

Houses for the future cannot continue to be the same as in the past

Climate change needs housing change

Why is Australian housing unsuitable for the 21st century ?

Houses which rely on fossil fuels have no place in Australia's future

A challenge to the housing industry to rethink its values in a rapidly changing world...

...with a suggestion for a low energy, self reliant house

Derek F. Wrigley

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Author's note

None of the designs shown in this booklet have intellectual protection, so if any of the concepts make sense to any reader and they would like to put them into practice, then they are free to do so. It is the author's belief that the environmental situation needs every bit of help it can get.

However, a good idea used with insufficient understanding of its fundamentals can be ineffective. From that point of view please let me know what you would like to do as I may be able to help you avoid making some of the mistakes I learned from. There is nothing worse than having to do a job twice or wrongly blaming it as ineffective.

Australia has a very poor record in the *acceptance* and *development* of good ideas, particularly in residential design and I have little faith in the accepted system of protecting them. I do, however, believe in the decent instincts of most people, so if anybody is able to make some profit from these ideas then I wouldn't be averse to sharing a little bit so that I can continue with my private researches - somewhat like shareware in the computer world.

Apologies to those owners and their builders who recognise the houses shown in this booklet - there is insufficient constructive criticism about architecture these days and consequently we never seem to learn from our mistakes. The effective use of natural resources is a critical environmental science and should be open for healthy, informative public debate, so hopefully these comments can be useful.

Otherwise, how will we ever learn and improve? The results of 'no criticism' can be seen anywhere around the suburbs of Australia and regrettably the housing industry has shown itself to be a slow learner.

There is an *urgent* need for rational voices to be raised in this debate. When are the opinions of concerned house buyers ever heard - where is their forum? It has been too one-sided for too long, as this booklet reveals. If you have something to say about housing standards, let your voice be heard, otherwise the status quo will only continue.

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Cautionary note - all comments in this booklet relate to housing in the southern, cooler areas of Australia, approximately south of Perth and Newcastle and should not be extrapolated without professional advice to other climatic zones.

Throughout Australia's history, housing has relied on artificial means to heat and, more recently, cool the spaces we live in.

We have belatedly realised that the fossil fuels we rely on - oil and gas - will not last forever and are likely to become unaffordable or unavailable within the economic life of the houses we are now building.

Worse still, the electricity we now cannot do without is significantly polluting the planet we live on. There is now ample scientific evidence to show that we cannot continue without penalising our children's future wellbeing.

And yet the housing industry, as a whole, shows little evidence that it understands this problem or realises that alternatives exist in the use of more benign, simple, modest house designs, *using free natural forces available to everybody*. Most houses built today give the impression that the long term wellbeing of the occupiers is of lesser importance than constructional convenience and profit to the industry.

Fuelled by the fear of competition and aided by the media's love of novelty and featurism, the industry has fallen into the trap of adding yet more gimmickry, ignoring the real purpose of housing based on human *needs* rather than *wants*.

In the 1960s, E.F. Schumacher said that *"the west has never learned when enough is enough"*. Now, nearly fifty years later, we are acting as if 'enough is *not* enough' and as if there is no tomorrow. The public has been fed the "dream home" image through the media and cheap energy has fuelled desire. In a finite world this is an impossibility in the long term and is already becoming evident in the form of unaffordable homes.

Recent reports of an increasing incidence of mortgage defaults are clearly showing that the ceiling of housing affordability has been reached, *yet the industry has not learned to optimise its use of the sun and other free, natural forces*. It continues instead to perpetuate the dream image, relying on expensive, polluting technology to compensate for what is fundamentally bad design.

Global warming and the resultant climate changes are now a wake-up call to us all. **The housing industry is being given a unique opportunity to create an exciting answer to meet this challenge.**

- to all who are involved in the design, regulation and approval, construction and sale of housing in the southern, cooler areas of Australia.

(the wake-up call will, no doubt, apply to the industry in the warmer climatic zones in Australia, but the building science relating to heating, cooling and ventilation will obviously differ).

Knowing the enormous damage it is causing, how can the industry, in all conscience, continue along this path?

Buyers are increasingly becoming more knowledgeable and have every right to expect a more educated response to changing circumstances. Many house designs have now become so out of touch with reality, so bloated and unaffordable that some attempt has to be made to design something more suitable for a *world with diminishing fossil fuels*.

How will owners heat their houses when fossil fuels become unaffordable, if their solar access is *ineffective*?

To stimulate discussion, one possible answer is shown on pages 8 -12. The EcoSolar integrated low-energy, self-reliant house has, as its primary aim, the best possible use of free winter solar gain and other natural forces, and to simplify and integrate all the other service functions.

However, the EcoSolar exercise has shown a much more deep seated area of inefficiency - ***the perpetuation of estate planning carried out without any consideration of solar fundamentals***, exacerbated by rises in land values, resulting in ever smaller, badly oriented, housing blocks. This trend has now made it impossible for even the most skilled designer to plan solar effective houses on about 88% of these blocks.

Every segment of the housing industry has a role to play in looking critically at this untenable situation - and then doing something about it. Science can only do so much in alerting us all to the dangers of continuing along our complacent paths. The industry should be putting science to work more effectively to build realistic houses which do much less harm to the environment over their lifetimes.

Dream homes need not be future nightmares.

Why is a re-think needed?

The Australian housing industry has become an enormous entity, with many diverse segments, all of them having grown to satisfy a need, but with little integration or coordination toward an agreed aim of effective housing.

Its present size in the national economy now demands much more effective organisation to produce effective living conditions for its clients - the buyers and users of its products.

Evidence from the countless houses produced by the industry over many decades shows that not only is a new approach needed to correct *current* inefficiencies **but that global warming will exacerbate the problems - current housing designs will not meet the climatic conditions forecast by science.**

A fundamental problem is that the housing industry has in the past been slow to apply the excellent building science produced by the Commonwealth Experimental Building Station, CSIRO and other research organisations.

The pages that follow give just a few examples of what has gone wrong, but here are a few initial pointers - with particular attention being paid to solar utilisation and energy effectiveness - eg :

- *badly oriented, narrow blocks often make it impossible for house designers to locate solar effective houses on them.*
- *roof designers appear to have no knowledge of the requirements of photovoltaic systems - hips and valleys severely restrict such installations and make retrofitting impossible in many cases.*
- *cathedral ceilings are notorious for their lack of insulation and inability to reduce summer heat penetration.*
- *new waste disposal technologies now make sewers and stormwater sewers unnecessary, yet infrastructure designers and regulators seem reluctant to take up these advances which could significantly reduce housing costs.*
- *builders perpetuate brick veneer construction despite building science research proving that reversed brick veneer would be more energy efficient and more comfortable for the occupants.*

- *houses with windows inappropriate to their orientation, usually without any consideration to solar control, leaving unsatisfactory situations for the unaware purchaser to resolve, often at considerable extra cost.*

- *existing houses are often so thermally inadequate as to make air conditioning essential for summer comfort. **A well designed house should not need an air conditioner.** Seen in context, air conditioners in houses are extremely anti-social and environmentally detrimental.*

- *housing designs are possible that have very small running costs, suitable for low-income families, but the housing industry shows little interest in their development.*

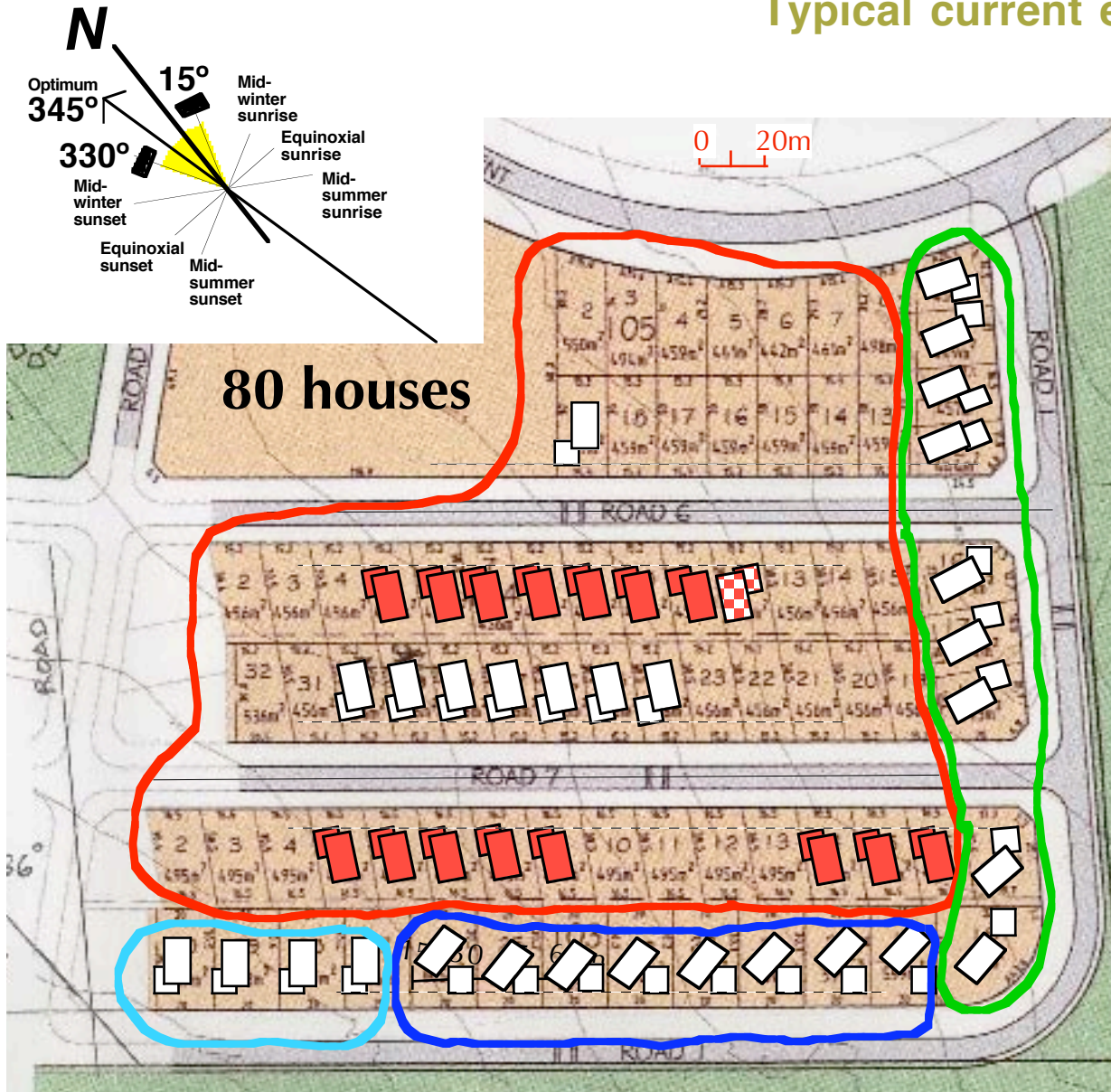
- *why is that virtually no houses built for sale include solar hot water heaters or photovoltaic arrays?*

- *why is it that our planning authorities are permitting such bad design to continue?*

All of the following segments of the housing industry need to work more closely together to counter the problems we are likely to face in the coming years :

Urban planners / estate designers
 Regulators / development authorities / legislators
 Landscape designers
 Infrastructure designers
 Architects, house designers, interior designers
 Builders, developers
 Materials manufacturers and suppliers
 Component manufacturers and suppliers
 Energy suppliers
 Solar technology manufacturers / installers
 Lending institutions
 Real estate agents

- and, of course, those who educate, train and certificate all the people in these widely variable disciplines.



Part of a recent development plan with notional 3BR houses of modest size, oriented to obtain as much solar effectiveness as the blocks will permit. Larger houses would be even less effective.

Analysis of this planning

This actual subdivision has been planned to maximise the number of housing blocks with little or no consideration given to optimising solar gain, conserving energy or reducing pollution. The blocks within the red line are too narrow to allow any useful degree of orientation for solar gain and permit no angular adjustment of house to block.

The blocks within the green line do permit a limited degree of solar orientation and those within the blue line are only suitable if all houses are suitably angled to face roughly north. This requires one builder to develop the sites, but if sold to individuals there is not likely to be such cooperation and will almost certainly be solar ineffective as within the light blue line. Houses coloured solid red will be doubly disadvantaged due to the requirement of having garages on the street side (NE) occupying a valuable solar position. If the garage is on the eastern corner (chequered red) the shadow from the northern neighbour could limit solar gain, particularly if a solid fence is erected between.

Only 9 blocks out of 80 (11% green) are really suitable to take advantage of solar gain. The plan suits a surveyor's convenience, panders to car convenience too much, lacks any quality of imagination and visual relief and is dominated by immediate profit maximisation rather than long term wellbeing for the occupiers.

This plan does not optimise sustainable concepts, does not give good value for money or enable most owners to effectively retrofit to correct the inherent bad orientation to improve their wellbeing. Such ill-conceived planning may very well be sowing the seeds of future slums, particularly when the fossil fuels for heating become too expensive to use.

Alternative solar planning for the same estate (p4)

Most houses shown on plan are 3 or 4 BR EcoSolar houses described on pages 12-16 with single carport/garages on blank east/west walls or in separate groups.

The EcoSolar design lends itself to terrace type development, reducing heat losses and providing many alternative arrangements for serendipity, individuality and variety.

Blocks will be of various sizes and shapes and hard fences could be replaced, if needed, with softer mesh panels of irregular forms with vines and creepers. (See plans on page 13)

It will be appreciated that this plan is conceptual and that it will be subject to finer detailing.

It does show that there are several advantages to be gained by rethinking our long established ideas of group housing - **particularly if we start from the basic principle of designing for optimal solar gain and aiming at self-reliance**, rather than drawing irrelevant rectangles on the land and hoping that the house designers can rectify the initial bad planning.

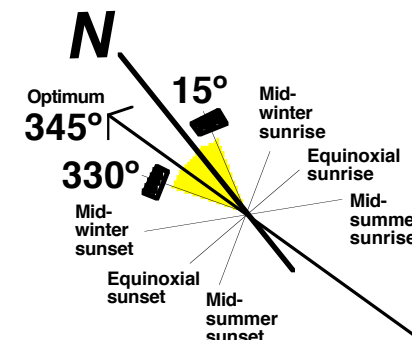


Potential alternative :

16 more housing units than before, comprising :
 81 - 3 BR EcoSolar houses
 + 15 - 4 BR EcoSolar houses
 + shop
 + community centre
 + oval
 + public parking

Less can equal more.

Mies van der Rohe



Rough conceptual plan of the same development area as shown on page 4, accessed from the same peripheral roads *with substantially more personal and community benefits*

Using the EcoSolar 3 and 4 BR houses (see pages 12 - 16), **EVERY house in this plan can enjoy excellent solar orientation with sunlight, cheerfulness and warmth in ALL rooms - north AND south.**

The plan enables *every* house to effectively use solar gain for space and water heating with psychological cheerfulness throughout the whole house by virtue of the southern reflectors which also reduce the aspect ratio of all the houses.

Every house would have from 10-20m of clear space on its northern side and visual relief on both its northern and southern sides to maintain privacy and solar access with room for selected low height deciduous trees.

All roads and foot/cycle paths would be permeable recycled rubber with no kerb and guttering. This would distribute stormwater on site more evenly, retain soil moisture and would reduce traffic noise. There would be less visual intrusion on the peaceful landscape + lower development and maintenance costs. *Less can equal more.*

The need for reticulated mains water could be significantly reduced to a fail-safe, top-up system with individual rainwater storage tanks under the floor slab. Complete recycling on-site of all organic wastes is now economically feasible, with or without composting toilets, eliminating the need for expensive sewers and treatment works. The need for stormwater lines could be completely eliminated with appropriate landscape design and soakaways, representing a significant cost reduction.

But these benefits can only come from bold and total coordination by those professionals who understand the basic science which underlies good design - not individual, uncoordinated attempts as with current development in which profit is the main motivation. Everybody involved in the promotion of housing should be certified as understanding the basic science.

The planning dilemma

Planning for solar effectiveness is *our last resort for free AND pollution free space heating*, requiring houses to accept a discipline **determined by the sun**.

Well trained architects take this as an article of faith, but unfortunately the evidence of recent planning and housing design shows that this is not accepted by developers and builders where maximising profit appears to be the main determinant.

With heating fuel, land and money becoming scarce, then **free** heat and a way of storing it overnight must inevitably become more attractive. There seems to be little option that solar effective planning must now become the dominant discipline, so some quality of visual similarity must be the inevitable conclusion - or must it? Is it really such a problem?

The solar effective alternative plan (pages 5 & 13) shows a prima facie case of what is possible - but at some 'cost' of visual similarity. *ie.* larger areas of glass on the north side and reflectors on the south with windowless east and west walls and *well integrated* photovoltaics (PVs) and hot water absorbers on the roof.

An important public need is to reduce or eliminate the current, visual dominance of PVs and hot water absorbers to make them less obtrusive on the roof structure. House designers must give more prominence to solar absorbing roofs of more appropriate sizes, pitch, and orientation. The days of the highly fragmented tiled hipped roofs, which are so unsuited to solar technology must come to an end. *(see Gungahlin photos, pages 6-10)*.

Global warming is giving us a wonderful opportunity to produce better housing - rather than further restrictions of our supposed liberties.



West facing houses in Gungahlin, noon, midwinter. Notice shading on north faces of neighbour's houses. Could visual similarity be any worse than the uncoordinated free-for-all shown above? *The orientation of these E-W blocks was actually very good*, but 15m frontages to the road are too tight for good solar effectiveness and human wellbeing; regulatory approvals are inadequate and individual builders are not yet aware of solar requirements, denying free energy to future occupants. *The streetscape above is an architectural mess and there is little solar awareness evident - not one solar hot water absorber or photovoltaic panel was seen in Gungahlin. Why? Yet air conditioners are increasingly being supplied to correct bad house design. It doesn't make sense. What are our regulators doing about this?*

Individual builders or the big developers?

Solar effectiveness requires some conformity to a solar discipline . *It is inescapable.*

Can this be produced by individual builders working under stricter, mandatory design guidelines with more effective regulatory approvals or can economic, effective planning only be carried out by the big developers?

Economies of scale become possible in large area developments , particularly when the concept of self-reliant housing takes on with its lack of need of sewers, bulk purchasing of solar technologies, tanks.

Is visual variety possible within the limits imposed by the sun? Certainly, but it requires the aesthetic discipline of good architecture.

There is a desirable degree of repose, of harmony, of quiet simplicity in similarity and it would be a serious mistake to think that boring monotony must be the inevitable result, as any study of history will show. Nothing could be worse than the variety shown by the '*freedom*' in this photo .

To continue as we are doing at the moment should not be an option - there must be better ways - and everybody connected with the housing industry must become alert to this imperative need now - *before global warming and climate changes force our hand.*

Gungahlin planning

The houses in these photos show that solar effective planning is not fully understood by planners, designers, regulators or builders.

It is not enough to just have blocks facing north - the science of design must follow through to make the houses into effective homes suitable for the 21st C.

Aesthetic concerns :

* the housing in this suburb is almost a modern equivalent of the 18th C Industrial Revolution terraces in the English mill towns which eventually turned into the 'slums'.

These Gungahlin houses will almost certainly become the slums of the near future when the reality of heating fuel costs and poor thermal construction become evident *within the life of these houses*.

Practical concerns :

- * although the blocks are well oriented for solar access, they are too narrow (15m) , the houses are too big for such blocks, severely restricting the effective use of winter solar energy .
- * the houses are so close together as to eliminate any views from the windows, fences make it worse and when close to the street the occupants often close the curtains for privacy (*see following house photos*).
- * such high mass buildings so tightly packed together create a high density of stored heat - the 'heat island' effect, making summer evenings hotter than usual with reduced ventilation due to dense planning.
- * many of the roofs are black or dark grey, exacerbating the absorption of summer heat, and the number of roof mounted air conditioners is the inevitable result - leading to more pollution and likely future blackouts.
- * the tight density of development offers little hope of effective relief from planting, due to lack of space and distance. Useful, softening, tree shade will not be really possible and in any case would work against the effective use of photovoltaics and solar hot water heaters.
- * northern windows will prove to be inadequate for space heating so when the fossil heating fuels become too expensive, *how are these occupants going to heat their houses in the cold months?*
- ***Overall, the rigidity of the planning and the design of these houses show a distinct lack of awareness of basic building science and of the physical and mental effects which will be imposed on the people who live here. It is thoroughly bad design and a lost opportunity.**



Despite a NNE orientation none of these roofs will support an effective retrofitted photovoltaic array

Close proximity to southern neighbours restricts useful solar access and only permits low planting. Privacy fencing becomes essential and exacerbates the spatial / shading problem

Double garages are increasingly occupying big frontages. No problem here as it faces east.

No skylights or vertical ventilation are evident. Heat is trapped in the roof space contributing to a hotter house interior in summer, creating a future need for an air conditioner.

Dark roof absorbs a high degree of solar radiation in summer. It is a high embodied energy, high mass roof, unsuited for its purpose in this climate and unnecessarily complicated. An air conditioner will undoubtedly appear soon, implying more consumption, more pollution, more expense and contributing to the heat island effect

Although an excellent orientation and roof angle for a photovoltaic array these hipped roof panels will only allow for a very small array. PVs and solar hot water absorbers have not been provided.

No sunshading is provided to prevent undesirable solar gain through windows in summer. Internal curtains or blinds are not effective in reducing solar gain.

This air conditioner already indicates an inadequately insulated house - even with a lighter coloured roof.

Small northern windows are inadequate for any effective solar heating in winter.



Gungahlin, noon, midwinter

This corner area will be uncomfortably hot in summer and difficult to shade. *This problem has been left for the owner to resolve.*

These small trees will probably grow to obstruct any useful solar gain in winter

All roof water is carried off site from this house instead of being harvested for domestic use. *Where would water tanks be placed anyway?*

'Face the street' mentality places great restrictions on the placing and sizes of windows to permit any useful solar gain in winter and is doubly restrictive for houses on corner blocks. Curtains or blinds will inevitably be closed (as here) to maintain a sense of privacy, thus nullifying any solar gain and increasing the use of electricity for internal lighting, meaning more pollution. This house is unsustainable and bad planning has been a major factor in its poor design.

There is a great danger that this sort of development will be taken as the acceptable norm with no awareness that it is (and will increasingly become) a very inefficient answer to comfortable low-energy living when fossil heating fuels become too expensive to use. Resale value will undoubtedly fall when this happens and buyer understanding develops.

Gungahlin example 2

'Feature' shades - useless at all times
Why were they approved?

Token windows are wasting
solar energy on this north side.



Gungahlin, north elevation, noon, midwinter

North window, acting as main street entry one third shaded in midwinter. Awning only effective around noon midsummer - oblique hot sun will heat interior in summer. Why was it not used over the adjacent window?

North windows, reflective internal blinds closed in winter when sun could be heating the interior. No external shade for summer.

Fences perpetuate 'Keep out' mentality. Appropriate planting would have been a far better answer.

Trees or solar gain ?

Visual delight or less pollution?

Eucalypts and solar effectiveness are often incompatible in our suburbs as this photo clearly shows. They are even worse in higher density development where they conflict with photovoltaic and hot water absorber panels.

The shading of roofs from large existing evergreen trees is quite common in Canberra and in this case retrofitted solar panels would be shaded most of the day for most of the year. It is possible that the panels could be sunlit in summer due to the sun's higher altitude.

Equally, these northern windows would be largely ineffective in absorbing solar gain in winter (*as seen in the photo*). In summer it is likely that the windows would be sunlit before and after noon and the eaves would only be partially effective in providing shade in mid day. External shades have not been provided.

To be really effective, the landscaping should be carefully designed considering species, transparency in winter, height, position etc. related to the solar effectiveness of the house. This *must* become an increasingly important decision in future planning.

The setback of the house from the tree in this case was done with the best intentions, but more knowledge of sun angles was needed. It is quite easy to calculate and such skills are becoming more necessary.



Gungahlin, noon, midwinter

The ACT Tree Protection Unit prefers to judge each case on its merits, which sounds sensible.

Designers and builders, however, need a clearer, more applicable policy which enables them to balance the value to society of saving trees v. reducing pollution by installing photovoltaic panels and solar hot water absorbers on house roofs.

There are hundreds of cases like this in the Canberra suburbs, affecting not only new houses but the retrofitting of existing houses.

Some clearer policy must be determined to assist the installation of roof top solar technology if we are ever to combat climate change.

This dark roof is likely to be fully sunlit in summer when the sun's altitude is higher! An airconditioner will undoubtedly have to be bought by the unsuspecting owner to rectify this design error - or paint the roof white and upgrade the ceiling insulation.

Why are the planners, designers, builders, regulators creating these problems and putting the responsibility and expense of solving them onto the owners?

11 We might be Down Under

*but does that mean that our housing has to be Wrong Way Round
Inside Out and
Upside Down ?*

Consider our current practices:

We regard the sun as our enemy when ***it's really the best friend we will ever have.***

We burn dirty coal, pollute our atmosphere and transmit our electricity thousands of kilometres to our houses, wasting *two thirds* of the original energy - ***yet we know how to produce clean and cheap electricity from the sun, and have millions of roofs which could be used to generate it - on the spot.***

We draw rectangles on the ground with little solar knowledge - ***then wonder why we can't put solar effective houses on them.***

We build the external walls of most of our houses inside out - ***and can't store the sun's heat to keep us warm on winter nights.***

We spend huge sums of money in making *all* our water drinkable - ***then ingest only about 2% of it.***

We build huge dams, pipe the water enormous distances, purify it all to a potable standard, use it once, put it into another enormous reticulation system, spend huge sums on cleaning it again, then throw it into a river so that somebody else can drink it downstream - ***then we wonder why we are short of water.***

We put all our black and grey waste water into the sewer - ***then import loads of fertilisers to improve the fertility of our gardens.***

We build another reticulated system to carry away the free rain that falls on our roofs - ***without even using it.***

We planted huge evergreen trees in our suburbs - ***then wonder why we can't put effective hot water absorbers and photovoltaics on our roofs.***

We have the world's best solar radiation - free - ***yet we probably have the world's worst record in making good use of it.***

We build houses with the most effective heat absorbing black tiles on the roof - ***then spend lots of money in cooling the house down, using inefficient electricity which overloads the system causing blackouts which is dangerous and illogical.***

When we do provide northern windows to take advantage of the warmth of the winter sun ***we find the occupiers close the curtains and the blinds, or the external awnings or security shutters and then turn on all the lights, creating more pollution and more global warming.***

We educate our architects to understand needs and think more clearly - ***then leave house designing to anyone who can build a house.***

The advent of global warming, climate changes and economic stringencies are not only warning us of these unsustainable and continuing practices....

***they are offering us a once in a lifetime opportunity to think
sustainably***

The following pages show one possible housing solution to some of those problems

....aims to show that we can design for a future without fossil fuels:

Good housing *can be built now*, ready for a future in which coal, oil and gas have become too polluting, too dangerous and too expensive to use - or have become unavailable.

Naturally available energies, with a little assistance from simple technologies, can provide reasonably comfortable living conditions at reasonable initial cost and with very low or no running costs and much less pollution.

It is now quite easy to reflect the sun's effective warmth and cheerfulness into southern rooms in winter with incalculable psychological benefit, no running costs, no pollution and improved personal wellbeing.

A house structure can store received solar energy to provide comfort conditions throughout the house over 24 hours.

The off-site removal of organic wastes from every house is unnecessary, using natural, low energy technology, enabling waste nutrients to be beneficially used in the garden at very low cost.

Continuing reliance on expensive sewers to every house is now unnecessary, given reasonably adequate land, thus saving a substantial sum of money and resources.

A house designed along these principles can provide improved estate planning with **every house having optimum orientation**, better occupant comfort, privacy and wellbeing (*see page 5*).

Industrially produced houses can provide a variety of plans and sizes based on an effective, integrated principle at reasonable cost.

Self-reliant housing can be economically feasible and aesthetically acceptable (*see pages 13-16*).

The technologies and know-how already exist, but have never before been *integrated* into effective housing designs.

Such houses can be almost completely *recycled* and *re-erected* in other locations with minimal waste.

Every single house can collect and store its own rainwater, generate its own electricity, warm and cool itself and recycle all its own organic wastes, saving on running costs and resources. In this way it can make a significant contribution to really sustainable living and social wellbeing - making sustainability more of a reality than a dream.

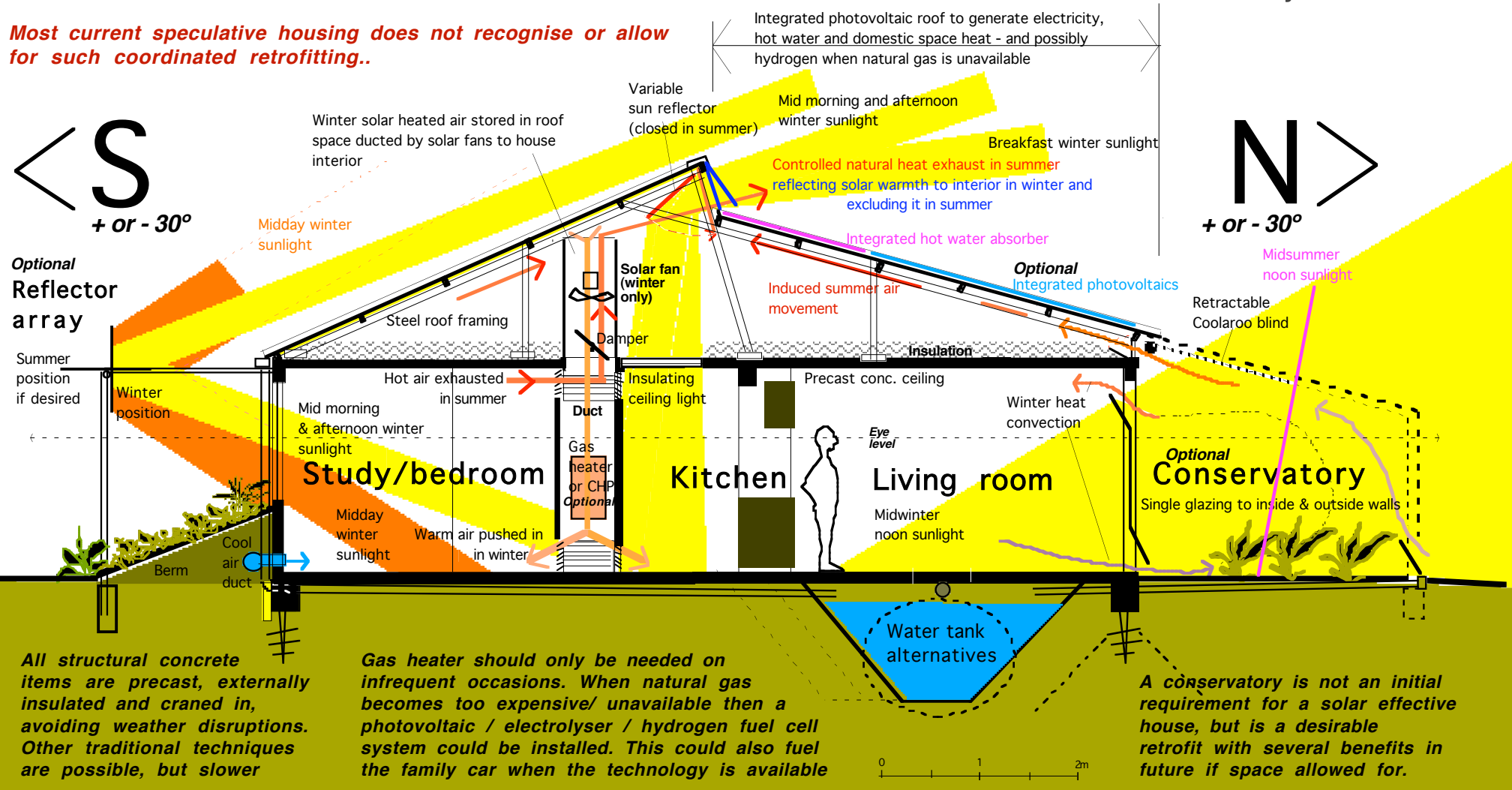
EcoSolar - how all the integrated functions work together 14

A functioning EcoSolar house does not have to be built all at once:

The house can be sold in various models in a similar way to cars. The basic house structure will function well using natural resources, but optional items - reflectors, conservatory, photovoltaics, gas heater, fuel cell combined heat and power units will improve ecological effectiveness. All options have been designed for easy retrofitting at a later stage if necessary, to suit future financial and/or climatic variations.

Typical functional section for 2, 3 or 4 BR houses - sizes will vary

Most current speculative housing does not recognise or allow for such coordinated retrofitting..



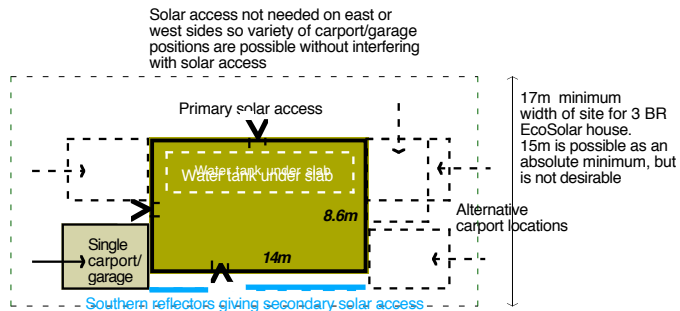
All structural concrete items are precast, externally insulated and craned in, avoiding weather disruptions. Other traditional techniques are possible, but slower

Gas heater should only be needed on infrequent occasions. When natural gas becomes too expensive/ unavailable then a photovoltaic / electrolyser / hydrogen fuel cell system could be installed. This could also fuel the family car when the technology is available

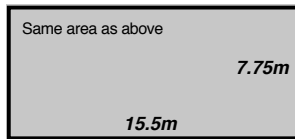
A conservatory is not an initial requirement for a solar effective house, but is a desirable retrofit with several benefits in future if space allowed for.

The EcoSolar house has been given a minimum Energy Efficiency Rating of 8 stars by Energy Partners, Manuka, ACT. Houses currently on the market range from 0 - 5 EER stars, predominantly 0-3.

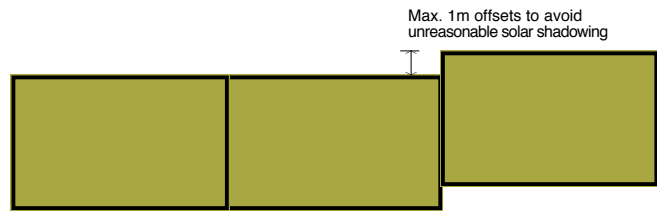
15 3BR EcoSolar house - orientation and landscaping integration



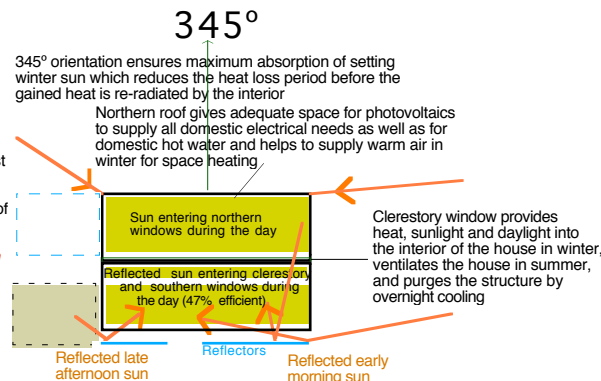
Basic EcoSolar 3 BR house incorporating southern reflectors 1.6 : 1 aspect ratio



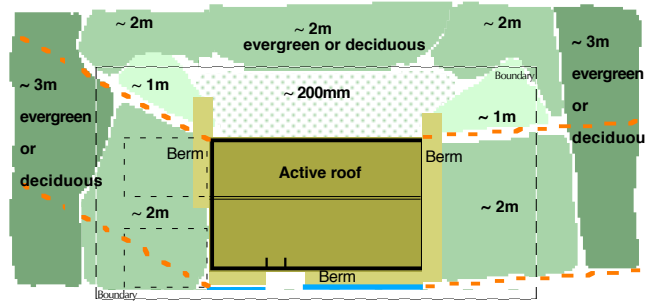
More traditional house *without* benefit of southern reflectors requires longer north facade to obtain adequate solar access with probable need for east or west windows ~ 2 : 1 aspect ratio. *Less solar effective*



Basic 3 BR EcoSolar terraced housing - detached garages/carports



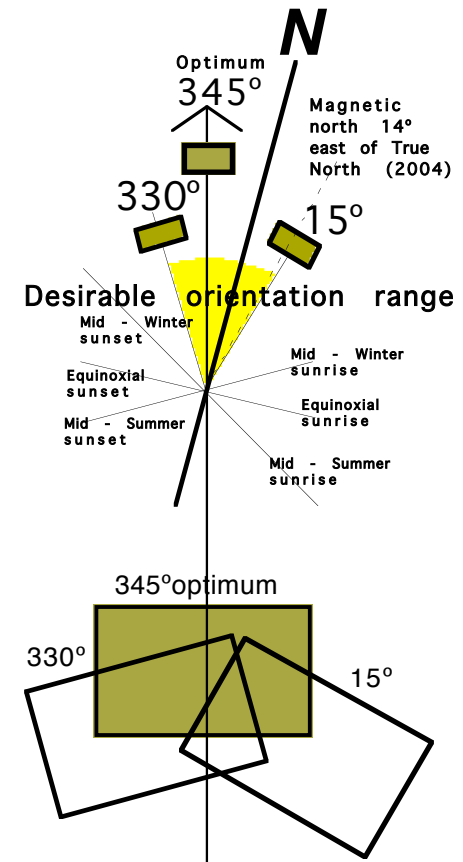
A self-reliant house requires good orientation and....



..a landscape that helps it to work effectively

Many existing houses in the ACT are shaded by large evergreen trees, making it futile to install solar technology. Future sites must be more carefully controlled at the beginning.

A symbiotic landscape will become essential when natural gas becomes too expensive to use and blocks become smaller



Orientation limits from optimum if effective solar gain is to be received *inside* the house and by the photovoltaics and water heaters on the roof

If we wish to use the sun to warm our houses then we must design our sites and our houses to suit the sun's movements - any other approach is wishful thinking in a fossil-fuel depleted world.

The days of 'designing' any shape and orientation of a suburban site and then trying to fit a 'solar' house on it will be regarded as one of the mistakes of history. It is inefficient, grossly expensive over the life of the house and has a negative effect on the wellbeing of the occupants. Our grandchildren will shake their heads in amazement at our lack of awareness of solar usefulness.

The sun is the only source of free renewable heat available to every site

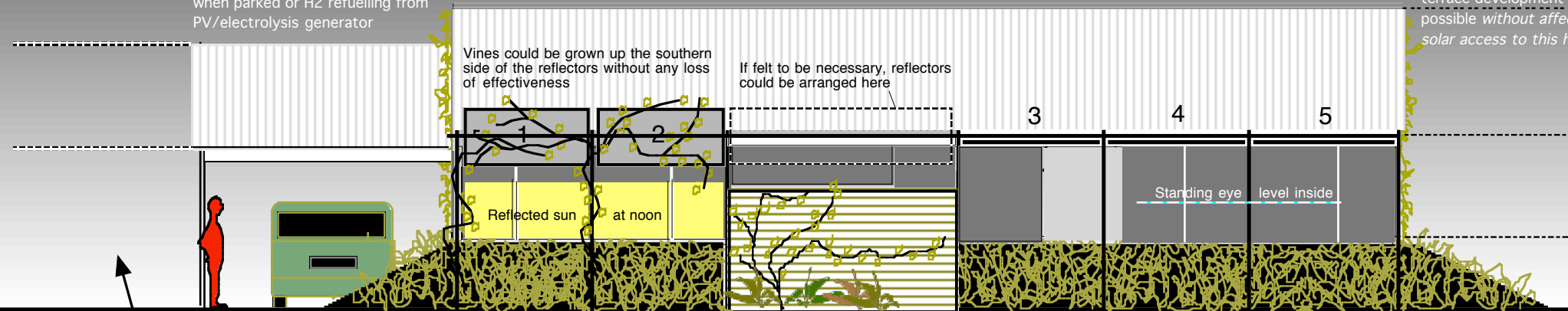
3 BR EcoSolar integrated southern reflectors

Future possibility - Hydrogen fuel cell car supplying electricity to house when parked or H2 refuelling from PV/electrolysis generator

Blank east or west walls makes medium density terrace development possible *without affecting solar access to this house*

Vines could be grown up the southern side of the reflectors without any loss of effectiveness

If felt to be necessary, reflectors could be arranged here



Continuing terrace housing will not affect solar access to this house

Reflectors will make these southern rooms much warmer and cheerful in winter - *and more useful*
Panels 1, 2 are in winter position and show reflected sun entering BR3 at noon (yellow)
Panels 3-5 are in summer position (horizontal)
Winter position (vertical as 1,2)

Earth berms reduce heat losses and gains, re-use spoil from water tank and reduce transportation costs and pollution

South elevation

The horizontally pivoted reversible stainless steel reflectors shown above (1 - 5) are calculated at 47% efficiency and are fully described in the peer reviewed paper* presented to the ANZ Solar Energy Society conference in September 2006 and as seen on the ABCTV *New Inventors* program 23 May 2007. This invention not only enables winter sunshine to shine into all southern rooms, virtually eliminating the need for heating in southern rooms, but enables a more effective plan ratio which in turn makes more effective use of available land (*refer back to page 5 showing solar planning possibilities*)

* A pdf version of this paper is available from <dwrigley@cyberone.com.au>

Current barriers to realisation

* Solar effective houses can *not* be placed on unsuitable suburban sites. Their effectiveness relies on the main (long) facade facing within 30° of north. The reason is simple - the sun has an inexorable daily transit across the sky which cannot be changed and if we humans wish to take advantage of *free* solar gain then we have to accept and work from this fundamental fact. It is irrational and uneconomic to continue to plan housing sites as we are doing at present. Estate planners must become conversant with solar needs, making it possible for designers to site effective solar houses. Only about 12% of sites on current estates have been suitable for effective solar houses in recent years, mainly due to decreasing block widths and ineffective orientation.

* Large, existing evergreen trees (usually eucalypts) in the wrong place make many sites unsuitable. If we wish to take effective advantage of solar gain then we must reconsider our tree preservation rules and lay down mandatory regulations for future tree planting.

* Currently, housing design is often in the hands of the large developers. They have the *capacity* and the *responsibility* to think boldly, using large scale proven technology, such as more effective thermal storage house structures, on-site waste treatment systems as alternatives to sewers, water tanks, photovoltaics, solar hot water systems, etc. to counter the enormous problem of global warming now facing us. Regrettably, there is little evidence that the housing industry is accepting this challenge, preferring to continue with housing construction and planning techniques which are already half a century out of date. This derogation of responsibility passes on a bundle of growing problems to the occupier and is an enormous barrier to effectively combatting global warming. It can only be seen as socially irresponsible. Many houses sold recently in Canberra could justifiably be brought to the attention of the ACT Office of Fair Trading as examples of poor performance and poor value for money.

* The overall level of understanding and skill in implementing renewable natural resources in house design is inadequate to the enormity of the task now facing us. All practitioners in the housing industry - developers, architects, regulators, estate planners, surveyors, engineers, builders, landscape architects, interior and equipment designers, mortgagors and the real estate industry - are too fragmented and unqualified in the intricacies

of solar utilisation - all need to be re-trained and imbued with a practical knowledge of *sustainable* design - ***and appropriately accredited as solar and low-energy practitioners as a mandatory requirement to practise their area in the housing industry.***

* Research in this field is desperately needed, *but does not appear to be carried out by those who profit from the supply of housing*. Other industries have learned that ongoing research and development is crucial to the improvement of their products. The housing industry has a captive sellers' market, but has become complacent and backward looking (eg anti-solar 'Federation' style houses). The building industry is unique in that any advancement in the past has invariably had enlightened clients or entrepreneurs who recognised, commissioned and promoted forward looking ideas. The other path to better housing is usually followed by the few pioneers who use their own money. Individuals who have ideas for improvement (but no money) find it almost impossible to obtain any research grants or to interest any members of the housing industry to support new concepts. This must change if we are to progress.

* Australia's training establishments for architects and builders have many restraints on their ability to produce the required professionals and skilled tradespeople with the global warming knowledge that society will need. The attitude "*we have always done it this way*" is now being challenged by new climatic forces and the industry must rise to this challenge.

Unless these barriers are removed, current practice will never advance housing quality or make significant contributions to counteract global warming.

Our previous bad practices have caught up with us and there is now little time to take corrective action.

The housing industry needs to put its house in order and the opportunity is clearly being presented to it on a plate.

It is not up for debate - there is no option.

The author

Derek Wrigley qualified as an architect in 1945 and has written and presented several papers on architectural responses to global warming and climate change. He has designed, built and lived in five solar passive houses since 1948 and in semi-retirement has retrofitted an existing house in Mawson, ACT, which resulted in a best-selling book "***Making your home sustainable***" in 2003 - still in demand by house owners who have realised there must be something better.

This house has been open to the public on 'Sustainable House Days' for the past five years, organised by the Australia and New Zealand Solar Energy Society. A frequent comment from visitors has been "*Why can't we buy houses like this?*"

In 2000 he conceived and developed the concept of southern reflectors for houses in cool temperate zones, which are now making significant contributions to the thermal and psychological performance of existing houses and are fully integrated into the EcoSolar house. The reflectors have architectural and planning benefits well beyond the provision of heat and sunlight into cold, southern domestic rooms. They were shown on the New Inventors program on ABCTV on 23 May 2007.

In 2006 the EcoSolar house received an award in the Sustainable Cities Awards.

Papers 1 and 2 were presented to the ANZ Solar Energy Society 44th Conference held at the ANU in 2006 and can be obtained by email (PDF) :

1 " ***Self-reliant housing for the cool temperate zones - a work in progress report*** " 2006

2 " ***Southern domestic reflectors - capturing unused solar radiation*** " 2006

3 "***The EcoSolar Design Rationale*** " - a description of the integrated nature of low-energy, self-reliance concepts in housing. 2004

4 " ***Making your home sustainable***" 2003, revised 2005, is available in soft cover from most bookshops. Scribe Publications, Carlton, Melbourne.

A step-by-step, assessable guide to buying effective solar houses is in course of preparation. Suggestions by email will be welcome.

More personally - none of this would have been remotely possible were it not for the ongoing ministrations of my wife Maxine who, along with my sister Shirley, patiently improved its readability. I take full responsibility for the seemingly provocative statements,(which are nothing more than the truth), but I have been encouraged by my colleagues who believe they need to be said. I will maintain their professional anonymity but must thank the many members of Nature and Society Forum for their support and encouragement in publishing this paper.

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