Soft Technology

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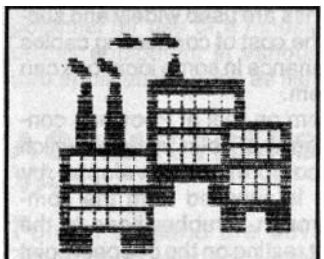
Grappling with the GREENHOUSE EFFECT

SIMPLE ANEMOMETER * AN INDESTRUCTIBLE BIKE RACK

SOFT TECHNOLOGY



GREENHOUSE Pg 7

This issue of Soft Technology was edited by Alan Hutchinson with the help of Mick Harris, Ian Scales, Ian Gray and others.

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What's Inside....

The Greenhouse Effect 7
What is it, where is it and who done it? Chris Moss grapples with the Greenhouse effect.

Selecting a Kit Home 13
What to look for when selecting a kit home. Ian Grey examines 12 plans and gives suggestions for improvement.

The Energy Education Centre 19
Come for a stroll round the Victorian governments new renewable energy display centre at Burnley.

Indestructible Bicycle Rack 11
If your present bike rack gives up on you, then try this bomb proof design.

A Simple Anemometer 28
Here is a beautifully simple design for an anemometer made from scrounged parts.

The Rocket 25
How Ian Sims built his electric vehicle and had fun doing it.

Solar Power: A Revolutionary New Approach 30
How can you efficiently utilise a low grade heat source like solar? J. Thillaimuthu looks at an ammonia based system.

Energy Flashes 4
The Zinc Bromine Battery, Lightweight electric car motor, Solar water aeration & more.

The ATA Report 24
What's been happening in the ATA lately? News, views and info from the Alternative Technology Association.

Handy Hints 29
Repairing a cracked battery.

Letters 33
Views from our readers..

For Sale... 34
The ATA's classified ads section.

ENERGY FLASHES

MOUNTAIN TRACKS

A new compound has been developed in Sweden to prevent erosion caused by hikers on heavily used tracks in mountain areas.

The powdered compound, called Solidry, is mixed with clay and churned up with a rotary hoe and hardens after compaction with avibrating roller. While the surface cracks it does not break up and prevents the destruction of a wide band of heathland on either side of the track in boggy areas. The Yorkshire Dales National Park, where the material is being tested in England, believes its use would be a cheaper and easier solution than erecting board walks over bad stretches of track.

ELECTRIC CAR MOTOR

A new 4Kg, 40 HP traction motor has been developed in Denver by a firm called "Unique Mobility".

The concept motor was originally for a high speed computer drive but is now being built to power cars. The breakthrough came with the ability to use high strength neodymium permanent magnets 10 to 40 times as strong as ferrite magnets. Engineering features include extremely thin armature windings located far from the centre of the drive shaft for higher torque and to dissipate heat. For smoother control, there are 3 sets of winding in layers, one for each speed range. An electric controller charges the winding as the speed varies, some forty HP is developed at about 2500 RPM.

ALTERNATIVE FUEL

The advantages of natural gas, which is up to 98% methane, are its greater efficiency making it cheaper to use than petrol & greater flammability which makes engines easier to start, and it's has lower toxic products reducing both pollution and engine wear and tear.

Unfortunately the gas has to be compressed or liquefied to 162 degrees centigrade, but recently the Traskent Institute of Road Transport has produced a new fuel by treating the gas and mixing it with diesel. The fuel is said to be 40% less toxic, 10% more efficient and about one third cheaper. The main expense is the cost of gas pipelines to the processing plant but some 500 vehicles use the fuel.

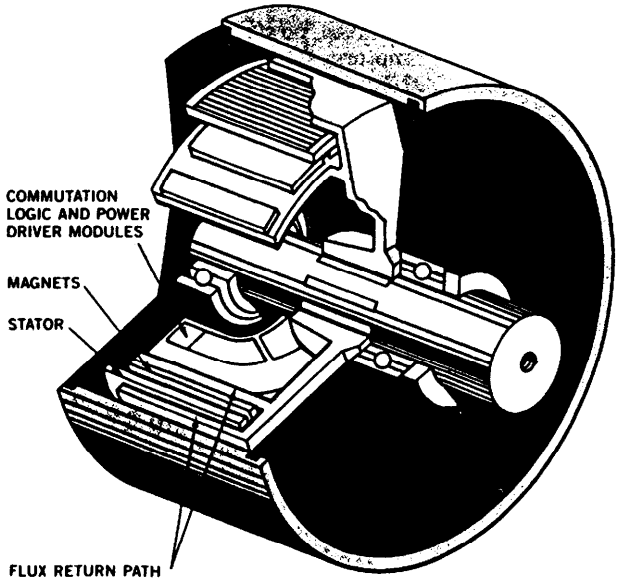
SOLAR WATER AERATION IMPROVES QUALITY

Cash Engineering Research, with assistance from the Solar Council, have developed a solar water aeration unit which is currently being tested at the Poowong reservoir in rural Victoria.

Aeration in reservoirs and dams ensures even water temperature all year round, and is vital in ensuring water quality for humans and the survival of animals and plant life in the water environment. Although traditionally powered units are used widely and successfully, the cost of connecting cables and maintenance in some locations can be a problem.

The system on trial at Poowong consists of an array of solar modules which power a compressor developed by Cash. Air is supplied from the compressor through a rubber hose to the aerator unit resting on the deepest point of the reservoir. The solar powered compressor pumps air through the hose, which is then released through holes in the aerator. Through aeration, a water circulation system is established which allows oxygen to be distributed through the water.

The Solar Council is confident this technology can be conveniently installed and is economical for use at



Unique Mobility s 4Kg 40Hp Traction motor.

locations that do not have readily available mains electricity. There is also potential for use of a modified version of this equipment in various aquaculture applications such as fish farming.

A SOLAR TRANSIT VAN

Ford in England are developing a Transit van with 1.2 square metres of solar cells producing up to 130 watts in full sunlight and about 80 watts in the shade.

This power is then stored in two large batteries with a total of 280 ampere-hours capacity. An inverter is also on board to produce 240V AC to run normal domestic appliances.

SOLAR RESEARCH

A disappointing story from Niger.

Since the price of uranium has fallen there isn't the money to fund the National Solar Energy Centre.

Work on a 10W solar thermal irrigation pump has ceased development. Solar water heaters are few in number and **a** solar cooker and oven have not been used because of the reluctance of the farming communities to change to eating in the middle of the day, a time when there is abundant solar energy. (Appropriate technology isn't appropriate unless it's socially appropriate as well - Ed) Natural forests have been removed to fuel wood stoves and desertification of the bare slopes accelerated despite the planting of irrigated eucalypts for firewood which is too expensive for the locals to buy.

The Centre has had some success in developing a solar water distiller made of cheap locally available materials. The distilled water was so cheap that sales did not take off until the price was raised to that which the people were used to.

A large scale drier was also a success, being used to dry a variety of crops.

HOPE FOR PARAPLEGICS

Trials of a cheap machine designed to help paraplegics walk with the aid of sticks or crutches are to begin this year, based on research by Brian Andrews at the University of Glasgow.

Solar Aeration at Poowong

A British company, Neurotech which specialises in electrical devices for slimming, exercising muscles and treating muscular diseases, plans to manufacture the electrical stimulator. Currents are applied to the patient's leg muscles by up to four pads by a microprocessor controller worn on the belt. A moulded plastic prosthetic device supports and bends with the legs. It also contains a small strain and position gauge which feeds the information back to the microprocessor which fires electrical impulses to keep the legs going. Instrumentation for Neurotech's walker costs about 6 pounds and is cheaper than an implanted stimulator. Not everyone will be able to benefit from the device but young people whose damaged areas have not completely blocked nerves in their spinal columns will benefit most.

25 KILOWATTS OF BATTERY POWER

The School of Chemical Engineering at the University of New South Wales have developed a new storage battery to store solar and wind energy in remote areas and to power electric vehicles.

It is based on the redox flow cell conception which two vanadium solutions, one positive and one negative are pumped through separate halves of the cell separated by a membrane. Electricity is produced when there is a transfer of electrons between these solutions. The team leader, **Maria Skyl**las-Kazacos, **says** there is no problem with crosscontamination in the new cell, it can be completely discharged without ill effect and should last indefinitely. To **recharge the cell the solu**tions are either recharged or are changed for rapid reuse. Commercialisation should be ready later this year through the Western Australian company, Andrew Clough Ltd.

GREEN POWER BATTERIES

A French firm, Wonder, working with a Belgian company has developed an organic substance, Polyethoxyde perfluore, to replace mercury as an anti-corrosion agent in batteries.

They will not last as long **as** alkaline batteries but will be cheaper and, more importantly, they will reduce the **amount** of mercury entering the environment from discarded mercury batteries now under threat of being banned in many EEC countries.

WAVE POWER FOR AUSTRALIA

The Sydney firm, Wave Power International, is planning to build an $8 million wave generator off the coast of Western Australia to demonstrate the technology and to provide power for the town of Esperance.

Approval is still to be given from the Environmental Protection Authority, but the WA Energy Commission has agreed to buy the total output of the one mega-watt generator. The machine relies on an American system called Neptune. It consists of a large box open to the sea, incoming waves hit the back and on reflection meet the next incoming wave making a larger wave. These larger waves move a concrete float which powers a sea water pump which in turn drives a turbine. At peak power the generator would supply 20% of the needs of Esperance, now dependent on an oil-fired station.

THE ZINC-BROMINE BATTERY

Murdoch University, Western Australia, has made' a breakthrough in battery technology by developing Zinc Bromine batteries of 20-200kWh.

The 20 kWh is approximately the size of a small bridge set on two gallon size tanks which contain external Zinc Bromine electroyte in which the energy is stored. Both plates are of carbon which will not deteriorate and are separated by a microporous membrane. During charging Zinc ions are drawn from one solution and deposited on the negative plate as metallic Zinc, on the positive side Bromine ions are converted to Bromine. A membrane, 30cm x 30cm, between the two halves allows a 30 ampere current at a voltage of 1.8V. Fresh solution is pumped continuously from the tanks whose size determines the capacity of a battery.

PEDAL FASTER

cyclists who want both speed and endurance should learn to pedal faster, says Anthony Sargeant of the Academic Medical Centre in Amsterdam.

Although muscle physiologists previously thought 60 RPM the optimum, Sargeant found maximum power occurred at 115 RPM but that cyclists can pedal longer if they do not use their maximum power on each stroke. 115 RPM represents the limit of highest speed and maximum push. Sargeant found that cyclists pedalling at 40 RPM use 70% of their total available power whereas pedalling at 99 RPM uses only 46% giving longer endurance.

SEA POWER

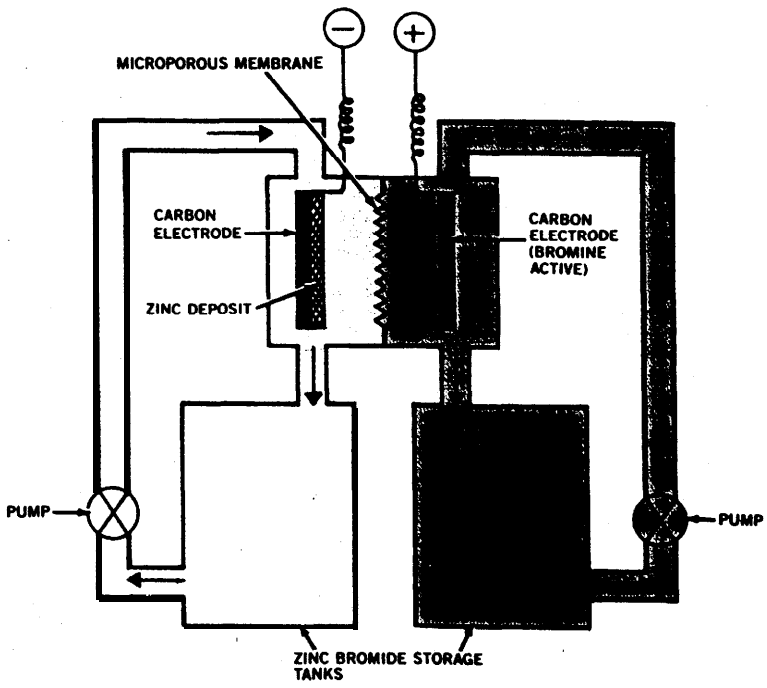
Global seawater circulation carries heat energy from the tropics to the polar regions where the seawater is cooled, and being denser, sinks to the bottom returning to the tropics.

Because of these different densities, the layers do not mix resulting in a difference of as much as 22 degrees centigrade. This temperature difference is to be used in four 100 megawatt plants to be built in Indonesia in 1989. J Hilbert Anderson, a pioneer in Ocean Thermal Energy Conversion, explains its operation. The plants will pump 28 degrees centigrade surface water into boilers through inlet screens. There the water's heat evaporates a working fluid (in this case a common household refrigerant) whose vapour spins a high efficiency turbine running a generator that produces electricity. Meanwhile 6 degrees centigrade water is pumped from about 1,000m below the surface into condensers which liquefy the working fluid for another cycle. Anderson calculates the electricity will cost 8.2 cents/ kilowatt-hour. A nuclear-fission plant's output is 11.7 cents/ KW hr., and a coal fired plant's is 10.7 cents KW hr. Each unit will cost $100 million and because 27 degrees centigrade is a critical temperature for cyclones the 120 x 35 x 60m plants will be semi-submersible and dynamically positioned. The four units will generate enough electricity for 400,000 people and there are 22 units under discussion.

SEA WATER MOTORS

Britain's National Engineering Laboratory is setting up a new company to develop hydraulic pumps and motors driven by sea water, the world's most abundant fluid.

John Currie, a pioneer in developing these pumps, has been seconded with 30 others to further develop these machines originally sponsored by Shell at the National Engineering Laboratory (NEL). Previously, because water is both corrosive and a poor lubricant, oil has been used to drive hydraulic motors but fire hazards and pollution particularly in the food industry have been drawbacks with oil. Now the need for toots such as saws and grinders to operate at hundreds of metres under the sea off shore exploration sites has caused Shell and Esso to promote research on water motors. The machine uses a rotating disc to supply water under pressure to a ring of cylinders whose pistons push on a swash plate (an angled plate) attached to the drive shaft giving a powerful motor with little vibration. Weight for weight these hydrodynamic motors are more powerful than electronic, electrical, or pneumatic pumps and are pollution free.



Zinc bromide battery

The Greenhouse Effect.

What is it, where is it and who done it?
How can we solve the problem?

By CHRIS MOSS

The ski season was short, the American summer was hot and dry, Bangladesh had the biggest floods ever. Suddenly everyone is talking about the Greenhouse Effect. Is this going to be another beat-up like the Oil Crisis of 1972, or is it really going to change things?

What is the Greenhouse Effect?

Much of the solar radiation hitting the Earth's surface is reflected back into the atmosphere and to space. Some of this reflected energy is absorbed by naturally occurring trace elements of gases such as water vapour, carbon dioxide, nitrous oxide and methane, and more is re-reflected back to Earth. This effect is similar to the effect of glass in a greenhouse, where the reflected light is trapped inside.

Increased burning of fossil fuels (and increasing deforestation) has slowly built up the levels of Carbon dioxide over the last hundred years, and the global temperature has increased overall by 0.5°C over this period. In fact, the results in terms of climatic change are at the low end of the predictions, and scientists are wondering if the oceans are keeping us cooler than we thought by acting as a cool reservoir.

You may wonder: "What's half a degree?" The major effect is climatic changes. Already, in Australia and other parts of the world, studies of meteorological data have shown changes in average rainfall (see fig 2.). In Western Australia, changes of up to plus or minus 4.8% have been noted over the period 1913-86. It will require major changes in agriculture in parts of the world and population changes if **areas** become too dry or too wet.

Worse?

However, worse is to come, as scientists are talking of an increase in Global temperatures of up to 4.0°C. in the next sixty to seventy years resulting from a doubling of the carbon dioxide levels. 'he rate of increase depends on whether we increase the release of CO2, carry on at present levels or reduce it. (see fig 1.) Much research is being done into likely effects, and the massive changes in population as some areas dry up or flood.

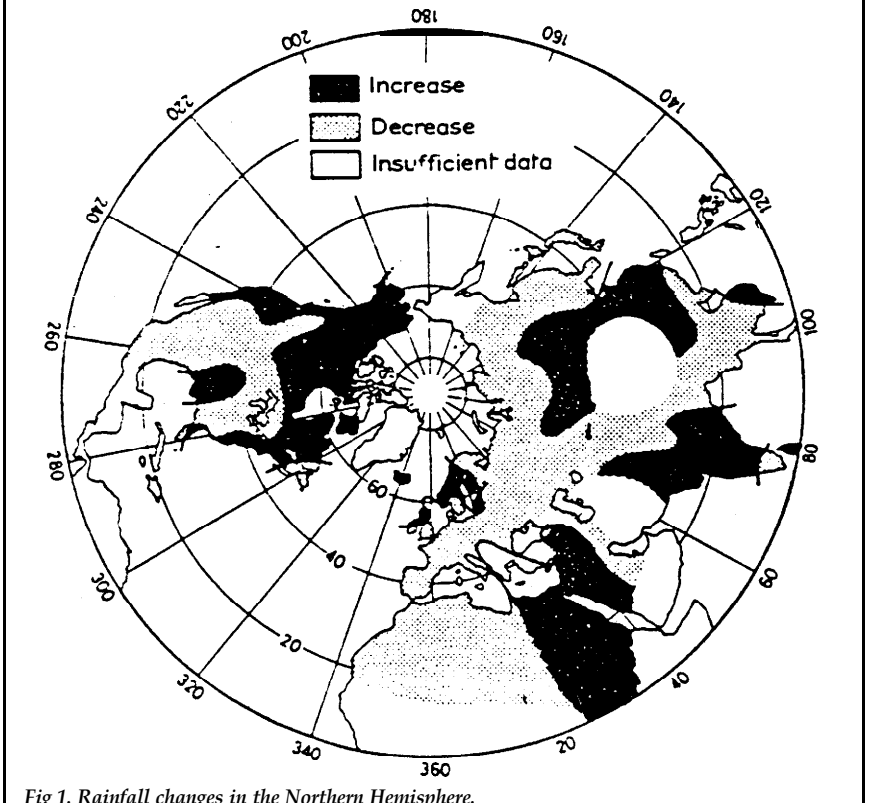


Fig 1. Rainfall changes in the Northern Hemisphere.

The facts are these:

1. Nobody is really sure how it will end up as there are so many different factors to take into account - e.g. will the increasing dust concentration in the atmosphere, caused by pollution or volcanic activity, counter the heating effect.

2. The polar ice caps won't melt, at least for a hundred or two hundred years, and only if the global temperature rises above 2°C.

3. The sea will rise, from between 20 cm. to 140 cm. by 2030. This will cause problems of salinity, coastal flooding, erosion and storm damage.

4. Cyclones will travel further south and perhaps more frequently. (Perhaps as far as Brisbane & the Gold Coast.)

5. Regional climatic changes will occur as the sub-tropics spread downwards. In Melbourne, storms will most likely be heavier and more frequent in summer, and winters will be drier.

6. Salinity problems will increase, both on the coast and inland due to a rise in the water table.

7. Plant species composition will change and species that could not adapt would be lost. Crops will fail as a result and totally different crops may need to be planted.

8. A shorter and less regular ski season (more apres less ski)

9. Reducing the Greenhouse Effect requires burning less fossil fuel. As coal is the easiest to substitute, and the worst offender, Australia's coal exports may fall dramatically.

Will this be enough to make the world - change its attitude?

Hopefully, yes. Seventy per cent of people in a recent Age poll were worried about the Greenhouse Effect. Many also worry about other pressing problems in the environment, - e.g. deterioration of the ozone layer, pesticide contamination of food etc. and are looking for answers.

The solution is, of course, to reduce the amount of carbon dioxide and other Greenhouse gas emissions. A dramatic shift in policy by Governments around the world is required in order to have a meaningful effect on the problem within the next thirty years.

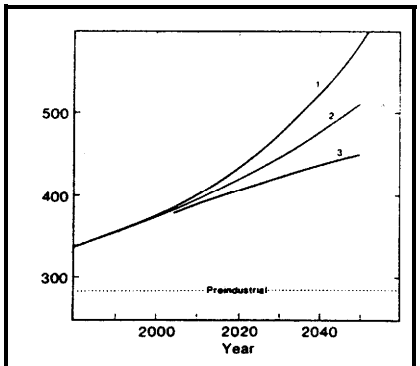
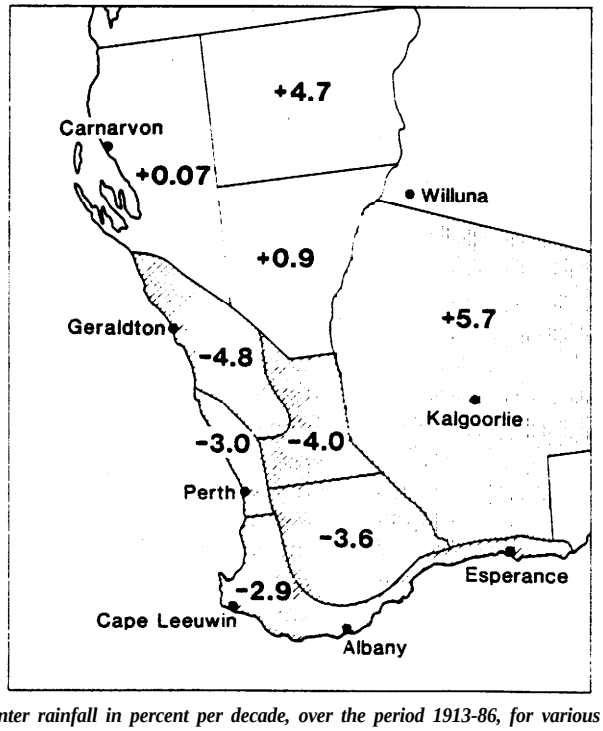


Fig 2. Predicted growth of atmospheric CO_2 concentration given the following assumptions concerning the annual growth in the rate of net release of CO_2: 1 - 2.3%/Y until 2050; 2 - 1.5%/Y until 2050 (current rate); 3 - 1.5%/Y until 2000, then no further



Trends in winter rainfall in percent per decade, over the period 1913-86, for various districts in the south west of West Australia. Shading indicates trends which are statistically significant at the 95% confidence level using the Mann-Kendall rank test. The Kalgoorlie trend may be due to problem with the data.

Nuclear Power - the answer?

The Greenhouse worries have given the nuclear industry new hope. Westinghouse is designing a cheaper "passively safe" 600MW reactor. This has the core covered with water at all times. However, even if the problems of radioactive waste and leakage are solved (Doubtful in itself), it is unlikely that they can provide the solution.

This is because 86% of our country's end-use energy demand is non- electrical and a lot of it is used for process heat or general heating. Most of this heat is presently supplied from cheaper sources than electricity.

A nuclear power station requires a lot of energy to run - in enrichment plants, cooling towers and manufacturing of parts. The expensive & energy intensive costs of construction, and processing of fuel require economic growth to finance it. It would cost around $15 billion to replace Victoria's coal fired power stations with Nuclear ones.

In the United States of America, even rosy estimates, ignoring the wider issues of waste storage and decommissioning costs, give a cost of $3200 per kW in 1986/87. Some 108 nuclear power plants have been cancelled since 1973 and construction lead time has extended to 12 years for large power plants. Many countries, such as Sweden and Switzerland, are closing or refusing to open nuclear power stations.

If energy growth carries on as now, and nuclear power used to replace half of the growth in energy requirements, power plants would have to be built at the rate of one new 1,000 MW plant every 1.61 days for the next 37 years, at a capital cost of 8.39 trillion dollars. Many Third World countries could not afford this and even fairly well off countries would find it difficult.

What Else Can We Do?

Instead of looking at how to generate the power we can look at how the power is being used. We are living in one of the most profligate, wasteful eras in history, and, if we look at what we are trying to achieve and efficient ways of

achieving this, we find that we can maintain our present lifestyle and comfort and expect economic growth of 1% to 2% while cutting energy demand by

How?

This can be done by introducing energy efficient technologies, improving building techniques and cutting out energy-wasting practices, particularly in industry.

The cost of this should be mainly funded by Government, using money that would otherwise be used for power plant construction. Many of the improvements will pay for themselves in time, and, therefore, could be financed by repayment grants or loans. It has been found that pursuing energy efficient strategies is six times more effective, in money terms, than using that money to build nuclear power stations.

In an energy efficient economy, renewable energy can have a significant role. Many countries, such as Sweden, Brazil and India, have plans for more energy efficient economies. The Brazil study found that a $10,000,000,000 (ten billion dollars) investment in efficiency would offset a $40,000,000,000 (forty billion dollars) investment in new power plant required to generate the 22 GW that would be saved.

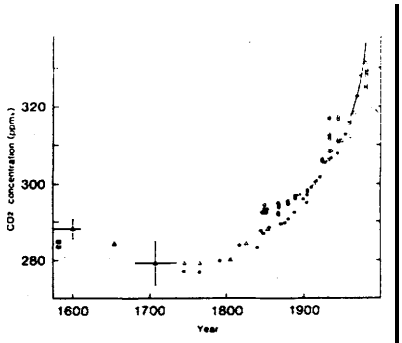


Fig 3. Changes in atmospheric CO_2 concentration over the past few centuries.

In the United States of America, studies have shown that they could cut energy consumption in half with no reduction in living standard, saving $110,000,000,000 (one hundred and ten billion dollars) a year for an investment of $50,000,000,000 (fifty billion dollars).

In addition to reducing the greenhouse effect, cutting down consumption would reduce the acid rain problem in Northern Europe and the United States.

Some Examples.

Heating, cooling and lighting of buildings produce 17% of todays global emissions and new buildings can use 75% less energy than counterparts, if properly built. Energy efficient light bulbs consume 18 Watts to give the equivalent light of a 75 Watt incandescent bulb. Each bulb would save the release of 130kg of carbon to the atmosphere. An energy efficient building can be built for about the same cost as an inefficient one, but with immense savings in power plant.

Due to the oil crisis, savings in energy have, since 1973, held overall US energy consumption about level, while it's GDP increased about 40%. This was mainly due to improvements in fuel efficiency in cars and improved insulation in buildings. There's a long way to go however, particularly in the US and the communist bloc.

Australia particularly needs to improve as it used 20% more energy than similarly developed countries for the same GNP per capita. The planned 'communist' countries are significantly less efficient than the market oriented 'western' economies (see table 1). In the USSR, it takes 31 gigajoules of

Table 1. Energy Efficiency and CO2 Emissions in 1983

	Energy intensity primary (megajoules per dollar GNP)	CO_2 Emissions from fossil fuels (million metric tons)	CO_2 emissions share (percent)
Market Oriented			
United States	19.3	1,138	23
United Kingdom	17.2	141	3
Italy	12.9	91	2
West Germany	11.8	179	4
Japan	9.7	224	4
France	8.6	103	2
Centrally Planned			
China	40.9	440	9
Soviet Union	32.3	911	18
East Germany	29.0	82	2
Poland	26.9	113	2
All Other		1591	32
Total		5013	100

energy to produce a ton of steel, whereas it takes only 19 GJ in Japan.

Once energy usage is cut, it becomes easier to supply the necessary load from renewable resources. While these may be more costly to generate, the net cost to the consumer may be the same as now, as less units of energy would be used. The Government is supposedly conducting stepped up research into renewable energy and resources, but the programs are underfunded. Other countries have massive programs in Solar, Wind and Wave power, but our Government has consistently cut research grants in recent years, despite there being a growing market, particularly in country areas.

The Production Side.

Looking at the production side. In the short term, we will have to carry on with our present methods of generation, mainly electricity from coal, gas and oil.

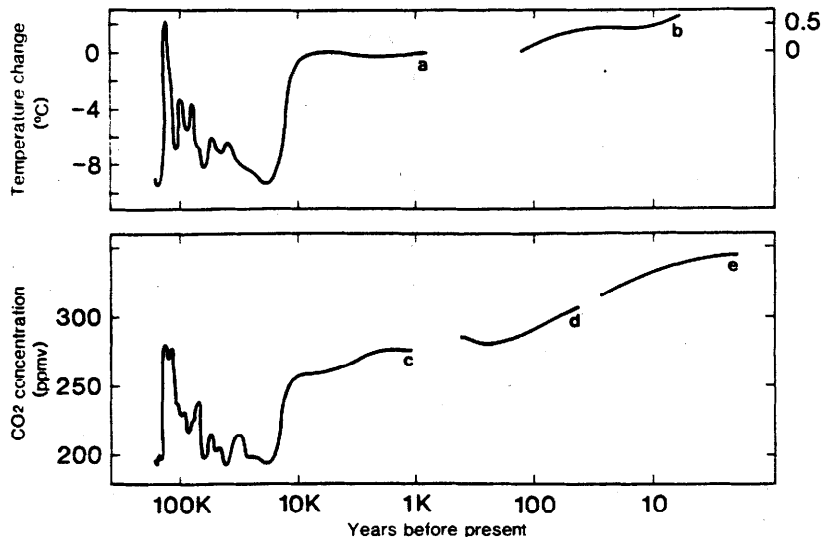
At present, in Victoria, coal produces 50% of CO_2 while supplying 16% of total energy as electricity, while oil produces 30% of CO_2 while supplying 46% of total energy. Gas is rather better, producing 20% of CO_2 while supplying 28% of total energy.

Electricity comes out so badly because five units of coal are required to generate one unit of electricity. While this sounds bad for electricity, it does mean that by cleaning up electric power stations, we can make a big difference to overall CO_2 emissions. This can be done by adding 'scrubbers' to the outlets or chimneys of the power stations to remove CO_2 at the source. This would be expensive, and would use more energy overall,. but would be a lot cheaper than the nuclear option. The price of electricity would rise a lot, but could be offset by improved conservation. This would mean that renewables are more competitive.

Conclusion.

So, in conclusion, it must be said that the Greenhouse Effect is already here, and will get worse in years to come. How well we cope with it will depend a lot on the decisions we and our politicians make now. Reducing CO_2 emissions now will slow down the effect and give more time for us to make the changes to a society based on renewable sources of energy. Conservation is by far the simplest method to start with, and has great potential to save energy in the short term without reducing our standard of living. This will allow time for renewable energy sources to become established.

Eventually, CO_2 concentrations will achieve a new equilibrium as plants increase in size and the oceans take up more CO_2. This could mean that all or some of the polar ice caps could melt, leading to a massive rise in sea level, say 5-7 metres. However, there are so many uncertainties abut what may happen that it is impossible to know what will happen in thirty to fifty years time.



Temperature and CO_2 variations in the past 160,000 years. (From Antarctic ice cores). Note the strong correlation between temperature and CO_2 concentation

FURTHER READING

(in ATA library)

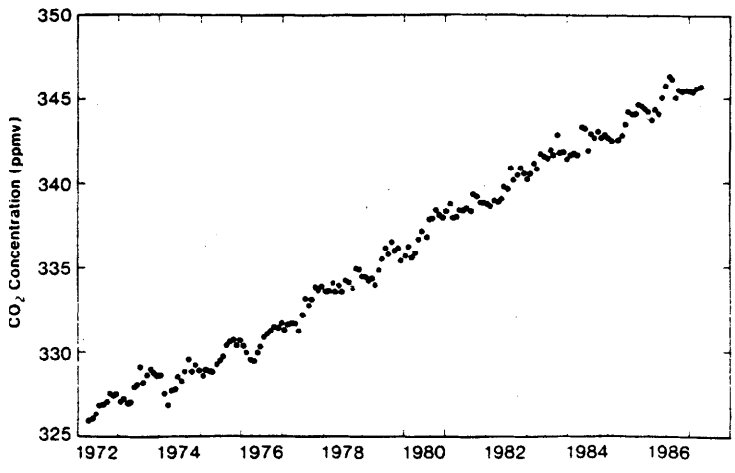
Energy Forum

Greenhouse G. Pearman

CSIRO Productions

Greenhouse Warning : Comparative analysis of Two Abatement Strategies. Bill Keepin and Gregory Kats Energy Policy December 1988

(We give you the latest info!)



Atmospheric CO_2 measured in mid troposphere over south eastern Australia.

INDESTRUCTIBLE BICYCLE RACK

by Ian Scales and Tony Murphy

If you have. been dismayed by the poor strength of commercially-made bicycle racks, then perhaps you may be interested in this bomb proof rear rack design.

The prototype rack pictured here has been on the road since January 1987 and has been through a lot since then, but still shows no sign of wear - and neither it should - it's made of welded 12mm square steel tubing!

The rationale for this rack design is that some people want a strong rear rack for carrying heavy loads (try dinking someone on an aluminium or light steel rack - heh!) and pulling bicycle trailers Another criterion was that if this rack did break, it should be easily repairable - we chose steel rather than aluminium as the building material not only for strength but because there's a steel welder in just about every country town across the country, while very few people weld aluminium.

Although made of square steel tubing, the rack is not all that heavy - the basic rack weighs 1.6 kg. We made it using a hacksaw and vice to cut the tubing to size, welded the pieces together with an arc welder and finished it off with a power grinder.

Reinforcing.

Two special points to note are that we ground two 4 cm long pieces of solid steel bar to push-fit up inside the tubing forming the stays that are attached near the back axle of the bike -their purpose is to reinforce the rack stays just where they are bolted to the bicycle frame. Often this is where bicycle racks break.

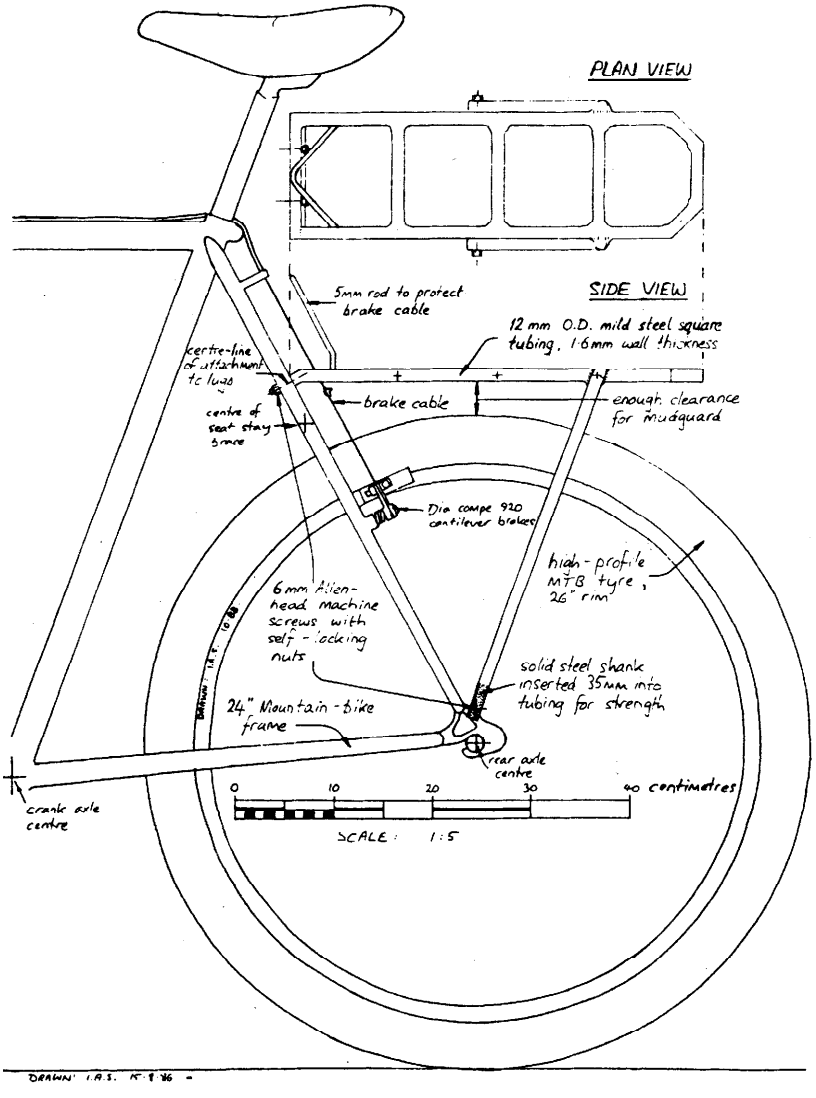
The other point is that the rack is bolted directly to the bicycle frame seat stays under the saddle. This was done to take the horizontal strain of towing a heavy trailer. After much deliberation, we decided that the easiest way to form a strong attachment point was to shape two solid cubes about 15mm across to snugly fit the shape of the seat stays just at the attachment point (see fig 2).

These attachment lugs were brazed on with ordinary bronze rod; but in order that they were properly aligned we had already drilled the 6mm bolt holes in the lugs and registered the position of the lugs with respect to the otherwise fully-completed rack and the bicycle frame itself. It was important to be careful here, as otherwise the rack might not have bolted onto the bicycle. Once the lugs were brazed on, we drilled the corresponding holes in the rack. It is worth mentioning that when brazing, the heat must be kept to a minimum to avoid distorting the seat stays themselves. A further precaution along these lines is to insert an old axle into the dropouts during brazing, to keep the frame rigid.

Finishing.

All finished, the rack was painted with a zinc-rich paint (anti-rust) and attached with 6mm Allen-type metal-

Fig I. Bicycle rack plans



thread screws and self- locking nuts. We had to pay special attention to the attachment of the derailleur-side rack stay, as the length of the screw and thickness of nut interfered with the free

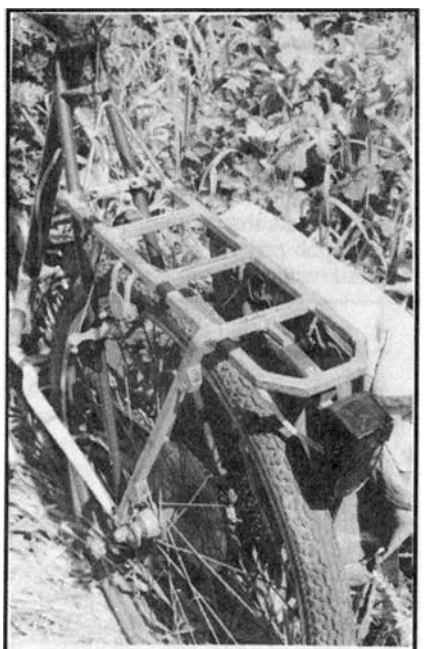


Fig 2. Photo of Bike Rack

action of the gears. The solution was to file the nut thinner and to cut the screw to length.

Cable Guard.

In fig 2 you can also see a thin (5mm steel rod bent and welded onto the rack near the seat stays: this is to guard against any luggage pushing onto the rear brake cable. Lugs along the sides of the rack are attachment points for panniers which are directly bolted on to prevent theft or accidental detachment The rear light is suspended on a tongue of stiff rubber to absorb road shock and so prolong the tail light filament life.

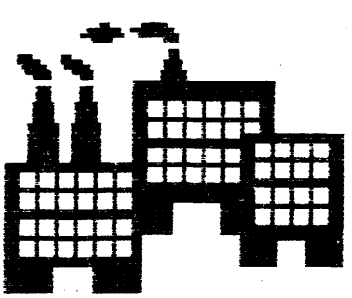
One small point now that you've finished your indestructible bike rack All you need now is an indestructible bike to hold it up!

Kicking the Fossil Fuel Habit

FOE Sydney is publishing the proceedings of the successful symposium 'Energy Strategies for Australiaand New Zealand: Kicking the fossil fuel habit' held in Sydney in May. It is intended to have them ready by the November 'Greenhouse 88' conference.

To order your copy of the proceedings, which will also include a paper on transport issues, general information on the greenhouse effect and a FOE perspective on solutions, send $5 to:

Friends of the Earth Sydney
4th Floor, 56 Foster St.
Surrey Hills 2010
Ph. (02) 2113953.



SELECTING A KIT HOME

by Ian Gray.

Selecting a Kit home involves many of the same decisions as selecting an estate builder designed and constructed house, but with added complications.

These complications are involved in what makes a kit home desirable to most buyers; they come pre-measured, pre-cut and often partly assembled like a giant plastic model kit. To create a home which will allow you to reduce the energy demand to a level where reasonable cost alternative technology becomes practical requires alternatives to the basic design. However, in many cases this alteration can be minimised by careful selection of the Kit you choose. To help you, we have compiled this buyers guide.

Low Energy Rules.

The basic rules for building low energy houses remain the same, wherever and whoever builds them. They are:

1. Face all actively used rooms north.
2. Face the maximum of windows north.
3. insulate all exterior walls and insulate ceiling.
4. High mass interior surfaces (ie. walls and floor)
5. Allow enough windows to the south for cross flow ventilation
6. NO windows unshaded to the west.

But then come the special rules..

1a. Pitched roof and flat ceiling over at least the service areas to allow for the solar storage tank to be inside the building.
2a. Short cable runs within the house to allow for low voltage (12 to 36V) wiring.
3a. Completely internal solid fuel heater (and/or cooking)

These rules can be achieved by the Kit home owner builder with some prethought and planning and need not involve a great additional expense in capital if this can be replaced by your labour. The best start would be to go through each rule and examine how the design can be utilised.

RULE 1. FACE ALL ACTIVELY USED ROOMS NORTH

This is a basic design requirement and ail the designs chosen here allow this. A common thought is that bedrooms should face south but in many families children study and play in their bedrooms and when this is a potential or actual situation selecting a design to allow for this is well advised.

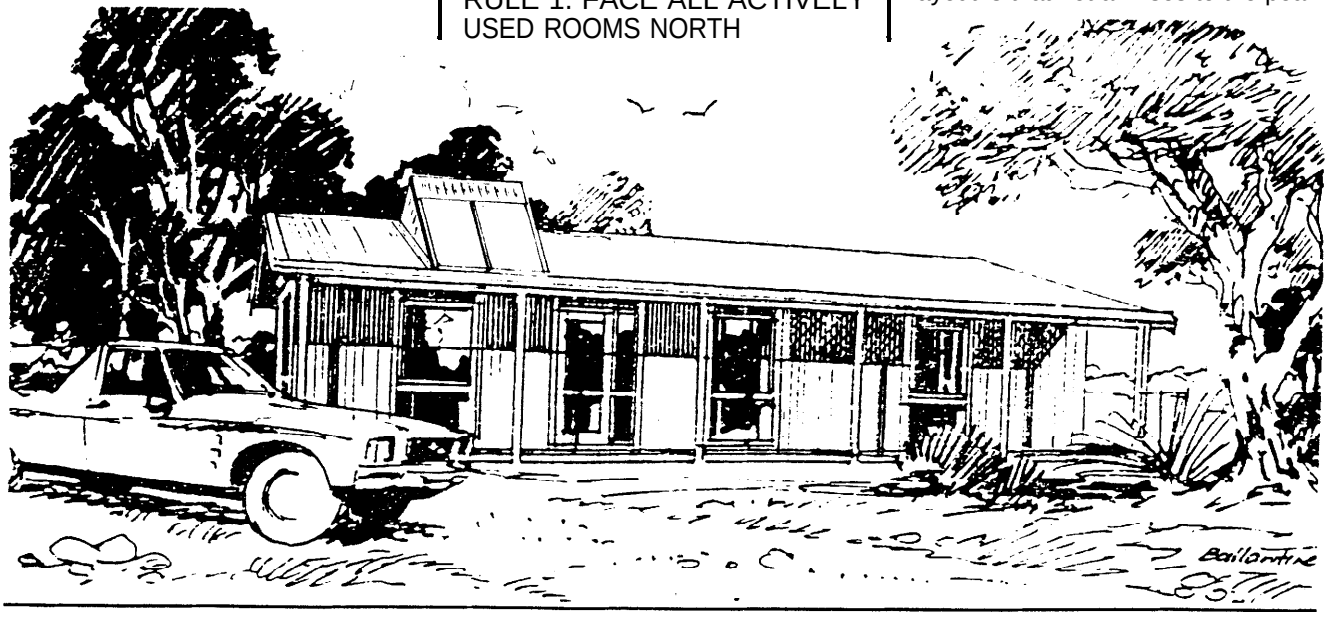
RULE 2. FACE THE MAXIMUM OF WINDOWS NORTH

Again all the designs used in this buyers guide have this feature.

RULE 3. INSULATE ALL EXTERIOR WALLS AND CEILING

Walls: Most designs have some insulation, but foil or split logs have very little insulation effect and it will be noted that in most designs additional bulk type (ie. fibreglass, rockwool, styrofoam etc.) is advised. While this can be a major expense, it can only be installed during construction and it has a major effect on reducing energy demands.

Ceilings: This again is a major requirement but is often complicated by cathedral or raked ceilings, because in this ceiling/roof layout only a minimal space is available to install the insulation and a high effect insulation material such as R3-4 rockwool is well advised. A further complication with this roof layout is that hot air rises to the peak



and some form of active system to bring the heat back down to floor level is needed if any degree of comfort is to be maintained. This is particularly important where convection heaters are used

This is of equal importance in all areas except in tropical or semi-tropical coastal areas where day and night temperature changes are minimal.

RULE 4. HIGH MASS INTERIOR SURFACES

This is the major alteration area for the Kit home builder as interior walls for this type of home are invariably timber frame with plastic or similar coatings, but using a foam insulated (styrofoam R/max etc.) concrete slab a good start is made and then utilising a mud brick wall either plain, rendered or faced with plasterboard in the central or spine wall of the house a very high, low cost, interior mass is achieved, of course clay or concrete block could replace mud brick at an additional expense. This increase in interior mass allied with well insulated exterior walls gives not only an increase in energy efficiency but also a great increase in comfort as a more stable temperature is maintained.

RULE 5. ALLOW ENOUGH WINDOWS TO THE SOUTH

This is important for all areas as without it in inland and southern areas the build up of summer heat that hap pens through the day cannot be removed at night. Hung or hopper type windows on the south are very good as they can be opened at the bottom while top opening windows t the north allow escape of heated air. In semi- tropical and tropical areas openable clerestory windows are advisable to increase the throughput of air to improve the comfort level in humidity.

RULE 6. NO WINDOWS TO THE WEST

This is a universal rule as any west windows will receive summer afternoon sun and raise the internal temperature rapidly. External shade can relieve this as a problem, but it will not stop the winter heat loss.

And the special rules:

Placing the solar storage tank in the ceiling cavity means that the tank can be much larger which means a greater solar efficiency and also the heat loss with this location would be much lower.

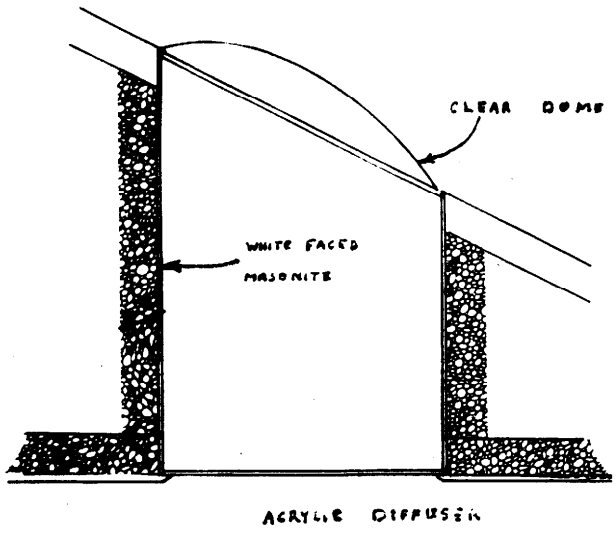
Voltage drop and power loss is a major problem for alternative technology users, particularly where photovoltaic panels and low voltage electrical distribution are used.

Placing the heater on inside walls is always a high priority as heaters against outside walls can increase the heat loss and hence reduce the overall efficiency of the heater.

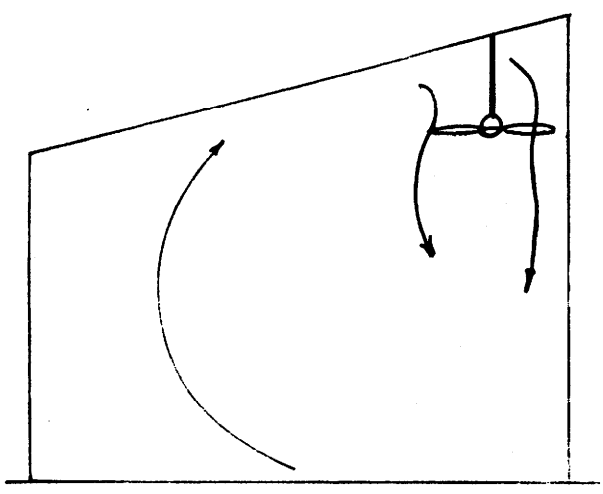
Some of the modifications mentioned may need clarification. The diagrams below may make these conservation tips a little clearer.

The house on its own is only the start as planting around the home can change the comfort of the home, but that is another story for later on.

Note: As all designs are built on a concrete slab, this is assumed in all cases.

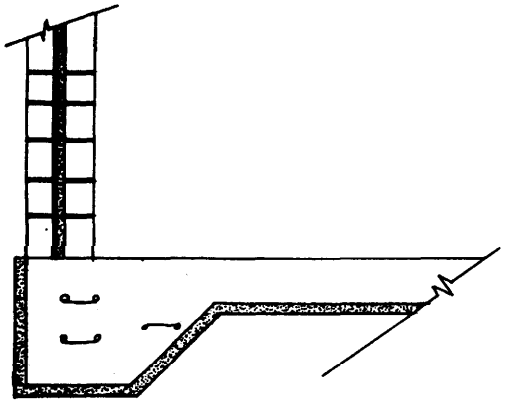


SKYLIGHTS

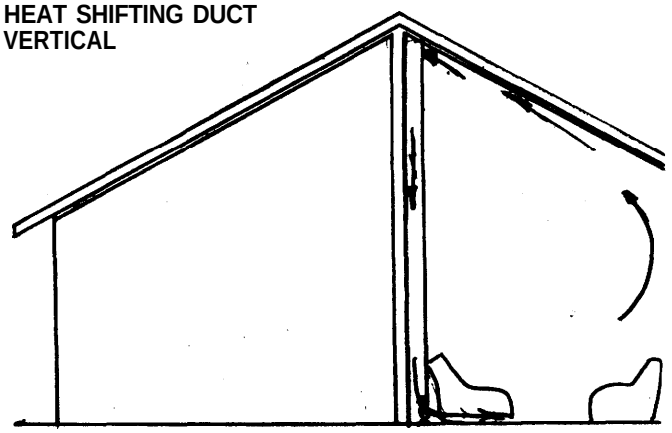


CEILING SWEEP FAN

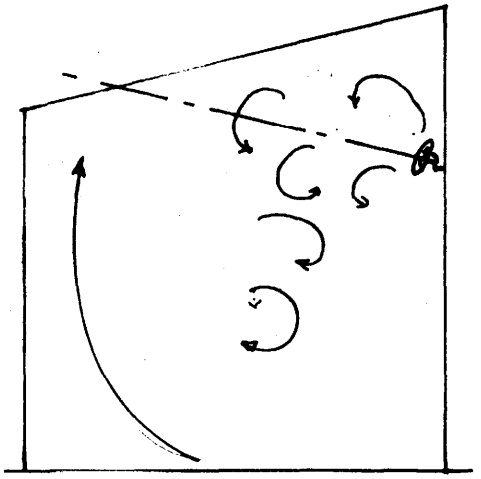
SLAB INSULATION

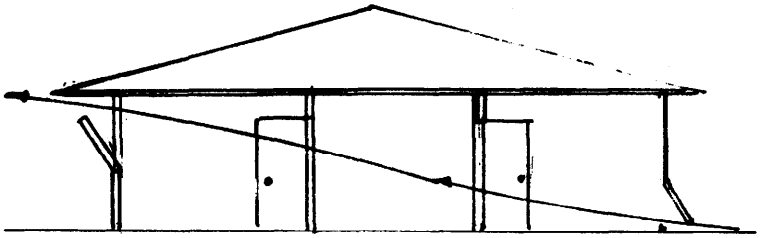


HEAT SHIFTING DUCT VERTICAL

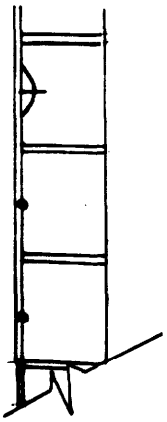


Turbulent mixing air

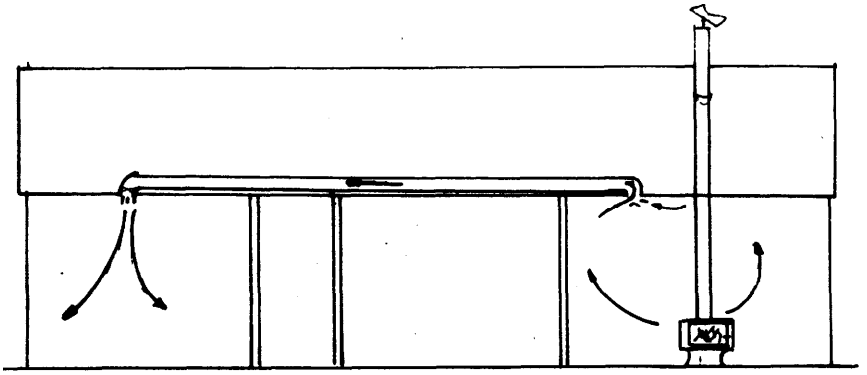




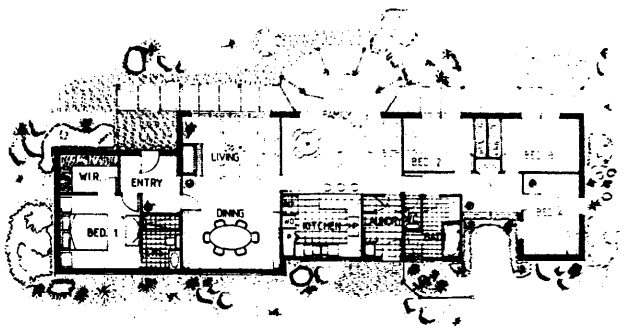
CROSS FLOW VENTILATION



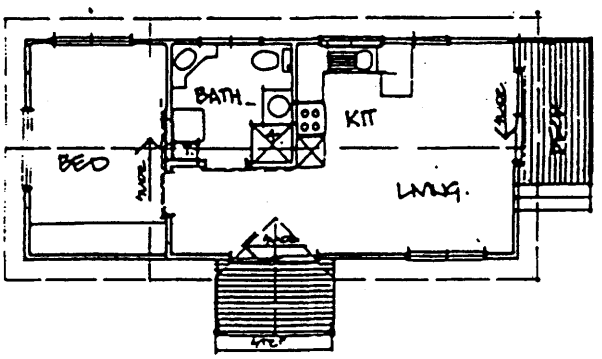
PLASTER BOARD ON MUD BRICK



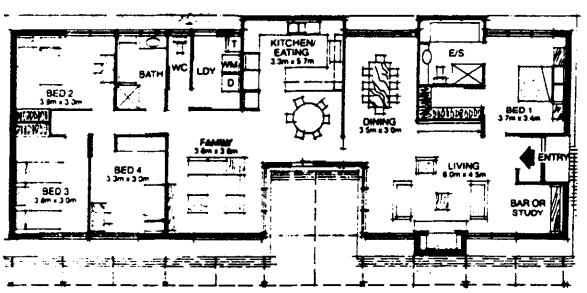
HEAT SHIFTING DUCT - HORIZONTAL



BUILDER Red Hill
MODEL Pavillion
SIZE 200.8m² PRICE $111 175 5 STAR Yes
POTENTIAL DIFFICULTY Lack of interior mass
VARIATIONS NEEDED TO OPTIMISE Insulated concrete slab, brick-wall to living 2/ bed 2. Replace foil in walls with R2 batts Replace R2.5 in ceiling with R3 batts.
SOLAR HOT WATER Yes
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Flat ceiling over Kitchen/ laundry group
HEATING STANDARD Pyrotenax elect in floor and Jetmaster high efficiency open flue.

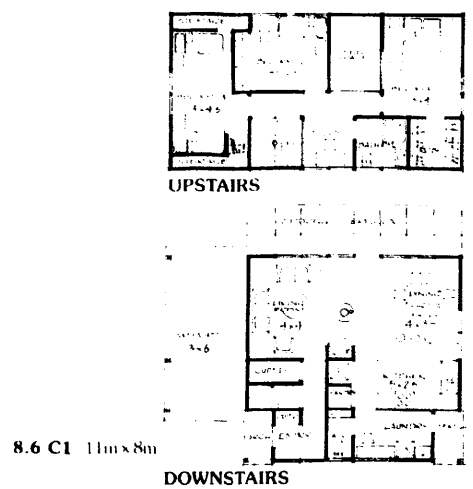


BUILDER Colonial
SIZE 750 feet² MAIN MATERIAL Timber PRICE $22 500
POTENTIAL DIFFICULTY Lack of interior mass - high and windows
VARIATIONS NEEDED TO OPTIMISE 1. Concrete floor 2. Insulation to walls and ceiling (supplied opilin) 3. Buck walls to bathroom.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Layout of this is very good for Solar hot water and Solar Electricity.
HEATING STANDARD Nil
HEATING ALTERNATIVES Pot belly type solid fuel heater.



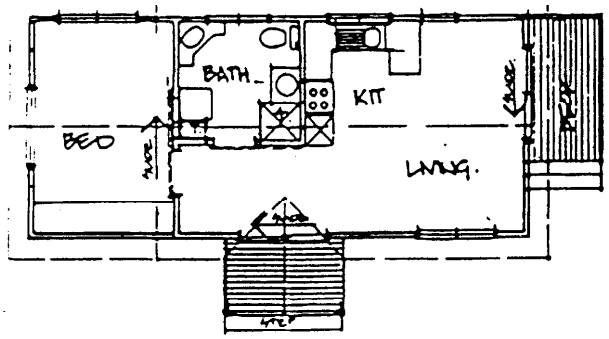
COURTYARD 3
Area: 175m² (18.9 Imp.sq.)

BUILDER Bush Haven
MODEL Courtyard 3
SIZE 175m² MAIN MATERIAL Timber
PRICE $30 640 - $41 720 5 STAR Yes
POTENTIAL DIFFICULTY Racked ceiling, glazed court, fireplace location.
VARIATIONS NEEDED TO OPTIMISE 1. Bath/corridor ldy/family wall to be of brick. 2. Living room/bed/robe wall to be of brick. 3. Flat ceiling over service rooms to allow for solar tank. 4. Upgrade wall and roof insulation.
SOLAR HOT WATER Yes
HEATING STANDARD Open fire
HEATING ALTERNATIVES 1. High efficiency open place with extra insulation to the rear of the fire box for living room. 2. S.C. heater on laundry wall for family room.

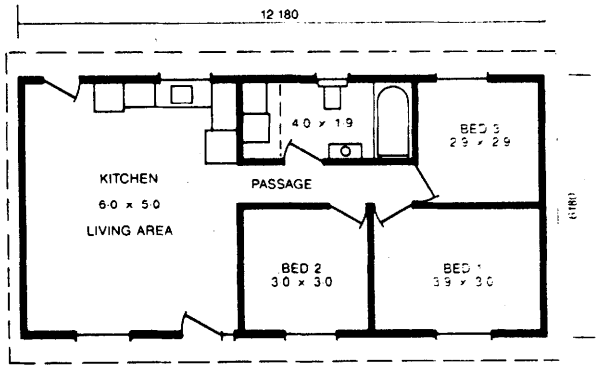


BUILDER Big & Little Solar Homes
MODEL 8.6.Cl
SIZE 156 m² MAIN MATERIAL Timber 5 STAR possible
POTENTIAL DIFFICULTY 1. open space above living area. 2. Low general mass.
VARIATIONS NEEDED TO OPTIMISE 1. heat shifting duct to balance heat levels.
SOLAR HOT WATER No.
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER flat ceiling to bathroom.
HEATING STANDARD Nil.
HEATING ALTERNATIVES S.C. heater with rear register in centre of living room/dining room.

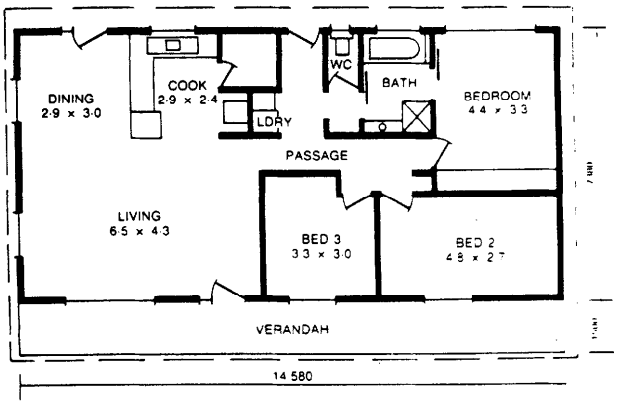
FEATURES



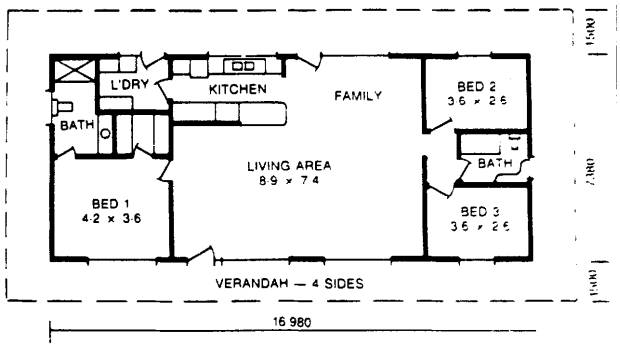
BUILDER Colonial
SIZE 7.5 sq
MAIN MATERIAL Timber PRICE $13 200 to $22 500 5 STAR No
POTENTIAL DIFFICULTY Lack of interior walls.
VARIATIONS NEEDED TO OPTIMISE 1. Remove large areas of glass to the west, 2. Increase glass area to north, 3. Move bedroom window to the north, 4. Wall and roof construction, 5. Increase north eave size 6. Make the west wall interior brick.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Use the option of flat ceiling.
HEATING STANDARD None supplied
HEATING ALTERNATIVES Solid fuel pot belly placed on the west Wall.



BUILDER Aussie Modular Homes
MODEL Burke
SIZE 75.27m^2 MAIN MATERIAL Steel wall frame, timber roof.
PRICE $11 325 to $14 220 5 STAR Possible
VARIATIONS NEEDED TO OPTIMISE 1. Interior brick wall to east wall. 2 Interior brick wall to living/bed 2 divide. 3. Increase eaves to north side.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER 1. In southern states the collectors would need to be elevated (refer to diagrams for a possible effect)
HEATING STANDARD Nil
HEATING ALTERNATIVES Fit pot belly or slow combustion stove to living/bed wall.
NOTE: ADDITIONAL WALL INSULATION AVAILABLE IN DULUXE VERSION

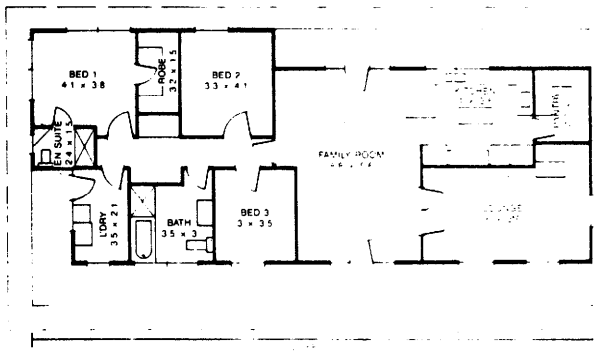


BUILDER Aussie homes
MODEL Eyre
SIZE 107.6m^2 MAIN MATERIAL Steel wall frame, timber truss
PRICE $15 250 to $18 950 5 STAR Possible
VARIATIONS NEEDED TO OPTIMISE 1. Interior brick walls to east wall 2 Increase window size in bed 2 3. Brick wall to living/ bed 3 wall.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Refer Burke
HEATING ALTERNATIVES Refer Burke

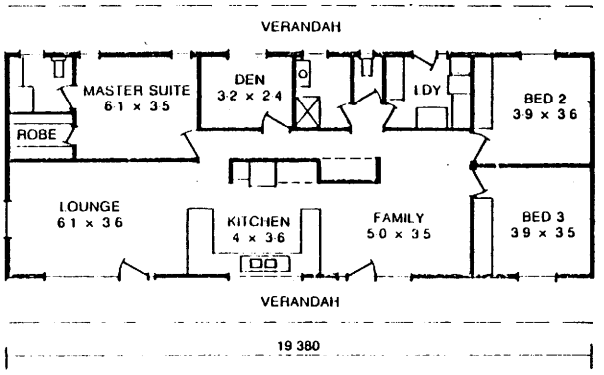


BUILDER Aussie Homes
MODEL Hume
SIZE 125m^2 LIVING 207m^2 total
PRICE $19895 - 24075 5 STAR Possible
VARIATIONS NEEDED TO OPTIMISE 1. Interior brick walls to living area.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Refer Burke.
HEATING - STANDARD Nil
HEATING ALTERNATIVES Fit slow combustion heater to living/Bed 3 wall.

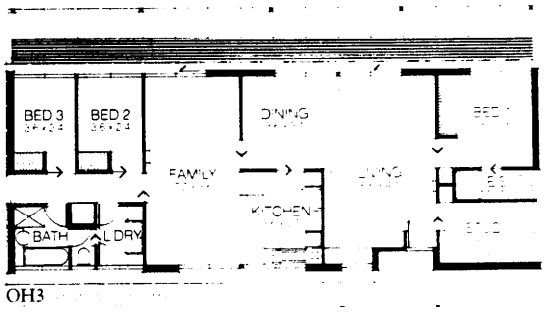
FEATURES



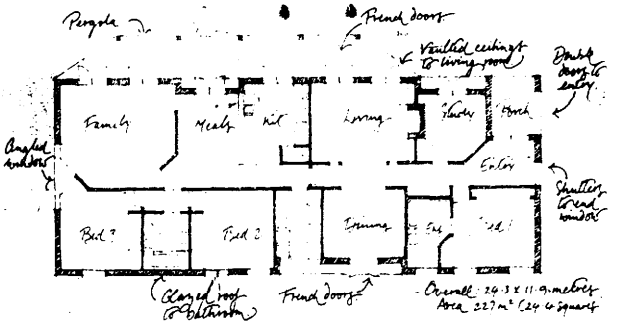
BUILDER Aussie Homes
MODEL King
SIZE 167m² LIVING 187m² total
MAIN MATERIAL Steel frame & timber trusses.
PRICE $25700 - 32485 5 STAR Possible
VARIATIONS NEEDED TO OPTIMISE 1. Interior brick walls to family and lounge rooms. 2. Heat shifting duct from the family room to the Passage outside bedroom. 3. Move west window or lounge to the north. 4. Double hung windows throughout.
SOLAR HOT WATER No.
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Refer Burke
HEATING- STANDARD Nil
HEATING ALTERNATIVES 1. High efficiency open fire to lounge or centre wall 2. Slow combustion heater to family room/bed 2 wall.



BUILDER Aussie Homes
MODEL Sturt
SIZE 141m² LIVING 232m²
MAIN MATERIAL Steel frame, timber trusses.
PRICE $20285 - $25450 5 STAR Possible
VARIATIONS NEEDED TO OPTIMISE Brick spine wall
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Refer Burke
HEATING- STANDARD Nil
HEATING ALTERNATIVES 1. High efficiency open fire to lounge/master suite wall. 2. Slow combustion heater to family/bed 3 wall.



BUILDER Merchant
MODEL OH3
SIZE 148m² MAIN MATERIAL Timber 5 STAR Possible
POTENTIAL DIFFICULTY shallow pitch to roof
VARIATIONS NEEDED TO OPTIMISE 1. improve insulation in wall by using bulk or board insulation in place of foil 2. Choose flat ceiling option. 3. Improve insulation in ceiling with a min R2.5 batt type insulation. 4. Interior-brick walls to living/dining & family rooms.
SOLAR HOT WATER No
VARIATIONS NEEDED TO INSTALL SOLAR HOT WATER Select either intergrated unit or alter roof as shown in "Aussie Homes - Burke".
HEATING STANDARD Nil
HEATING ALTERNATIVES 1. High efficiency open fireplace or slow combustion heater on living/bed 1 wall. 2. Slow combustion or pot belly heater on family/ bed2 wall.



BUILDER Merchant builders
MODEL The gable House GB3P
SIZE 227m² MAIN MATERIAL Timber 5 STAR possible
POTENTIAL DIFFICULTY Skylight in kitchen
VARIATIONS NEEDED TO OPTIMISE 1. Heat shifting ducting or ceiling fan to living room. 2. Increase of window area to kitchen. 3. brick spine wall. 4. Bulk insulation in walls & ceiling.
SOLAR HOT WATER No
HEATING STANDARD Open fire to living room
HEATING ALTERNATIVES 1. Fit high efficiency insert to open fire or slow combustion heater with mar register to family/meals wall.

The Energy Education Centre

The Energy Education Centre is a new education and display centre put together by the Victorian Government.

The idea of the Centre is to provide students (and adults) with a chance to learn about renewable energy and energy conservation through actually experiencing it in working displays and exhibits.

Wideranging.

The EEC includes a large range of displays. The displays on recycling include paper, aluminium, garbage, plant matter and glass. A methane digester shows how organic matter can be used as an energy source. Solar energy is demonstrated for cooking, water heating, electricity and space heating. Wind power, water power and people power are also shown with working equipment and displays.

Targeted.

The primary emphasis of the Centre is for school students, who can be involved in interactive activities with real live equipment. Although the displays are designed for students they have attracted a lot of interest with adults, with many enquiries coming from adults wishing to visit the centre.

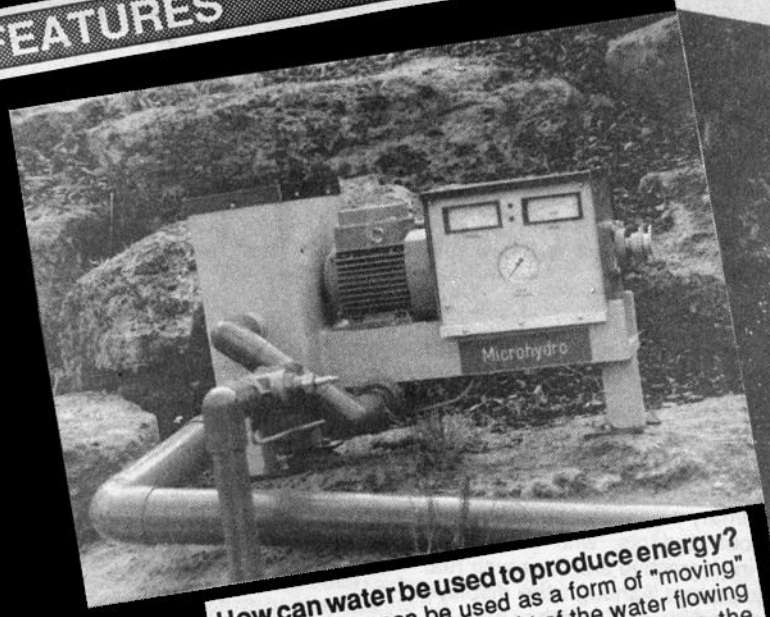
An Antipodean clone.

The EEC has at least partly been inspired by the "Centre for Alternative Technology" in Wales, England. That Centre which we looked at in Soft Technology Number 20, is a large community run display centre which covers areas ranging from renewable energy through to organic gardening. The Wales centre tries to make the links between all the components in our environment, energy, plants, resources, etc showing how rational uses of these can lead to a better world for us all.

The Burnley centre tries to do the same thing on a smaller scale. Although it is a somewhat sanitised version of what was done in Wales, it still does a good job.

We will now have a look at the displays at the Centre, reading the signs as we go. If you want to get more information about the Energy Education Centre then write to the Energy Information Centre, at 139 Flinders Street, Melbourne, 3000. Alternatively you can ring them on (03) 650 1195

The Energy Education Centre at Burnley Gardens receives it first wave of visitors when officially opened in September.

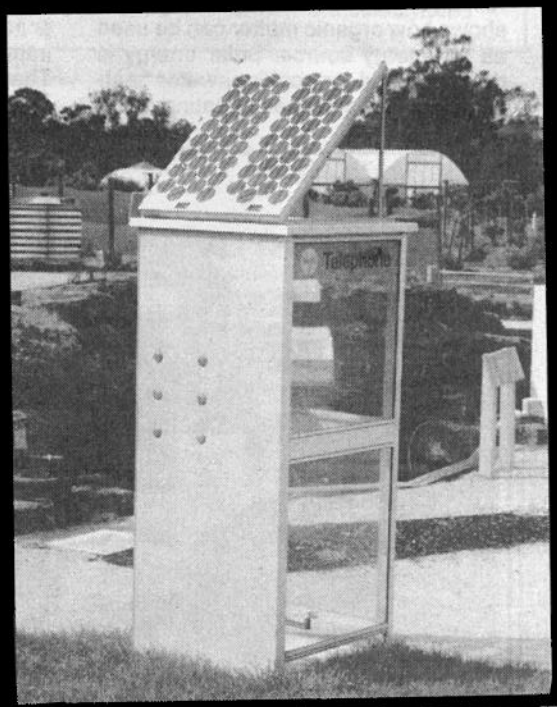


How can water be used to produce energy?

Falling water can be used as a form of "moving" or kinetic energy. The weight of the water flowing into the buckets of the waterwheel causes the wheel to turn and this can be used to do work. A high pressure jet of water pushing against the cups of the micro (small) hydro (water) makes the wheel spin at a high speed. This can be used to produce electricity.

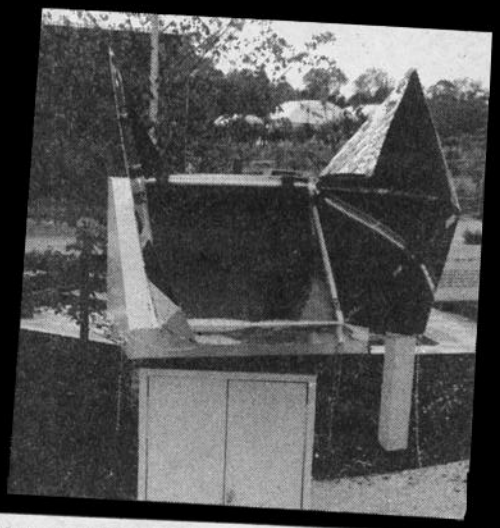
Which materials can best store the sun's energy?

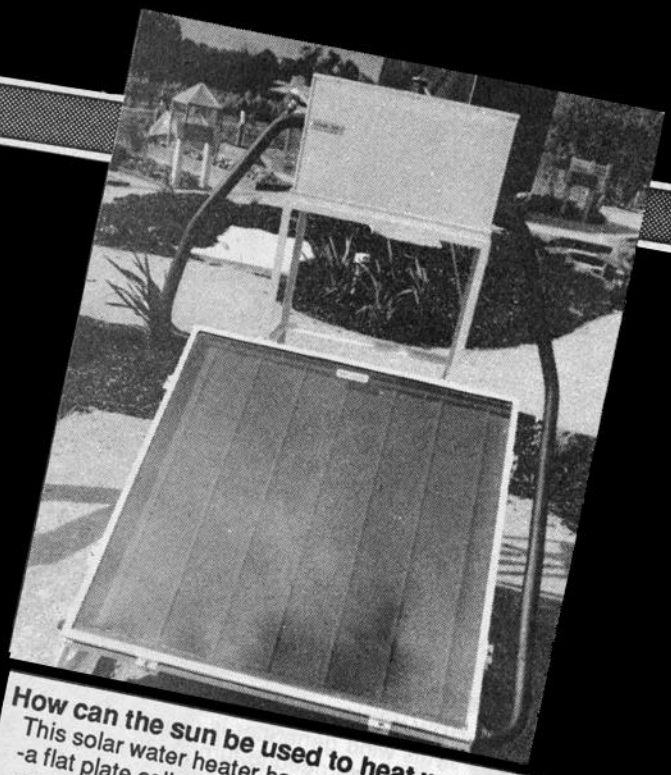
Each box is filled with a different material with a thermometer reading the temperature from the centre of the box. The suns energy can be collected as heat and stored in the boxes. The heavier the material and the greater its mass, the better it is at storing heat.



How can the sun's energy be used to power a telephone?

Solar energy is being used in many isolated areas of the country to supply the power for telecommunications. The two photovoltaics modules attached to this system provide the energy to power the electronics to operate this phone.





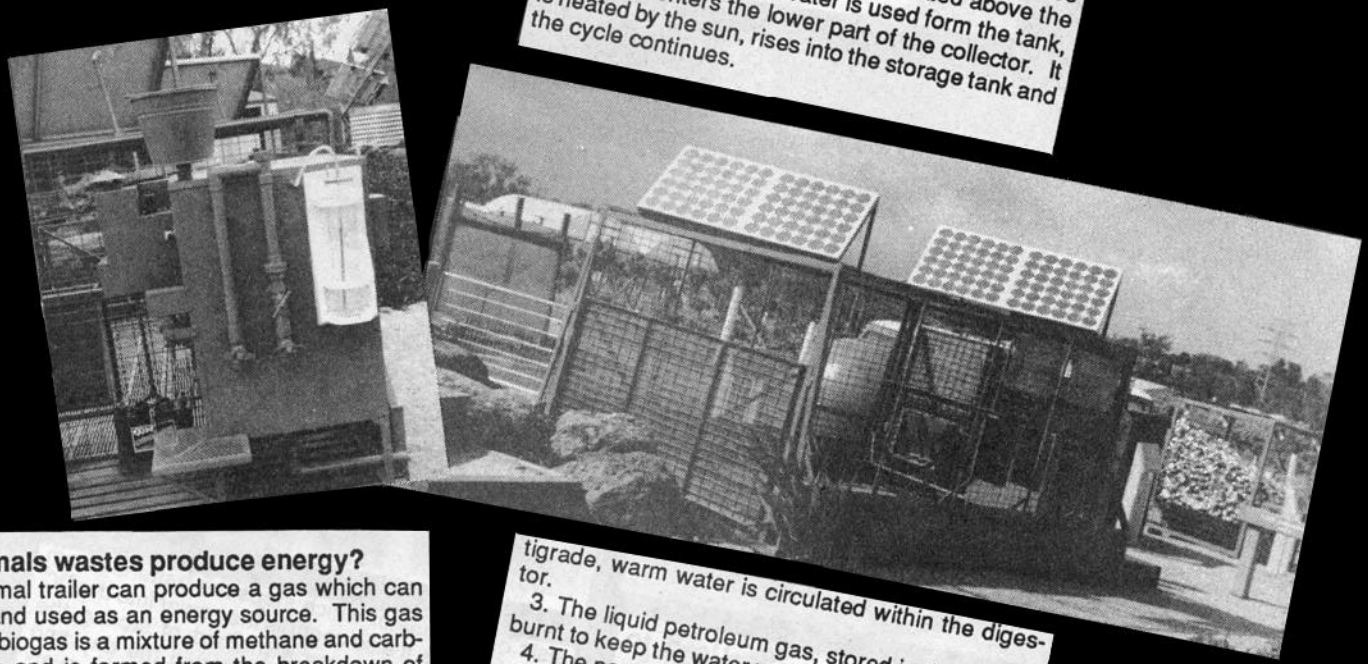
How can the sun's energy be used to bake food?

The sun's energy in the form of light, enters the oven and is changed to heat energy. Large reflectors help to concentrate more energy through the glass surface. As more heat is captured within the oven the temperature increases and slowly cooks food (eg: roast chicken).

How can the sun be used to heat water?

This solar water heater has two parts:
-a flat plate collector
-a storage tank.

This simple hot water system shows the Thermosyphon Principle. When water is heated, it rises naturally and flows into the tank located above the collector. As the warm water is used form the tank, cold water enters the lower part of the collector. It is heated by the sun, rises into the storage tank and the cycle continues.



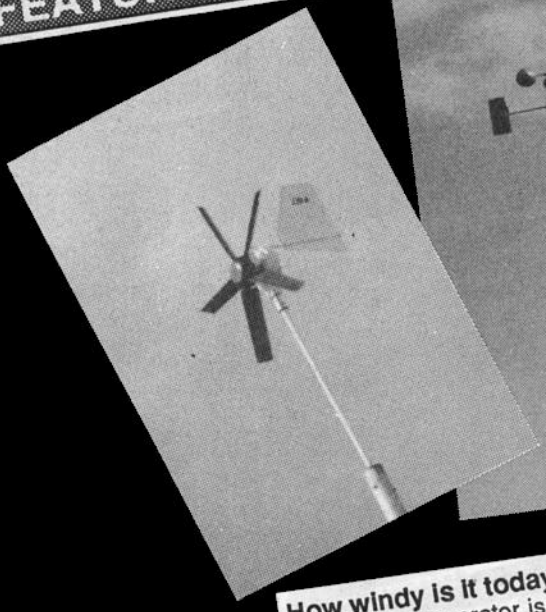
Can animals wastes produce energy?

This animal trailer can produce a gas which can be burnt and used as an energy source. This gas known as biogas is a mixture of methane and carbon dioxide and is formed from the breakdown of animal and plant wastes by bacteria.

1. The animals produce waste material which is fed into the digestor with some water.
2. The bacteria break down this material in the digestor.

The bacteria prefer warm, airless conditions. To keep the temperature at a constant 35 degrees centigrade, warm water is circulated within the digestor.

3. The liquid petroleum gas, stored in the tank, is burnt to keep the water warm.
4. The power to circulate this warm water around the digestor is provided by the sun from the solar panel.
5. The solar energy from the panel is stored in the battery, so that water can be continually circulated, even when the sun's energy is not available eg:at night.
6. The methane gas produced by the bacteria can be seen bubbling through the gas outlet.

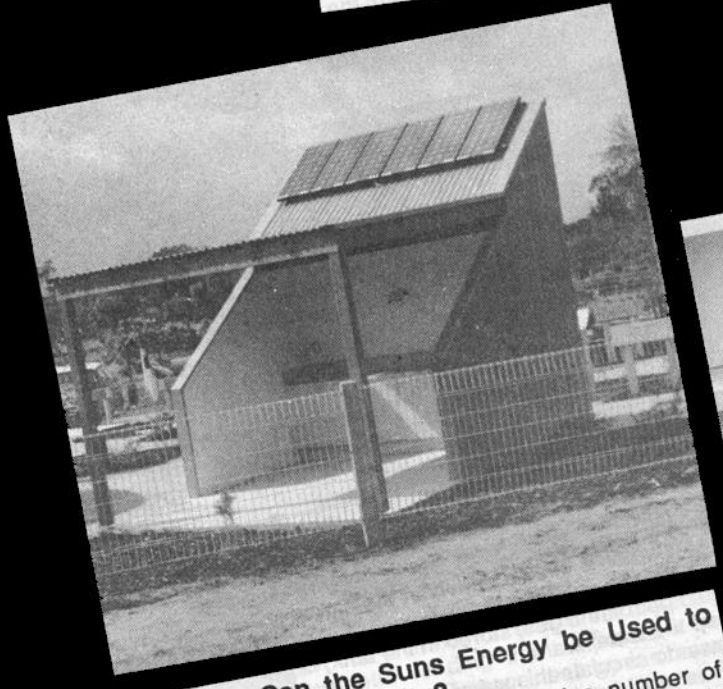


How windy is it today?

This wind generator is called a Savonius Rotor. Its does not need to turn to face the wind and will spin in winds from any direction. It is often used in pumping water because it spins slowly. The monitoring equipment gives us information about voltage, power and total energy over the day. It also has a wind speed indicator and a wind direction vane.

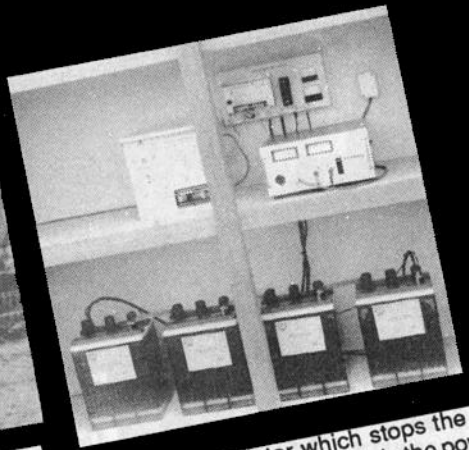
How is a garden an example of recycling?

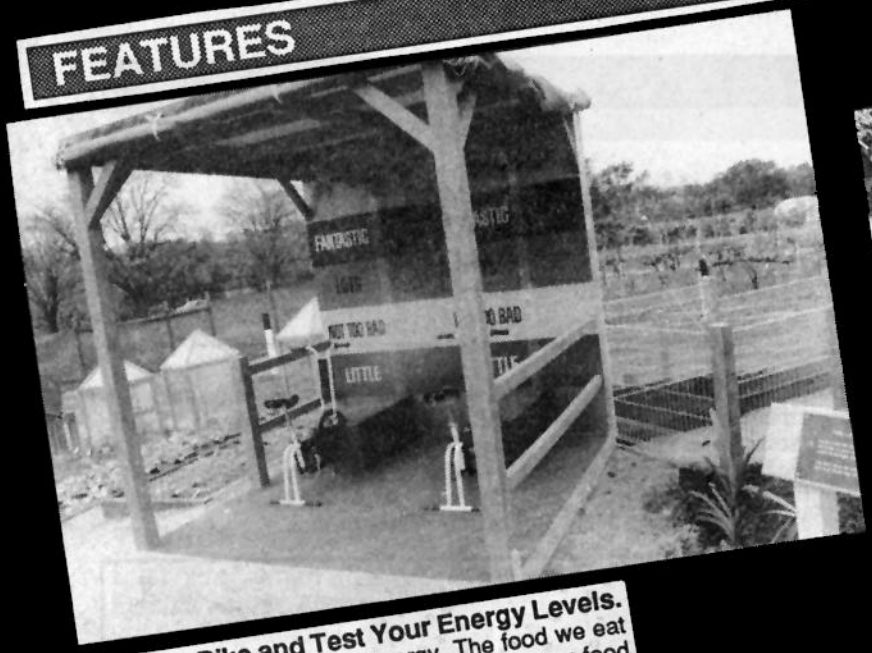
This vegetable garden is a good example of how nature recycles energy gases, water and minerals. In sunlight the green leaves take in a gas (carbon dioxide) from the air and water and minerals from the soil. By a special process they make food for the plant. When leaves fall off the plant or compost is added to the soil, this matter is broken down by decomposers, like bacteria or small animals, into minerals which can be used again by plants.



How Can the Suns Energy be Used to Produce Electricity?

A solar module is made up of a number of photovoltaic cells. These cells have the ability to produce electricity (voltaic) from light (photo). The controller connects and protects the system. It consists of a regulator which stops the batteries from overcharging. It also controls the power into the DC load. The batteries are a method of storing the electricity. They are charged during the day and supply power when it is needed, such as on overcaste days or at night. The solar cells produce direct current (DC). Many appliances run on Alternating Current (AC) electricity and the inverter changes DC to AC current.





Pedal a Bike and Test Your Energy Levels.

Humans need and use energy. The food we eat is the fuel for our bodies to grow. Energy from food is stored in our bodies as chemical energy and converted when we do an activity. The more active the more energy you use, while different aged and sized people also use different amount of energy.

How can the sun's energy be used to cook food?

This solar barbecue uses a large dish to focus the sun's energy along one central area. By concentrating sunlight, higher temperatures can be reached. Ideally the collector should follow the sun's movement across the sky to get the most direct energy.

How can plant wastes be recycled?

Plant matter, such as vegetables or fruit peels, are very rich in nutrients. Compost is the breakdown and decay of this plant matter.

It is very useful in a garden because-

-the nutrients and elements help plants grow

-it helps retain moisture in the soil

-it increases the earthworms in soil

How can we save energy by recycling cans?

We can buy many sorts of drinks in aluminium cans today and they are excellent for recycling. By recycling we save a valuable mineral ore called Bauxite. We also save energy, the most expensive part of making cans.

How can recycling paper help save our forests?

The paper we use in newspapers, books and packaging comes from trees. The more paper we use, the more trees we need to cut down. Used paper can be pulped and reused in the making of cardboard. Recycling paper makes good sense for the environment.

continued on page 27....

News, Events and Activities from the Alternative Technology Association

Well, here we are...what do you think of the new format for "Soft Technology"? As you can see we have finally got around to the new improved version thanks to the (at times somewhat dubious) wonders of desktop publishing.

We could have started typesetting Soft Technology a long time ago however the cost was too high for us to afford. With desktop publishing the cost is almost the same and so we end up with a better looking magazine which contains more information (because the letters are closer together), at the same cost.

As you might remember from the last ATA report we used design ideas from such impressive titles as Business Review Weekly and Australian Society.

Hopefully this won't make us look too formal, however we will be fine tuning the design of the magazine over the next few issues, so if you have any comments please get in touch.

On the practical side we are putting a new bank of 500 Amp Hour batteries into the Solar Workshop. Also a lathe will be added to our already substantial arsenal of tools and it will shortly be available for people to use.

We are also tidying up both the workshop and the display trailer in preparation for the Solar Energy Societies conference "Environmental Improvement through Solar Energy".

We will be taking interested delegates from the conference, through the workshop, to show them what a group of determined people can achieve in berms of a practical, living demonstration of renewable energy.

The display trailer will be making its first appearance at the Solar Conferences exhibition complete with two pop up windgenerators, solar electricity, working water power equipment, and displays on house design, methane digestion, recycling, solar water heating, ap propriate technology and solar food drying.

Stop it or you'll go blind!!! Well not exactly, these earnest little faces pering though their safety goggles belong to students at our last home welding workshop.

On the policy, area we like many others, have turned our minds to the problem of the Greenhouse Effect. The article in this magazine gives you a short but concise outline of the problem and some solution. We have been doing some other research on the topic and are trying to convince some politicians and bureaucrats that they should be paying more attention to energy conservation and renewable energy.

Also on the Greenhouse effect we have just agreed to help fund the printing of 10,000 leaflets on the issue of the Greenhouse Effect and Nuclear energy. The leaflet which is called "Cooling the Greenhouse" will be distributed to persons attending the Greenhouse 88 Conference as well as a large number of community groups.

Lastly at this time of the year, we start planning for next year. We are going to place a higher priority on weekend and evening workshops next year.

Some of the topics we thought may be a good idea are "Home Welding Skills" (we have this one down pat now), "Putting together a Solar Electric System", "Make your own Wood Heater", "Basic Lathe Use", and "DIY Water Supplies" (including how to make your own water tank).

If there are any other areas you want covered please let us know.

THE ROCKET

by Ian Sims.

How to have fun building an electric vehicle.

Last year when the Australian Electric Vehicle Association held its yearly Electrathon - a competition to see who could build a vehicle to go the furthest with 25 Kg of batteries, my son Paul and I decided to build a machine for this year's event.

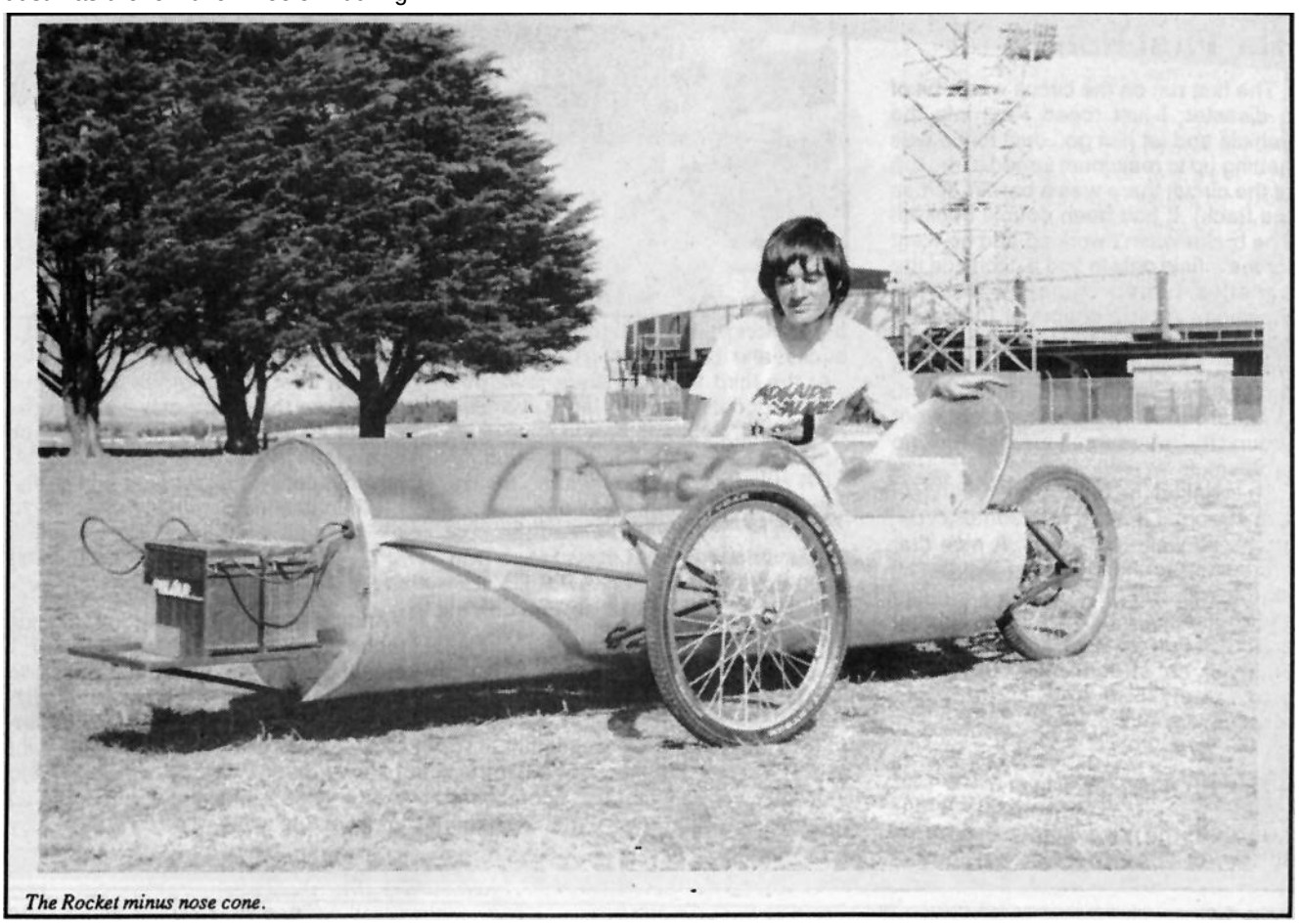
The original idea was to have a low two wheeler with a perpetual motion machine to keep the battery charged up while running! The first idea to bite the dust was the low two wheeler - during rolling trials it was found to be a doodle to steer sitting on top of it, extremely difficult to balance sitting upright in it, and almost impossible when lying down in the designed driving position. So out came the hack saw and welder, and our two wheeler became a three wheeler.

The Design.

After dropping the idea of a perpetual motion charger and deciding that the vehicle should be as simple as possible and fun to make, I started work. The basic chassis was a cylindrical tube made with four hoops of 18G x 1/2" square steel tube connected with 6 runs of the same, top, bottom and two each side. The hoops were bent around an old MG wheel rim and ended up about 18" in diameter. A 6 x 3' sheet of galvanised steel was pop riveted to the bottom 2/3rds of the tub to strengthen it and provide the outer skin.

The brilliance in the design concept was that beside being low drag etc, it should also be designed for the corners in the circuit - ie. it should go around the corners without having to slow down and then accelerate - the reasoning being that power required varies as the speed cubed and therefore any variation in speed is detrimental to efficiency.

So we selected the 20" BMX bicycle rims and made special wide hubs for them out of an old 3" bar of high tensile steel. That took Paul a few hours on the lathe! However with $5 worth of chrome plating, a couple of 1/2 price



The Rocket minus nose cone.

chrome alloy rims and set of 12 gauge spokes they looked terrific.

The hubs were fitted with 1/2" shielded bearings and I welded the heads of 2 1/2" bolts together to form the stub circle and King pin. There is no suspension as I believe most suspensions absorb power - especially those with shock absorbers. The toe out on the corners was made adjustable and the steering linked to handlebars for quick response and feel. King pin inclination was aimed for zero offset and castor 15 degrees to give really good feel to the steering. Brakes were a couple of contrasting bands on little screw on drums - just adequate.

The piece de resistance was the motor, control system and transmission. The motor was a unmodified car generator, the control system an old dip switch (on - off) and the transmission a single speed fixed bicycle chain and sprockets. Rationale was that any transistor control must waste power (besides being expensive) likewise gearboxes, and we were going to travel at a fixed speed any way. Batteries were fitted at front to improve cornering.

The First Run

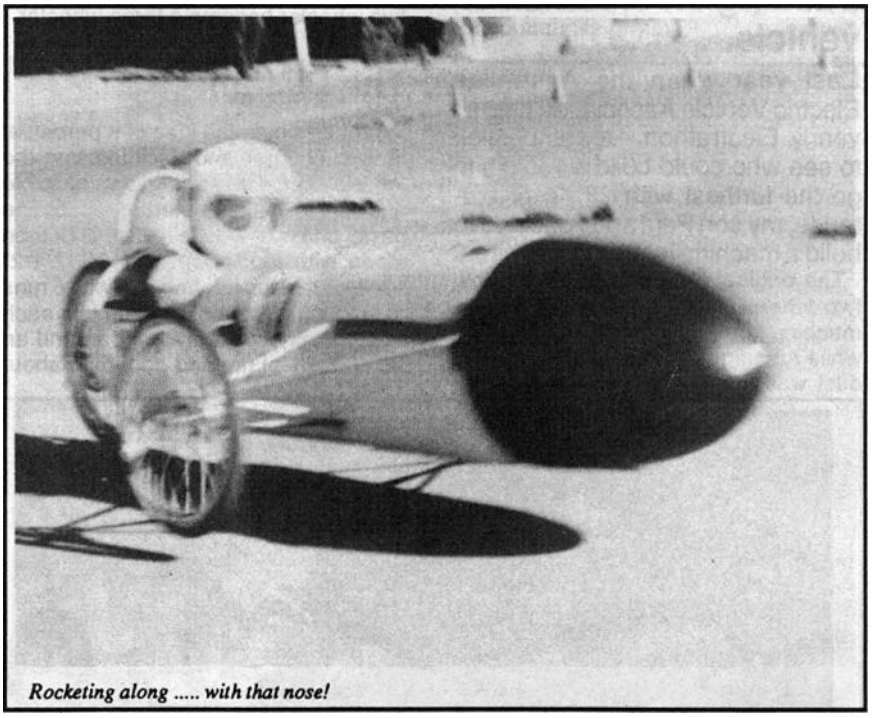
The first run on the circuit was a bit of a disaster; I just roped Paul into the vehicle and let him go. Just as he was getting up to maximum speed at the top of the circuit there was a barrier across the track! It had been double booked! The brake wasn't working and he went for the infield only to find a ditch and the batteries parted company with the machine. After a couple of frustrating hours the driving school went home and we ran. I found duct tape doesn't hold battery acid in very well - minor point. With ordinary bicycle tyres it went around the roundabout at full speed, no problem.

So I yanked the battery out of the MG and strapped that on with some "occy" straps as well - 36 volts. A nice drift around the roundabout and the generator was just warm.

At the second trials we were lapping at 36 KPH on 24 volts and 44 KPH on 36, with no streamlining, using approximately 530 and 1,260 watts respectively.

The Nose.

Next was the nose. After consulting a number of tests I decided on an oval shape like a football. So I drew an ellipse with the two pins and a piece of string and cut out a female former from plywood. We then put a bucket on top of a four gallon drum and proceeded to cover them with plaster to make a fibre glass mould. We ended up using three bags of plaster and an equal amount of sand and PVC powder before we had enough to form a male mould. After endless rubbing down of plaster and fibreglass I discovered I had been so slack with my sealing and waxing of the mould that it wouldn't come out! It took a very long time to dig out the drum, bucket and all that plaster!



Rocketing along ..... with that nose!

At the third trials we were rewarded with a doubling in efficiency with the nose cone, Paul was now lapping at 39 KPH on 24V using 340 watts, and 47 KPH on 36V using 580 watts. So we decided to use three small batteries for the event. Next we changed the outside ordinary 40 P.S.I. bicycle tyre (run at 60 P.S.I.) for a BMX 85 P.S.I. "slick" run at 100 P.S.I. - surprise - no drift at all!

The Race.

Race day was real excitement. To make it a bit different to the other vehicles we painted it a fluorescent green\yellow, and before the race The Sun selected it for photographs and an article. In a demonstration run for the camera, the new three phase contactor I fitted in place of the old dip switch to satisfy the regs, welded itself on. So I spent a frantic 1/2 hour or so pulling it out from the depths of the Rocket working our how it came apart, fixing it and shoving it all back together, only to be abused by the starter for being late up to the line!

Paul led the field of sixteen through the first corner and after two laps started lapping the field. By half time he led the entire field by five laps, however he had to slow down to less than half speed a number of times when slow vehicles were in front of him on the corner and each time the ampmeter went off the end of its scale when he switched on again until he got back up to speed. At fifty minutes he lost the lead and at fifty-five minutes the batteries gave up.

After...

After the race I borrowed a balance tacho from work and whipped up a small dynometer using a small disc brake to absorb the power. I discovered that the old Lucas C45 generator we were using was putting out over 1 Kwatt on 36V at 60% efficiency and was only 33% efficient at our intended input of 680 watts. The 60% efficiency

spanned just 300 RPM from 1700 to 1300 RPM.

Next I tested the smaller Lucas C40. It was over 50% efficient between 650 and 1,650 watts input with a span 2,350 to 1,300 RPM, and a peak of 66% @ 1,080 watts.

Two Hour Races.

As a consolation for people who had vehicles built for the previous Electrathons which were 2 hours duration (same 25Kg battery weight) the AEVE organised a 2 hour event. By this time we had fitted a 5 speed rear hub and the smaller C40. On 20 amp and 24V it was giving just over 50 %, rising to a maximum of 60 @ 30 amp. Power was only to be used for about 2/3 of the circuit. At the last minute the circuit was changed to one with a hill in it. (double bookings again). This time there was a greater spate of flat batteries. For the first race I had a box full of spares including spare motor and wheel which was not touched. This time Paul had a puncture part way through the race I had a mad scramble to get the wheel tyre and tube off, find another tube and tyre, fit them and pump it all the way up to 100 P.S.I.! Despite this mishap Paul drove a superbly judged race to finish second just one lap behind the leader who was using a permanent magnet motor and a solar panel. For next year we will try sticking some rare earth magnets in the **C40.**

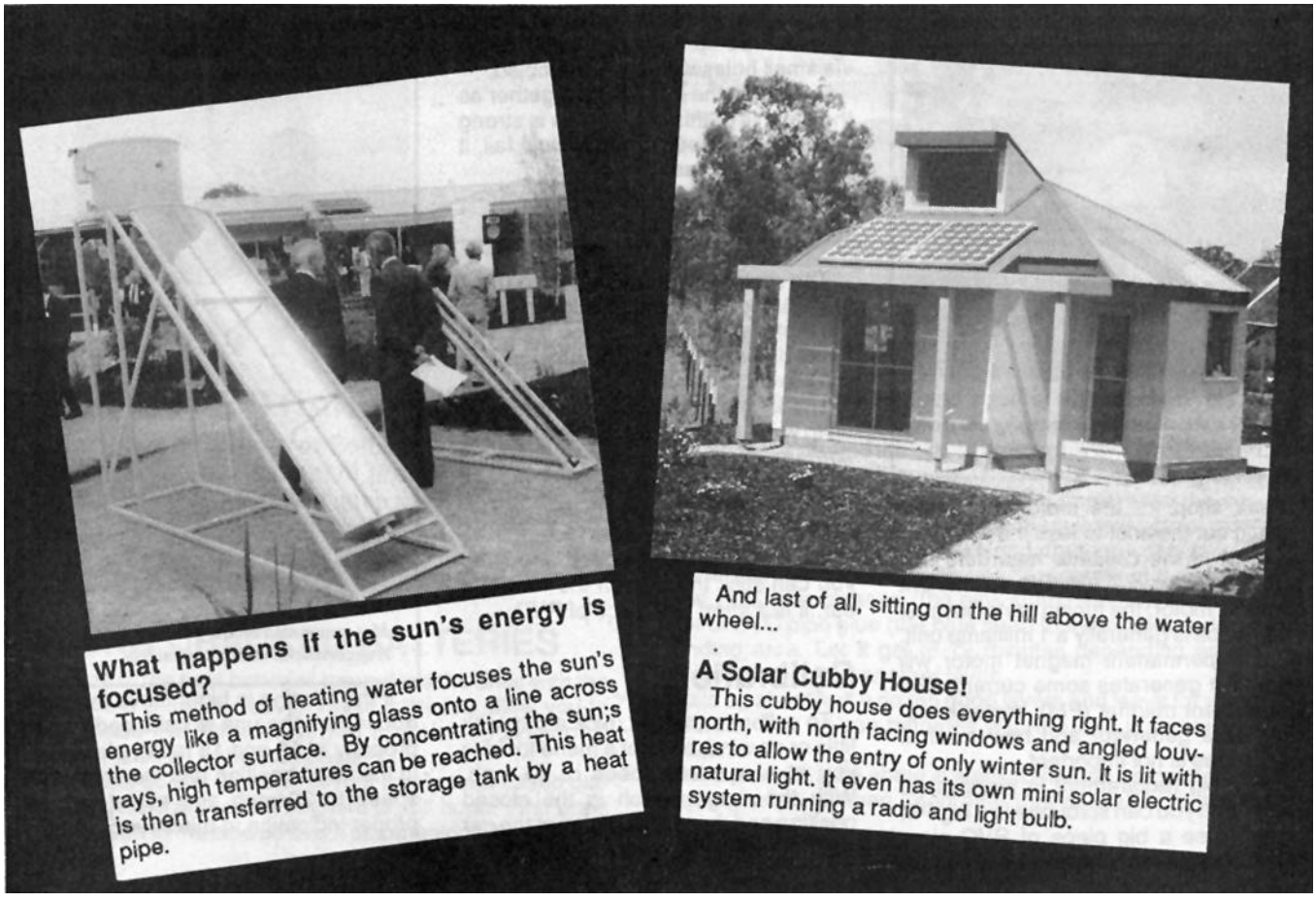
If you compare a motor car with a push bike there is something wrong. Why do we persist in carting a ton of metal around with us? Is it a security blanket? Not for the person who gets hit with it! With an all up weight of 60 Kg including batteries and motor the Rocket shows what can be done with old technology. All that is needed in addition for pollution free transport is a windmill or solar bank at home and you would have a range of 80 Km at approximately 40 KPH or a 50 Km at 50 KPH without sweat!

Incidentally I tested the C40 using a 7 1/4" saw blade for a brake disc and gave up trying to turn off the teeth (for safety) when I was only 1/2 way (hard going). Even with the resulting blunt teeth the motor sawed through wood easily, pulling only 15 amps on 36V - a good soft tech workshop motor!

Paul and I are always pleased to talk to people about the details of the Rocket or generator/motors.

Our address is
69 Mountain Gate Drive,
FERN TREE GULLY,
Victoria 3156. ph.758 5541

The Energy Information Centre: continued from page 23.



What happens if the sun's energy is focused?

This method of heating water focuses the sun's energy like a magnifying glass onto a line across the collector surface. By concentrating the sun;s rays, high temperatures can be reached. This heat is then transferred to the storage tank by a heat pipe.

And last of all, sitting on the hill above the water wheel...

A Solar Cubby House!

This cubby house does everything right. It faces north, with north facing windows and angled louvres to allow the entry of only winter sun. It is lit with natural light. It even has its own mini solar electric system running a radio and light bulb.

A SIMPLE ANEMOMETER

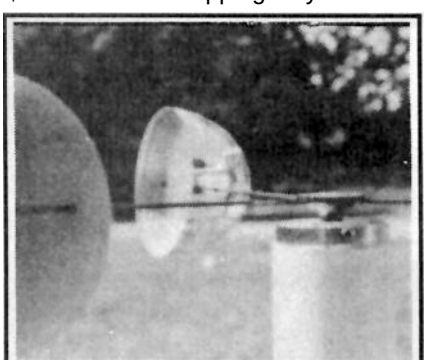
Here is a beautifully simple design for an anemometer.

This could be ideal for people considering the use of wind power, who want to get an idea of the amount of wind energy available on their site.

But remember it will only give you an idea of the energy available, you will need to use an anemometer that monitors wind levels around the clock to get a really accurate idea.

Parts.

All parts are available at most electronic stores and plumbing shops. The cost of all parts would run about $40 but a little shopping at your local



Here's the motor. Try scrounging one from an old cassette recorder.

repair shop for the motor and meter would cut the cost to less than half.

Most of the cassette recorders use the same basic 7 volt DC permanent magnet motor; the tuning meter in most CB radios is generally a 1 milliamp unit.

Any permanent magnet motor will work if it generates some current. The permanent magnet (PM) motor is acting as a generator and how much it generates is not important.

The big requirement is its physical size. If all you can scrounge is a big PM motor, use a big piece of PVC pipe. That also doesn't have to be a certain size, as long as it isn't so ungainly that you can't use it.

Sources include tape recorders, cassette players, small garden tools, electric toys, almost any of those useless Electric convenience items you see around Christmas time, small record players (kid's units, etc.).

I'm sure that a little creative thought will come up with dozens of other sources, but this is the general idea.

Range switching.

The switch S-l is a range switch. The original unit was set up to read **0-15** mph with the switch in the closed position and O-30 mph in the position shown in the drawing. The cap C-l is to damp en out the meter oscillations. R-l and R-2 are the calibration pots and should be mounted so they may be adjusted via small holes with unit assembled.

Don't glue the PVC joints together as the push fit of this plastic pipe is strong enough and, if some part should fail, it sure makes it easy to work on.

Motor mounting

The motor will probably fit into the 1 1/2" PVC pipe. If the fit is loose, wrap the motor with tape; if it's too tight, use a hair dryer and soften the tubing. This will allow it to stretch.

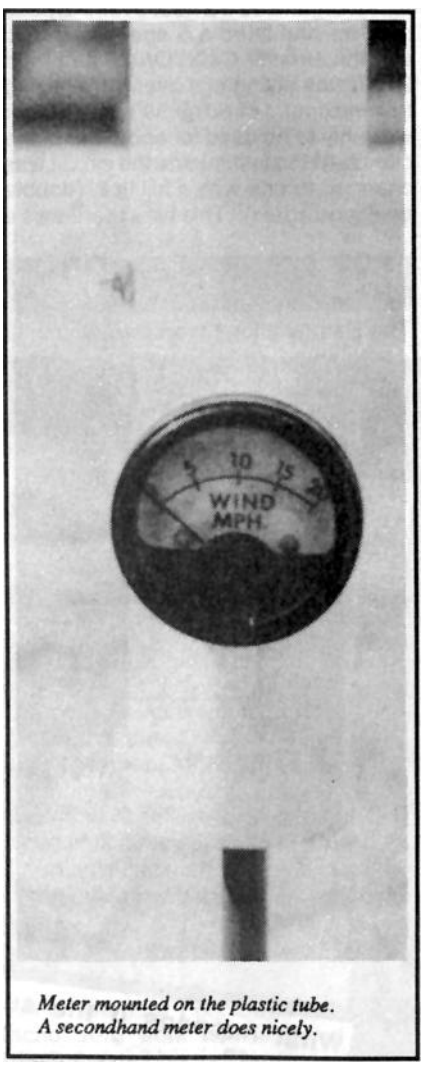
The length of the pieces of tubing is up to you. Just be sure that the top section is long enough so the wheel doesn't hit you in the head when you try to read the meter.

The suction cup was not on the original. This is an added goody so you can stick the unit on the roof of a car. It is a short (6") piece of PVC.

Calibration.

To calibrate the unit, pick a day with little or no wind, and get a friend to drive you at a constant speed of 10 mph. With the range switch in the closed position and the unit stuck out of the car window, adjust the pot, R-1, to indicate 10 miles per hour.

Now increase the speed to 15 mph and note the reading. If the indication is too low, move the cups in on the spokes a little and repeat the operation.



Meter mounted on the plastic tube. A secondhand meter does nicely.

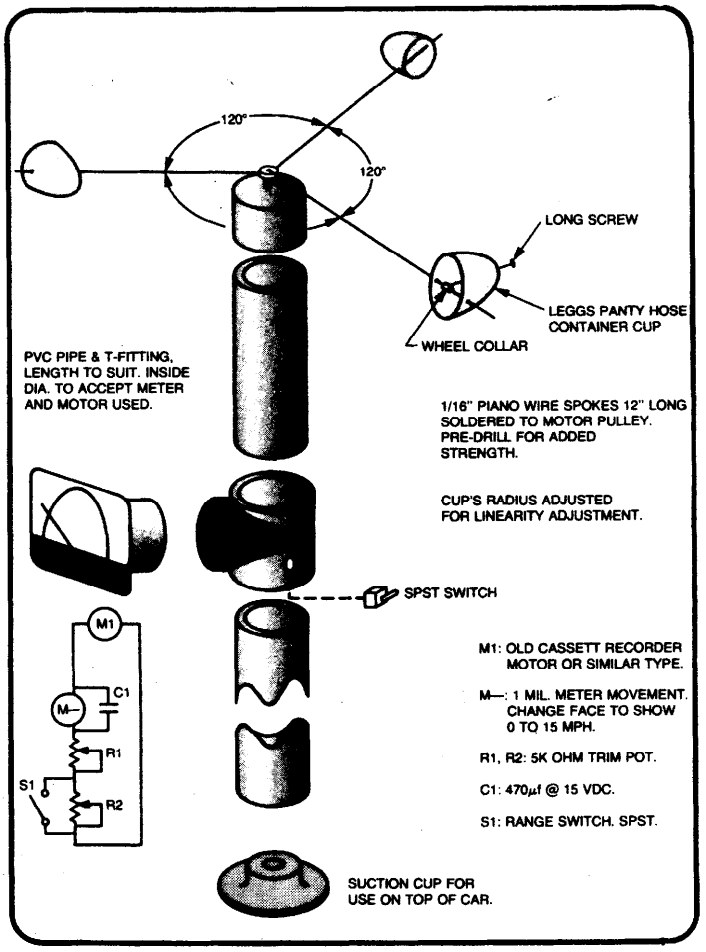
If the reading is high, move the cups out. Once the unit is balanced (reads properly at 10 and 15 mph), place S-1, in the open position and increase your speed to 20 mph and adjust R-2 for proper indication at this speed.

Finally

One final note about the mount. The one indicated is slick but not essential. You can use a pole or a car antenna mount or most anything else that will support the anemometer. Only criteria are that mount be strong enough to support the unit and it allows you to read the meter.

This article is an edited version of an item written by Fred Chappa, in RC Modeller, Volume 15, No 4, 1978.

Right: circuit and assembly diagram for the simple anemometer.



HANDYHINTS.

THIS ISSUE'S HANDY HINT

This is a new column of Soft Technology. Handy hints that can get you out of trouble or help make life that little bit easier. We have a few up our sleeve which should keep you interested, however if you have a handy hint you would like to contribute then please send it in.

FIXING CRACKED BATTERIES

Some of the best batteries around are the ones with the nice clear perspex cases. These batteries allow you to see inside the batteries so you can pick up signs of ill health, such as battery sulphation.

So what do you do if one of your lovely clear cased batteries gets cracked! Well there is still hope. First drain off enough of the acid so that it stops leaking through the crack. Clean off the acid and rinse it with plenty of clean water.

Dry the case around the crack throroughly and roughen the area with sandpaper. It may be worthwhile scratching out a shallow V along the lines of the cracks to increase the surface area for the glue. If at any stage there is any sign of more acid oozing out of the crack wash and dry thoroughly.

Once you are satisfied with your preparation, splash on some PVC pipe cleaner, (the pink stuff). Next apply a thick layer of PVC pipe glue (the blue stuff) to the cracks and surrounding area. Let it gel (8-12 minutes depending on the climate), and put on another layer.

Build up about half a dozen good layers and leave for about 12 hours. Top up you batteries with the acid you removed earlier.

The patch will take about a week to harden completely so treat it gently until then, (and after that as well). Good luck and happy gluing.

SOLAR POWER

A REVOLUTIONARY NEW APPROACH.

Recovering Mechanical Power from Low Grade Heat Sources.

by J. Thillaimuthu

It is well known that solar heat collector panels using water or special fluids have efficiencies of up to 90% whereas the best direct thermoelectric (silicon) panels are limited to efficiencies of 11% to 18%.

The inherent difficulty with fluid media solar panels is that the heat is low grade, suitable only for hot water systems, swimming pools and the like. However thermodynamic power is technically feasible if the hot water is used with low temperature boiling liquids such as freon and other refrigerants. But the high cost, hazards and power required for compression and recycling makes it unsuitable for general application.

AMMONIUM HYDROXIDE - DISSOCIATION AND ABSORPTION

Whilst researching on a unique new ammonia pulping process for the paper industry, it was discovered that ammonium hydroxide dissociates rapidly at temperatures 60 degrees to 90 degrees centigrade to produce workable pressures 40 - 100 psi (2.8 - 7 kg/cm2) to drive motors and turbines. Chemists have long known that ammonia

(NH3) gas is rapidly absorbed by water exothermically and dissociated endothermically when pressure is reduced. (The principle is used in certain refrigeration systems)

Experiments are being done in the US for recovery of waste heat from power stations on a large scale with turbines, but that is a different story. On small and medium scale applications for outback houses, isolated farms and industries, the pressurised gaseous ammonia can be used to drive suitable sized piston engines and vane type rotary motors in the range of 5 hp to 100 hp to meet the requirements.

The diagram shows the basics of a system for a rural application producing 10 kw. Fig. 1 represents the solar panel system connected in parallel such that the heated water is drawn out by a pump 2 and fed into the heat exchanger coil and returns to the solar panels. Optional storage for hot water is omitted to simplify the diagram.

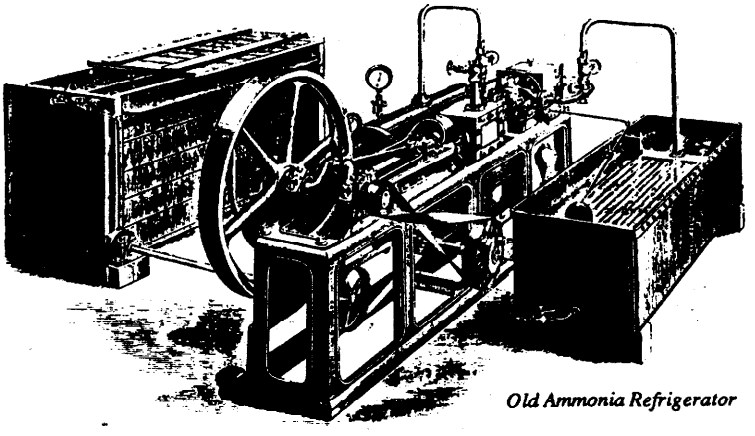
The heat exchanger or boiler is a vertical pressurised steel cylinder for up to 150 psi (10.5Kg/cm²) as in Fig. 3. and is filled to near the top with concentrated aqua ammonia (30% NH3 w/w). A floating separator 4 on top of the liquor prevents any dissociated ammonia gas recombining (and lowering pressures).

Dissociated ammonia gas and water vapour rise up the pipe 5 and is led to the 5-bladed vane type motor drive 6 coupled to the generator (12/24 v DC) or power take off, at 7. The panel water circuit and the aqua ammonia circuits are totally separate and the heat transfer occurs in the hot water coil in the heat exchanger.

When the solar panels have heated up by 30 degrees Centigrade above ambient temperature the pump 2 circulated the hot water to the heat exchanger. In a few minutes dissociated ammonia gas builds up pressure. Flowing through pipe 5 it starts the vane motor 6 and the generator, and charges the batteries. Relatively simple solenoid valves controlled by temperature and pressure will regulate the whole system and divert surplus hot water to a storage and assure extended operation when the sun sets.

RECOVERY OF SPENT AMMONIA GAS AND RECYCLING

The important recovery and recycling of the hot gaseous ammonia is greatly facilitated by the chemical and thermodynamic properties of ammonia which are well known. Gaseous ammonia is very highly soluble in water al-



Old Ammonia Refrigerator

though exothermic (producing heat). Fortunately the expansion in the motor cools the gas considerably according to thermodynamic principles. To take advantage of this a small high pressure ejector 8 is fitted at the outlet at the motor. The ejector is powered by a 1/2 hp electric motor driving a high pressure pump, bleeding off a small quantity of cooled depleted liquor from the base of the boiler/ heat exchanger. (Weak ammonia liquor is denser and gravitates to the bottom of the tank, which is very convenient for the present purpose). From ejector unit 9, the enriched ammoniacal liquor is fed to the boiler 3 at the top end as shown in the diagram, and is thus recycled continuously.

A separate pressurised ammonia gas storage may be added, off the outlet pipe 5, to reduce fluctuation when there is excess heat and reduced power demand.

Battery storage at 12 or 24 volts must be of such capacity to handle required power over 24 hours. A electronic inverter system has to be added to convert the DC to alternating current at 240 volts for supplying power to the installation.

THE OVERALL EFFICIENCY: THERMODYNAMICS.

The quantity of useful power obtainable from any solar energy system depends on a number of factors which are well researched, actual incident sunlight, cloud cover, latitude, daylight hours, ambient temperatures. However the established solar energy recovery using silicon panels provides a degree of comparison under equivalent weather conditions. The overall efficiency between incident/ambient energy from sunlight and recoverable electric power using silicon panel systems maintained in dust free conditions is from 11% to as high as 18%.

These compare favorably with those of the silicon panel systems and have advantages which are not possible in that type or thermo-electric system such as:-

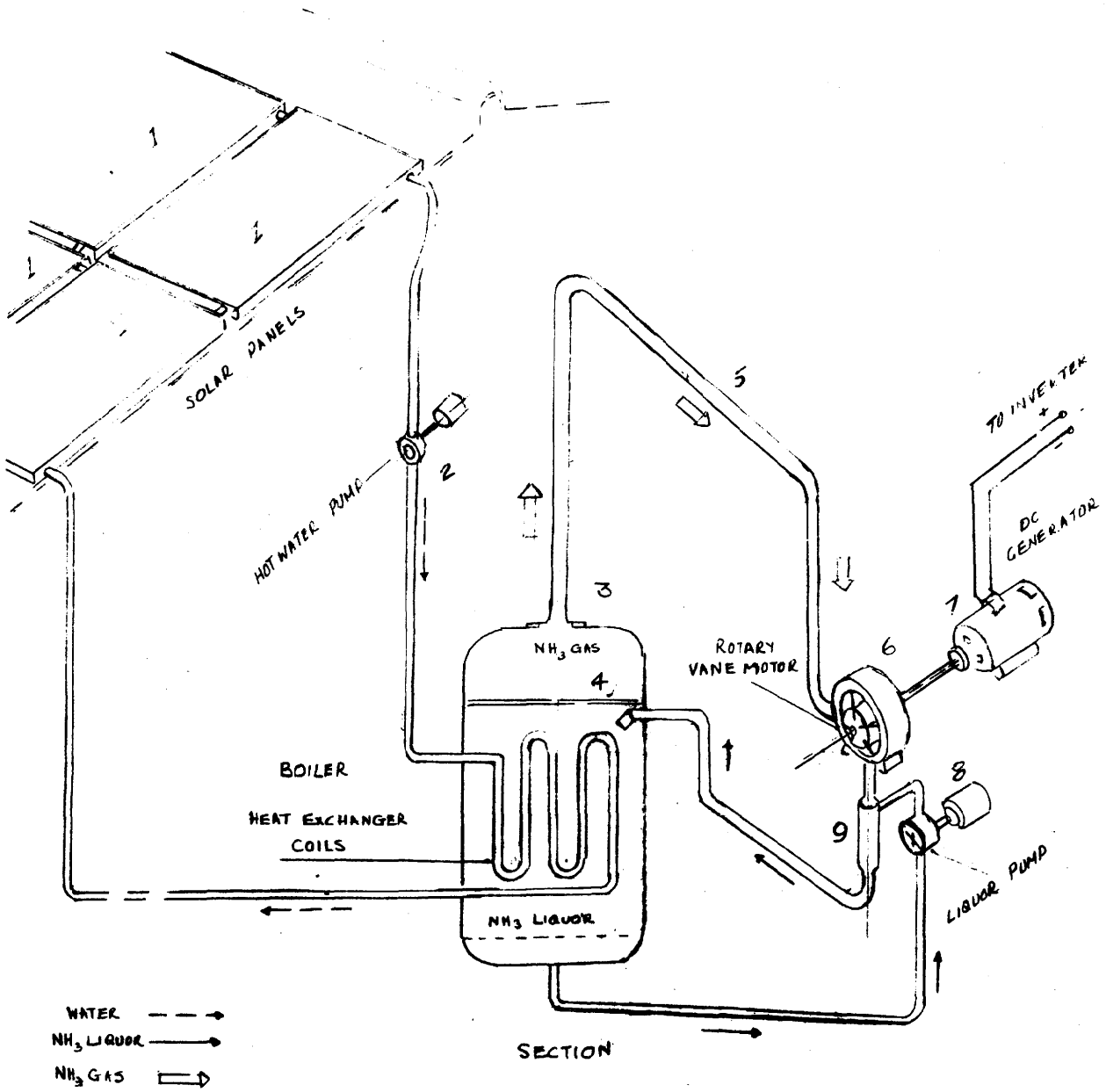
1. Smoothing out energy collected and available voltage.
2. Storage of hot water and pressurised ammonia gas permits extension of operation after the sun has set.
3. Because of the above, the total energy recovered is greater.
4. Last but not least, on days when sunlight is not available because of weather conditions, the heat exchanger can be operated with waste heat or hot water from boilers using wood or sawdust burners - a matter not feasible with silicon panel units.

The system is very safe as the total quantity of ammonia gas used is in the form of aqua ammonia and is less than that required for refrigeration systems of comparable size. All equipment used must be made of steel, cast iron and teflon. No copper, brass or zinc can be used as ammonia attacks these.

Depending on the quality of the components available, a 10kW unit working with this ammonium hydroxide system will require between 26 m² and 60 m² (280-650 ft²) of working panel. Total cost must include ancillary equipment such as inverters, wiring, storage tanks and control gear if necessary, which have not been discussed in this article.

RELATIVE EFFICIENCIES

Thermodynamic efficiencies:	min %	max %
1.Solar panel collector, water filled	70	90
2.Heat exchanger: ammonia dissociation	80	90
3.Vane Motor mechanical efficiency	60	75
4.Ammonia reabsorption,allowing for energy for pumps,ejector etc.	55	65
5.Electric generator 12/24 v	85	95
Net overall efficiencies	16%	38%



SYSTEM DIAGRAM

Radiator Solar Panels

A.D Fuller
406 Pennant Hills Rd
Pennant Hills,
NSW 2120
Dear Sir,

I have now completed the small solar heater as dealt with in April 1987. I enclose a few notes I made while working on it, that may be useful. The job has been delayed one year due to illness on my part but is now complete and operating.

1. Insist on a pressure test for leaks of the radiator, otherwise don't buy.
2. Don't use plastic for front of absorber panel. It is too expensive and is brittle. Other faults are that it is dangerous, as in some cases it has a slight concavity which could focus the sun and cause a fire up to 100 yards away.
3. Insulate the connections, especially the outlet, as is the case with any more conventional solar heaters.
4. The hot water outlet should be further down (see sketch) and not at the top as shown in April 1987 as the pressure is more vigorous here.
5. If connecting to a garden tap the pressure may be found to be too great. If so a pressure reducing gadget should be used. This should be at the garden tap and is nothing more than a small aluminium disc about 2cm diameter at some point in the garden hose. This has a 2mm hole in it to reduce the pressure.
6. Use good clamps to hold the various connections. it is the weight of the water which has to be considered. They will soon blow out if not tight, the type with continuous serrations operated by a screw is best. Any other type is useless.

RESULTS I cannot give any exact figures but my experience is that these are very good and seem to be even better than more conventional heaters.

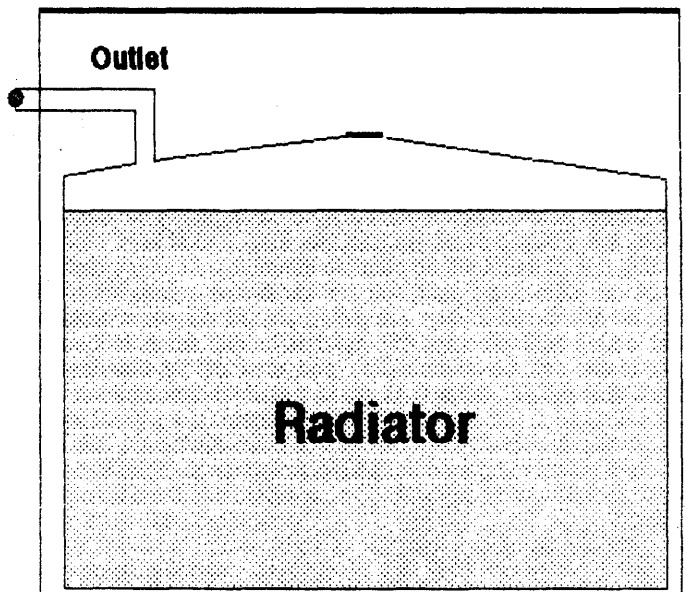


Diagram of the radiator based solar water heater.

Finite Earths

Mr. C. M. Friel
38 Stobbo Cres.
ALAWA 0810
Dear Sir,

Extension of the uranium mining industry will contribute in two ways to the further degradation of the human environment.

Firstly, if this uranium is used for the production of energy, and that is the intention, the end result of this injection of additional energy into the biosphere will be to increase not only the human population, but the rate of population increase. With the world's population doubling every fifty years, we already face massive environmental pollution problems, not only from burning fossil fuels, but from the uncontrolled production and disposal of industrial wastes; a problem that is independent of the energy source that allows their production.

Humanity has to realise that the earth is finite, hence its resources are limited and hence the human population that it can support is also limited.

If our politicians had a shred of statesmanship, they would be urging worldwide population decline, they would be deterring energy consumption by making it prohibitively expensive, and would adopt a policy of making nations responsible for the support of their own population excesses.

Instead, what do we see?

Calls for cheaper electricity, more immigration, increased productivity, notwithstanding we are already so efficient, in terms of human labour, that we have a vast pool of labour no longer required in the production process.

The second effect of uranium mining is the obvious one of more undisposable, highly toxic radio-active waste to dispose of. People should realise that the contamination that came from the Chernobyl nuclear power plant accident is inside every nuclear power plant and the amount continues to increase with each new one.

Those who call for increased population should visit the over- populated countries, the Cairo rubbish dumps for instance, where hundreds of thousands scavenge from birth to death, those who take world trips to familiarise themselves with the uranium industry can expect to have no credibility without having visited Chernobyl.

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ATA Classifieds
The Alternative Technology Association
222 Brunswick St. Fitzroy 3065.

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30/11/88

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Complete with 20 watt inverter, tube and do-it-yourself assembly instructions. $40 ea plus $5 post and packing.
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Compact, rugged, hand held windmeters. Ideal for quick on site checking of windspeed. $15 ea plus $3 post and packing.
A.T. Technology. 1 A Alsace Street, Brunswick. Vic. 3057. Phone 383 4295 for more info.

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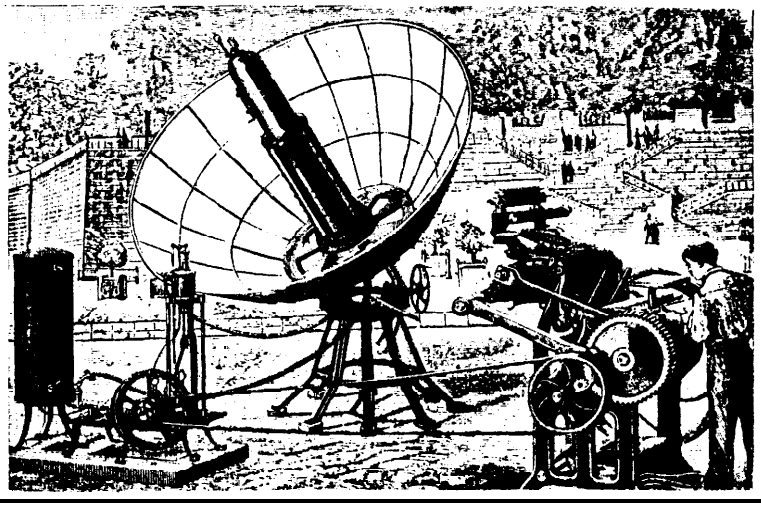

Front cover: 1945 advertisment for prefabricated solar homes.

Back cover: Experimental solar house built in 1949 in Dover, Massachussetts. The scientist was Dr. Maria Telkes, Eleanor Raymond was the architect and Amelia Peabody funded the project.

Soft Technology is produced by the Alternative Technology Association. We are a group of people interested and involved in alternative technology and our activities include meetings, film nights, workshops and field trips.

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