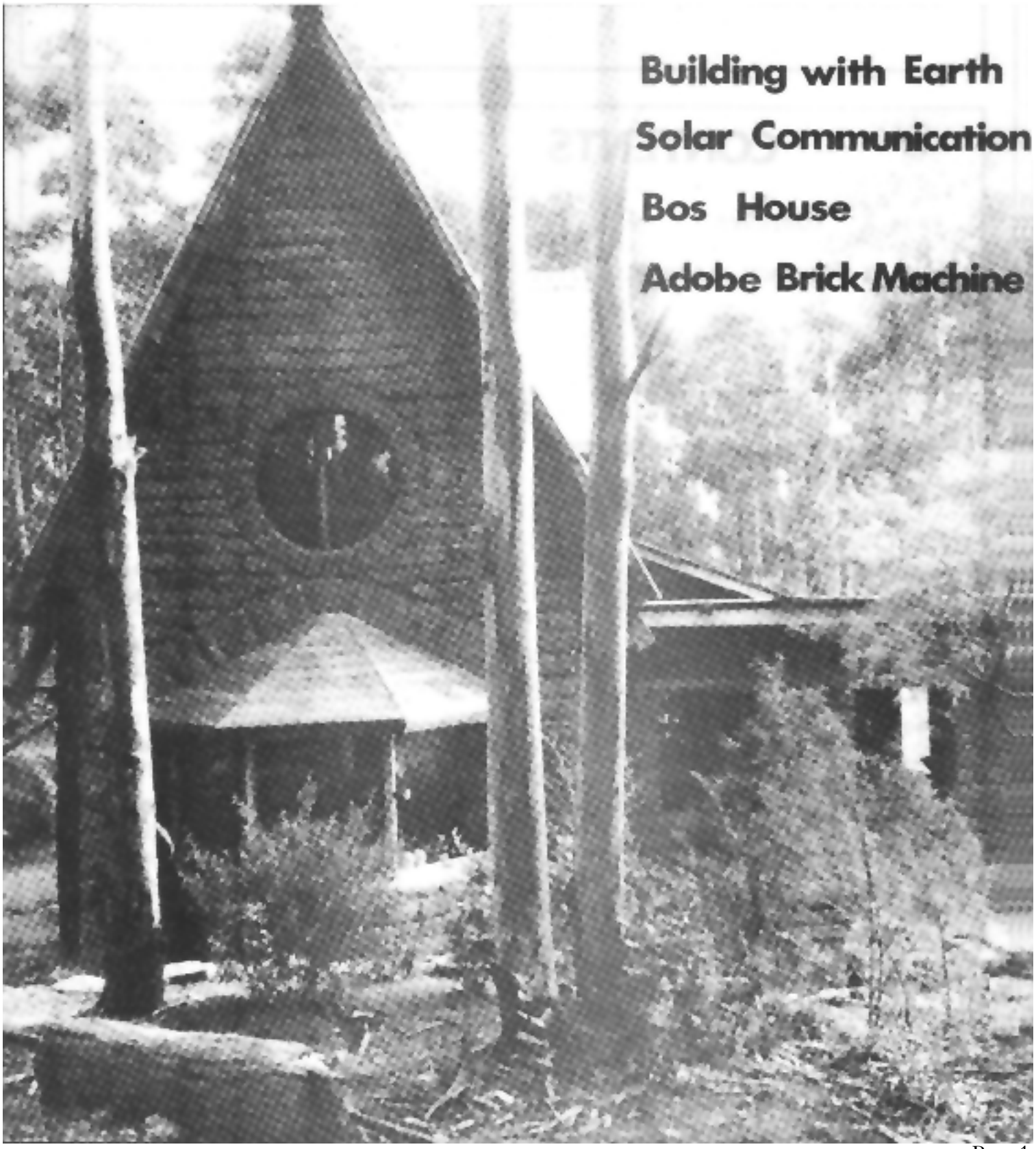
SOFT TECHNOLOGY

85c

Alternative Technology in Australia

No 2 Sept. 1980



Building with Earth

Solar Communication

Bos House

Adobe Brick Machine

THIS MAGAZINE

This the second of a series of simple magazines on Alternative Technology in Australia produced by the Alternative Technology Association, Melbourne. Offers of assistance in the writing of artiles and help in production will be welcomed. Critisisms and comments are also welcome. Address any correspondance to the Alternative Technology Association, 366 Smith st. C,ollingwood, Victoria, 3066.

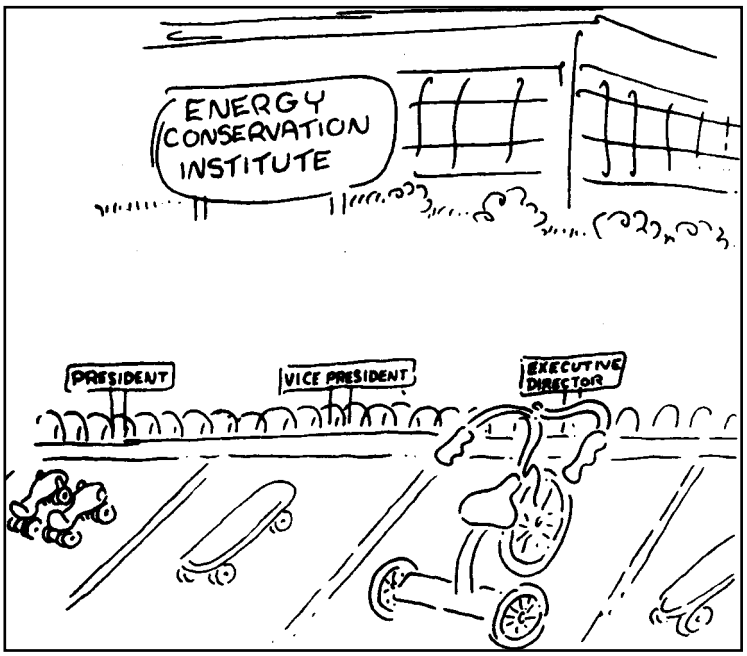
CONTENTS

This issue was produced by Mick Harris, Tony Miller, Frank Jones and Janet Llewellyn.

Energy Flashes.....

INCREASED BATTERY RESEARCH

As a result of renewed interest in electric vehicles, many new batteries are being developed which promise to be lighter and have a much higher power density than the conventional lead acid battery.
The pace of research is particularly energetic in the United States. For instance, a new lead plate has been developed at the California Institute of Technology's Jet Propulsion Laboratory In Pasadena. It will give conventional batteries a fourfold increase in power density and a doubling of battery life, according to a recent report.
The U.S. currently has an estimated 3000 electric vehicles. Nearly all models now in use rely on some variation of the familiar lead acid battery.
The situation is about to change. Last June, for example, Gulf and Western Industries released in the U.S. three new vehicles powered by a new zinc chloride battery system. The cars can travel 240km at 90km/h carrying a family of four.



MAGMA TAP

Researchers at Sandia Laboratories in Alburquerque New Mexico, are working on an ambitious project they call "Magma Tap", which involves the tapping of energy potential of underground lakes of magma; molten rock with a temperature of over 1,000 degrees C. The national Magma Energy Advisory Panel consisting of experts in volcanology, geophysics, tectonlcs, and magma petrology, has concluded that the extraction from magma is feasible, and recommends that further research be carried out.
Present plans call for a heat exchange system to be sunk directly into a body of magma with a temperature between 1,000 degrees C. and 1,250 degrees C. The extracted heat would generate electricity at the surface in a conventional way—with steam turbines for example. Research over the past few years has concentrated on the known reserve of magma under the Kilauea Iki Lava lake in Hawaii.

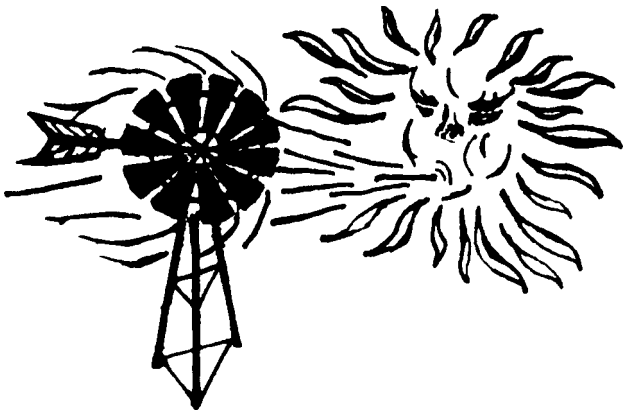
NEW SOLAR CELL

A new discovery may go a long way towards bringing down the cost of electricity. Sanford Ovshinsky, a self made Michigan inventor, has developed a solar photovoltaic cell that is both cost and energy efficient. Energy efficient photovoltaic cells have been developed in the past but their cost has been too high for large scale use.
The estimated costs of the Ovshinsky device once the cell is in production are comparable with what your utility is charging you today. So far there is one small hitch: Ovshinsky needs $10 million in development funds to make it a reality.
The major problems are overcome, says the MIT professor of electrical engineering, David Alder. "This is the first time where the solution looks straightforward enough to work." The solution, as Adler puts it, is the use of a silicon-hydrogen fluorine hybrid combination that makes the heart of the new solar cell. This amorphous silicon is capable of being produced in thin sheets that can be put anywhere to produce electricity.

Energy Flashes.....

ENERGY EXHIBITIONS

A series of Energy Alternatives Exhibitions are to be held in Brisbane, Melbourne and Sydney in the near future. The first will be held in Brisbane on the 2nd to 5th of October, in the John Reid Hall, Exhibition Grounds. In Melbourne the display will be at the exhibition buildings between the 4th and 7th of Dec-ember. Finally in Sydney at the Manufacturers' Hall between the 17th and 21st of June, 1981.
The Alternative Technology Association has been offered display space at the Melbourne Exhibition. We are beginning to assemble a range of display material and "low technology" equipment. Anyone interested in helping with the organisation of the display, or with suitable material or equipment, is urged to contact Bob Fuller on 489 7862 after hours.

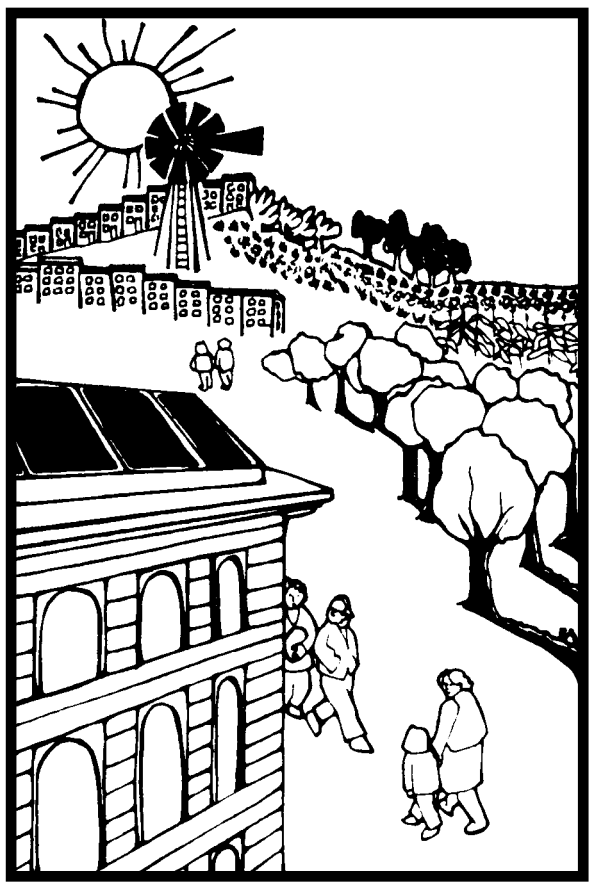


ALCOHOL AGREEMENT

A 50/50 joint agreement which could enable Australia to achieve world leadership in alcohol fuel production technology has been signed between Ampol Petroleum Pty. Ltd. and Biotechnology Australia Pty. Ltd., an Australian company formed in 1979 by Dr David MacLennan.
The agreement will lead to the construction of Australias first continuous fermentation alcohol fuel plant capable, it is hoped, of supplying 2 million kilolitres or around 15 percent of Australian motor fuel requirements within five years.
The pilot plant, to be constructed at the former Miller Brewery at Taverners Hill, Petersham, N.S.W. and operated by Biotechnology, would lead towards a scale of production requiring almost as much wheat as Australia produces at present.

GEOTHERMAL HOT WATER

The first British attempt to tap geothermal energy—the heat contained in rocks deep below the earth's surface—has been successful, resulting in the discovery of a large underground deposite of water with a temperature of 70 degrees celcius. Early this year a test bore was drilled in the grounds of a power station at Marchwood, near Southhampton in southern England, and indications are that there is sufficient water in the area to heat about a thousand houses for several decades.
Heated water from geothermal rock structures has been used to warm buildings since the beginning of the century and, more recently France has started to use water from "hot rocks" to heat apartment buildings around Paris.
By 1990 it is expected that nearly half a million French homes will be heated by geothermal energy. Water from underground sources has also successfully used for power generation in New Zealand.



Alternative Technology

For the Urban Dweller.....

These days Alternative Technology, (or Appropriate Technology as I prefer), is a term which, due primarily to the impending conventional energy crises, gets quite a deal of media coverage. Hardly a week goes by without articles appearing in the daily papers concearning some new concept for reducing our dependance on fossil fuels.

However as the articles are received and absorbed by their captive audience, I suspect that for the average city dweller they are only of academic interest. Certainly, for those fortunate enough to have aquired a piece of land out in the bush, the interest may be more than academic. But even for those people, the transition from "Gee, that would be a good idea for our place" to even a limited form of usage of A.T. is not easy.

The fact I think should be faced, is that the vast majority of us live in cities, do not own five acres in the bush and probably regard A.T. more as D.T. (Difficult Technology) to apply to their lives.

Perhaps at this point I should expand on why I prefer the term Appropriate Technology rather than Alternative Technology, and henceforth will use the former term.

Basically my dissagreement with the term Alternative Technology is that it is not explicit enough. After all, nuclear fission is an alternative technology to oil. What I prefer about the term Appropriate Technology is that there is no such confusion, since to me it means that the technology being employed for a particular task is the "right" or at least better suited one. Anyone who has ever heard Proffessor Barry Commoner may recall him likening the use of inappropriate technology to warming a baby's bottle with a blowtorch.

So, back to the city dweller and Appropriate Technology...

It would seem to me that the time when every Melbourne household is powered by renewable energy sources is a long way off. Most people would, I think, agree and hence what gets generated in their minds are the ideas put forward earlier—namely "It's not for me".

With the above in mind, I propose to conduct a regular column in this magazine, where we can examine the ways in which A.T. can be brought, albeit in a small way, into the lives of any city dweller.

What you may rightly ask is the benefit of using A.T. in only small ways. Apart from the more obvious reason of perhaps reducing our own fossil fuel bills, I firmly believe that reducing one's reliance on the caprices of that Mighty Trio—the SEC, the Gas and Fuel Corporation, and the MMBW—even in a small way can have an enriching effect on one's life. Basically, it makes you feel a little bit more in control of your life, and in consequence, I would argue, improves the quality of that life. It is definitely more than a feeling of self-righteousness, though that may be involved too.

Hopefully the ideas that will follow will prompt some of the readers of this magazine to supply their own ideas on how A.T. can be brought into urban life. In this way I'm hoping a real crossflow of information will take place.

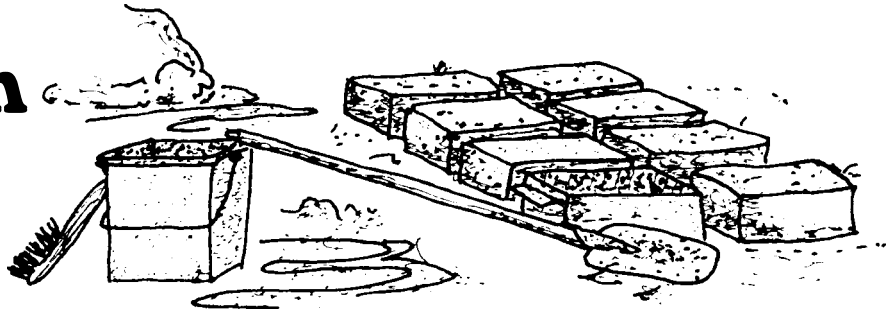
Some of the topics which come immediately to mind are Insulation, Solar Fruit and Vegetable Drying, Refuse Disposal and Composting, Solar Greenhouses, Alternative Cookers and Coolers etc. Also a good down-to-earth and easy to follow guide on the economics and practicalities of solar water heaters and photovoltaic cells might serve as a guide to prospective users. There are, of course many other possibilities and hopefully some response and/or contributions from other members will bring these to light.

Using the above format, hopefully the practical use of alternative or appropriate technology will become less the exclusive domain of the "bushy" and have a little more meaning for those who either choose to or have to live in urban areas. We'll see.

To start off the series, I might try to examine the question of insulation—the types, what savings can realistically be expected, and therefore, whether it is worthwhile.

BOB FULLER.

Building with EARTH

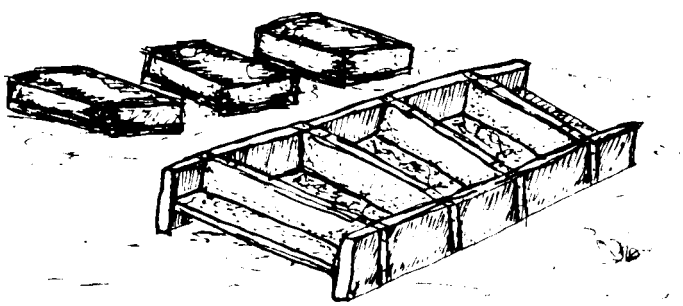


It is now 35 years since the end of World War 2. It is nearly as many years since G. F. Middleton produced his first report on the practical feasibility of building in earth. That report was decidedly in favour, and soon afterwards helped Alistair Knox persuade the Eltham Council to accept mudbrick as a building material. One would have thouht that from then on, with the backing of the Commonlwealth Experimental Building Station in Sydney, and the Etham Shire Council on the fringe of metropolitan Melbourne, mudbrick builders would have had it easy. But not so. There have been problems.

I have been involved with mudbrick buildings for nine years now. Each project was the first in its respective shire to utilize earth as part of the structure. The spread of information has been astoundingly slow in the age of the media revolution with its so called information explosion.

It was 1971 when I first stumbled across the idea of earth building in an American magazine, "The Mother Earth News'', from the tiny "Whole Earth Bookstore' in Melbourne. The very idea of creating something as functional and potentially beautiful as a house of common clay soil fired my imagination to its very core. Here was the possibility that I could house myself for nothing, or next to nothing using the materials I found around me. I went bush soon after to try out my theory.....I just had to try it out.

Well I succeeded In building a 24' by 18'



mudbrick cabin on a hillside with a slope of 1 in 4, entirely by hand, including the excavation of the site and the mixing of the concrete footings. The finished building cost me about $289 at 1972 prices, including $50 for a slow combustion stove, $80 for two large windows, and transport costs of building materials. I used not a single kilowatt-hour of electric power or any power machine except a utility to carry water up from the creek. Even the 44 gallon drums of water were filled using buckets. Its called learning the hard way.

I have learnt that a little help from the right power tool or machine in the right place would have been 10 or 20 times more efficient, and would have saved many many hours of grinding labour, which could of then been put to many other socially useful tasks. I toiled doggedly on for one year. (With machine tools it would have taken only a few months). Through the haze of physical pain and exhaustion, I began to:

1. harbour a hate for hard yakka, which has still not completely worn off,
2. have a new respect for technology and machines; they can help us so much.

It was during this building project that I heard there were other mudbrick builders around Eltham. (Prior to that I had thought I was the only one). I seized on the opportunity to draw on the experience of others and made a few visits. It was probably that the seed of commercial enterprise was sown in my desperate brain.

At the completion of this first project I began working with a conventional builder, and drifted into helping others with mudbrick projects of one sort or another. This took me all over Victoria and as far as Tasmania and South Australia. One of the lessons from this period was that there are no hard and fast rules that apply to every site, since the soil varies so much, as well as the working conditions on each site. Mud is everywhere, and that should mean that using it as a resource will have low envir-

Building with Earth

onmental impact. It is also cheap. The trouble is it's never quite the same from one yard to the next. And it's so heavy. How different to a conventional timber frame house, with its light but sturdy elements of wood, available in plentiful supply almost anywhere in Australia, and for timber at least the same constructional and methodological rules apply no matter what the site. And incidentally, in which the building industry has been forming and improving techniques for decades.

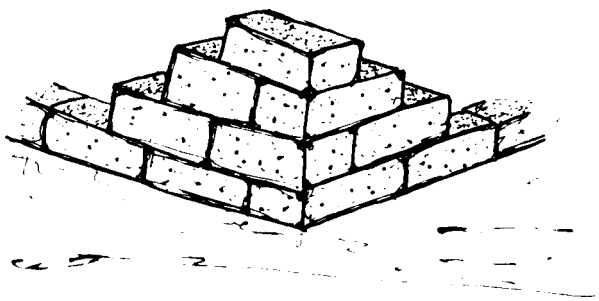
For a couple of years now I have been involved with a small group of people supplying and laying mudbricks on a commercial basis, under the name of Sunearth Pty. Ltd. The barrier we are coming up against is the most unbusinesslike nature of mud. People who want their bricks made on site cannot always have this done if their site is unsuitable. If bricks are made on site, the owner and builder have to put up with the mud, sometimes ankle deep or worse, over large areas of the site where the bricks are made.

Handling the heavy sticky mud mortar can be a headache where there is a danger of staining expensive unpainted timber panelling, ceiling lining, floring and framing, which is often the case. With an average 125 x 250 x 375 mm adobe block weighing in at about 18 kg, you have only 56 of them to the tonne. This means, firstly, that the handling of the blocks all day is very heavy work. I heard that one of the unions working on the Eltham Community Centre refused to work with this block size, and I don't blame them. Why do they have to be so massive? The Egyptian masons, under the direction of that visionary architect Hassen Fathy, used a brick size very close to that of the conventional fired brick to construct their incredible buildings, domed roof and all. With blocks so heavy it is sometimes difficult to obtain willing labour for a large project.

It also means that transporting and then handling them is a costly business. Over long distances the cost of transport can reach the cost of manufacture. I have already mentioned some of the reasons why the bricks cannot always be made on site. Lack of time, experience or labour are some other reasons why individual builders should get help. And since not every town has a mudbrick manufacturer yet, occasionally there is a call for long distance delivery.

Manufacturing adobe bricks on a commercial scale is no picnic either. The occasional (or rather all too regular), disaster requires workers in the industry to come from a small group of altruistic sado-masochists.

For example, how would you like to make 2,000 bricks on a customer site (after first making some full sized test bricks), and then find that three quarters of them had fallen apart? We concluded that the production run used a wetter mud than the test mix, resulting in more severe shrinkage and greater cracking. We bit our lips and doggedly remade 1,500 bricks for nothing.



We have had problems with one particular batch of soil that at first produced thousands of good bricks. Gradually the number of reject bricks increased. We tried shading the wet bricks; this helped. We tried making them at night. Inconclusive. We tried making them only on overcast days, even wet days, but the number of rejects increased until it peaked at 90%. We were working our sides out for absolutely nothing. We still have not solved this partiular puzzle satisfactorily.....but we're working on it.

Were not the only ones with problems. I mentioned the union trouble at the Eltham Community Centre. This large complex, made with an earth block pressed under high pressure in a hydaulic ram is not without its

Building with Earth

technical problems also. The last time I saw this building (1978) the external render was peeling off parts of the wall. I have been told some of the earth blocks were too crumbly to use. Yet I have seen excellent blocks made in a hydraulic press, and also in a hand operated Cinva ram.

The point is that different soil types seem to require different processing techniques. The industry could benefit from a set of indicators which will show which process to use for a given soil type, and a thorough examination of the effect of each process (ramming, pressing or puddling, at various moisture contents) on the stability and strength of the resultant wall.

A final thought: earth building techniques are improving all the time. Providing a potent force in this improvement will be the people who are helping others build in earth as a livelihood. It is the contractors that will build up the prerequisite pool of esperience that a one-off builder simply cannot do.

ROGER STRICKLAND.

Comment or further enquiries will be welcomed by the author who may be contacted on 059 681280 After Hours only, or by writing to him c/o P.O. Gembrook 3783.

Sunearth Pty. Ltd. contracts to make, supply and lay handmade adobe blocks, and will provide a design consultant on request, especially for low energy earth buildings. Enquiries to Lot 3 Freyne St. Wonga Park, 3136, Phone 03 722 1518. After hours only.

BOS HOUSE

Autonomous Housing

In a quiet corner of the Victorian countryside Michael and Judy Boss have built a totally energy independent house which uses a wide range of solar energy and energy conservation technology.

It operates without outside electricity, gas, water and sewerage services. Solar energy provides their electricity for lighting and all appliances, central heating, cooling and hot water. Their coke fired kitchen stove, which soon will be converted to methane gas produced at home, assists in water heating during winter. Water for the Bos' home is collected from the aluminium clad roof. The only concession they have made to the outside world is an underground telephone line.

An industrial chemist, Michael Bos has been experimenting with solar technology for more than 20 years. He has an Australian patent pending on a solar panel for heating swimming pools and established his own small company to manufacture the panels.

The radical feature of the final design was not that it contained new solar technology—in fact the technology has been around for years—but that Bos has included the broadest possible range of existing knowledge into one complete unit, with a few improvements of his own along the way.

"We went back to first principles to design the house," he says. "First, the house was oriented on an east-west axis with the front facing the northern sun. The ratio of length to width was set at 1.5:1 in order to maximize energy gains and minimize energy loss.

The thermal mass of the house can therefore be used at top efficiency in heat control. Keeping these basic principles in mind it is possible to construct an energy independant house in almost any way you like."

The design of the house has received worldwide attention. In fact the Bos family now keeps a visitors book that resembles the who's who in the solar energy field.

Bos House

Locally, the design won a $500 award from the Victorian Gas and Fuel Corporation's low energy competition. Bos has received $5000 from the National Energy Research Development and Demonstration Council and $2500 from the Victorian Solar Energy Committee. The Committee's grant will be used to monitor each system in the house over a two year period to accurately determine energy output and use.
It was essential to Bos that the new house should have all the conveniences of modern living. The electrical system is perhaps the most interesting and innovative feature.

Eight photovoltaic cell arrays each supply 2.5A at 14.5V with a combined rated capacity of 20 amps. Interestingly, the combined ouput can increase to as high as 30 amps on a clear winter day. According to Bos this occurrs due to the lower angle of the winter sun and reflections from the aluminium roof.
Electricity is stored in 18 lead-acid batteries. Bos plans soon to double the number which will then provide a storage capacity of 1300 amp hours or roughly a full months supply. The batteries are unobtrusively located behind a wall panel on the first floor.

Many of the appliances in the house can be run from the 12 volt system. Lighting is provided by eight 8 watt fluorescent lights of the type used in caravans. Bos has built a 12 volt refrigerator similar to a box type freezer in appearance but with 7.5 cm of insulation all around. The counter top refrigerator is claimed to use only about one tenth of the electricity used by a conventional refrigerator.

After extensive research he is even confident he has found a way to convert an automatic washing machine to 12 volts. He has tracked down a 12 volt Japanese motor capable of carrying the high start up load of the machine. A 240 volt inverter will be used to provide power for the automatic controls of the machine.

Colour television, a stereo system, and a wide range of electrical appliances are powered through the household system. Where appliances can't be purchased to run on 12 volt a 240 volt inverter is used.

All living spaces, including bedrooms, family room and living room face north to enable maximum esposure to the sun. Eighty five percent of the north face is glass to maximize passive solar energy collection.

According to Bos the traditional way of building houses with brick on the outside and cladding inside is like building a house inside out. The thermal mass of a house—walls and concrete slab floor—should be used to collect and contain energy, not repel it.

The floors and walls are insulated with 60 mm urea formaldehyde. The roof is clad with aluminium decking and insulated with 100mm urea formaldehyde and double sided sisalation. U values (the measure of ability to transmit thermal energy) range from 0.54 to 0.62. In comparison a normal brick veneer house can have U values ranging upwards from a minimum of 5. An air lock at the south side entrance prevents excessive heat loss.

Bos has been selective in his use of carpets. Most rooms have ceramic tiles on the concrete base to permit maximum heat transfer from the slab. Ducts in the concrete slab take cold air from the south side to the warmer north

Bos House

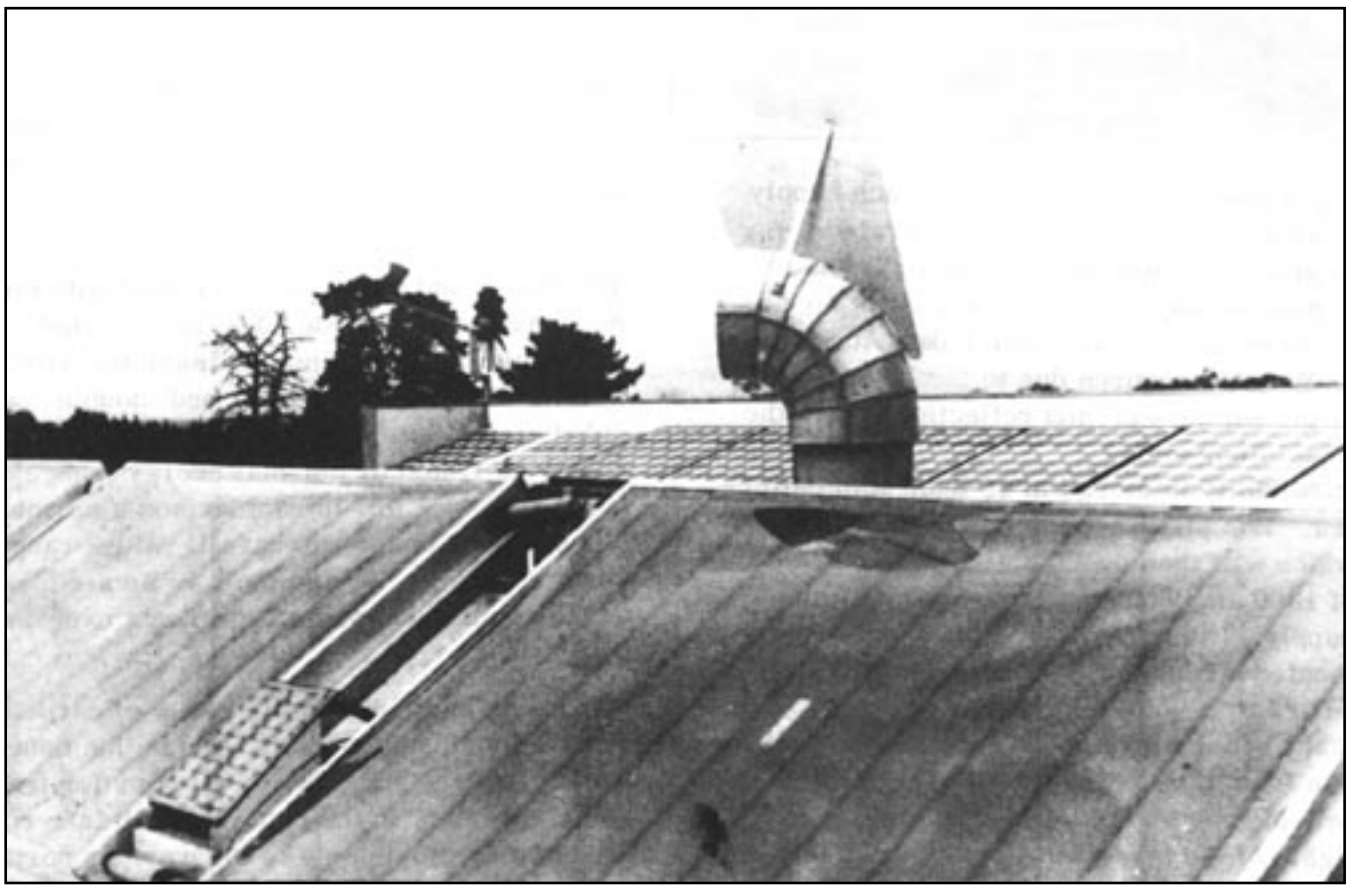
side near the full length windows. By reversing the air flow in the ducting system (and using small 12 volt fans) a cooling effect can be achieved in summer.

An unusual passive use of solar energy is the greenhouse located adjacent to the living room on the north side. It contains a unique solar heated circular “plunge pool” which serves a purpose other than being great fun for the three girls of the Bos family. Its more practical application is to provide a heat sink to augment the concrete slab. Cool air is drawn into the greenhouse from the south side of the home and returned as warm air. On a clear winter day it can contribute over 10% to the heating load. The greenhouse is ideal for beautiful tropical plants.

The house makes extensive use of active solar energy collection techniques. Hot water is supplied by eight squares of conventional flat plate collector. Storage is in a 730 litre tank which has 15 cm of insulation. The Aga coke fired kitchen stove supplements water heating in winter by up to 410 litres per day. It consumes about 2 tonnes of coke per year.

Methanol gas however will ultimately be used to fire the stove, while a methane digester will replace the septic sewer system. Gas production will be boosted with the addition of sugar beet. Bos has already begun cultivation with a trial plot of sugar beets and plans to also produce ethnnol to fuel the family car.

The house uses fire places to heat the living room and den. Of special interest, however is the solar chimney. Designed for wintcr heating, the chimney is a rectangular duct coated with heat absorbing black paint. The aluminium framed chimney has an surface area of 20 square metres double glazed with polycarbonate sheeting and has 5cm of foil covered insulation. It slopes from the front of the house to the roof at an inclination of 40 degrees. The sun heats the air inside the duct causing it to rise. Under ideal conditions the air temperature



Bos House

in solar chimneys of this type can be as high as 150 degrees C.

The rising air is controlled to pass through a heat bank built in the centre of the house. It is insulated with 5 cm of urethane. The heat bank consists of 68 round aluminium tubes five metres in length and 100 mm in diameter. The sealed tubes contain a total of 1100 litres of water.

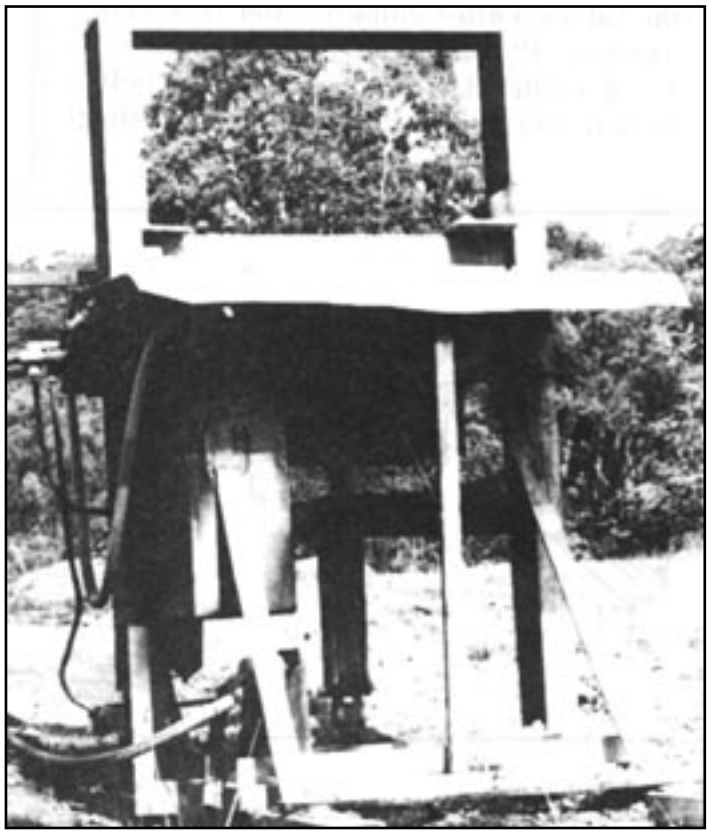
The system operates when a cold air duct connecting the bottom of the solar chimney to the heat bank is opened. Small 12 volt fans enhance natural circulation at night when stored heat in the heat bank is transferred to circulating air. With only 40 degrees C temperature rise in the solar chimney the heat bank can store 232,000 kilojoules (222,000 BTU). The system can be used for cooling in summer by reversing the system—exhausting heat from the house by night and cooling the internal air by day.

At a total cost around $90,000, Bos is using his house to demonstrate that total energy independant living is indeed a reality. How far the cost can be reduced is now a second step.

Bos is eager to talk with design and construction experts to devise ways of reducing building costs to an affordable level. In the meantime he is happy to continue with his esperiment and new way of life.

This article originally appeared in "Aluminium" April 1980, published by Comalco Limited, Victoria. It was printed here courtesy of Comalco.

Adobe Brick Machine



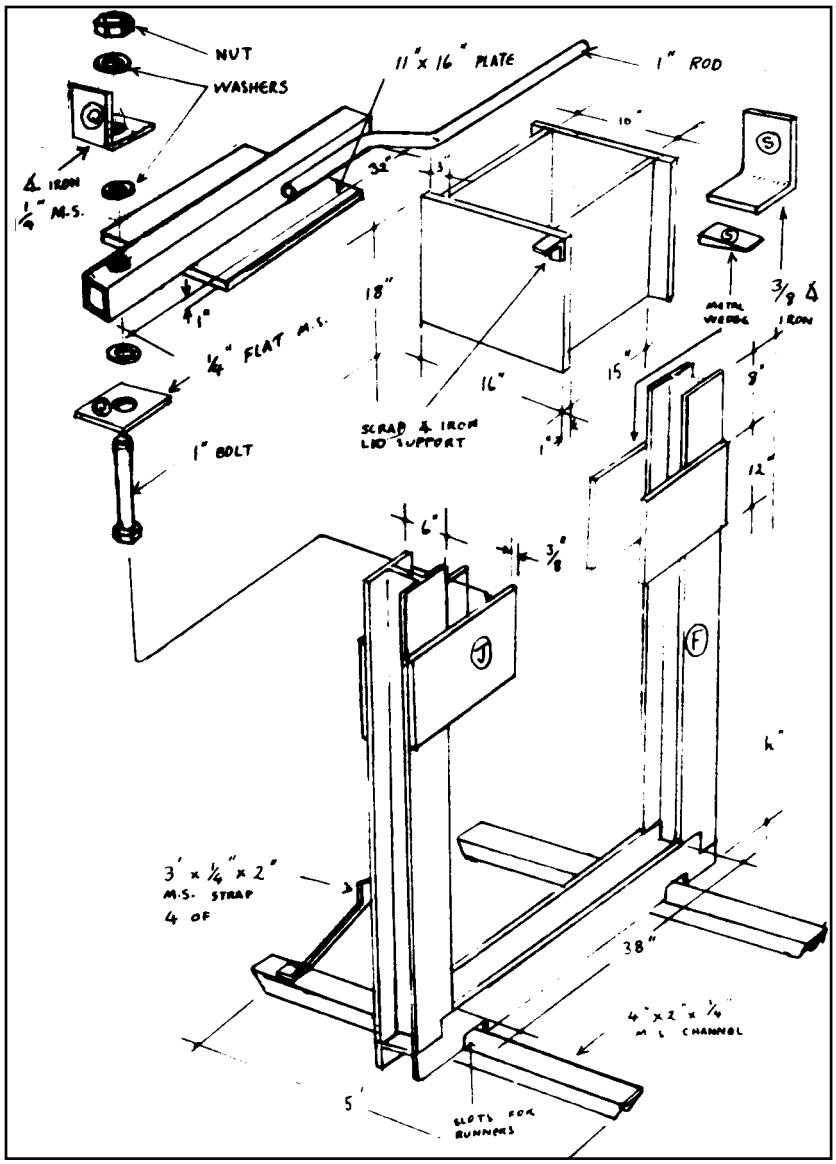
This article is about how to build a hydraulic adobe brick making machine. The bricks made in the machine are about 15" x 10" x 6". They are regular sharply defined and can be stacked for drying as soon as they come from the mould. Depending upon how they are laid a wall of these bricks can have all the charm and character of a wall constructed of bricks made in the traditional "puddle" method. The advantages of such a machine are: (1) large volume production; (2) reduction of handling; (3) a saving of materials and time and hence money.

<u>STAGE 1</u>

The mould is contructed of 1" steel plates of the dimensions shown. Bearing in mind a volume reduction of 2:1 when the earth in the mould is compressed, we require 7" x 2 = 14" of mould depth to be on the

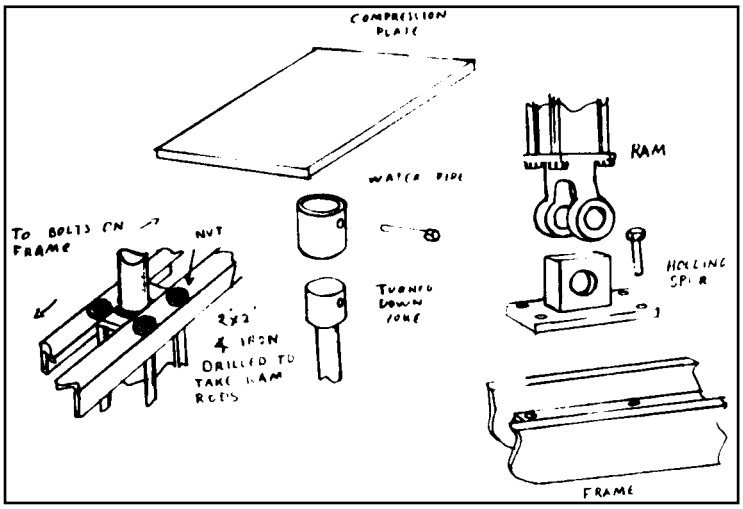
Adobe Brick Machine

safe side. With a 1" compression plate this would leave us 3" of freeboard so to speak. The measurements of the plates must be exact so it is best to get a steel fabricating firm to precision cut your steel. Next comes the welding. Unless you are skilled this job is best done by a professional person as the dimensions must be exact.



STAGE 2

The frame, (F), can be constructed of 6" RSJs. You will note that the two vertical members are keyed into the horizontal member. This is for more welding surface and hence strength. This is a welding job that can be done by any competent welder. Next comes the joining plates, (J). Then you are ready to weld the mould to the joining plates making sure of component positions. Next are parts (Q) and (S). Now there is a gap of about 1/16" between the top of the lid arm and the metal wedge so it is advisable to have the lid and arm at hand so you get this measurement right. The gap is to ensure you can pull the lid open after compression. The arm can be 1/4" angle iron welded together 4" on a side. The lid hinges on a 1" bolt so size your washers and holes accordingly.



STAGE 3

The runners; by now your frame mould and lid should all be together and functioning. The rod handle incidentally should be at least 2 1/2 feet long and welded on. Weld the runners into the slots you have provided and brace with steel straps. Your basic unit should now be upright, the lid swivelling on the 1" bolt. A small arm projecting from the mould will help support the lid.

STAGE 4 The Hydraulics.

The hydraulic ram should have about 15" free travel, and is fitted onto the compression plate by turning down the yoke of the ram. (they usually unscrew), so that the reduced

Adobe Brick Machine

yoke now fits into a section ot waterpipe which is weld ed to the centre of your compression plate, Have your compression plate cut so that there is about 1/16" clearance between the edge and the walls of the mould. The yoke is attached to the waterpipe rocket by a bolt. The travel of your arm should be such that when the ram is fully extended the top of the compression plate is flush with the top of the mould allowing you to lift the brick off at chest level.

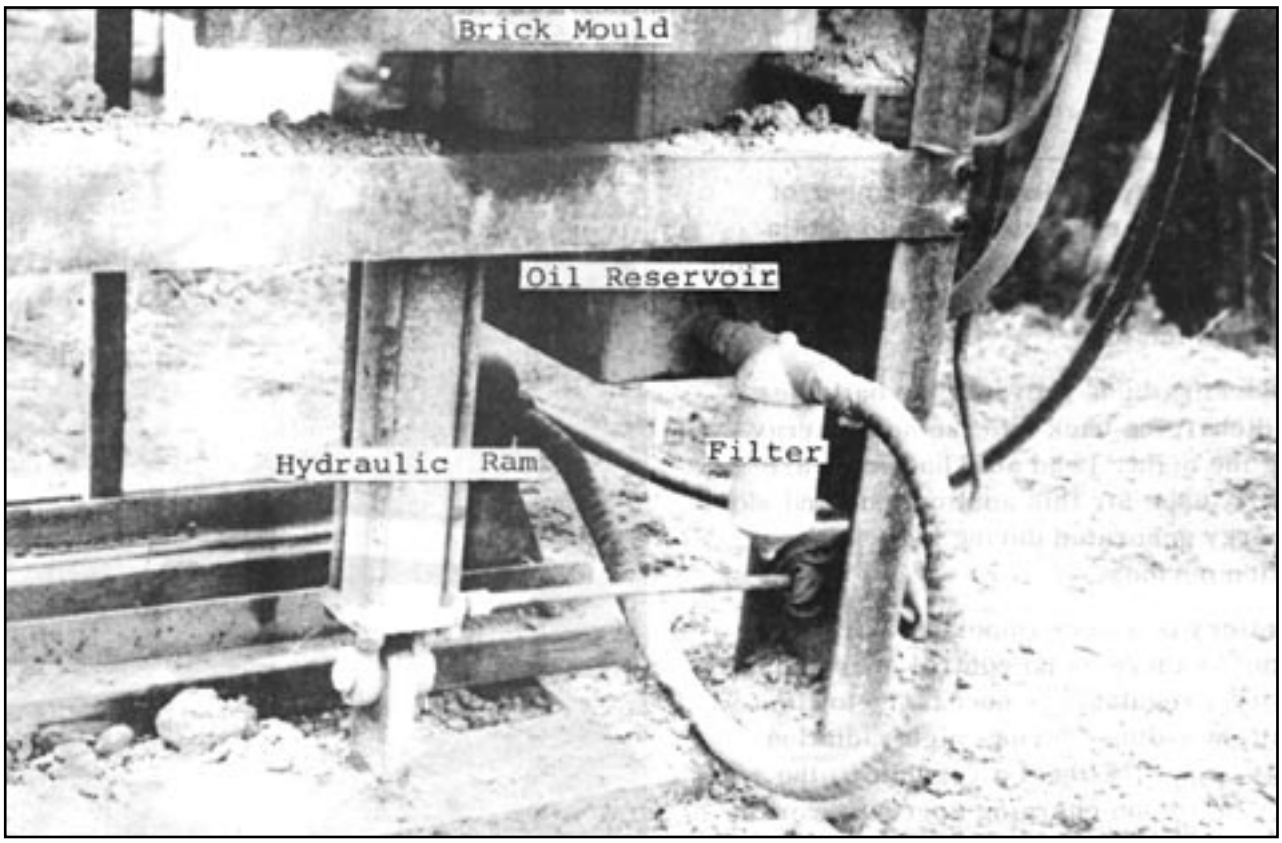
Your hydraulic system should consist of (1) a power plant, (2) a hydraulic pump, (3) an oil reservoir, (4) filters and breathers, and (5) a control valve system with built in pressure relief. A basic diagram is given but the best thing to do is to consult a hydraulics firm about the type of system you intend using. They will help you match up your power plant/ pump, your filters and hydraulic lines with the ram. *It is best to obtain your hydraulics first.

USING THE MACHINE

Operation is pretty straight forward. Open the lid and fill with soil. Close the lid. Push up the control valve and the ram compresses the clay. Reverse direction for a second and pull the lid open. Push the control valve up again until the ram is fully extented. The compression plate should now be flush with the top of the mould, so all you have to do is pick up your brick and stack it.

Moisture content is important. If you grab a handful of clay and squeeze it into a ball that stays compacted and yet crumbles when you poke it, then the moisture content is about right. Your clay should be excavated and heaped near the machine. Depending on your clay a little sand or fine gravel may be needed in the mix to make it "crumbly". Keep your clay covered with a plastic sheet to keep it from drying out or getting too wet. You can produce 100 bricks a day with the machine if you are fit. If you are not at the begining .....you soon will be.

RON KING

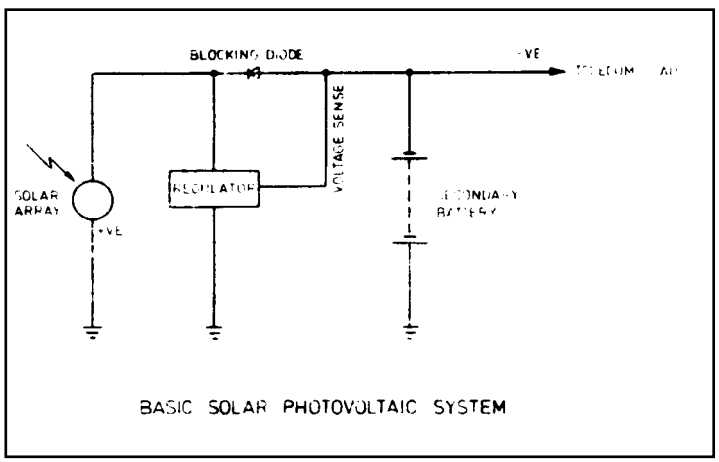


Solar Communications.

Silicon solar cells are being used in large quantities to power communications systems in isolated areas of Australia. Telecom has found that silicon cells are becoming cost competitive for loads up to about 200 watts.

A basic solar photovoltaic power system, of the type commonly used in remote locations, consists of four main components:

- Silicon solar array
- Voltage regulator
- Blocking diode
- Storage batteries



BASIC SOLAR PHOTOVOLTAIC SYSTEM

The solar array consists of a number of series/ parallel connected cells to obtain the desired voltage and current. The current from the cells is used to charge the batteries and to feed the load.

The blocking diode prevents the batteries from discharging back into the solar array during the night. Lead acid batteries are generally used for this application, and store the energy generated during high solar radiation periods.

The battery is a very important part of the system. As there is no control over radiation intensity a regulator is necessary to limit the battery voltage during high radiation periods, since, without a regulator, the solar array can produce charging currents capable of causing excess battery voltage.

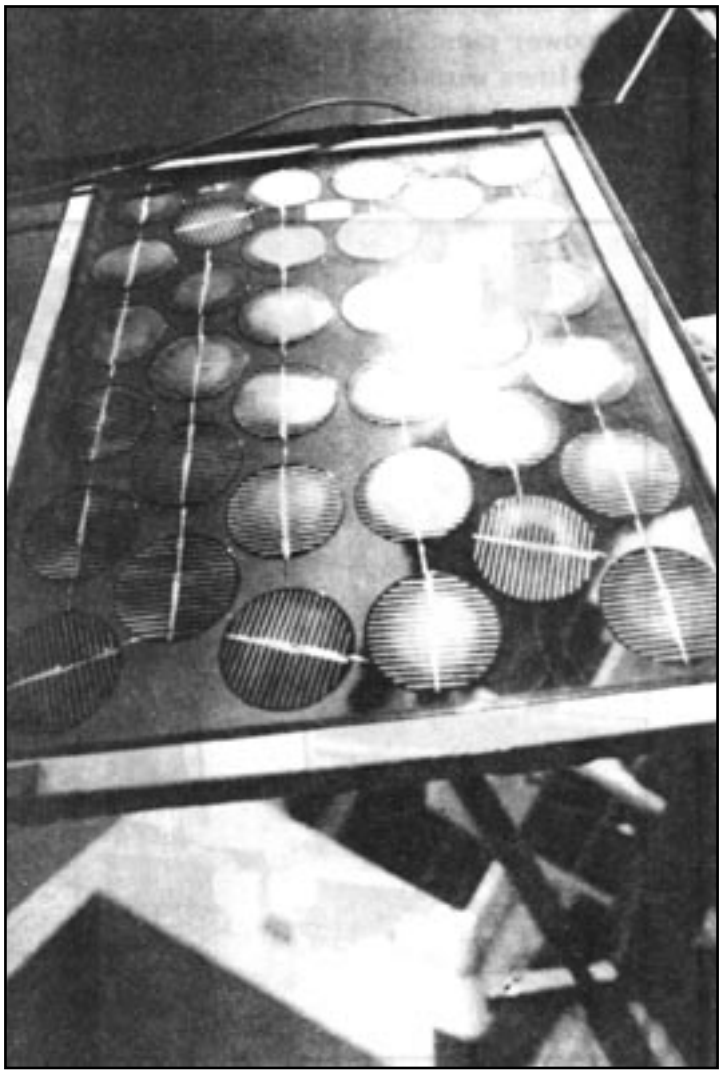
The capacity of a solar array is dependant on a number of factors:

- The load
- The storage capacity of the batteries
- The radiation received

The matching of these by Telecom has resulted in battery reserves of about 12 to 20 days in their remote systems.

THE TENNANT CREEK - ALICE SPRINGS SYSTEM.

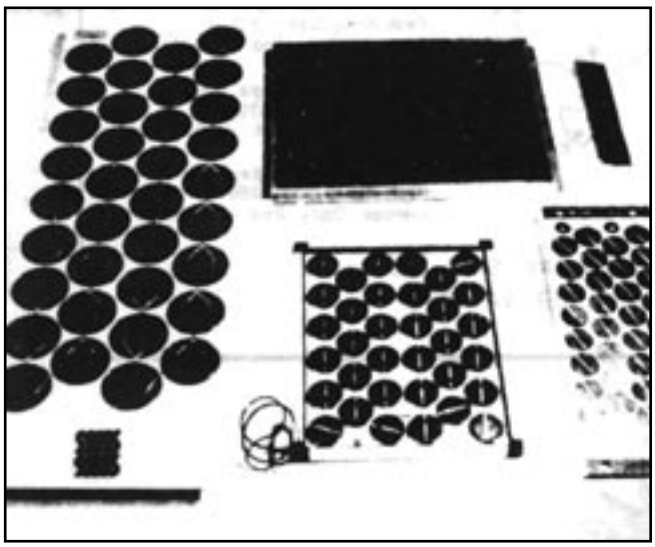
The communications system between Tennant Creek and Alice Springs is the first of its type in the world. It uses solar power on 13 non-mains powered repeater sites for a new 580 km microwave radio system between Tennant Creek and Alice Springs in Central



Solar Communications

Australia. Station load at is 132 watts where an array of 814 watts peak is used with 1500 amp hour battery reserve.

The concept of a packaged solar power plant for communication purposes was developed and proven in the design and construction of a prototype solar plant by Telecom as part of their Solar Power System Programme. The solar power plants make use of nearly 1000 Philips BPX 474 solar modules with a total capacity of nearly 11 kilowatts.



In July 1978 the first off unit (shown in the photo) was completed and testing began. The unit was installed at 16 mile creek north of Alice Springs in August 1978. The final units where installed in early 1979 and the system was operational in that year.

Initially 3 banks of 500 amp hour cells giving a total battery capacity of 1,500 Ah were installed. The battery has 11 rather than the normal 12 series cells for the nominal radio equipment voltage is 22 volts.

The total radio system installed cost was approximately 3 million dollars with about $550,000 of this attributed to ths solar power plant at the non-mains powered repeater sites.

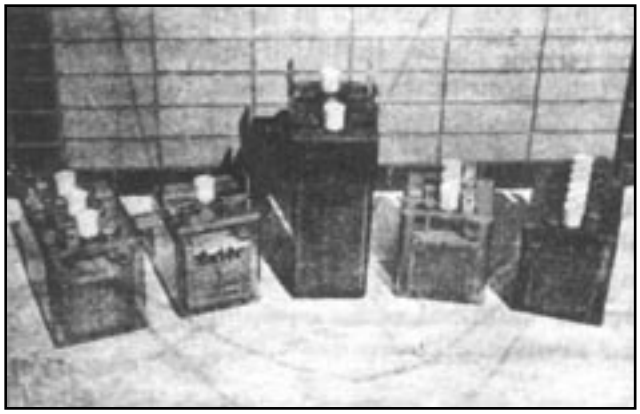
FAULTS IN THE PANELS.
While working with the silicon cell power systems Telecom was able to observe the causes of failure in the systems.

Some of the more common failure mechanisms encountered were:

- Delamination of silicon rubber encapsulants from cells, surface materials and substrates
- Penetration of moisture into the cells, causing corrosion and deterioration of cell grid and underside metallisation materials
- Breakdown of interconnection between cells
- Discolouration of clear ‘potting’ encapsulants
- Deterioration of materials, especially plastics, used in packaging
- Cracking of the silicon cell wafers
- Damaged interconnects and output terminals.

Telecom also had problems with the destructive habits of Australian parrots which tended to enjoy chewing on the equipment. For this reason they used glassed surfaced modules as against silicon rubber surfaced modules.

Solar Communications

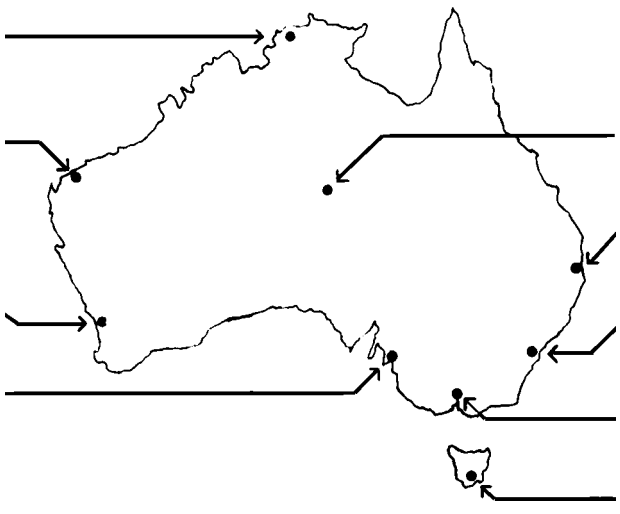


TELECOM PASTED PLATE LEAD ACID BATTERIES FORM L TO R;
6V 90AH, 2V 200AH, 2V 500AH, 6V 45AH, 12V 25AH

CONCLUSION.

Since the installation of the system the cost of the diesel fuel which would have been the alternative has continued to increase rapidly, making the solar cell alternative even more attractive.

Experience with this sytem has shown that photovoltaic cells can provide a reliable, cost competitive source of power for a growing number of applications in rural and isolated areas. The possibility of dramatic drops in the cost of solar cell modules in the near future are likely to lead to even greater use of silicon solar cells in the future.



DARWIN
Optimum array angle - 11°
Peak array size - 603W
Average daily rad - 21.3MJ/m²

ONSLOW
Optimum array angle - 37°
Peak array size - 581W
Average daily rad - 22.2MJ/m²

PERTH
Optimum array angle - 54°
Peak array size - 721W
Average daily rad - 19.0MJ/m²

ADELAIDE
Optimum array angle - 57°
Peak array size - 800W
Average daily rad - 17.7MJ/m²

ALICE SPRINGS
Optimum array angle - 38°
Peak array size - 588W
Average daily rad - 21.5MJ/m²

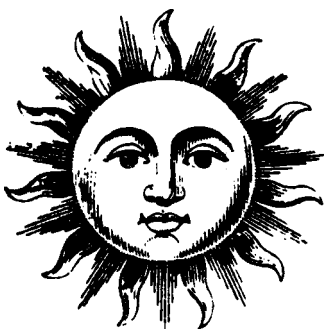
BRISBANE
Optimum array angle - 45°
Peak array size - 634W
Average daily rad - 19.2MJ/m²

SYDNEY
Optimum array angle - 53°
Peak array size - 704W
Average daily rad - 17.2MJ/m²

MELBOURNE
Optimum array angle - 58°
Peak array size - 879W
Average daily rad - 15.9MJ/m²

HOBART
Optimum array angle - 64°
Peak array size - 886W
Average daily rad - 15.0MJ/m²

FIG 10 - OPTIMUM ARRAY ANGLE AND PEAK ARRAY SIZE FOR 24V, 100W SOLAR POWER SYSTEMS FOR VARIOUS SITES WITHIN AUSTRALIA



ALTERNATIVE TECHNOLOGY CO-OPERATIVE

The Alternative Technology Co-op is a group of people interested in the use and promotion of Alternative Technology. Alternative Technology, (which can also be thought of as Appropriate Technology), is technology that is ecologically sound and does not conflict with the environment by causing pollution or destruction.

The membership of the Association covers a wide variety of interests and skills. Solar and wind energy are areas of common interest, with other areas of interest including water power, methane digestion, agriculture, energy efficient houses and other buildings, crop fuels, bicycles, electric vehicles and alternative transport, domes, mudbricks,.....etc.

WHAT DOES THE ASSOCIATION DO?

* We hold regular meetings, with films and guest speakers talking on subjects of interest.

* These meetings are preceded by a newsletter which provides details of the meetings, and also informs members on any current events of interest.

* We produce this publication, which has Australian based information on Alternative Technology.

* We hold other activities from time to time; such as day trips to energy saving houses and workshops where members can come and work on individual projects.

If you are not a member already, why not fill in the form below and become a member.....

Fill in this form and send it to the Alternative Technology Association: c/o 366 Smith St. Collingwood, 3066.

NAME..... Date.....

ADDRESS.....

.....Postcode.....Telephone.....

Please find enclosed my membership fee of

$10.00 normal membership.

$5.00 students, unemployed, pensioners, etc

Areas of interest.....

.....