Soft Technology

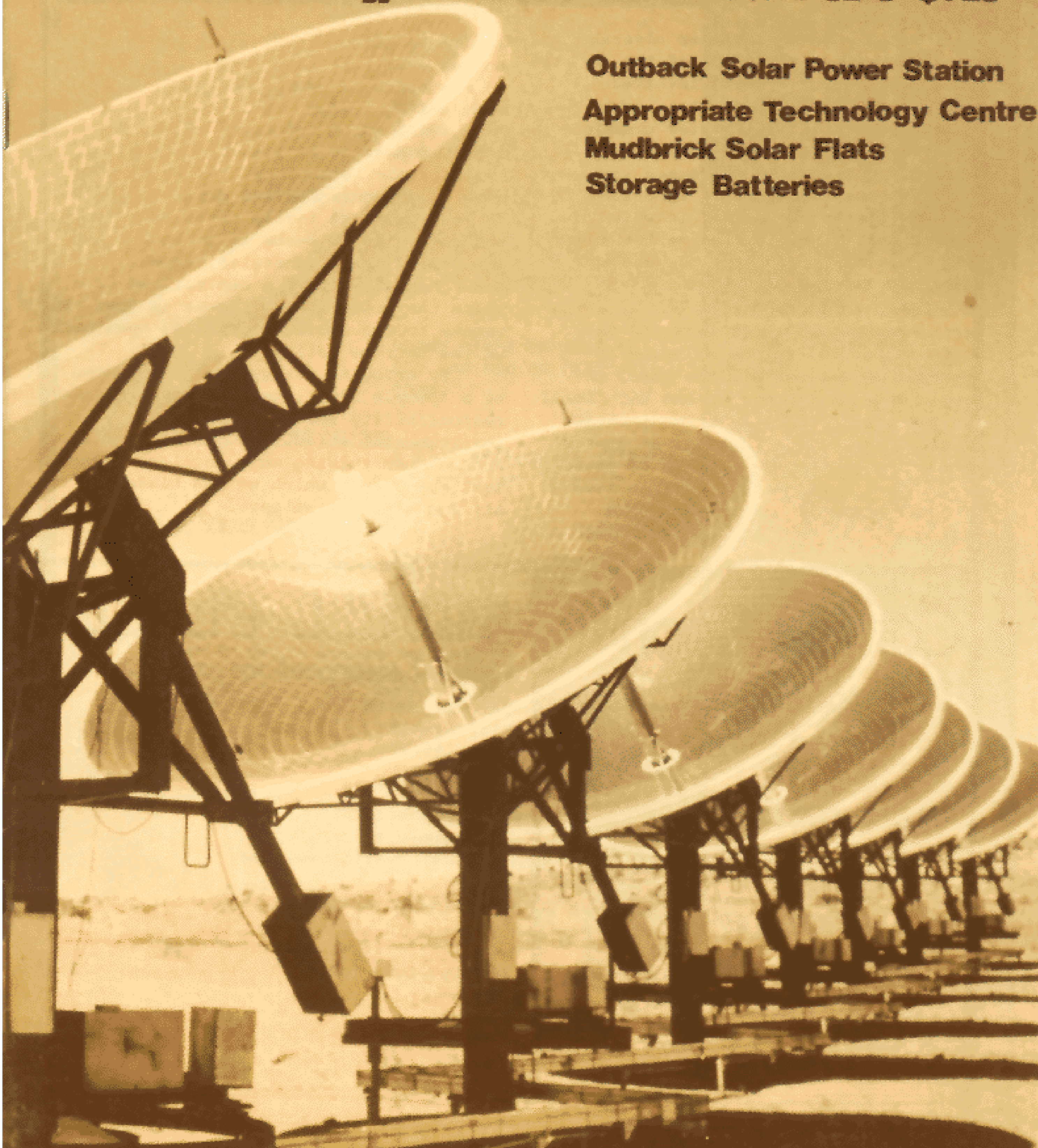
Alternative Technology in Australia No. 10 Nov/Jan 82-3 $1·25

Outback Solar Power Station

Appropriate Technology Centre

Mudbrick Solar Flats

Storage Batteries



Editorial

Often when we consider alternative technology, we only think of the actual energy-producing systems involved, such as solar cells, electric cars, or whatever, But as our cities continue to grow larger and more polluted, the need to consider the processes involved also becomes increasingly important. By this I mean the manner in which the city and it's people receive the energy, the scale it is produced on, and who owns the generating equipment.

When confronted with our existing economic system, which sees the only options for the future as being in growth at all costs, the ideas of people such as Schumacher and his 'Small is Beautiful' concept become increasingly attractive. That is, an energy producing system (as well as an economic and social one) which is geared towards maximum accessibility rather than minimum mobility. And it is through the effort of people involved in political action that real change can be expected in the types of energy we use and how they are generated.

Small scale industry, geared for local production is ideally suited for 'appropriate technology' After all, do huge wind generators and acres of silicon cells or mirrors really constitute 'soft technology'? It seems to me that these are really 'hard' energies, especially when channelled into a centralised grid, where the production of power is just as remote to the average person as open cuts in the Latrobe Valley.

By bringing energy technology down to a 'people size', we can begin to take responsibility for the social and environmental effects of our lifestyles, rather than relying on a faceless government department which we can blame for all the problems we have,

Cam Walker.

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This issue of Soft Technology was edited by Mick Harris and Cam Walker with help from Alan Hutchinson, Tony Stevenson, George Lilley, David Anderson and Andrew Blair. Photographs by Tony Miller and Alan Hutchinson. Thanks to Richard Nankin and Peter Greenaway for assistance with the cover.

Comments, Contributions and Critisisms are welcome and should be sent to the Alternative Technology Association, 366 Smith St. Collingwood, Victoria, 3066.

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Cover: The solar power station at White Cliffs in operation during tests this year.

Energy Flashes

Power in the West

A 5 kilowatt AC power system, designed for use on homesteads in remote locations, was commissioned in May by State Energy Authorities in Western Australia.

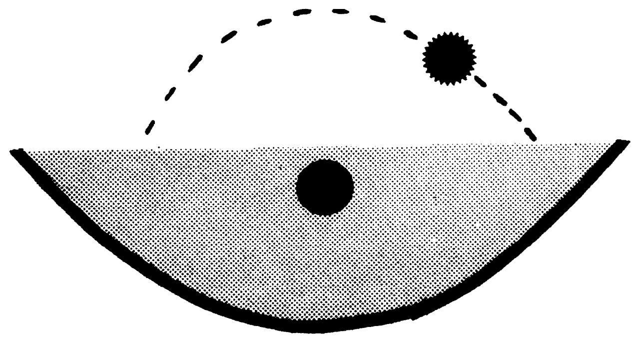
The Solar Photovoltaic system, designed by ARCO will be tested for a period of two years at a site just outside Perth, and then will be moved to a more isolated location for further evaluation. The 160 - module system is designed to deliver 5,280 peak watts, and direct current is converted to 240 volt, 50 hertz alternating current by a BEST inverter.

In Western Australia it is estimated that some 3,000 homesteads using privately-owned generating equipment and the Government sees photovoltaic systems as being a viable alternative to petrol generators.

The Solar Energy Research Institute of WA has developed a very low cost, compact and easily installed charge/discharge controller for lead-acid batteries. Although designed basically for solar applications using photovoltaic-battery power systems, it is also useful for a wide variety of situations where lead-acid batteries are employed, including electric batteries,

The controller provides a readout of 'state-of-charge' of the battery, and, when charging, prevents overcharging.

Elastica



An industrial solar collector which tracks the sun throughout the day is being manufactured and marketed in Western Australia.

The collector was the result of four years research and development undertaken jointly by the University of Western Australia and National Iron and Steel, a Perth based company, and was made possible by a grant from the Solar Energy Research Institute of Western Australia Total research and development cost were $160,000.

Made of aluminised acrylic film, with steel backing and acrylic cover, an 'elastical' curved mirror concentrates the sun's rays onto a black absorber pipe As the sun moves, a sensor activates an electric motor and moves the solar panels

The first major project using the collector was to supply a water heating unit to a large plant nursery The 223 square metre collector panels will supply 12,000 litres of hot water to heat the nursery's greenhouses

Solar Pumps

Two recent solar programs in Africa are now pumping bore water for villages in remote regions

In Botswana, a solar-powered water pump was installed in a village near the Kalahari desert. This system has 8 ARC0 solar modules and a positive displacement pump which is driven by a three-quarter horsepower motor. It provides 2,500 gallons of water per day for crop irrigation from a depth of 15 metres.

The system, which was installed by local villagers, requires virtually no maintenance, and is considered to be cheaper than a diesel powered system.

In Somalia, a portable solar electric system is being used to pump drinking and agricultural water to the surface in a number of villages and refugee camps.

Over 100 of the systems, each on wheels for ease of movement and employing seven ARCO units, are used to pump water from lakes or wells by a D.C. - powered submersible water pump,

Hydro Controller

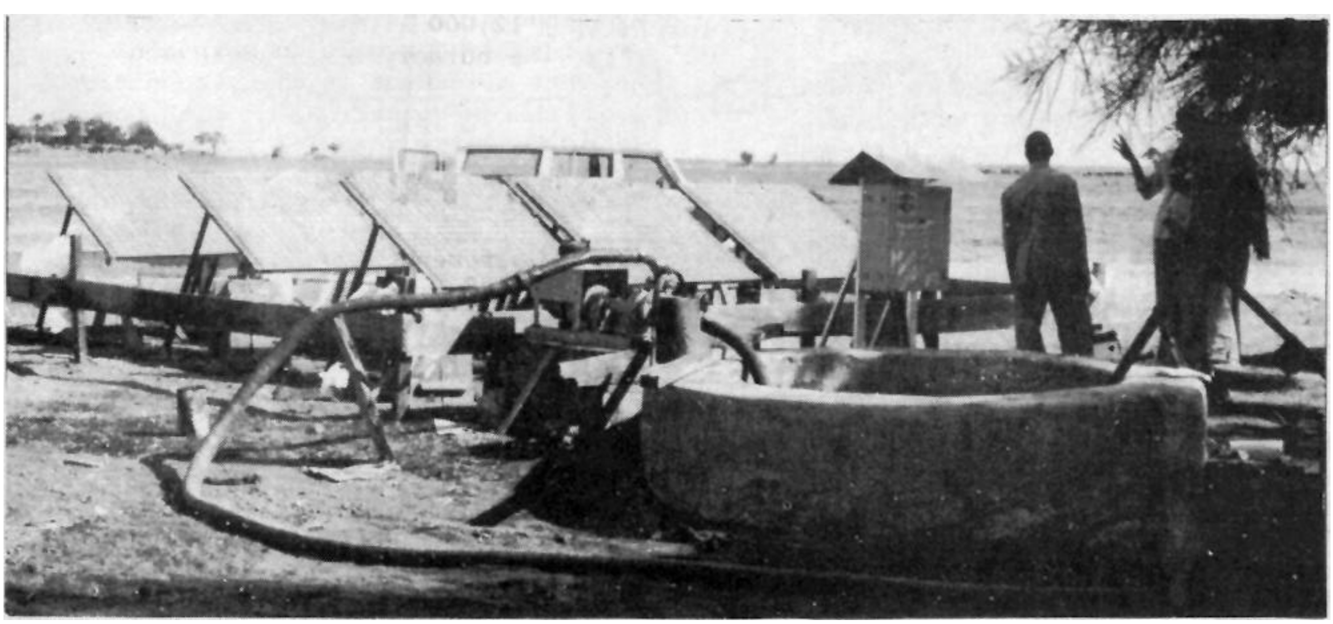
The Intermediate Technology Development Group, founded in the U.K. in 1965 by E.F. Schumacher, has recently been working on the development of an electronic controller for hydro electric systems.

The controller works on a new principle of 'load control'. As the demand for electricity varies (lights, appliances or equipment being turned on or off) the controller instantly adjusts the amount of power fed into a secondary 'ballast' circuit while keeping the primary circuit absolutely steady and the speed of the turbine generator constant. This eliminates the expensive mechanical equipment - and all the associated maintenance problems - used to control the flow of water through the turbine, and allows for the use of much simpler and cheaper turbines.

The combined savings with the electronic controller and the simple turbine could halve the costs of a small hydro-electric plant,

A number of controllers have been installed in hydro-systems in Sri Lanka, Thailand and Columbia over the last few years and have proved a success.

China with over 100,000 small scale hydro-electric plants has also expressed interest in the controller and the ITDG, is currently involved in negotiations regarding licensing the manufacture of the devices.



The SOLAR POWER STATION At White Cliffs

On the 12th of May, 1979, the Premier of New South Wales - Neville Wran announced that the government had commissioned the Australian National University to construct a Solar Power Station The prototype power station was to be constructed at the small opal mining town of White Cliffs in North-West N.S.W. It was to be the first of its kind in Australia, with its construction being supervised by the Department of Engineering Physics of the Research School of Physical Sciences, A.N.U.

THE POWER STATION

The project uses 14 parabolic collectors to vaporize water and produce steam which turns a steam engine and in turn generates up to 25 kilowatts of electrical power.

The collectors which are made of fibreglass are lined with squares of glass mirror' and are each five meters in diameter. The power station is set out in a V shape with seven collectors on each branch of the V and the generator house at the base of the V.

HOW THE SYSTEM WORKS

The parabolic concentrating collectors concentrate the suns rays onto an absorber where water is vaporized at high pressure- The collectors automatically track the sun. This is achieved by the use of four photo-transistors mounted at the top of the collector around a small pole, If the collector comes out of alignment with the sun, a shadow from the pole falls across one of the photo-transistors which in turn activates a drive motor which re-align the collector.. The tracking system only operates intermittently, switching on every 15 to 20 seconds. This is done to reduce stress and wear on the system which could be created by buffeting winds. If the tracking system operated continuously, it would be forced to continually struggle to maintain perfect alignment in windy conditions, even though the alignment with the sun would be quite', adequate. Thus, the intermittent operation reduces stress

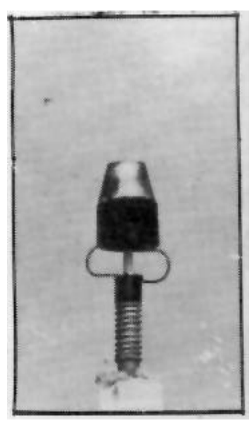


Fig 1. The Absorber of one of the coll-ectors. Note the coil of stainless steel pipe below the top of the absorber.

and wear on the system while maintaining efficient tracking,

When operating, water is pumped into the absorber of the collectors via high pressure rotating joints, necessary because of the tracking movement of the collector. At the absorber which is made of a coil of stainless steel piping, the temperature reaches up to 550° with a maximum pressure of 70 atmospheres.

The high pressure steam then returns to generator room via insulated ducts. The duct insulation - being used is "Microtherm", which is made up of rare earth materials; about 70% silicon oxide and 30% titanium oxide.

Upon reaching the steam engine the temperature will have dropped to a maximum of about 500°C at 60° atmospheres., However, this is only under optimum conditions. Temperature and pressure are generally closer to 400°C at 50 to 60 atmospheres at this stage

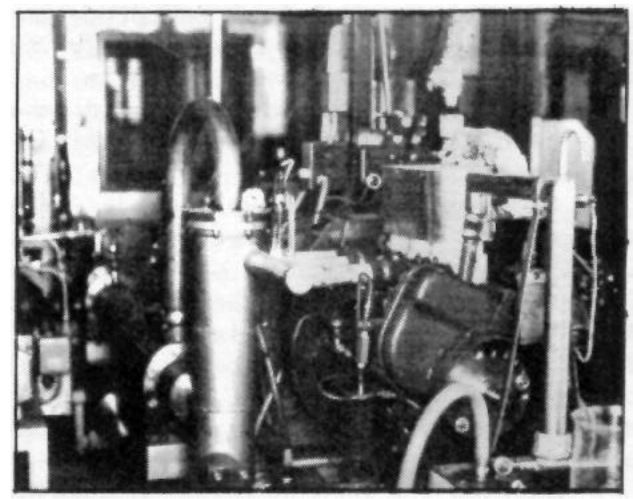
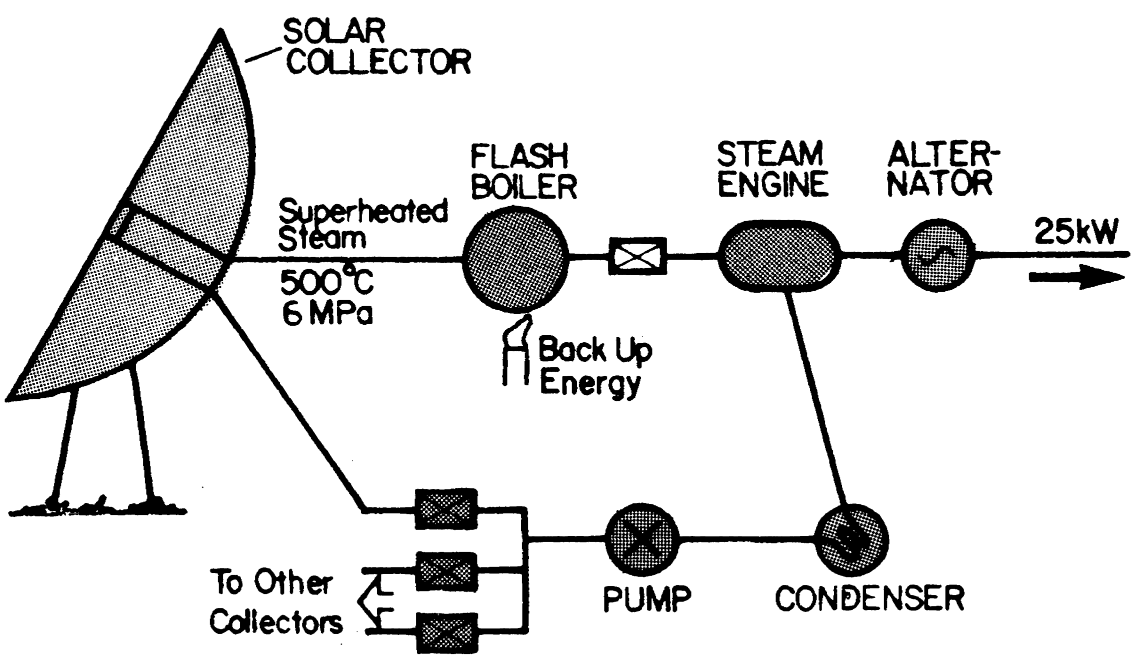


Fig.2.The generator room of the power station. The steam engine is to the right of the photo.



SCHEMATIC DIAGRAM OF SOLAR POWER STATION

SOLAR POWER STATION

The steam engine is a reciprocating uni flow type which is approximately 20% efficient This type was chosen in preference to a turbine which would have only been about 10% efficient in this application*

The steam engine involved a considerable amount of development in itself, At the beginning of the project investigations revealed that no suitable "off the shelf" steam engine was available- The engine uses a basic block and crank from a diesel engine, General Motors pistons and a specially manufactured cylinder head.

Running the engine revealed a major problem While in use the condensed steam and the engines lubricating oil mixed, The oil and water mix could not be fed directly back to the collectors as the heating and vaporizing of the mix would quickly clog up the system. So, a method of separating the oil and water was successfully devised,

The steam engine drives a single phase alternator which supplies the towns power supply. Also, on the same shaft is a DC machine which supplies power for the storage batteries. The alternator is connected to the steam engines shaft in such a way that it will only engage and produce power when the steam engine is running at sufficient speed. The DC machine on the other hand, is continuously connected and supplying power to the batteries

The battery bank is made up of Lucas Mining Marathon lead acid batteries. These cells are designed to operate efficiently at temperature, of up to 70°C. They have a rated life of 5 years. The battery bank has a capacity of 760 amp hours at 300 volts, It cost $22,000 and holds one days storage,

In the event of the battery bank being exhausted, power can be provided by a back-up diesel generator set, The system also includes a flash boiler. This can only be operated manually and can be used for testing of the system under controlled conditions or if sunlight is not available. It can also be used as a secondary back-up in the event of failure of the diesel generator set..

The generator shed and water storage tanks are both surrounded by a large rock and gravel structure.. This was designed by John Ballinger of the University of N S W , and had a twofold purpose. It was to act as a buffer between the water and the hot sun keeping the water cool and providing a cool thermal mass. It was also considered important to have a structure which fitted in with the surrounding environment.

Unfortunately, the thermal mass has worked in the opposite way. It has kept the water warm rather than cool, slightly reducing the efficiency of the system.

Fig.3. The rock and gravel structure around the generator shed was designed to keep the water cool; it had the opposite effect.

COST AND ECONOMICS

When first announced the project was allocated $800,000. It was anticipated about one quarter of this would be used for development work involved in establishing the construction facility. At that stage the ANU researchers estimated that on a production run of 500 units the per unit cost would drop from the $250,000 for the prototype to $30,000. This corresponds to a production cost of electricity of about 7c per kilowatt hour, which compares very favourably with the cost of electricity from diesel sets.

However, the initial grant of $800,000, has had to be increased to $1,048,000. This is largely due to the fact that after the initial grant was made the N.S.W. Energy Authority decided the power station should include automatic control equipment and power storage. Both these involved additional research and development as well as purchases of equipment.

With this taken into account the cost of the prototype power station becomes approximately $300,000. The cost of power from this facility is between and 80 cents a kilowatt hour. This is something over 10 times the cost of utility power supplied to urban consumers Despite this high cost, even this prototype power station (which is much more expensive than would be a power station from a production run) is competitive in some areas of Australia. Some generating sets in-Australia supply electrical energy for costs as high as $2.00 to $2.50 per kilowatt hour, while many cost 8Oc or more a kilowatt hour

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Storage Batteries

This information has been supplied by Century and while it relates to their 110 ampere hour batteries, it would also apply to the charging and discharge rates of any comparable home-lighting battery.

To give the longest possible life, batteries should be carefully maintained. We recommend the use of Century home-lighting batteries because with the inbuilt gravity balls and the clear case it is very easy to check the state of the batteries, As these important checks are less likely to be carried out with other batteries, the Century batteries should last longer, if these instructions are followed:

Charging rate: Start: 10 amps.
Finish: 5 amps.

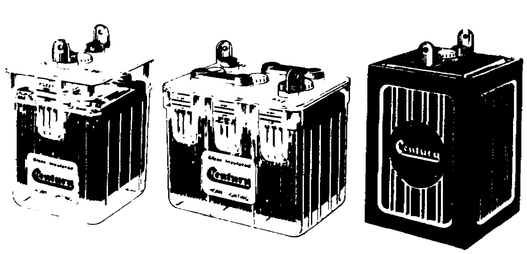
Rated discharge: 11 ampere for 10 hours.

Maximum rate of discharge: 12 amperes.

Maximum rate of charge: 12 amperes.

Inspection:

A thourough inspection of each battery cell should be made immediately on unpacking. Any damage or breakages must be reported immediately to the supplier. On receipt of the batteries the white gravity ball in some cells may not be floating This condition is normal and charging will restore the ball to the top of the hydrometer cage when the battery is fully charged.



Gravity Ball Indicators:

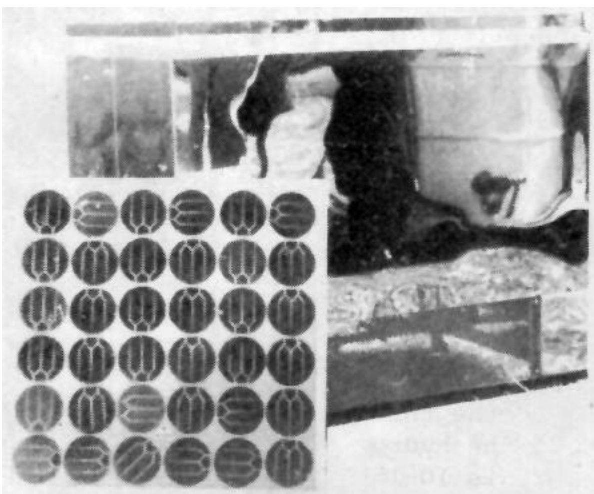
These gravity ball indicators, held in a cage in the front of each cell are one of the special features of this battery and indicate the state of charge of the battery at all times and the use of a squeeze bulb hydrometer is unnecessary. When the battery is fully charged the three balls float at the top of the hydrometer cage. When the battery is 10-15% discharged, the white ball will fall to the bottom of the cage, the green ball will fall when the battery is 50% discharged and finally the red ball will sink to the bottom of the cage when the battery is almost fully discharged.

Electrolyte Level and Topping Up:

The electrolyte level in these cells should be maintained at all times between the white lines on the front of the container. Only use distilled water, or rain water collected in a clean glass or earthenware vessel. Acid must never be used in topping up. Particular care must be taken not to overfill above the top white line as the excess water will lower the electrolyte specific gravity and cause the white ball to drop even though the battery is fully charged. If this occurs, no amount of charging will make the white ball rise, and it will remain at the bottom of the cage until the excess water has evaporated, and the correct level restored.

Andrew Blair

Solar electric Fridge



When setting up an autonomous power supply, it is relatively easy to provide enough capacity for the low drains from lights or appliances used intermittently, but the big problem has been the continuous 200-300W drain for a refrigerator,

Solarex Pty. Ltd. have developed a highly efficient refrigerator which has a power consumption low enough to allow it to be powered by a panel of solar cells.

The coolbox has its lid on the top rather than the side so that the cold air does not escape out the bottom every time you open the door. It has a fibreglass inner lining and a stainless steel outer lining with 120mm of polyurethane foam as insulation. This coolbox is vastly more efficient than your conventional domestic refrigerator with its front opening door and very little insulation The internal capacity is 170 litres (6 cubic ft.).

The refrigeration unit is built into the back of the coolbox and is a conventional hermetically sealed motor/compressor system with a 24V brushless DC motor and a wire fin type condenser,,

The power drain is quoted as 12 amp hours/day.. This is an average power drain of 12 watts (c.f. about 200W for a conventional fridge). Batteries of 6OA.H. capacity will supply 5 days operation under sunless conditions (a battery cutout is provided to prevent excessive discharge). Assuming an average of 6hrs/day sunlight, you would need at least a 50 watt solar cell panel. (Two conventional 30W/13V panels in series would do).

Designed to operate in a 43°C environment, the unit is aimed at providing refrigeration facilities in areas without a reliable mains supply such as up the bush or at a village level in developing countries,

It is a nice unit and it all sounds lovely until you hear the price. They want approx. $1500.00 for the fridge and to that you would need about $2000 for the cells and battery bank. Despite this, they have sold a few,

had any fun with A.T. lately ?

THEN DROP US A LINE.....

if you're into something interesting then send us an article or a letter and let us all know.

the solar mudbrick flats

Natural energy sources and building materials can work in together to produce a building which is not only energy efficient and comfortable to live in, but also aesthetically very pleasing.

The home of Peter Kurz at Mallacoota is an excellent example of this Over the last 15 years Peter has built a number of solar/ mudbrick buildings. There are now five buildings on his 1 acre block. Four are rented out as holiday flats to bring in an income. The other is Peters home, All the flats and

Fig.1. Peter Kurz in the kitchen of his home.

Peter's home itself make use of solar energy through both passive and active means1

All the buildings face north making it possible to make maximum use of the sun for heating in winter and easier to exclude unwanted sun in summer. Verandahs on the north side help keep out hot summer sun, while the stone or dank timer flooring absorbs and stores heat from the sun in winter. All the flats have a large window area on the north side to allow in as much winter sun as possible.

The heavy mudbrick walls act as an energy store and buffer. They level out the temperature change inside the flats, stopping it from cooling down too much on cold winter nights, and heating up on hot summer days. The roofs are insulated with pink batts and sisalation.

Active energy feature on the building include solar water heating pot belly stoves. The solar water heating uses the thermosyphon system to circulate the water from the panels to the storage tank. Peter used to use a solar switched pump in his early solar water heating system. However, it did not work well and now all the solar water heater uses the thermo-syphon.

The solar water heating can be boosted by electricity or by the pot belly stoves in the flats.. All the pot bellys have heat exchangers on the chimneys to heat water. The pot bellys are of course also used for heating the flats,

Fig.2. All the solar water heaters now use the thermosyphon system of circulation, Peter's house can be seen in the background.

As well as being made from mudbrick all the flats and Peters house use large heavy timbers. These include S.E.C. power poles, old bridge timbers and huge tree trunks. One particularly striking feature of the buildings are the bottle windows. Old bottles of different colours are set into the walls as they are built., A combination of patterns and colours result in breath-taking effects. Especially when the evening sun strikes the bottles.

Fig.3. All the flats have wood stoves both for space heating and water heating.

Also, on his one acre, Peter has a large vegetable garden. He fertilizes the garden by pumping waste from the septic tank. The waste is allowed to break down in the tank for some time and by the time it is pumped to the garden there is no smell and the garden flourishes.

Fig.4. The vegetable garden is fertill-ised by waste from the septic system.

Solar mudbrick

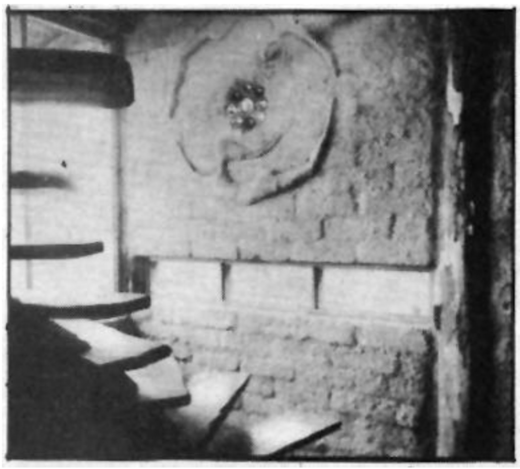


Fig. 5, A spiral staircase made from an old tree trunk. One of the bottle windows is set into the rear wall.

The whole philosophy behind Peter Kurz's home and the flats that he makes available to people is one of working with the environment rather than trying to conquer it. Everything possible is recycled, from vegie scraps to bottles, Natural energy sources are used and buildings feel as if they really are part of the environment, not just plonked down on top of it.

Peter Kurz welcomes visitors. So, if you are ever in that neck of the woods do not hesitate to drop in for a chat and a cup of tea. The address is:

Adobe (Mudbrick) Flats,
P.O. Mallacoota. Vic., 3889.
Phone: (051) 58 0329

Centre for Appropriate Technology

In May, 1980, the Centre for Appropriate Technology was founded at the Community College of Central Australia at Alice Springs through the provision of funds from the department of Aboriginal Affairs Since that time, through programs involving contact with Aboriginal people located on out-stations in the Northern Territory, the Centre has played a positive role in regards to developing the concept of appropriate technology in Central Australia.

The development of appropriate technology has been guided largely by the actual needs of the communities involved and has been carried out through information dissemination and practical workshops The purpose of this work is to develop technology which the people on the settlements can build and maintain themselves.

The first project undertaken by the Centre was the development of a handpump suitable for raising water from bores. Bores had been sunk at a number of proposed outstation sites under the Government drilling scheme but a lapse of 18 months to 2 years was expected before these bores would be equipped with water pumps As a result of this, hand pumps were designed and installed as an interim measure at a fraction of the cost of a windmill and tank. Furthermore. the use of a hand pump rather than a windmill means that occupation of an outstation can occur almost immediate

-ly after the bore is drilled.

The water obtained from these bores is often not suitable for human consumption as drinking water and therefore requires some treatment before use. In these isolated regions where demand for water is relatively low and service structures for high technology treatment of water is lacking, the only feasible means of removing dissolved particles from the water is through solar distillation. To this end, the Centre is currently working towards the development of a small solar still suitable for use by small groups in isolated areas.

Two other areas in which the centre has been involved have been the development of handpowered washing machines and also mobility aids for disabled people suitable for use in remote communities. In conjunction with the School of Mechanical-Engineering at the NSW. Institute of Technology, three prototypes of varying sophistication have been built, These aids, easily produced in a small workshop, are suited to the climate, terrain and needs of people living on outstations.

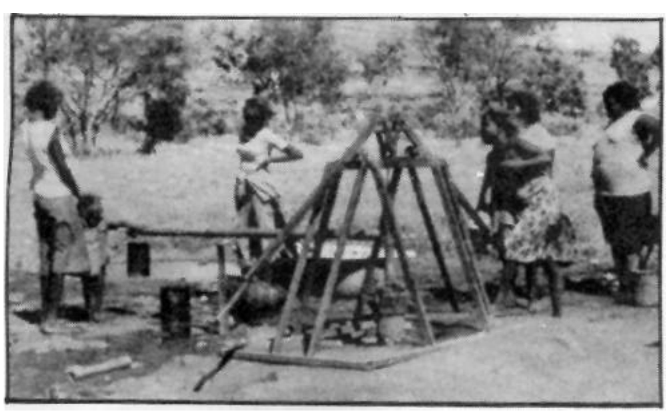


Fig.1. A hand pump for raising water from bores.

Fig.2. A simple but rugged handpowered washing machine.

As a result of a number of requests from people, old and broken washing machines are being converted so that they can be run by hand. Conversions are cheap and relatively easy to carry out and may be done in a small workshop situation, While these conversions were originally perceived as being an interim measure in overcoming the problem of electricity and servicing difficulties, it appears that ease of use and upkeep has made the "new" machines a permanent solution.

The Centre for Appropriate Technology welcomes information and feedback from readers involved in areas it is working on. Correspondence should be directed to:

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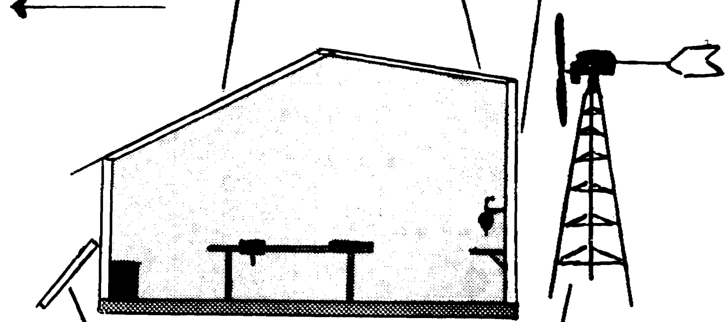
Head,
Centre for Appropriate Technology
Community College of Central Aust
P.O. Box 795,
ALICE SPRINGS- NT., 5750,

A Solar Workshop



Imagine a workshop which obtains its energy needs from natural energy sources, (such as solar and wind energy), and is used to construct solar and other alternative energy equipment. Well, just a workshop will be being constructed early next year, by the Alternative Technology Association with support from Survival Technology.

The workshop which will be about 20 by 40 feet, will be built of a heavy pole frame with walls filled in with rammed earth. The building will face north so as to make use of the natural heating effect of the sun. Half the roof will be galvanized iron with Alpanite insulation; (Alpanite is another name for eelgrass, a seaweed which can be used as excellent insulation), The other half of the roof will be a double layer of fibre-glass roofing. This will allow natural light to enter while the double layer with an air space will act as effective insulation for that part of the roof.

Power will be supplied by a 300 watt wind generator (built from a modified Dodge starter-generator), and in the long term solar cells and possibly a water turbine. A back-up generator will also be present for times of high power consumption. The power will be stored in a battery bank. Water will be taken from the roof and stored. It will be heated by two homemade flat plate collectors, and stored in a water tank in the roof. In the long term a composting toilet could be built for use by people in the workshop. A combustion heater will be used for heating of the workshop and water in winter.

It is hoped that the workshop will be fitted out with work benches, hand tools, welding equipment, a lathe, drill press and electroplating facilit-ies.

Perhaps the most exciting part is that all ATA members and subscribers to "Soft Technology" will be free to use it. And that means you, So, if you are working on or want to build a piece of appropriate technology you will have access to this well equipped workshop. We will also be using the workshop for meetings and practical workshops.

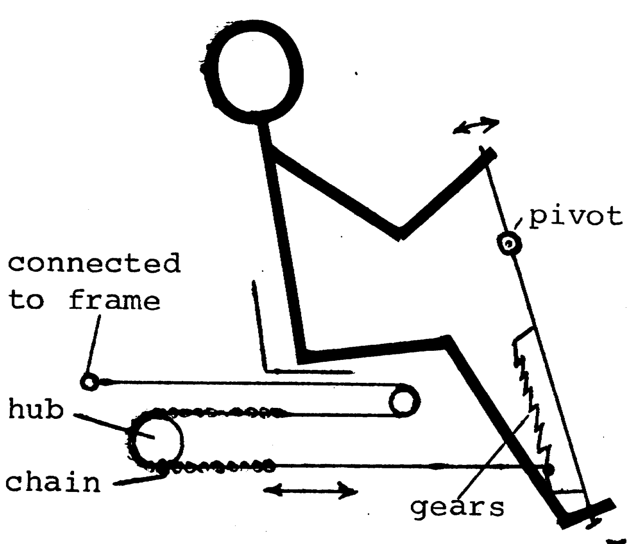
At the moment we are looking for materials - so if you can help us with any of the following we would be very grateful. We will even pick them up. Here is what we need: roofing iron, 2 single doors, one large door (suitable to drive a vehicle through), window glass and frames, electrical wire and fittings, fibreglass roofing (new or nearly new), a water tank, 2 sinks, plumbing pipes and fittings, roof guttering and down pipes, timber for partitions, and anything else you think may be useful- If you think you can help us with any of these items, please, please, please get in touch, Ring Mick Harris on 419 8700 (BH) or 481 2204 (AH) or Tony Stevenson on 725 5550 (BH). In the meantime stand by for further reports We will. be starting construc-tion in February and anyone who would like to come down and see construction in progress (or even help), will be very welcome

the rowing bike -

A new type of bicycle has been designed by Sill Fraser, a 60 year old inventor, The bike involves a rowing action using both arms and legs then you would be able to get more efficiency and overall body exercise in riding a bike.

Four years ago, Bill with the help of Alby Smith (who provided all the conventional bike-building know-how) built the rowing bike.

The rowing bike works by sitting in a small bucket type seat with both arms and legs involved in pushing and pulling the steering column moving it backwards and forwards. The steering column is connected to the back wheel by way of a chain, thick nylon cord and an extendable rubber cord.



The rowing action moves the chain backward and forward producing a rotation of the back wheel (which has to be free wheeling and not fixed).

Since the movement of the bike is caused by a lever action, i.e. push, pull of the steering column, the gearing is a very simple matter. All that needs to be done is to move the position where the chain is connected to the steering column. On the bike that Bill rides he has 16 different gear positions and all he does is move a little hook (connected by way of a nylon cord to the chain) to a different position up or down on the steering column. This is done by hand and you do not have to go through the middle gears to get to top or low gear In fact, this arrangement is so simple and practical that a bike designer asked Bill if he could make it look more sophisticated!

The steering column is connected by way of a small coupling, to the front wheel. This ensures the rowing action does not interfere with steering.

The advantages of the bike are that you can have a broad seat with a back-rest which is a lot more comfortable than the narrow seat that riders are more familiar with. The rowing bike

the rowing bike

enables the rider to sit in a more streamlined position as well as being lower to the ground.

You do not have to lean forward as in a conventional bike but rather can sit in a more comfortable position so you are less susceptible to upper spinal injuries. Also, by sitting this way it is easier to observe all the things about you.

When a crash occurs on a conventional bike it is quite common for the rider to go headfirst off the bike. *However,* on the rowing bike you can stick your feet out in front of you if you are going to run into anything, Also, being closer to the ground means 'that it is easier to regain your balance by putting your feet on the ground. This is especially an advantage to posties and people who have problems with the crossbar on a conventional bike,

Mechanically and structurally, the bike is very durable, without the gearing problems and maintenance necessary with the conventional bike. You do not have the problem of having to adjust the rear wheel when the chain stretches. The only susceptible part is the rubber cord connected to the chain, but this is easily replaced,

Bill rode his bike from Canberra to Newcastle as part of the anti-nuclear protest ride around Australia. The total distance was 500km and Bill averaged 40km per day, Bill explained

that he could never do that on a normal bike even when he was a lot younger.

Bill is concerned that too many people treat his bike as a novelty rather than a viable alternative. His main reason for building the rowing bike was to create interest in bike-riding and therefore attract more people to bicycles and away from cars.

A few innovative changes to the bike are the tricycle which has an axel and two back wheels and adding more stability. This is a tremendous advantage to the handicapped, who perhaps have lost the use of one or two limbs, since it is possible for them to still ride the tricycle.

Also, a tandem version of the rowing bike has been designed. With this bike the riders sit side-by-side and so can still talk which is very socially relaxing, This has advantages. for handicapped persons too, for example you could take a blind person for a ride in which that person participates in the moving of the bike. Bill sold the first tricycle to the Balwyn Special Development School.

If anybody is interested in buying one of Bill's inventions he can be contacted on 583 1500 (03).

George Lilley

air wells

In last quarter's issue we mentioned a system called an 'Air Well' which was used to condense water out of humid air. We received a number of enquiries and we have decided to include a more detailed description of the system

A sketch of the system is shown in figure 1. It was conceived by Cal Courneya and developed in conjunction with Crossroads Ltd. of Minneapolis, Minnesota, USA.

The purpose of airwells is to entract the water from the air. You may not think there is much water in the air, but at 30°C and a relative humidity of 70%, one cubic meter of air contains 22ml of water. Or, you could squeeze one litre of water out of every 46m² of air you could catch. This quantity of water can vary from 37 ml/m³ at 35°C and 90% RH down to 4ml/m3 at 12°C and 40% RH.

How do you get the water out of the air? The airwell uses a combination of cooling the air and increasing the pressure. At a particular temperature, there is a maximum amount of water vapor that the air will hold. Air with this water concentration is referred to as 'saturated'. Humidity is a measure of how much water vapor there is in the air Relative humidity is the percentage of water vapor actually in the air compared to the maximum possible or the saturated water vapor content (at that temperature).

At 30°C, saturated air will contain 31ml/m³ but at 15°C can only hold 13ml/m³ If you take lcu metre of saturated (l00%R.H.) air at 30°C and cool it to 15°C then the air will contain more water vapor than it can hold at 15°C and so some of it will condense as liquid water (ie. a dew will form) For this 30° to 15° drop, there is 31ml of vapor in the air initially and only 13ml can remain so 31-13 = 18ml must condense out as liquid.

Similarly, if you could get lcu. metre of saturated air at 30°C and compress it to fit in ½cu metre (without increasing its temperature) then half the water vapor would have

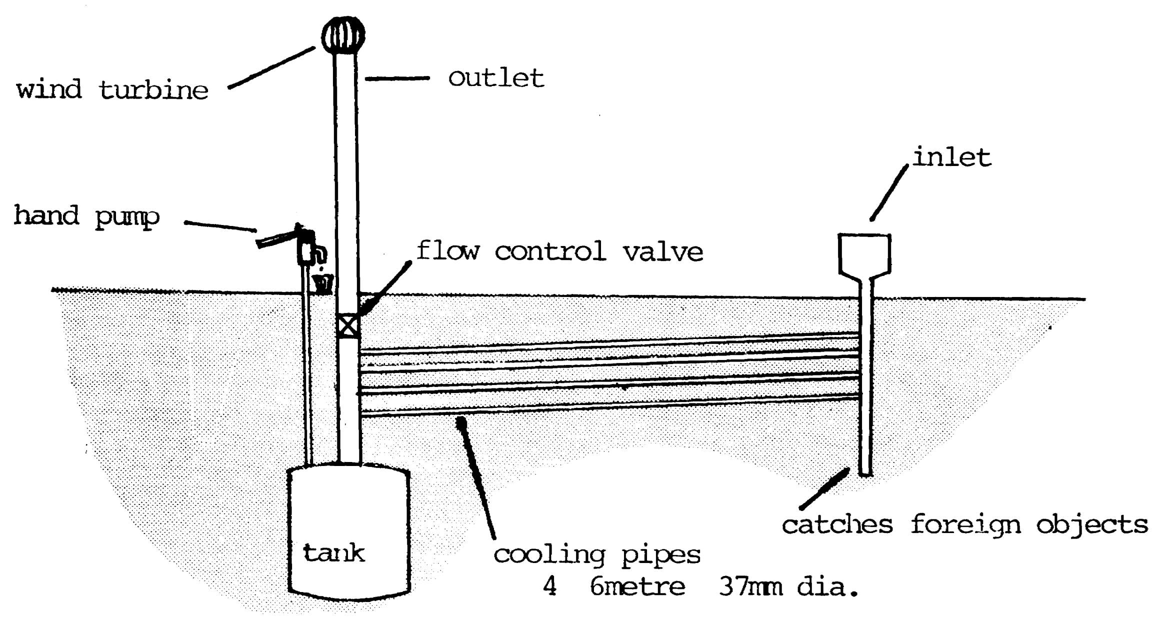


fig 1. air well

AIR WELLS

to condense out to keep the vapor pressure the same.

The airwell combines these two effects to be able to extract 90% of the available water (at 30°C, 70%RH).

The airwell cools the air by drawing it through the heat exchanger pipes which are buried in the ground. (The ground temperature in Victoria is about 15°C, varying a few degrees up and down seasonally). The air is pulled through the pipes by a wind driven turbine (similar to those found on many roof tops).. In the exit pipe there is a flow control valve which aids condensation by compressing the air slightly. Water which condenses out collects in a 30 gallon tank and can be pumped up with a simple diaphragm hand pump.

Investigation has shown that air-borne pollutants do not find their way into the water and so it is safe for drinking (they showed a ph of 5.3 - slightly acidic),

The motivation behind this invention was the entrance shortage of safe reliable drinking water This method offers a simple and cheap method which is suited to low rainfall but medium to high humidity areas such as Coastal Africa, Saudi Arabia and much of South America. In Minnesota, on a summers day with 30°C and 70%RH they typically collected 20 litres day. If you go to a country (such as Saudi Arabia) with 95% humidity and 35°C temperature than the same system could give about 10 gallons a day.

The airwell is much less susceptible to contamination than a conventional well and is very attractive where the water table is a long way down.

ALAN HUTCHINSON,

STOVE PLUMBING FEEDBACK

After the last issue of Soft Technology we received some comments from Bruce Revel1 from Revel1 Solar. He was commenting on the diagram on page 7 (part of the wood stoves article).

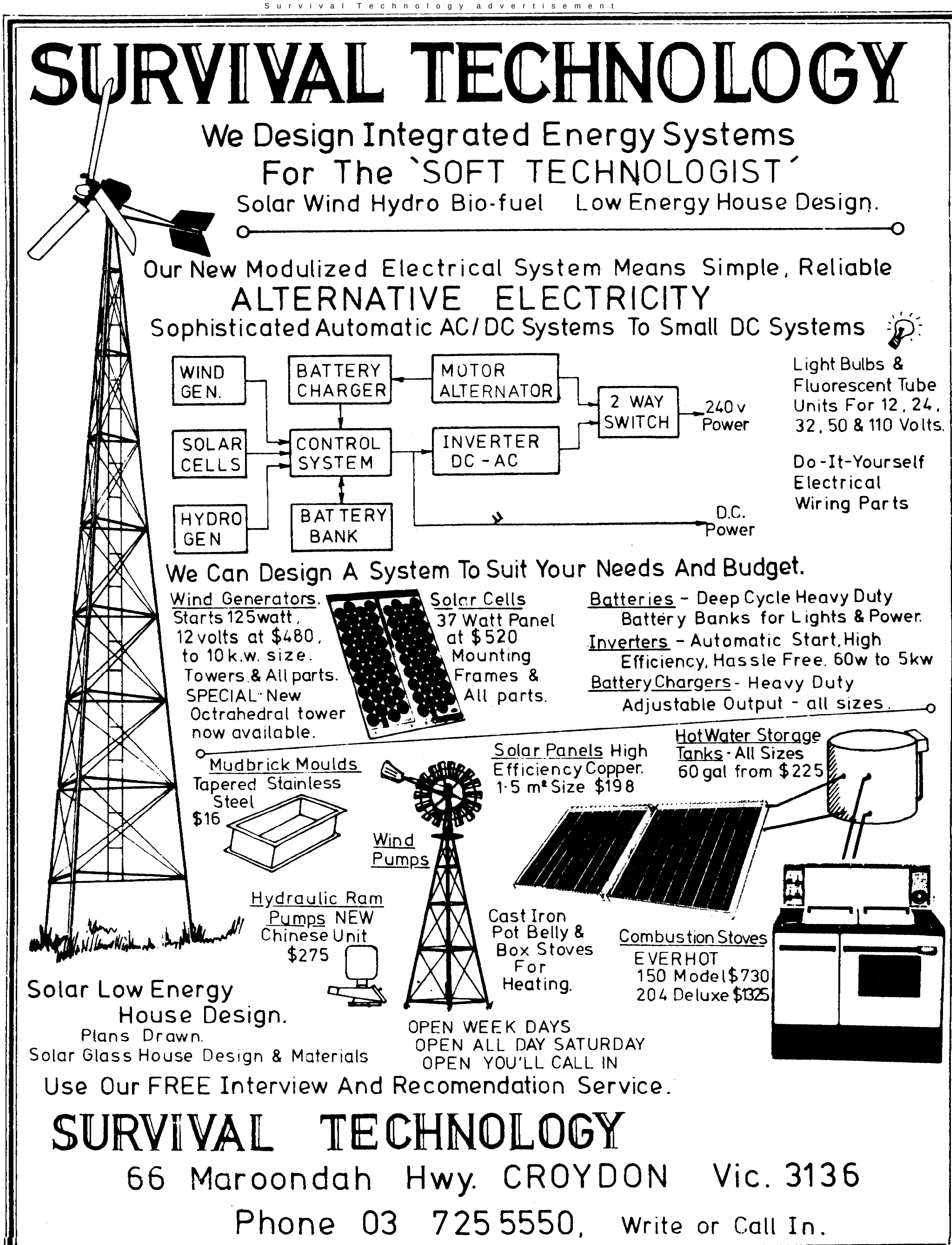
Bruce made these comments:

l. "I don't think that there is a one way valve sensitive enough to be lifted by thermosyphon pressure as set out in the diagram.
2. The diagram indicates a flat cast iron boiler; can these stand high pressure?
3. The diagrams show three tapings at the top of the unit, I have never seen one with more than two.
4. I would like to see the bottom of the gas unit at least 150mm above the boiler. As shown in the diagram circulation would be very slow and boiling could occur in the stove back boiler,"

The diagram we used in the last issue of Soft Technology was obtained from an American publication which could help account for the errors in it. It was included only as a general guide to give people a rough idea of the plumbing involved.

Having said that most of Bruce's comments are accurate, so readers should avoid trying to do plumbing as shown in the diagram.

Survival Technology advertisement



SOLAR POWER STATION (Continued from 9)

CRITICISMS AND PROBLEMS

The solar power station at White Cliff has received a large amount of criticism over recent months. Originally it was anticipated the power station would be completed in mid 1981. As 1982 is now drawing to a close and the station is still not on line, the project has been criticized for this seeming delay. However, the initial completion time did not allow for the provision of automatic operation and storage. If this is taken into account the current delay is not as startling. What is more the station had met design specifications by June this year - a year after the original planned date, which can be considered good, bearing in mind the additions to the station and the fact that it is the first of its kind. The current delay in the station coming "on line" seems more due to dawdling on the part of the NSW. Energy Authority than due to any problems with the stations completion.

Criticisms have also been made at the higher than anticipated cost of the' station. However, once again these fail to take into consideration the addition of storage and automatic tracking which were not originally planned.

One newspaper report stated "the project has been dogged by breakdowns". This is untrue. In fact, there has been only one major breakdown. That involved the failure of an actuator lead screw on one of the collectors, This caused one of the dishes to "flop" down damaging the absorber. The failure which was quickly repaired, was caused by faulty manufacture, by one of the contractors. Other failures have been minor involving such' things as faulty relays and minor faults in electronic equipment. Although there have been few failures in the complete power station itself, some formidable problems did occur during development of the equipment. One was that of separating lubrication oil from water in the steam engine, as already mentioned-

However, the major difficulty that was encountered involved the fabrication of the parabolic reflectors. Originally, it was intended to make the 5 metre diameter collectors from aluminium sheets shaped on a vacuum press. This relatively new method of manufacture seemed likely to be cheaper and easier than the altern-atives of a spun aluminium of fibreglass dish.

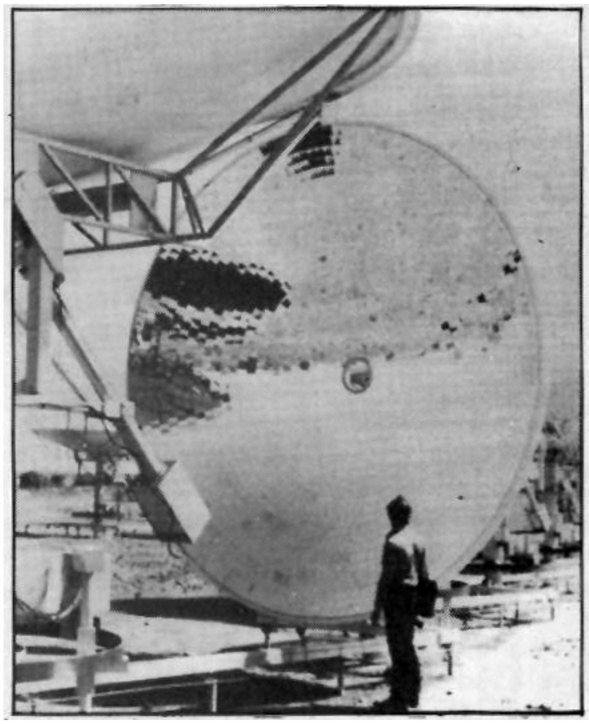


Fig.4. This-was the collector which failed due to a faulty actuator screw. The centre absorber has been removed for repair

However, ANU found that they could not obtain sheets of aluminium that were large enough As a-result they used special high quality welds to join' the sheets. However, these welds failed consistently. and this method of construct-ing the dishes had to be abandoned. In the end the dishes were fabricated from fibreglass and covered with small squares of glass mirror. Although this was not a particularly innovative approach it was a

SOLAR POWER STATION

reliable approach which was certain to be successful in the time available.

The White Cliffs Project has been criticised for the amount of power it supplies. Its critics have suggested that the 2.5KW that the 25KW station would provide to the ten buildings it is envisaged the station would supply, is inadequate It is true that an all all electric suburban home, using electric heating, cooking and air conditioning would be likely to need much more than 2.5KW at times,

However, if a house is run with energy conservation in mind energy use can easily be kept at 2.5KW or lower almost all the time. Many of the houses at White Cliffs already run on wind generators which supply between 1 and 2 KW. These generators can supply the owner with power for all basic needs.. Consequently as long as energy is used with care, an average of 2.5KW per house is likely to be quite adequate.

Another criticism of the system is that with both a diesel generator and a flash boiler in addition to the collectors themselves, they have excessive back-up, The diesel generator is quite justified as most smaller solar and wind system consist of a back-up generator. Although one can be enthusiastic about solar, one must also be realistic and recognize the sun does not shine all the time. The flash boiler has been more important in the testing of the system as it was set up and may not be as important when the system is running reliably. However, it has had an important role in the initial stages of the project.

The collection of dust on the collectors which would reduce the collector efficiency has also been a matter for criticism. It is true that this could be a problem under certain. conditions. However, dust storms are unlikely to occur regularly enough to be a major problem, and cleaning of dust from the surface of the collectors is an easy matter.

Finally there is the problem with water. A deep bore was sunk at the station in the hope of finding a good water supply. However, the bore has produced little water. Water is of course required for the system, (to be vaporized in the collectors and drive the steam engine), however, because it is a closed system - large input of water is not required and what is required can be easily brought in by road.

More important are the implications of this lack of water is in the plan to use low grade heat from the station for water desalination to supplement the towns water supply. This may now not be viable.

Fig.5. Finding the focal point of a *prototype dish in the grounds* of *A.N.U.*

THE FUTURE

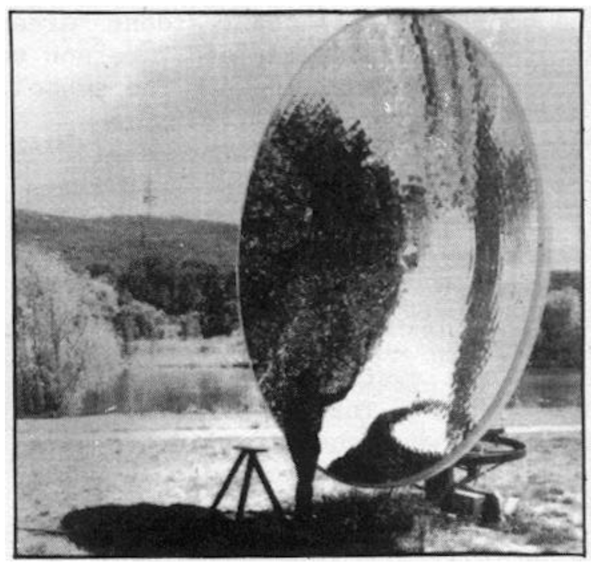
Once put on line the power station will be monitored full time for a period of several months. After that the station will operate automatically with local back-up where necessary

If more plants of this type are to be built in the future then the researchers would increase the size of the collectors from 5 metres diameter to 10 metres diameter This would mean a four fold increase in area. That would mean a station like White Cliffs could be built with only three and a half collectors instead of 14. The smaller number of collectors would of course mean lower costs and cheaper electricity costs

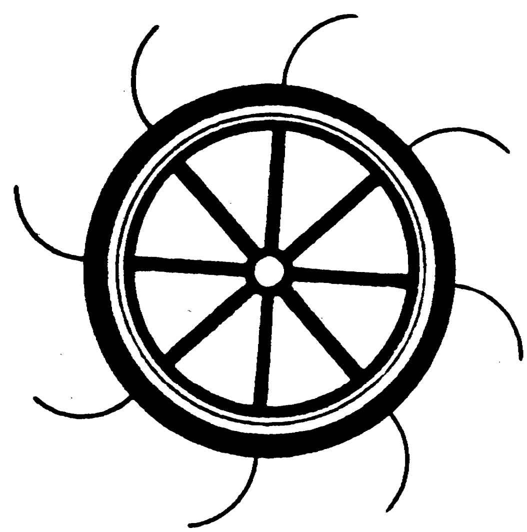
The biggest question still hanging over the power station at White Cliffs is when will it go on line and have a chance to really prove its worth. It is now complete and capable of operating and could have been put on line months ago, soon after it meets its design specifications in June, 1982

To date the plant seems to have progressed well for a "first of its type, prototype", Hopefully, it will not he long before the NSW Energy Authority gives the go ahead for the final conclusive test.

MICK HARRIS



SMALL SCALE HYDRO ALIVE AND WELL IN TASMANIA



We recently heard of a water turbine manufacturer manufacturer in Tasmania who specialises in in small to medium sized water turbines. They produce high speed low flow turbines compared to the low speed water wheels. They pointed out error in the water power article in the last issue. Thearticle stated you could get about l.5 KW from a garden tap. This would not actually be possible because the narrow width of the pipe running from the mains to you tap would reduce the potential energy available from the water.

If you like more information on the turbines and water power systems these people design they are Tamar Design Pty. Ltd. Deviot via Sidmouth Tasmania. Phone (003)\ 947357

The Letters Page

Dear People,

I am pleased to have discovered you! It happened in a roundabout way - you sent a copy of "Soft Technology" to our school. library, and the librarian passed the copy to me, as the resident "Greenie, alternative lifestyler etc.' person to assess its suitability for the school.

I am at present, trying to "develop" 75 acres here by planting thousands of native shrubs and trees for windbread/woodlot, plus establish an orchard etc, I am on the way to starting an octagonal mudbrick home. I have wind power on the borehole at the moment, and intend running a 12V electrical system based on wind and solar cells. This is annoying to my neighbour who recently paid $8000 to have 240 volt connected and is hoping I will "hook up" and thus pay a proportion of this. I constantly scour the local auctions for useful bits and pieces and have got quite a collection - SC, stove, and hot water system, a couple of old Lister 3 H.P. engines to run pump during low wind (can easily be converted to gas, ethanol, methane etc,). My interests in Alternative Technology are therefore many and varied.

Looking forward to receiving the mags-

MICK DENNIS

Dear Sir,

I read with a great deal of interest your article on Solar Ponds in "Soft Technology" (No. 8 May/July 1982 issue)- I am helping a friend design and build a piggery shed in which we are attempting to heat a concrete slab floor with hot water circulating through polythene pipes. The source of this hot water was to be a 'whole roof' trickle plate collector via an insulated 22,500 litre concrete storage tank. The cost of building this collector, and its limited capability is beginning to frighten us A solar pond appears a more attractive proposition, particularly with its apparent potential to supply electrical power as well.

You mentioned several items that I would appreciate fuller comment on from yourself, or alternatively, the names and addresses of people able to help me. These are:-

1. The organic "Rankin cycle" engine - what is this-machine? I do not know that I have heard of it before, so I would like any information you may have.

2. The methods used to control the upward diffusion of the salt in the podd, and the methods used to control wave action.

*Soft Technology' was loaned to me by a friend. I had not know of its existence before I have had an interest in alternative technology fox many years now since spending time in both Papua New Guinea and Vanseath.

JOHN McCLELLAND,

Ed's Comment.

A Rankin engine is similar to a steam engine but uses a low vapourising temperature fluid such as ammonia. Wave action can be controlled by a plastic membrane over the top of the pond, Diffusion of salt upwards can be regulated by removing salty water at the top of the pond and pumping buck fresh water, while returning the salt to the lower levels.

Replies

These replies were supplied by Andrew Blair of Outlook Alternatives. For more information you can write to him at Outlook Alternatives. RMB 9010, Wangaratta, 3678.

Dear Peter,

The answer to your query regarding lead acid batteries is fairly straight forward, though perhaps not as precise as you may feel that you would like.

Lead acid batteries last well if they are kept well charged and are not permitted to become completely discharged. They should be charged and discharged at as low a rate as possible. There is no magic rate as a maximum for charge or discharge, but a maximum rate is about 10% of the capacity of the battery in ampere hours. They should be kept topped up with rain water caught in a glass or porcelain bowl, or with distilled water

From some examples you can work out for yourself how long your batteries should last,

A Western Victoria farmer had his wind generator sheltered by trees, and as a result his batteries were usually discharged. He said that the average life of his batteries was about 3 years and he was delighted when the S.E.C. became available and he could do away with the costly lighting plant.. A neighbour charged his batteries with a petrol generator every week or so, His batteries lasted about 5 or 6 years,

Telecom have batteries in their telephone exchanges, and the only time they are discharged is when the SEC, (which keeps them charged) goes off. The charge and discharge rates are well within their capacity. These batteries are replaced after about 15 years, usually before they fail,

At Outlook Alternatives we have an electric moped, They are no longer made, the reason being that the battery life was often as short as 3 months, The rate of discharge was high, and often it was complete. That is, the battery was flattened. If the rate of charging was also high, this would cause further deterioration.

The guarantee must cover the manufacturer against severe usage, which is why a 2 or 3 year guarantee is all that is available.

The enclosed copy of Century's information sheet may be of interest.

Dear Yvonne,

For pumping water you have little option open to you. By the sound of it your river flows far too slowly to use it as a source of power. A direct solar pump or solar electric pump would be unlikely to give you sufficient water, A windmill may give you enough if you have sufficient storage for non windy times, but often the very time that you want water, the wind does not blow.

This leaves you with what you want to avoid. A pump that requires fossil fuel. Petrol, diesel or electric. Expensive to run, but if the right gear is selected, most reliable.

The type of pump that is chosen is of the utmost importance, and will be determined by the total lift, friction of the pipe, the amount of water to be lifted, and the location of the pump in relation to the height above the water from which the pump is lifting,. To go into all the different types of pumps would take several pages, but could I suggest that you consult your local pump expert, if he is any good, and get him to recommend a pump. The chances are it will be expensive, but water is too vital in the country not to have it when you need it,

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