Soft Technology

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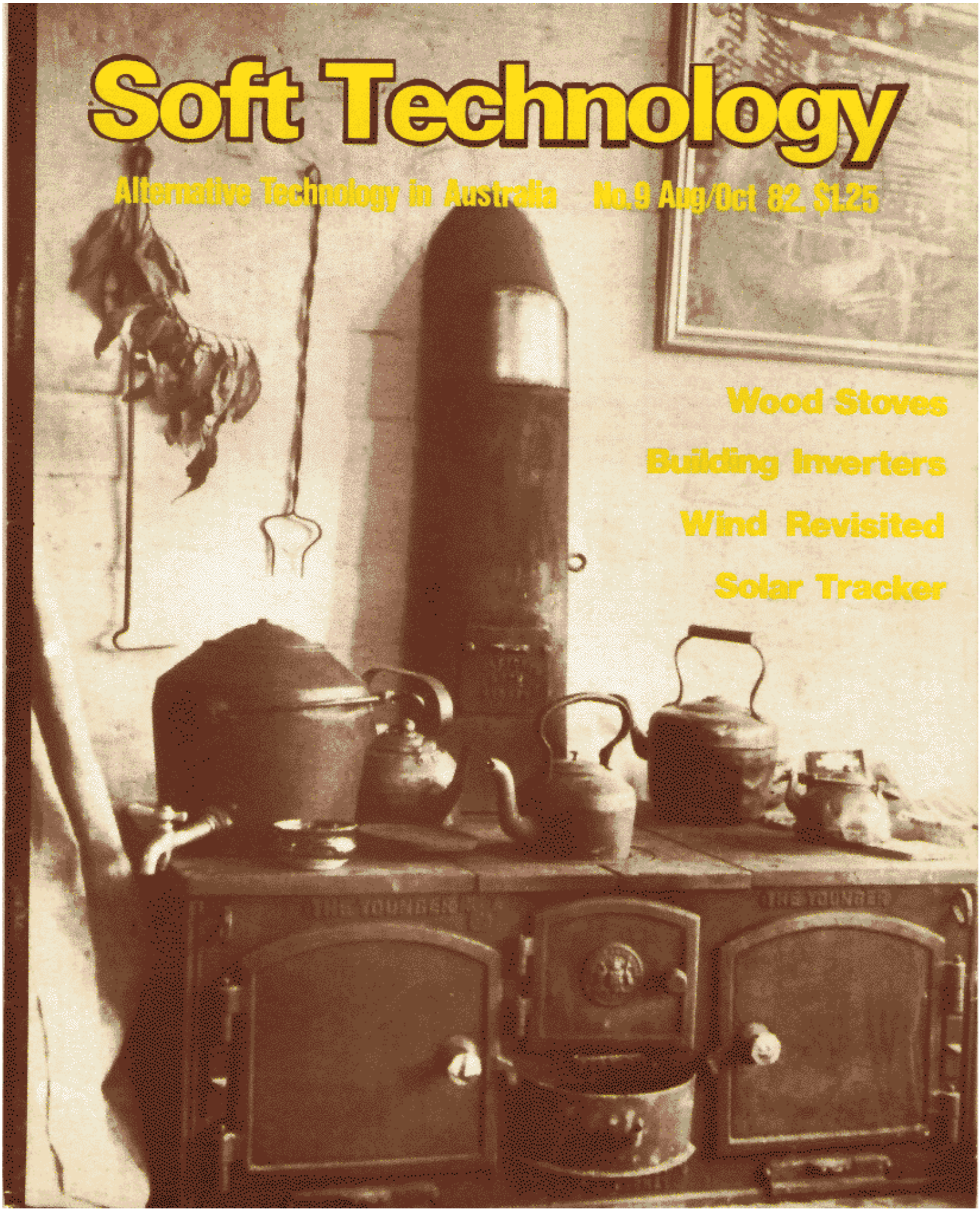


Wood Stoves

Building Inverters

Wind Revisited

Solar Tracker

Editorial

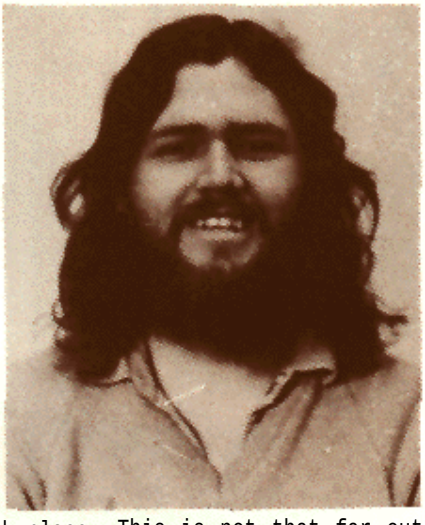
One of the heavies in the Northern European alternate energy scene visited Australia this month. He is Prof. Bent Sorenson who is Professor of Physics at Roskilde University Centre, Roskilde, Denmark He made his name in wind power and has recently got into doing energy strategies for various developed and developing countries.

I caught up with him at a lecture he gave in Melbourne, and this is a brief summary of what he was on about.

He is strong on medium power wind generators. In Denmark, the most economical size is the 50KW generators at about $20,000 (includes tower & maintenance contract). With the subsidised interest rate alternate energy loans available there, the effective cost of energy from these machines is about 3c/KWh. (this would be economical here). It would only require 7000 of these windmills to supply all Denmark's electrical energy needs. (They have already identified 12,000 potential sites). This is simplified, because no storage is used and, unfortunately, the winds don't necessarily happen to coincide with the daily peak demand. However, the electric grids of Denmark, Sweden & Norway are connected together and so the Danish wind power can be used as an erratic part of the base load with Norwegian hydro used to fill in the peaks. (as we do with the Snowy). The Danish system is different, in that, the electric utility is obliged to buy back from you any excess power you produce (@ 4.5c/Wh).

Denmark's complete complete energy needs could be met using only renewable energy sources. Given their current heavy dependence on one fickle source (Middle East Oil), this would make their economy far less vulnerable.

Self sufficiency in energy is a desirable goal, but trading in renewable energy is possible (as above). In fact, Prof. Sørenson argues that the whole world could be self sufficient in renewable energy if a little energy trading took place. This is not that far out, Sweden will have completely dismantled it's nuclear power industry by 2000 and if they can do it, with our energy resources we needn't ever turn to nuclear.



In preparing his energy strategies for a country, he first considers 'can you provide any of the existing or desired services by' other means that use less energy?' Over the range of his studies, Prof. Sørenson has concluded that energy requirements can be cut by l/2 to 2/3 for very little capital cost but beyond that, the costs tend to increase rapidly. He then looks at what sources of energy are available locally and draws up strategies based on mixtures of different sources.

A friend of mine recently remarked that "the energy crisis is over so why worry about alternate energy". In fact the energy crisis has only been postponed. In the next 20-30 years, the age of oil and gas will begin to close and new crises will arise. Victoria's natural gas supplies will only last until the year 2000 at current usage and what will gas appliances run on then?

That's the beauty of renewable energy sources: they don't run out.

Alan Hutchinson.

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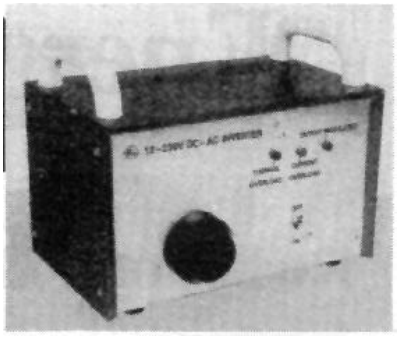

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This issue of Soft Technology was edited by Alan Hutchinson and was produced with the help of Mick Harris, Tony Miller, Cam Walker, Tony Stevenson, Lyn Stevenson, George and Glen Sneddon

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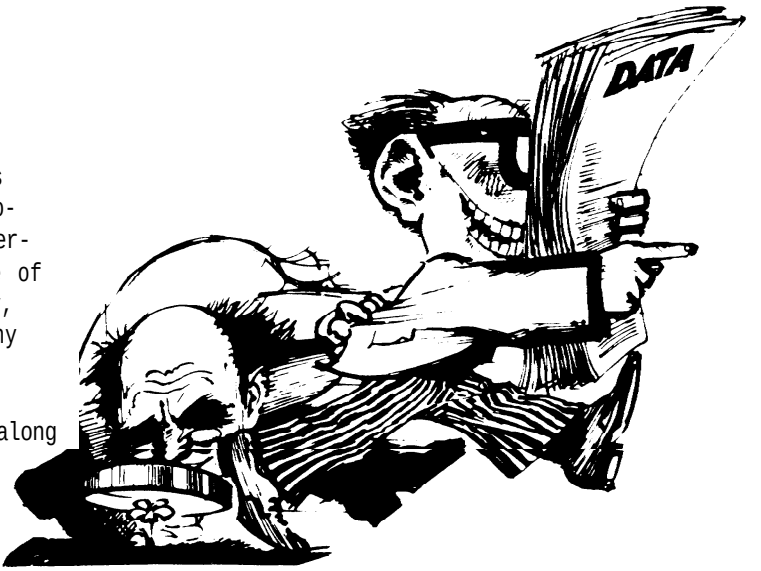
Cover : An old wood stove lives on in a house on the outskirts of Melbourne.

Energy Flashes

Research Granted

The South Australian Government has awarded a grant of $88,000 to two workers for research into the production of hydrocarbons from plants. Professor R.E..Underdown, from the South Australian Institute of Technology, School of Chemical Technology, and F. Van der Sorrmeren, of the Roseworthy Agricultural College are particularly interested in Ascelepias rotundifelia, a broad leaf cotton bush which grows wild along many South Australian roads.



The Big One

A 10.8MW solar electrical generating facility called Solar One, the largest of it's kind in the world, began operation in early April. It is situated in the Mojave Desert, (to the east of Los Angeles, California) and consists of a central receiver, thermal storage system, and a conventional steam generator, with 1818 sun tracking mirrors, or heliostats surrounding it. The project, largely financed by DOE and run by Southern Californian Edison Company, is designed to demonstrate that solar power can be produced on a commercial scale. Edison also have plans for a 100MW station which should be in operation by 1988.

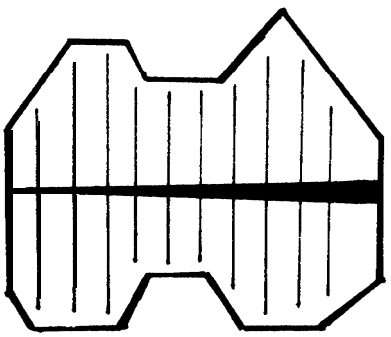
Solar Research Vehicle

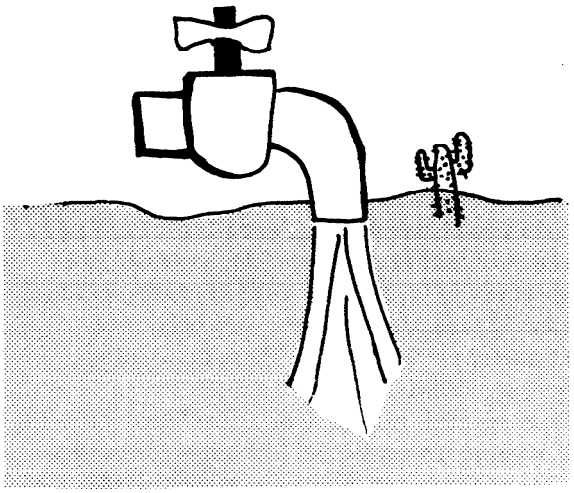
An experimental solar powered car has been developed in Britain which can travel up to 200km a day while using about 1000th of the energy consumed by an average family sized car. The car, which is built from glass fibre and aluminium alloy, weighs only 59kg (130lbs), travels at 25kmh, and is run by 10 solar panels (total of 360 silicon cells), which power a 140 watt electric motor. A small auxiliary battery, also charged by the cells, provides power when the car is in the shade or on a steep incline. A foot pedal starts the motor, which drives the single rear wheel and other simple features of this single seat car include 5 gears, and a cycle-type hand brake which can be locked for parking.

Australian Cells

In July 1981, Tideland Energy Pty. Ltd., established a production line in Sydney to make solar cells. This has proved so successful that Tideland now supplies cells to the parent company in America and other overseas subsidiaries. The production line is turning out nearly 2,000 76mm diameter silicon cells a day, and there is capacity for increases. 100mm diameter cells can also be produced with existing equipment. An AIRDIB research grant has helped enable further research into processing sequences for 100mm silicon cells and new silicon substrates, up to 100mm square.

P-type silicon wafers are coated on one side with a liquid polymeric diffusion source which contains phosphorus. These are dried in infrared furnaces. Aluminium paste is then screenprinted onto the rear surface of the wafer and dried and fired in another IR furnace. A silver paste is then screenprinted onto the front in a grid pattern and then fired again. Finally, a high precision microprocessor controlled laser scriber is used to cut a narrow channel around the edge of the wafer for edge junction isolation (this cuts off leakage between the front and back metal contacts.) The use of IR furnaces for drying and diffusion as well as lasers for cutting channels are both previously untried processes.





Air to Drink

A recent invention from America may be able to provide low cost drinking water in many parts of the world where lack of water is a problem.

Developed by Cal Courmeya, of Minnesota, the "Air-Well" condenses moisture out of humid air by passing the air through underground pipes. The Air-Well uses a system of 4 pipes, each 20 feet long and 1½" in diameter. A wind driven turbine at one end pulls air through the intake pipes, and a flow control valve is used to aid the condensation of air. The condensedwater is stored in 30 gallon underground tanks and is pumped out by a diaphragm hand pump.

In experiments on warm summer days in Minnesota, (30°C, 70% humidity), to to 90% of the moisture content of the air can be extracted to give about 20 litres of water a day.

Original fears that airborne pollutants may appear in the water have been largely dispelled and currently the company involved, Crossroads Ltd., is attempting to have the system introduced to a number of developing countries.

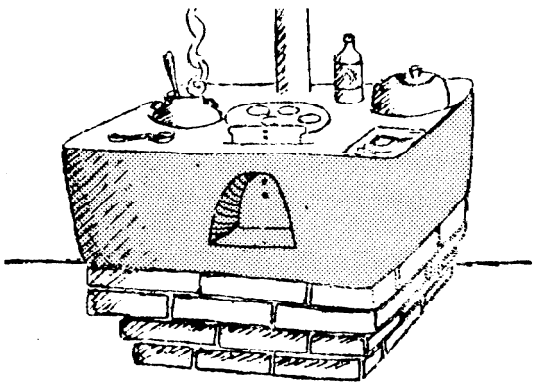
WOOD STOVES.

For thousands upon thousands of years man has depended on the burning wood for his warmth, food and protection. Without it he would not have survived! It is only this century, with our giant cities that we have ventured away from firewood to use stored fossil fuel for meeting our needs.

With specialization and centralized control, fossil fuel suits us better, or so we thought. Suddenly depletion of previously considered depletable fossil fuel stores looms ahead. The people thinking ahead can see the importance of m-direction to the soft technology path before depletion or catastrophe occurs.

Using up fossil fuel is an irresponsible act ion, like inheriting money which is spent on a high standard of living. Once accustomed to living it up and not working, all the money is spent retaining this, until disaster strikes when the money runs out and there is no other income. It would be wiser to put the inherited money to work in a substantial business and keep sane in reserve for emergencies.

Applying this logic on a global level would stop the rapid depletion of non-renewable energy. We should use what is remaining to build a



substantial renewable energy system. This is possible, man could achieve it with ease— however, it is up to us, the forward thinkers to inform the others of the urgent need for change.

After our 50 year party, we must come to our senses and solar, wind, hydro and bio-fuel. Going back to fire wood is a good move – but we must be very careful.

Wood can be a renewable or non-renewable source of energy – it depends on how we manage it. Already, with the latest craze of solid fuel heating, our forests are treated in the same way we sucked the oil-well dry.

So, to make it work we need to do two things:

1. Use wood as a renewable source of energy - that is make sure we use it at a lower rate than we grow it.

2. Conserve – always the first step in appropriate technology. That is, use it wisely in efficient stoves in insulated solar houses.

Neither of these things are difficult, it just takes organization.

With legislation to limit wood carted from state forests to an acceptable level, the price of wood would increase giving rise to economic tree faming. This would be a boost to the rural industry and improve the environment of the forests, as well as providing a renewable energy source.

Instead of our basic brick veneer we now have proven that little extra cost and effort is needed to build or convert a house to a solar low energy building. This can mean reducing heat loads by as much as two thirds. With this done, a wood

STOVES.

stove then does not have too much work to do.

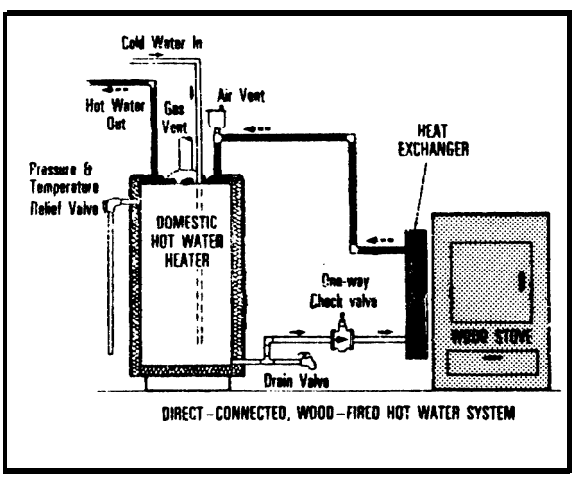
A lot can be done to bum wood efficiently, compared to the old open fire. The heat you heat from an open fire comes only from the direct radiation which enters the room. The rest of the heat goes up the chimney in the form of heated gas, and this would be at least 95% of the energy created.

The energy created comes by reversing the chemical reaction which took place when the sun shone on the leaves of the tree - and though the solar conversion is only 2% it is an effective, beautiful solar storage system.

In order to improve the efficiency there are several things we can do:

1. Arrange the stove so the burning is as complete as possible - a minimum of unburnt gas escapes from the flue.
2. Keep the hot gas in the stove for as long as possible so that the heat can escape - that is slow the burning rate to a minimum - "'slow combustion'.
3. Use materials and design of the stove so a maximum of heat is transfered from the hot gas to the designed place - good heat exchange.

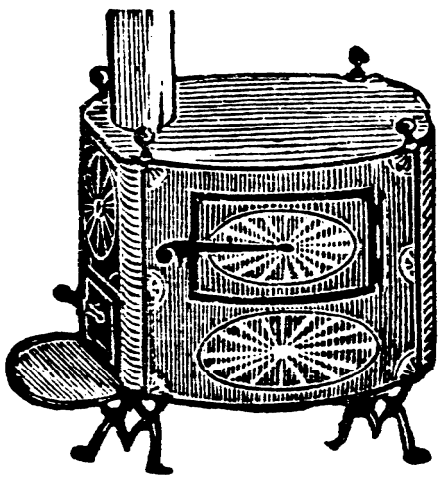
by applying these things, much more heat, or much less wood is the result.



DIRECT-CONNECTED, WOOD-FIRED HOT WATER SYSTEM

Some very efficient stoves, with secondary bum chambers, are rated at 70% efficiency - this is probably close to the practical maximum, as the other 30% is needed in the flue to make the fire draw properly - otherwise it would not work.

Also, with very high efficiency stoves excessive build-up in the flue can occur due to low temperature of exhaust gases - this is not desirable.

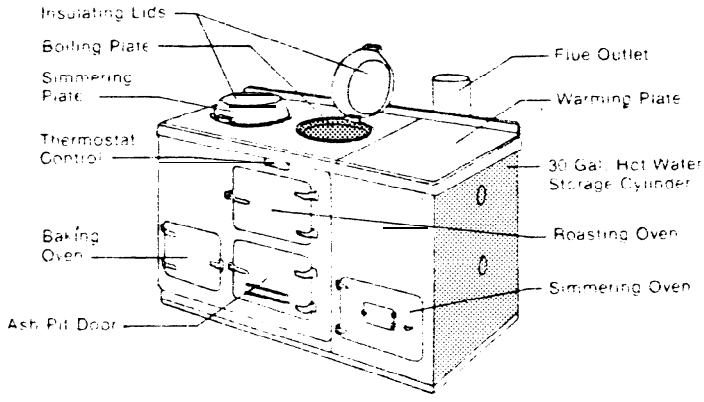


Cast iron is, of course, the only good stove material as it conducts heat well, lasts well and costs a reasonable price. There are other materials which conduct better, but they are expensive and would not last.

In picking a stove you need to look at several factors - how much heat that you want, what you want it to look like etc. The pot belly stoves have been very popular for space heating, but now there is a huge range (perhaps too large!) of different types. A lot of other shapes are better for larger pieces of wood, which can be a real help.

Things that I would look for in a cast iron space heating stove are: weight - heavy is better for life and even heat. Air tight seals and good air flow controls to give slow combustion. If possible, a secondary combustion chamber is good.

Stoves



Aga Cooker 1929

My favorite stove is the slow combustion cooking stove - what a great machine !! It provides cooking, hot water and some heating and nothing tastes as good as a cake or loaf of bread just out of the wood stove oven. It works hand in hand with solar hot water, complementing almost perfectly.

Taken to their fullest extent, the larger stoves can also provide hot water for hydronic space heating. That means all your cooking, heating and hot water from an efficient single stove - VERY NICE!

After saying all that, there is something else that should be mentioned - that is the beauty of the open fire. I am writing this in front of our open log fire, we have not got a cast iron stove yet (only a slow combustion in our kitchen), but when we do we will still use the open fire. I can sit and watch a fire for hours, very beautiful, very relaxing as other non-T.V. addicts will know.

So, plant a tree, and keep warm.

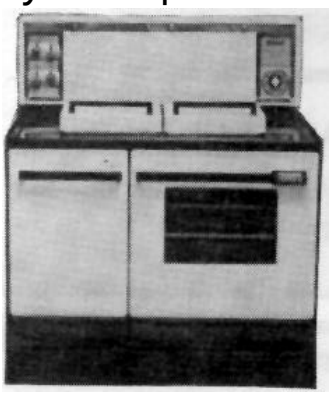
TONY STEVENSON

SURVIVAL TECHNOLOGY

Stove Guide.

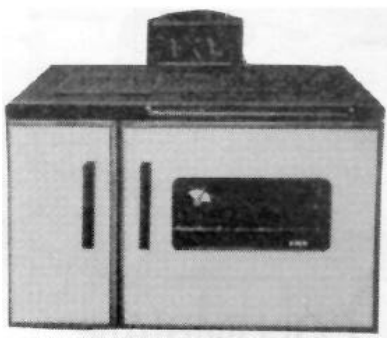
Here is a run down of some of the wood, combustion and pot belly stoves around at the moment. This Listing by no means includes all that is currently available, but it will give you an idea of what's around. The review of stove doesn't include wood burning space heater or high efficiency open fireplaces. Prices listed vary from retailer to retailer and are an indication only.

how they compare



EVERHOT Deluxe

TYPE: Slow combustion stove
DIMENSIONS: Height: 1194mm; Width: 622mm; Depth 559mm
HOT WATER: Heats water for domestic uses.
PRICE: $1250.
CONTROLS: Hot water, flue, fire, oven, timer, oven them meter.
ORIGIN: Australia.



IXL AVALON (small)

TYPE: Slow combustion stove.
DIMENSIONS: Height; 489mm; Width: 762mm; Depth: 514mm.
HOT WATER: Water heating optional extra.
PRICE: $804.
CONTROLS: Fire, flue, oven thermometer.
ORIGIN: Geelong, Victoria.

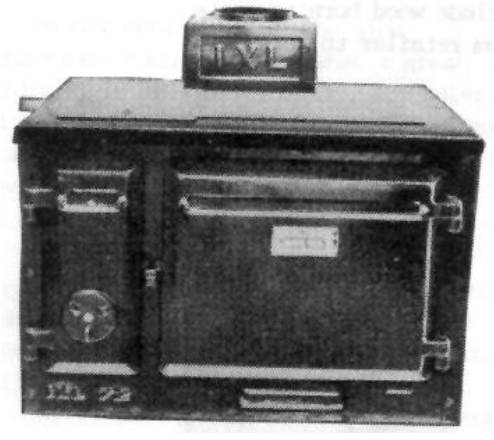
IXL AVALON (large)

TYPE: Slow combustion stove.
DIMENSIONS: Height: 1187mm; Width: 762mm; Depth: 597mm
HOT WATER: Heats water for domestic uses.
PRICE: $1177.
CONTROLS: Fire, flue, oven thermometer.
ORIGIN: Geelong, Victoria.

DEFY DOVER

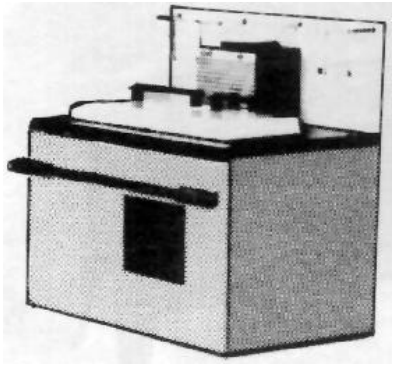
TYPE: Wood stove.
DIMENSIONS: Height: 635mm; Width 1826mm; Depth: 622mm.
HOT WATER: Side boiler optional.
PRICE $330.
CONTROLS: Fire.
ORIGIN: Victoria, Australia.

Stove Guide Continued.



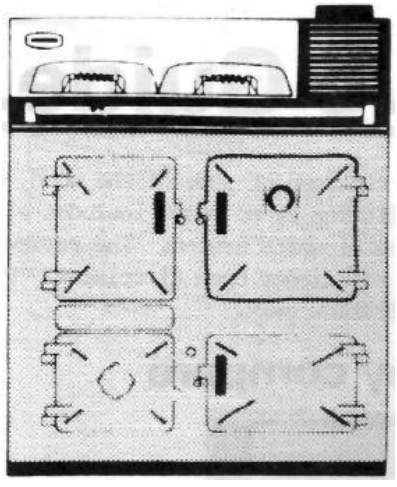
IXL 71

TYPE: Slow combustion stove.
DIMENSIONS: Height: 483mm; Width: 610mm; Depth: 483mm.
HOT WATER: Domestic water heating optional extra.
PRICE: $484.
CONTROLS: Fire, flue, oven thermometer.
ORIGIN: Geelong, Victoria.



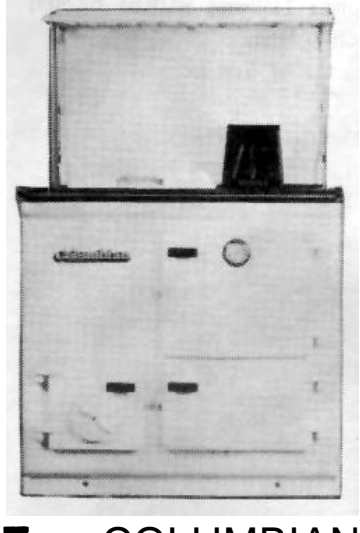
EVERHOT 150

TYPE: Slow combustion stove.
DIMENSIONS: Height: **1150mm Width:** 787mm; Depth: 483mm.
HOT WATER: Water heating circulator optional; not on standard model.
PRICE:
CONTROLS: Flue, fire, oven thermometer.
ORIGIN: Australia.



RAYBURN M.F.

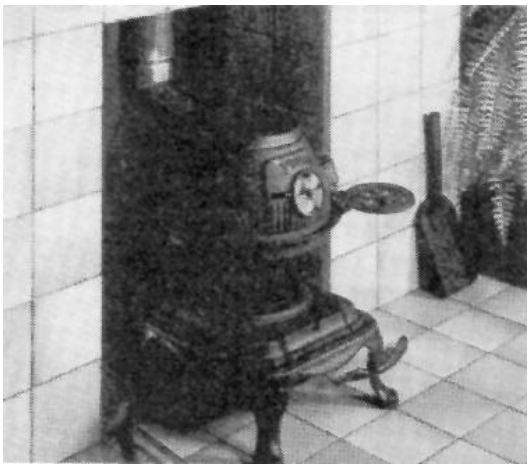
TYPE: Slow combustion stove
DIMENSIONS: Height: 997mm; Width: 584mm; Depth 575mm.
HOT WATER: Heats water for domestic purposes. Also heats enough water for space heating an area of approx 10sq. metres.
PRICE: $2,200.
CONTROLS: Flue, fire, oven thermometer.
ORIGIN: Melbourne, Australia.



ESSE COLUMBIAN

TYPE: Slow combustion stove.
DIMENSIONS: Height: 1346mm; Width: 838mm; Depth: 508mm.
HOT WATER: Domestic water heating; continuous flow output for space heating of house.
PRICE: $2,100.
Controls: Fire, flue, **oven** thermometer.
ORIGIN: Scotland, U.K.

Pot Belly Stoves



MASPORT YUKON

TYPE: Pot belly stove.
DIMENSIONS: Height: 545mm; width: 370mm;
HOT WATER: Domestic water heating.
PRICES: $219.
CONTROLS: Fire, flue.
ORIGIN: New Zealand.

OADDL SCHOONER

TYPE: Wood/coal stove.
DIMENSIONS: Height: 915mm; Width: 35mm
HOT WATER: Domestic water heating optimal extra.
PRICE: $610.
CONTROL: Fire, flue.
ORIGIN: New Zealand.

ROMOLD SCION COLONIAL

TYPE: Pot belly stove.
DIMENSIONS: Height: 755mm; Width: 420mm;
HOT WATER: DOMESTIC Water heating.
PRICE: $297.
CONTROLS: Fire, flue.
ORIGIN: New Zealand, Australia.

MASPORT OREGON

TYPE: Pot belly stove.
DIMENSIONS: Height: 565mm; Width 460mm.
HOT WATER: Domestic water heating.
PRICE: $390.
CONTROLS: Fire, flue.
ORIGIN: Australia.

ENERGY POLITICS.

POLITICAL OPTIONS FOR ENERGY ALTERNATIVES

The Canberra Group of the International Solar Energy Society ran three political meetings this year at the Australian Academy of Science to allow the public to hear the Liberal, Labor and Democrat viewpoint on the subject of 'The Use of Alternative Energy Sources in Australia". Senator Colin Mason spoke for the Democrats in April, Barry Jones M.H.R. (Shadow Minister for Science and Technology) represented Labor's views in May and Senator Sir John Carrick (Minister for National Development and Energy) capped off the series on the 8th of July.

Given the generally recognized "images" of the three parties one would have expected their speakers to rate first, second and third in the order of their appearance in terms of appealing to the sort of audience that such a topic attracts; but this was not so.

The Democrats

As expected, Senator Mason gave an excellent address which was, in effect, the launching of the Democrats policy on renewable energy development. He impressed the audience with his high level of understanding of both the currently available tech.-nologies and of the importance of renewable energy sources in the attainment of a sustainable and environmentally benign economy.

Labor

Barry Jones, however, was a sorry disappointment. He brushed aside the Democrats as being able "to say anything they liked" and then said nothing himself. He told the bored and increasingly hostile audience about how low a priority alternative energy development held with his party (although they would "significantly increase research funding" eventually, he thought) and lectured on the merits of the Nitinol (shape memory alloy) low temperature heat engine, before leaving in a huff after a stormy question time.

Liberal

Senator Carrick, of course, had the advantage of knowing what had gone before him; but even allowing for this his address seemed a surprising positive contribution, taken as a whole. His formal speech was predictable, describing the government's four-point "energy-policy" incorporating "conservation", "substitution", "exploration" and "alternatives", in that order.

Under the heading of "conservation" he quoted the International Energy Agency estimate that the developed nations can reduce living standards and the implication was that we are doing just that. One astute member of the audience wittily pointed out this inconsistency however, by later asking, "Why don't you tell the Premier of Tasmania so he won't have to dam the Franklin?"; but Ministers don't tell Premiers what to do, it seems.

Another "interesting statistic" was trotted out under this heading and gave an insight into the Senator's thinking: that a 10% energy consumption saving would avoid the need for one extra power station (worth $1 billion) in N.S.W. per decade. It confirmed our worst fears - that the "limits of growth" penny has not yet dropped, in the Senator's mind.

The "substitution" and "exploration" points are well known for their orientation toward oil supplies and for their heavy dependence on "'world parity pricing" for their implementation, but some lower term vision

HOW ALTERNATIVE ENERGY RATES IN CANBERRA

was shown in his brief discussion of the ultimate problems (like acid rain) inherent in accelerating consumption of fossil fuels even if they were inexhaustible.

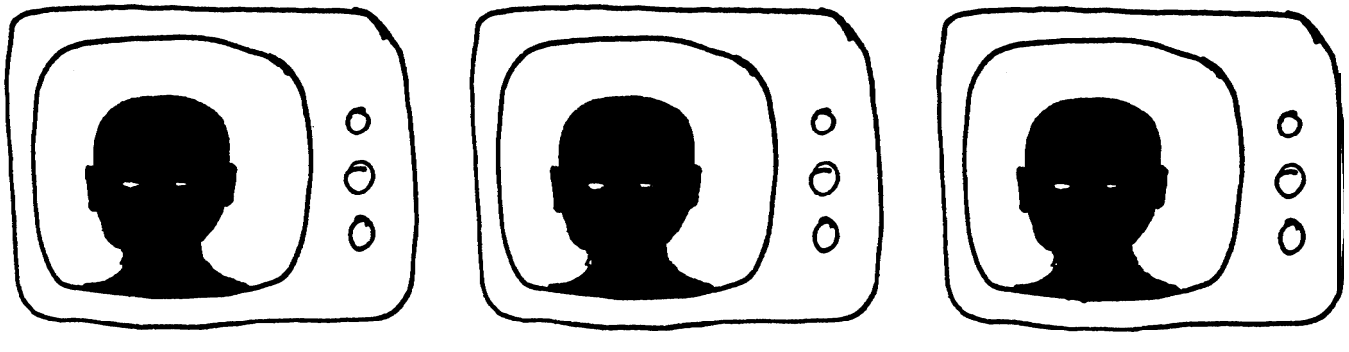
Lies & Statistics

Getting at last to the "alternatives" he cited many of the recent research projects funded by his NERDDC (National Energy Research Development and Demonstration Council) and others and told us how much they had spent in each field despite his seeing renewables as not currently offering a significant substitution for conventional fuels. There were a few ironies here, too. For instance, he expressed his keenness that some syncrude developments get into the pilot plant stage and also his fear that the biomass fuels have small (possibly negative) net energy outputs - a staggering contrast to Senator Mason's enthusiasm for ethanol from cassava grown on "marginal sugar land" and his allegation that oil shale projects are "frauds" because they will run at a net energy deficit. Carrick also boasted about the large increase in the funding of CSIRO solar research up to 1980-81- an inventive, if less than honest, response to Mason's charge that funding had been decimated in 1981-82. Sometimes it helps to have old statistics!

Despite all this, Senator Carrick came across as being willing to improve; particularly in the question time where (nuclear policy questions aside) his responses were always positive, offering to follow up and reply when a question was asked and he didn't know the answer. He offered to "look hard" at the solar disincentive aspects of compulsory off-peak electric boosting (as proposed by the A.C.T. Electricity Authority for domestic solar water heaters); to see whether our "Energy Expo" display, currently in Knowville, U.S.A., could be set up in Australia as a permanent public information focus, possibly incorporating our renewable energy hardware exhibition now touring Commonwealth countries in the Pacific; to report on the energy efficiency of the new Parliament House; and he even conceded that Canberra subdivisions display a lamentable failure to incorporate solar access planning principles, offering to give the National Capital Development Commission "a bit of a prod" in that regard.

All good stuff. But it fits too neatly into the scene described by Senator Mason three months before - how he would propose some action to the Senate to increase the use of renewable energy (or conserve some of the conventional) and how Carrick would reply, "Good" and then do nothing. We will have to wait and see.

TREVOR LEE (Architect)
Chairman ACT Group of ISES
(this article has also been printed in "Australian Planner").



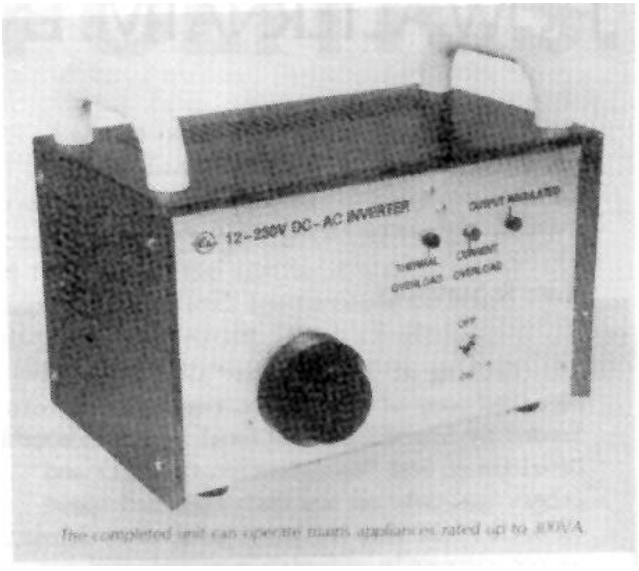
INVERTERS

What's an Inverter?

When you use some alternative source of electricity such as solar cells or a wind generator you will find you have a problem. Because these systems produce low voltage direct current (DC) electricity, they cannot be used to power your average domestic appliances which run on 240 volts alternating current (A.C.). One way to change your electricity into this form is to use a device call- an inverter.

A suggested rule of thumb for what inverters should cost is "about a dollar a watt". That is, a 40 watt inverter should cost about $40, a 500 watt inverter about $500 and a 1,000 watt inverter about $1,000. However like all rules of thumb remember this is only a rough guide. The power output of the inverter is important in that a low power inverter can only run low power appliances, whereas a high power one can run much higher more powerful appliances, (or a number of low power ones).

Also, take note of the input voltage of the inverter. These can range anywhere between 12 volts and 110 volts. It is important to have the same input voltage as your battery bank voltage.



In the past many other conversion methods have been used. One is the "genne-motor". All this was was a motor running of the DC electricity supply combined with an AC generator on the same shaft. The, 240 volt AC taken from the generatoris then used to power the appliances.

One way of saving money on an inverter is to build your own instead of one of the more expensive commercial units. However a do-it-yourself inverter can have problems as the following shows.

why not?

Visit the ENERGY INFORMATION CENTRE... 151 Flinders St, Melbourne, ph 631195, to learn about energy.

See their displays and take a few pamphlets.

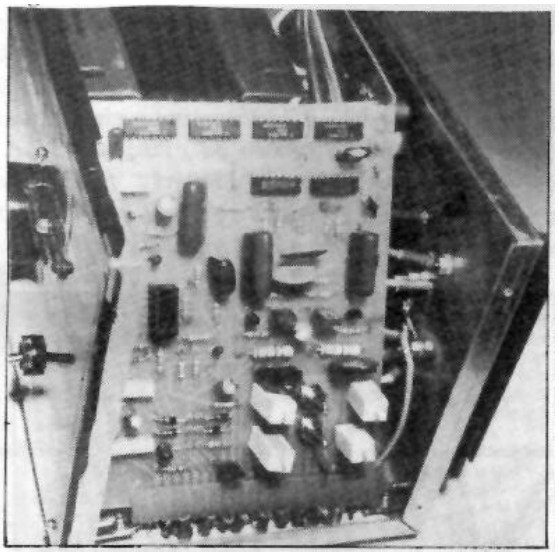
Tell the staff about your home and ask for ways to reduce your energy consumpt ion to save money. They'll give good advice.

That's their job.

It's all free...!

Building Your Own INVERTER

The worst thing about this inverter is it took twice as long to debug, as it did to build. Other than this problem of finding the faults,the 300 watt, 12-230 volt inverter functioned well. The inverter design appeared in the June, 1982 of Electronics Australia. I bought an inverter kit for $186 from Rod Irving, Electronics in Melbourne.



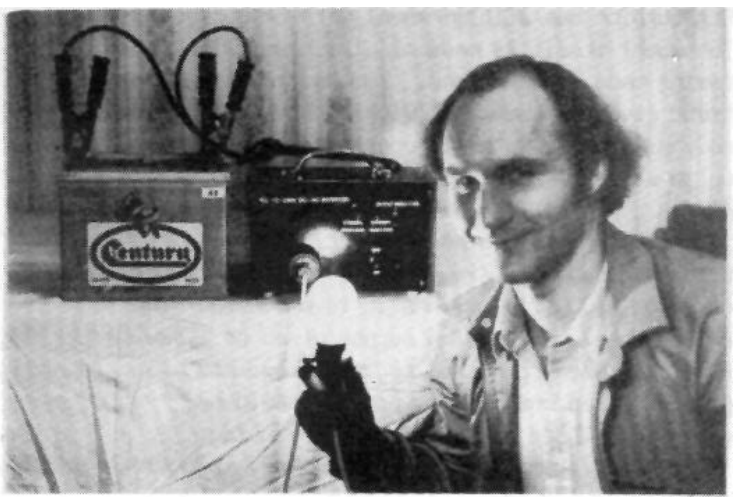
Construction of the inverter was relatively straight forward. The biggest problem occured when I tried to isolate the power transistors from the case of the inverter. In the end I used a sleeve of wire insulation over the screws which held the power transistors in place, where they passed through the heatsinks. (That 's in addition to the mica washers and insulating bush.) The only other major construction problem was caused by the small size of the case. While it was possible to fit all components into the case it was a tight fit and it could have been better if the case had been larger.

Now onto the major problems. In getting the inverter working we found 2 wiring errors (my fault), 4 faulty components, and one error in the text (their fault). Oh, and that doesn't include the components that were missing from the kit. These included 1 power transistor, 1 crystal, 1 diode and assorted mounting hardware. More annoying, we later found a 0.22 *u* f capacitor for which they had supplied a 0.22 *u* f capacitor. Components that failed included a power transistor, a trimpot, a 2.7 volt Zener diode and an I.C. The error in the text was on the component overlay where SCR 1 was positioned backwards. The cathode was where the gate should have been and visa versa. Anyone wanting to build this inverter should take note of this.

As you might have guessed tracking down all these faults took some time; about 20 hours in all. It also required the use of an oscilloscope and an experienced electronic engineer, (not me). If it had not been for these resources I doubt I would ever have got it working. This is not to say that all people will have the problems I had. I know of one person who built this inverter and had it working within 10 minutes.

Once the inverter was finished we tested it on a variety of appliances. These included an electric drill, incandescent lamps, a T.V. and a stereo. All ran well even though the drill seemed a little bit slow. Overall it is a good inverter once working. But be aware there might be some bugs to be ironed out. And at a cost of $186 it is not the kind of kit one gives up on because you can't get it working.

MICK HARRIS.



Water Power.

Early this year I was at an alternative Energy fair where I met someone with a very small Pelton wheel water turbine. Despite the small size of the Pelton wheel it produced quite a useful quantity of energy. As it turned out, the owner of the Pelton wheel, Tom Noye was a water power enthusiast from way back. He told me how his father had owned a 160 horse power, Frances reaction turbine.

APM's turbine

The turbine was originally installed by the Australian Paper Mills in 1885. A.P.M. used the turbine in production of strawboard. It ran at a speed of approximately 400 r.p.m, The water race for the turbine was 2,900 metres long and built by convict labour.

In 1921 an ice works was set up at the old paper mill site. The water turbine, now owned by Tan Noyes' father, was used to provide the energy needed for the ice production plant. Later the turbine, which drew it's water from the Barwon River near Geelong (in Victoria), fell into disrepair and disuse.

Tom's turbine

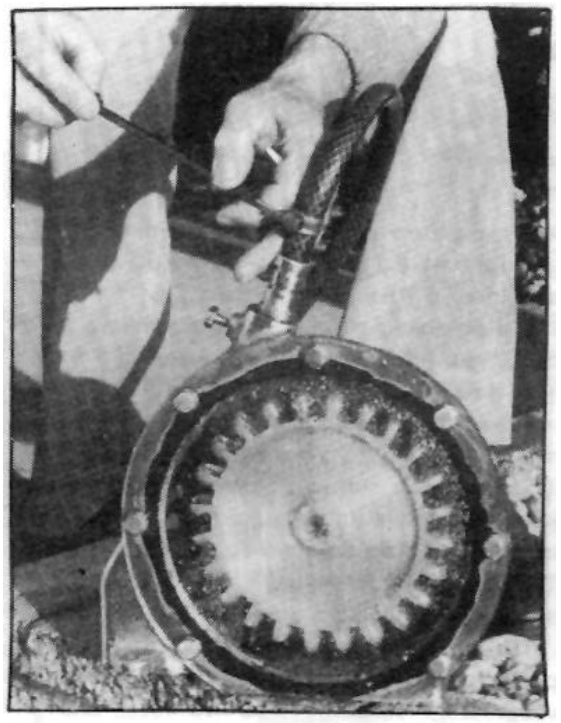
When I asked Tom if I could have a look at his Pelton wheel he was happy to oblige. His turbine has a 165mm wheel with 24 buckets. The wheel itself is made of aluminium, with the casing made of cast iron. Tom had replaced the front cover of the wheel with a sheet of perspex so you actually watch it operating. He has made up an adapter so the turbine can be run off a garden tap. At Tom's home, the water pressure is equivalent to a head of about 50 metres. With this set up it is possible to reach speeds of about 6,000 r.p.m. when it is unloaded. The Pelton wheel produced an output of about 1.5kw (2 H.P.) When connected to an appropriate generator, an output of over 1 Kw could be expected. *That's* not had when you consider it's coming from a garden tap!

Pelton Wheels

Pelton wheels work by the action of a high pressure jet of water passing through a nozzle and striking the buckets of the wheel. Due to near perfect streaming in the buckets, the wheels are 80 -90%, efficient. The larger the installation the more efficient the turbines tend to be. Efficiencies can get as high as 93%.

Because Pelton wheels operate at such high speeds they tend to reduce or eliminate the need for gears to drive an electric generator. Because the wheels require a high pressure pipe, added advantages are

present because the pipe provides a source of high pressure water for agricultural or domestic uses. It could also be used for fire-fighting in country situations.

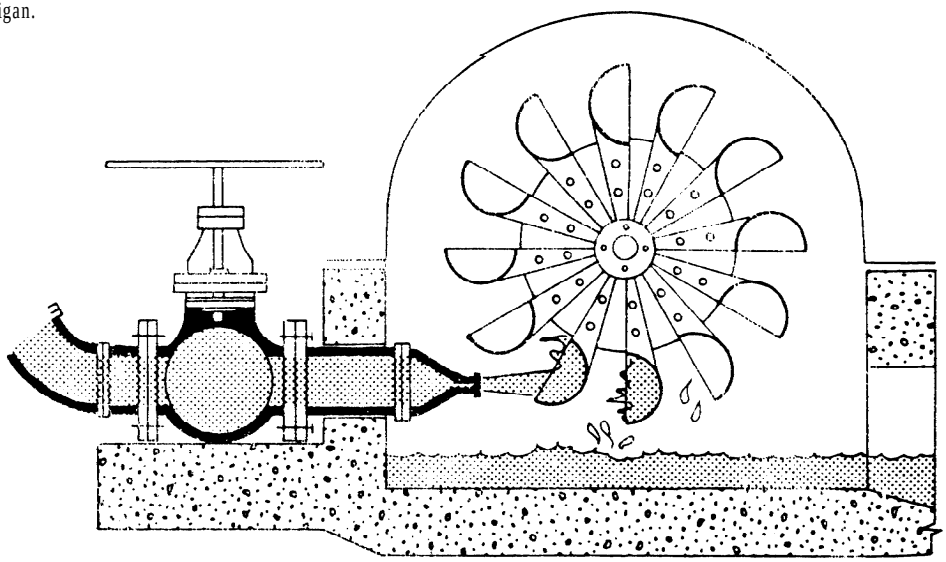


Practical problems

One disadvantage is the cost of piping to the Pelton wheel can be expensive, especially if the pipeline has to be long. But there are two much greater problems for people wishing to install a Pelton wheel in Australia. One is to find a good, reliable source of high head (pressure) water. This means water turbine installations tend to be limited to mountains and hilly areas. The other problem is the availability of turbines. Few if any are manufactured here and old ones are hard to track down. People interested in getting hold of a turbine should think of looking to the United States where a large variety of turbines are available.

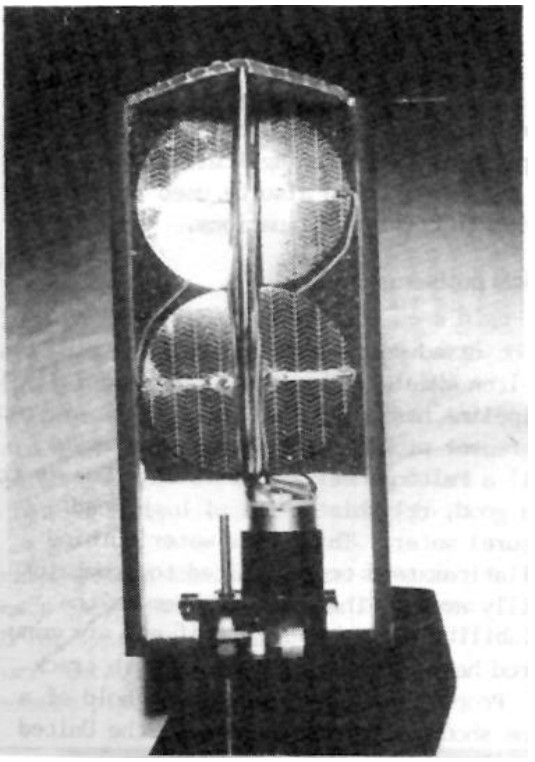
MICK HARRIS.

SOURCE: Harnessing Water Power for Home Energy. Dermot McGuigan.



The water jet streams out of the nozzle and strikes the curved buckets of the wheel

Solar Tracker

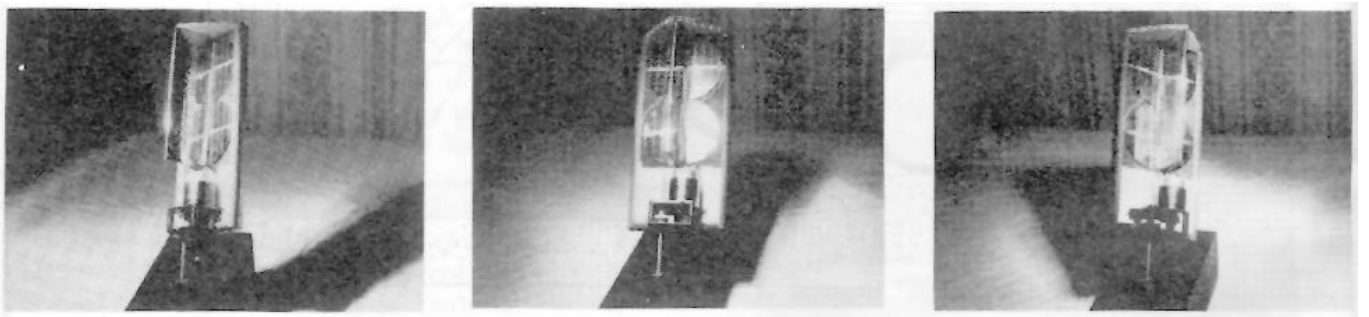


A big problem with highly concentrating solar collectors is that they have to stay aimed at the sun. It becomes rather tedious have to re-aim them all day. One way to get around this is to use an automatic tracking device. The solar tracker described below just could be the worlds most simple solar tracking device. It will follow the sun as it moves across the sky, keeping the cells aimed at the sun all day from sunrise to sunset.

The basic components of the tracker are four solar cells, a geared motor, and some wire. The solar cells had a output of about .4 amps at half a volt. The motor would operate over voltage range of 1 to 4.5 volts and had a variable speed gearbox. The speed of the output shaft is varied by changing the number of gearwheels in the gearbox. output shaft speedscan vary between 3rpm and 2,200rpm depending on the voltage and number of gearwheels.

The motor, gearbox and solar cells are mounted on a rigid base. The cells are placed in pairs with a light baffle in between. Wiring is done as shown below.

This is how it works. The two pairs of cells are wired up to the motor in opposite directions. Electric current from one pair of cells will turn the motor in one direction but current from the other pair of cells will try to turn it in the opposite direction. When equal sunlight falls on both cells, the currents cancel each other out and the motor doesn't move. However if a shadow from the baffle falls across one set of cells then more current is produced by the other set of cells which then turns the motor until both cells once again receive the same amount of light. If on the other hand a shadow were to fall across the other cells the voltage at the



The Solar Tracker in operation. No matter what direction the light source is from the tracker turns to face it. Note the way in which the shadow is always behind the tracker.

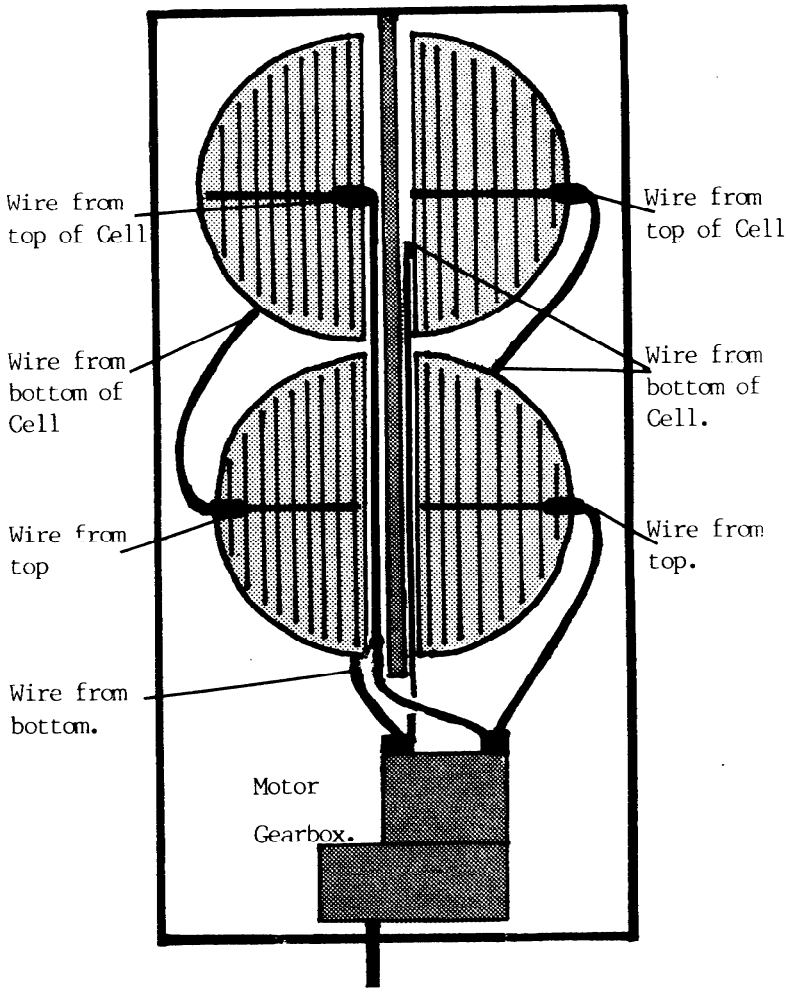
motor would be reversed and the motor would turn the tracker in the other direction.

Thus the changing of polarity causes the motor to "search" for the correct alignment. The tracker has the advantages of using the cells both to provide automatic guidance and power to run itself.

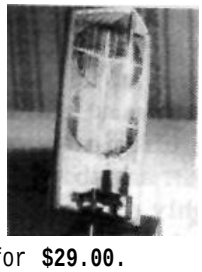
A major limitation is that the tracker will not reset itself at the end of the day, ready for the next days sunrise on the opposite to horizon. The tracker could be made to do this better, (even though not perfectly) by different positioning of the cells. Adding a reflective curve could be one way of improving the tracker in this respect.

The tracker shower is only suitable for for small systems. A larger system using more cells and a heavier motor (say 6 or 12 volts). and gearbox can be used just as easily. A hint re. gearboxes. It is better to have a low gear ratio giving a lower speed the motor is less likely to stall with current running through it and thus bum out. I set the speed of my tracker to 90 r.p.m. But it could be set much lower if movement of your light source, (ie. the sun) is going to be slow.

WIRING FOR SOLAR TRACKER.



Solar Tracker Kit



As some readers may find it difficult to obtain the variable speed geared motor contained in the solar tracker we have put together a kit which contains all the basic parts of the tracker. The kit includes four silicon solar cells; (approx. 400 mA), one variable speed geared motor; reflective mylar; wire and construction notes.

The kit is available for **$29.00.** Postage and packing of the kit is an additional $2.00.

To order the **kit write to** Soft Technology at **366** Smith Street, Collingwood, 3066. Please enclose a cheque or money order for the above amount.

WIND GENERATORS REVISITED.

It has been about two years now since I built the wind-generator I described in this magazine on August last year. Between then and now I have tried a few other designs with mixed success.

The biggest problem for me in the home-built wind generator is that of obtaining a suitable slow-speed generator or alternator.

The design in last years Soft Technology suffered limitations in the alternator due to rewinding of the alternator stator with thinner wire. This reduced its output considerably,to just over 100 watts. (The rewinding was necessary to obtain a low cut-in speed).

Since then I have just about given up playing around with car alternators, unless they are driven to speeds over 2000 RPM. Auto-alternators are quite inefficient anyway, below 3000RPM.

Direct Coupled Generator

Following that wind generator, I made a high speed propeller of about 2 metre diameter and coupled it directly *to* a rewound 2 pole tractor generator. The generators fields remained the same, while the armature was rewound with more turns of thinner wire, although not as thin as in the rewound auto-alternator. This rewound generator seemed to perform much more efficiently at low speeds in the order of 350RPM and above. This generator shaft speed roughly corresponds to a wind speed of 9MPH. Also being direct-drive, construction was simplified and gear train friction and noise were eliminated.

Maximum output from this generator was about 13 AMPS at 900 RPM. This roughly represents a windspeed of 25 MPH on my propeller. After adding automatic high-wind shutdown, this wind-generator worked well.

The tail of the W.G. was offset from the generator s axis and pivoted at the point where the tail rod joins to the generator. The tail is held out straight by a large spring on the pivot point. When the wind blows on the tail vain and prop there is a turning force exhibited on the tails pivot. At a certain windspeed this turning force overcomes the retaining spring and the tail folds 90° and is locked parallel to the propellers swept area. The tail then orients the propeller out of the wind. This sort of high-wind protection although crude and sometimes operating on gusts can save propellers that took weeks to carve.

Another generator I rewound was originally a 240 volt D.C. motor (with a wound armature). This generator ran well, giving out more power than I could measure at 24 volts, but its weight and bulk eventually got the better of me.

Oldies but Goodies

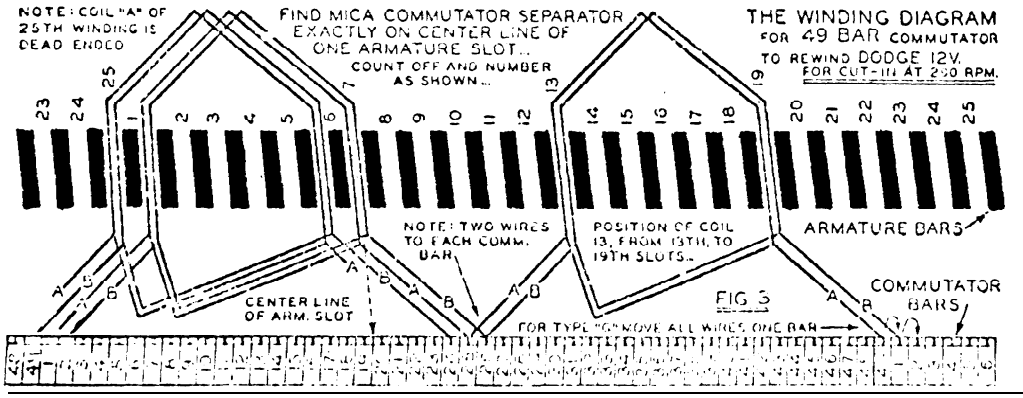
One of the cheapest and sturdiest generators I found to be of all things a 1928 Dodge starter-generator! Believe it or not they can still be occasionally picked up from the "Age" or the "Trading Post Newspapers and at Vintage car swap meets. I have picked up four of them and the most I paid for one was $20 Even though it goes against the grain to be using 1930's technology I'm quite happy with their performance, and these generators were really "built".

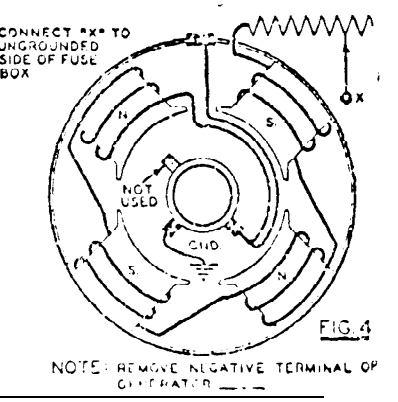
Rewound for slow-speed service, the one in my wind-generator will put out 25 AMPS at 12 volts (650 RPM), and it will cut in at very low shaft speeds (290 RPM). It will probably last for another 50 years!

Information for rewinding the Dodge "G" generator was procured from two 1930 publications, one being "Autopower", and the other "the Le Jay manual". Both of these books give detailed information in modifying generators and making propellors.

Effort to Benifit

I have not attempted building any wind-genertors over the 250 watt range mainly because for me the effort to benefit ratio becomes expanentially worse in larger machines.





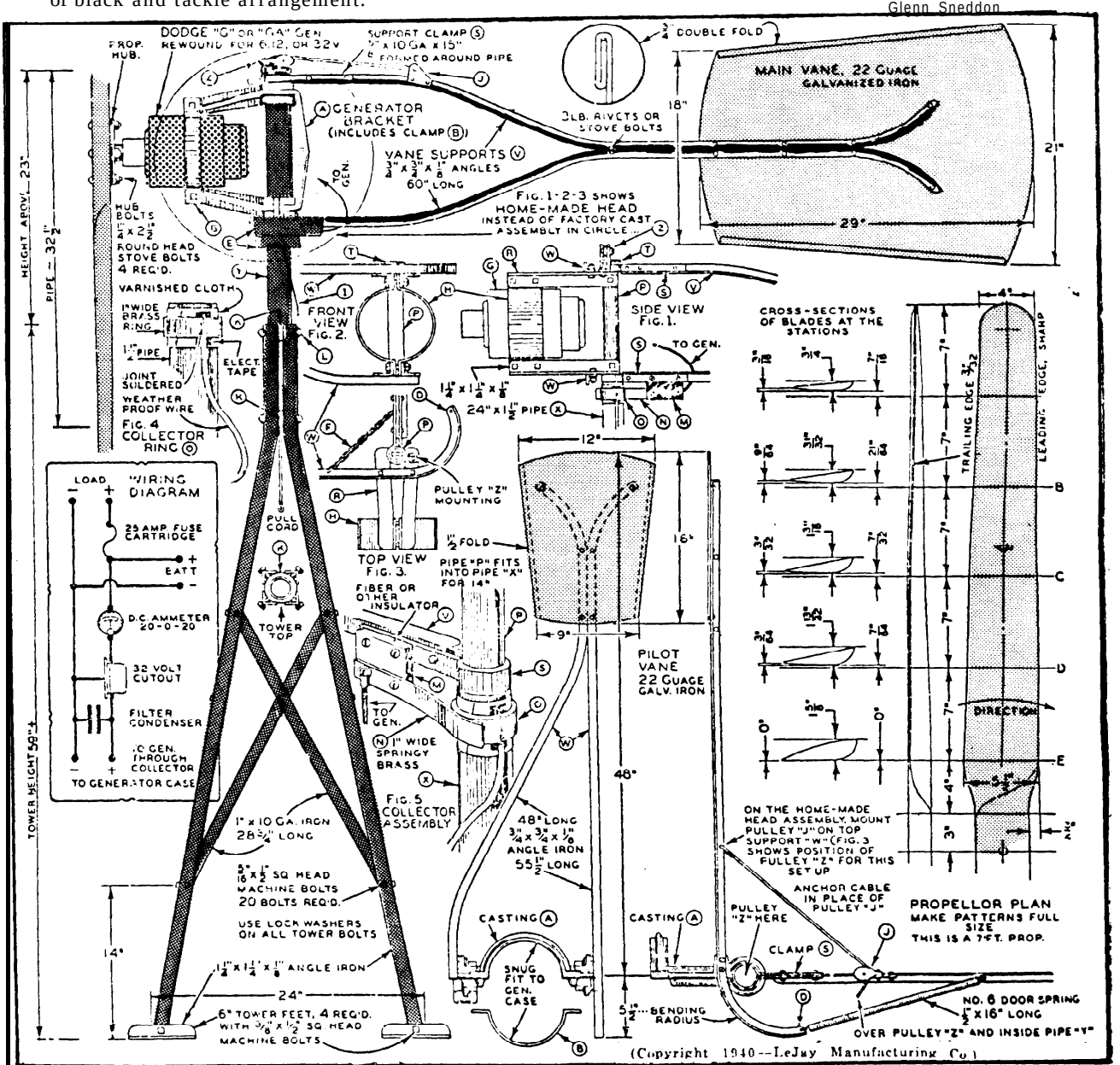
Larger machines become unmanageable for simple one person maintenance. If my demand in power was for a couple of kilowatts, I would rather build 3 or 4 500 watt machines. This can improve reliability over a single machine system in that if one of your machines suicides you can still have 3/4 of your power potential. In a one machine system you are relying entirely on one unit.

As a bonus, one person could disassemble the generators from the towers using some sort of black and tackle arrangement.

I have installed a detachable pulley on the top of my small tower for hoisting the generator up and down.

My wind machine, at the moment, charges two 100 amphour 12 volt battery banks. To convert 12 volt to 240, I have one 100 watt inverter and one 300 watt inverter. This small system can run up to six fluorescent lights, and small electric tools (power drill, Jigsaw etc.) Of course the time these appliances can be used for depends totally on the amount of wind available per day or week.

Glenn Sneddon



Plastic Films.

Clear plastic films are very useful in such applications as greenhouse walls, solar collectors, etc. There are many different types of plastics available as clear film. Each type of plastic has different properties and in this article I attempt to provide a guide to some of them. I had reason to collect this information while looking for a film cover for a high temperature collector I was building.

The sort of properties that I found use- are: (a) Transmittance - how much light gets through.

(b) Temperature range- at what temp. will it sag under its mm weight.

(c) Lifetime - some plastics (such as Polythene) degrade very quickly outdoors due to the action of UV light. The addition of a UV adsorbing compound can increase the lifetime & is used in so called UV stabilised" films

(d) Price

(e) Thickness range

(f) Strength

(g) Common trade names.

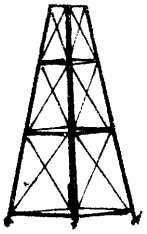
Plastic films tend to be more transparent than glass but are also more transparent to infrared radiation so more heat will be re-radiated out. Polythene is the cheapest and most widely available film but it yellows and gets brittle (especially at folds) after about 6 months exposure and is also a pain to glue.

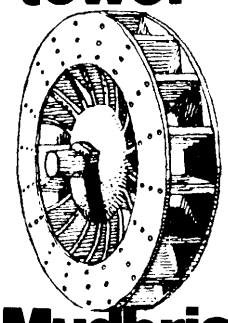
I finished up choosing Mylar to cover my collectors. A reflective aluminised Mylar film is available for use as a reflective surface, (eg. Going Solar has some at $\$2/m^2$)

Type	Trade Names	Solar Transmittance	Softening Temp	Outdoor Lifetime	Strength	Thickness Range	Price Range
Polyethlyene	Polythene	90-95 %	100°C	3 – 6 Months	Excellent brittle on exposure	50–100 µm	20–50 c/m^2
Poly Vinyl Chloride	PVC	90 –95 %	80 °C	1 –2 Years Stabilised 3–4 Years	Good	100–400 µm	0.5–1 $/$m^2$
Polyesters	Mylar	90 %	200 °C	4 – 8 Years	Good	25–300 µm	$2/$m^2$
Polycarbonates	Lexan	88 %	220 °C	10 Years +	Very Tough	Film not readily avail- ible. Sheet is.	$20–30/$m^2$ (sheet)
Acrylics	Perspex Plexiglas	91 %	80–100 °C	15–20 Years	Fair	Sheets only.	$15–20/$m^2$ (1/8" sheet)
Poly Vinyl Flouride	Tedlar	95 %	–	5–10 Years eventually embrittled	Excellent	150µm	–

Coming Soon

Windgenerator tower



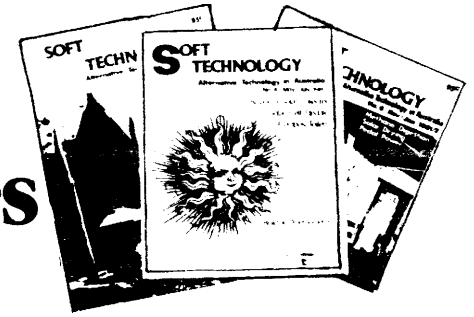


More on Waterpower

Mudbrick solar flats

Solar Fridge

Back Copies



Limited quantities of back copies of al.1 issues are now available.

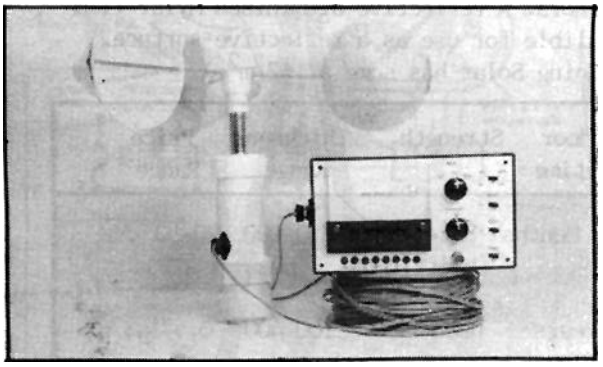
Issues No. 1, 2, and 3. Only small stocks left. Copies generally include the odd photocopied page where we have run out of pages.

Issues No. 4, 5 and 6. Also only relatively small stocks left. However all issues are complete; no photocopied pages.

Issues No. 7, 8 and 9. Plenty of copies available. Sets of copies including 1 to 8 are $11.00

The price on all back copies are $1.50 which include postage.

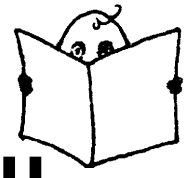
Anemometer for Loan



Yes the anemometer described in previous issues of Soft Technology has been improved, (it now records 2,000 wind samples, one an hour for 44 days), and it can be hired out at a low charge by members and subscribers. It is currently being used by one member to test how good his site will be for-wind power. If you are interested in using the anemometer then please write to us.

HEY YOU!!

me ??



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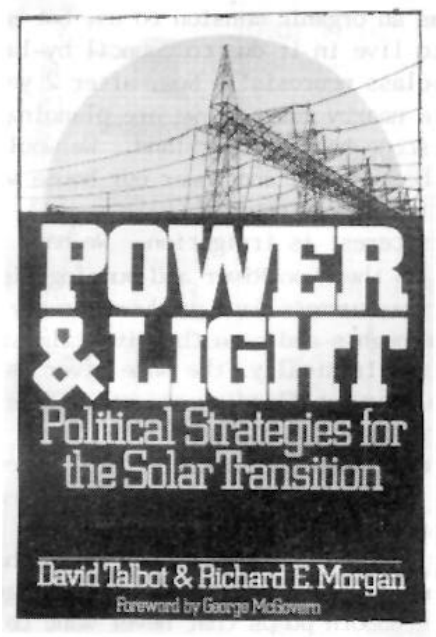
Book Review.



Power & Light

Political Strategies for the Solar Transition

David Talbot & Richard E. Morgan

The Pilgrim Press, New York $7.95

The widespread use of solar energy has two sets of problems associated with it. First are the technical problems of how to put a system together which works effectively at a reasonable cost. Making sure the blades don't fly off your wind generator or the glass doesn't crack on the solar collector. The second set of problems are the political ones. What to do about a power utility that charges massive electricity rates simply because you choose to install solar heating or an oil company which buys up a successful alternative energy business and then runs it down so they have' less competition for their oil sales.

The latter (ie. the political problems) are the ones dealt with by this book. In particular it examines how the current utilities and energy corporation have created a system which has stifled the development of renewable energy options. The methods which will be used to perpetuate the current situation are also examined.

The silver lining comes in the second half of the book when methods of changing from our current methods of energy production and supply over to renewable solar are discussed.

For those wishing to cane to grips with the political barriers to the widespread use of solar energy this book provides an excellent outline of the problem and approaches for solving them.

The Letters *Page*

Battery Aging

Dear S. T.,
In designing any solar or wind powered home energy system the cost of storage batteries is a significant factor. It seems, therefore, quite important to know how long they will last, and this letter is written after reading, in Soft Technology no. 7, of Michael Bos's 20-25 year estimate for the life of his battery bank.
One factor which determines the lifetime of batteries is the number of times they are discharged and recharged since, I suppose, the plates do not reform perfectly. On the basis of 200 complete charging/discharging cycles I estimated a lifetime of 10 years for a battery bank I was thinking of buying. However the warranty of home lighting/power batteries is only two years, and on further enquiries I obtained an estimate of only five years for the battery life – no matter how they were used. I suppose this is due to a gradual deterioration of the chemicals, perhaps due to impurities in the material used.
I was wondering if anyone who has used batteries over a fair length of time would comment on the lifetime of their battery bank as to have to replace a few thousand dollars worth of batteries every five years would be a significant cost in running an alternative technology system.

Peter Taylor.
(Guildford, Victoria)

Pumping Problems

Dear S.T.,
We are living on 27 acres of beautiful river flat and eucalypt bush in Gippsland. Approx. 5 acres is cultivated in flowers, herbs and vegies for market and pasture for goats, ducks and our Clydesdale.
We have built one house, a traditional bark-hut which was an organic mansion to us, but are unable to live in it due to council by-laws (middle-class neurosis!). Now, after 2 years renting a nearby cottage, we are planning to build a stone house on our land. We would like to heat, light and power our house with alternative energy sources.
Another interest is irrigation. We have river frontage on the Avon River and pumping rights. The last two summers have produced pretty severe droughts and seen the river almost slow *to* a halt. Ironically, the same river is prone to frequent flooding at other times of the year.
Historically water (or lack of it) has been the cause of family feuds and farmers not speaking to one another in this area.
The problem with water is pumps. Second-hand, cheap pumps in our case and we've had a gut full of stubborn pumps that never want to start and seem to be always breaking down, when the garden is at its driest and turning up its toes. We've saved enough money to purchase a good trickle irrigation system and diligently collect and apply mulching materials from a 30km around. Our aim is to set up several tanks on the hill behind the garden for bulk storage of water and gravity feed the precious liquid down the hill and through the trickle hoses.
We'd like to be able to do this without depending on petrol or diesel pumps. We've been told that an hydraulic ram pump wouldn't work in our situation, due to **lack of** fall.
We have also read of a "Plata" pump, which is a turbine pump. We've been unable to find much information on this type of pump. They are manufactured in NZ and are expensive. A mechanic friend of ours feels he could **construct** one with more information.
I'd be grateful for my contacts with people working on similar projects.

Yvonne Benson
(Boisdale, Victoria)

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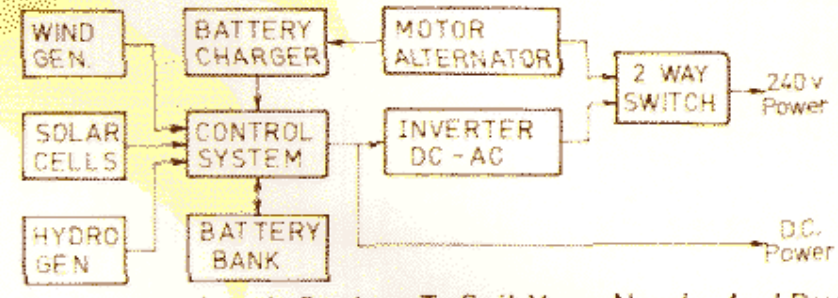

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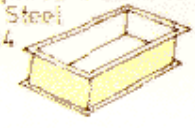

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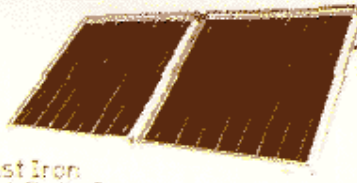

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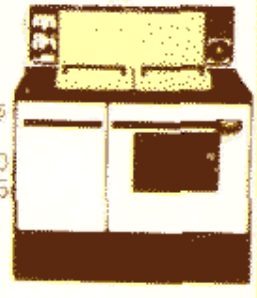

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