Winner case study
TGV Hydro, Wales

2015 Ashden Award

Community Energy Award

Award supported by Esmée Fairbairn Foundation

Cleaning the intake for a micro-hydro system.

A Welsh farmer inspects his micro-hydro system.

23 sites built
across Wales

850 tonnes
of CO_2 saved per year

472 kW
capacity installed

"TGV Hydro has played a game-changing role in creating a model for micro-hydro development in Wales, breaking down barriers to its uptake across the country. It has also proved that renewable energy can generate new income for rural communities."

Ashden judging panel

Unexploited potential for hydro

Wales has both hills and significant rainfall, making it an ideal location to use micro-hydro to generate renewable electricity. This can contribute to the stability of the UK's overall supply, as rainfall is highest during the winter, when generation from solar PV is at its lowest and demand is at its highest. However, micro-hydro requires significant capital investment, and the processes of gaining planning permission, applying for licenses and carrying out construction are more complex than solar PV, for example. As a result, there are many potential micro-hydro sites in Wales and elsewhere in the UK that have not yet been developed.

Reduced costs

TGV Hydro Ltd, a wholly owned subsidiary of The Green Valleys Community Interest Company (CIC), has been working since 2010 to develop micro-hydro sites in Wales. It has reduced costs by involving site owners in construction work, making careful compromises on system design and by helping found Hydrolite, a local turbine manufacturer. It has also worked with several local planning authorites and eased the planning process in a number of different regions by demonstrating how micro-hydro projects have a low environmental impact.

"I can now proudly say that I've applied my engineering skills to a great cause; I'm contributing to the local economy of South Wales; and I absolutely love my job, every time a new turbine starts up, feels like delivering a new born baby!"

Roberto Sotgiu, Founder, Hydrolite (supplier of turbines to TGV Hydro)

Why they won

TGV Hydro's work has made micro-hydro financially viable for a much wider range of potential sites in Wales, by reducing costs and smoothing the path to gaining all of the required permissions and licences. The micro-hydro projects bring benefits to the local community and region, through the jobs created in designing and developing the sites, by supporting supply chain manufacturing jobs and through site owners spending the additional income they receive from electricity sales. TGV Hydro estimate that their work is supporting at least 16 jobs (full-time equivalent) in the local area, with half of them being skilled.

While many of TGV Hydro's completed projects have been for private clients, several have been for the National Trust and also for community-owned energy companies, with many more of these expected in future.

TGV Hydro's profits are used by The Green Valleys CIC (its owner) to fund its work, including mentoring community energy groups that are planning to build micro-hydro projects.

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Business model

A typical customer starts by paying for a feasibility study; if this indicates that their micro-hydro site is viable and they decide to proceed, TGV Hydro carries out design work and also applies for planning permission from the local council and a licence from Natural Resources Wales (NRW) to abstract water from the stream. At this point the customer could then build the project themselves, or bring in other contractors, but the majority pay TGV Hydro to carry out development and commissioning. TGV Hydro uses its own staff for much of the construction work, and sub-contracts the installation of the turbine and associated equipment to Hydrolite (see below). Site owners can also get involved in construction to bring the overall cost down – for example, farmers often have the equipment to dig trenches to bury pipelines or build foundations under TGV Hyrdo's supervision.

Most of TGV Hydro's completed projects are in private ownership, but two are owned by the National Trust, and three are in community ownership – community projects take longer to develop than private projects, due to the time taken to run a community share offer, but over 20 are now in development.

Technology

The TGV Hydro founders knew that they needed to find a cheaper source of hydro turbines than those on the market at the time if they were to make the smaller hydro sites economically viable. Their solution was to provide start-up funding and business advice to Hydrolite, a local company which now supplies all of their turbines and also supplies other installers across the UK.

Hydrolite manufactures Turgo turbines, which, compared to Pelton turbines, are smaller, cheaper to build, can handle larger flows and spin faster. These factors reduce not only the cost of the turbine, but also allow it to be connected directly to a generator, avoiding the need for a belt drive. Hydrolite also makes the spear valve, which directs a water jet onto the turbine, and the turbine housing. The electronics are supplied by Sustainable Control Systems, another local engineering business.

Achievements

TGV Hydro has been growing fast in the past few years; it currently employs eight staff and has a turnover of just under £1m. Since 2010, it has secured licenses for 47 micro-hydro projects and completed construction of 23. A further 13 sites are under construction, with the remainder either currently raising finance or completed by other companies, with technical input from TGV Hydro. The completed projects have a combined maximum output of 472 kW, and generate about 1,900 MWh per year – enough to supply over 500 homes. Annual CO_2 savings are about 850 tonnes.

Future plans

In five years' time TGV Hydro aims to have doubled in size and be completing micro-hydro projects at a rate of at least 15 per year, of which a larger proportion are expected to be community-owned than at present. There are hundreds, perhaps thousands, of potential micro-hydro sites across Wales, not to mention Scotland, Cumbria and moorland in Yorkshire and south west England, so there's plenty of room for TGV Hydro to expand in Wales, and for expansion or replication in other areas too.

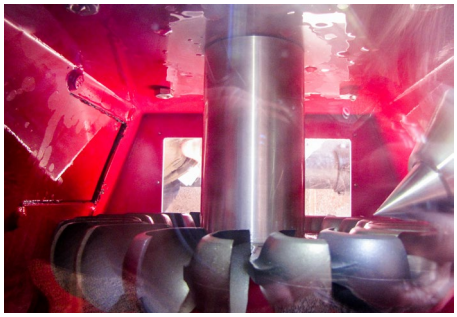
The Green Valleys CIC also has plans to grow, and is in the process of developing six micro-hydro sites to provide it with additional long-term income to fund its work in local communities.

Economic viability of micro-hydro

While the size of solar and wind projects is decided on the basis of available space, finance and demand for energy, different constraints apply to micro-hydro projects. These are limited by the size of the stream that feeds them and the quantity of water they are allowed to divert from it, but in rural areas the capacity of the local electricity grid can also be a limiting factor. Because upgrading a grid connection is expensive, TGV Hydro sometimes designs micro-hydro projects that are smaller than the stream could support. As a result, the capacity factor (see below) is higher than normal, usually about 50% . This minimises installation costs while only marginally reducing electricity generation, thus improving the economic viability of micro-hydro projects.

"We want to make hydro power low-cost, affordable, and we want to do it at scale."

Chris Blake, Development Director, TGV Hydro



A Turgo turbine and spear valve (to right), built and installed by Hydrolite for TGV Hydro.

Capacity factor

No electricity generation project, whether renewable or fossil-fuelled, can run at full power all the time, due to maintenance, faults, refuelling, etc. Renewable energy generation is limited by the availability of the resource it depends on; solar panels can't generate at night, and hydro turbines can't operate during a drought. The amount of electricity generated by a project compared to that which would be produced if it ran 24/7 is known as the capacity factor, and is expressed as a percentage; a capacity factor of 100% would mean it generated continuously, and 50% would mean it generated, on average, at half its rated output.