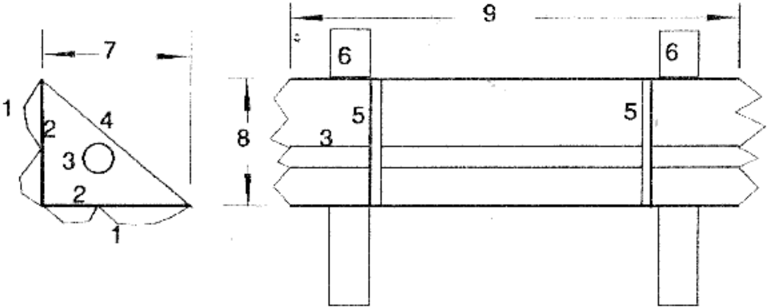
D I Y SOLAR WATER HEATER

Test Data Available on request.



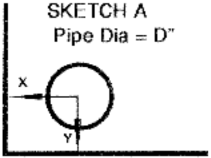
GENERAL CONSTRUCTION

1 Half sawn poles to give flat inside surface. Or planks planed one side

2. Flat surfaces @ 90 degrees covered with aluminium foil. **
3. 1" nb. black iron pipe. Or copper pipe.
4. Glass/perspex cover
5. Pipe and reflective surface supports.
6. Main supports (eg, fence posts)
7. Width, approx 16 cm
8. Height approx. 16 cm
9. Length, can be several hundred meters, depending on site.

SKETCH A

Pipe Dia = D"



Distance X = D/sin z

Distance Y = D/cos z

where z = the angle of inclination of the Sun at noon on midsummer day at the location of the solar heating system

NOTES

** These surfaces must be exactly at right angles. With the back surface vertical. And the front surface level as far as possible.

Any domestic aluminium foil is suitable. Using any cheap adhesive to glue it to the planks. Adhesive backed foil is available but is more expensive.

The position of the pipe in relation to the reflective surfaces is governed by the latitude of the installation, and the sunlight reflective paths. See sketch A.

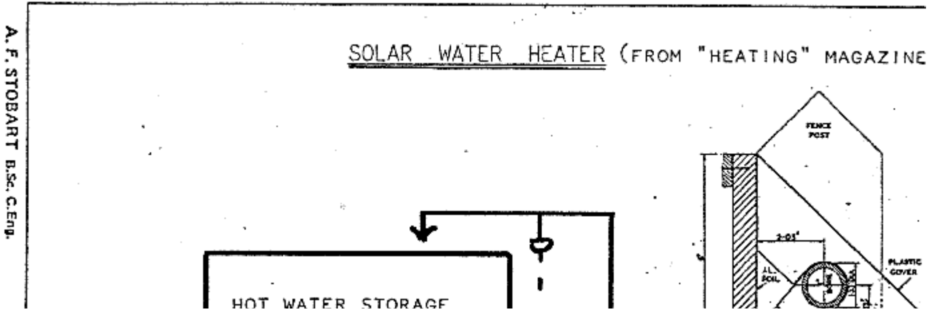
The whole unit must face directly South, and be in full sunlight at all times. i.e no shading from trees etc.

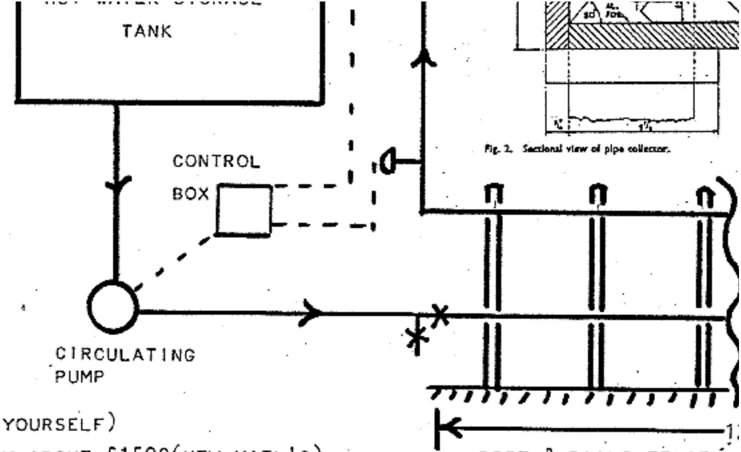
The system can be used in two ways:-

1. Continuous flow. Water is pumped through the pipes, and is heated

to about 80-90°F for central heating.

2. Discontinuous flow. A thermostat at the exit end of the system is set to the maximum temperature expected (about 140°F) with a cut off at (say) 110°F. Once the top temperature is reached the thermostat switches on a pump to deliver the hot water to a storage tank for baths, washing etc. At the lower temperature the pump is switched off to allow further heating of the water in the system piping.





RESOURCE CONSERVATION

COST (DO IT YOURSELF)

COLLECTOR ONLY ABOUT £1500(NEW MATL'S)

KWHR/YEAR UP TO 21000, WATER TEMP UP TO 75C

KWHRS/ANNUM/£ = 7 TO 14

POST & RAILS FENCE W

SHOULD FACE DUE

£INCOME/£ CAPITAL = 0.2

Article extracted from Marine Scientist, N0.9 Q4 2004 page 42, by A F Stobart BSc.Chem.Eng
See www.grunweb.org.uk and http://myweb.tiscali.co.uk/aferrand HYDRO section

ENERGY FROM THE TIDES

This form of energy has been harnessed from Roman times for small milling operations on coastal sites. No part of the UK is further than 70 miles from tidal water. The gravitational energy from the Sun and Moon move sea water up and down in a regular, predictable and constant pattern. Thus Britain is well placed to take advantage of this inexhaustable energy source. To do this either the flow of the tide must harnessed as it moves round these islands [Ref.1]. Or the sea must be channeled to flow from a high tide level to a low tide level, which is the approach of this paper. This involves creating "ponds" in the walls of which equipment is sited to generate energy from the flow. As the ponds will both fill and empty, the equipment must be capable of bi-directional flow. The equipment must also be effective under conditions of flows below it's maximum capability, and have a high conversion of flow energy to mechanical or electrical energy.

WATER ENGINES

These conditions are met by a Water Engine. The operation is that of two weighted floats being alternately raised and lowered by water entering the chamber underneath them, and then draining out of it. The flow is controlled by flap valves. Flow can be in either direction, as may be controlled by the valve programme.

The floats are linked to two sets of hydraulic rams, so that the force of the floats rising and falling is converted to hydraulic oil (or water) pressure. This pressure stream can then be used to power machinery, including electricity generation equipment, heat pumps, and other rotating equipment.

The mechanism is essentially a pressure intensifier. In that the low pressure of a few feet of water is converted into 3-4000 psi hydraulic pressure. The operating range for single units is from 1ft to 10ft head of water, and is thus suitable for large flow, low head, installations in rivers, and for tidal power collection using "ponds". Higher heads can be handled by "cascade" installations of two or more units in series. Though reverse flow is thereby inhibited.

In the 1980's two machines were built and reported on by ETSU [Refs.2,3,4,] but since then only two small test machines have been built. he mechanisms are simple and robust, and in volume production should be comparable in cost with other hydropower equipment. Maintenance should be simple, and given good construction parameters, the equipment should have a long life. For example all parts in contact with sea water could be made of fibreglass or other non corroding materials.

A major cost however is the construction of the ponds. Three approaches can be considered for Tidal energy collection. The estuary approach , the Shoreline approach and the open sea approach . Both the last two envisage additional energy income being generated from Wind and Wave energy and from fish farming. The open sea approach is similar to that being pioneered by Tidal Electric off Cornwall, but using Water Engines, and adding the additional income generating items mentioned above. For estuary and inshore installations the hydraulic power could be piped ashore, have hydraulic accumulators included for some energy storage to help iron out demand peaks and troughs, and the driven items, heat pumps, generators or other machinery mounted well away from sea water.

HYDRAULIC POWER APPLICATIONS

The Estuary and Shorline approach benefits from the possibility that initially all power developed by Water Engines would be collected by an hydraulic main, and taken on shore. Where a central generating or other energy using facility could be set up, well away from the sea. Given suitable materials of construction the Water Engines could just act as pumps, delivering sea water under high pressure into the hydraulic main. In a similar manner to the London Hydraulic Power Company, which at its height in 1930 supplied 8000 machines with power through 186 miles of pipes.[Ref.5] Or Bristol's Avonmouth Docks, which were originally powered by hydraulics. [Ref.6] There are of course many inland applications for water engines, in locations with heads of 3m and below. But sadly while Eire has surveyed such sites, [Ref.7], the UK has only done surveys down to heads of 3m. Not below. [Ref.8]

HEAT PUMPING

A major potential application for Water Engines is to drive heat pumpsThe major energy advantage is that while electricity generation may give 60-65% of the Tidal Energy as usable power, a direct driven heat pump, which excludes electrical machinery, "adds" to the energy output to the extent that for every 100 units of hydro energy available, up to perhaps 250 units of heat energy can be delivered by a heat pump system. The "extra" energy coming from cooling the sea.

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Article extracted from Marine Scientist N0.9 Q4 2004 page 42 by A F Stobart BSc.Chem.Eng
See also www.grunweb.org.uk and http://myweb.tiscali.co.uk/aferrand WIND section

WIND ENERGY COLLECTION USING CONTRA ROTATION

The basic mechanical principles of the currently popular three bladed large Wind Energy Collectors (they are not strictly turbines having only one rotor) go back to 1185 or before when Nicholas rented the "milling by the wind" (Molendium venti) from the Knights Templars in E. Yorkshire. And possibly as far back as when the "slave skilled in the manufacture of windmills" slew the Sultan Omar of Baghdad in 644 AD. A good history of wind energy developments from 1905 to 1972 can be found in [Ref.1].

A friend of Betz who is sometimes described as the "father of modern wind energy collection theory" [Ref.2], Hans Honneff, wrote a book on the use of contra-rotation, using two rotors one behind the other, driving the two halves of an electrical generator.Thus creating a true "Wind Turbine" [Ref.3] The concept was for very large wind turbines, three to a tower, 150m, dia, each, generating a total of 21 MW. The two rotors for each of the three turbines had a 120m, dia. set of magnets and coils as the electrical system, each rotor revolving separately from the other. Small (10m. dia.) models of the above were tested by the Third Reich Wind Energy Ministry, [1935-45].

In fan and turbine engineering the energy collected by two or more rotors in series is additive.[Ref.4] This point was confirmed for wind energy collection with model trials in 1976 by Simon Bromet (unpublished manuscript). Further confirmation of this fact was published recently following some trials by the California Energy Commission. But using a conventional alternator. [Ref 5] An attempt to the additive effect of contra-roation was made by Trimble Windmills in the period 1976-82. A small (5kW rated at 10 m/sec windspeed) machine was built, and a number sold to farmers and isolated sites for heating. [Ref.6] With some tap off for local electric power. The machines had a contra-rotating permanent magnet alternator, and sail wing blades attached to each half. Current collection was through slip rings. While the full additive effect shown by Mr Bromet was not achieved, probably due to the two sets of blades being too close together, a respectable Cp of 0.37 was achieved. [Ref.7] Blade spacing requires further research and development. Note that contra-rotation electricity generation does not require a gearbox, thus saving costs and energy loss.

Later the concept of "ganging up" many contra-rotating rotors was conceived due to the discovery of German work by the 3rd Reich Wind Energy Ministry (1934-45) indicating an interesting synchronous non electronic method of linking contra-rotating turbines. [Ref.8] Other work on this may be contained in a FIAT report, not yet traced. [Ref.9] This concept was called an Integrally Linked Multiple Array (ILMA) which was chosen for display at the Rolls Royce sponsored poster session at the 1988 Techmart Exhibition.. [Ref.10] The system has yet to be tried out, albeit several wind energy collectors on one tower (single rotors) had been proposed earlier for Marine work [Ref 11] and tried out on land.[Ref.12] The latter unit had six rotors to give a total rating of 400 kW.

The rationale for many rotors, provided they can be cheaply mass produced and electrically linked is that as a Wind Energy Collector is an area for income, but a volume for cost, above a certain diameter is seems probable that the cost of many rotors will be less than one large rotor of the same rated output. This principle of "many circles" is found in piston engines. The original ILMA concept was put forward in 1983. [Ref 13] One potential advantage of this approach for marine work (and for wind turbines on buildings [Ref.14) is that rotors can be dispersed over the supporting structure, eg a redundant Oil Platform, without the need to have means to support the considerable overturning moment of a single large rotor. Losses due to breakdowns are minimised as not all the small rotors are likely to fail at one time. Due to rotors being point suspended (as per Honneff), loads on supporting structures can be considerable reduced, together with overturning moments, as this suspension converts side wind forces into a downward load on the supporting structures.

An important matter for future developments is to change the alternator design for ILMA from a radial air gap, as is found in most electrical generators, to an axial air gap. A generator in this configuration has been reported. [Ref,15] The original Trimble alternator, designed and manufactured by Clarke Chapman at Gateshead was robust, virtually trouble free (one ran for over 10 years with no maintenance attention), efficient, but very heavy and costly.
Honnef placed his generating ring almost at the tip of the rotors, where the angular speed is greatest. A similar approach is required with ILMA units, especially as the centre one third of any WEC is useless for energy collection, and the wind in this area can with advantage be directed outwards with a nose come. A theoretical study of contra-rotating electrical machines is known of. [Ref.16]

The single rotor concept however has had it's advocates for Marine use [Ref 18]. Honnef envisaged very large rotors, barge mounted, with the energy collection at the base of the rotors rather than all round the edge. A similar proposal for a large single rotor made by Mullett in 1956, is quoted by Bockris. [Ref.11]

APPLICATIONS FOR MARINE RENEWABLE ENERGY USING CONTRA - ROTATION

The first application is clearly to bring it onshore.

Electricity from WEC's. The usual application with synchronous generation (feasible with the ILMA concept, if the Kloss electric linkage theory proves effective) is direct use, fed into the Grid in UK.

If generated as "crude" (asynchronous) current by allowing the WECs to "run with the wind", which improves energy collection efficiency, the current can be stored as high temperature heat from resistance heaters in Cowper Stoves, to provide Process Heat, which, as noted above, is a much greater energy demand in UK than electricity per se. [Ref.13]

This could be applied in the Chemical Industries, and in Ireland, Scotland and Wales for whiskey distilling. [Ref.17] It might also be used for powering a superheater section in a Nuclear Power Station's steam circuits, whose temperature conditions often leave something to be desired.

DC electric current can be used to fix atmospheric Nitrogen (Birkeland & Eyde process, pioneered by Norsk Hydro). Which has been examined on a small scale in Canada, using a "nitrolyser". [Ref.19]

An application for both on and off shore is Hydrogen production from sea water by Electrolosis. [Refs.11, 20] This gas is becoming increasingly considered as a Road Transport Fuel. (Second largest UK energy usage). It can also be used to convert Coal to Liquid fuels. [Refs.11, 21, 22 & 23] And has been considered for processing domestic waste to fuel.[Ref.24] This technology might provide an extended life for redundant oil platforms. Although existing oil pipelines might be metallurgically unsuitable for its delivery to shore. And it cannot be mixed with Natural Gas to add to the latter's energy content as all gas using appliances would have to be altered. [Ref.25]

Offshore, [Ref.11] offers an interesting concept of the electrolosis taking place at depth in sea water. Providing Hydrogen under compression for transport and storage, and a means of disposing of the chlorine produced though dispersion in the sea.
However extensive enquiries over the past few months in both the USA and the UK have found no references to this technology having been tried out. Albeit Hydrogen compression at the point of production by electrolosis is being investigated in the USA. [Ref 26] The chlorine might however have commercial uses too.

Not everyone is convinced of the economic viability of a Hydrogen Economy. Ref 27] But the possible economic advantages of the technologies discussed above could change this view ? Certainly one island off Norway, Utsira, has recently gone to a Wind and Hydrogen energy supply system. Some of the wind energy is used to produce Hydrogen, which through Fuel cells produces electricity and heat when no wind power is available. [Ref 28]

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