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INTRODUCTORY GUIDE TO SAVING ENERGY IN THE HOME

Text by
THE ENVIRONMENTAL ENGINEERING DIVISION
and
P. A. BILLINGHAM

Drawings by
TONY FRANKS

also available in Afrikaans

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INTRODUCTION

It has become fashionable to talk of the 'energy crisis' but in fact there is still no shortage of energy – if one is prepared to pay the price.

This situation, however, cannot continue indefinitely because our limited supplies of coal and oil are fast running out and their scarcity value is increasing all the time.

What we really have is a balance-of-payments crisis brought on by the high cost of energy and these high costs are impoverishing not only our country but every one of us.

In recent times we have seen the birth of the R800 million Koeberg power station, but what may be a shock to most of us is that projections into the future show that the rate of increase in overall energy demand is equivalent to the output of one similar sized plant every year until, at least, the turn of the century.

If we all make an effort to use less power we may be able to do without one or two such stations and save ourselves a thousand million rands or so. The capital costs of such a plant are thus to be saved right now in our homes.

Saving energy is not just the patriotic thing to do; it is practical and profitable too, since many of the steps we take will pay for themselves in reduced fuel bills.

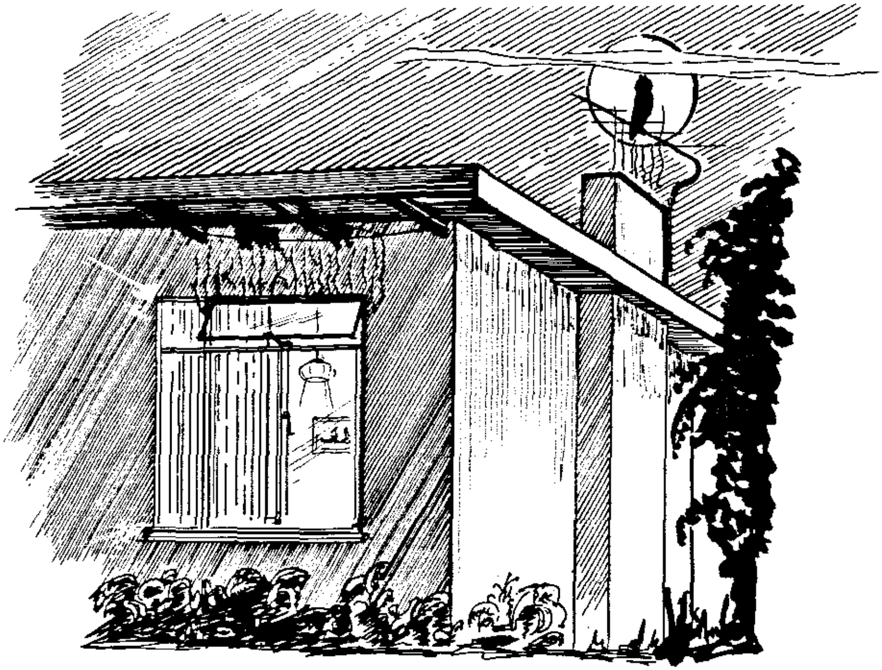
For example the installation of a solar water heater can save up to a third of a household's electricity bill and, since home use accounts for an eighth of our national energy usage, this step alone, in every home, could save a Koeberg between now and the end of the century.

Saving energy is largely a matter of the commonsense application of some fairly simple principles. The only difficulty arises from the fact that energy is intangible and invisible.

Talk about saving water or recycling waste and everybody can understand – a dripping tap or a heap of old tin cans cries out to have something done about it.

If we could 'see' the energy around our earth we could watch it ebb and flow like the tides as the sun rises and sets.

It would be a simple matter to site buildings so that they trapped as much heat as possible and after dark we would be able to see which materials stored heat and which soon lost it.



If escaping heat were visible, as in this picture, householders might realize how much energy and money they might be able to save.

WHERE THE ENERGY GOES

One of the most important concepts to grasp in our mental picture of energy loss is that this warm air rises. Your houseful of warm air is submerged, in winter, in a sea of cold air, in much the same way as a diving-bell lowered into the ocean remains full of air. If there is a leak in the top of the diving-bell the air will escape and the bell will soon fill up with water.

If your house has leaky ceilings, windows, etc. the hot air will escape, only to be replaced by cold air from the 'ocean' outside. To prove this, just place your hand on the floor just inside the front door and feel the cold air coming in below the door and remember that it is replacing nice warm air, heated at your expense, that is rising into the sky. Apart from this direct waste of energy, excessive air movement can also result in draughts making the house feel even colder than it really is. Similarly, during the warmest part of a summer's day, cool indoor air may drain away out of a leaky house and be replaced by warm air.

Rule 1 is to cut out excessive air leakage and draughts as far as possible.

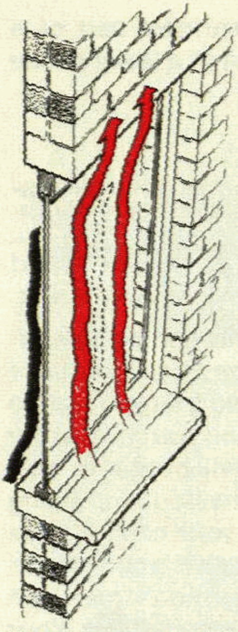
Heat, like water, always tends to find its own level. Put your hand against a piece of cold metal and feel the heat run from your hand.

Air, too, can draw heat from its surroundings. This can be demonstrated by lighting a candle and standing it on the floor. Hold your hand well above the candle and to one side of it so that you feel no warmth. Now move it until it is above the candle and you will feel the hot air rising from it. With a little imagination you will be able to 'see' the cold air being drawn into the flame, being heated, and rising towards your hand. When the warm air reaches your hand it gives back some of the heat. A column of rising air is called a convection current and it is very effective at spreading heat. When it meets an object and passes heat by contact this is called conduction. Your hand, for example, heated the piece of iron by conduction.

To prove to yourself that this mechanism can remove warmth from your home, hold your hand below a window-sill on a cold night and feel the cold air cascading over it. If you hold a burning cigarette there you will actually see the smoke being washed downwards by the tide of cold air. If it is a still night you can go outside and hold your hand above the window on the outside and feel the hot air rising up to the sky. There need not be a leak; the window may be perfectly sealed. In summer, when the outdoor air is hotter than the indoor air, just the reverse can happen. The heat is being lost or gained by conduction through the glass.

Rule 2, therefore, is to insulate regions where conduction can take place by protecting them with non-conducting materials or to keep their areas to a minimum.

Heat, just as light, can also get about by radiation. One has only to stand in the sun and feel the warmth spreading through one's body to know that the heat energy is pouring down on the earth like the rays of a floodlight. When a cloud passes overhead the radiation is 'switched off'.



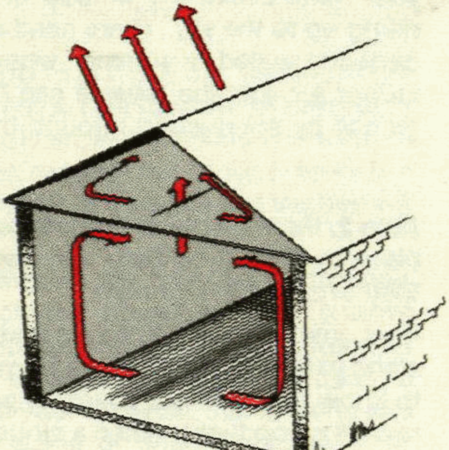
Cold air cascading down inside and warmed air rising to the sky outside.

Every warm body can radiate heat – even yourself. Stand in the open on a clear night and turn your face to the sky and you will feel the warmth of your body radiating away into space. If you now move inside, you will find that the roof over your head blocks this radiation.

In the same way the windows, walls and roof of the house will be radiating their warmth into space and, as they get colder, will themselves absorb radiant heat from their surroundings. If you stand in front of a window at night you will feel your body radiating heat to the cold glass. Draw the curtains and it will stop.

Glass is unusual, however, in that it is almost completely transparent to radiant heat from a high temperature source such as the sun. This is why a greenhouse gets so hot; because the sun's heat passes through but, once inside, reappears as long-wave radiation which cannot pass directly out but must do so by conduction and convection.

A roof facing directly into the black night sky will radiate away heat it gets from the house below. Generally speaking, the lighter the roofing material, the colder it will get. Put your hand on the underside of a steel roof at night and you will readily understand why it is important to prevent household heat getting into the roof space.



Heat escaping from the house into the ceiling space and out through the roof.

Rule 3 – Control radiant heat gains and losses effectively.

Another thing to remember is that energy cannot be destroyed: it is only changed from one form into another.

When a housewife switches on the electric mixer it does a lot of work churning up the cake mix or beating the eggs. Where does this energy go? It all ends up as heat. The noise of the machine is absorbed by the house whose molecules are moved by it and this results in an infinitesmal increase in their temperature. The cake mix itself will also get a fraction of a degree warmer as a result of the energy expended. Friction in the bearings of the motor will also account for some of the heat produced.

So if your family home is drawing 2 kW to power radios, television set, refrigerator, electric lights and other appliances, this will be equivalent to having a two-bar electric fire going full bore.

This will not be so serious a disadvantage in winter, but in summer when you are using an air-conditioning unit or other means to pump heat out of the house, every appliance that you can turn off saves power two ways: by reducing the amount of energy the appliances use and by reducing the additional heat it generates.

Rule 4 – Remember to watch all forms of energy production.

When the sun beats down on a steel building, the sunlit surfaces rapidly reach a temperature at which they start re-radiating heat in all directions. This can make it like an oven inside. The moment the sun goes behind a cloud the radiation is reduced and, within minutes, the occupants will feel cooler.

A brick building on the other hand can take hours to heat up and may still be radiating heat long after the sun has set.

Rule 5 – Make sure that your house is properly designed to store energy or dissipate it, depending on your local climatic requirements. (The NBRI Introductory Guide to Temperature Control* explains this aspect of building design in more detail.)

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*Write to The Director, NBRI, P.O. Box 395, Pretoria, 0001.

PRACTICAL WAYS TO SAVE ENERGY

Whether heating in winter or trying to stay cool in summer, it is essential to be able to control the flow of energy into and out of the house.

The five rules we have mentioned above will already have given you many good ideas but we will deal with them individually to see how we can exploit them in practice.

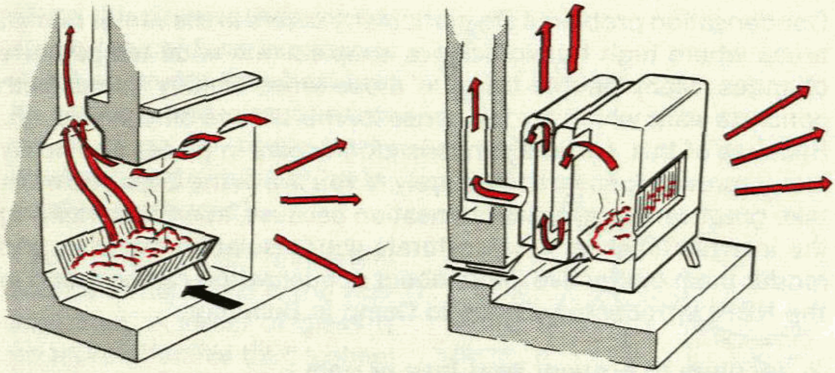
1. Reduce air leaks and draughts

The most significant sources of air leaks will probably be ill-fitting external doors and windows. These need careful sealing to prevent leakage because even steel frames let through a lot of air. In prefabricated houses the joints between panels may need attention.

It is possible to buy a self-adhesive foam strip that can be applied to the edges of doors and windows so that leaks can be blocked. The most important thing to remember when fitting this strip is that it must be applied to a scrupulously clean and dry surface if it is to survive regular opening and closing.

Draught proofing a door frame with self-adhesive strip.

One opening you should not forget is the trapdoor to the roof space. Another large opening that may be overlooked is the chimney. This is built with the express intention of stimulating updrafts to draw the fire and carry away the smoke. Besides being banned in many urban areas, open fires are extraordinarily inefficient since it is mostly just the radiant energy that reaches the room. Modern convection heaters, besides burning clean, leave one's chimney draught under control at all times. When not in use chimneys should be shut off with the damper, or the throats should be stuffed with crumpled newspaper.



Above, left: the heat goes up the chimney and pulls a draught across the floor. Above, right: most of the heat is kept in the room while cool air is fed direct to the convection heater without creating a draught in the room.

Many ventilated floors with old boards leak cold air from below the floor. This frequently comes up to replace the warm air going up the chimney. If you have any kind of open fire it will pay you to build a cold-air inlet into the ash-box area beneath the grate. The warm air in the room will not then be needed for combustion and will stay there.

Unfortunately sealing a house cannot be done without paying attention to the problem of condensation. Water vapour exists everywhere in the air and because it is a true gas it can diffuse *through brick walls and other porous materials. In the same way that* heat tends to find its own level, so, too, diffusion tends to eliminate local concentrations of moisture even when air movement is minimal.

The trouble springs from the fact that temperature and moisture concentrations are interdependent. If a house is too well sealed it may not be able to disperse the moisture generated in it rapidly enough and, if the temperature then falls below the 'dewpoint', a fine mist will appear on the coldest spots which are fortunately usually the windows. If you are living in a traditional brick-built house and you find this mist appearing on some windows overnight, then you must consider that the process of 'sealing up' has gone too far.

Bathrooms are naturally damp places in which one can expect to find condensation. If, however, after using the bath, one opens the window and closes the door for a few moments, one can release the humid air and prevent it from spreading throughout the house.

Condensation problems are particularly severe in the winter rainfall areas where high humidities are coupled with wide temperature changes. Many people living in those areas occupy homes with concrete walls which are too dense for moisture to diffuse through. Because of this, surface condensation occurs in places and heavy mould growth follows immediately. If you live in the Cape you must take great care to avoid condensation because, apart from marring the internal finishes, it can saturate your insulation materials and render them ineffective. More about condensation can be found in the NBRI *Introductory Guide to Damp in Buildings.**

2. Insulate to prevent heat loss or gain

Heat, like water, always tries to find its own 'level' and the colder it is outside, the more difficulty you will have in keeping your house warm inside because the 'pressure' assisting the heat to leak out will be that much greater. Careful insulation is the only answer to this problem.

Once again the ceiling is a vulnerable point because warm air rises to the underside of the ceiling and transfers its heat to the cold air on the other side. Thin ceilings are particularly bad from this point of view and a layer of insulation equivalent to 40 mm of mineral wool laid above such a ceiling is almost a necessity. Insulation is easily laid in the roof space and results in a significant decrease in the loss of winter heat. It also helps to keep summer heat out.

Commonly used insulation materials are vermiculite, expanded polystyrene granules or boards and mineral wool. The first two are supplied in sacks. They can be poured on the ceiling from above and then spread to a uniform thickness. The last two come in slabs or rolls and must be cut to size and laid between the ceiling joists. It is recommended that this insulation be tucked beneath electric supply wires. People living in damp areas such as the Cape are advised not to use vermiculite because it tends to absorb moisture from the atmosphere and this reduces its efficiency. Expanded polystyrene is not popular with fire officers because it burns readily and, if there is a fire it may help to spread the flames and acrid smoke throughout the house.

Another point to note about ceiling insulation is that, whereas in Europe and America it can pay for itself in one winter, in South

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*Write to The Director, NBRI, P.O. Box 395, Pretoria, 0001.

Africa this does not happen because the cold we experience is not so severe (less heat loss to prevent) and also because we have mainly single-storey houses (greater area to be insulated per house).


Laying insulation in the roof space.

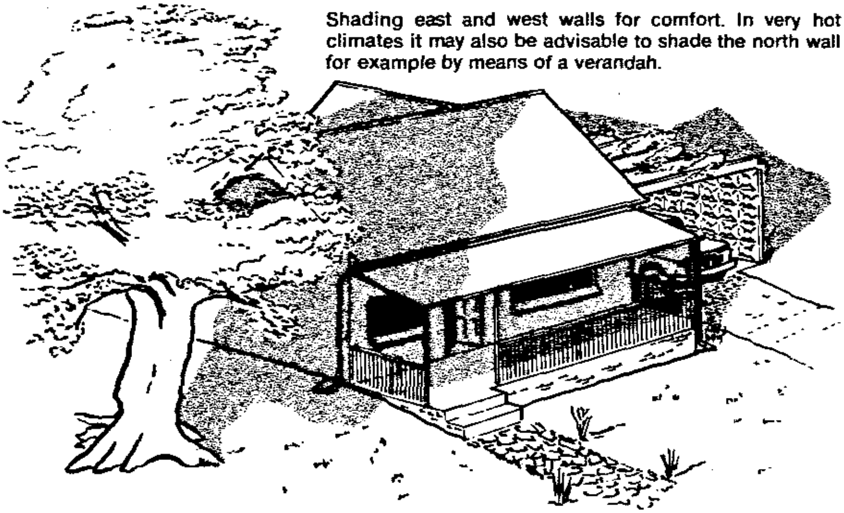
The next most important source of heat loss is the window area. A sheet of glass is no more effective than a sheet of galvanized steel for keeping heat in. In Europe and North America, where it gets very cold in winter, it is a common practice to double-glaze, and now even triple-glaze, windows and the additional thermal resistance of the sealed air space between the panes, about halves the heat lost through them.

Here in South Africa the difference in temperature between the inside and outside of a house is such that only rarely is it practical to consider double-glazing. A heavy curtain drawn across windows at nightfall will normally be enough to reduce heat loss to acceptable proportions.

It will be found that houses with substantial north-facing brick walls give ample warmth on winter evenings. In fact it is the mass of the house that cushions it against temperature changes and, for this reason, one must be careful when cladding heavyweight materials such as bricks or concrete with lightweight insulators such as panelling or wood-blocks. From a purely thermal point of view the cladding should be on the outside.

An important warning about insulating your ceiling is that you must have your motives clear in your mind beforehand or you may be disappointed. If you want to save fuel and thus pay for your investment, *you must realize that after insulating you will be able to achieve the* same temperature with less fuel. However, if you expect to feel warmer after insulating the house, you may have to continue to burn the same quantity of fuel to achieve the higher temperature. You cannot feel warmer and save money!

In areas where heat rather than cold is the problem throughout the year, the best kinds of building are those with lightweight insulating walls and roofs which store little heat. Shading the windows will make the air-conditioning unit far more efficient.



Shading east and west walls for comfort. In very hot climates it may also be advisable to shade the north wall for example by means of a verandah.

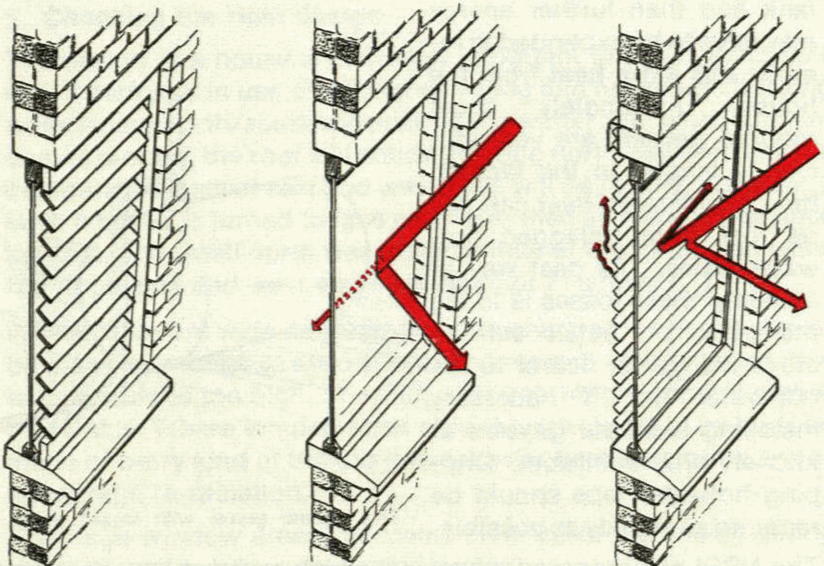
3. *Control radiant heat*

The sun's rays are the source of most unwanted heat in summer and this can best be combated by shading. East and west walls should be shaded by means of tall trees, creepers or even screen walls. A car-port, for example, can sometimes double as a source of shade for hot west-facing walls.

Colour plays an important role in the amount of heat absorbed and this fact can be used to help control the temperature of walls and roof. A dark painted surface can absorb up to three times as much heat as a white one, whilst coloured surfaces fall between these extremes, depending on whether they are light or dark.

Windows should be shaded, preferably from the outside, by means of awnings or louvres. Alternatively, special heat-reflecting glass can be used. Venetian blinds or light-coloured curtains will reflect a lot of the sun's energy back through a window; but they are not as effective as heat-reflecting glass.

Once you have shaded your windows, do not install pools or light-coloured concrete paths in such a position that they can reflect the sun's heat into the room from below.



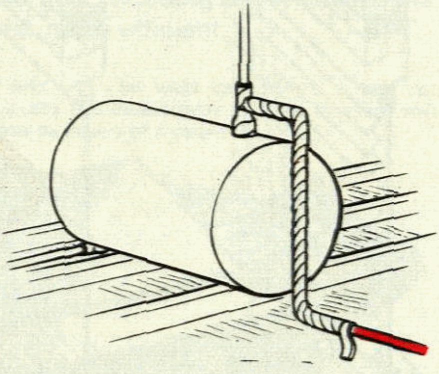
Above: Left, external louvres. Centre, heat reflecting glass. Right, internal venetian blinds.

In an area where winters are cold, it is important that the sun be allowed to reach the north wall, so any protective measures must allow for this. A natural way is to plant shade trees that shed their leaves in winter. Alternatively, roof overhangs or external louvres can be angled so that they let the winter sun in but keep the summer sun out.

In warm areas the roof can be a source of excessive heat and, if the ceiling is not insulated, the roof should be shaded. Shade tiles provide an ideal answer in warm humid areas because they lower a home's temperature over the entire thermal cycle. Air constantly circulates between the shade tiles and the roof. By day this cools the tiles and prevents the heat reaching the house, while by night the heat of the house is rapidly carried away. Because of the efficiency with which this set-up disposes of surplus heat, it should not be used in cold winter areas. Ceiling insulation is not necessary if shade tiles are used.

4. **Internal sources of energy**

The largest single user of power in the home is probably the electric geyser. If this is insufficiently lagged energy will be lost from the tank and then further energy may have to be expended to remove this extra heat from the house. Fortunately most modern geysers are very efficiently lagged in the factory, but considerable heat can still be lost from unlagged hot-water pipes. The best way of *avoiding these losses is to lag* the pipes or, better still, to move the geyser nearer to the hot-water tap, if necessary installing separate geysers at *kitchen and bathroom.* Dripping hotwater taps should be repaired as quickly as possible.



The electric geyser with lagged pipes.

The NBRI has prepared a booklet* which explains how to make a simple solar water heater which can cut your hot-water bills substantially.

The cooking stove also converts a lot of energy into heat; this, too, *can impose an extra load on the cooling equipment.* An extractor hood above the stove eliminates this waste heat easily but it must be possible to close it off completely when not in use otherwise it will provide a source of draught.

A forty-watt electric reading lamp behind one's chair makes reading a pleasure whereas a five-bulb chandelier loaded with 100-watt bulbs in the middle of the room will produce much more heat and may not give as good a light. Soft indirect lighting is even more inefficient and, although it may create a more relaxed atmosphere, a light for each task will be better and more economical.

It also pays to watch power consumption very carefully because some strange things can happen when electric wiring systems have *been extended piecemeal.* Householders have been found to be using electricity even with all their appliances switched off!

Radios and television sets also produce waste heat and these should be turned off when not being used; this, incidentally, saves power directly.

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*The Introductory Guide to Solar Energy is available from The Director, NBRI, P.O. Box 395, Pretoria, 0001.

5. Choosing the right design

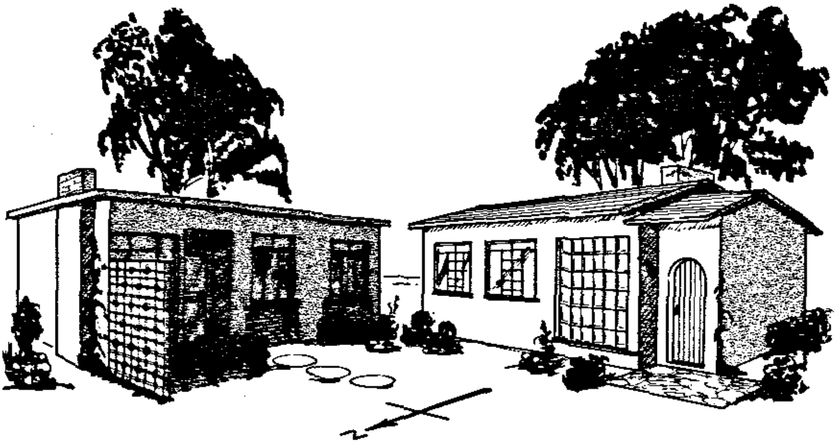
The design of a house is extremely important in determining how well it performs in use. For instance a long thin house with the long walls facing north/south will soak up the winter sun; when summer comes around, the roof will shade the long north wall and only the comparatively small east and west walls will be heated. However, if *such a house* is turned to face east/west then all these advantages are lost. The small north wall absorbs little of the winter sun while the large east and west walls get very hot in summer.

Where there are wide daily temperature changes the house should be massive enough to absorb heat and store it, unless the average temperature is too high, in which *case lightweight construction* is preferable. Where temperatures only change slightly, use must be made of every kind of trick to prevent solar heat absorption and to encourage re-radiation.

Too large window areas can completely upset the energy-saving character of an otherwise sound design.

Not only the shape of a house and the materials of which it is made play their part in improving the indoor climate, but insulation, ventilation, orientation and even the way of life of the occupants.

More about the *correct design of houses for* South African conditions will be found in the Introductory Guide to Temperature



The north facing house soaks up the winter sun.

Control.* A more active approach to using the natural energy of the sun is taken in the Introductory Guide to Solar Energy.*

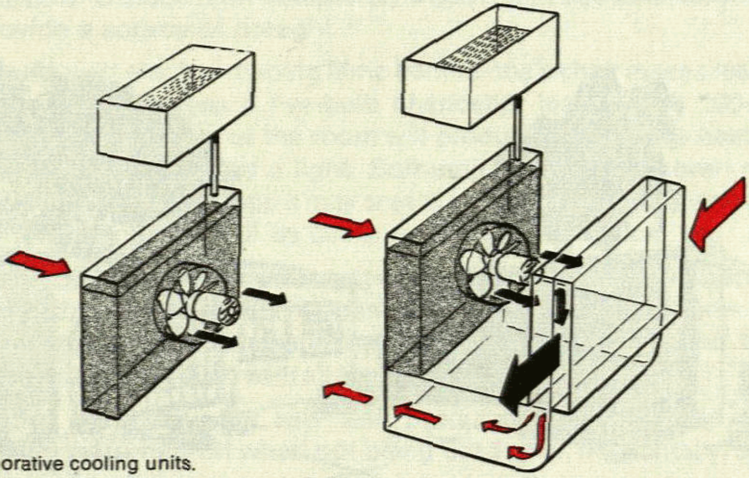
6. Choosing the right appliances

The climate in most parts of South Africa suits what is known as evaporative cooling. In this a fan blows air through a porous medium that is kept moist. The forced evaporation cools the air and, incidentally, raises its humidity at the same time. Only in the hot humid regions will this system not work well.

Coolers of this type are widely used in parts of the United States and are cheaper to buy and to operate than normal refrigeration equipment. They are, in effect, up-to-date versions of what the old-time farmer knew as a 'coke cooler' and many handymen would have little difficulty making one for themselves.

It is possible to buy an evaporative cooler in which the moist cooling air does not enter the house but is merely used in a heat exchanger to cool outside air. Such a system should be used where an increase in humidity cannot be tolerated.

Another power-saving idea is the heat pump. This is a refrigeration unit that takes heat from the house and releases it outside in summer but can be reversed to draw heat in in winter. Its advantage is that the electrical energy is used to move heat rather than to



Evaporative cooling units.

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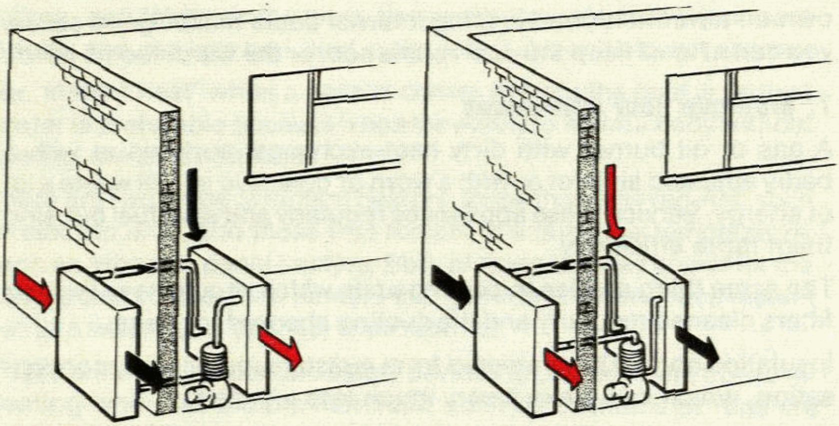

A heat pump to take warm air out in summer or bring warm air in in winter.

create it. The result is that one unit of electricity can be used to pump an amount of heat that would have taken up to three units of power to generate with an *electric fire.*

If you find that you need to buy an air-conditioning unit it is very *important that all recommendations on insulation and shading* be carried out **before** you specify the size of unit. You may then purchase a smaller unit more appropriate to the needs of your more energy-efficient house. The ideally sized unit will run continuously during the hottest part of the day.

Much energy can be saved by settling for an acceptable temperature rather than the so-called ideal one. Those who set their thermostat for 21 °C and leave it there all the year round will probably use 30 per cent more power than those who alter the setting to 24 °C in summer and 20 °C in winter, though it will be almost impossible to detect any difference in the comfort levels achieved, provided that suitable adjustments in clothing are made from season to season.

Fitting a time switch on the thermostat to regulate the temperature more efficiently will also save an appreciable amount of power. Just make sure that the thermostat is placed where it will call for the correct amount of heating and/or cooling. That is, it should register the temperature that people are exposed to, not conditions in some *remote corner of the room.*

Yet another energy-saving idea is to install your air-conditioner so that it can cool or warm only one or two rooms at a time. In this way you don't waste money on unoccupied space. Even if you do not own an air-conditioner, closing internal doors makes good sense; you can at least keep the cool rooms cool or the warm rooms warm.

7. **Maintain your appliances**

A gas or oil burner with dirty heat-exchanger surfaces or with a badly adjusted air inlet or with a worn or defective jet will waste a lot of energy. Service these appliances regularly and save fuel by using them more efficiently.

The same thing applies to cooling units which should have their air filters cleaned regularly and the ducting checked for leaks.

Insulation should be protected from moisture, particularly condensation, which can make it very much less effective.

8. **Select the right heater**

There are several different kinds of household heaters and choosing the wrong one can cost much money and energy.

The average family is out of the house for most of the day and asleep in the bedroom for most of the night; so, when do they need supplementary heating?

The usual answer is from 17h00 when the winter sun sets till about 23h00 when television broadcasting closes down.

The important thing is that warmth is needed quickly when the family first settles down and one of the fastest ways to do this is with a fan heater. Because this circulates the air rapidly it raises the temperature of all the air in the room uniformly. The air soon reaches the lowest acceptable temperature at which point heat loss to the surrounding walls and ceilings is still not excessive.

Further savings can be effected by using thermostat switches to control heaters. These are available in the form of adaptor plugs which can be set to any point in a quite wide range of temperatures. Because the plugs can be carried around with the heater, controlled heating is available in any room in the house.

Where a convector heater without a circulating fan is used, the air is very hot and promptly rises when it leaves the unit. A temperature gradient is then established in the room and by the time the air at chair level is warm enough that up near the ceiling is much hotter than it needs to be and heat losses are consequently greater.

If this is the kind of heater you own then don't put your fan away at the end of summer but rather stand it in a corner, point it at the ceiling, and let it stir the air in the room. You will feel warm more quickly and use less fuel. Just make sure it doesn't blow **at** anyone.

For 'instant heat' when a person comes in from the cold, a radiant heater is preferable because it has the ability to warm a body without heating the air in between.

There are two kinds of radiant heaters, those that glow red-hot, such as *electric fires, and those that remain at a fairly low temperature,* such as asbestos panel heaters. Both of these use less power for the same comfort level than heaters that generate hot air. Place radiant heaters where you can feel their warmth.

These units should contain safety devices to prevent them from overheating when flammable materials, such as cushions or rugs are dropped on them and prevent natural convection from occurring. Otherwise they can present a fire hazard.

There is a tendency for people to want to 'walk into a warm house'. This may feel all very well when you visit the Joneses, but one must think of what it is costing them to heat the house when it is not occupied.

Think how quickly a room cools when you switch off the heat and you will understand how much heat must be poured in to keep it at a *uniform* temperature day in and day out. If you now consider that the lounge in a house may be out of use for eighteen hours out of every twenty-four then the futility of trying to heat the whole house becomes apparent.

Under-floor heating, because it is slow-acting, practically demands to be left on permanently *and, since the same calculations apply to* all rooms as they do to the lounge, three quarters of all the energy used must be wasted, not to mention that portion which goes to heat the earth underneath the house.

9. Energy-saving tips for home-owners

As a general rule in normal brick-built houses, when it is hot out of doors you should keep doors and windows shut but open up at night so that cool air can enter. Close up early in the morning to prevent warm air from coming in. If the roof has been well insulated then it will stay cool all day. This is what made the old Cape Dutch houses so comfortable to live in. You should reduce radiant heat gains during the day by drawing curtains and shading windows exposed to direct sunlight.

Don't try to heat the whole house when you are cold – put on an extra sweater and, if you still feel cold, warm yourself with a small heater. Heat the people – not the house.

If your geyser is set to produce almost boiling water turn it down to about 55 °C (120 °F). You will find this quite hot enough for all normal purposes and heat losses will be reduced.

Another tip to save hot water is to remind the children **not** to use the hot tap when they want cold water.

EFFECTIVE COST INDEX

Some of the energy-saving steps we recommend cost a lot of money, but some of the best cost nothing at all. We list four groups here in the order of group priority which relates to their cost and with the most effective first.

A. ENERGY-SAVING STEPS THAT COST NOTHING

1. Don't fit under-floor heating if you wish to save hundreds of rands in capital and running costs.
2. Keep internal doors shut, so that you only heat or cool occupied rooms.
3. Use doors and windows to control indoor temperature and ventilation.
4. Place radiant heaters where they are not blocked by furniture – let the people feel the warmth.
5. Don't heat the house – heat the people.
6. Use the right kind of heater and
7. Switch it off when it is not really needed.
8. Don't use heat-generating appliances unnecessarily.
9. Turn the thermostat on the geyser down to about 55 °C.
10. Use the cold tap whenever possible.
11. Stuff chimneys of open fires with newspaper when not in use.
12. Open the bathroom window for a few moments after a bath.

B. ENERGY-SAVING STEPS THAT COST LITTLE TO IMPLEMENT

1. Prevent unwanted solar energy from entering windows by:
   (a) Planting deciduous shade trees; or
   (b) Drawing heavy curtains or blinds.
2. Prevent sunlight from being reflected into windows.
3. Maintain heating and cooling equipment properly.

4. Repair faulty washers on hot water taps promptly.
5. Run all air heaters through a thermostatic switch.
6. Seal loose-fitting doors and windows.
7. Fit a cold air inlet to the ash-box of an open fire.
8. Draw curtains across windows at night.
9. Circulate warm air with a fan.
10. Use separate lights for each task.

C. ENERGY-SAVING STEPS THAT ARE COMPARATIVELY EXPENSIVE

Where HEAT is the problem

1. Solar water heaters.
2. Insulate ceilings or shade roofs.
3. External shades on windows.
4. Reflective glass.
5. Evaporative cooling (not for humid areas).
6. Shade walls on east and west.
7. Insulate walls.
8. Extractor hood above stove.
9. Repaint any dark areas with light colours.
10. Insulate exposed hot water pipes.

Where COLD is the problem

1. Solar water heaters.
2. Replace open fire with more efficient form of heater.
3. Insulate ceilings.
4. Install heat pump.
5. Insulate exposed hot water pipes.

D. ENERGY-SAVING STEPS THAT COST LITTLE AT THE DESIGN STAGE BUT ARE EXPENSIVE OR IMPOSSIBLE TO TAKE LATER

1. Make certain that the house is correctly oriented.*
2. The eaves should have the correct overhang for the latitude in which you are building.
3. The window area should not be excessive.**
4. Choose lightweight or heavyweight building materials depending on the location of the house.***

*Introductory Guide to Temperature Control.
**Solar Charts for the Design of Sunlight and Shade for Buildings.
***Windows and the Environment.
All available from The Director, NBRI, P.O. Box 395, Pretoria, 0001.

5. Install solar water heaters at the outset.
6. Minimize hot water pipe runs.
7. Insulate hot water pipes.
8. Choose light colours for permanent external finishes.
9. Don't design for air conditioning – design to do without it and only install it if you must. Buy the smallest unit required for your purpose and look into the economics of heat pumps. If you use the energy-saving remedies listed in this book you may not need artificial controls after all, so try the least expensive solution first.

CONCLUSIONS

In the past the cost of energy has been insignificant beside the capital cost of equipment needed to utilize it and, once one had acquired this equipment, there was little incentive to economize.

In fact the reverse was true – there were, and still are, financial benefits in the form of reduced tariffs for those who use more energy.

All around the world the picture is changing. In parts of America all new houses must have solar water heaters. Municipal rates are reduced in some towns for those who use solar energy, tax concessions are being granted to those who install energy-saving equipment and in some places low-interest loans are available.

At the moment saving energy is something that gives one a self-satisfied feeling that one is 'doing one's bit' but the day will soon come when energy will be so expensive that we will all have to think twice before switching a fire on.

When that day comes, energy-saving equipment will be installed everywhere and solar water heaters will be a common sight.

In the inflationary times in which we live equipment such as this will probably never be cheaper than it is right now. For those who decide to invest at present prices there will be the certain knowledge that once power costs have risen to the point when alternative equipment becomes a necessity, they will be able to sit back with a self-satisfied look at their cheque books and know that they have done more than 'their bit'.