



## Mine-water Energy Toolkit – Toolkit

### Appendix 8 - Private Wire

#### Case Study – Caerau Heat Network

As well as a low carbon heat network in Caerau, Nordic Energy assessed the option of a private wire network fed by the local Upper Llynfi Afan 24MW Wind Farm in order to

- a) improve the commercials
- b) improve the low carbon local story.

The concept included

- 1) an overhead line from the wind farm to the energy centre. There wasn't enough demand at the energy centre to warrant the capital cost of the wire by itself
- 2) an underground cable, using the trenches dug for the heat network, to take power to the main commercial buildings and to the Tudor Estate social housing.

A detailed study to connect the wind farm to Caerau was completed, which included

- a) a Front End Engineering Design (FEED)
- b) a suppliers tendering exercise to provide an 11kV private wire connection to the village boundary.

**FEED Design Concept:** The energy centre would include a step down 11kV to 400V transformer, power distribution board, heat exchanger, heat storage tank/accumulator, programmable logic controller and instrumentation panel. Property connections from a 400V ring main service cable would be stepped down for dwelling consumer demand at 230V. Non-domestic buildings (School, CDT, Surgery etc) would be supplied via 400V connections. A grid supply remained in place for backup during periods of low/no output from the wind farm.

**Market Engagement:** The market test was for budget quotations for an Engineering, Procurement and Construction (EPC) contract including costs for: the dual energy supply network, route planning, network operating conditions (heat supply and return flow/pressure), cable schedules, transformer and substation configuration, metering arrangements and indicative section drawings for trench and trefoil details to accommodate both heat pipework and 11kV and LV cable connections.

The EPC Contractor budget quotations estimated that the Programme of works would be for 12 months including all civil, mechanical and electrical engineering activities from Design, Pre-Commencement, Construction, and Commissioning including practical completion and handover.

**Stakeholders:** Nordic Energy engaged early with the Bridgend County Borough Council Planning Department and wider stakeholders to ensure an efficient project delivery process could be realised. The project team developed EPC Contract documents with legal counsel input for project delivery.

**Regulation:** Private wire is reasonably common with non-domestic customers, but very rare with domestic because of concerns over regulation, although it is possible. It is critical when looking to supply or sell electricity to consumers that regulatory framework and the roles of retailers flow from the following definitions. The project provided a detailed assessment of how compliance could be maintained against this regulatory framework.

The supply of electricity is defined in the Electricity Act 1989 as

“supply to premises in cases where (a) it is conveyed to the premises wholly or partly by means of a distribution system, or (b) (without being so conveyed) it is supplied to the premises from a substation to which it has been conveyed by means of a transmission system, but does not include its supply to premises occupied by a licence holder for the purposes of carrying on activities which he is authorised by his licence to carry on.”

The distribution of electricity is defined in the electricity Act 1989 as to

“distribute by means of a distribution system, that is to say, a system which consists (wholly or mainly) of low voltage lines and electrical plant and is used for conveying electricity to any premises or to any other distribution system.”

The Distribution Network Operator (DNO) for Caerau Tudor Estate was Western Power Distribution (it has since changed to National Grid Energy Distribution). The private wire evaluation assessment considered as an alternative to installing a completely new private wire network the potential for adopting the existing DNO Tudor Estate Network and associated substations.

Nordic Energy obtained information from the DNO showing that Tudor Estate properties were connected with a single phase service cable which then has offtakes for individual properties with each property having a metered supply. The benefit of adopting the DNO network for Tudor Estate Private Wire was centred around reduction for capital expenditure that would be required for a new private wire cable, however through initial discussions it became clear that there was a high level of uncertainty that WPD would want to transfer ownership of the network and if this was an option the cost of transfer would be significant.

### **Private Wire: avoiding grid constraints**

Private wires can offer generators a route to market in cases where expensive grid reinforcement would be necessary and could be avoided with a private wire. That was not the case here as the wind farm already had a grid export connection.

They can also be used for new developments which are struggling to get a new grid import connection, but who could get a reliable supply via the private wire. That was not the case here as

- a) wind is not a reliable supply
- b) all the buildings had existing supplies, and there was no new development.

### **Private Wire Economics**

There are four elements to an electricity tariff:

- 1) a £/kVa/year capacity charge which is based on the size (capacity) of the connection.
- 2) a £/kWh distribution charge
- 3) a collection of £/kWh taxations charges
- 4) a £/kWh charge covering wholesale electricity costs.

There are potential savings for a customer to change from a retail supply of electricity to a private supply of electricity.

The capacity charge (1) cannot really be avoided, because the spare capacity needs to be retained for when the wind supply is not there.

The distribution charges (2) are avoided, but the developer of the private wire will need their capital and operational costs covered. So this is actually a replacement of one set of distribution charges with another. If the private wire is short enough (i.e. the generator is physically close to the customer), this can lead to savings.

The taxation charges (3) are avoided. This is a significant cost and is normally the prime driver behind most private wire projects. However, the government recognises that the excessive taxation on electricity is hindering the rollout of heat pumps because it makes electricity arbitrarily expensive when compared to gas. And so the government has committed to reduce the taxes on electricity by the end of 2024. When this happens, the economic benefits of private wires may completely disappear.

Wholesale costs (4) are very unstable (they shot up from £40/MWh to £400/MWh following the invasion of Ukraine). A private sales agreement can create stability for all parties involved.