soft technology

Alternative Technology in Australia No 37 September 1991 $3.00

Inside:

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- Which inverter? A 1991 buying guide
- Heatshifters: a low cost heating alternative
- Governments in the spotlight: energy planning review
- Water turbine follow-up

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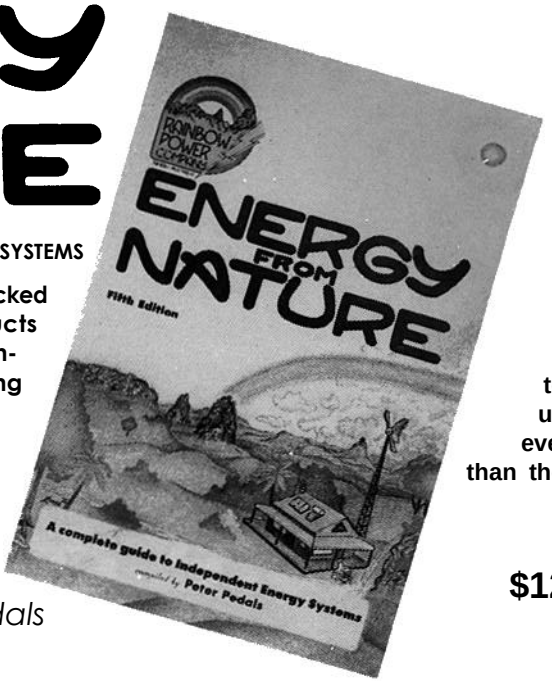

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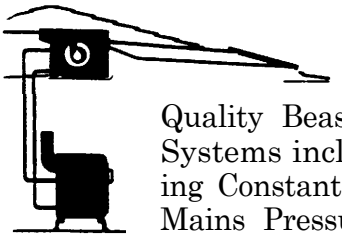

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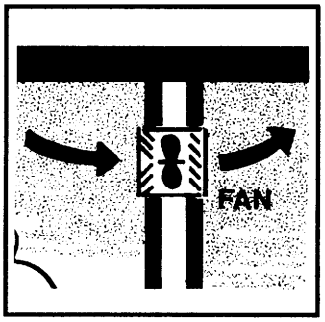

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Cover: Photo: One of the "Peak" series, cost effective homes, by Fairweather.

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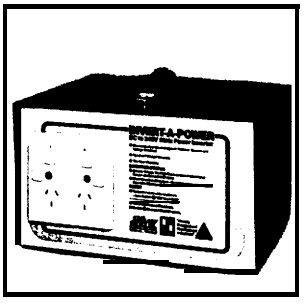

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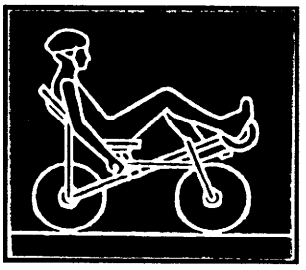

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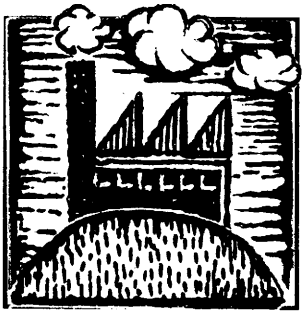

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ENERGY FLASHES

Solar Powered Flight

The flight of a photovoltaic-powered aeroplane across the United States (from California to Kittyhawk N.C.) in July 1990, made history as the longest fuel-less flight ever made.

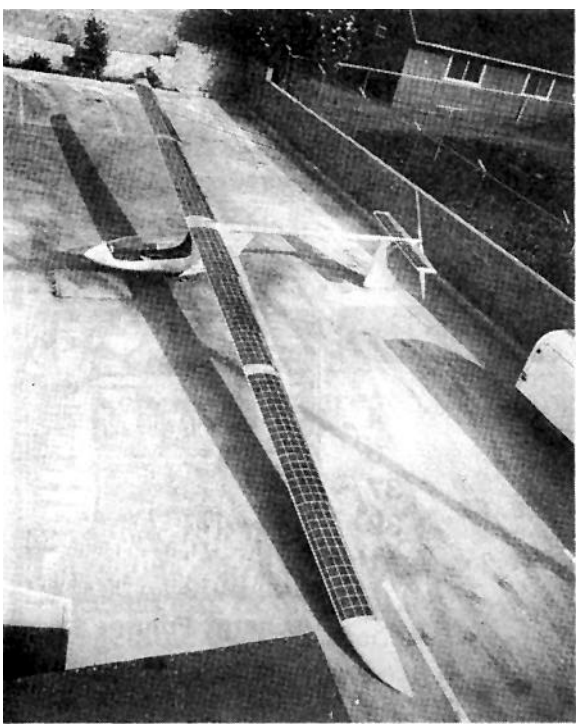
It also marked a major breakthrough for renewable energy technology, through the use of PV power to drive the 90Kg plane's 2.2KW motor.

The Sun Seeker, designed by Eric and Aida Raymond, was essentially a powered glider. 8.2 sq. metres of Sanyo amorphous PV cells on its 16.6m wings powered a brushless DC Inland Motor.

The PV array ran at 160V open circuit, and 120VDC, feeding 2.5 amps into a FET power controller, through the motor, to drive a 2.4 metre diameter variable pitch propeller at 600RPM.

The maximum speed was 160km/h, and the 4060km trip took 125 hours in the air. Stops were made at night and there was no flying on rainy days. To assist take-off, an extra array of PV cells was laid on the ground each morning.

SunWorld



Sunseeker having a well-earned rest

Energy-Efficient Window

Using tiny glass pillars, Professor Richard Collins of Sydney University has produced a highly energy-efficient double glazed "Vacuum" window, 'which could substantially cut heating and cooling costs in severe climate architecture.

It is estimated that the "vacuum" window has a heat transfer efficiency of between three to five times that of conventional glazing.

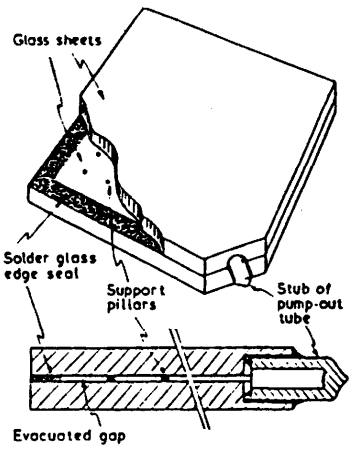
Typically, single glazing transfers heat at 6 watts per square metre, per degree Kelvin temperature difference. Double glazing can reduce this to 2-3 watts per square metre, and evacuated glazing with low emittance coatings, to at least 0.6 watts per square metre (per degree K).

The key to the process is the use of very short, low melting-point, solder glass edges, and glass pillars at 30-50 mm intervals to support atmospheric pressure of 10 tonnes per sq. metre.

The small pillars are only 0.2 long, retain good optical properties and can hardly be seen.

Work is now necessary to test the system over larger areas and to try various gases to produce a thermal switch.

Tech Monitor



The new energy-saving window

Wind Power

A new type of wind generator is being developed at Altamont Pass, south of San Franscisco. It is the Variable Speed Turbine; the fruit of a collaboration between the Electric Power Institute, Pacific Gas and Electric and US Windpower, each of which has been dealing with wind turbines for 10 years.

The advanced turbine, the 33M-VS3, has three 16.5 metre, variable pitch, blades, which drive two 180kW AC generators through a speed raising gearbox.

The output of an AC wind generator is variable in both frequency and voltage, and cannot be fed directly into the grid unless the speed is constant. Hence underspeed and overspeed output is lost.

The VS turbine converts the AC to DC, which is then inverted back to a 60Hz constant voltage output. The variations in wind direction and propeller pitch are controlled by hydraulic motors. The final output will be approximately 300kW, resulting in electricity at a cost of 5.3 cents per kWh.

New Scientist

The Electric VW 1st Production Electric Car

The Volkswagen Citystromer has become the first electric powered car to go into series production.

The two-seater is intended to be an urban commuter car, with a top speed of 100km/h.

Even so, the range is rather limited; 80km normally but in city traffic only some 56km. The batteries weigh 480 kg and the car accelerates to 50km/h in 13 seconds.

The German car costs $50,000 and really does not cover production costs, but VW, who have built some 300 experimental electric vehicles since the early 1970's, say it is a step further in developing environmentally clean vehicles.

The lead gel batteries drive an 18.5 kW electric motor through a standard Golf Manual Transmission.

The engine compartment houses the charging unit, which allow batteries to be recharged from a household power point. Forty Stromers have been sold, with forty more on order. Fifteen of these are on the road in Sweden and the rest in Germany.

Berwick City News/Electric Vehicle News

Wave Energy Fibs?

Wave energy research is again to be funded by the European Commission.

The story began in the early 80s, with the development of a number of wave machines - particularly Salter's Ducks, so-called because they bobbed up and down with the waves.

But costing was done by the Energy Technology Support Unit (run by the Department of Energy) at its Atomic Energy Authority Laboratories at Harwell. It mistakenly calculated the cost of wave energy at more than twice the correct figure.

As a result of this report, the British Government ceased funding wave energy research in 1982. This did not halt interest, however.

The European Commission had a study of wave energy done by Professor Tony Lewis of Cork University in 1985. He recommended a four-year research and development programme, as he calculated there was the potential to generate up to 110 gigawatts of power along the European coasts; a figure which represented 85% of current demand. Nothing was done.

Then in 1990, a Welsh Member of the European Parliament asked why there was no funding for this area.

The official reply from the Vice-President of the European Commission for Research and Development, was that a British Government report in 1985 advised nothing be done.

Further questioning by a Scottish MEP, Margaret Ewing, brought an apology and 1.2ECU's (about $2 million) for evaluation studies. Llewellyn Smith, the Welsh MEP, said "We all know it is not just a question of wave energy but about protecting the nuclear industry by discrediting other sources of energy."

New Scientist

Energy From Pigs

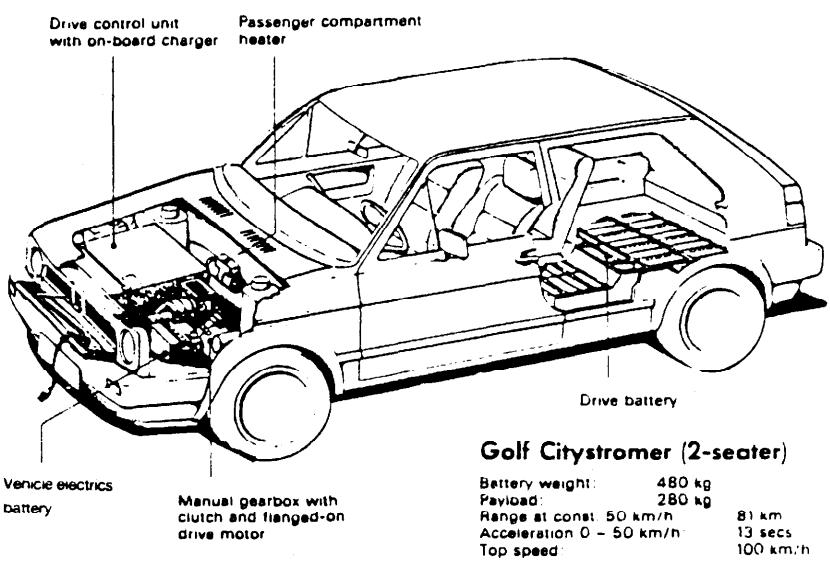
A major new integrated waste and energy management project is almost completed at Windemere, near Ballarat.

The Charles Integrated Farming Enterprises piggery is being built in conjunction with Bio-Resources Australia at a cost of $1.6 million.

The energy system uses organic waste from the piggery to produce biogas, a mixture of carbon dioxide & methane, which will be used for heating. A gas engine will generate electricity, making the farm self sufficient in energy.

The system offers a solution to the conventional waste disposal methods used in many large piggeries. Energy Victoria is supplying $50,000 towards monitoring the system

Solutions



The Volkswagon Citystromer

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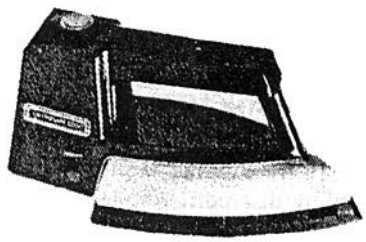
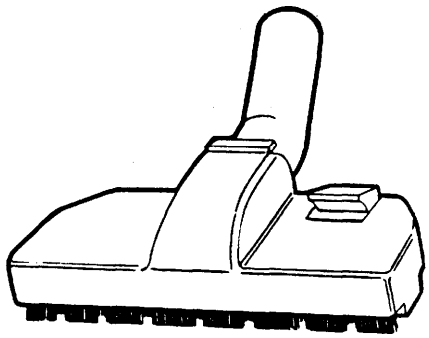




At Last A 12V Vacuum Cleaner that Really Sucks!

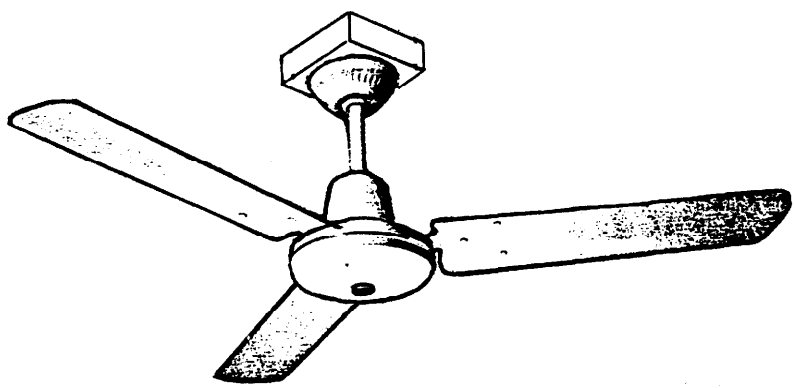
Although it looks and performs like a good quality 240 volt vacuum cleaner, the Volta Satellite is designed to be a rechargeable vacuum cleaner.

It can be recharged from a 24 volt battery bank or modified to plug into a 12 volt home power system. It comes complete with floor tool, upholstery brush and nozzle, crevice nozzle, hose and steel extension pipes. $220.00

These appliances are available from the Rainbow Power Company, Nimbin, NSW, 2480. Phone:(066) 89 1430

12 volt, 3 Speed Ceiling Fan

1200mm ceiling fan with dedicated inverter and 3 speed wall controller. This fan can be operated in reverse to recirculate warm air back into the room to save on heating costs. 12volt battery powered. $315.00

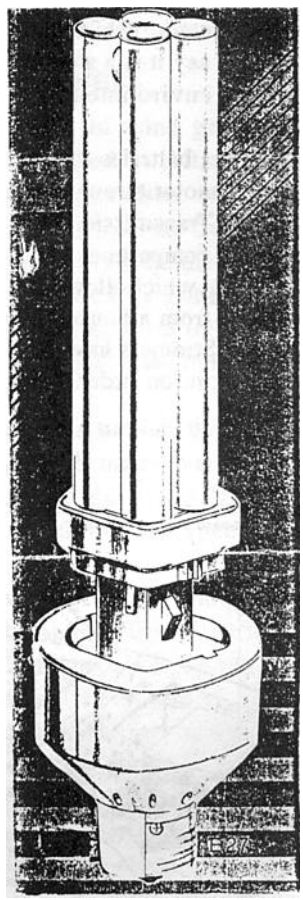


AUSLAMP Compact Fluorescent

It's now available; a compact fluorescent lamp with a replaceable tube. Instead of throwing the whole lamp out when the tube fails, you can keep the base and replace the tube.

The base is designed to last 36,000 hours (about 5 replacement tubes) and uses standard tubes made by Philips, Osram, Sylvania and Auslamp.

The unit is available in 11 and 15 watt models. Unfortunately it is unsuitable for square wave inverters but OK for sine wave inverters. Recommended retail price is $22.00.



Information supplied by: Solar Charge, 175 Martin Street, Gardenvale, 3185. Phone:(03) 596 1974.

HOLISTIC HOUSING

An Imaginative Approach to Housing and our Environment

Fairweather Homes is a building company which has committed itself to the ideal of an environmentally sustainable housing industry. The following article, by the creator of the group, explains their philosophy and methods.

By John Baird

A Sustainable Philosophy

Housing, which is at the centre of our lives and dreams, is an appropriate vehicle for initiating changes in our environment; changes which would offer an opportunity for both individuals and the community to respond to urgent environmental problems.

Almost half of the greenhouse effect-producing carbon dioxide, and most of our air and water pollution, is caused by industrial processes and products. This is a compelling reason why industry should seek a new equilibrium, in which it can be sustained with maximum human benefit and minimum environmental damage.

The housing industry could be a natural leader, firstly because of the ubiquitous nature of housing, and secondly because of its intimate relationship with people and their perceptions of environment.

Achieving a more sustainable housing industry requires some changes. Structurally, the houses would need to be compact and efficient, and built of high quality materials, to ensure a long and useful life. These materials should ideally be locally produced (as excessive transport is expensive and wasteful of resources), and should be environmentally sound in the areas of resource management, production methods, and renewability.

The design of these houses must be practical. They must be energy efficient, using both passive and active solar energy systems. They will require precision engineered structural systems with maximum performance and adaptability, and minimum wastage of resources.

To be truly flexible, the homes also need to make the most of the available site(s). They should also be designed and sited to be sympathetic to, and

Fairweather-designed active and passive solar courtyard house at Flinders, Victoria

minimise impact on, the surrounding natural environment.

This new system must also meet the human and social requirements of housing. A priority must be fresh and sensitive design, expressing a new concord between people and their environment. These designs also need to be flexible and adaptable, to meet the future needs of growth and change. To make all of this possible, we also need financing systems with incentives to build smaller, energy efficient houses.

Fairweather Homes is a building company which has made a committment to promoting these ideals.

There is an interesting, and perhaps prophetic, analogy in the motor car industry of the 1960s and 1970s, when the large, romantic, dream machines of Detroit were made obsolete by the Japanese design of small, fuel-efficient and reliable cars of fresh design and human scale.

We have a legacy of 3 - 4 bedroom, brick veneer houses built over the last 30 years for the "average family", of 2 parents who never grow old and 2 children who never grow up. Static thinking in a dynamic and changing world; resulting in human frustration and waste of resources. Even an "average family" needs housing which is adaptable to its changing life cycle - and a much greater diversity of need exists when "non-average" households are considered.

Another example of the Fairweather Homes holistic design philosophy

Housing More And Consuming Less

The first principle of conservation in housing is to build smaller houses, which consume less resources and require less fuel, mortgage, maintenance and rates etc.

The large, status-seeking, market-oriented housing of the past may not represent the same value to the buyer of the future, who may find the fuel and maintenance costs prohibitive.

Fairweather Homes, and its philosophy of change, was born out of a recognition of this community need.

In 1982, the designer of the Fairweather Homes system, John Baird, wrote a book on Australian housing entitled "By Design - Changing Australian Housing". Research for the book confirmed his belief that a gross mismatch existed between the diversity of housing needs and the housing offered in the market place.

Although the book addressed some of the issues, it provided more questions than answers. The Fairweather Homes building system was conceived and designed as a response to these questions.

In 1989, Fairweather Homes received the "Australian Design Award" and was given the following citation (Product Citation - Design Council Quote):

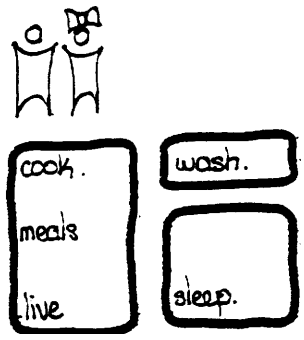
"Fairweather Homes is a versatile, low cost modular design and construction housing concept, combined with an interactive consultative architectural service. Fairweather Homes provide customers with an opportunity to design their own home around their needs, to obtain domestic architecture of high quality at a more accessible price."

Community Response

The initial response to the Fairweather Homes system was from people whose lifestyle and household requirements could not be met by the conventional housing market. Others had clear perceptions of their needs and the confidence to seek solutions through a new design process.

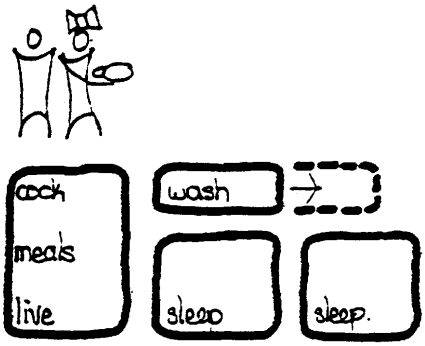
Many of these initial respondents were people pursuing lifestyles which, in our evolving society, could replace current conventions. For example, people working from home, all adult households, couples and singles, three generation households, dual occupancy houses, energy efficiency through appropriate design, and so on.

Of course, the "average family" will not disappear, and any good housing system needs to be applicable to all family forms. The following diagrams trace the changing needs of an "average family" through its life-cycle stages.



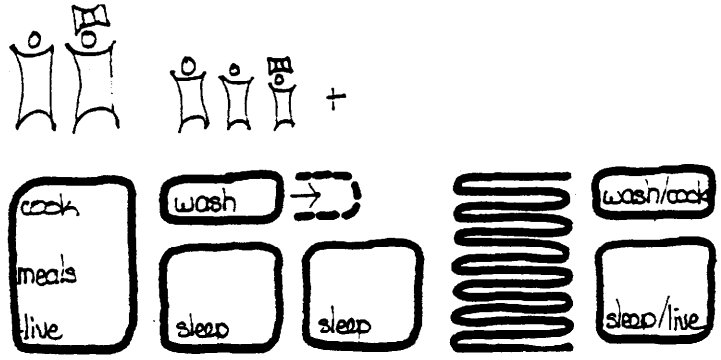
Stage1

The need is for a small self-contained unit, which could be the first stage of a house, or it could be a small self-contained "dual occupancy" unit.



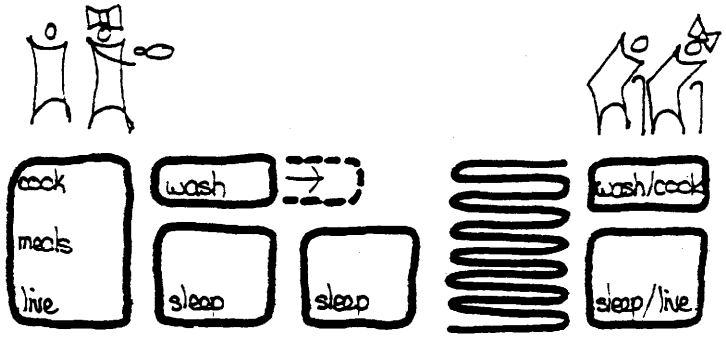
Stage 2

The need is for a basic house including a sleeping area for the children



Stage 3

Teenagers need a place of their own in the house. This can be the second stage of building and financial commitment. The "independent unit" suggested here is a major break from conventional housing and provides the major key to future flexibility of the house.



Stage 4

The independent unit could become accommodation for grandparent(s) in a three-generation household, or it could be rented out as a means of financing its construction and/or additional income.

Affordability

Of course, none of this has any meaning if it is not affordable. The open market of today will not determine the type of housing which will conserve our resources, without the intervention of new marketing values, financial incentives based on minimum resources use, and readily accessible information and built examples for public examination.

This readily accessible information needs to include much wider access to architechtural services. At the moment, two very distinct groups of people use architects for housing; the (approx.) 10% at the very top of the market, who commission architects to design their houses; and the lower (approx.) 10%, who live in public housing designed by architects. The other 80% of people, who shape most of our living environment, receive little professional design service.

Accessible

Fairweather Homes' aim is to make a professional architectural service accessible to this previously neglected group, by producing houses at 30% less than conventional one-off residential architecture.

Part of this saving is possible because the system was designed with the owner-builder in mind. Its "build-by-numbers" approach, and large lightweight components, facilitate ease of construction, and give the owner-builder a sequence to follow.

Owners can purchase a kit and owner-build, have a house built to lock-up, or nominate particular trades or tasks to do themselves, in order to meet their budget.

A Fairweather house at Flinders, Victoria, designed for an astrophysicist and his family

Flexibility And Diversity

The flexibility of the system allows adaptation to a wide range of design criteria and environmental needs, within the discipline of an in-built cost control.

By the end of 1990 Fairweather Homes will have completed over a hundred and fifty buildings ranging in basic form through rectangular, courtyard, cluster, split-level, elevated, two storey, roof-loft and mezzanine, to town-house and dual occupancy.

Their locations range in sites and climates across town and country, temperate and hot inland, mountain and coastal, and have been shipped to tropical and cyclonic Samoa.

Building Materials:

This sustainable philosophy must extend beyond design. Fairweather Homes evaluate the materials used in construction against the following criteria: renewability of source materials; energy used in production of products; disposal of industrial waste in production; known long term effects of products on health.

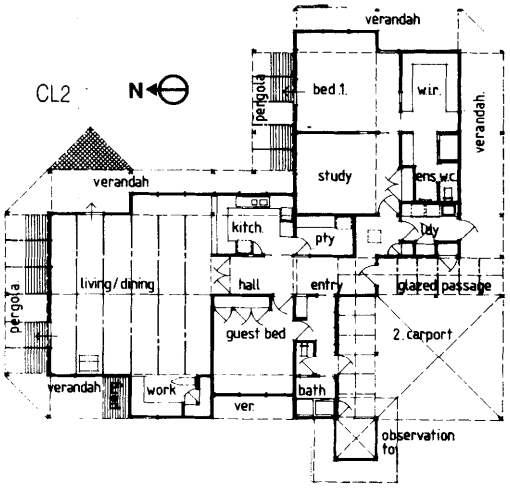
The use of timber for housing should be the primary choice, not only because it is the only practical renewable resource, but because it also has many other environmental advantages, and a highly developed local technology and use. The use of timber in housing could include all structural framing, external and internal cladding, flooring and joinery.

The most appropriate timber resource would be pinus radiata (or similar selected), developed and managed on a sustainable yield basis without damage to other important forest and agricultural uses.

The production and use of timber on this scale would require radical and creative planning, but the environmental advantages could make a crucial contribution to our future when the following factors are considered:

The rate of carbon fixation from atmospheric carbon dioxide is up to 1400 times greater for young regrowth and plantation pinus radiata trees than for a mature rain forest. Expanded plantation areas of radiata pine, coupled with the maximum productivity of the timber, would give the biggest reduction in atmospheric carbon dioxide concentration. Harvested wood utilised in buildings accumulates carbon in long term storage and would not contribute to increased atmospheric carbon dioxide.

The table below compares the energy use in the production of one tonne of timber, steel and aluminium.



Floor plan and lounge from house at Flinders

Material	Kilowatt Hours	Equivalent Use of Ashtree-Coal (TONNE)
Timber	435	0.13
Steel	3,780	1.15
Aluminium	20,169	6.12

Note: The above information was published in "Australian Forest Industries Journal" and attributed to Dr. John Turner of the Forestry Commission of NSW).

Note 2: With regard to brick production, it is known that the figures are considerably larger than those for timber, but scientifically verified information has been singularly hard to obtain.

For the use of timber to achieve a new balance in the housing industry, environmental values must predominate over consumptive values, timber resources must be carefully managed, and both design and production of timber products must be of the highest standard.

The development of "Scrimber" by Australian industry in partnership with the CSIRO, will increase the timber yield from the trees, lower the demand for imported timber and provide an economical product which is more stable and predictable than conventional timber. Scrimber is harvested from pinus radiata "thinnings" after 8-12 years of growth (at half the age of sawlogs), crushed into long timber strands, then reconstructed (using special resins and pressure) into large slabs of "scrimber". The slabs are then sawn up into building components, including framing members and joinery items.

Laminated veneer lumber is another structural timber product made from pinus radiata, which is an alternative to imported Oregon. Manufactured by International Plywood and Lumber (IPL), it is of high strength, dimensionally stable, available in long lengths and treated for durability in exposed conditions as required. There is also a range of structural plywood sheet materials available, with high-quality, durable surface finishes, for flooring and external and internal cladding.

Materials

The brands and types of materials used in Fairweather houses are selected in accordance with the above philosophy.

1 Framing: Precision engineered from laminated veneer lumber beams and fascias and kiln dried pine wall frames and trusses. Oregon used for posts and pergolas will be replaced by locally produced "scrimber" when it is available in 1991.

2 Windows: "Stegbar" WRC windows and external doors.

3 Cladding: Recommended cladding is locally made "Shadowclas", a treated, pine faced, grooved structural plywood. It provides light weight, strength, durability, erection speed and provides bracing for cyclone resistance.

Other masonry, lightweight and timber claddings may be used by choice.

4 Roofing: Corrugated profile (custom orb) zincalume or Colorbond roofing

5 Insulation: Insulation is provided for all houses to comply with the star rating developed from the CSIRO Building Research.

Construction Services

After the architect has visited the site and consulted with the client, a design is created from the "menu" of kit components. The rest of the design process involves fine-tuning the details, preparation of documents, and quality control visits.

The Fairweather Homes Building Advisor coordinates the manufacture and delivery of the kit, and provides advice to owner-builders on the site, from job start to completion.

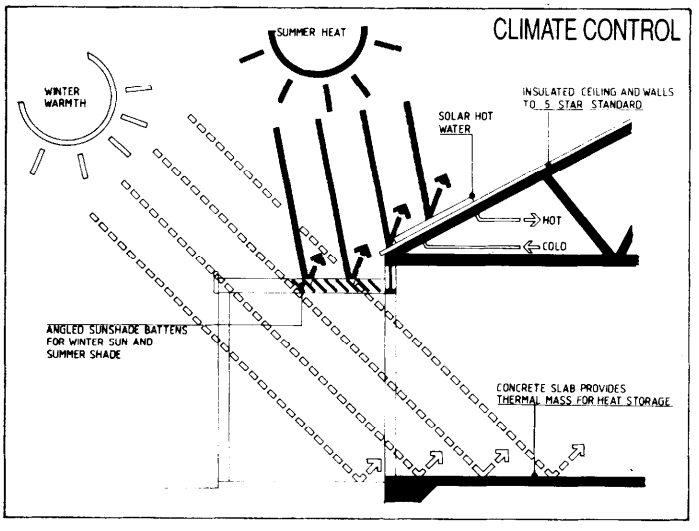
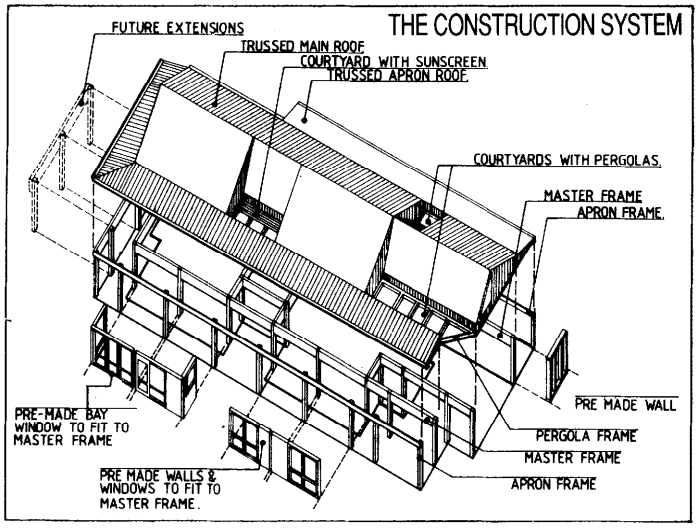


Diagram showing typical climate control measures used by Fairweather Homes



This diagram shows a sample Fairweather construction system

Each component in the Fairweather Homes framing system has a code number, and each item appears with its number and location on our documentation, and on the completed product.

Pre-made kit components are packed, labelled and transported to the site by road. Packs are unloaded by crane, and the light-weight individual components by one to two people on site.

Builder's instructions, erection sequence drawings and a specific set of documents for each job, combine with the pre-made kit of components to simplify and speed the building process and virtually eliminate on-site problems.

A timber master-frame is erected first, then pre-made wall and roof members placed within this frame. The master frame facilitates the simplicity and speed of erection and allows the roof to be completed before the walls.

The main components are connected with metal connectors which facilitate future alterations and additions. The construction system is readily adaptable for cyclonic and earthquake loading.

In Melbourne, the client contracts Fairweather Homes for design and kit manufacture and FWH Constructions or other selected builders for the erection of the kit and completion of the project.

Next issue we examine the specialised Peake Series. (As pictured on the cover of this issue.).

A Summary Of Benefits

After eight years of development and use the following benefits have evolved:

1 Low cost - high quality architecture by the use of a planning/construction/cost control system which places creativity within a framework of predictable outcomes. (Costs are approximately 30% less than comparable "one-off" architect designed houses.)

2 Flexibility and adaptability to a wide range of sites, climates and client needs.

3 Fully transportable, pre-made construction components which are inspected before leaving the factory.

4 Simple to erect building system saving, on-site erection time and material waste. Roof may be erected before walls in inclement climatic conditions.

5 Variety of materials and finishes available to meet varying resource, environmental and aesthetic needs.

6 Energy efficient design, with both passive and active solar energy systems available.

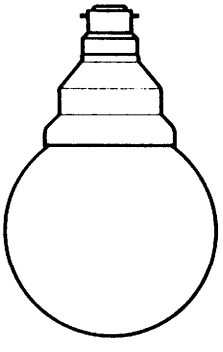
COMPACT FLUOROS Follow up

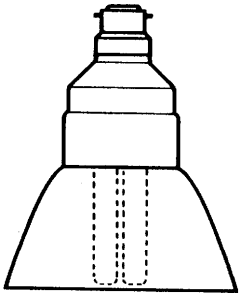
In the last two issues of Soft Technology we have looked at issues surrounding compact fluorescent lamps. Since the last issue we have written to the major Australian suppliers of compact fluoros—Philips, Wotan, Sylvania and an Australian manufacturer, Atco.

Philips was the only company that did us the courtesy of reply and we thank Philips for their co-operation. Sylvania did ring us once, but failed to respond to our subsequent calls. Neither Wotan nor Atco responded to our letter or follow-up fax.

In addition to the letter from Philips which follows, we have received some news from the City of Brunswick, Electricity Supply Department regarding some lamps with replaceable tubes. Read on for both these letters.

Note: David Lewis, the spokesman for Philips, asserts that we made several errors in our original article. We do not agree with this view. The article in question can be found on pages 11-12 in issue no. 36 of Soft Technology. The first article in this series of articles is on pages 7-9, issue 35. Ed.





Phillips Speak Out.

Dear Mr. Harris,

Re: "More News on COMPACT FLUORO'S", Soft Technology June '91

Thank you for your letter and copy of the magazine.

We support your inclusion of such an article. It is important to "raise the awareness" of this technology (although it is not exactly new).

You asked for our comments and they follow the sequence of your article.

PRICE - Apples and Oranges.

You compare the US price to Australia, unfavourably. Firstly the US has a mains supply of 110V compared to 240V in Australia. The lamp is thus a different animal - different components. This is even the case with Europe where it is 230V. The 240V version has to be made especially for the few remaining 240V countries. Secondly the US lamp is made in the US; the European lamp is made in Europe. The lamp sold in Australia is made in Europe in special runs and shipped here.

"CHINESE COPIES"

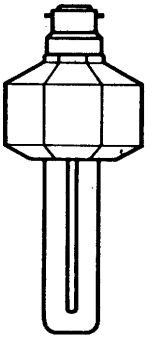
The cheaper imports, mainly from the Far East are, in blunt terms, a con. First, contrary to your statement, they have greatly reduced lives. This is a serious problem. The whole concept of the energy-saving lamps is based on making a lamp that will last a long time, thus the pay-back becomes very realistic. A quick sum on the quality $30 lamp shows that during its lifetime it will actually SAVE you money. The biggest cost to the house-holder with standard incandescent lamps is the energy bill (see annex). A "cheaper" lamp with shorter life destroys the energy-saving concept.

All the lamps that we have had tested do not perform as claimed and in addition they clearly infringe the registered patent.

Your second error is in that the lamp "copy" costs $3. The glass part itself may cost $3 but the copyists claim that the electronics cost an additional $10 - 12 leaving them with an unrealistic profit.

NEW TECHNOLOGY

The range of compact fluorescent lamps (CFL) available in Australia is almost the same as overseas. Certainly the same as Europe. The US range may vary and, again, this is mainly due to the technological restriction when changing voltages. Another error, or rather confusion with the facts, is that they are dimmable. Dimming any



The Lamp that Saves More - Philips PLC*E Lamp

Cost comparison for 8000 hours

	PLC*E15	Incandescent
Power consumption (Watts)	15	75
Light output (lumens)	900	960
Lamp Life (hours)	8000	1000
Buying Price per lamp	$29.00	$0.80
Electricity cost /kWh	$0.12	$0.12
Energy cost	$14.40	$72.00
$\frac{8000 \times 15 \times 0.12}{1000}$		$\frac{8000 \times 75 \times 0.12}{1000}$
Lamp cost(s) over 8000hrs	$29.00	$6.40
Total costs	$43.40	$78.40

Total Saving $35.00

fluorescent is extremely difficult, although the only successful way is with electronics. Let us make one thing perfectly clear (and have seen many examples of mis-application) you may be able to initially dim a CFL but unless it was designed to do so, it will not last!

THE CHEAPEST SOLUTION

The separate compact fluoro lamp is also widely available in Australia but, so far, is mainly used in the commercial area. There are very many hotels, offices, public buildings with the separate CFL, installed in downlights, pendants etc. (as an example, see enclosed leaflet dated 1989). [The pictures in this article are largely taken from this leaflet. If you would like to see the leaflet itself, Philips could, no doubt, supply it.]

SEPARATE vs INTEGRAL

A ballast that has to last the life of many lamps has to be of a very high quality. The integral ballast only has to have the same quality as the tube.

The main point, though, is the integral lamp was developed so that it could be readily substituted in the average domestic (and commercial) light socket. The ballast part was made as small as possible to try to keep the dimensions similar to the old technology incandescent lamp.

The usage of the separate ballast is predominantly confined to new installations where the ballast can be an integral part of the light fitting (known as a luminaire).

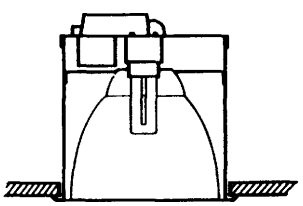
When domestic luminaire manufacturers see the light and start to incorporate the ballast in their table lamps, then the concept will be more widely available, with the resultant benefits. Again, let us be quite clear, the separate lamp has to mechanically interlock with the ballast and thus requires a socket. Some suppliers have a ballast fitted to a socket for the lamp at one end and a "plug" or end-cap, as it is known, at the other. The whole contraption is now heavier, clumsier, twice as big and ugly . . . and very difficult to hide (which you confirm).

The ferro-magnetic types, besides being heavy, perform rather well but, as stated above, are only suitable for certain applications.

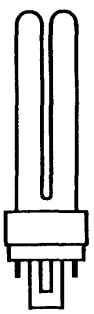
The separate electronic types are a real problem. The "cheap" Asian imports not only have the same harmonic problem as the integral types, but they do not drive the lamp optimally - resulting in a much shorter life and lower light output. This last fact is very important.

Yes, some local utilities are working with local manufacturers to solve the problem but they, too, will find out as they catch up to the European/USA manufacturers that an effective solution is probably 2 - 4 years away.

Your last statement is the most erroneous of all. In fact, the comparative cost calculation between the humble incandescent lamp and the CFL, and also between the USA/Europe and Australia is almost identical. The SAVINGS are the same. If you take the lifetime of a (reputable) CFL, the initial



Recessed Light Fitting
with Replaceable Tube



Separate Tube

cost and the electricity cost into account you will find the payback and the relative SAVINGS in dollars are the same.

Many years of research (by the large lamp-makers) go into the making of new light sources before they are released. The optimal solution is found. Remember the CFL was invented (by Philips) 12 years ago - it is only now that the environmental conscience of our community has "discovered" them . . . and can't buy them quick enough! In those 12 years many refinements have been made to produce a high-quality product where ALL can save - the utilities, the planet and you!

David Lewis
Manager - Lighting Design and Applications

Encls : Extract from "Electronics Australia"
Leaflet showing types available
Extract from price list showing range
Pay-back calculation (see table opposite page)

The Latest from Brunswick

Dear Michael

We were very interested to read the articles on compact fluorescent lamps which appeared in the last two issues of your magazine.

Your readers will be pleased to know that compact fluoros with separate tubes and electronic ballasts are now available. Our information tells us that by Christmas there will be two or even three brands available, all being derived from Asian sources and all promising Australian production in the near future.

The first on the market was the Auslamp which comes in a 15 Watt and an 11 Watt form. These are the first lamps to meet the interim standards. Tests by the SECV show that they have a much improved power factor of 0.8 and their stated and measured light output are in close agreement.

As a long term supplier of Compact Fluorescent Lamps, our organisation welcomes these lamps; especially considering that the replacement tubes cost only $8.00 to $10.00 and the ballast is expected to last 5 or more tube changes. The base of the tube is a standard G24 configuration so any brand tube can be used as a replacement.

We have tested Philips and Osram tubes as well as the Asian tube supplied with the lamp, and found that their performance is similar.

These lamps appeal to us greatly, as the consumer need not have to reinvest so heavily each time a lamp fails. We see this as being of particular benefit to low income households who are being energy conscious. In addition there are the environmental benefits of fewer discarded ballasts.

At present we can supply these lamps for $21 each and like yourself we hope the price will fall considerably with the commencement of local production. Unfortunately early indications are that the prices will be in the range of $25.

If readers are interested in these lamps they can view them at any time, day or night, in the window of 368 Sydney Road, Brunswick. We never turn the display off.

We trust your readers will find this information of value.

Ross D. Horman
Energy Programs Officer
City of Brunswick, Electricity Supply Department

Further comments on Cross-flow Turbine Design

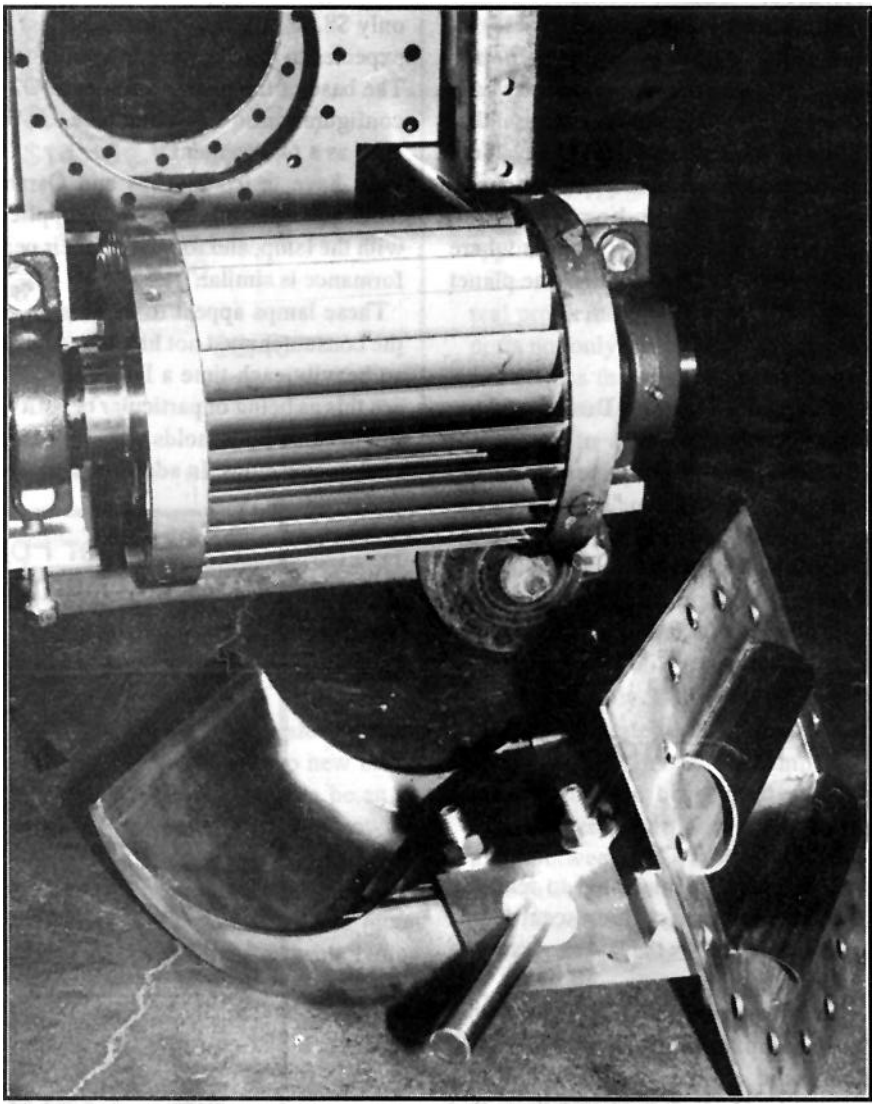
Ian Scales

This brief note gives some additional comments to the article on cross-flow turbine design in Soft *Technology 35* based on some research work that has come to light, and makes a small correction to the previous article.

Some additional design considerations

Khosrowpanah et. al. (1988) performed a series of experiments on small cross-flow turbines and found some useful results. ***Runaway speed*** was seen to decrease as the nozzle entry arc increased, with the highest ***ratio*** of runaway speed/speed at max. efficiency equal to about 3, and usually about 2.5. An ***aspect ratio*** B/D_1 of 0.5 was found to be more efficient than an aspect ratio of 1.0, attributed to the tendency of water to rotate around the shaft in the smaller diameter rotor.

Some further interesting experimental results are detailed in Fiuzat and Akerkar (1991). They found that the average contribution of the first and second stages of the turbine to the shaft power developed is about 55% and 45% respectively when the nozzle arc is 90°. They found that the contribution to output by the second stage increases as shaft load increases and turbine speed decreases. These results show a much greater contribution from the second stage than the previous theoretical predictions, and one implication of the new results is that interference by the shaft with the flow passing between stages may cause significant losses (however, the shaft is necessary for mechanical strength and should remain).



Cross-flow turbine under construction in the workshops of the School of Mechanical Engineering, University of Technology Sydney. At top are the supporting frames for the circular plenum tube receiving water from the penstock, at centre the runner, and in the foreground the nozzle/throat assembly with a guide vane. Notice the bell-mouthing on the throat entrance.

Some general observations as to the characteristics of the cross-flow turbine should be made. The speed of rota-

tion depends on the velocity of the free jet issuing from the nozzle, according to the relation

$$V = \sqrt{2 \cdot g \cdot H}$$

It follows that an increase in head will be compensated by either increasing the rotor diameter or alternatively, in order to keep generator speed constant, by changing the gear ratio on the shaft. Flow variations will not be compensated by altering the diameter of the rotor, but by altering its length or changing the nozzle arc angle (i.e. altering the cross-sectional area of the nozzle).

Correction to blade spacing

Further investigation has shown that the empirically-based equation used to determine the number of blades for the cross-flow turbine rotor should be revised. I previously defined the equation for blade spacing as:

$$t_1 = 1.03 \cdot a$$

where

$$a = \frac{(D_1 - D_2)}{2}$$

and

$$t_1 = \frac{\pi \cdot D_1}{Z}$$

There is a compound error in this equation. The value of 1.03 was reported as empirically derived by Khosrowpanah et. al. (1984 - see ref. in previous article). The first error in the equation I supplied was to ***multiply*** **a** by the value 1.03, rather than divide. Khosrowpanah et. al. stated the optimal blade spacing in their experiments was

$$t_1 = \frac{a}{1.027}$$

This conclusion was reiterated in the more detailed paper by Khosrowpanah and Albertson (1985), and again by Khosrowpanah, Fiuzat and Albertson (1988). However, on reworking their equations and experimental data, it appears the statement is incorrect by their own methods of analysis. Their highest-efficiency test turbine was 305 mm in diameter with $D_2/D_1 = 0.68$ and a nozzle arc of 90°. On this model they tried 10, 15 and 20 blades. Their experimental data shows that 15 blades gave the highest efficiency. This result supports the conclusion that the optimum blade spacing is

$$t_1 = \frac{a}{0.764}$$

which is different to the equation supplied by Khosrowpanah et. al. The validity of this latter equation is justified by reference to the two equations relating the number of blades to the value σ that are supplied by those authors:

$$t_1 = \frac{\pi \cdot D_1}{Z}$$

and

$$\sigma = \frac{a}{t_1}$$

where σ is defined as solidity and is the label for the values 0.764 and 1.03 referred to above. The difference in efficiency was quite marked. Although the experiments were not perfect because head varied between the turbines over a range of 0.44 to 0.74 m, efficiency varied between 63% for 10 blades, 70% for 15 blades and 66% for 20 blades. As with Djoko Sutikno's experiments (Sutikno 1991), efficiency increased as the nozzle entry arc was increased to 90°. It is interesting to note, however, that blade number may not be too critical, because data collected by Hothersall (1985) from different machines show good efficiencies with up to 32 blades and diameter ratios of about 0.66 to 0.68.

Sundry comments

A further point relates to the Soft Technology article referred to above. The photograph of flow through a cross-flow turbine on the first page was reproduced upside-down. The photographed turbine was undergoing tests in the hydraulics laboratory in the School of Mechanical Engineering, University of Technology, Sydney last year. It achieved a peak efficiency of 68% (Sutikno 1990). Note it has 24 blades and a solidity σ of 1.26.

The computer program mentioned in the previous Soft Technology article is now updated to XFLOW version 2.0 (still GW-BASIC), and is obtainable from the author via the ATA for $20 to cover costs.

Response to the cross-flow article has been good and demonstrates the potential popularity of these machines. Future articles are planned to cover details of other aspects of micro-hydro systems, including electrical systems and water supply.

References

Hothersall, R., 1985. A review of the cross-flow turbine. Proceedings, *Water Power '85 Conference*. ASME, New York

Khosrowpanah, S., and Albertson, M.L., 1985. Experimental study of the cross-flow turbine. In Waldrop, W.R. (ed.) *Hydraulics and Hydrology in the Small Computer Age*, v.1. Proc. of the Specialty Conference, Hydraulics Division of the American Society of Civil Engineers. Lake Buena Vista Florida, August 12-17 1985. ASCE, New York: 644-649.

Khosrowpanah, S., Fiuzat, A.A. and Albertson, M.L., 1988. Experimental study of cross-flow turbine. *Journal of Hydraulic Engineering* 114 (3): 299-314.

Fiuzat, A.A. and Akerkar, B.P., 1991. Power outputs of two stages of cross-flow turbine. *Journal of Energy Engineering* 117 (2): 57-70.

Scales, LA., 1991. Cross-flow turbine design. *Soft Technology* 35: 33-39.

Sutikno, D., 1990. *Experimental Study of the Cross-flow Turbine*. Master's Thesis (unpub.), Faculty of Engineering, University of Technology, Sydney.

HEATSHIFTERS
Cheap and Effective

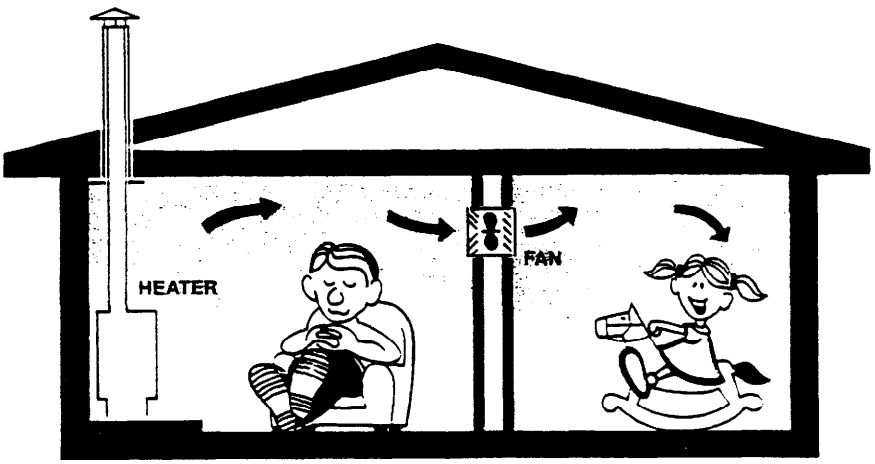
By Stephen Reardon

It is a sad fact that a solid fuel or gas room heater heats the top part of your room long before the lower part even feels warm.

The top part of the room can be quite hot even though you, sitting in your lounge chair, are barely warm. To prove to yourself how much heat is wasted heating the ceiling, measure the temperature at floor level and then again at ceiling level. You will find that if the room feels uncomfortably warm, the ceiling temperature will be as high as 40 degrees Celsius.

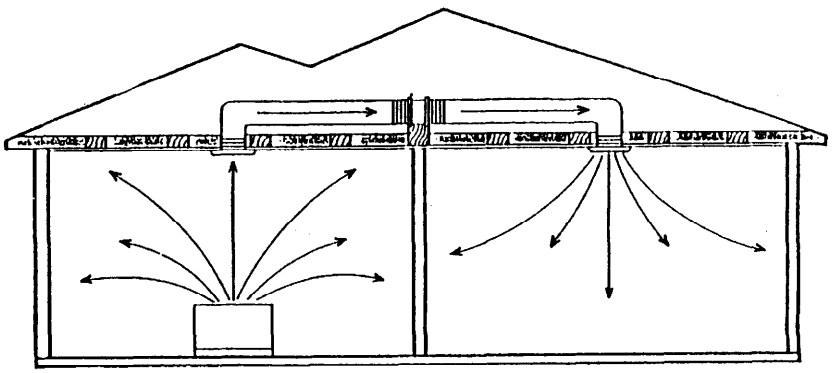
A heat shifter takes advantage of this principle. The heat collected near the ceiling can be transferred to another room by using a fan and some ducting. A typical application of this is from a lounge room to a bedroom. The system is ideal for transferring the heat out of a room no longer in use (for example, when you go to bed), or for using excess heat if a room becomes too warm.

Fig. 1.



The heater shifter system is also ideal for general warm air circulation to stop damp, and for bringing heat back down from upstairs landings.

Fig. 2.



COMMERCIALLY AVAILABLE KITS

Heat shifters are available commercially, and have proven to be quite popular. They are best used as problem solvers, where they can be retrofitted to an existing house with good heating in one room and poor heating in others. In a properly designed, thermally efficient house, the need for such fittings is minimised.

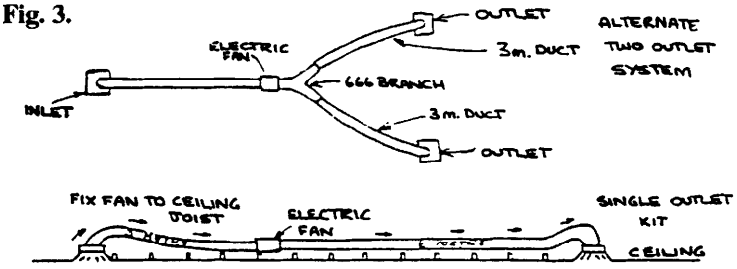
Commercially available heat shifters come in kit form, making them ideal for owner installation. The basic elements are an air intake grill, a fan, some flexible ducting, an outlet grill and a speed controller.

The simplest kit (figure 1) is for heating an adjoining room. The system consists of a fan, with suitable air grills, which is positioned high in the adjoining wall. For flat or low pitched roofs (houses having no roof space), this kit is usually the only option.

The most popular kits (figure 2) include a length of 150mm diameter insulated ducting (flex) up to 12 metres in length. These systems usually incorporate an incline fan into the duct itself which runs quieter than a normal kitchen type exhaust fan. The fan is usually fitted with a variable speed control, and can move a maximum of 100 litres of air per second. The fan draws around 40 watts of electricity at full speed. For best results, only one outlet should be fitted using the same fan and a split duct (figure 3).

Heat shifter kits range in price from $200 for the simple, through-the-wall type, to $300 for a ducted system. You can install the kit yourself, but may need an electrician to install a plug for the fan.

Fig. 3.



MAKING YOUR OWN HEAT SHIFTER

Making your own heat shifter using readily available parts is an attractive proposition. For simplicity's sake, you may wish to opt for a standard ceiling fan instead for an incline fan.

To make your own heat shifter you will require:

200 mm ceiling exhaust fan $25-30

6m length of 250mm length $50 insulated flexible heating duct

Low spread discharge grill

If there is no natural path for air to flow back to the heater (for example a door or hallway) you will probably also need a ventilation grill, 300mm x 400mm. An electrician is required for any electrical wiring work.

POSITION INLET AND OUTLET

Positioning the inlet and outlet grills is quite critical. Place the fan at the hottest point of ceiling in the heated room. The discharge grill in the other room should be placed near the wall to avoid annoying downdraughts and also at the furthest point from the door. Don't forget to allow 400 mm clearance in the roof space to run the ducting.

So, if your house is fitted with a solid fuel or gas heater, you can redirect the heat around the house to where it can do the most good, instead of using wasteful electrical spot heaters. The advantages are amazing. The temperature of a room can be raised from a cool 15 degrees Celsius to a warm 21 degrees in minutes, using a simple device you can make yourself for around $100.

Inverter Buying Guide

by Alan Hutchinson

Back when electricity was beginning to be used on a large scale, decisions were made that have predetermined how we will use it.

For reasons of ease of generation, distribution and efficiency, it was decided to supply electrical energy from a distribution grid at about 100 to 200 volts and in an alternating current (AC) form. In Australia, 240 volts was chosen with an alternation rate of 50 times per second (50Hz). This standardisation has allowed mass production of electrical appliances and there are few appliances available which operate on different voltages.

This is fine until you are trying to run appliances from an alternative power source such as solar or wind. The energy from these sources is usually delivered in a low voltage direct current (DC) form and usually stored in batteries. How then do we find electrical appliances that will use energy in this form?

Because of the size of the automotive industry, there is a limited range of 12 or 24 volt appliances available. This range may be adequate in some cases, but many devices are not available

(have you ever seen a 12V microwave oven?), will not be portable or conventional ones have already been acquired. The way out of this difficulty is to use an inverter.

What is an Inverter?

An inverter is a device which changes DC electrical energy into an AC form similar to what you buy from the electricity supply utilities. This allows you to run conventional 240V AC appliances from a low voltage source such as photovoltaic panels or batteries. It works by using fast electronic switches to effectively reverse the connections to the battery 50 times a second and then feeds this through a transformer to change the voltage to 240 volts.

When do you need an Inverter?

The most common form of energy storage is a battery. This is a low voltage DC source. Bearing this in mind, there are two main reasons for choosing to use an inverter:

1. You want to use conventional 240V AC appliances from it.
2. If you are trying to draw a lot of power from the battery, the wiring at low voltage needs to be very heavy and hence expensive. Reliable high current switches are also expensive and more difficult to operate. For large systems it is preferable to use conventional 240V wiring and run the whole system from a large inverter.

(Variable frequency inverters are also used as efficient speed controllers for induction motors.)

CHOOSING AN INVERTER

There are many considerations involved in choosing an inverter, but the main two things you need to determine are the power output required and the input voltage.

Power output

The power level that may be drawn from the normal mains power supply is only limited by the wiring and the fuses. However, inverters can only supply up to a fixed level of power. If you attempt to draw more than this they will turn off to protect themselves.

The inverter maximum power rating must be larger than the maximum load power required to be supplied. So you need to determine the appliance or appliance combination (if they have to be on at the same time) which will draw the most power and choose an inverter that will deliver this.

Inverter power ratings range from small 20 Watt inverters intended for single fluorescent tubes up to large 10,000W dreadnoughts (see table).

Input voltage

An inverter is designed to operate with a specified input voltage and cannot be used with a different input voltage. The commonly available voltages are 12, 24, 32, 48 and 110 volt.

At the low power end, 12 and 24V inverters are most common but as the power rating increases it is necessary to go to higher input voltages to keep the

input currents to practical levels. The largest available 12V inverter is 2000W and even this is considered undesirable by many in the field as it requires average currents of 200A which not many battery banks will support for a sustained period. The largest 12V sizes from other manufacturers are all around 1200W continuous.

As a rule of thumb, for low power, 12V is a good choice as it reduces the number of cells in the battery bank, but above 1000W it is better to think about going to 24V. Above about 3000W, then think about 48V.

THE BUYING GUIDE

Set out below is a table comparing most of the inverters available on the Australian market today. There are also a list of inverter manufacturers or agents. (Inverters will be available from your local suppliers as well.) From these you should be able to select a suitable inverter for your situation.

The listings are arranged in order of increasing continuous output power. This allows you to compare the various inverter options around the power capacity you desire.

The data for each inverter was mainly derived from the manufacturers responses to a questionaire or else their published specification sheets. We have taken care to get this as accurate as we can but we have to trust that the information supplied by the manufacturers fairly describes the real performance of their product and is not 'optimistic'. Where there is no figure in a table position, this means we were not able to obtain that information.

There are many other factors to consider in selecting an inverter. The following discussion is meant to explain some of the points of comparison used in the buying guide and to give some more detailed information on inverters. For the sake of brevity, this will be written using the normal technical language. There is also a box which explains the more important terms.

INVERTER DETAILS:

Power Output

Inverter power output capability can be expressed in a variety of ways.

Continuous

The continuous power rating is the usual basis of comparison. (Note, this is dependent on the ambient temperature and can decrease by up to a factor of two for operation at 45°C - keep the inverter cool and well ventilated).

Some manufacturers make provision for additional inverters to be slaved together with the original master inverter to increase the available total power. This allows extra power increments to be added at a later date.

Surge

Most inverters can supply considerably more power than their continuous rating for a short period of time. This surge capacity is useful for appliances - particularly motors and heating elements which will often draw at least 2 to 3 times their rated power when starting up. E.g. a fridge may well draw an average power of 200W but may re-

Basic Electrical Terms

Voltage

The unit used to measure the electromotive force driving an electric current to flow round a circuit. Like the fall on a river.

Current

The rate at which charge is moving along a wire. Like current flow in a river.

Power

The rate at which energy is being transferred or used up. This is measured in Watts. In AC systems the term VA (Voltamps) is used instead of watts to describe the power rating because Watts is used for the real power use which depends on the phase angle between the voltage and the current waveforms. When the phase angle is zero (i.e. for resistive loads like an incandescent light globe) the real power drawn in watts is equal to the VA rating. If the load is inductive or capacitive the real power Watts will be less than the VA rating.

Power factor

The power factor is defined as the cosine of the angle between the the voltage and the current waveform.

A power factor of 1 means that the current and voltage waveforms are completely in phase and all power delivered by the source is used.

A power factor of 0 means that the voltage and current are completely out of phase and no power is actually used by the load. (e.g. a pure inductor or capacitor doesn't use any power). All power delivered from the source is returned to it.

Load

Any device or appliance which is connected to the inverter and draws power.

Reactive load

Any load which has a capacitor or inductor in it.

quire 1000W for a couple of seconds to start it.

Inverters which will sustain surges of up to four times larger than their continuous ratings for 5 seconds are available for heavy load starting situations.

Comparisons between figures in the surge column should be treated with a little caution. There is no standard time period over which the surge rating is to be valid. Typically it is about 5 seconds. If this is critical in your application you should look at the actual specifications of the inverter or contact the manufacturer to check its suitability.

Overload handling

There are differences in how inverters handle overloads. All inverters have thermal overload protection which will protect against sustained moderate overload.

When confronted with a large overload, such as a stalled motor, some inverters will simply turn off. Others handle this by current limiting which is preferable because it will still deliver some power into the load which may be enough to get it going.

Reactive Power Handling

Inverters vary in terms of their ability to handle loads which are not purely resistive.

These are the main strategies for dealing with the reactive power returned to the inverter.

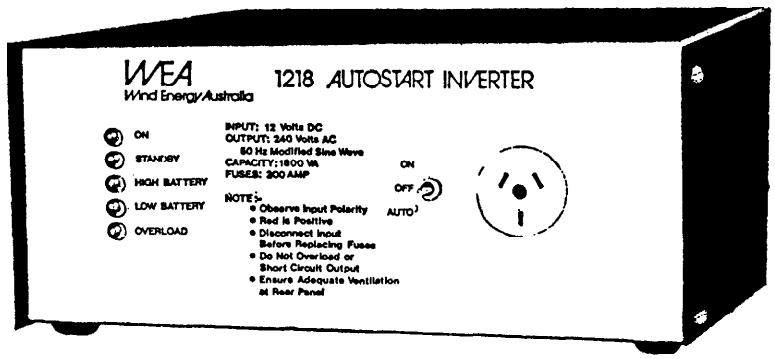
a: The power can be dissipated inside the inverter or

b: It can be stored inside the inverter or

c: It can be returned to the battery.

Some, such as some of the Power Conversion Devices range, dissipate the power internally. This limits the power factor range and makes them less suitable for running motors.

Most of the larger inverter designs use various forms of 'reactive current control' which allow them to handle loads of any power factor. If you are running motors or complex loads such as a large bank of fluorescent lights, you would do well to consider an inverter which can handle any power factor.



Efficiency

Inverters waste some energy in the process of conversion. There are two components to this loss. The standby or no load loss is the energy wasted when the inverter is not supplying any power to a load. The other part of the loss is roughly proportional to the power being drawn. Efficiencies range from 95% (i.e. 5% lost) at best down to about 50-60% at worst. There are significant differences between inverters in this area and you need to consider what power you will be using the inverter at most and to make comparisons of efficiency in this range.

Autostart

To avoid wasting a lot of energy while no appliances are turned on, most inverters now automatically switch into a standby mode which doesn't consume much energy at all. As soon as the inverter detects that an appliance has been switched on it changes back to normal mode and starts supplying power.

There are a variety of autostart techniques, some a lot better than others. Older inverters used a low DC voltage to test for current flow which worked OK on resistive loads but was a problem with some other loads such as fluorescents. More recently most manufacturers have switched to using a high voltage pulse system which is less easily fooled.

There is a minimum load which will autostart, usually about 10W.

Waveshape

The voltage supplied by the electricity utilities varies smoothly with time in the form of a sine wave. The cheapest way to make an inverter is to merely switch the DC voltage back and forward. This produces a square wave output voltage. This is fine for many resistive loads such as incandescent lights or heaters but will cause motors and ballasts to run hotter than normal. By using 2 or more windings and switching them on in sequence a modified square wave can be created which is a better approximation to a sine wave. Some appliances will not operate correctly on square wave in-

verters. For instance, I had a turntable which refused to automatically turn off when run from a square wave inverter.

Recently a number of true sine wave inverters have appeared. These produce quite an accurate sine wave either by using resonant circuits or filtered pulse width modulation schemes. e.g. the Rainbowsine uses resonant circuits and the Siemens Sunsine uses filtered PWM. These inverters produce the best approximation to the mains supply but at a price.

When driving non linear or highly inductive loads, the output waveshape may become distorted, particularly at the zero crossing. To improve the waveshape a variety of techniques are used such as dead space clamping.

One thing to be careful of regarding modified square wave inverters is that they vary the on/off ratio as a means of regulating the output voltage. This means that when the battery voltage is high, the output dead space can be large enough to cause problems for some switching power supplies such as those in personal computers. In this case an inverter which uses a different regulation scheme would be better.

DC isolation

In most inverters the output is electrically isolated from the input. This is safer if there is a fault in the wiring or under marine conditions.

Noise

Some inverters make significant amounts of audible noise e.g. the Sunsine. Square wave inverters can couple audio and radio frequency electrical noise into appliances which may be annoying. E.g. bars on a TV or hum in a stereo system.

Fluoro inverters

Most large inverters are not very efficient when only delivering 20-30W of power. If you are only running low power fluorescent lights for substantial periods of time, it may be better to use a separate small inverter for each light. One tube fluorescent light inverters are available from about $20 for the cheap imports from Choice electric up to $50 or so for the more substantial units from Selectronics.

Protection

Inverters are usually protected from a variety of things you can do wrong.

Reverse polarity

Most inverters use a contactor relay both as an on/off switch and as a protection against connecting the battery the wrong way round. This is preferable to a diode which wastes a lot of power.

Battery undervoltage

Inverters usually turn off if the battery voltage falls too low. This is to protect the battery from damage due to overdischarge.

Battery overvoltage

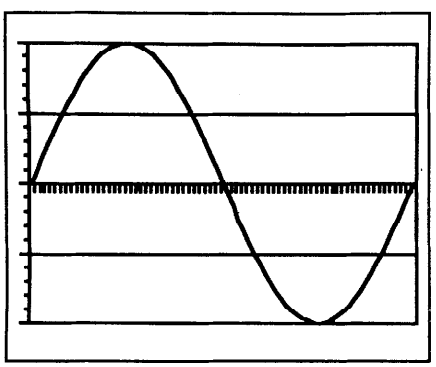
To protect the inverter (and the load) there is usually an overvoltage cutout. The voltage at which this occurs is something you should note with care. There is an increasingly common problem occurring because battery manufacturers are wanting higher boost voltages when charging their batteries and some inverter cutoff voltages are below these. This means that these inverters will turn off sometime during the daily charge. This is very annoying if you happen to be using a computer at the time!

Output overload/short circuit

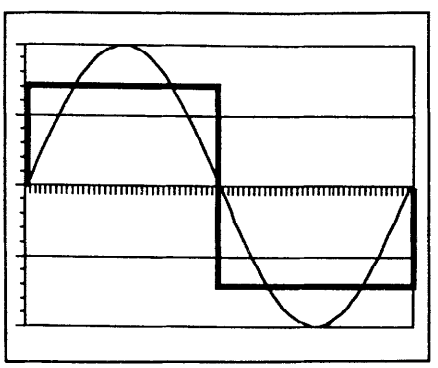
If the inverter is overloaded it will get too hot and the over temperature protection will turn it off.

Low Output Voltage (brown out)

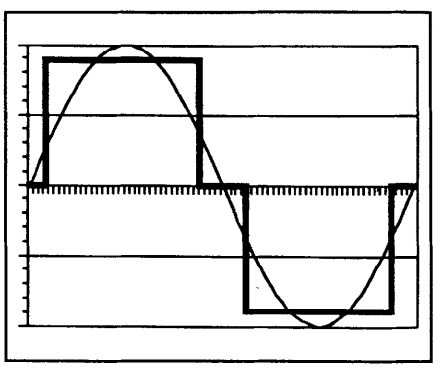
Some inverters will switch off if they are unable to keep the output voltage high enough. This will protect some



Sine wave



Square wave



Modified Square wave

appliances which can be damaged by under voltage.

When a fault occurs, the inverter can reset itself automatically if the fault condition ceases or it can wait to be reset manually. The automatic reset is useful if it saves you a frequent walk to the inverter shed but the manual reset is safer and makes fault finding easier because you can see what fault caused it to turn off. It is also possible to get remote indicators for some inverters.

Physical design

Case design is important to prevent dust penetration, condensation and bugs. The case material finish should be considered because a battery shed is a corrosive environment.

An inverter which uses a 50Hz transformer will of necessity be rather heavy. Inverters which use high frequency transformers can be a lot lighter for the same power rating.

Cooling may be done by natural convection or enhanced by fan forcing (At the expense of having moving parts).

The battery connection is either a pair of bolts on the back of the case or a pair of short heavy duty flying leads (some with alligator clips on them).

Dale Butler (who was behind the design of the Sunsine inverter) used to claim that by liberal use of zener diodes across FET gates etc. that he could give his inverters a sporting chance of surviving a lightning strike on the solar panels. I'm more inclined to think that some judiciously placed lightning rods and lightning arrestors may be a surer option. If you are in a bad lightning area you need to give some thought to this.

Battery charge option

Some inverters will work backwards as battery chargers. This adds an additional level of complexity which may not be worthwhile as many generators have a battery charger built into them.

Warranty

Warranties are usually in the one to two year range.

Installation

The connection between the battery and the inverter should be as short as possible and use heavy wire or copper braid. The connections should be done up tightly (or else they will get hot) and covered with a grease layer as corrosion protection.

Due to the proximity of the inverter to the battery bank, spark precautions are needed. The initial connection should be done with the inverter turned off or the fuse taken out so that there is no spark when the lead is first connected to the battery. If the inverter case is open there is a further possibility of sparks from the relay contacts.

To reduce losses in the front panel power outlet sockets, some of the larger inverters provide a junction box for a hard wired connection.

If a 240V backup generator is to be used as an alternate energy source, a double pole change over switch should be used to switch between the inverter and the generator.

Safety

240V AC is enough to kill you. Be careful. 240V wiring should be done by a competent person. It is generally safer to have the inverter output floating with respect to ground than to earth the neutral. This is because shorts or accidental contact between one side of

the circuit and ground are far more likely than between the two sides of the circuit. If the inverter output is floating then shorts to ground will not be dangerous.

Inverter Problems

Fluorescent lights.

Some inverters won't autostart fluorescent lights on their own. Sometimes it was necessary to turn on an incandescent lamp to get the inverter going. Once running it could then be turned off. Most of the inverters here claim to start with fluorescent lamps.

Flicker and buzzing can be a problem when square wave inverters are used. (Fluoro lamps are noticably more noisy on square wave than sine wave). Also compact fluoros with electronic ballasts may not work properly.

Motors.

The start up power requirement for larger induction motors will often trip out the inverter overload. If you want to start motors, pick an inverter with a high peak power rating and with the ability to handle any power factor.

Problem loads

There are some problem loads.

Half cycle loads

Some hair dryers or heating elements use a diode for their half power setting and this results in a large imbalance between half cycles and transformer saturation. Use only on high.

Waveshape intolerance

Some electronic controllers for fans, some electronic timers without transformers and some VCRs cannot cope with a modified square wave power source.

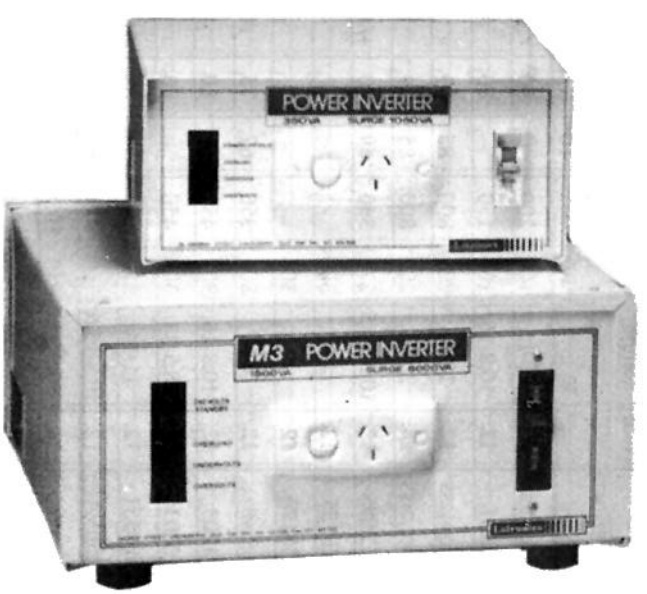
Mains powered halogen lamps may flicker because they can cool significantly during the waveform dead space.

Computers

Most computer switching power supplies don't have a lot of energy storage capacitance. If an appliance with a large starting surge is turned on while the computer is running, the computer power supply may drop out causing the computer to crash. You might consider a separate small inverter of about 300W just for the computer. (And connect the printer to the main inverter).

Inverter Suppliers

Altronics Distributors Pty Ltd
174 Roe St. Perth WA. (09) 328 2199
Latronic Sunpower Pty Ltd
P.O. Box 73 Moffat Beach Qld
(071) 91 6988
Solartronics
WA. (09) 291 7891
Selectronics
25 Holloway Drv Bayswater Vic
(03) 762 4822
Wind Energy Australia (WEA)
20 Homestead Drv.
Bangholme, Vic (03) 773 2935
BP Solar (Trace)
98 Old Pittwater Rd
Brookvale NSW (02) 938 5111
Power Conversion Devices
Unit 2, 6 London Drv.
Bayswater, Vic (03) 761 1252
Siemans
544 Church St. Richmond, Vic
(03) 420 7111
Rainbow Power Co.
70 Cullen St. Nimbin, NSW
(066) 891 430
Choice Electric Co (Santech)
3 Prospect St. Bowen Hills Qld,
(07) 252 4909
Elante (Various)
380 Caterbury Rd, Surrey Hills
(03) 836 9966



Soft Technology INVERTER BUYING GUIDE Entries are in order of increasing power output

Manufacturer	Model	Input Voltage		Power Output		Efficiency at % of Full Load		Power Factor Range	Idle Power Used	Wave shape	Auto start	Min. auto start load	Start with fluro only	Output Isolation	Indicators	Output Current Limit	Protection	Size W*H*D	Weight	Comments	Recd Retail Price
		Nom	Range	Cont	Surge																
		V		W	W	10	100		W			W						cm	kg		$
Santech	Pocket Inv	12	10-15	100	200	-	90	-	1	M	N	-	-	-	L	-	ROTU	10*4*12	0.5	Compact	179
WEA	1201	12	10.8-16	100	150	-	80	-	7	M	N	-	-	-	LHO	N	ROTV	16*17*11	4		299
Selectronics	SPI200-12SS	12	10-16	200	800	85	89	-	0.24*	M	Y	3	Y	Y	OVT	Y	ROTV	18*12*22	5		415
	SPI200-24SS	24	20-31	200	800	85	89	-	0.48*	M	Y	3	Y	Y	OVT	Y	ROTV	18*12*22	5		415
Pwr Conv	PC300S	12	10.5-14.5	275	360	69	80	+/-0.9	5	SINE	Y	5	N	N	-	Y	ROTV	26*8*22	2	3%THD	695
Altronics	K6755	12	11-15	300	-	-	-	-	0.2*	SQ	Y	Adj	N	N	LT	N	RLT	30*10*24	-	Can be bought as a kit	379
	M8120	12	-	300	-	-	-	-	-	SQ	Y	-	-	-	-	-	-	26*16*24	-	Cheap Taiwanese Import	199
RPC	RainbowSine	12	10-17	300	350	67	75	All	14	SINE	Y	15	N	N	LTS	Y	ROTU	23*14*32	11	keeps going under overload	630
WEA	1203	12	10.8-16	300	450	-	80	-	12	M	N	-	-	-	LHO	N	ROTV	22*18*13	6	Remote Start Version	449
	3203	32	28.5-43	300	450	-	90	-	12	M	N	-	-	-	LHO	N	ROTV	22*18*13	6	Remote Start Version	500
Solartronics	MO351	12	11-14	350	1000	83	81	to 0 lag	7	M	Y	10	N	N	LHOT	N	ROTH	20*12*25	7		449
Latronics	350VA	12	10.8-15.6	350	1050	85	92	All	0.3*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	25*12*21	6		635
	350VA	24	20.5-32	350	1050	85	92	All	0.5*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	25*12*21	6		635
	350VA	48	41.5-64	350	1050	85	92	All	0.7*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	25*12*21	6		635
WEA	1204	12	10.8-16	400	600	-	80	-	18	M	Y	25	-	-	LHOS	N	ROTV	24*27*15	8		759
Trace	612A	12	10.8-15.8	425	600	65	90	All	0.25*	M	Y	1	N	Y	-	N	RTV	27*15*20	8	also batt charger, 2Yr war	976
WEA	2404	24	21.5-32	450	650	-	87	-	17	M	Y	25	-	-	LHOS	N	ROTV	24*25*15	8		759
Selectronics	SPI480-12DS	12	10-15	480	1000	80	85	-	0.48*	M	Y	6	N	N	ac on	Y	ROTV	19*20*23	9		630
	SPI480-24DS	24	20-31	480	1100	80	85	-	0.96*	M	Y	6	N	N	ac on	Y	ROTV	19*20*23	9		630
WEA	3205	32	28.5-43	500	750	-	90	-	16	M	Y	25	-	-	LHOS	N	ROTV	24*25*15	7		795
Pwr Conv	Powermax 500	24	21-29	500	1000	76	91	+/-0.5	15	SINE	N	-	-	Y	LHOS	Y	ROTV	44*9*32	7	Full Rating @ 45°C	2595
	Powermax 500	48	42-56	500	1000	76	91	+/-0.5	15	SINE	N	-	-	Y	LHOS	Y	ROTV	44*9*32	7	Full Rating @ 45°C	2595
Latronics	550VA	12	10.5-16	550	1650	85	92	All	0.3*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	8		864
	550VA	24	20.5-32	550	1650	85	92	All	0.5*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	8		864
	550VA	48	41.5-64	550	1650	85	92	All	0.7*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	8		864
Altronics	K6774	12	11-15	600	-	-	-	-	8	SQ	Y		N	N	LT	N	RLT	-	-	Can be bought as a kit	525

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		Nom	Range	Cont	Surge	10	100														
		V		W	W				W			W						cm	kg		$
Altronics	K6775	24	11-15	600	-	-	-	-	16	SQ	Y		N	N	LT	N	RLT	-	-	Can be bought as a kit	525
Solartronics	M2012	12	10-15	600	2000	-	80	-	9	M	Y	10	-	-	LHO	N	ROTV	28*15*28	13		975
Solartronics	M2024	24	20-30	600	2000	-	80	-	12	M	Y	10	-	-	LHO	N	ROTV	28*15*28	13		975
Latronics	700VA	12	10.5-16	700	2100	85	92	All	0.3*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	12		1145
	700VA	24	20.5-32	700	2100	85	92	All	0.5*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	12		1145
	700VA	48	41.5-64	700	2100	85	92	All	0.7*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	12		1145
WEA	1210	12	10.8-16	1000	1500	-	80	-	24	M	Y	25	-	-	LHOS	N	ROTV	35*30*19	15		1425
	2410	24	21.5-32	1000	1500	-	87	-	22	M	Y	25	-	-	LHOS	N	ROTV	35*30*19	14		1449
Pwr Conv	Powermx 1000	24	21-29	1000	2000	76	91	+/-0.5	16	SINE	N	-	-	Y	LHOS	Y	ROTV	44*12*32	10	Full Rating @ 45°C	3200
	Powermx 1000	48	42-56	1000	2000	76	91	+/-0.5	16	SINE	N	-	-	Y	LHOS	Y	ROTV	44*12*32	10	Full Rating @ 45°C	3200
Latronics	1050VA	12	10.5-16	1050	3100	85	92	All	0.3*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	14		1630
	1050VA	24	20.5-32	1050	3100	85	92	All	0.5*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	14		1630
	1050VA	48	41.5-64	1050	3100	85	92	All	0.7*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*26	14		1630
Selectronics	SPI980-12DR	12	10-15	1100	1700	84	87	-	0.01*	M	Y	11	N	N	ac on	Y	ROTV	24*24*26	16		1100
	SPI1100-24DR	24	20-30	1100	2300	84	87	-	0.02*	M	Y	11	N	N	ac on	Y	ROTV	24*24*26	16		1140
	SPI1200-12SS	12	10-15	1200	4600	86	89	-	0.72*	M	Y	4	Y	Y	ac on	Y	ROTV	32*21*31	20		1495
Trace	2024A	24	21.6-30.7	1200	2000	65	90	All	0.21*	M	Y	2	N	Y	-	N	RTV	16*25*32	17		2497
Solartronics	M3012	12	10-15	1200	3000	-	80	-	18	M	Y	10	-	-	LHO	N	ROTV	28*15*28	21		1140
	M4024	24	20-30	1200	4000	-	80	-	24	M	Y	10	-	-	LHO	N	ROTV	28*15*28	21		1399
Latronics	1250VA	12	10.5-16	1250	3800	85	90	All	0.3*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*32	17		1923
	1250VA	24	20.5-32	1250	3800	85	92	All	0.5*	M	Y	Adj	Y	Y	LHOS	Y	ROTV	30*13*32	17		1923
Trace	2012	12	10.8-15.8	1300	2000	65	90	All	0.13*	M	Y	1	N	Y	-	N	RTV	16*25*32	17		2004
Selectronics	SPI1500-24SS	24	20-30	1500	5600	85	89	-	1.44	M	Y	4	Y	Y	ac on	Y	ROTV	32*21*31	22		1650
	SPI1500-48SS	48	40-60	1500	5600	85	89	-	2.88	M	Y	4	Y	Y	ac on	Y	ROTV	32*21*31	22		1780
WEA	1218	12	10.8-16	1800	2700	-	80	-	30	M	Y	25	-	-	LHOS	N	ROTV	42*35*26	20		1999
	2418	24	21.5-32	1800	2700	-	87	-	29	M	Y	25	-	-	LHOS	N	ROTV	36*35*20	20		2125

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		Nom	Range	Cont	Surge																
		V		W	W	10	100		W			W						cm	kg		$
WEA	3218	32	28.5-43	1800	2700	-	90	-	32	M	Y	25	-	-	LHOS	N	ROTV	36*35*20	20	Also a 1000w Unit	2235
	4818	48	43-64	1800	2700	-	92	-	29	M	Y	25	-	-	LHOS	N	ROTV	36*35*20	20		2235
Latronics	1500VA	24	21-31	1800	6000	88	93	All	0.5*	M	Y	5	Y	Y	LHOS	Y	ROTV	35*18*40	19		2402
	1500VA	48	42-62	1800	6000	88	93	All	0.5*	M	Y	5	Y	Y	LHOS	Y	ROTV	35*18*40	19		2402
Siemens	2Inv24/240/50	24	20-36	2000	4000	85	83	All	50	SINE	Y	10	Y	Y	LHOS	Y	ROTV	45*37*32	35	<4%THD	4000
	2Inv48/240/50	48	40-63	2000	4000	85	83	All	50	SINE	Y	10	Y	Y	LHOS	Y	ROTV	45*37*32	35	<4%THD	4000
Solartronics	M6012	12	10-15	2000	6000	-	80	-	36	M	Y	Adj	-	-	LHO	N	ROTV	48*38*17	35		-
	M8024	24	20-30	2400	8000	-	80	-	36	M	Y	Adj	-	-	LHO	N	ROTV	48*38*17	35		2499
WEA	2425	24	21.5-32	2500	3700	-	87	-	36	M	Y	25	-	-	LHOS	N	ROTV	42*35*26	30		3079
	3230	32	28.5-43	3000	4000	-	90	-	38	M	Y	25	-	-	LHOS	N	ROTV	42*35*26	35		3719
	4830	48	43-64	3000	4500	-	92	-	38	M	Y	25	-	-	LHOS	N	ROTV	42*35*26	35		3719
Siemens	4Inv48/240/50	48	40-63	4000	6000	92	86	All	65	SINE	Y	10	Y	Y	LHOS	Y	ROTV	45*37*32	45	<4%THD	5000
WEA	11040	110	98-145	4000	6000	-	95	-	39	M	Y	25	-	-	LHOS	N	ROTV	42*35*26	40		5055
	2450	24	21.5-32	5000	7500	-	87	-	72	M	Y	25	-	-	LHOS	N	ROTV	84*35*26	60		4265
	3260	32	28.5-43	6000	9000	-	90	-	80	M	Y	25	-	-	LHOS	N	ROTV	84*35*26	70		7279
	4860	48	43-64	6000	9000	-	92	-	86	M	Y	25	-	-	LHOS	N	ROTV	84*35*26	70		5460
Siemens	10Inv120/240/	120	103-163	10K	15K	90	92	All	120	SINE	Y	15	Y	Y	LHOS	Y	ROTV	76*39*65	160	<4%THD, Heavy!	9000

COLUMN CODE KEY

General
Y- yes
N- no

Waveshape
SQR-Square wave
M- Modified Square wave
SINE- Sine wave

Indicators
L - low battery voltage
H - high battery voltage
O - overload
S - standby
T - over temperature

Protection
R - reverse connection

O - overload
T - over temperature
V - over or under voltage
U - under voltage only
H - over voltage only

Idle power
* indicates figure is standby power rather than idle power

Manufacturer
Pwr Conv - Power Conversion Devices
RPC - Rainbow Power Company
WEA - Wind Energy Australia

Rec. Retail Price
Does not include 20% sales tax.
Inverters are exempt if used for solar electric systems

Laid Back Cycling the Greenspeed Way!

Want a vehicle which travels at up to 100km/h, is more convenient than a car, is far cheaper, pollution free, safer and will improve your health? In this series of three articles, Ian Sims will demonstrate how you can achieve this seemingly impossible dream.

By Ian Sims

When I compare the weight of a push bike to the weight of a car, I come to the conclusion that in driving the car, I am carrying a extra TON of metal, plastic, and glass with me everywhere I go. Is this not a wanton waste of energy and resources? And what about the two TONS of poisonous gas spewed out by the average car in a year? Are we raping our environment?

There is no need for cars to be so HEAVY. My electric vehicle "The Rocket" (see Soft Technology. No.) weighed only 76 kg, with batteries. There is obviously no incentive for car manufactures to make lighter cars, as being profit driven, the greater volume and weight of product they sell, the more they make! One car designer even said if someone could show him where he could save a pound in weight, then he could save another TEN!

Now, the main reference book I used to build my Rocket was a book on BICYCLE technology - namely, "Bicycling Science", by Whitt and Wilson. At the end of '89, after I gave up my job as a technician with a large chemical company, I had another look at it, in an effort to find something even more environment and people friendly. I was intrigued by the design of bikes known as recumbents. Having built many vehicles, I felt I could do a bit better.

While the bicycle is often considered to be the most energy efficient form of transport we have, in absolute terms it is quite poor. In fact, if we consider a normal trip, where a person returns to his or her starting point, then their potential energy remains the same, and it would therefore be theoretically possible for the trip to be undertaken without ANY expenditure of energy. The fly in the ointment on this planet is, of course, air resistance. This is where the bicycle is rather poor. At 20 mph, 80% of the rider's energy is spent overcoming air resistance. Imagine a cyclist pedalling through water..... and then compare this image with a streamlined shape like a fish or even a swimmer!

Recumbent cycles take their name from the position of the rider, who is reclines backwards at an angle of 60 to 30 degrees to the horizontal. A chair, or hammock-like seat, supports the rider, and the legs reach forward to the pedals, instead of down. Thus the rider is in a much more steamlined position, the bikes go faster, and they are easier to pedal. Records indicate that they were first used in the 1930s, when an unknown Frenchman used one to beat the world champion cyclist. The result was that the body governing world cycle racing (Union Cyclist International [UCI]) banned them, and

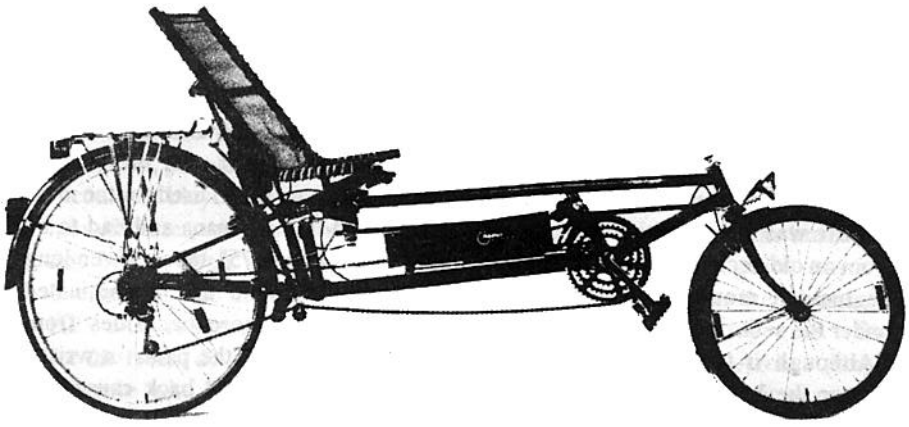


Fig. 1. The Peer Gynt Recumbent Cycle

without a competitive incentive the design was not pursued.

In 1974, two Americans recognised the need for a better bike. One that would be faster, safer, and more convenient than the one hundred year-old safety design. In 1975 they founded the International Human Powered Vehicle Association (IHPVA) to encourage the development of vehicles for land, sea, and air. Unlike the UCI, the only IHPVA rule for competition is that the machine must only use human power.

Since then, the dream of human powered flight has become a reality and human powered land vehicles have exceeded 100km/h on level road. The basis for the most successful machines has been the recumbent cycle.

When I built my first recumbent bicycle (from spare parts I had on hand) at the start of 1990, I confirmed that they were indeed easier to push, and faster.

I went a bit further than the long wheelbase machines that are used overseas. These are typified by the Peer Gynt, Avatar 2000, Easy Facer, Foulandt, Infinity, etc.. The normal arrangement is a large rear wheel (27"), a seat with back rest angle of about 60° to the horizontal, a 16" front wheel, and the pedals positioned just behind the front wheel (see fig. 1.). The handle bars may be in the normal position (e.g. Easy Facer) or under the seat (e.g. Peer Gynt.) In contrast, I used 20" BMX wheels front and rear, shortened the wheel base to that of a normal bike, and mounted the pedals above, and just ahead of, the front wheel. I used a five speed rear hub and a front drum brake. A seat was made with woven mesh from on old deck chair and angled at 45 degrees. I mounted the handle bars under the seat.

Although it took me some time to master the balance, my teenage sons took to it straight away, and rode it in preference to their mountain bikes. In rolling tests it was faster than their friends' racers: due, I guess, to the riders' legs being horizontal instead of vertical and the reclining seating position - which reduces the frontal area and improves the shape presented to the wind.

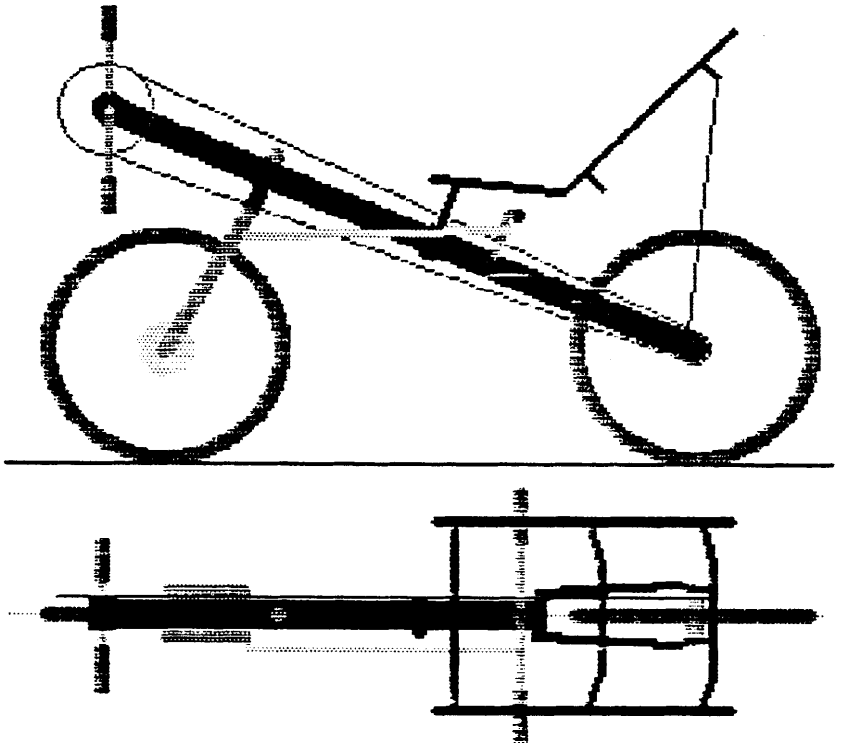
Besides being easier to push, I found this bike had a number of other advantages. I felt safer on it than on my sons mountain bike. With my feet out in font, and my weight further back on the machine and lower down, I could brake much harder without any fear of "going over the handle bars". With the seat forming a positive back stop, more force could be exerted on the pedals, making it faster off the mark at traffic lights. In fact, the amount of pedal thrust was so great, that the original 1.25" diameter tube I used for the main tube bent like a banana and had to be replaced by a 1.75" tube! Over long distances, I found that it eliminated problems with sore backsides from bike saddles, and the pains in wrists, arms, shoulders, and back caused by the conventional riding position.

In fact, I got so enthused, I decided to build a decent demonstration bike (see fig 2. this page), so that other people could try riding a recumbent; the idea being that if they liked it, I could build more. This time, I used a 2" diameter main tube (even the 1.75" had developed a slight curvature), alloy BMX wheels, drum brakes front and rear, and a two-speed rear hub with a six speed cluster, giving twelve speeds. It was fitted with a 72 tooth chain wheel, made by drilling 72 holes in a plate of aluminium and filing out the teeth. This gives it a range of gears from 108 inches down to 38 inches or from 81 to 28 on the 54t chain wheel (also fitted but seldom used). I had the frame powder coated and the seat frame and steering chrome plated.

Fig. 2. The second model of the Greenspeed Recumbent Bicycle

With the seat sprung by lacing the mesh with elastic cord, the new bike proved even more comfortable and faster that the first. It was ridden by my son Michael, in the 1990 Great Victorian Bike Ride from Bairnsdale to Melbourne, and he averaged about 30 km/h without any pain.

Meanwhile, my elder son, Paul, had got into the act and constructed one of his own design (see fig 3., opposite



Wheel size 20" by 1.75", or 20" by 1 1/8"
Wheel Base 42", Crank height 29", Crank Extension 14"
Steering head angle 67 degrees, Seat height 24", Scale 1:10
Main tube 2" by 16g (51 by 1.6mm) round steel tube
Rear forks 1.375" by 0.75" by 16g rectangular steel tube
Seat frame 3/4" by 18 or 16g round steel tube
Support to main tube 1" by 16g (weld or make clamp for adjust)
Support to forks 5/8" by 18g (weld or pivot for adjust)
Handle bars 7/8" by 16g steel tube
Pivot bolt 12mm by 100mm
Connecting rod 1/2 by 18g steel tube
Rod ends 8mm or 5/16"

page). This bike featured a simple straight through frame design and a cross-over, step-up drive - instead of using hub gears or an oversize chain wheel to get the gearing high enough for the 20" wheels

At the start of this year, I did a New enterprise Incentive Scheme (NEIS) course for unemployed people with a small business idea. As a result, I now have a year's income support to work on a business in developing, producing, and marketing a range of human powered vehicles, that are faster, safer, and more comfortable than bicycles currently available in Australia.

So from the time this magazine is published, people will be able to obtain recumbent bicycles from an Australian manufacturer, which will be as good, if not better, than anything available overseas. I also intend to establish an HPV club, to share ideas and resources for the future developed of HPVs.

People who have the facilities and wish to make their own, can simply copy the plan shown on this page, or devise their own. The only important aspects are the head angle and the pedalling angle. My early bikes had a normal steering head or caster angle of 71 degrees to the horizontal and were a bit twitchy on the steering. This is due to there being less weight on the front wheel than a normal bike. The long wheelbase models, with even less weight on the front wheel than mine, have found they need to use 65 degrees. We have now found that using the straight through frame design, with the head tube inserted at 90 degrees to the maintube, works fine. This results in an angle of about 67 degrees to the horizontal, and good steering.

Tests overseas have shown that the most comfortable angle for pedalling is about 120 degrees. This is the angle between a line drawn through the centre of the crank axle and the base of the seat, and a line drawn down the back of the seat.

I have found mild steel to be perfectly satisfactory for the frame. It is cheap, easy to cut, easy to weld, and just as stiff as high-tensile steel alloys. Furthermore, unlike high tensile alloys, if it does fail, it does so with plenty of warning. 16 gauge, or 1.6mm thick, (exhaust pipe!) is more than strong enough and, if you can find it and weld it, 18g (1.2mm) will be O.K., and somewhat lighter.

BMX front forks and wheels are readily available, and almost any sort of running gear can be used. The simplest machines I have constructed have just used a single speed, back-pedal coaster brake on the back wheel. These are fine for level riding and if you're not in a hurry. To make the most of the recumbent's advantages, I would recommend a front drum brake and a reasonable spread of gears - say a five speed hub, which has the advantage of a 50% step up in top gear. Sachs (alloy), or Sturmey Archer (steel or alloy) drum brakes, front or rear, with internal or external gears, are available through good bike shops e.g. Abbotsford Cycles (phone (03) 417 4022.

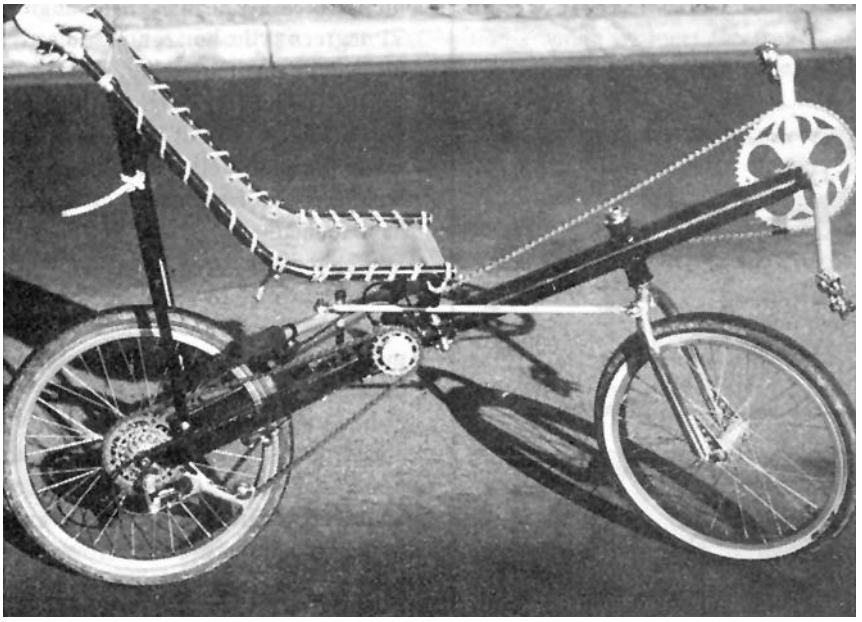


Fig. 3. Paul Sims' recumbent design

They provide for better braking than calliper brakes and are not dependent on the rim condition or the weather!

The ball joints used in the remote steering are called red ends and are available from bearing suppliers, as are the bronze bushes used in the handle bars. I have found the PVC coated polyester mesh used on outdoor furniture quite good for the seat, as it is strong and allows cooling to the back. It is available from Clark Rubber.

Learning to ride a recumbent can be fun. Some people can just get on and ride straight off. Others, like me, take some time to master the balance, and it can be a good party activity to see how people manage it! The easiest way to learn is to start off on a gentle downgrade to get the hang of the balance before you attempt to pedal it. The other way is to start with your left foot on the pedal, with the crank at about 1 o'clock, hold the brakes on, push the pedal and then let the brakes off as you bring your other foot up. You will probably wobble for the first few yards and then be O.K. Alternatively, you can get someone to hold the back of the seat till you get the hang of it. Either way, there is less distance to fall from a recumbent!

For people who want a more stable machine with no balance requirement, I shall describe the development of a recumbent tricycle in the next issue of Soft Technology.

For anyone interested in more information, the contact details for Greenspeed Bikes are below:

69 Mountain Gate Drive,

Ferntree Gully Vic, 3766.

Phone: (03) 766 5547

Contact: Ian Sims

NEWS FLASH

Rainbow Power Company Goes Public

The Rainbow Power Company is going public and will be issuing shares to interested people.

RPC has sold their shop and have plans well underway for a new factory which will be powered by 100 solar electric panels, wind, water and steam power.

If you are interested in the developments or maybe even some shares contact the Rainbow Power Company on (066) 89 1430.

RAINBOW POWER COMPANY
NIMBIN - AUSTRALIA

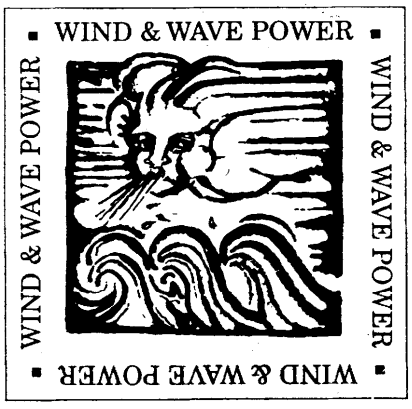
What Governments are planning for our Energy Futures

Energy has become a big issue. All of a sudden both the state and federal governments are very interested in electricity, gas, renewables and energy conservation. Virtually all the states and the Federal government have recently conducted or are conducting major revues of the energy sector. Revues could have significant impacts for us all.

So why the sudden interest. One reason is our old friend the Greenhouse Effect. The burning of fossil fuels to provide us with a cheap and plentiful supply of energy is a primary source of Greenhouse Gases. Any effort to control Greenhouse means it is necessary to take energy conservation and renewable energy much more seriously.

The other reason for the hard look at the energy sector results from the current fad in favour of privatisation, deregulation and economic efficiency. This has led to the "economic rationalists" as they are called, to target the energy industry as an area for major reform.

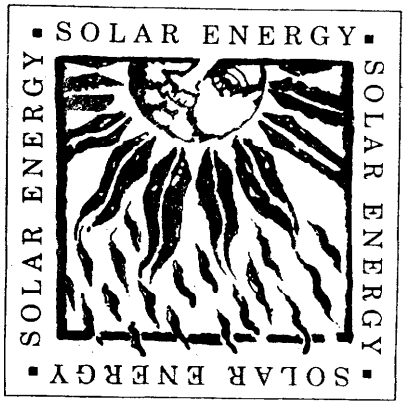
Here is a run down of some of the major energy moves in South Australia, Tasmania, and Victoria.



SOUTH AUSTRALIA

In January 1991, the South Australian Government released an Energy Green paper designed to stimulate discussion of energy issues which will confront South Australia. After discussion of the paper a State Energy will be produced.

The Government views the role of the energy sector as supporting the achievement of the community's realistic expectations with respect to standard of living, social justice, economic development and environmental protection through the provision of energy in its various forms in an efficient and secure manner.



Key issues facing the Energy sector.

Gas Supply and Price

Additional gas discoveries have been made in the Cooper Basin which ensure that South Australia's projected gas needs will be fully met until 1994, and that increases in the field price of gas are restricted to 95% of the rate of inflation.

Future Power Station Construction

At the present time, ETSA is emphasising the need to reduce the average price of electricity. This has led to improved efficiency and to deferment of the addition of new capacity to its existing system.

Declining Self-Sufficiency in Crude Oil

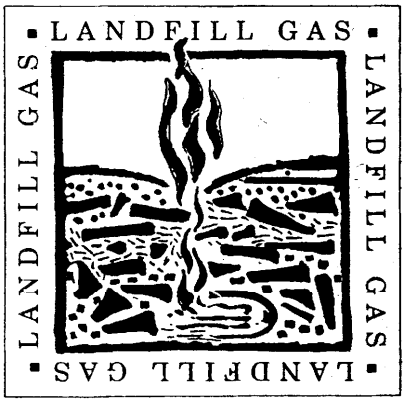
Crude oil production from Australia's major oil field in Bass Strait is declining. Options include increased support for oil exploration, development of alternative transport fuels and increased efficiency of use of conventional fuels.

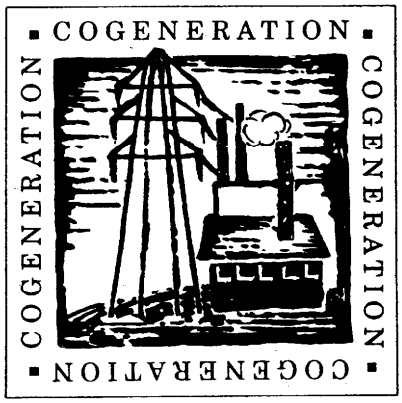
Electricity and gas prices.

The average price of electricity for ETSA customers has fallen by about 20% in real terms since 1985. It is important that such trends be maintained to benefit all consumers but particularly, the State's industry.

Sustainable Development

Environmental concerns have now become a major factor in energy planning. Both the Federal and State Governments have recently adopted an interim planning target to stabilise





emissions of Greenhouse gases (excluding CFCs and halons) at 1988 levels by the year 2000, The State Government is reviewing Greenhouse gas strategies. Possible measures include promotion of conservation initiatives, cogeneration of electricity, and community education. Alternative energy forms continue to be reviewed for longer term application.

Energy Demand Management.

Techniques for the more efficient use of energy include low energy building design and construction, high efficiency appliances in all sectors, better use of transport resources and urban consolidation. Energy utilities should adopt a least cost approach.

Alternative Energy Forms.

A variety of alternative energy sources and transport fuels (e.g. LPG, CNG), will be used increasingly in the 1990s and beyond, though much development work remains to be done to achieve their wide spread introduction.

Questions for the future

Provided sufficient gas at reasonable price can be obtained, will there be significant advantage to the State in increasing the level of gas usage in the energy system, particularly for electricity generation? Environmental concerns may discourage construction of further coal-based power stations in SA, unless they operate on cleaner, more efficient technologies.

Is the goal of energy independence relevant to SA?

Increasingly, the Australian states will need to become interdependent in the supply of various energy forms, particularly electricity and gas.

How can social costs be incorporated into the assessment of energy projects?

Adoption of principles of sustainable development requires that such social costs (or externalities) be incorporated into the analysis.

How should energy efficiency be encouraged?

The significant potential for increased end-use efficiency in the energy sector has already been noted. It is likely for example, that average electricity prices will continue to decline in real terms through most of the 1990s providing a reduced incentive for energy efficiency. Increased government and utility intervention (through regulation and financial incentives) may be required.

What type of planning process should energy utilities adopt in meeting consumers' needs at least costs?

A traditional planning approach by an energy utility is based upon forecasting anticipated consumer demands and ensuring that energy is available to meet those demands with acceptable reliability. The emphasis is on supply-side planning. Least cost planning, by contrast, sets out to define a least cost path to meeting consumer needs for heat, light, motion etc. The emphasis is on satisfying those consumer needs rather than on supplying energy to consumers. There is reasonable agreement

about the need for least cost planning processes to be adopted within the energy sector.

What structural changes should occur in the electricity and gas industries?

There are further substantial economic efficiency gains to be made through changes within the electricity and gas industries. How will the Government fund the so-called community service obligations (particularly social justice initiatives) provided by the energy utilities if not through tariff structures?

What level of Research and Development funding should the Government support in the development of alternative energy forms?

There are many alternative energy forms which could play a major role in the State's energy future. Is it reasonable to expect that SA, with a small research infrastructure could have a significant impact on the development of these alternatives? Would it be better to utilise technological innovations developed elsewhere?

Copies of the Green Paper may be obtained from the Office of the Minister of Mines and Energy, phone (08) 226 3510.

TASMANIA

Tasmania released the report "An Energy Efficiency Blueprint for Tasmania" in November 1990. The report, which was prepared by the consultants "Energy Efficiency Inc." of California, USA, outlined a range of options.

The report recommended some 117 measures. In general the recommendations covered these areas.

* Set ambitious goals.

The Hydro Electric Commission (HEC) should set ambitious goals for the future. The consultants suggested a 15 year target of 15% or better.

* Involve the public and industry.

The HEC should involve the public in the development of programs. (The consultants suggested the strong "Green" movement could be an ally in this process).

*Adopt standards for buildings and appliances.

One of the easiest ways to achieve energy efficiency is to adopt standards for new appliances, residential insulation, commercial buildings and so on. The consultants suggest minimum home insulation standards of R 2.5 in the ceiling and R 1.5 in the walls.

*Use King and Flinders Islands as Laboratories.

Because energy costs are high on these islands many energy efficiency measures would be cost effective. They could be used as testing sites for programs which could later be expanded and implemented in the rest of Tasmania.

*Begin systematic data collection.

Data should be collected systematically to help develop expertise that will make the implementation of new programs more effective.

*Elevate the Status of Energy Efficiency and Demand Side Measures.

These measures could have a higher status, more resources and greater visibility. Existing advisory services should be integrated to provide a more coherent service.

The HEC has adopted a number of the specific measures recommended in the report

In conjunction with the Victorian SEC, the HEC is conducting a feasibility study into connecting to the Victorian electricity grid via a cable under Bass Strait. This would allow Tasmania to use Victoria's cheap coal fired electricity for base load while Victoria could use Tasmania's hydro electricity for peak load.

Other investigations are being conducted into the use of gas for the industrial and domestic sector, as well as the option of coal fired electricity generation.

A "State Energy Strategy" which identifies the options for Tasmania will be released shortly. It will be available from the Department of Resources and Energy, PO Box 56, Rosny Park; Tasmania, 7018. It will cost $10.00 (As far as we know the energy policy papers in other states are all free).

VICTORIA:

The State Government has just released a five-year Energy Efficiency Strategy to promote energy conservation and renewable energy.

The Government's objectives for energy are to reduce Victoria's dependence on fossil fuel resources, such as brown coal, oil and gas; reduce the impact of energy supply and use on the environment, and develop energy conservation and renewable energy technologies.

A first for Australia: Costing the environment

The State Government, as an interim policy, will give a 10 per cent advantage to energy conservation and renewable energy options when comparing them with fossil fuel options in planning future energy developments.

For example, the Government needs to increase its electricity supply. It can build a brown-coal-fired power station or initiate a selection of energy conservation programs. In doing a cost evaluation of both, a 10 per cent advantage would apply to energy conservation options.

This recognises that there are some additional costs to the environment. These include such things as the cost of global warming, air pollution, and damage to land and water resources.

The Plan of Action

Solar Energy:

A feasibility study for a solar thermal electricity plant in Northern Victoria was completed this year. A Solar radiation monitoring study is proposed. Solar water systems are being promoted by Energy Victoria and the utilities.

Wind and Wave power:

The SECV will develop a 10MW Wind Farm on Victoria's south coast. A Wind Atlas for Victoria has just been completed. A study on wave potential was also completed this year.

Landfill Gas:

From 1991, EPA regulations require that methane from major new tips is to be collected. Two landfill gas projects are under construction and a further six are undergoing feasibility studies. Altogether, 25MW of landfill gas projects are planned or underway.

Mini/Micro-Hydro Resources:

A 6MW hydro generator has been installed at the Thompson Dam. A report detailing the potential for hydroelectricity was released in June 1990. Between 10-20MW of potential hydro projects have been identified.

Geothermal:

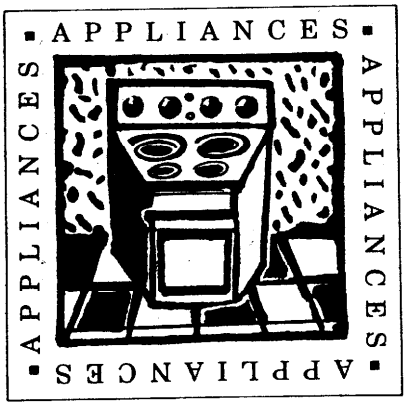
A preliminary study of potential geothermal supplies in the way Basin and the Latrobe Valley was completed in 1991 by the GFCV.

Cogeneration:

Projects totalling 72MW capacity are operating or under construction under the SECV Incentives Package. A further 183MW are provisionally committed. Under the Public Hospitals Cogeneration Project, it is planned to develop a further 40MW.

Residential Buildings:

Insulation regulations resulting in "Three Star Houses" classification were introduced in March 1991. New Energy Standards, for "Five Star Houses", incorporating passive solar design principles will be introduced in 1993. A House Energy Rating Scheme for house owners and buyers will be available from 1992.



Appliances:

Appliance labelling is already provided for eight major appliance types, both gas and electric. This will be extended to cover other appliances, including solar hot water systems. Minimum appliance efficiency standards will be introduced by 1993.

Commercial Buildings:

A lighting replacement rebate program is operating. A similar program is planned for air-conditioning. Commercial Building Energy Standards for all new commercial construction will be introduced by 1993.

Industry:

An Industrial Energy Efficiency Program, which includes free audits of energy use and funding for retrofits, is operated by the SECV.

Transport:

The Government is working with the Commonwealth and other States to introduce new vehicle fuel efficiency standards from 1995. Ten trial buses will be running on natural gas in 1991.

Public sector:

The Government has set a target to reduce energy consumption of Government occupied buildings by 25 per cent over five years. New Government buildings will comply with the Commercial Buildings Energy Standard from 1993. Government purchasing policies for appliances and equipment will be reviewed to incorporate energy efficiency criteria.

Local Government:

A program to develop local area energy plans will be piloted by a municipal council in 1992. Design guidelines for solar efficient sub-divisions are being produced.

Demand Management Planning:

Both the utilities have adopted integrated least-cost planning processes. The SECV is implementing a $55 million Three-Year Demand Management Action Plan (1990-93). The GFCV is developing a Demand Management Action Plan to be ready by 1992.

Copies of the Government's Energy Efficiency Strategy (Part I & Part II) can be obtained from:

Resources Policy and Planning Division, Department of Manufacturing and Industry Development, Telephone (03) 412 8310

References

Future Directions for the Energy Sector in South Australia. Green Paper The Government of South Australia, January 1991.

Conservation Strategy: a summary of Victoria's energy efficiency strategy. Department of Manufacturing and industry development. June 1991.

An Energy Efficiency Blueprint for Tasmania. Dr. Fereldon R Sloshansi, Energy Efficiency Inc. Irvine, California, USA. November 1990.

In the next issue of Soft Technology we will have a look at the latest energy developments in New South Wales, Queensland, Western Australia and the Northern Territory.

Behind the Scenes

News on the work of the Alternative Technology Association

Annual Report.

a. General

The year was a busy one, both in terms of public activities and the less-visible, behind-the-scenes work.

During the year, total membership increased steadily from just below 1,000 to nearly 1,200 people. The numbers of information inquiries handled by the office also increased, to nearly 1,000 over the 12 month period.

The increasing workload has led to a number of changes, including a move to a larger office area, (in the same building), and the employment of a new Office Manager, Imelda Evans.

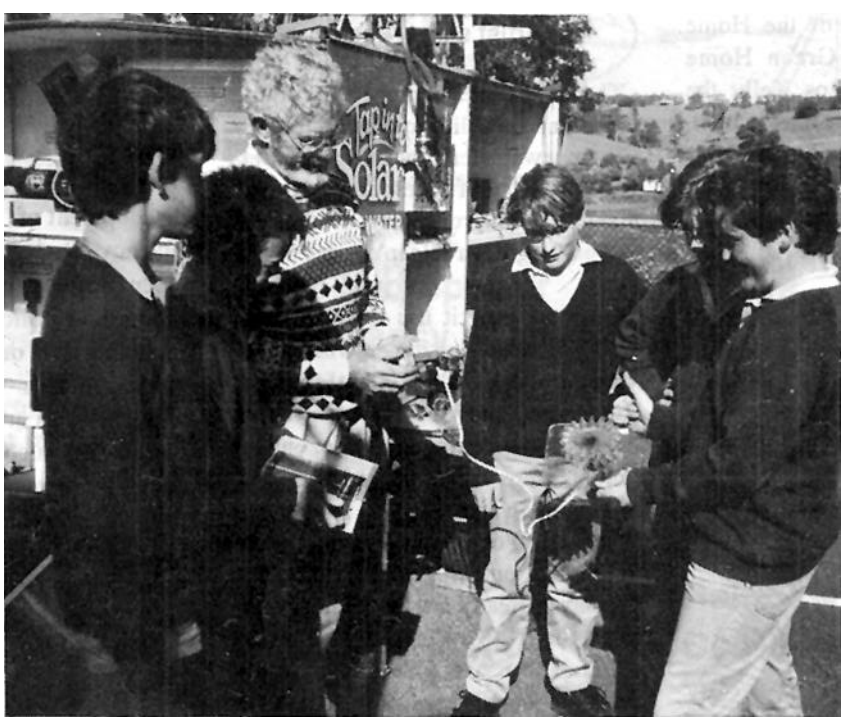
An increase in the Association's income has made it possible to put more time into developing and improving administration. This included a major upgrade of the Association's database and membership record systems.

We now have an office which is staffed more hours than ever before, and better mechanisms in place to effectively handle the needs of both our members, and the general community.

b. Activities

The ATA organised some 19 meetings, courses and field trips during the year. In addition to this, we went to a considerable number of open days, displays and exhibitions.

Meetings included, guest speaker Damien Randle from the Centre for Alternative Technology in Wales talking on energy education, a "show and tell" meeting which brought to light a range of interesting pieces of technology, a look at the new RAPSIS grants scheme for renewable energy systems and a session on some exciting energy conservation options for the future.



Noel Jeffery with the existing Energy Display Trailer at a school

Nine courses on "Power Without the SEC" and "Home Welding Skills" were run in conjunction with the Council of Adult Education, with the income used to fund course and venue running costs.

During the year we visited 3 houses which had been constructed by owner builders and used solar or solar/wind to provide all their energy needs.

c. Publishing.

In October 1990 we published the 200 page book "Build Your Own Green Technology". The book included the best construction articles from Soft Technology. Since its printing we have sold nearly 2,000 copies and it has been a great success.

At the beginning of 1991 we published the first "Soft Technology" magazine with a revised format. The magazine included increased coverage of energy-related conservation, urban and policy issues. The front cover of the magazine was completely redesigned, giving it a more modern and visually exciting image. By making use of some of the latest computerised desktop publishing technology it was also possible to go to full process colour on the front cover, at little extra cost.

d. Displays.

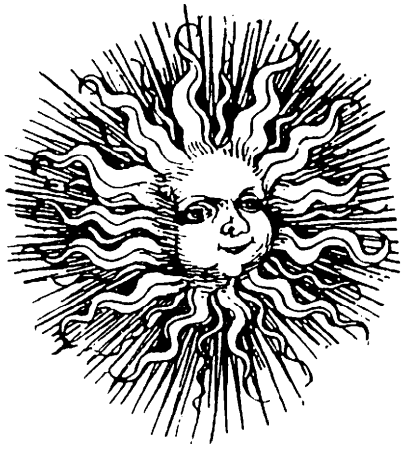
The ATA was much sought after for the provision of high quality displays on renewable energy and appropriate technology, and provided displays at 17 community events, shows and conferences.

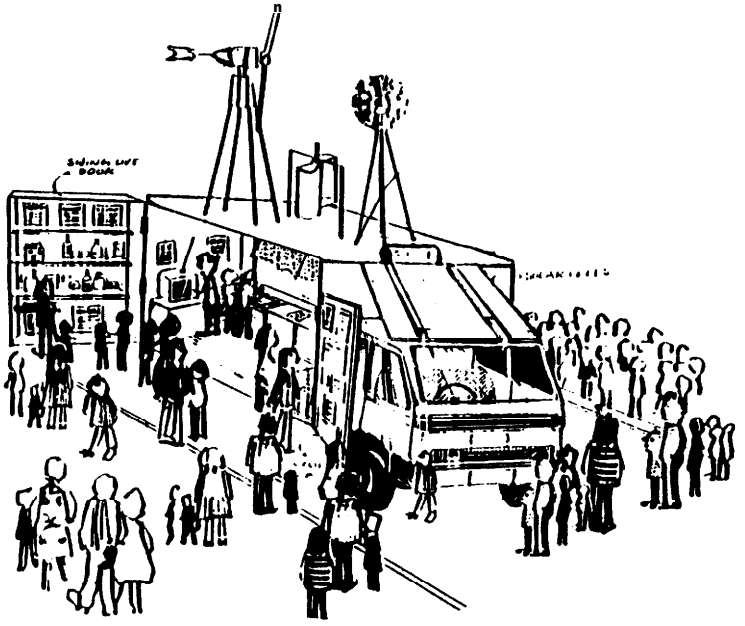
Displays were provided at the Wangaratta regional seminar "Our Energy Future", the Palm Sunday Rally, the Festival of Labour, the Flinders Lane Festival and the Gould Leagues display during Environment Week, just to name a few.

The largest display included two working windmills, a waterwheel, solar BBQ, photovoltaic panels, a solar fruit dryer, a range of other working models and static displays as well as a range books and information. This stand, which was part of the Home Improvement Show's Green Home Expo was visited by Ros Kelly the Federal Minister for the Environment. The show ran at the Melbourne Exhibition Buildings and attracted over 100,000 people during its 9 days.

e. Energy Display Trailer

The Energy Display Trailer has been an outstanding success, with approximately 6,000 students being involved with classes which make use of the trailer.





An artist's impression of the proposed new "Energymobile"

The trailer uses a range of working models and real-life equipment to show how renewable energy, energy conservation and careful resource management can improve the environment and play a greater role in our day to day lives.

Over the year it has travelled some 6,000 kilometres, visiting towns such as Wangaratta, Colac, Castlemaine, Rutherglen, and Geelong. As well as the country tours many dozens of schools were visited in the Melbourne metropolitan area.

On several occasions demand for the trailer has outstripped its availability. We have already started taking bookings for 1992. Due to this great demand, we are planning a major upgrade for 1992. Noel Jeffrey has done an excellent job promoting and running the trailer and the committee wishes to express it's sincere thanks to him.

f. Energy Policy

The Association continued its work on shaping the decisions of policy makers so that renewables and conservation can play a bigger role in the future.

We provided substantial input to the development of "Victoria's Energy Efficiency Strategy" and can certainly claim some of the credit for many of the progressive policies in this document, including the one which deals with "Externalities".

Externalities are the costs to the environment, such as pollution which occur when generating electricity. In future, partly due to our efforts, these costs will have a 10% value placed on them when fossil fuels are used to generate electricity. This will mean renewable options such as solar will have a 10% benefit, which could be enough to push energy planning decisions their way.

We also provided input to the development of the SECV's Remote Area Power Incentives Scheme resulting in some improvements. Input was also provided to the Renewable Energy Authorities "Five Year Plan".

At Your Service

Where to get energy saving and renewable energy equipment

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Paul Dee
(03) 786 3931
Building with natural forces for wellbeing and ecological balance in your living environment. Solar design, appropriate landscaping, new or recycled materials.

Elante Pty. Ltd.

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Photovoltaic panels and components for remote area power supplies. Also agents for a range of wind generators and other equipment.

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(051) 57 9304.
Supplier of solar electric systems, inverters, batteries, solar tracking, solar panels, generator sets & refrigerators etc. Including electrical installation.

Going Solar

320 Victoria Street
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(03) 328 4123
Solar electric systems, batteries and components, appliances, wood stoves, books, beekeepers' supplies, environmentally safe paints, solar water heating.

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Qld. 4551
(071) 91 6988
Fax (071) 91 6792
Manufacturers of inverters. Variety of distributors.

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Design and advice for civil works, turbines and electrical aspects of farm and small community micro hydro-electric systems.

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Central heating, Solar hot Water, Solar Electricity Systems, Wood Heating Systems, Water Pumping and Filters, L.P. Gas.

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99 Mary Street,
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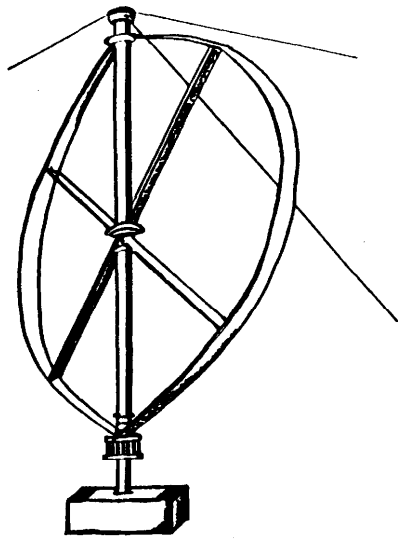
(002) 95 0000.
Solar, wind, hydro, batteries & battery chargers, inverters, 240V generators. Also bio paints & Nectre wood heaters.



Rainbow Power Company

P.O. Box 217
70 Cullen Street,
Nimbin. N.S.W. 2480
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Low voltage equipment, including appliances, batteries, control boards, electric fences, hydro systems, inverters, lighting, pumps, solar panels, wind generators, etc.

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Independent Power Systems including solar Panels, Powerstore Inverters, Batteries, Solar Hot Water, Bio Paints and Thermolux Slow Combustion Stoves.

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Large showroom, easy parking. Inverters, gas fridges, ex-Gov Deep cycle batteries, solar panels, components, appliances.

Solar Flair

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Solar Power House

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Solar, wind and water powered energy systems, Solar pumping and Solar water heating. Wood-fired heating and central heating systems.

Solar Sales

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Welshpool. W.A. 6106
(09) 362 2111.
Ten years experience in remote area power supplies. Water pumping specialists, Manufacture mechanical and gas solar tracking systems. Distributor for "Solarex Solar Panel" in W.A.. Supply and install systems in W.A., N.T., and S.E. Asia.

Stellar Echo Enterprises

1527 Poincettia Way,
Kununurra. W.A. 6743
(091) 68 2429.
Toll Free 008 099 808
Diesel-Solar battery systems, solar pumping, wind and hydro power systems. Low voltage equipment, including appliances, control boards, tools, inverters, regulators, 12V motors, steam generators, stoves, 12V fridge-freezers, evaporative air- conditioners, cornposting toilets.

Sunpower Enterprises

(Bruce McKenzie)
Garry Road,
Kernot. Vic.
(056) 788 2700.
Renewable energy systems, including those that conform with Victoria's Remote Area Power Supply Incentive (Grant) Scheme. Produces portable solar electric systems for cars, campervans and caravans.

Calling all Business!
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Suntron Energy Company

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Trak Pull Engineering

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FAX (09) 497 1335
Manufacturers of wind turbines. Large range of sizes. Accessories available.

Mark The Spark

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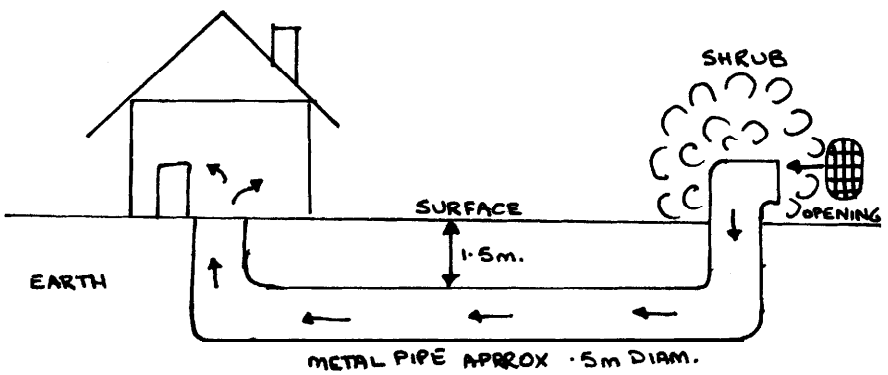
Hobart Tas 7000
(002) 31 2881
FAX (002) 31 1580
Design, supply and installation of alternative energy systems. Huge range of appropriate technology products, books and accessories. Licensed electrician and certified solar installer.

The Letters Page

Mr. Harris,

I am seeking information, and hopefully a design of an old air conditioning system, which I can vaguely remember encountering numerous years ago. Below is a rough outline of the system I can remember.

The air passed through the pipe, which had to be at least 1 metre below



the surface, where the temperature level is constant and entered the house through an outlet in the floor or wall.

I have a couple of mates who are building low set homes here in Cairns and during the summer will operate air conditioning and with the installation of a system set out above, it could help cut back high need for using the air conditioning.

Because more and more low set homes are being built in the tropics I think the home builders may be very interested in examining such a useful system.

It would also be very useful for maintaining storage areas at a constant temperate, which is vital for computer rooms. If the air conditioning cut out because of power failure or mechanical fault, it can result in major problems.

I thank you for your kind attention and look forward to receiving your reply.

Yours faithfully,
Graham Boyle

Dear Graham,

Thanks for your letter.

The idea is one we have known of for some time and we have every reason to believe would work well.

A few comments; if the pipe is not long enough (or the pipe network not large enough), the earth around the pipes would heat up and the effectiveness of the system would gradually drop off.

The pipe and air inlet should be located south of the house to take advantage of the fact that the south side of the house is the coolest; (this is even more important in the southern states where the sun is lower in the sky).

It is also important that the house being cooled is enclosed with air vents high on the wall or in the ceiling. This will result in the warm air drawing the cool air in from the buried pipes, as the warm air rises out of the vents.

We would like to hear more on how your work is going. Please keep in touch.

Mick Harris. ED.

Dear Sir/Madam or Ms

I recently wrote a letter to the Age re. the possibility of using the tremendous power or energy, wasted every day, and which I feel could be harnessed, generating electricity, caused by the strong tidal flow 4 times everyday, twice in and twice out, through Port Phillip Heads.

Millions of tons of water flow in and out at speeds up to 8 knots, and have been doing this for millions of years, and will continue for more millions of years.

Power stations built at appropriate places, possibly Pt Nepean & Pt Lonsdale, this tremendous supply of energy could be used, with machinery, with suitable gearing, to spin high speed generators to at least supplement existing power supplies.

The source of energy would be free and the whole project would be absolutely pollution free.

Four times a day there is slack water for about 20 minutes only.

Some other countries use tidal power, and although I am aware that some of those places have a greater rise and fall than we have at Pt Phillip Heads, the power is there and with modern engineering could be used.

I received one reply to my letter in the "Age", from someone who said it would be too expensive.

Compared with Loy Yangs costs and the cost of mining brown coal which, after all is a finite commodity whereas the tidal water is infinite. I cannot agree with the one person who replied.

I then wrote along similar lines to the General Manager SECV, but have not had the courtesy of any reply from him.

I cannot believe that this idea is so stupid that only one person in Victoria was interested enough to reply.

What is your Associations thought on this matter.

Yours Sincerely,
Howard J. Glover.

P.S. One other thing my one critic said was that tides are unpredictable—that is absolute rot. Accurate Tide tables are

available telling times of high and low tides every year for the year ahead.

Dear Howard,

Thanks for your letter. Your are right that there is significant potential energy from the movement of the tides. While there are technical problems which need to be solved in projects such as these, the problems are not insoluble. The biggest problem we face is a lack of imagination and vision from the energy utilities, government and industry. Lets just hope the message eventually gets through

Mick Harris, ED

Dear Sir,

I have recently read "Build our Own Green Technology" by Harris & Hutchinson which I found of great help particularly as it covered several subjects that I am working on at the moment.

Your Association is listed in the back of the book as a possible source of further information.

At present I am seeking any information on thermoelectric cooling devices that work on the electrical principal of PELTIER JUNCTIONS. These are used in small-portable "Esky" type cooler box refrigerators, mainly available from the camping or caravan equipment suppliers. These coolers work off 12 volts in your motor car from the cigarette lighter outlet.

I am trying to obtain any published items on this technology, especially any type of "do it yourself" details, so that I might make my own unit for camping trips etc. Any information on suppliers of components would also be of a great help. Enclosed is a self addressed envelope and I would be very grateful for any information you may have.

Yours faithfully,
Kevin Harivel

Dear Readers,

Since Kevin wrote to us there have been some interesting developments. Two members of the ATA are working on a fridge using the same "Peltier Junctions" Kevin describes. We wrote back to Kevin and found he has made substantial progress and actually constructed a working fridge. We are hoping to pool these experiences and use them for the basis of an article on how to build your own low cost, 12 volt fridge. Stay tuned to Soft Technology for the details.

Mick Harris, ED.

Dear Michael,

I would like to see more space in Soft Technology allocated to house building and related topics, but with specific emphasis as seen from an alternative technology perspective. Owner builders are able to consult a wide variety of sources when trying to solve standard building problems, so that it would appear to be pointless to treat the subject comprehensively, at the expense of other topics.

This is an urgent matter for two main reasons:

1. Society has a big investment in housing in terms of the materials used and the energy required to run them. Poor design now must often be endured for the life of the building.

2. Because of the high investment in terms of finance, time, and developing skills, few owner builders ever get the chance at a second attempt to refine their innovations. It is imperative that new owner builders be given access to theoretical and practical background experience thus avoiding at least some of the pitfalls.

I submit some examples which may be relevant.

1. Building methods which allow easier recycling of component materials, if the house is demolished in the future.
2. Non destructive fixing methods.
3. Building materials which are durable and easily repairable.
4. Building methods which do not require toxic or allergy causing substances.
5. Reduction of flammable material.
6. Reduction of materials which emit toxic gases in fires.
7. Designing a home for living and work (aiming at reducing transport costs).
8. High density and easy access storage methods - important for reusing and recycling.
9. Utilising building methods which are suitable for low cost tools.
10. Recycling of materials or equipment for which the background material is not readily available.
11. Conversion of new equipment for different uses.
12. New white ant control methods.
13. Elimination of unnecessary sections of a building.
14. Communication and power line channelling.
15. Leakage in underfloor water heating systems - reducing the chance of leaks and designs whereby leaks may be repaired.
16. Improved insulation methods.
17. Incorporating aesthetic (?) design as a technique to develop new skills as compared to assembly line design.
18. The mechanisms of evaporation and condensation and the part they play in heat transfer and loss, and in damage to materials.

I have put the above into practice with varying degrees of success and can give details of methods employed.

I urge owner builders, and others who have attempted to improve any aspect of a building, to send in a description of their innovation. I hope equal space will be accorded to failures and successes alike.

Yours Sincerely,
Rob Leereveld.

Thanks Rob,

Point taken. There certainly is room for an exchange of ideas on these aspects of building. The Fairweather article in this issue takes a refreshing look at energy efficient building construction. We will be following it up with a number of other articles. However there is nothing like real homegrown experience,

and we would encourage readers to write in with information about what they have learnt while building.

Mick Harris, ED.