra-rapid charging infrastructure.

Question 7: Renewable Energy and District Heat Networks (policies 10-15)

NGET supports Welsh Government's positive policy position that sets out a presumption in favour of development of renewable energy projects in Priority Areas, and an acceptance of associated landscape change. Development of these areas will assist in bringing a critical mass of renewables developments together to build a case for new or reinforced grid infrastructure. To deliver this, the NDF should give grid infrastructure the same positive planning treatment as renewable energy development.

New or reinforced grid infrastructure has a critical role to play in facilitating renewable energy development, connecting sources of energy to the places where it is used. To some extent, renewable energy development is viewed in isolation in the NDF, yet it has to be connected to, and make use of, the high

voltage transmission and/or distribution networks. For development to connect to, and make use of such networks, grid infrastructure may require further development and/or significant improvement.

Significant renewable energy development, particularly large scale wind generation, is often likely to be proposed in areas remote from the existing transmission and distribution networks, for example mid Wales. As a result, such networks have to be physically extended, possibly over a considerable distance, in order to connect to the transmission and distribution networks. It is likely to take a considerable time to connect Priority Areas that are a long way from the existing transmission network, and this should be considered in achieving renewable energy targets. Where it is required, the further development and improvement of grid infrastructure must be viewed as an integral and essential part of renewable energy development.

Improvement of the transmission network may take the form of substantial new infrastructure in the form of 400KV, 275KV and 132KV connections. These high voltage connections require the appropriate technology to allow energy to flow while keeping the public safe. NGET's technology is comprised of overhead line (high voltage wires carried on steel pylons), underground cable (high voltage cables encased and buried underground) or subsea cables (high voltage cables encased and laid on the seabed) and associated electrical plant and equipment (substations and converter stations).

To support the NDF's development, we have outlined in Appendix 1 of this response, the transmission network's current capacity to connect development.

Any connections to the transmission network will need to go through a rigorous options appraisal process. This process will assess the positive and negative effects across a wide range of criteria including environmental, socio-economic, technical and cost factors to determine the best way to make a connection. NGET will continue to work with developers to understand their requirements and the Welsh Government and stakeholders to find the most appropriate connection solution. We are continuously working to find new, innovative solutions, responding to changing demands in the way energy is generated and consumed.

We note that Welsh Government's preferred position on new power lines, as set out in Planning Policy Wales 10, is that they should be laid underground where possible. This policy refers to projects which fall under the Developments of National Significance (DNS) regime, where consenting powers for connections up to and including 132kV have been devolved to Welsh Government. However, the consenting regime for 275kV and 400kV infrastructure sits with the UK Government, under the Planning Act 2008. Under this regime, decisions are made in the context of the UK Government's National Policy Statements (NPSs).

The NDF should recognise, and be consistent with, the NPS policy towards overhead lines, underground and subsea cables at 275kV and 400kV. In relation to underground cables, NPS EN-5 (electricity networks infrastructure) suggests that the impacts of new overhead lines can generally be mitigated to an acceptable level, but where the effects may be particularly significant, underground and sub-sea cables should also be considered.

The approach set out in the NPSs is consistent with the regulatory framework for electricity transmission networks. The regulatory framework requires transmission licence holders to balance a range of important factors, including the need to develop and maintain an efficient, coordinated and economical electricity transmission system (s9 of the Electricity Act 1989). New connections and infrastructure improvements are funded by bill payers and we must demonstrate the need for our work, to ensure value to the consumer. Given this policy and legal framework, and the fact that underground and subsea cables are generally substantially more costly than overhead lines, we will typically only propose the use of technologies other than overhead line where there are particularly significant effects.

We ask that this understanding be included in the NDF to provide clarity about the different consent regimes the role that Welsh Government has in shaping and consenting both renewable energy development and the associated grid infrastructure that will be needed. The NDF should articulate the need for new transmission infrastructure, if it is required, for Welsh Government's decarbonisation targets to be achieved. If Welsh Government believes that new infrastructure investment is required ahead of need, in anticipation of the developments that would utilise the infrastructure, it should make this clear in the NDF and discussions with the regulator.

Our recent experience in developing options to connect mid Wales windfarms, and the Wylfa Newydd nuclear power station on Anglesey, to the transmission network showed that grid infrastructure is often viewed by the public as highly contentious in planning and environmental terms. As was the case with this project, new infrastructure may be distant from the development itself, possibly falling across administrative boundaries. Therefore, the NDF should plan positively for grid infrastructure, and include policies that help to co-ordinate strategic action. It should also identify the decisions that that need to be made, providing a platform for a shared understanding across industry, Government and the public of why significant investment in energy infrastructure is required, and the benefits and trade-offs to gain a safe, secure, affordable and sustainable energy future.

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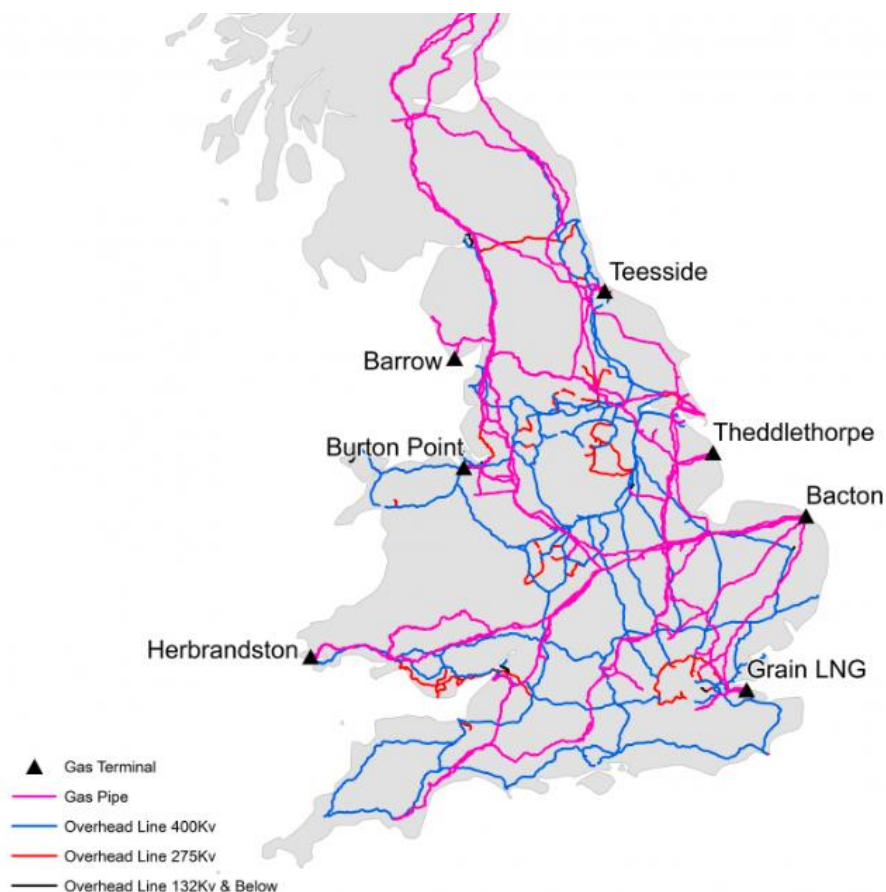
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1 Introduction

This briefing note describes National Grid's high voltage electricity transmission network in Wales. It also describes potential capacity for connecting new generation in the Priority Areas identified in the draft NDF to the existing network.

1.1 Overview of the Wales transmission network

The Wales high voltage transmission network consists of a northern and southern network. There is no transmission network within Mid Wales.



The onshore network in North Wales comprises a 400kV circuit ring connecting Pentir, Connah's Quay and Trawsfynydd substations. A 400kV double-circuit spur connects the now decommissioned nuclear power station at Wylfa to Pentir. A short 400kV double-circuit cable spur from Pentir connects Dinorwig pumped storage power station. A 275kV spur connects Trawsfynydd to Ffestiniog pumped storage power station. Most of these circuits are of double-circuit pylon construction. However, Pentir and Trawsfynydd within the Snowdonia National Park are connected by a single 400kV circuit, which is the main limiting factor for capacity in this area.

The South Wales network is connected via two 400kV double circuits from Pembroke via Swansea North, Rassau and Cilfynydd towards Melksham and Walham 400kV substations. There is also a 275kV double circuit connecting the 275kV network from Swansea North via Aberthaw. The South Wales network

connects several thermal generators including Pembroke and Severn Power gas powered stations and Aberthaw, powered by coal. Some of the older power stations are expected to close in the future but significant amounts of new generation capacity are anticipated to connect, including generators powered by wind, gas and tidal. It is important to highlight there is currently a thermal limitation within South Wales, which limits the generations to technologies that do not include thermal or energy storage devices. Requests for connection of new thermal or energy storage power generators could result in the need for significant work to the existing network including potentially new infrastructure such as new connections and substations.

1.2 Potential capacity to connect new generation into existing National Grid network

To maintain safe operation, connection of new generation is made at substations. These can be existing substations or where required a new substation will be constructed.

Table 1 highlights the current capacity on the existing network available for new connections at existing National Grid substations within the Wales transmission networks in North and South Wales. There is currently no transmission infrastructure within Mid Wales and any new generation in this area would require development of significant transmission infrastructure to connect to the transmission network. It is important to note that the capacity highlighted in the table 1 is based on the current generation and demand levels. An application to connect into any of the sites will have a varying impact on the generation headroom available at both the connection site and the other sites in the region. There is interactivity between the generation headroom available at each site and the total available headroom is not as high as the sum of the headroom at each site.

Table 1 Possible connections into existing National Grid substations within Wales transmission network

Substation Name	Voltage (kV)	Substation Extension Required for new Connection	Approximate capacity available to connect new generation (MW)
Bodelwyddan	400	No	~ 900
Legacy	400	Yes	~500
Trawsfyndd	275	No	~700
Wylfa	400	TBC	~1800
Aberthaw	275	No	~500
Aberthaw	132	No	~350
Cilfynydd	400	Yes	~2000
Margam	275	Yes	~900
Pembroke	400	Yes	~1000
Pembroke	132	No	~480
Pyle	275	Yes	~850
Rhigos	400	Yes	~1200
Swansea North	400	Yes	~450
Upper Boat	275	Yes	~500

1.3 Connecting the Priority Areas

This section provides a high-level overview of potential options for connecting the Priority Areas to the transmission network. The overview is supported by, figure 3 at the end of this brief. Any potential options for connecting the Priority Areas will be dependent on the exact location of the new generation and will need to go through a rigorous options appraisal process. Our Options Appraisal approach is underpinned by a set of overarching principles which reflect our statutory duties, which assist us in our decision-making and which help achieve an appropriate balance between competing interests that must be taken into account. We will generally consider options to have an advantage if:

- we can use or adapt existing infrastructure, or
- where we can negotiate different commercial arrangements with our customers to achieve a need, rather than building new infrastructure;
- they are shorter, compared with longer routes;
- they are financially less expensive compared to other more expensive options;
- they avoid or mitigate environmental or socio-economic impacts, for example avoiding International Designations such as National Parks or AONBs

Full details of our approach to Options Appraisal process can be found [here](#).

1.3.1 Priority Areas 1, 2, 3, 4 and 15

Priority Areas 1, 2, 3, 4 and 15 are located in proximity to the North Wales transmission network. There is the potential to connect new generation in Priority Areas 1, 3 and 4 into nearby substations. Priority Areas 2 and 15 are located further away from the network. Therefore, substantial new infrastructure will be needed to connect new generation in these areas into the network.

1.3.2 Priority Areas 5, 6, 7 and 8

Priority Areas 5, 6, 7 and 8 are located within Mid Wales where there is currently no transmission network for generation to connect into. Developing a strategic approach to connecting these areas is therefore likely to be beneficial. Options developed to connect new generation in this area to the transmission network would be in line with our Approach to Options Appraisal as outlined in paragraph 2.3 above. For previous connections for Mid Wales windfarms the preferred option was via a connection from a location between Priority Areas 5 and 6 into the closest existing transmission network close to Shrewsbury substation. The connection was proposed to be made via a marshalling substation in Mid Wales to bring the power together from the windfarm locations and a combination of overhead line and underground cable. Any option like this would also have to consider potential connections in Priority Areas 7 and 8.

1.3.3 Priority Areas 9 and 10

Priority Areas 9 and 10 are located close to the west coast, in places which are not near to the transmission network. Therefore, substantial new infrastructure will be needed to connect generation in into the network. It is likely that connection would be by new infrastructure into the South Wales transmission network.

1.3.4 Priority Areas 11, 12, 13 and 14

Priority Areas 11, 12, 13 and 14 are located in proximity to the South Wales transmission network. New generation within Priority Areas 12, 13 and 14 has the potential to connect into the nearby existing network. Priority Area 11 is located further away from the network. Therefore, substantial new infrastructure will be needed connect generation in this area into the network.

1.4 Design of new infrastructure connections

New connections are likely to require the construction of overhead lines. Overhead lines can be designed at different voltage levels dependent on the amount of power required to be accommodated. Table 2 provides a guide to the characteristics of a standard overhead lines designed at 400kV, 275Kv and 132kV. The exact capabilities of an overhead line will be dependent on conductor types, pylon type, pylon height, overhead line safety clearance level requirements, mechanical protection etc. used in the design of the connection.

Table 2 Standard Overhead Line Characteristics

		Standard Pylon Design
Voltage (kV)	Capacity (MW)	Height (m)
400	3820	~50 (L6)
275	1650	~40 (L2)
132	335	~26 (L7)

Figure 1 shows the comparison in height between the pylon types identified in Table 2 above. It highlights, the lower the voltage, the smaller the capacity of overhead line to transmit energy. This means that depending on the generation connection requirements, multiple connections will be required if a lower voltage design, to meet the generation required to be transmitted through the network. There are alternative pylon designs, as shown in Figure 2, that are more compact. These designs are significantly more expensive to develop and would be used only where there is an overriding evidence base to reduce the visual impact of a standard design pylon

Where generation is located close to existing overhead lines or substations, we will generally consider lower voltage connection options into the existing network. Where generation is located further away from the network, aggregating a high voltage connection to one point is considered to be appropriate.

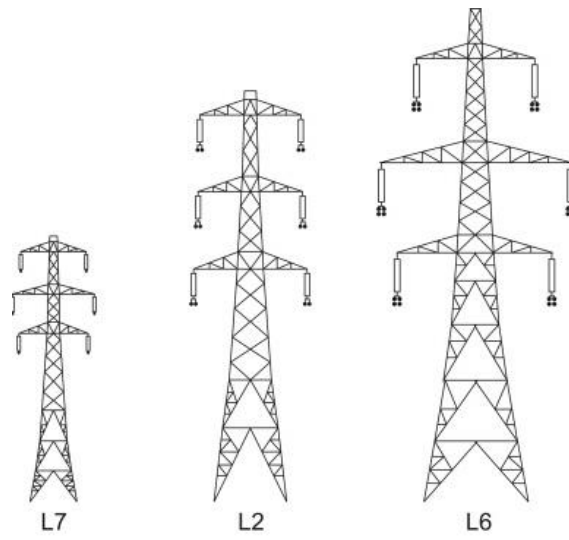


Figure 1 Standard Tower Designs highlighted in table 2

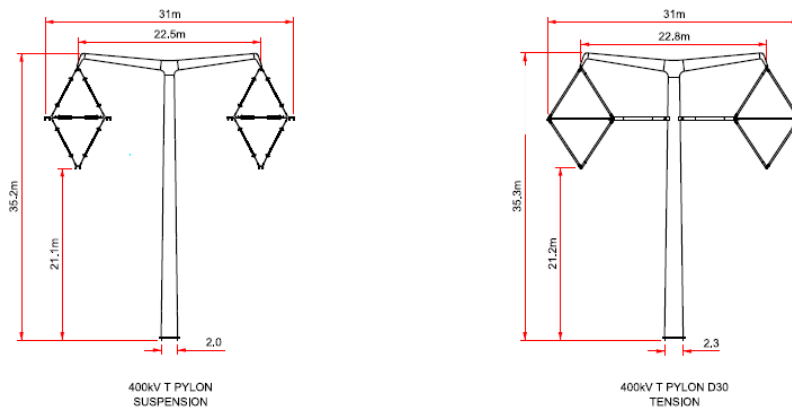


Figure 2 Compact 400kV T Pylon tower design

1.5 Appendix

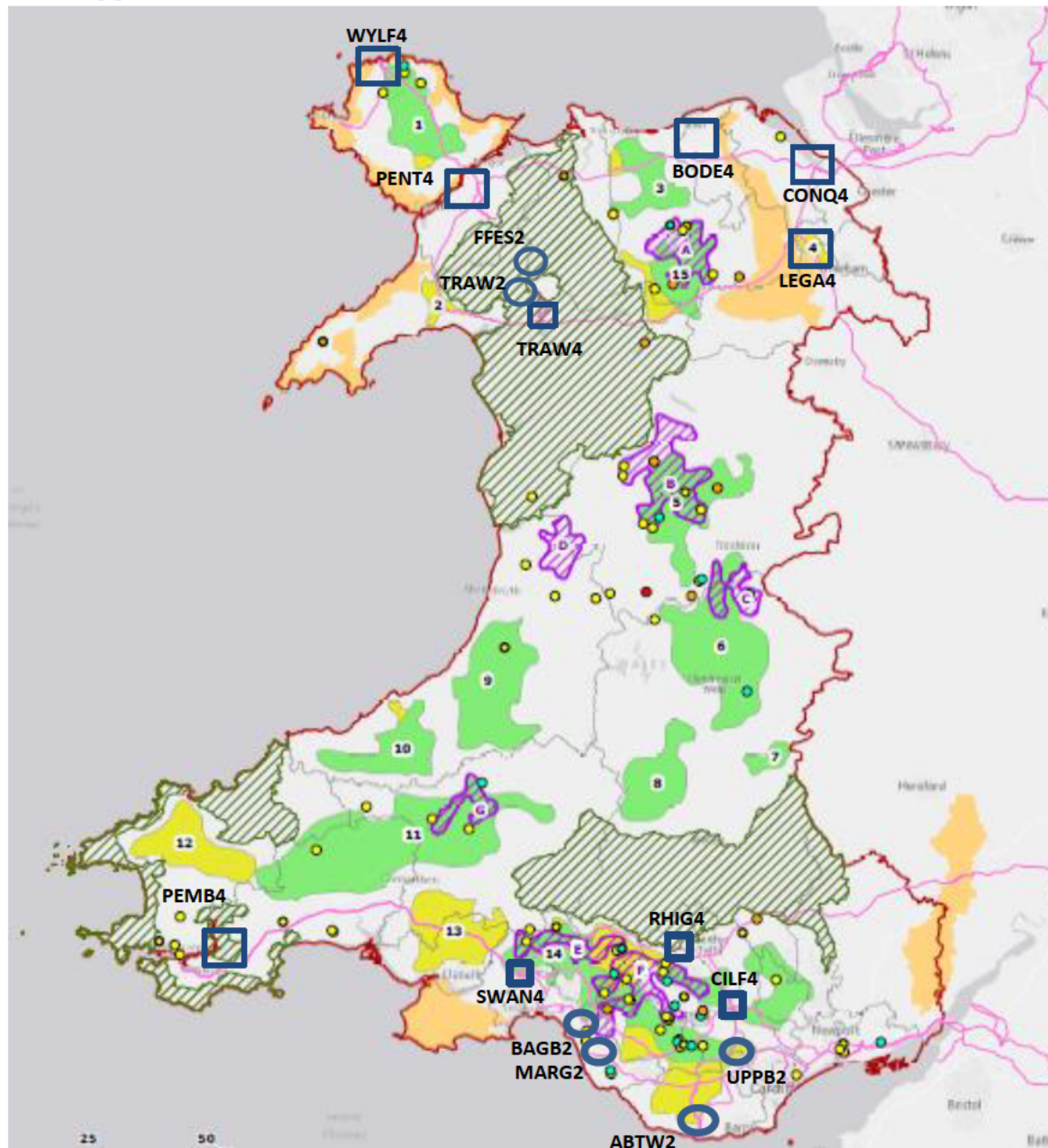







Figure 3 Existing Transmission Network and Priority Areas

Scaling as follows for figure 3 above:

	Existing 400kV Substation		HV Transmission Network
	Existing 275kV Substation		Wind and Solar
	Wales Boundary		Solar
	Regional Boundary		AONB
	National Parks		TAN 8 Strategic Areas