Electricity Distribution nationalgrid

## Independent Advisory Group (IAG) on Future Electricity Grid for Wales: Request for information

National Grid Electricity Distribution (NGED – formerly Western Power Distribution) is the Distribution Network Operator (DNO) serving South Wales, the Midlands, and the South-West of England. We serve over 20 million customers across our 55,500 $KM^2$ operational area, making NGED the largest DNO by geography in England and Wales.

NGED sits at the heart of Wales's energy system, connecting millions of people and businesses to the energy they use every day. Across South and West Wales, our team of over 1,000 people, based in 10 depots, maintains 36,000 km of overhead and underground lines, which distributes 10TWh of electricity to over 2million people. Between 2023 and 2028, we are investing over £1.2billion on new connections, network reinforcement and asset health and maintenance.

We are regulated by the electricity market regulator, Ofgem, who require us to provide value for money for consumers, and to satisfy our legal duties. These duties are set out in the Electricity Act (1989) and require us to develop and maintain an efficient, economic and coordinated energy transmission system and have regard to the desirability of preserving amenity. On average (based on an annual consumption of 3,100 kilowatt hours), NGED domestic customers pay around £104 per annum for electricity distribution costs. Our costs form part of the bill to customers from the electricity suppliers.

The electricity distribution network is undergoing a fundamental transformation as the nature of demand and generation decentralises and becomes multidirectional. There is a rapid increase in the number connections associated small scale renewables, and the electrification of heat and transport, placing greater importance on distribution network infrastructure. As such, we welcome the opportunity to input to the Independent Advisory Group's work.

### 1. How is our network designed?

The distribution network differs significantly from the transmission system. NGED's network is five times bigger than its transmission network, and the majority of network upgrades are undertaken through the mechanisms built into the Electricity Act, and where appropriate the Town and Country Planning Act system, rather than, rather than the Development Consent Order route, as with transmission.

The drivers of growth on the network are different between transmission and distribution too. Transmission has a clearer view of drivers that are linked to the deployment of large projects, often the result of Government policy, which have reasonable certainty of scale and location. Conversely, distribution networks involve a combination of new distributed generation capacity and demand growth from low carbon technologies (LCT), like Electric Vehicles, Heat Pumps, and small scale solar/wind renewables. These are inherently more dispersed, smaller schemes that are less geographically defined and carry more uncertainty surrounding timing, but the volumes and demands on the network are materially significant.

There are two entities involved in designing the distribution network:
**NGED is the distribution network operator, and is responsible for designing new connection works and connection specific reinforcement works**. These works are designed in consultation with the

customer and our network planners and a quote is issued before work is delivered. Consultations with the customer take into account their needs and requirements, the type of connection they're seeking (demand or generation and the technologies involved), what is possible to deliver on the network in relation to capacity and reinforcement and accounts for our regulatory duties to ensure best value for money for the billpayer.

Separately, **National Grid Electricity Distribution's Distribution System Operator (DSO**) – a functionally separate entity from National Grid Electricity Distribution – is **responsible for the strategic planning of the distribution network, based on growth forecasts.** You can read more about how the DSO and DNO interact here. The DSO recently launched their own separate website too, which can be viewed here.

The DSO undertakes constant extensive stakeholder engagement, liaising with local authorities and key industries to inform the development the Distribution Future Energy Scenarios (DFES). DFES reports are published annually and identify how customers will use the distribution network in future. You can view the latest DFES reports and maps here.

The understanding of future network demand that is developed through DFES is then used to undertake a network impact assessment. The network impact assessment is incorporated into the Network Development Plan, which aims to identify where and when investment is expected to accommodate forecasted growth. You can read more about this here.

All constraints identified are evaluated using the Distribution Network Options Assessment (DNOA), which outlines the optimal investment pathway to take. You can read more about this here.

Once the investment need is established and solutions identified, these are incorporated into NGED business plan submission, which are submitted to Ofgem for approval every five years. NGED's 2023-2028 ED2 final business plan submission can be viewed here, and Ofgem's final determination here.

## 2. What does electricity grid infrastructure consist of and what are the variables?

Our network in South and West Wales is around 36,000km in length, comprising of approximately 18,000km of overhead lines and around 18,000km of underground cables, and 41,000 transformers. The vast majority of distribution network's overhead lines are hosted on wooden poles, with some higher voltage lines being hosted on towers. In South Wales, we operate 132 kV, 66 kV and 33 kV, 11 kV, and low voltage systems.

You can find out more about National Grid's network:

- Our Long Term Development Statement here.
- Distribution Network Options Assessment here.
- Our mapping hub here.
- Our data hub here.
- Our connections hub here.

## 3. What are the processes associated with creating new grid?

'New grid' typically refers to new transmission infrastructure, rather than the distribution network infrastructure. The below refers to the process NGED undertakes to build its distribution systems. In addition to regulatory and DSO processes outlined in question one, this very much depends on what is being built and where.

Primarily, expansion and reinforcement of the distribution network is customer-driven, so typically we are confined within their site/arrangements. Depending on the voltage and infrastructure

significance, we also use wayleaves and easements to secure access rights and land for substations. This ranges from 4m by 4m for a distribution substation with parking in front of the site to 40m by 40m for larger bulk or grid supply points.

Cable routes are typically agreed with landowners and developers and laid in such a way that access is not an issue for the future maintenance and repair work. Once agreed, excavation and cable installation will take place, sometimes in tandem with switchgear construction and placement.

Some of the frameworks we use require review and change if we are to support the ambitious net zero targets being set by policymakers – including some that are reserved for Westminster.

For instance, building or reinforcing a line over private land requires land access negotiations with landowners or undertaking a lengthy Section 37 (of the Electricity Act) process through the Department for Energy Security and Net Zero. We also have to follow the S37 process even to add an additional cable to our existing infrastructure – see to the right. Given the minimal impact on visual amenity of this change, we believe we should be empowered to undertake this work through permitted development.

*Single phase overhead line* *Three phase overhead line*

Meanwhile, we can build some assets under permitted development rights, such as substations up to 29m$^3$ in volume, but we are pushing for this threshold to be increased to 46m$^3$ to allow us to reinforce our network faster, while minimising the burden these applications superfluous place on local planning authorities. In Scotland, they have already implemented this change, which means slightly bigger substations can be built to house bigger transformers that are needed to meet the projected future increase in electricity demand that will come with the decarbonisation of heat and transport. We believe Wales is well placed to similarly lead on this important matter.

We can increase the heights of our existing wooden poles by 10% under the Overhead Line Exemption Regulations 2009 (OLER). Although we believe this threshold is not sufficient to allow the necessary and timely network reinforcement for rapidly increased demand for electricity, associated with low carbon technologies. We believed the OLER 2009 should be scrapped in favour of a maximum height for wooden poles of 20m.

These changes to permitted development rights and land access rights (S37) would allow us to significantly and rapidly reinforce our current network in a more timely manner to cope with the surging increase in demand for low carbon technologies that require connections to the distribution network.

In relation to NGED's footprint and supply chain, we have 10 depots across South Wales with a workforce of over 1000 strongly rooted in the communities they serve. These depots host out Heads of Operations, Team Managers, Network Planners, Technicians and trade staff, like linesmen, jointers and fitters. Similarly, our Welsh depots utilise local contractors to complement our network maintenance and field operations on a frequent basis. Our suppliers come from all over Wales, including Wrexham, Port Talbot, Cardiff, Newport, Carmarthenshire (to name but a few), and they support our operations across the Midland and South West, as well as our Welsh operational area.

## 4. What are the impacts from grid installations on communities, landscapes, biodiversity and environment?

**Communities**:
The primary impact of distribution network infrastructure is that it provides a reliable, efficient electricity supply to every home and business in our Welsh license area. This infrastructure is the lynchpin on which economic growth, day-to-day life and the decarbonisation of homes and transport rests.

As already mentioned, a reliable, efficient electricity supply is becoming all the more important as increasing numbers of customers turn to electricity to power their vehicles and heat their homes.

We have many diverse assets ranging from distribution substations, bulk/grid supply points and underground cables, to wooden poles and towers:

*28m³ substation*

*Three phase overhead line*

*132 kV tower*

**Biodiversity/environment**:
As part of our ED2 business plan, NGED is committing to achieve a 10% biodiversity net gain for new major projects and for selected primary and grid substation sites. Additionally, since 2011, we have been certified to ISO14001, the international standard for environmental management systems (EMS), across all four of our licence areas.

For more information on NGED's approach to biodiversity and the environment, please see here or view our latest Environment Report.

## 5. Have you used cable ploughing at all? If so, where did you use it, why did you choose it for this work, and what advantages/drawbacks did it present?

Cable ploughing is not standard practice at NGED, but we have explored its use in some areas on a trial basis. We have used it to install small sections of 11kV cable on agricultural land, unmade ground and verge areas – and have no plans to use it on any lines of a higher voltage.

This method has been explored as an alternative to conventional open trench methods as it can allow the faster laying of cables with less damage to land. It reduces the impacts of weather on the timing of our works (ie surface water run off and drainage concerns are minimised in comparison to open trench methods). The equipment involved is large and requires good access, so it not suitable for all environments.

Nonetheless, the advantages of cable-ploughing over traditional open trench methods are only really found in the actual laying of the cable. In terms of ongoing maintenance and fault repair, the drawbacks of underground cabling remains the same regardless of whether a cable has been ploughed or laid via trench.

It is far more difficult and disruptive to investigate, monitor and find faults on underground cables. There are additional financial and carbon costs associated with excavation needed to find and fix faults. Similarly, this can involve disruptive streetworks if cables like on or near the public highway.

Moreover, underground lines are more likely to be subject to third party damage and the disruption this causes – ie a third party contractor accidentally digging through a cable, particularly in areas where the underground services (broadband, gas, water pipes) are congested. Underground cables also are not immune to the impacts of extreme weather – land movements, sinkholes and erosion will affect an underground cable in much the same way they will affect water or gas pipes.

Overhead lines remain the most efficient option when it comes to building, inspecting, maintaining and monitoring power networks. We can inspect up to 160km of overhead line in one day using our helicopter unit and this cannot be replicate when assets are underground.

## 6. How are faults found and maintenance / repair carried out?

There are many ways by which faults are identified and repaired, so this answer will focus on the most common methods:

- **Customer reports**

We are heavily reliant on customers reporting issues to us via our contact centre. While we can proactively identify issues on our network using our digital network systems or through the control room, often information from customers is crucial to finding and fixing faults on our network. This is particularly the case in rural areas where automation on the network is not widespread.

- **Control room and remote switching**

We have two control rooms across NGED's four licence areas – in Cardiff and Castle Donington. The systems in place show network faults and allow engineers to remotely reroute supplies where possible, while we allocate field teams to fix repairs. We would be more than happy to show the IAG around the control room in Lamby Way in Cardiff, if it is of interest.

- **Aerial unit**

Based at Bristol Airport, NGED's helicopter unit has a fleet of five helicopters that, along with drones, undertake mass inspection of overhead lines. Helicopters patrol our overhead lines using high tech cameras. The helicopters are able to inspect up to 160km of overhead line in a five hour shift – far more than we would be able to inspect by sending technicians out to physically inspect the lines, and the land access difficulties a manual inspection requires.

A forward looking infra-red Kelvin 275 electronic camera is used with a digital video recorder to detect hot spot faults. Used mainly on the 132kV and 33/66kV systems, this technique can also show heat coming from buildings to measure how energy efficient they are. The system also gives advance warning of potential faults, helping to improve fault records, and ensures that we have an effective preventative maintenance policy.

We also use technologies, such as LiDAR and thermography, to feed data back to our teams in real time, informing how we manage the network and deal with faults. Our LiDAR technology can receive

up to 750,000 measurements a second, enabling us to build a comprehensive picture of our network and, in particular, enabling us to manage any risks to our network posed by vegetation.

The Helicopter unit also is used in construction, delivering poles and even heavier loads to inaccessible areas. The larger machines have also been equipped with special capabilities for stringing of lines which can help make the task much more efficient and avoid any risk of land damage.

You can find out more here.

- **Underground cables repair and maintenance**

Overhead lines are subject to ongoing routine maintenance and inspection regimes, which are not physically possible to replicate on underground lines. Typically, underground cables are repaired when we become aware of a fault, as this requires excavation, and possibly streetworks, to investigate and repair. We do use technology, such as ReZap, to monitor cable health and assist with locating faults, but this does not entail the same level and frequency of inspection that we are able to undertake on overhead lines.

Securing necessary streetworks permits and land access rights/wayleaves are issues that are particularly heightened when working on underground cables, in comparison to overhead lines. These all come with additional implications in terms of costs, time, inconvenience to road users, and increased carbon emissions.

## 7. What can or should communities expect when it comes to remediation works following installation of maintenance of infrastructure?

For underground cables, this depends on whether works are being undertaken on private land or in the public highway. Remediation on private land is typically undertaken in agreement with the landowner, but typically we will return land to its original condition as far as practicable. For remediation works in the public highway, DNOs adhere to the Specifications for Reinstatement of Openings in the Highways.

For overhead lines, the need for remediation work is much more limited owing the cables being overhead and any groundworks largely being confined to distribution assets, such as substations or the base of poles/pylons. Maintenance of overhead lines typically involves cutting trees near lines to reduce the likelihood of debris hitting the lines.

## 8. What is the expected lifespan of the different parts of the infrastructure and can or should communities expect when it comes to the end of infrastructure lifespans?

The age and lifespan of different parts of the network very much varies depending on what the asset is, and where it is located, what it is exposed to in terms of the elements. Nonetheless, we generally build our assets on the assumption they will be in service for around 70 years.

How long they remain in situ very much depends on a number of factors too. Overhead lines near coastal areas will depreciate faster than inland lines owing to the effects of exposure to the wind and sea. We tend to build assets on the assumption that they will be replaced, given we provide a critical service and the need to distribute electricity to properties will unlikely diminish as the decarbonisation transition persists.

Upon approaching the end of an assets life, we assess the demands on the network, look at expected growth in the area, account for any expected connections, and any other considerations (ie land access or whether the line would benefit from any change, like rerouting or undergrounding). Once we have taken into account all of the above, we will either upgrade, replace, or change the design of the network in order to continue providing clean electricity to Welsh communities.

## 9. What schemes or structures do you have or use for community benefits for schemes or for compensation payments to landowners?

At National Grid, we are committed to doing the right thing, delivering social and environmental value for our colleagues, customers and wider society. Our stakeholders tell us we have a role to play in supporting communities across our region, helping to tackle social challenges and deliver wide-ranging benefits.

NGED's Social Contract outlines our commitment to be a good corporate citizen, demonstrating the purpose and values that underpin everything we do as a company. The three key focus areas: 'our customers and communities', 'our people' and 'our environment', bring together our wide-reaching efforts to deliver positive social and environmental impact within a single strategy. You can read our Social Contract here.

Our approach to community benefit is therefore centred around supporting organisations across our licence areas, irrespective of where works are in progress. For example:

- Our Community Matters Fund is a longstanding grant programme, supporting grassroots organisations and small charities. Since 2021, this fund has seen £11m awarded – including £2.7m to 463 organisations in South Wales, with an estimated 200,000 beneficiaries.
- Our electrical safety education programme has reached more than 30,000 young people in South Wales since April 2024, sharing important messages to keep young people safe around our assets.
- We also offer grants of up to £25,000 for schools in areas of high economic deprivation to install solar panels. Alongside the financial savings and carbon savings, schools benefit from a programme of renewable energy educational outreach, so students can learn from their classrooms - not just in them.
- Community Energy – we have a dedicated team that helps provide information guidance on how to get their projects up and running.

## 10. What guidance do you provide to communities when consulting on schemes in their area, and at what point in the process do you provide it?

The public can view our major schemes being delivered under Section 37 of the Electricity Act here.

For our major projects, we typically utilise third party agencies to undertake the planning and consultation on our behalf. This typically involves (where appropriate) letter drops, community meetings and other engagement activity with community groups.

In our more day-to-day operations, such as upgrading and repairing maintaining the network or working in the public highway, we will undertake letterdrops for residents in the affected area so they have a point of contact to discuss the ongoing or planned works with the local team. Of course, much of how we do this depends on the nature of the work – whether it is planned or unplanned, and under what frameworks it is undertaken.

NGED has also established an in-house public affairs function to assist with stakeholder queries and support project specific stakeholder engagement.

## 11. What evidence do you hold on the impacts of networks on health, both mental and physical?

All of our machinery is compliant with industry standards and the limits on noise disruption that this entails. We have also included this in our routing and planning to try and avoid neighbourhoods, hospitals, and schools, to ensure that these places receive minimal noise disruption.

We rely on authoritative and independent scientific organisations, such as the World Health Organization (WHO) and the UK Health Security Agency (UKHSA), to review the worldwide body of scientific evidence on electric and magnetic fields (EMFs) and health, as well as reviewing the science ourselves.

We believe it is right that the decision on what is acceptable or not is made independently of industry. We ensure that all our assets comply with the guidelines set by Government on advice from the UK Health Security Agency (UKHSA).

A vast amount of research has been done into the possibility of health effects, without establishing any risks below these levels set by the guidelines.

## 12. Overview of innovation being explored to meet electricity needs

You can find out more about our innovation work here. We welcome to set up a separate session discuss this topic area with the Independent Advisory Group if it is of interest.

Please contact the NGED public affairs team on edpublicaffairs@nationalgrid.com to discuss further.