Micro hydroelectric power scheme TfGM (Manchester)

CONCEPT

To supplement the energy requirements and reduce the carbon emissions of the new Rochdale Interchange, TfGM developed a micro hydroelectric power (HEP) scheme. Rochdale Interchange became Europe's first public transport interchange to be powered by hydro-power and makes the investment highly innovative.

SUPPLIER

Hydroelectric turbine (supply and installation):
Spaans Babcock Ltd.

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OBJECTIVES

- Contribute towards achieving TfGM's Climate Change Strategy commitment to reduce carbon emissions by 771 tonnes or 13.5% by 2015 (from 2007/08 levels);
- Meet Rochdale Local Planning Authority's requirement that all new, non-residential developments should generate at least 10% of their energy needs from on-site renewable energy;
- Develop low carbon capability through projects and business activities to increase energy efficiency and reduce carbon emissions

INVESTMENT DESCRIPTION

Hydroelectric power (or HEP) is the term used to describe the generation of electricity through the use of the gravitational force of flowing or falling water. The kinetic energy of flowing water rotates a turbine, converting into mechanical energy, which in turn drives a generator, converting mechanical energy into electrical energy.

The suitability and potential power that can be generated from a hydro turbine is determined by the height (or head) of the weir and the quantity of water flow. The larger the head and height, the more power can be generated. A feasibility study identified that the new Rochdale Interchange site had a good hydropower resource with a relatively high flow rate albeit with a relatively low net head.

The Rochdale micro hydroelectric power scheme, abstracts water from the River Roch adjacent to the Interchange through the use of an existing weir. The equipment consists of a 2.1 m diameter Archimedean screw, which is fed by up to 1890 l/s (1.89 m³/s) of natural river flow. The water flow through the intake and passes through a 100 mm spacing bar screen to prevent large debris entering and potentially damaging the screw. The screen also prevents the ingestion of larger fish and other aquatic animals. The flow enters the slowly rotating (approximately 28 rpm) screw flights fitted with rubber buffers to prevent any impact damage to fish. The flow rotates the screw, which in turn transmits the water power through an upper bearing and coupling to a gear unit. The gear unit increases the speed of rotation for the generator thus creating the electricity. Varying the speed of the screw and adjusting the opening of the inlet gate helps to maintain an acceptable flow rate within conditions of the Environment Agency's Water Abstraction Licence.

A separate fish pass was also installed adjacent to the screw section allowing migratory fish such as brown trout to ascend the weir.

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Technical Data	
Max flow rate	1890 l/s
Diameter	2100 mm
Angle of inclination	22 degrees
Head	1.5 m
Peak power output	21.1 kw
Screw efficiency	84%
Overall efficiency	74%

Results	
Investment costs (€)	441,600
Annual maximum production (kWh)	86,000
Lifetime CO_2 savings (TCO_2)	1,900
Operational costs (€/year)	7,493

CONTACT

TfGM
Customer Relations
+44 161 244 1000
customer.relations@tfgm.com

COST AND FUNDING

The total cost of the supply and installation of the turbine (excluding internal resource) was €441,600 (£368,000). The scheme was funded through a combination of T2K INTERREG grant (50% of the investment) and further grants from the North West Development Agency's (NWDA) Carbon Challenge Fund and the Environment Agency.

RESULTS

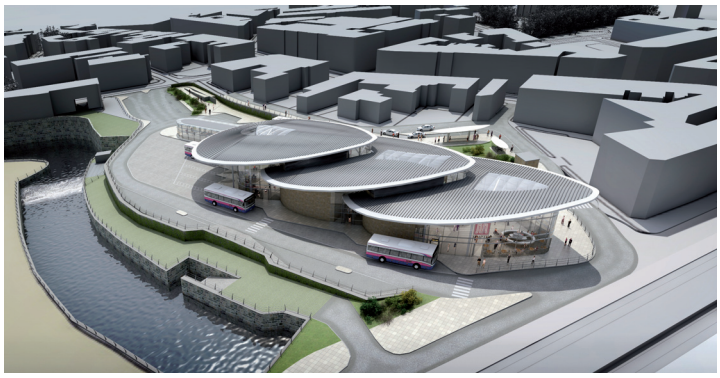
The Rochdale Interchange micro-hydroelectricity power scheme is predicted to produce up to 86,000 kWh of electricity per annum, which will help to reduce the new Interchange's carbon footprint by over a quarter. Following completion of construction works for the new Rochdale Interchange, the micro-HEP was re-commissioned on 22nd October 2013 and is now fully operational.

Current EU state aid rules means TfGM are ineligible to claim the Feed in Tariff (FIT) for the HEP. FIT is a financial incentive from the UK Government to encourage uptake of renewable electricity-generating technology. From 1st April 2014, for hydro generating stations with totalled installed capacity between 5 kW but not exceeding 100 KW the tariff is 19.7 p/kWh. It is anticipated that TfGM will claim FIT once compliant.

In addition to FIT payment, an extra payment can be received for any excess electricity exported back to the grid. This is called the export tariff and is currently at a rate of 4.64 p/kWh and paid by the electricity supplier.

LESSONS LEARNED

Before the Ticket to Kyoto project, TfGM had no prior experience of investing in renewable energy-generating technology. It was imperative that due diligence was performed in the tendering process to appoint a supplier and installer with adequate knowledge and experience. With all new technology, there is always a period of understanding how it works in practice. Fostering a close working relationship with Spaans Babcock has allowed a greater understanding of the maintenance requirements of the hydro turbine. For example, there has been an increase in the anticipated amount of debris that needed to be cleared from the screen and as such maintenance regimes had to be changed.



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