

# Substation construction/ refurbishment

National Grid owns the high-voltage electricity transmission network in England and Wales and operates it across Great Britain. This transmission system is made up of approximately 7,200 kilometres of Overhead Power Transmission Lines (OHLs), 690 kilometres of underground cable and over 330 substations.



## What is a substation?

A substation is an integral part of the UK electrical transmission system. It provides a connection point for generators to input power to the network or can connect the main network to the distribution networks that supply consumers and businesses.

Substations contain electrical equipment to transform the voltage to lower or higher voltages, switching equipment to connect and disconnect circuits, and protection equipment to ensure the network operates safely and reliably.

## Why does National Grid need to replace, upgrade or build new substations?

The majority of National Grid's network was built from the 1950s to the 1970s, which means some equipment has been in service for more than 40 years and needs replacing as it comes to the end of its operational life. We upgrade existing substations to connect additional power generation or to meet increased demand from business and domestic consumers primarily in large towns and cities. These substation upgrades can be extensions of existing sites or can be new substations built alongside existing substations.

New substations are built to connect new generation or to meet major increased demand from business and domestic consumers. Wind farms are often in remote areas well away from the existing transmission system. National Grid therefore needs to reinforce the system with new substations to connect these new generators.

## How do we replace, upgrade or build a new substation?

Wherever possible we always prefer to extend existing substations or build a new substation at an existing site, rather than build on a new site.

When a new substation is required or an existing one needs replacing or upgrading, our engineers and designers develop the electrical, civil and mechanical designs to maximise the use of the land so that the design is safe to construct, operate and maintain.

Whatever National Grid plans to build, whether it is at an existing site or on a new site, we ensure that environmental issues and the impact on the surrounding area are fully considered.

For new sites, National Grid will look to make the substation as unobtrusive as possible within the local surroundings and we work with the local community, elected officials and statutory consultees, to minimise impact from construction activities and for when the site becomes operational.

Planning, designing and building a new substation can take several years, depending on the complexity of the project.

## What will you see as work progresses?

### Site establishment

Before any site construction work can start, the workers set up the site. This is called 'laydown' and includes the establishment of offices, toilets and storage areas or containers, which are required to support the operation of the site on a day-to-day basis. The size of the site establishment will depend on the amount of work to be undertaken.

For large construction projects where there is insufficient land within National Grid's ownership for site establishment, we will lease or purchase land as appropriate in agreement with local landowners. Traffic management plans will be agreed with the local community to minimise the impact of construction traffic movements.

### Civil Build

Whether the project is a replacement, upgrade or new build, the construction process is very similar. In order for new equipment or upgraded equipment to be installed, the ground needs to be levelled to provide a flat and stable surface for the foundations.

For sites that are exposed to pollution, for example in heavily industrialised areas or by salt near the coast, we may need to construct a building to install specialist equipment.

Where major earth movements are required, which is mainly for new sites that are not level, we design the construction works to maximise the re-use and recycling of on-site material and to minimise the need to take material to and from the site.

The foundations are excavated and then steel reinforcement or piles are installed, before concrete is poured. This forms the platform or building for which the equipment will be supported and/or housed.

### Mechanical and Electrical Build

Once the foundations have been built, the structures are assembled and fixed to the foundations. Due to the nature of electricity, the equipment installed is raised off the ground to provide electrical clearance, which prevents the flashover of high voltage electricity to the ground.

The electrical build process is set out methodically, building each part of the structure piece by piece, including cable connections to the automatic control and protection equipment.

### Commissioning

Once the equipment is in place, we begin commissioning. The equipment is first commissioned off line using test equipment to ensure that it is connected correctly and then it is energised (made electrically live) at high voltage by connecting to the National Grid Transmission System.

### Site Demobilisation

Once the equipment and substation have been made live the site is tidied up and screened through landscaping. The construction site laydown is cleared and re-instated to its original condition and the site is demobilised of all construction workers. If the land is non-operational (not part of the day-to-day operations of the substation), we may rent it back to the landowner to use for grazing or growing crops.

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