TRANSPORT FOR THE NORTH

Appendix 1 – What electricity grid connections mean for transport outcomes

1. Rail

Capturing benefits from rail electrification demand:

Our ambition is for a rolling programme of electrification across the network supporting decarbonisation by facilitating a transition from diesel to electric rolling stock. Currently just 38% of the UK rail network is electrified, but with over 60% of rolling stock either electric or hybridised. Electric trains have wider benefits than just environmental. The dynamics of these fleets with better acceleration mean that journey times can be reduced, and these fleets are statistically more reliable, with higher miles per significant incident.

The provision of power supplies which meet demand at the time this is needed is critical to the operation and enhancement of the rail network.

Power Supply Constraints:

Where lines are already electrified, delivery of solutions to power constraints can present a limitation to the network and hold back passenger benefits. For example, there is an opportunity to operate more train services on the West Coast Mainline (the busiest mixed-use railway in Europe, carrying intercity, regional and local passenger services, freight, charter and heritage rail), but this is currently limited by the available power supply.

Network Rail have issued early warning notices of congested infrastructure for three portions of the network where the power supply in a given area is insufficient to meet what is needed to run a complete service. They are due to issue a further four early warnings where the aspiration for service enhancements cannot be accommodated with the current supply.

The impact is:

- ***Fewer trains:*** Where a power supply constraint means that an uplift in trains, or an additional draw on power cannot be accommodated, Network Rail will declare congested infrastructure. This places a limitation on the quantity of trains which can operate through a given section of the network whilst a solution, such as an increase in power, is delivered.
- ***Shorter trains:*** It is not just an increase in the quantity of trains which increases the power requirements. As passenger demand grows, a solution used by the rail industry to meet demand is to operate longer trains. In some cases, this sees a 4-carriage train increased to 6 or 8. Where supply constraints exist, these can limit the opportunity for operators to extend trains.
- ***Lower speeds:*** An alternative solution to capping the number or length of trains, is to reduce the power draw by reducing the speed of trains in the constrained section. Whilst this addresses capacity challenges, it has substantial knock-on impacts to journey times and can cause congestion elsewhere where trains then present out of sequence.

New Technology:

The rail industry has targets set by government to decarbonise and cease use of diesel only traction by 2040. Currently, 29% of the UK's rolling stock is diesel only, with a large proportion of these within the North of England.

With no rolling programme for network electrification, operators and rolling stock owning companies are exploring with manufacturers the use of bi- and tri-mode trains, using a combination of diesel, electric, battery and even hydrogen. Battery trains are expected to be a favoured solution in the North of England, with trains charging when operating on an electrified potion of the network and switching to battery when operating on a section of the network which has not been electrified, e.g. branch lines. However, where a service is confined to an unelectrified line, battery charging points may be required.

With either approach, the power draw is set to increase with the move from diesel to hybrid, electric and battery trains. This will require substantial investment by the rail industry and energy sector to plan for and meet future demand.

Station Developments and Enhancements:

Many of the railway stations in the North of England are operating at close to the maximum available power supply. This despite both Network Rail and operators having made efforts to reduce consumption with the transition to LED lighting, the introduction of building management systems, and installation of voltage optimisers. Power demands at stations have increased significantly as new technology (such as customer information screens, ticket gates, and CCTV), with any station enhancements likely to trigger need for additional grid connections.

Examples of where the time taken to install a new grid supply has substantially extended programmes, delaying the realisation of benefits to customers.

- ***Selby:*** The Access for All programme provided two new lifts at the station with a new overbridge and stairs. Delays to the programme were incurred whilst a new grid supply was installed to provide the power required to operate the lifts.
- ***Stafford:*** A new grid supply enabling upgrades to be carried out to the upper floors of the station bringing them back into public use have been in the works since 2020 and are still not complete.
- ***Huddersfield:*** When the lifts were originally installed at Huddersfield station, there was a significant delay between the completion of the installation and the lifts being operational whilst a power supply uplift was delivered.
- ***Newcastle-Edinburgh****:* Strategic Advice anticipates that the number of trains on the Newcastle-Edinburgh ECML corridor, and for stopping connectivity north of Newcastle, will increase substantially over the coming decades. Requiring further power supply upgrades to what was planned in the East Coast Upgrade programme.

2. Electric Vehicles and charging infrastructure

Deployment of EV charging infrastructure continues to rise, with over 15,000 (plugs) now available in the region, more than double the number two years ago. Our Electric Vehicle Charging Infrastructure (EVCI) framework projected requirements demonstrate that as much as a fifteenfold increase could be needed by the end of the decade, with 178,000 to 240,000 public charge point plugs required across the North of England. Clearly, the impact on our energy network is significant with an estimated 6,816 Gigawatt-hours (GWh) of additional electricity required annually under our scenario for the most rapid transition to EVs (not including home chargers). This is the equivalent of annual household consumption of around 1.7 million households (applying average use according to Ofgem).

Our EVCI Framework assesses EV uptake, user movements across our road networks, land use and spatial aspects to determine how many charge points (and type of charger) are required in a certain area. From this we can calculate the energy demand needed at regional, local authority or granular Middle Super Output Area (MSOA) level. You can explore more using our freely available online visualiser tool.

We have recently progressed an enhancement to our EVCI Framework, with support from the three DNOs in the North. This joint work has merged Distribution Network Operators (DNO) data such as the current and future headroom capacity in primary substations, with our future projections for EV and charging demand. Whilst the 'snapshot' outputs do not include grid enhancements in the pipeline, the work will go some way to highlighting expected pinch points or focus areas for grid reinforcement and increased capacity across our region.

This can help to future-proof decision making with regards to electricity supply, and target priority areas for action which often need to be made years ahead of delivery. The images below showcase that whilst currently over 90% of primary substations have good levels of capacity currently, this situation will radically change due to increased energy demand for EVs by 2035 (note the shading change from dark to light in the images as capacity reduces). We will continue to work with the DNOs in the region to increase the accuracy of this work to inform future grid capacity planning.

Figure 9: Assessment of primary substation headroom capacity in 2025

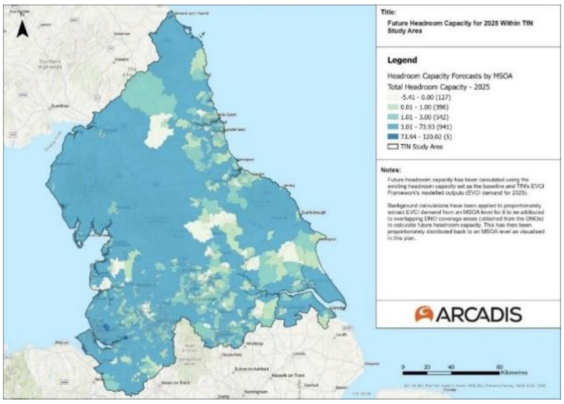


Figure 10: Assessment of primary substation headroom capacity in 2030

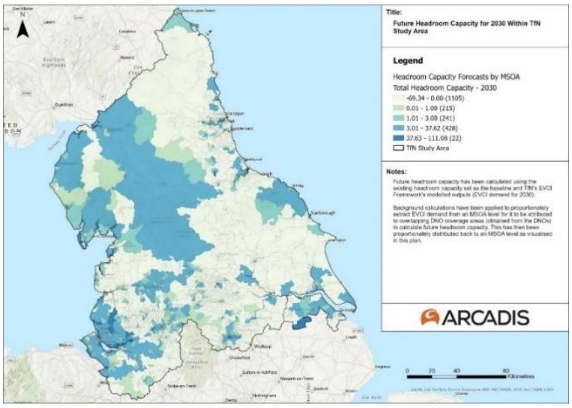
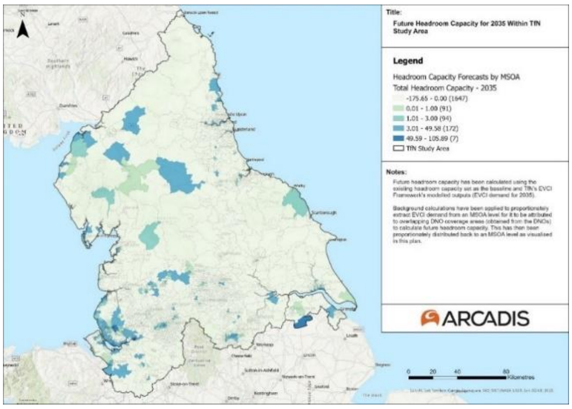


Figure 11: Assessment of primary substation headroom capacity in 2035



3. Freight and Logistics

The freight industry is a significant contributor to carbon dioxide (CO_2) emissions, primarily through the use of fossil fuel powered vehicles. Decarbonising freight is crucial for mitigating climate change and reducing the region's overall carbon footprint. 28% of the North's surface transport emissions in 2018 came from HGVs. Transitioning to cleaner and more sustainable freight solutions will improve air quality in the North of England, benefiting the environment, health of local communities, and economic growth.

From the current baseline, there is a requirement for a significant increase in the number of recharging stations in strategic locations to support long distance electric HGV journeys. Operators are deterred from transitioning from diesel to electric fleets due to range anxiety and operational inefficiencies. Addressing grid limitations is essential for the widespread adoption of electric HGVs and achieving sustainability goals in the logistics sector.

Significant expansion of high-capacity HGV charging points is required, particularly at fleet depots, en-route locations such as motorway service areas and lorry parks, key transportation corridors and distribution centres. High-powered and fast charging infrastructure is crucial at these locations to enable rapid charging and minimise downtime in an industry where time equals money. In the short to medium term grid capacity will inevitably dictate the siting of electric HGV recharging infrastructure.

A challenge for national Government, Local Authorities and the private sector is planning and delivering a comprehensive charging network with confidence. In order to assist with evidence-based decision making on suitable locations for charging infrastructure, our EVCI Framework includes HGV as a vehicle type. Our evidence assists by providing information on the likely scale and pace of change required across our region to support a rapid and consistent transition to electric vehicles.

4. Buses

The government has set a target to have a fully zero emission bus fleet by 2035, and to support the transition has been actively funding Local Authorities and bus operators through the Zero Emission Bus Regional Areas (ZEBRA) fund to help with the purchase of zero emission buses.

There are over 32,000 public services buses operating across Great Britain, travelling just under 2 billion KMs per year. Charging requirements for buses include at depot charging, typically with an option for overnight charging combined with rapid on route top –up charging, particularly for longer distance and more rural services. The size of bus depots and therefore the future power requirement for charging can vary significantly depending on the operator and the region, though depots typically range from accommodating a bus fleet of 20-50 for smaller operators through to 150 buses based at depots in large cities.

The government is committed to improving local bus services and has set out plans to give local authorities more powers and greater flexibility in designing bus service that work for their area. Grid connectivity at depots and where needed for rapid on route charging, enabling the ten-year transition to zero emission buses is national and local priority.

5. Hydrogen for transport

It likely that hydrogen will be utilised as a niche solution for:

- vehicle operations that will be hard to decarbonise with straightforward deployment of battery electric technology (e.g. buses or waste vehicles with rural duty cycles), and
- in places where other drivers of hydrogen supply and/or demand may exist, such as industrial areas requiring hydrogen for industrial decarbonisation and where there are

opportunities for transitioning carbon intensive jobs into the production of hydrogen with carbon capture and storage (CCS).

The interface between hydrogen for mobility demand and connections to the electricity grid may lie in two important areas:

- Firstly, the supply for hydrogen for mobility purposes should be obtained ultimately through electrolysis (i.e. green hydrogen). It will be important to exploit the economies of scale that can be achieved through locating green hydrogen production plants in close proximity to refuelling infrastructure particularly as demand grows (potentially beyond the capacity of a hydrogen tanker distribution model). These electrolyser facilities will require grid connections and sufficient electricity supply.
- Secondly, there may be opportunity for co-location between electrolysers, hydrogen refuelling stations and hydrogen energy storage facilities. The location of potential transport demand could be a material consideration when assessing potential locations for hydrogen energy storage and the grid connections that allow these facilities to feed back into the grid when required.

6. New spatial developments

There is a need to better align investment in the energy distribution networks with development plans and ambitions which will ultimately deliver better outcomes. Local Plans provide a good starting point in terms of forecasting where future development may come forward.

However, TfN's Development Log, often referred to as D-Log, is a comprehensive database that tracks proposed developments within the region. TfN have engaged with Local Planning, Transport and Highways Authorities and undertaken several successful rounds of Development Log data collection, which saw us process the development data collected from Local Planning Authorities and National Parks into a standard format. This includes both residential and commercial projects. The log contains detailed information about each development, such as:

- Location: Where the development is planned.
- Type: The nature of the development (e.g., housing, commercial).
- Scale: The size and scope of the project.
- Timescale: The expected timeline for development and build-out

This database has the potential to play a role in planning and coordinating infrastructure improvements, ensuring that the necessary support systems, such as transportation and utilities, are in place early enough to accommodate new development and thus enable economic growth.

Strategic investments in energy systems that are aligned with planned development both spatially and sequentially have the potential to become an enabler of economic growth as opposed to an obstruction to it.

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