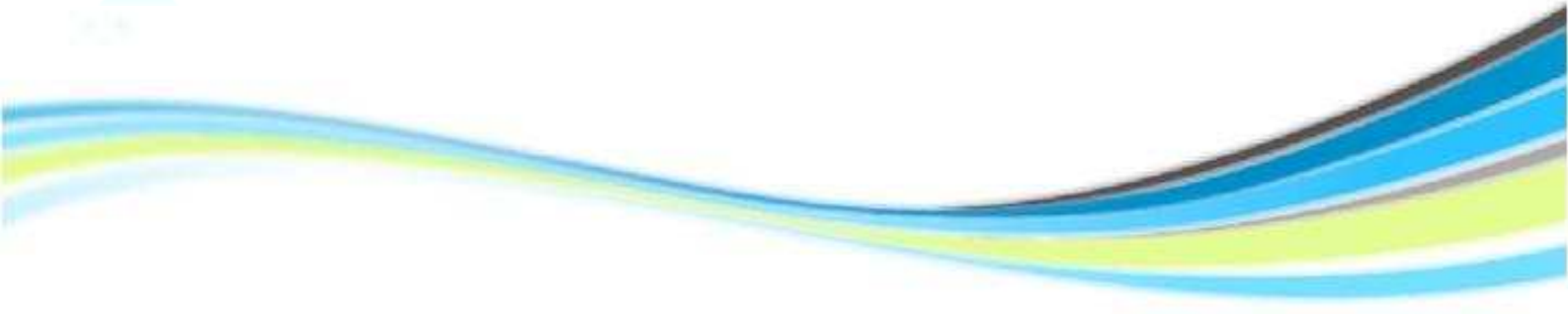




Hydropower

Clean, renewable energy from water



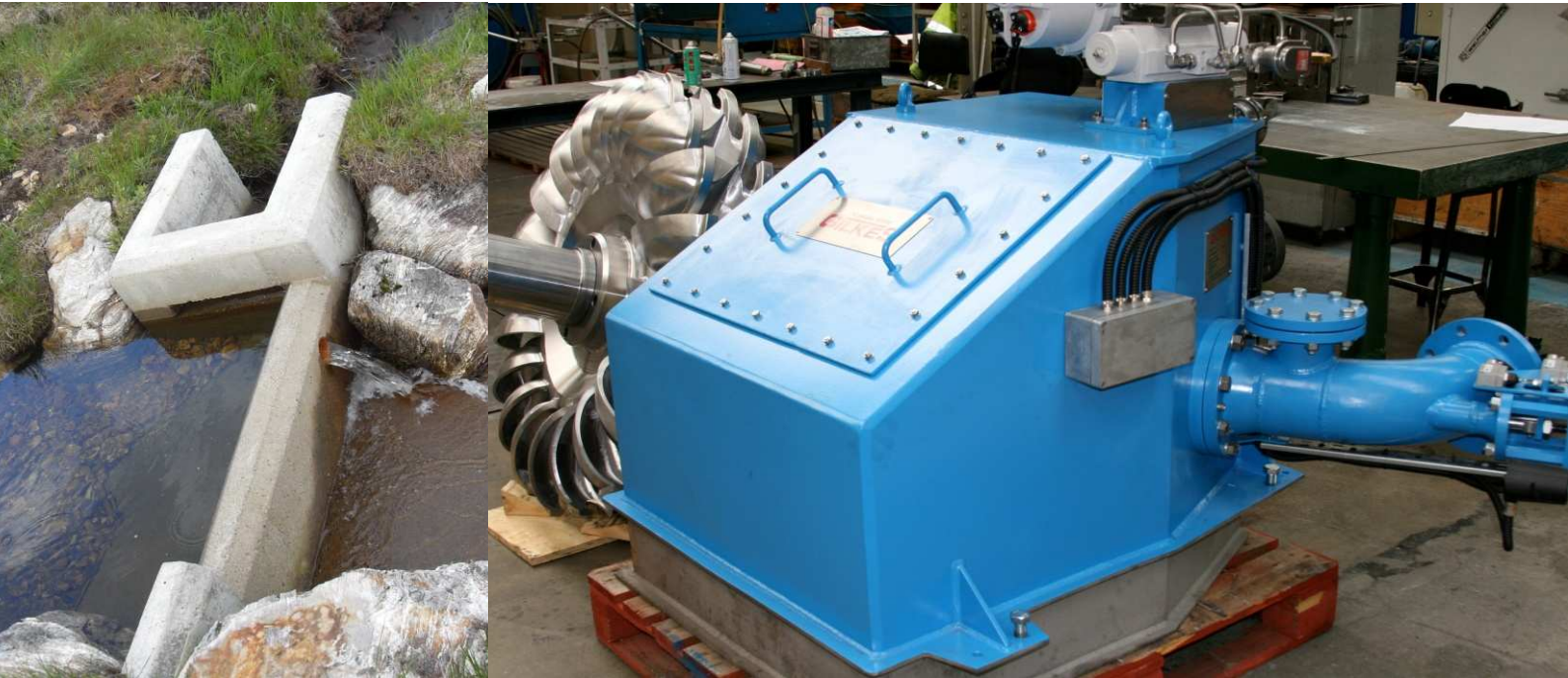
Abernethy Trust Hydro Case Study



Gilbert Gilkes & Gordon Ltd.,
Canal head North, Kendal, Cumbria LA9 7BZ
t 01539 720028 • f 01539 732110
hydro@gilkes.com

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Abernethy Trust Hydro Case Study



The Abernethy Trust Hydro Scheme is a conventional 'run-of-river' scheme situated at Ardgour on the shores of Loch Linnhe on the West Coast of Scotland. It was developed by the Abernethy Trust in partnership with Gilkes Energy Ltd.

Summary:

Gross head of water: 126.4 m
Design Flow: 96 litres/second
Pipe work: 850m long by 285mm OD
Catchment area: 1.6 km²
Average annual rainfall: 2,376mm
Power produced: 89kW

The Abernethy Trust Hydro Scheme is an 89kW 'run-of-river' scheme developed by the Abernethy Trust – a non-profit making charity organisation specialising in outdoor activities.

Barry Edmondson, manager of the Abernethy School of Adventure Leadership, conceived the scheme in early 2008, as a way of generating valuable income for the Trust.

The scheme was installed and commissioned in June 2010.



SUMMARY



The catchment area feeding the Abernethy Trust scheme is approx 1.6 square kilometres and is subject to, on average, 2,376 mm rainfall per annum.

The water is abstracted at a 1.3m high weir using a 'Coanda' style self-cleaning screen. This screen also allows no more than the design flow of 96 l/s (litres per second) to enter the intake.

The water is then conducted via a 850m long penstock pipeline to a powerhouse, giving 126.4m of gross head.

A secondary intake was utilised on a tributary to the main watercourse, in order to increase the size of the catchment captured by the scheme.

From the intake channel beneath the Coanda screen, water is conducted through a header tank, and then into the main penstock. Throughout its length, the main pipeline is provided with concrete thrust blocks at all significant changes in direction. Access to the pipe is provided for cleaning and 'pigging' via a custom designed pig launcher which was integrated into the pipeline.



TECHNICAL



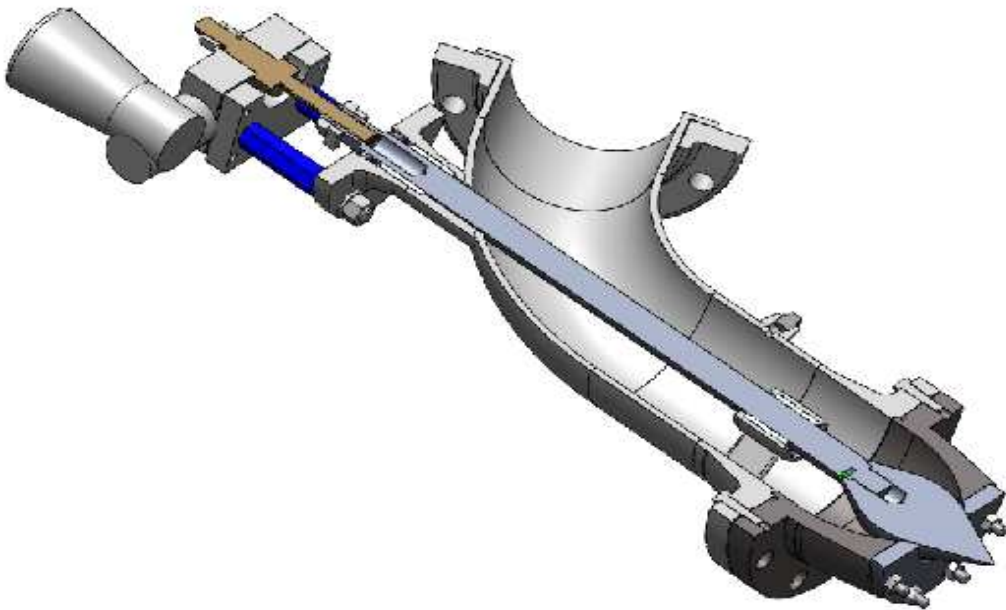
The powerhouse is constructed just above road level approximately 200m from the main Trust building. Built from concrete block and corrugated steel roof it measures approximately 5 by 5 meters. The powerhouse contains the turbine, generator, hydraulics, main inlet valve and the protection and control panels. A 415V/11kV transformer and switch unit are pole-mounted and located approximately 50m from the powerhouse.

The turbine installed is a Gilkes 265mm (10.5") Single-Jet Turgo Impulse Turbine running with an in line 4-pole induction (asynchronous) generator and producing 89kW peak power.

The turbine has been recently re-developed and optimised to suit the 100kW market defined by the UK Feed In Tariff.

The optimization process included reducing the manufacturing cost by standardization of components and value engineering. New features include: a reduced 'footprint' and a self-contained electro-hydraulic actuation unit rather than the traditional, separate hydraulic unit.





A deflector mechanism is used to control the speed of the turbine during start up and as a shut down device to stop the generator when required. The actuator has an integrated, electro-hydraulic system (shown in photo below) that allows precise control in normal operation but will 'fail-safe' to the closed position in the event of loss of power.



A Spear Valve arrangement (shown in the above diagram) is used to control the flow of water through the turbine and is operated by 24vDC forward/reverse motor. This motor is controlled by Open/Close digital pulses from the PLC which is governed by the data received from the Head Level Sensor. This system ensures the scheme produces the largest power output possible relative to water availability.

The deflector mechanism allows flow to be instantaneously removed from the generator in the event of a fault, without interrupting the flow through the penstock. This prevents 'over-speed' whilst allowing a slow, smooth, controlled closing of the spear valves with no risk of excessive surges in the penstock.

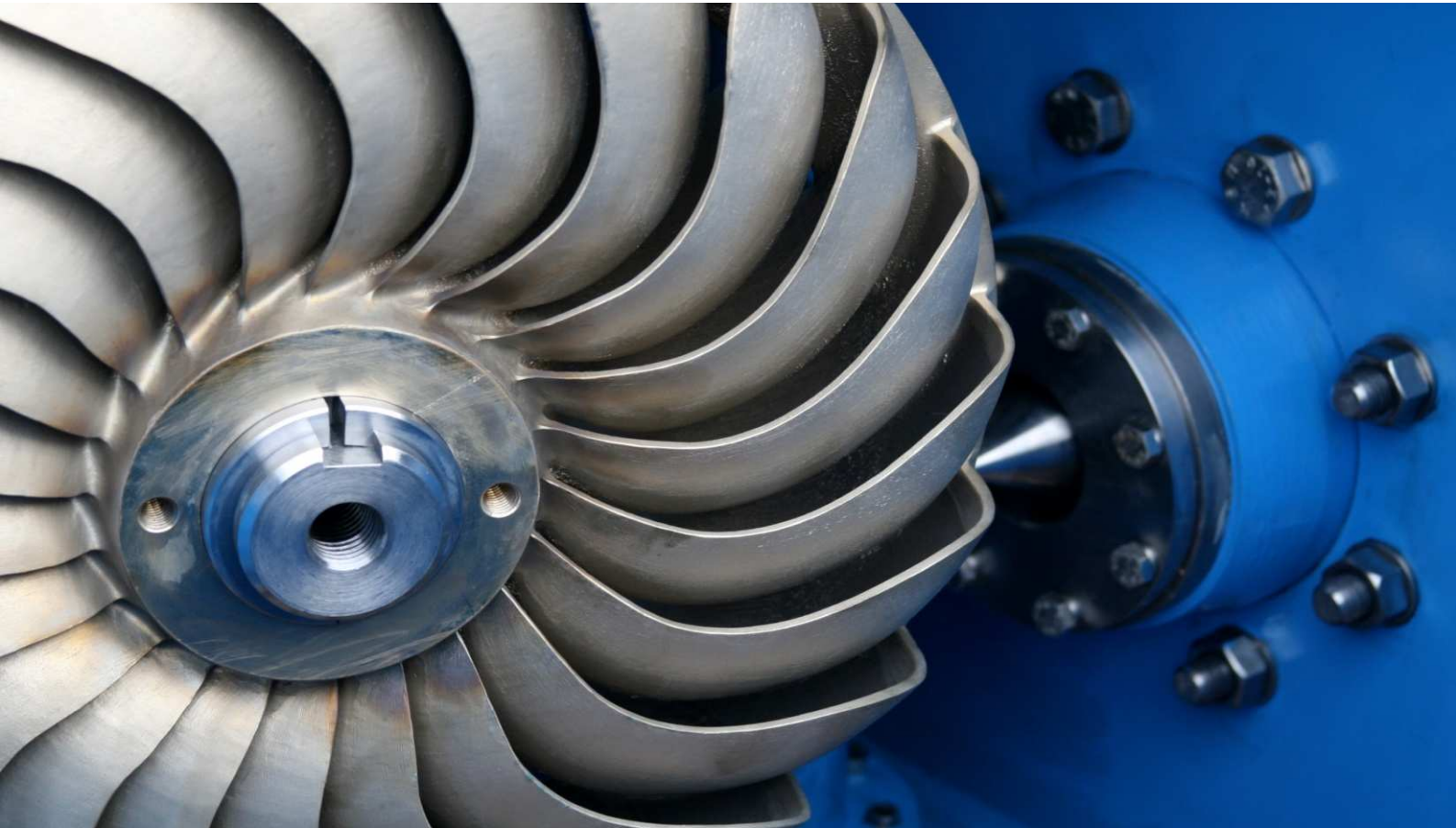
COMMERCIAL

The scheme was one of the first in the UK to benefit from the new Feed In Tariff but was originally conceived as a 50kW scheme to take advantage of the 'double-ROC' subsidy. The project manager, Barry Edmondson, sensibly built-in additional capacity to the intake and penstock design to allow the scheme to be 'upsized' to its 'organic' size of 89kW should the subsidy scheme change. With the introduction of the Feed-In Tariff the decision was made to upsize to the full 89kW.

The scheme was part financed using a Gilkes long-term equipment lease which allowed the scheme to upsize at short notice to the larger 89kW without having to raise any further capital investment. The full E&M (Electrical & Mechanical) package incorporating turbine, generator, main inlet valve and control panel, was provided using the lease.



The Gilkes finance package meant that approximately 20% less capital was required in order to develop the scheme. The lease is linked to an agreed % of revenue – if the scheme is not generating no lease payments are due (unlike bank debt). This reduces the overall financial risk for the owner as in dryer than average years the lease cost reduces. This financing package and 'partnership approach' provides a reassuring incentive for Gilkes to keep the equipment running as efficiently as possible and develops a very close partnership between Gilkes and the Estate owner.



Commenting on the project, Barry Edmondson, Abernethy Project Manager said: *“The Abernethy Hydro Project has been a very interesting project for me to work on, along-side my full-time ‘day-job’ as manager of the Abernethy School of Adventure Leadership. The project will provide valuable income to the Trust and secure its financial security for the long-term future. The project was not simple with a number of unforeseen technical issues arising midway through the project. However, with Gilkes’ help, on both the technical side and the innovative financing package they developed, the project has now come to a happy fruition”.*

Commenting on the project, Alan Robinson, Gilkes Project Manager, said: *“We, at Gilkes, are all very proud of the Abernethy Hydro Project. The turbine design uses proven and patented Gilkes Turgo technology optimized to suit the 100kW market. Reducing the footprint and weight of the turbine by almost 50% means we were able to offer the Trust a cost effective, reliable solution, without sacrificing our usual high standards of quality which has been serving the UK’s hydro market for over 150 years”.*