

Archimede's Screw

Copley Hydropower Generator

CO2Sense has carried out a study on the relative costs of an Archimedes' screw and the more common Kaplan turbine for a small scale hydropower site.



The Archimedes' screw – used for over 2000 years as a pump – is now becoming a popular technology choice for low-head hydropower generators.

The Archimedes' screw is well suited to low-head sites and is less harmful to fish. Although initial installations were found in Germany, there are now multiple sites in the UK generating electricity from these turbines.

However, it is hoped that with the numerous potential low-head sites at river weirs across the country, proliferation of these installations will take place. It is often hard to justify the capital expenditure of installing a modern hydropower scheme on such sites given the relatively low revenue from electricity sales.

Renewable Energy

	Kaplan Turbine	Archimede's Screw
Annual energy output	390 MWh	448 MWh
Installed capacity	95 kW	124 kW
Capital cost	£414,000	£371,000
Capital cost (per MWh/yr)	£1,061	£828
Return on investment (IRR, 20yrs)	5%	9%

CO2Sense commissioned this study to evaluate the capital costs of the two systems for a specific low-head hydro site.

The study compared the costs of installing a Kaplan turbine and an Archimedes' screw at the potential (and former) hydro site at Sterne Mill in Copley, near Halifax.

One hydropower consultant was asked to design a system using the Archimedes' screw, while a second consultant was asked to design a scheme with a similar annual energy output but using a Kaplan turbine.

Each consultant was also asked to cost the equipment and its installation but excluding the civil engineering costs. The two designs were given to an independent civil engineering firm which calculated cost estimates for the civil works.



The study also demonstrated how much different assumptions can affect the civil engineering costs, and that by taking a different approach, money can be saved. If the spoil from the construction had to be landfilled, for example, this would add from 30% to 40% to the costs above for both schemes.

The costs for a hydro scheme are highly dependent on the site, so this study cannot be used universally, but is provided this site with concrete evidence, and gives precedence for other such reports to be carried out.

It is hoped that a hydro system will be installed as part of a major property development around the weir.

The two scheme designs did not arrive at exactly the same annual energy output, but nevertheless the study showed a strong cost advantage for the Archimedes' screw.

For an energy output of about 15% more, the Archimedes' screw cost about 10% less. So in terms of capital cost in £ per MWh per year, the Archimedes' screw was 22% cheaper than the Kaplan turbine.

The results are summarised in the table on page 1.

CO2Sense can now use this study to demonstrate the strong financial benefits and effectiveness of using the Archimedes screw, and so encourage such projects to be developed within the region.

CO2Sense was established by Yorkshire Forward to help businesses in the region to prosper in the low carbon economy.

We provide expertise and funding to help environmental companies to grow. We work with partners to help all organisations to fund and develop initiatives that reduce their carbon emissions.