Coping with Heat
(and Cool)

With a focus on low-cost retrofit

www.underthechokotree.com
Sustainable Living in the Suburbs

By Nev Sweeney

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1.0 Introduction:

I would like to set the context of this eBook, by saying that we have lived in our brick veneer, 110m2 home here in western Sydney for 45 plus years. During that time we have found the summers are getting hotter. The title reads 'Coping with Heat and Cold' and in terms of living in western Sydney that means a lot more 'Heat' than 'Cold'.

While we have been listed, at times, as the hottest place on earth, when it comes to 'Cold', it should probably read 'cold', or perhaps 'cool'. The coldest that I have measured it at our place is -3^{o}C and that was some years ago now. We still get frosts, but they are a rarer thing than they used to be. So if your climate stretches to -10^{o}C or below like we experienced on a trip to Belgium a while ago, my apologies if you don't get much out of the 'Cold' Section.

What I have learned - It's the end that matters, you can change how you get there.

The winter of 2020 was a fairly cold one and after the summer we had just come out of it was not a bad thing, but we still want to be comfortable.

Quite often the answer to 'how can I be comfortable in the winter' is 'let's heat the whole house!' Certainly we have applied that logic, by installing an open fire when we

first moved in (replaced by the more efficient slow combustion cooker/heater some years back) and the Petite Godin slow combustion up the other end of the house when Angela was born. (More detail on this in part_____)

Lots of people do similar things using reverse cycle aircon, gas or electric heating, and this certainly makes for a comfortable house to be in on cold days and nights, but it can also burn through a lot of energy and a lot of money as well. Yes, we burn wood, which is short cycle carbon, rather than fossil fuels which produces carbon dioxide originally locked away millions of years ago, but wood burners still produce greenhouse gases. So what to do?

If our goal is to remain comfortable in cold weather(without costing a bundle and screwing up the environment), we can shift how we get there by concentrating on keeping our bodies warm directly rather than heating the air around us and allowing it to then keep us warm.

We try to do this these days, using a number of techniques. We do use the wood burner at night to give us a bit of heat and to cook on, but we use clothing layers to keep us warm during the day. One idea we have found very useful is our wearable blankets as our outer layer. These are basically warm blankets which have been modified to make them……wearable!

The detail on how to do that is accessible in in section _____but it is about applying buttons or press studs so that you can wrap the blanket around yourself and then close it up to keep you warm. We find it works very well and when teamed up with a woolly hat, warm fingerless gloves and warm socks or other footwear you can still do most inside jobs and yet remain toasty without heating up the surrounding area.

We also use a heated throw rug while we are sitting down reading, watching a movie or whatever, we sit together and with the extra bit of warmth it provides we are quite comfortable. For us it makes use of the power our system generates, but even if you are using coal fired electricity it only uses 160 watts maximum whereas an electric space heater can consume ten times this much or more.

Oddly enough, we don't use electric blankets on our bed but use a number of other techniques to keep warm including microfleece sheets, sleeping together and stored heat from a hot water bottle, or wheat bag etc. More detail on this approach can be accessed in section _____.

So I have found that once we have worked out our objectives, it is a case of being open to new ideas as to how we can attain them by the most efficient, least wasteful means and at a reasonable cost!

2.0 Heat

2.1 Keeping out the summer heat Pt 1

Our house is made of dark brick and when the sun goes towards the west in the afternoon it blasts straight onto the back wall and bingo – solar oven. Great to cook with but not so great to live in! Polystyrene sheeting does a wonderful job on the windows but if you put your hand on the inside of the western wall you can feel the heat seeping into the house.

Unfortunately my preferred option of insulating the western wall is impractical without ripping off the gyprock from the inside and putting glass wool or whatever inside then replacing the gyprock. A lot of work and/or a lot of expense, so I needed to come up with something else. My initial thought was to make a blind of some sort using shade cloth, but during discussions at the Permaculture design course that I did, another idea was floated.

It appears that matchstick bamboo blinds have many things to recommend them –

- They are made out of natural materials and so can be recycled or composted at the end of their life.
- Unlike shade cloth, little oil is consumed during their manufacture.
- They can cost one tenth of what a commercially produced shade cloth blind of the same size costs.
- They are easily available and ready made
- They are easy to fit, roll up and roll down.
- They let the light and air through while reducing the heat
- They come in a light tan colour that reflects the heat

So all-in-all, I thought why not?

We measured up the back of the house and decided to only get enough blinds to cover half the length, just to see how they worked and putting them up was fairly straight forward, drill into the bottom edge of the eaves and then screw in the three cup hooks that came with the blind. The wire supports that hold the blind itself could then be threaded over the cup hooks and the blind was in place. The blind is the width of the eave (about 30cm) away from the window and wall of the house to allow any breeze to move through and keep the house cool.

Before *After*

The day has been a hot one, good to see how the blind does its job and one of the first things that surprised me was the amount of light reflected through the blind into the house, the kitchen and dining room area actually seem brighter rather than duller, which I was not expecting. They do the job though and there is a sensible difference between the bricks directly in the sun and those in the broken sun behind the blind and as one would expect the ones behind the blind are cooler.

If there is a high wind coming the big hint is to roll the blinds up and secure them, or take them down entirely so they don't get shredded and when winter rolls around I will be taking them down for storage too. Also remember that they are made of a natural material and if you roll them up wet and leave them that way it will shorten their life so dry them out first where possible and definitely makes sure that they are dry before removing them for storage.

Light coming in through the kitchen window

Keeping out the summer heat pt 2

Our New Sun Protection in Place

Last summer I wanted to put in something to keep the heat off the back of the house. The back of our house faces west and on a 40°C+ western Sydney day we have our own house sized solar oven! We installed some matchstick bamboo blinds (see previous section) on the basis that they were biodegradable but last year was unseasonably wet and the damn things biodegraded right there on the side of the house and we wound up having to remove and compost them after only one season!

So here we are again, it is 42°C outside as I write this and we have a new protective curtain up over the kitchen/ dining room area to break the sun down a bit and keep it from hitting the bricks. It seems to work pretty well and looks alright too; this is what we did...

The Raw Materials

I wanted the fabric to be synthetic this time so we would get some better wear out of it, but after measuring up the size we needed, we found that it was unavailable as usual. We had to go bigger or smaller so we elected to go bigger and cut it down rather than smaller and then try and add a bit on.

Sewing the pocket for the bottom dowel

We needed a piece 4500mm long by 3000mm wide and the nearest was a piece 6000mm by 3660mm so that's what we bought. The fabric we got was "Coolaroo" Extreme Exterior Fabric which keeps out 84% – 90% of the UV radiation and presumably heat as well and has a 15 year warranty. This should do the trick. We also got a light sandy colour working on the idea that it would reflect rather than absorb the heat, and while it works pretty well I do wonder how a darker fabric would go.

Covered in fabric!

The sides of the fabric were selvedged so that they did not unravel but the ends were not so I cut 1500mm off the length and put it away for later use. The sides were a bit more difficult: I needed to get rid of a bit less than a metre but not lose the selvedge. In the end after finding out that the fabric was folded into quarters I decided to only use three quarters of the width and leave one quarter folded over the top to provide extra protection.

Pre-drilling the pine

On the top edge, to secure the fabric to the eaves I planned to wrap it around some 45mm x 19mm DAR pine (two pieces because the longest single piece I could get was 2400mm). To weigh the bottom down and make it easier to handle I put in two pieces of 2400mm x 25mm dowel. To fit the dowel Linda sewed a pocket in the bottom of the fabric big enough to accommodate it with her sewing machine and synthetic (polyester) thread. This proved somewhat easier than expected but still meant that towards the end of this operation I was sitting there covered in fabric while I helped pull it through the machine.

Fits like a glove!

Prior to fitting the pine I drilled a series of holes along both pieces about 200mm apart to accommodate the fixing screws. I wanted plenty of screws to spread the wind load that the fabric would be subjected to, and with that done we went outside and laid the fabric out on the ground. I placed the pine down along the top edge, folded the fabric over and stapled it to the pine. Unfortunately, once the fabric was folded over the pine I could no longer see the holes (Yeah, I know, I know you're yelling "well duh!" at your computer screen but some of us are smarter than others....). Anyway, using a bradawl I pushed through the hole from the other side, then through the fabric, placed the tip of the screw on the tip of the bradawl and then removed the bradawl from the hole feeding the screw in at the same time. I then used the battery drill to partially screw each of the screws into the holes so that they were secured in the pine. Fitting the screws meant spending some time on my knees working my way along the fabric, which turned out to remarkably abrasive on bare skin – note to self: wear jeans not shorts next time.

The fabric folded over and stapled

Once the screws were in I got my brother to help me roll the whole shebang up then secure it with straw bale twine into a long sausage....or blind; either description is good! With each of us on step ladders it was just a case of holding the blind in place on the fascia about a finger span below the gutter and drive the screws home into the fascia. Our fascia is fairly soft timber so I did not pre drill first but if it was MDF or hardwood then I probably would.

Using the Bradawl to locate the screw

Once it was in place it was just a case of untying the bailer twine, leaving it in place and letting the fabric uncurl, which all happened fairly easily. The weight of the dowel helps keep the blind down. In the future I may put some spring clips or something in to hold it more firmly but even without them it did not flap about much in the wind. You could still see a bit into the backyard through the blind but it did cut down the blaze of the sun hitting the bricks and warming up inside.

Fixing it to the fascia

I'll see how it goes with the double flap up the top and if I find it irritating I may cut it off, because it does tend to blow about a bit although it also increases the protection for the house too. I may also make a second one for the other side of the back of the house, to keep the heat out of the bathroom and office but if I do it will be a dark colour to test out which is better at keeping out the heat – watch this space!

Rolled up and ready for use

2.3 Keeping out the summer heat Part 3: defence in depth

Back in 2011 I put together an article about keeping the summer heat off the kitchen and dining room area, (see 2.1 above) then in 2012 I added a sequel (see 2.2.above). Both of these articles concentrated on using a blind-type material to construct a barrier between the Western Sydney summer afternoon sun and the kitchen dining area, first with matchstick blinds and secondly with light coloured 90% shade cloth. But in the ten years plus since those were written I have put more effort into protecting the back (and other parts) of the house from the summer sun using a number of strategies. I thought it was time to share what I have done.

Kitchen Dining Area

To be fair, this is still a priority area, but a few years ago I built a back deck, and while the roof is clear corrugated polycarbonate roofing, it is covered with a double layer of 90% shade cloth and there are a series of bamboo blinds across the western side of the deck. This works pretty well to keep the sun off this strategic area of the house. For more details on how I constructed the deck (with the help of friends) there is

The Rest of the West

Of course the deck only covers six metres of the western side of the house ie the kitchen, dining room and laundry (partially). There is still another other six metres of the back of the house, consisting of the bathroom, toilet and third bedroom, which is currently my office. To cover this area we have a number of layers of vegetation – defence in depth.

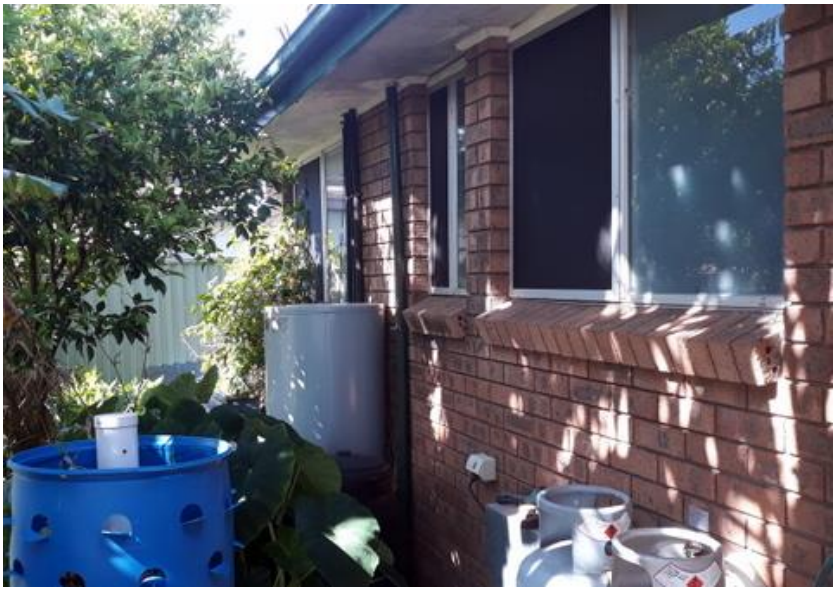
The first (and most westerly) part of this defence is the banana circle. As well as providing bananas, using greywater and looking really cool, the banana circle provides afternoon shade for the laundry, bathroom and toilet.

The banana circle

Closer to the house and a bit more northerly is the mandarine tree. It was originally located on the western side of the yard, but turned out to be where I wanted to put a shed, so I dug around the roots and pruned it back heavily then used a winch (and lots of pushing) to move it to its current position in front of the office/third bedroom. The mandarine tree provides shade mostly for the third bedroom/office back wall and part of the window.

Mandarine tree, passionfruit vine on the window and papyrus from the constructed wetland

The northern part of the office/third bedroom window is covered mostly by a passionfruit vine and, depending on the time of year, the vine will creep over to the southern side of the window as well, eventually melding itself into the mandarine tree. It does die back somewhat in winter and is trimmed to allow some winter sunlight into the window, but it regrows each year.



Shade from the assembled foliage on the back of the house

Between the banana circle and the mandarine tree and the house there is the constructed wetland. The constructed wetland grows large taro leaves and papyrus, which both provide some early afternoon shade on the lower part of the western wall off the house. The taro in particular dies back in winter and then comes back in spring.

The North East

The second bedroom/craft/spare room composes the north east corner of the house and gets sun cover in the morning and early afternoon from our mature mulberry tree. The mulberry tree covers the east face of the room, part of the roof and probably half of the northern wall of that room. The north wall of the house does also get some sun protection from the 5,500 litre rainwater tank and a couple of storage sheds that prevent the sun coming in direct contact with the north wall.

From the north

From the south showing shade provided on a summer morning

The East

We have quite a bit of foliage in the front yard including three large melaleuca alternifolia trees, a large bay tree, a large olive tree and several smaller fruit trees along the front boundary, but the foliage is high up so that we tend to get early morning sun on the house. We also have the fruit tree circle directly in front of the lounge room, but due to the angle of the house on the block, we usually get some morning sun on the lounge room windows in summer, but not so much in winter, when we do want it.

Melaleucas from the East

Fruit tree circle and the hibiscus (olive in the foreground)

Next to the house at the front door and part of the main bedroom wall, we have a large hibiscus and a moderately sized bottlebrush and these do provide some morning shade for the eastern wall of the house.

The South

Usually the southern wall of the house is not that much of a worry because it doesn't get much, if any, sun. However, due to the skewed position of the house on the block, the south wall actually faces somewhat west of due south so that in late summer afternoons the sun would hit that wall. This is not a big issue for us, though, because the whole south wall is protected from the sun by the garage and so little sun falls directly on it.

Conclusions

So it can be seen that over time we have been able to put in place barriers so that the sun does not come into direct contact with the dark house brick and warm us up in summer. We have been able to do that, in the most part, with trees, shrubs and bushes that are productive in their own way, as well as providing sun protection for the house. This did not happen overnight. The mulberry tree on its own has probably been in place for over 30 years. Having said that, the banana circle and passionfruit vine have been working for us after only a couple of seasons.
I would love to say also that this 'defence in depth' was developed as a result of a coherent strategy and master plan. Unfortunately this was not the case and the whole thing has developed over a long time. Certainly it would have developed into an effective and productive sun barrier much more quickly if I had put a plan together first, and mistakes were made!

The banana circle was originally in the front yard in a totally inappropriate place. Where the banana circle and constructed wetland are now was originally the site of an unhappy and not very productive lemonade tree. Where the mandarine tree is now was a scrappy peach tree that acted as a very effective lure for fruit fly, which then went on to party in the veggie patches. It was only once I had done some study and hung around with some awesome permaculture bods that I was able to design things to be more productive and more effective.
I have made mistakes so you don't have to! (That's rubbish but I always wanted to say it!). My suggestion if you want to do something similar to what we have is –

- Do your research, read the books, join a permaculture group, and do a course if you can.
- Put a plan together, it will give you a chance to think about things as you put them down on paper before you put them down on your land (which is also a lot more work to change!).
- When you have a plan, give it a go and implement it! Even if it doesn't work out it will hopefully still be fun and give you some good practical experience.

Good luck!

2.4 Setting up a cool retreat

It seems to me that out here in western Sydney the summers are getting hotter. In the last two years (2017 & 2018) we have had several days over 45°C and more than I care to think about over 40°C. Along with this has been the feeling that levels of heat that never used to bother me are now causing me some trouble. I mentioned this to my doctor and she made some comment that sounded like it was because I was getting bold, but I may have misunderstood.

One way of dealing with this, and it certainly is the method of choice for some of our neighbours, is to run the air-con 24/7. This is expensive and there has been talk of power issues on the really hot summer days and the possibility of blackouts. We have our own standalone power system, but when I was designing it the theory was that because the air-con is a major current draw and is only used for a few hours on the couple of hottest days of the year (ha ha), it would remain grid connected. Anyway, so much for that idea!

So what is the answer? A cool retreat!

A cool retreat is an area of your dwelling which has been set up to remain as cool as possible during heat wave conditions and which you can…….. retreat to. The area may be set up specifically to function as a cool retreat during construction or, as ours was, an area retrofitted into our standard 1970's era dwelling. To work out where we were going to put our cool retreat we had to look at our house and identify the best location. The criteria we used to identify where our cool retreat was going to be were –

- The area was, or could be insulated and/or protected from high outdoor temperatures,
- It could be isolated from the rest of the house,
- It had existing mechanical cooling assistance, and
- There was sufficient area and facilities to be comfortably habitable for extended periods.
-

After looking closely at all rooms of the house we decided our cool refuge would be our Livingroom/kitchen/dining room area. We have a comparatively small house (120m2) and these three rooms add up to a total of about 30 square metres (or one quarter of the house floor area).

So, to look at the criteria and how this area fitted them more closely –

1. Insulation/Protection from Outside Temperatures

The whole ceiling is insulated with fibreglass batts, which was done the year after we moved in and they still seem to be working well. There is no wall insulation, much as I have tried to organise something, it would require electrical rewiring as the current wiring is rated for open air only (heat could build up and cause a fire if we insulated the wiring).

Probably 15 to 20% of this part of the roof is also covered with solar panels which will provide a bit of sun protection.

Our house is oriented so that the front faces a little south of east, and the back faces a little north of west. Due to the greater sun arc in summer, the nominally southern wall of the house gets a blast of afternoon sun, which would add to the heat load of the lounge and dining room, but the garage is along that wall so most of it is protected from direct sunlight.

Double 90% shade cloth cover over the deck and solar panels on the roof

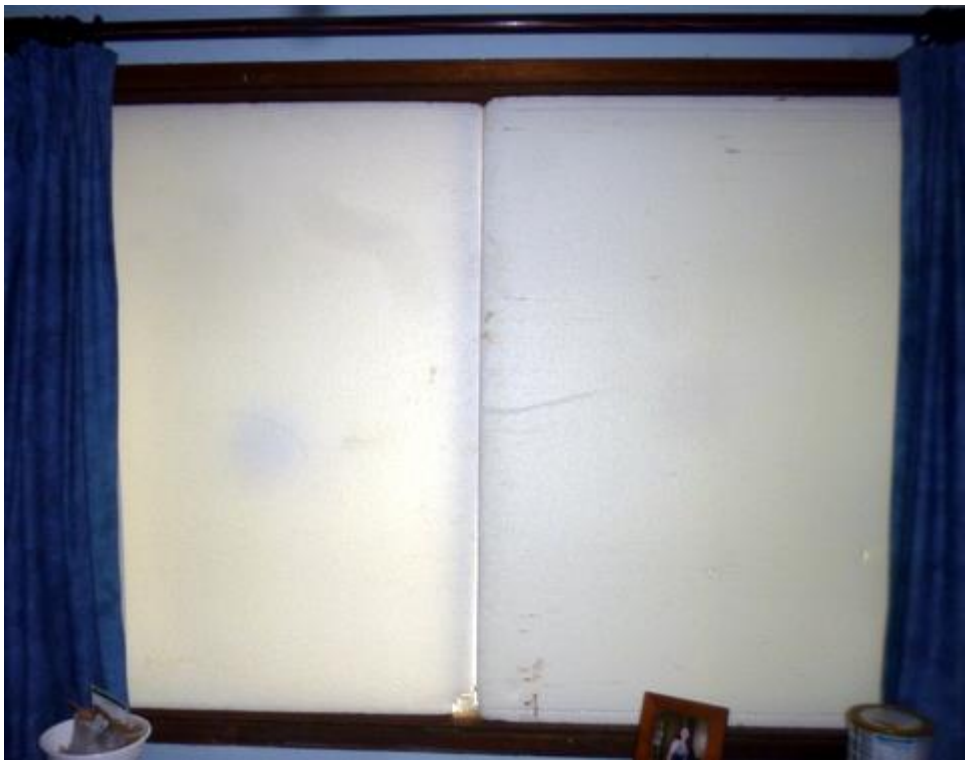
Our biggest heat gain has always been from the west, and since the early days things would become uncomfortable from about 1:00pm onward, so this is where a large part of our efforts to provide protection to our cool refuge were expended. We have a deck built on the back of the house, protecting the kitchen and dining room western wall. The roofing is clear but we cover it in a double layer of 90% shade cloth for the summer and it provides excellent shade.

Bamboo blinds in place

We also put in bamboo blinds on the front of the deck so that the wall is still protected as the sun sinks lower in the west and the direct sunlight can get under the deck roof and hit the walls and windows. Due to the slightly off kilter orientation of the house there is an open spot between the deck and the garage which allows sun light and heat to hit the dining room window and part of the wall. To cover this area I installed another bamboo blind on the fascia board at the outside of the eaves, which now provides shade for that part of the dining room window and wall.

Bamboo blind covering the exposed dining room window and wall

The windows are obviously an area where the outside heat can be transmitted into our cool room. The lounge room window has a roll down shutter for insulation and we use thin (1 to 2 cm) sheets of polystyrene which fit inside the window frame and act as insulation against the heat.



Polystyrene sheeting on the inside of the windows

2. Isolation from the Rest of the House

There is an archway leading from the lounge room into the hallway and the front door, an open doorway leading from the kitchen into the same area and an open doorway leading from the kitchen into the laundry/back room area.

Temporary blanket door

Concertina door

In the lounge room arch and kitchen door way to the hall we have installed concertina style doors, which allow the area to shut off fairly well, but the laundry/kitchen doorway was still open so as a low cost fix we have attached a blanket to cover the doorway. We can still get in and out of the laundry but the blanket is very effective in keeping the cool air within our cool refuge.

3. Existing Cooling

The only air conditioning in the house is a split system on the outside wall of the kitchen dining room, which means we can cook and eat in relative comfort. We also have a ceiling fan in the lounge room to help keep the air moving and increase comfort. As we have put in more and more protection against the heat for our cool refuge, we have found that when we get those scorching days we don't need to put the air-con on until 4:00pm or sometimes even later.

4. Facilities for Comfortable Habitation

In the kitchen area we have……the kitchen! So we have facilities for cooking our food without leaving the cool refuge. This is good, because we don't need to leave the refuge to cook, but bad because it can act as a source of heat into the cool refuge. Generally

the air-con can take care of that problem but it is something to think about. The fridge is also a small source of heat into the cool refuge.

The dining room provides a place to eat but also a place to set our computers up in the cool (to do things like writing this article) or to play games etc.

The lounge room has the TV, music machine and bookshelves etc as such rooms tend to do, but the lounge itself also folds out into a bed so that we can sleep in our cool refuge if required.

In general terms we have found the cool refuge concept to work fairly well for us. It has considerably reduced our reliance on air conditioning as our primary means of cooling, which has also reduced our electricity bills and increased our level of resilience in the event of blackouts, which have been threatened but not occurred in our area at least (so far!)

If you want more details on the "cool retreat" concept or other means of coping with heat wave conditions, the document "**A framework for adaptation of Australian households to heat waves**" produced by the National Climate Change Adaption Research Facility (Part of the University of South Australia) is worth a look.

2.5 Retrofitting Windows to Conserve Energy

Windows are wonderful features of our houses; they let light and air in and make our houses nicer places to be. It is unfortunate that they tend to be energy black holes, accounting for up to 25% of the heating bill in winter, but this is Australia and they also let lots of heat in during our long hot summers. They cause you draw extra energy to keep the place cool if you have air conditioning or turn your house into a solar oven if you don't!

The design of our houses can help or hinder our quest to reduce energy consumption but still live with some comfort. I have an enduring grudge against the idiot who designed our house – a huge expanse of glass on the east and west faces of our house but absolutely none on the north wall. Unfortunately many houses are the same, and there are not many of us who can afford to just hack holes in the walls to open up new windows when we feel like it or design their own house. In many cases we have to live with what we are given so I have tried over the years to come up with low cost retrofits to improve the energy performance of our windows without replacing them with low 'e' glass or double glazing.

I'd like to share some of our successes and failures with you!

Before we move onto the good stuff though, I would like to put down a few words about block out shutters, because we have had them fitted to our front windows for over 10 years. There were expensive and a quote to place the same kind of shutters across the back of the house (4 windows) was almost $4000 including a bit of tarting up of the original ones.

Block out Shutter on the Front Window

They do block out the sun and reduce internal temperatures; they also do work towards keeping heat in during winter too. Ours are a dark brown and when the sun is on them you can feel heat being transmitted through the shutter and then through the window,

but it is definitely an improvement. You can open the shutters up slightly so that holes appear between the shutter slats for ventilation but the amount of ventilation provided is small. The reduction in feeling cold in winter due to the shutters from my experience has been small and I think there are better ways to achieve this. Shutters have their place if you have the money, but my focus was on low cost! So, on with the show!

Bubble wrap

One cheap way to reduce heat going out of, and coming in through your windows is to place a layer of bubble wrap against the inside surface of the window. This traps a layer of still air against the glass and acts like de facto double glazing, but at a much cheaper price. I was all for going ahead with this; it was cheap and appears to work while still letting some light in. Unfortunately, my lovely partner in sustainability declared that windows covered in bubble wrap looked like crap. So that was the end of that! If you are not likely to face veto from The Boss, this is a good, low cost energy saving measure worth trying.

Fortunately she reconsidered her position on bubblewrap some time later and the results of the trials and much more detail are recorded in 2.6 below.

Shade cloth (eg Sarlon)

While this isn't much good for keeping the heat in during summer it is does provide a bit of respite from the heat. I made up a frame of 19mm x 50mm DAR pine (light, cheap and available) which fit into the brick surround of the outside window frame. I then fitted one or two braces across the frame, depending on the size of the window, to increase strength and give me extra surface to attach the shade cloth to. I then cut 70% shade cloth to size of the frame and secured it using the flat steel shade cloth, for want of a better term, nails. Bingo!

I just fitted it into place and secured it with a couple of wedges. I didn't do the wedge thing originally and the damn things would fall out when it got windy. They reduce the solar load on the window, but still let you see out and let a cool breeze come through. They don't have much effect on keeping out the cold in winter.

Shade cloth and frame on bedroom window

Gift wrap

Yup, strange as it sounds, the silver metallised plastic gift wrap that you get at the "el cheapo" shops for a dollar or two a roll can be used to reduce the heat load through your windows. Use a frame similar to the one mentioned above, but making sure that the braces are spaced so that they are no wider apart than the width of the roll of gift wrap. If you can get gift wrap that is plain silver on both sides, so much the better but gift wrap that is silvered on one side will do the trick. Apply double sided tape to one side of the frame and then roll the gift wrap shiny side out onto the double sided tape on the frame.

Once the frame is covered fit it to the window and secure with wedges.
The gift wrap will reflect solar radiation, reducing the heat load through the windows and keeping the house cooler. It may also reflect heat back into the house during winter. During the day you have a lower light level inside than out, which allows you to still see out through the gift wrap cladding, especially if you were able to get the stuff silvered on both sides. The gift wrap is a bit fragile and can be torn by high wind and also, the reflected heat and light can really crap off your neighbours if it is aimed at them. When setting the reflector up, make sure it is angled up or down so that the neighbours aren't in the firing line.

Window Quilts

If someone you know is into quilting, get them to make you up some quilts the same size as the inside of your windows. In the same way as a quilt on your bed keeps you warm in winter a window quilt puts an insulating layer between you and the thermal loss or gain through the window. You can make the outside face of the quilt white to reflect light and heat, and put a nice pattern or even a piece of material with a view on it facing inward. Unlike the solutions above, this will not let you still see out and may

work a bit better in keeping the heat in during winter than keeping the heat out during summer.

Polystyrene Foam

We get large blocks of polystyrene at work, usually with a thin protective layer of polystyrene foam on the outside of the delivery which is thrown away. We cut the polystyrene to shape with a hot wire cutter so I measured up the interior of our back windows and got the guys at work to cut some of the polystyrene foam to size for me, in two pieces for the larger windows. They fit into the inside of the window and the effect is immediate, the room instantly feels cooler and they also keep the heat in during winter, reducing heating bills. The polystyrene foam I used varies in thickness from 10mm to 25mm and there doesn't seem to be much difference in performance with thickness although (obviously enough) the thinner the foam the more light is transmitted. You can't see through it but it will let enough light through to be able to carry on most household activities.

While I cheated by getting hold of large sheets free, you can make the same thing by getting hold of a hot wire cutter (I got one from Hobbyco in Sydney) and slice up waste polystyrene veggie boxes etc into squares and then stick them together edge to edge with double sided tape. The polystyrene is light and easy to take in and out of the window but somewhat fragile so care must be used when taking them in and out of the window area.

Out of all these I really like the polystyrene sheets, perhaps because they work so well. We were going to spend the $4000 and get shutters across the back to try and reduce the solar oven effect (My wife doesn't put up with the heat well) but since I got hold of the polystyrene sheets we have agreed to put the money towards better things. In reality though, any and all of these are worth trying to see which one works best in your circumstances.

Inside Bedroom showing polystyrene foam in place

2.6 Bubble wrap as double glazing

What do these two things have in common? You may well ask, and the fact is that bubblewrap can be used as a cheap, easily applied and removed, fairly effective substitute for double glazing your windows. Interested? Read on!

WE have a '70s house, and large aluminium windows were the 'in' thing when it was built. That is great for light, but not so great for heat – the windows let heat in when we want to stay cool, and let heat out when we are trying to stay warm. We have developed ways around it: we have wind up shutters on the front of the house and use fitted in sheets of polystyrene for the windows along the back (we have no windows on either side wall of the house). This can work very well in summer, when a dark and cool house interior is desirable, but in winter we want to let the light in while keeping the heat in too, and both of these strategies (shutters and poly sheets) reduce the light coming in considerably, if not entirely.

I have had this thought in my mind that we should give bubblewrap a go as a window insulator since I read about it quite a few years back. Unfortunately, Linda was not quite as enthused as I was and thought that it would look tacky at best, or look like crap at worst. I eventually wore her down and got her to agree to trial some on the glass panel beside the front door. She would be able to get a feeling for how it looked without it being too obvious from outside. I had gotten hold of a 25m roll of 500mm wide bubblewrap with 20mm bubbles when I first got the idea, and kept it hanging around until I got approval to use it. So, the thing was, I applied it to the window near the door and she loved it!

To apply it was deceptively simple, I just –
1. wiped the inside of the window over with a damp cloth to remove and dirt, dust etc.
2. used a pump action sprayer full of water to spray the inside of the window with a fine spray such that the window was wet all over.
3. Placed the bubblerwrap against the window, bubble side against the glass, then smoothed it down with my hands so that all bubbles were in contact with the wet glass.
4. That was it!

It was a remarkably easy process with the bubblewrap adhering to the wet glass almost immediately it was applied, but still being able to be moved around so it fits the window properly. It only took a couple of minutes to smooth it out to the point where it was completely attached to the window and was ready to go.

From the inside

We now have it on the lounge room window (largest in the house), dining room, kitchen, and Linda's work room, and did have it on the bathroom window. All of this has taught us a number of things about using bubblewrap as double glazing.

1. Cutting out – I tried a sharp knife cutting s number of layers but a sharp pair of scissors works best. When cutting across the sheet (at least for the sheet I used) pick a spot between the lines of bubbles, this is the easiest to cut as well as making it easy to keep cutting a straight line. Cutting along the sheet is also easy to follow a straight line but one line of bubbles will get cut because there is no clear line between them in this direction. It is also better to cut a little short rather than a little over the measurement if you can't get it exact, because if it is a little over it can cause the edge to lift and start the bubblewrap coming off, over time.

2. The clarity of the bubblewrap improves over time while it is in place – when you spray the water on the glass, then apply the bubblewrap, it reduces the clarity of the glass somewhat and makes it more difficult to see through. It turns out that this effect is only temporary and over a week or two the water layer seems to evaporate (or something) and you are left with a much clearer window.

3. It won't work on stippled windows – you know, the privacy window glass used in toilets, bathrooms and sometimes other rooms as well. The interior of the window glass is made translucent but not transparent by a whole stack of tiny protrusions designed to stop you seeing through the privacy glass. These protrusions allow the bubblewrap to adhere to the glass only while the glass remains wet. As the glass dries (see 2 above) the bubblewrap slowly starts to come away from the glass under the action of gravity and eventually it falls off entirely. So you can use this method on toilet/bathroom windows but will have to wet down and re-apply every 2 to 3 weeks, if you are okay with that, go for it!

From the Outside

4. It allows more light in (sort of!) – This one is a little more difficult. As with most houses, the front of our house faces the street. We have large windows facing the

street and use a combination of block out curtains (which we draw at night) and continuous lace curtains which we use to maintain our privacy during the day. These lace curtains do reduce the light coming into the front rooms, particularly the lounge room and particularly during winter. What we found, however, was that the bubblewrap provided sufficient obscurement from the street for our privacy such that we could dispense with the lace curtains. On balance the bubblewrap lets much more light into the lounge room making it an easier and more pleasant place to be on a winter's day.

5. Does it work? – This one is also a little more difficult. I have read of a phenomenon called cold radiation, which allows something like cold glass to suck heat out of a room to the point where you can feel it cooling you when you walk past a cold sheet of glass. If I touch one of our windows on a cold night, it feels cold (yeah, I know, DER!) but if I touch the back of the bubblewrap applied to that same cold window, it feels a bit cool and that is it. You also don't get the cold feeling waking past a window with the bubblewrap on it. The window does not cool the air in the room by convection either (warm air hitting the window, having the heat sucked out and then falling to the floor then being replaced by more warm air, you get a cycle which cools the air in the room). There is some residual cooling by the aluminium window frame which is not covered and is still transmitting cold into the room but the vast majority of the area where the heat is lost has been covered.

The end result of this is that the room seems to warm up quicker when we put the fire on and stay warmer longer, increasing our level of thermal comfort. Sorry, I don't have access to technology like a thermal imaging camera so I can't give you any numbers, but it does feel warmer for longer.

So, in summary, bubblewrap is a cheap and readily available, easily applied and removed substitute for double glazing which reduces the heat lost through the windows to which it is applied, thus improving comfort and saving money on heating.

3.0 Cool

3.1 Sleeping warm without an electric blanket

Some fifteen years ago we were doing some work on reducing our power consumption and generally working our way through appliances to see if we could eliminate them or come up with another way of doing what it was they did for example a hand can opener to replace an electric one. It is coming up to winter here in Aus and we have a double electric blanket and while the power drain of an electric blanket may not be huge at around 200 watts for a double, they are a power drain. If you use them as intended, to warm up the bed before you get into it then turning it off this is not really a problem, but we would not only leave the damn things on all night, they would sometimes be left on all day as well when we forgot to turn them off.

After a while this sort of power drain could add up and not only that but weight placed on the bed that has an electric blanket left on high on it can cause a fire and there is also another hazard. Any electrical appliance will emit an electromagnetic field or EMF and these can affect the body in negative ways. The EMF produced by an electric blanket is emitted very close to the body, penetrating 150mm or more into the body and you can be exposed for 8-10 hours a day in winter. Epidemiological studies have thrown up a possible link between exposure to electric blanket EMF and childhood leukaemia as well as miscarriages.

Take it for what it is worth, we decided to get rid of our electric blankets. OK so call me a wimp but I don't like being cold, especially when I am trying to sleep and we can get down to -2°C out here in Western Sydney so we needed to do something. We cast around for some old ideas (they didn't always have electric blankets) as well as some new ones and this is what we came up with.

Insulation

It is hardly a new idea but one of the first things we tried was the old flannelette pyjamas and nightgown. I gave up wearing pyjamas to bed when I got married and with the exception of a couple of hospital stays haven't used them since, I find they get caught up and wake me up. So if I can't apply some insulation directly to me (Linda wears them OK) I needed to do something else.

One new thing was to introduce microfleece sheets. These sheets are warm to the touch, even warmer than flannelette sheets, and help you over that first plunge into a cold bed. They also keep you warmer through the night. They are available from Manchester shops but if not you could always get hold of some polar-fleece fabric as wide as you can and sew them together to form a sheet. They have a different feel than every other sheet we have used but they are very warm. We have always had a pair of woollen blankets but added a feather doona in between and a synthetic comforter on top and that with the microfleece sheets and man, we were starting to sleep WARM!

There is an old saying when sleeping rough – to keep the feet warm, put on a hat – and seeing as 10% of the body's heat can be lost through the head this advice makes sense. A nice soft beanie or other form of cap can help keep you warm throughout the night by stopping the heat loss through your head.

Reflective Blanket

You can get those reflective "space blankets" that you find in first aid kits and camping shops. They are very thin silvered plastic and the idea is that they reflect body heat back onto the person wrapped in them and I wondered how they would work in a bed. Being plastic they would not be good in direct contact with the skin but if placed on top of the sheet they should do OK. I had a bit of difficulty finding one in our local shops but I was able to buy a couple of rolls of foil gift wrapping quite cheaply, one side was printed but the other was a plain silver reflective surface. I unrolled it and placed it on the bottom half of the bed to see how effective it was compared to the top half, which did not have any foil blanket. It seems to me that there was an increase in the feeling of warmth where the foil was and that part of the bed stayed warm longer if you had to get out for any reason. The downside was increased noise in the room do to the foil making a resulting noise when anybody moved, although it was not loud and certainly did not cause any problems with sleeping. It is a cheap easy way to get more thermal comfort from your existing bedclothes.

Biologic Heating

Keeping the heat in is one thing but it helps if you can generate some heat as well so at this point I want to introduce you to that most perfect biologic heater known to man – woman! But seriously folks, sleeping with your significant other shares body heat and can be a great way to keep warm.

We also have two cats and they sleep on the bed when winter comes so we can all keep warm together and you could do the same with your dog(s), we have friends who do. The one thing that does bug me is that I can't understand why on earth a cat would want to have a bath at 3:00am, and in the process vibrate the bed and wake me up (I'm a light sleeper). Drives me crazy!

Stored heat

The classic way to introduce heat into the bed comparatively safely is the old standard, the hot water bottle. They are still available and even come with nice fluffy covers so that your skin doesn't come into contact with the hot rubber. I've never had one leak or bust, which is just as well because I don't think either of us would enjoy that, but if you don't have a hot water bottle or don't trust them there are some other options.

Wheat bag – this is simply what it says on the tin, a cloth bag with or without quilting to ensure the wheat stays distributed that you heat up in the microwave for a minute or two and then put down the bottom of the bed to keep the feet warm. They are commercially available but it seems that they are ridiculously easy to make with even

rudimentary sewing skills and if you could fill the bag with home grown wheat, how good would that be? They are usually used to reduce pain in sore muscles but there is no reason why you couldn't use them as a sleeping aid.

Warm brick – You may not have thought of this one and certainly it is not all things to all people but if you are caught short it can be handy to know about. If you want to be a bit techo make yourself a cover or even a cloth (flannelette, why not?) bag to keep your feed off any sharp edges, then heat the brick next to your heater (wood fires work really well) or heat it in the oven making sure you don't get it too hot. Once it is nicely warmed put it back into tis bag and place in the bed. Instant warm feet!

3.2 Wood burning Heaters – our experience

When we moved into our house over 45 years ago, we decided that the first thing we wanted to have in our new home was an open fire place. It came before a lounge suite, a dining room table or even a decent bed (we were sleeping on a mattress on the floor). In the intervening years we have picked up some experience with wood burners which I would like to pass on to those who are interested.

The Burning Log Open Fireplace

We looked around at what was available on the market and even then good wood burners were expensive, but we settled on a "Burning Log" brand open fireplace made in Australia and it cost us about $700. Burning Log are still around but no longer make open fire places, I assume because of tighter emission standards. It was basically a double skin black sheet metal hood mounted on a raised brick hearth and a sheet metal chimney, with a plain Chinamans' hat on the top and lead flashing. The hearth could be mounted on the ground or raised up three bricks to allow wood to be stored underneath, it was also more comfortable to sit on at that height so that is the one we chose. They were originally made with a single skin which got hot and radiated heat into the room but by the time we bought one they had the double skin, which kept the outer skin cool. This meant that although you were less likely to get burned if you touched the outer skin, more heat went up the chimney and less went into the room.

The first year we had it was particularly cold; we did not have any doors fitted to section off the lounge room from the rest of the house and no insulation in the roof. We spent a lot of time sitting on that brick hearth trying to keep warm! After putting in the doors and the insulation it worked much better for the next winter but it was a true open fire place and a lot of heat went up the chimney. There was a damper where the hood met the flue but if you closed it down at all the only result was to get smoke in the room so the only time it was used was if there was a lot of wind and the fire wasn't going, it stopped any heat getting sucked up the chimney.

OK, so it wasn't super efficient, but it was 110% on atmosphere and ideal for those winter nights at home just the two of us (well the house kept us broke so we had no money to go out) and when the kids came along they loved it too. Family winter nights in front of the open fire, toasting marshmallows were absolutely wonderful and gave us memories we will carry for the rest of our lives. When we finally came to update it I thought our eldest would be upset but in the end the kids were OK with it.

We did cook on the open fire occasionally but for the most part we used it for heat only. It heated the lounge, dining room and kitchen very well but due to the layout of our house the other end, comprised of bedrooms, bathroom and toilet stayed pretty cold. If we waited for the lounge room to heat up and then opened the connecting doors we were able to get some heat up the hall, but the bedrooms themselves just about had the chill taken off them. Hence our next foray into wood heating.

The Godin Slow Combustion Stove

When our eldest daughter was born there was no fixed heating up the bedroom end of the house and the thought of bringing home a baby in the middle of a bloody cold winter (she was born in April) did not fill either of us with enthusiasm. So we put a wood heater in the bedroom. It was a French brand, Godin and it was the smaller one of the two available at the time and hence was a "petit". It is an upright cylinder approximately 26cm in diameter and about 65cm high. There is a cast top opening to admit the fuel which is covered by a decorative cast iron lid and a door on the front which has clear mica window set into it. With the cast iron lid down it looked very nice but seemed to reduce the amount of heat getting into the room quite a bit so the lid was left up while the fire was on and down only when the fire was not burning.

The door is opened for lighting and to remove the ash, and the chimney comes out of a cast iron fitting in the middle of the back. The place where the chimney is turned out to be very handy because rather than take the chimney straight up and out the roof, we

took it through the wall and into our daughter's room and then up through the roof. This enabled the hot flue gases to keep both rooms toasty.

To get the most out of it we would light it up with the bedroom door closed and then when the bedroom got to the temperature where you couldn't keep your clothes on, we would open the door. This allowed all the hot air to flow into the bathroom, toilet, other bedrooms and the hall. Unfortunately it wouldn't really do much for the kitchen/dining room/lounge area and on rare occasions when we had all the family over we might keep both going for the night.

The Godin is a firebrick lined slow combustion heater which could theoretically be used for cooking on the cast iron lid where the wood went in but we never found it to be all that successful, it took forever even to boil water. The Godin is multi-fuel in that you can use wood or coal but we have only used it as a wood stove.

As it is slow combustion it is much more efficient than the burning log fire place, but it is an absolute bugger to start! I don't know if it is because of the extra run of horizontal flue running into the next bedroom or if they are all like that. You have to get the fire burning hot very quickly, or you get no draw and a room full of smoke. This happened regularly at the start of every winter until I got the knack of how to do it back; I was not popular on those occasions! The trick is to put enough scrunched up paper and thin twigs in to get it going quickly, but not to obstruct the place where the smoke exits at the back of the stove. A little bit of encouragement in the form of a firelighter or some metho helped, but if you didn't have the packing right, you were going to take up smoking quick smart.

The other problem was that the firebox was too small to be able to efficiently bank it so that it would burn overnight. Whatever I did I had to get up at 3:00am and refill it or it would be stone cold by morning.

Apart from those minor flaws the Godin has given us great service for over 30 years and is still going strong, although with our new and improved wood burner in the lounge room, we did not use the Godin at all last winter. Which brings me to –

The Nectre Stove

We all dearly loved the old burning log, but I was concerned that after 35 years it was starting to get a bit tired, and it was as inefficient as hell so I decided before the winter of 2013 was on us, we would have a new wood burner. We had seen a wood fired heater that was also a baker's oven the previous winter and after much searching, many enquiries and several quotes we decided that the Nectre bakers oven was the one for us. Again, it was Australian made and the guy who installed it for us was a local fellow who made his own flues. To remove the old one (we kept the bricks) buy and install the new one didn't give us much

change out of $4000.

It has been pretty much worth it. It has a good draw and is easy to light, as with all slow combustion stoves it takes a while to get going and it takes a while for the oven to heat up to baking temperature. It is far more efficient than the old open fire so we use less wood and because it is easy to cook on we use less gas during the winter. I cook on it as much as I can and Linda doesn't mind cooking on it either. Even a simple task like boiling the kettle for a hot drink can be done by putting the kettle on the cook surface rather than the gas stove. It also warms the house better. We have experimented with fans to push some of the hot air up the other end of the house and they work OK, but if the Nectre is going all day it will keep the almost the whole house comfortable and the lounge, kitchen, dining area toasty!

According to the blurb you can bank it up, close the vents down, it will smoulder all night and be ready to go the next morning. We have not tried that yet. One issue has been that the fire box will not take the size of logs the old open fire would, but this just means chopping the wood up into smaller pieces. Remember heating with wood warms you twice, once then you chop it and once when you burn it!

Feeding the Fire

When we got the open fir originally put in I needed to get some wood, so I went to see our local timber yard (yup 35 years later it is still there!) and talked to one of the managers. Every few days they would send a dump truck full of off cuts and sawdust and crap to the tip, so I took in a slab of beer for him and the driver and a load appeared beside the house the next week. This was back before the garage so we had an open area for the truck to dump in. The sawdust was composted and the off cuts kept us going for most of that winter, but they were all softwood and burned away pretty quickly. It got very tedious constantly feeding the fire but the price was right and we did it a few times the first couple of years to keep us warm.

After those years our wood came from a number of sources. We bought some, some loads I was to get through friends who had properties or waste wood floating about.

Having a chain saw was certainly a help and enabled me to cut stuff up that was too big to get into our little Toyota station wagon. Even if you live in an urban area you can pick up a surprising amount of unwanted wood, some we got in some area which had been left treed by the developers (not a lot) and these trees would drop limbs every so often. Over the years we have cut down an apple and a carob tree, both of which provided lots of good burning wood, and we also burn off cuts from the melaleucas and the mulberry tree regularly.

One thing which can be difficult to do but is important to remember is that you should not burn wet timber in any wood burner. This can cause tar and creosote to distil out, head up the chimney and then cool on the inside of your flue, forming a layer on the inside of the flue which builds up over the years. This layer is combustible and under the right circumstances can catch on fire resulting in a flue fire, which is bad news indeed. To prevent this only burn wood which has been seasoned or dried for at least 12 months.

Around here lots of wooden fences were replaced over the years by colourbond steel fences and I know that some people took advantage of the free wood for wood fires or worse yet, barbecues. Unfortunately the fences had been treated with CCA (copper chrome arsenic) and I would never burn them due to the risk of poisoning. Another trick we tried was to burn some particle board off cuts we were given. They really burned very quickly and very hot, I was afraid that I might do damage to the hood of the fire, especially when it started giving off a hot metal smell we had not had before. We let the fire die down and didn't try that stunt again.

We have tried using newspapers with only limited success. The first time was with a newspaper roller where you wet the newspapers, roll them tightly together and the tie them off and let them dry. When dry you can burn them like normal logs, or so the blurb said. The just seemed to continuously come apart and the burn like.....well, sheets of paper! Out it went. I did try another type a few years later; this was more like a steel box with lots of holes in it. You soak the paper and tear it up, which was remarkably time consuming, then scoop it out (cold and wet!) and place it in the box. The lid of the box was then levered down onto the paper, forming a brick, which was again left to dry before burning. It worked better than the roller but was still a lot of work and did not burn anywhere near as well as the wood. Bugger!

The wood heaters have been a wonderful part of our family and they still continue to be of service. They allow us to make use of our own sustainably grown timber as well as found wood, supplemented by some wood bought in. They are a great way to keep warm sustainably, but if you want to get one do your homework and make sure you find the right one for you.

3.3 Walkable Warmth – making a wearable blanket

We spend a lot of time, effort and (dare I say it) money on heating our homes in winter to keep them comfortable, even here in mild Sydney the winters still get below freezing at night, well at least where we are it does! The thing is though, if you FEEL

comfortable, it doesn't matter what temperature the room is, so if you can keep yourself warm you don't need to waste all that energy heating the space around you. The classic thing is to dress up warmly even if you are inside, but we have found that by making a few small modifications to a blanket, you can carry the heat with you wherever you go.

A packet o' studs!

We have been using a commercial wearable blanket for several years and it is great, particularly when you are sitting still for any length of time whether it be in front of a computer, the TV, a sewing machine or just while you read. I say we have been using a commercial wearable blanket because we only had the one, and rather than fight over it, we have made ourselves a homemade one. We made some mistakes but we'll cover those so hopefully you won't make any, or at least you can pick some new ones!

The Blanket

Which blanket you use is obviously pretty critical to the whole enterprise, the commercial one is acrylic and while that doesn't sound too promising, it is wonderfully warm and has just enough stiffness to make it hold its shape well. The one we modified is a double layer polyester blanket and while it is softer to the touch it doesn't hold its shape well, and required an extra press stud on the neck to keep it on. It also takes longer to warm up, but once it is warm it is just as comfortable as the commercial acrylic one. It would be worth trying out a wool blanket to see how well that works.

The blanket needs to be a maximum width of 1600mm or about the width of a single blanket, any wider than this and the front tends to hang down and trip you up when you try to walk. For the length, it needs to be as long as the height of the person who is going to wear it, this makes sure you get good coverage but are still able to walk while wearing it. It is unlikely that you will find a blanket exactly the right size, so get the width right then trim the length to size and sew on bias binding to the cut edge to keep it from fraying.

The Tools & Fittings

To make a wearable blanket you don't need much, but you do need a few specialised tools and bits and pieces –

- A set of press studs – a pack of 20 should do the trick
- A punch and anvil to set the press studs in the blanket (you can get a set with the press studs but you get less studs in the packet)

- A hunk of steel to set the anvil on to absorb the shock when setting the press studs.
- A hammer, just about any kind will do, but I used a small ball pein hammer.
- Some chalk to mark where the holes will be in the fabric (we couldn't find the tailor's chalk so I used regular blackboard chalk ant it worked fine. Needless to say once the job was finished I found the tailor's chalk)
- Tape measure
- Something to make small holes in the blanket with and therein lies a tale!

It was my intention to use a leather maker's rotary punch to make the holes in the blanket, which makes sense in theory but soft cloth is not firm leather and it just did not work. That wasn't a problem though because I had a plan "B", a series of small hollow (AKA belt) punches and one of these would do the job. So much for plan "B"...I beat the living daylights out of the punch and it just wouldn't cut through the spongy material. Fortunately, my older daughter was helping me and she has considerable sewing experience, she said to use a sharp pair of scissors and push them through to make the hole. It worked like a charm so ignore plans "A" and "B" and just head straight for the scissors.

The Process

1. Assuming you have your blanket, it has been cut to size and hemmed or bias binding attached to the bottom of it, lay the blanket out on the floor so it is flat and grab your tape measure. Then...

Studs and Setting Tool

- Make chalk marks along both edges of the blanket about 100mm to 150mm apart, starting at the bottom corner, for about half the length of the blanket, then
- Make one more chalk mark on each side about 25mm towards the top
- Make three chalk marks along the top edge starting at the top left corner and spaced 150mm apart, then
- Make three more chalk marks along the top edge starting at the top right corner and spaced 150mm apart.

2. Using a pair of very pointy, very sharp scissors make a hole at each chalk mark 15mm in from the edge of the blanket.

The Awl (That didn't work either!)

3. To make sure the press studs go in the right way around (some of ours didn't) try setting them out next to each chalk mark so that the studs are the right type (male or female) and orientation (face up or face down). This reduces the work and thought later on when you are madly installing the studs.

4. Set the press studs in the blanket in accordance with the diagram using the accompanying tool and putting a lump of something heavy and flat (such as the cobblers last that I used) underneath it to act as an anvil and setting the studs with a couple of sharp hits.

5. When the studs are all in, hold a test fitting for the person who will be wearing it and see if there is any adjustment needed. As previously mentioned ours was a bit floppy and needed an extra stud higher up on the neck to keep the blanked from slipping off Linda's shoulders.

Note – The commercial ones make use of long zippers, particularly on the lower part of the blanket around the legs. We didn't use a zipper for a number of reasons –

- They are much more complicated to fit and require sewing expertise that I did not possess.
- A long chunky zipper of the type required would have added considerably to the cost.
- If the zipper stuff up (and they eventually do) they are almost impossible to fix and in most cases require replacement.
- If the zipper goes the blanket is buggered until you fix it, if one stud lets loose you are still good to go.
- If you catch your feet the studs may let go in time for you to stop a fall, if you catch your feet in a blanket with a zipper, you are going face first into the floor.

We love our wearable blankets, we wore them recently to a Permaculture meeting held in a (coolish) school hall and they kept us toasty, even if one of the ladies did christen us "Mr & Mrs Blanket"!

4.0 Resources

4.1 General books on Energy

There is a mixed bag of alternative energy books here. Some are DIY how-tos, others are more about what sort of technology was available at the time of writing and still others cover history and theoretical concerns. Most contain suggestions on how to mitigate the effect of heat and cold using low energy and retrofitted solutions.

The Carbon Buster's Home Energy Handbook – Godo Stoyk – New Society Publishers (CAN) 2007 ISBN 978 0 86571 569 1 – This book not only covers home energy usage, particularly electricity, but also covers transportation options and touches on water, and household consumption too. It goes through how and why of energy reduction but figures are based around North American consumption. Home design is also covered and green options for heating and cooling are discussed.

The CSIRO Home Energy Saving Handbook – J. Wright, P. Osman & P. Ashworth – Pan Macmillan (AUS) 2009 ISBN 978 1405 039611 – This is a great book, lots of info, drawing and colour photos. It covers the why and how of reducing household energy consumption not only through direct consumption but also though waste, water, transport and buying stuff. Lots of tips and discussion of options that could be for retrofit or new build.

Converting to an Eco-Friendly Home (The Complete Handbook) – Paul Hymers – New Holland Publishers (UK) 2008 ISBN 978 1 84537 406 8 – a small book with lots of line drawings, it reflects the UK experience but still has great retrofit ideas. Chapters cover light, power, heat, shelter, air, waste and water. Good stuff on new technology and some innovative ideas including a good section on siting solar panels. Overall a very good book.

The Earth Garden Book of Alternative Energy – Alan T. Gray – Thomas C. Lothian Pty Ltd (AUS) 1996 ISBN 978 0 85091 701 7 – This book is also "how to" but also with discussion of available technology. It has 3 sections – "generate": covering power generation by solar (electric and hot water) wind, micro hydro and steam, based around a power plant by the now defunct Strathsteam Company which was based in South Aus. The second section called "store, regulate, invert" is predicably enough a digest of batteries, inverters and regulators available and their use. The third section, "consume" covers appliances and the energy efficient home. The book has a good mix of line drawings and black and white photos.

Making Your Home Sustainable (a Guide to Retrofitting) – Derek F. Wrigley – Scribe Publications Ltd (AUS) 2005 ISBN 1 920769 49 8 – A retrofitters bible! The book covers solar hot water, improving performance of windows, using wasted sunshine, rationalising electricity consumption, rationalising water usage, making a useful landscape and even some advice for renters. A great book with lots of information with lots of line drawings and black and white photos to illustrate concepts in the text.

Warm House Cool House – Nick Hollo – Choice Books (AUS) 1997 0 947277 22 6 – This is mainly for the new build, although there is some discussion of existing houses, mostly using extensions and additions. The book gives a simple explanation of the principles of low energy housing design and then illustrates these principles with more than 110 examples from around Australia. There a whole stack of floor plans (if that is your bag) which help you work out which of the ideas might work at your place. Lots of line drawings and black and white photos with a colour photo section in the centre of the book.

The Energy Freedom Home – Beyond Zero Emissions – Scribe Publications P/L (AUS) 2015 ISBN 978 1 925106 71 8 – The book helps you work through a series of steps to reduce you household energy consumption including lighting, draught proofing, insulation, windows, appliances and cooking, heating and cooling, hot water, energy monitoring and control and solar power. The last section is about "putting it all together". Most of the info is about what is on the market but there is a little bit that could be DIY, but because it is a new book it can make you aware of the latest technology out there. Lots of colour photos are used to illustrate the text.

Energy Alternatives – Editors of Time-Life Books – Time-Life Books (US) 1982 ISBN 0 8094 3494 6 – This is primarily a DIY book for retrofitters (yay!). It starts off with strategies to make your home more energy efficient including window treatments that save energy and superinsulation, then moves on to various ways of harnessing the suns heat including a trombe wall. The third part of the book examines other energy sources including heat pumps, wood and coal, heat pumps, water and photovoltaics. Some stuff (like furnaces) does not apply here in Aus and be circumspect on some of the electrical and plumbing recommendations but this is a good book. Lots of line drawings are used to illustrate how to carry out the work they recommend.

The Green Technology House & Garden – Michael Harris & Claire Beaumont (Eds) – ATA Publications (AUS) 1993 ISBN 0 646 15196 7 – This is a series of articles around improving the energy performance of your home and garden. Some are a bit light on detail but others would enable you to replicate what they have done. The section on turning a disaster into a low energy house is very good. There are also sections on building and design, greening your garden, getting practical and living with alternatives. Lots of black and white photos and line drawings.

5.0 Appendix 1