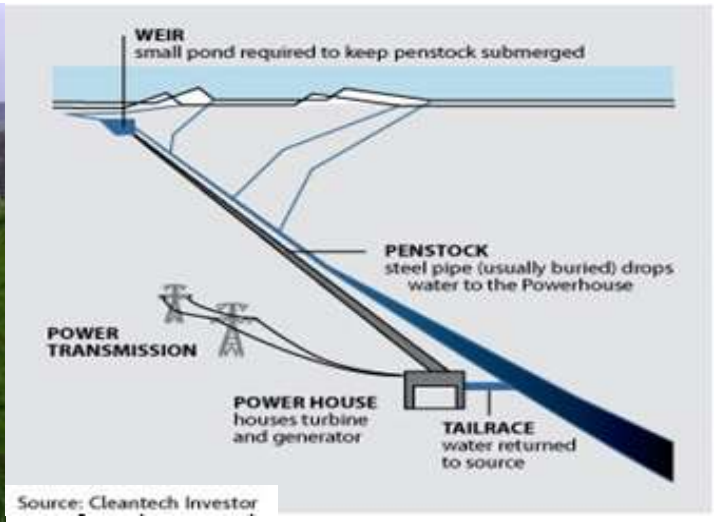
Fact Sheet – Hydro Power



Hydro power is a well proven renewable energy technology having been in existence for thousands of years, and is ideally suited to Scotland's topographies and relatively wet climate.

Hydropower systems use the energy in flowing water to produce electricity. The energy that can be captured is a result of the vertical distance that the water drops (known as the head) and the volume of the water in the watercourse. The amount of energy that a relatively small river can hold is often surprising if the head is high enough, these schemes are known as 'high head' run-off-river schemes. Equally a slow moving river that has a high volume of water can hold a large amount of energy these schemes are often refer to as 'low head' projects with Archimedes screw systems normally deployed.

A small river on a hillside with high head, i.e. a vertical drop of at least 10m for every 100m of distance on the ground, would be diverted into a penstock (pipeline) that would feed pressurised water into a turbine. River catchments which are located above waterfalls are especially attractive because these can restrict the passage of migratory fish. Ideally there would be no environmental designations in the locality and no migratory fish, eels, or any other protected species in the watercourse. The presence of such species can usually be managed but may adversely affect project design and payback periods.

Archimedean screws, are usually used in flatter valley watercourses which are at least 2.5 metres wide and usually have catchments sizes of over 10km^2. The large catchment area indicates a high volume of water will flow throughout the year. The presence of a dam or weir can be advantageous because this reduces project construction costs as well as making planning and environmental consents easier to secure.

Because hydro schemes are commonly located in more remote areas, their financial viability is often determined by the distance over which the generated electricity must be transmitted to the grid. It is therefore crucial that there is a nearby grid connection point, which would ideally be three-phase. Good road access is also important in order to allow large delivery vehicles and equipment to reach the site. If there is no existing access a new road can be constructed, although there are obviously additional costs associated with undertaking such works which reduce payback periods. Both banks of the watercourse in question would ideally be under ownership, i.e. the watercourse does not form an ownership boundary. This means that commercial agreements between landowners are then not required. For larger schemes, economies of scale can help to meet the legal costs that may be incurred in order to come to an agreement with neighbours.

Hydro systems generally have a long project life; equipment such as turbines can last many decades, while civil works can last for hundreds of years. This is important for hydro projects, because although their initial capital costs tend to be comparatively high because of the need for civil engineering works, they can function effectively for much longer than other renewable energy technologies.

FAQs

Q: **What might a hydro scheme cost to install and what are the likely payback periods?**
A: The capital cost of a hydro scheme is very site specific and can be highly variable, being dependent on a number of factors such as how rocky the ground conditions are and the distance to the electricity grid network. However, as a very general rule £8,000 could be allowed per kW of capacity for smaller sites up to 20kW, or £3,000 per kW of capacity for a larger system. A 500kW scheme could therefore cost in the region of £1.5M and could produce 1.75GWh of electricity over the course of a year. Based on the current Feed-in-Tariff rate of 15.59p/kWh, this level of generation would equate to income of approximately £272,825 per year; in addition, sales of electricity would amount to a further £83,500 of income annually for the best sites a 5 year payback is achievable, a 10 year payback is commonly accepted.

Q: **Does a hydro scheme need any licenses or planning permission?**
A: Normally a Controlled Activities Regulations (CAR) license will be required from the Scottish Environmental Protection Agency (SEPA) to allow for water to be impounded and/or abstracted from a watercourse. Planning permission is also required for any hydro scheme due to the extensive engineering works involved. For any hydro scheme it is prudent to begin consultations with both the local authority and SEPA as soon as outline feasibility has been established. This can help to ease the process of gaining the necessary permissions and prevent abortive work on project designs.

Q: **How long does it normally take to get through planning?**
A: The process of gaining planning approval for a hydro scheme can take up to two years or more from start to finish. There are a number of surveys to be completed such as flow monitoring, habitat surveys and ecological surveys. Certain surveys such as electrofishing can only be carried out at specific times in the year and must therefore be timed carefully in order not to cause undue delays to the progress of a scheme.

Q: **How long does it normally take to build a hydro scheme?**
A: Construction of a hydro scheme is dependent on the size of the project, but can normally be expected to take approximately 12 months. For a low head project, an Archimedes screw can be completed in about 4 months (if an existing weir is used).

Q: **Is a hydro scheme visually intrusive?**
A: The image on the other side of the factsheet shows what an Archimedes screw system looks like, as for high head scheme they are not normally visually intrusive. Once a scheme has been constructed there is usually relatively little to see. There is a weir, often constructed of concrete, with an intake structure leading to the penstock pipe, which is buried below ground completely out of sight. In most cases there will also need to be a fish pass incorporated into the intake to allow any resident or migratory fish to circumvent the intake and pass upriver. This structure often takes the form of a side channel containing a series of baffles which disrupt the flow and allow fish to ascend the channel. The only other visible structure will be the power house where the electricity generator is located and the power lines connecting this to the grid network.

Q: **How do I qualify for the FIT and will they be cut?**
A: Hydro schemes which are connected to the local electricity grid network will be able to qualify for the Feed-in Tariffs, with different sizes of project being eligible for different rate bandings. All FIT rates are due to be cut from April 2015, although hydro is expected to also see a cut in October 2014. FITs must be applied for before the 31st December each year prior to an April cut. The extent of FIT cuts varies because the level of cut applied is contingent on the deployment of the relevant technology. Pre-accreditation for hydro schemes affords protection of the current FIT rate for a period of up to 2 years.

Q: **Where can I find a list of hydro suppliers and installers?**
A: http://www.british-hydro.org/hydro_in_the_uk/hydro_companies/hydro_companies.html

http://www.therenewableenergycentre.co.uk/hydroelectric-power/small-scale-hydroelectric-system-suppliers/