

Hydro Power

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Source: M Curran



Benefits of Hydro

- High efficiency (70 – 90%)
- High capacity factor (normally >50%)
- Predictable
- Slow rate of change
- Good correlation with demand
- Long lasting and robust technology



Source: www.proactiveinvestors.co.uk

Suitable Sites



Source : www.dartmoor-npa.gov.uk



Source: www.anglesey.info



Source: www.wildsight.ca



Site Assessment

To main factors for hydro site:

1. Head – Vertical distance water falls (m)

10m or less = 'low head' site

10m – 50m = 'medium head' site

50m plus = 'high' head

2. Flow – Volume of water passing every second (m^3/sec or l/sec)



Source: www.bliss-stick.com

Other important considerations...

- Grid Connection
- Land permission
- Fisheries and environmental factors
- Planning and abstraction license



Source : www.theengineer.com



Source : www.flickr.com

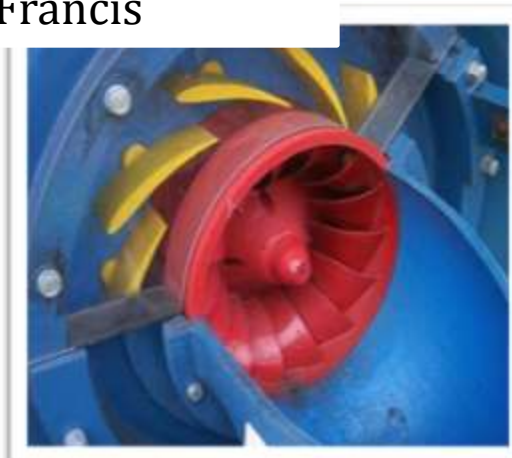
Electro – Mechanical Equipment

Turgo



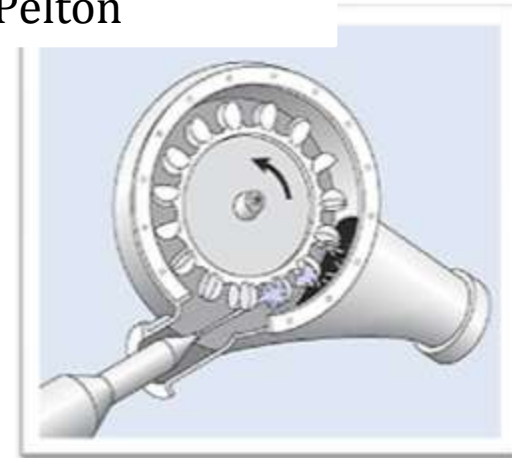
Source: www.varspeedhydro.com/Turgo.html

Francis



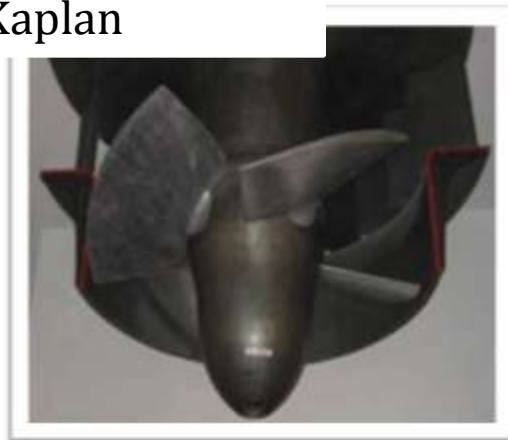
Source: <http://hydroelectricitypower.blogspot.com>

Pelton



Source: www.isoenergy.co.uk

Kaplan



Source: www.mpoweruk.com

Archimedes Screw



Source: www.westernrenew.co.uk

Crossflow



Source: <http://en.wikipedia.org/wiki/File:Banki.svg>

Generators

Two Types:

1. Generates electric at constant frequency – **synchronous**
2. Generates electric a variable frequency – **asynchronous**



Source : hydroturbine.en

Transmission

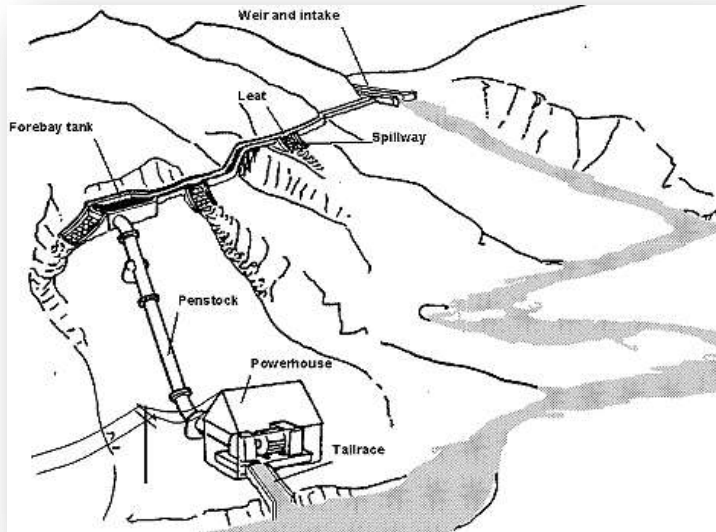
- Cable length kept to min to prevent power loss and costs
- Main factors : Power to be transmitted, voltage, transformers, underground or over ground



Source : islayenergytrust

Civil Works

Hydro Set Up



Source: British Hydro Association

The Intake



Source www.geograph.org.uk

Penstock



Source : www.practicalaction.org

Powerhouse



Source : <http://home.btconnect.com>

Economics

Hydro Scheme Income

Generation type	No. of ROCs/kWh	Value of ROCs in pence	Electricity value pence/kWh	Total value pence/kWh
Up to 20kW	4	16.92	5.49	22.41
21kW – 250kW	3	12.69	5.49	18.18
251kW – 1MW	2	8.46	5.49	13.95

10kW Site

Estimated Capital Cost £90,000

Less 50% Grant £45,000

Net Capital Cost £45,000

Estimated annual output 39,500kWh

4 ROCs £6,700

Electricity £2,150

Total Annual Income £8,850

Payback 5 years

Total value of ROCs over 20 years £134,000

CO2 saving p.a. 20,816 kgs

CO2 saving 80 year lifetime 1,665,320

New "Cost-curve" b



Development Timeline

Phase	Typical timeframe	Who to involve
Initial assessment	10-15 mins	Hydro Consultant
Pre feasibility study	1-2 months	Hydro Consultant. Landowner
Project Design and Environmental Assessment	2-14 months	Planning Service NIEA Water Management unit and Nat. Heritage
Licensing and Planning	6-18 months	Planning Service, NIEA Water Management unit and Nat. Heritage. Electricity company
Construction <ul style="list-style-type: none"> - Detail design - Eqt purchase - Construction - Commissioning 	8 – 15 months	Source of finance e.g. bank Electricity Company Ofgem (ROCs)

References

- British Hydro Association – A Guide to UK Mini-Hydro Developments
- Going With The Flow – Small Scale Water Power
- Hydro NI
- Rob Gwillim – Centre for Alternative Technology