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BUILDING A LOW CARBON FUTURE:

The Builders Declare movement and the path to carbon zero homes

WORDS Jeremy Spencer



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Cost-effective, comfortable carbon zero homes are achievable already; this 8.5-Star family home in St Kilda East, Victoria, by Positive Footprints, is a great example of following the roadmap. Builders Declare aims to spread the knowledge to take high performance mainstream. Images: Dianna Snape

Australian builders have formally moved to declare a climate and biodiversity emergency, following hot on the heels of architects and engineers in 2019. Founding member Jeremy Spencer outlines a simple roadmap to making carbon zero homes mainstream, the core aim of the Builders Declare movement.

Change is coming in the building world, and it may be sooner than you think. What do we need to do to move to the holy grail of homes that produce as much energy as they use, including embodied energy? What will it take for domestic construction to move to carbon zero?

Let's look at what we already have:

- When I started Positive Footprints back in 2001, finding double glazing was a challenge. Now all window manufacturers have a range, prices are competitive, and clients are coming to expect it as standard.
- Incandescent downlights were the rage. Now efficient LEDs are ubiquitous and pendant lighting is the trend.
- Air conditioners were energy-guzzling monsters. Now they

are so efficient, they are the darlings of the sustainability movement. And the same heat pump technology that has revolutionised space conditioning has also come to hot water systems.

- The range of insulation products like sisalation tape and expanding foam was smaller and they sometimes needed to be ordered specially. Now there is a wide range on the shelves at hardware stores.
- Gas was good and electricity bad. Now it's the other way around, with all-electric homes making it easier for owners to know exactly how much energy they are using.
- Appliance energy consumption was poorly labelled. Now we have a robust star rating system for many appliances, making efficient choices easier.
- Solar PV panels were expensive. Now you can buy a 10-kilowatt system for the same price as my first 1.5-kilowatt setup.
- Sustainable homes were truly niche. Now *Sanctuary* magazine, Sustainable House Day, and others have expanded community awareness, and the number of sustainable designers and architects has blossomed.

Looking at this list, though it felt glacially slow at the time, things have changed – in a good way – and cost-effective low energy technologies have fortuitously appeared right when we need them.



HOME ENERGY USE (VICTORIA)



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Typical breakdown of total energy use for an average $200m^2$ Victorian home. This represents 68,889MJ of combined gas and electricity use per year, an average total annual energy bill of \$2,686 and 8.8 tonnes of CO₂ emitted per year. Derived from tables for 'Total energy per dwelling by end use by state: 2014 (MJ)' in the Australian Government's Residential Energy Baseline Study: Australia 2000-2030.

All we need now is an educated workforce to roll it all out.

So, when Simon Clark from Sustainable Homes Melbourne contacted me to ask if I would join him in starting Builders Declare Climate & Biodiversity Emergency with a cadre of other amazing likeminded builders, it was like the last piece of the puzzle falling into place. This could be the last step needed to make low carbon homes mainstream.

The aim of Builders Declare is to spread the knowledge that we already have, and get builders ready for the low carbon future that is coming. The rollout of carbon zero homes is currently held back by lack of understanding within the industry and among the broader public that it is possible and cost-effective, and by lack of knowledge among builders of how to do it. This is something Builders Declare seeks to correct.

ROADMAP TO CARBON ZERO HOMES

What is the secret to achieving an affordable carbon zero home? It is, of course, no secret at all, but something that *Sanctuary's* publisher Renew has been advocating for years. The difference is that today, the technology is here, and the price points are right.

Here is my builder's take on how to do it, based on success we've had in the past. I focus here on new homes for the sake of brevity, but renovations generally follow the same methodology. I will use the average Victorian home as an example, working my way through each wedge of the home energy use 'pie'. Victoria has the highest average home energy use of any state. So, if you can achieve cost-effective carbon zero here, you should be able to do it anywhere in Australia.

1. MINIMISE SPACE CONDITIONING REQUIREMENTS

Aim for a National House Energy Rating Scheme (NatHERS) score of 7+ Stars

A 200-square-metre, 7+ Star house in Melbourne uses less than half of the energy for heating and cooling than the average existing Victorian home (described in the above graph), and costs only minimally more to build than a 6-Star home in most cases. 7 Stars is not hard for designers to achieve if they follow basic passive solar design principles, and there is a high probability a 7-Star minimum standard will appear in the next iteration or two of the National Construction Code.

Ask a thermal assessor to rate the design concept and suggest improvements early in the design process while changes are still possible. Remember, the bigger the house, the more Stars you should aim for when going for carbon zero. The Star rating is judged in energy use per square metre, so bigger homes use more energy than smaller ones of the same Star rating, and thus will have larger carbon footprints.

Build to achieve the Star rating

There is a big difference between a rating certificate and a built house performing to that rating. This is where choosing a builder who knows what they are doing is paramount, and why a movement like Builders Declare is so important. Regardless of what construction system you choose, the important thing is that the builder understands how to achieve the thermal performance with that method. That is, they know how to

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implement the building envelope tightness and insulation consistency assumed by the rating.

How do you choose the right builder? You could of course do worse than look through the Builders Declare signatory list (available on the Builders Declare website). Builders on this list are in tune with your aims, and very likely to have experience with high performance construction. They are also tapping into the webinars and information on high performance building strategies that Builders Declare are bringing out.

I would also suggest that you ask your builder the following questions to test their knowledge:

- What do you do to maintain a tight build?
- Where does building performance often fail?
- · Have you ever had a blower door test on a project?
- · How does your system manage moisture?
- Do you have any past clients with really low energy bills I can talk to?

These are all reasonable questions, and if the builder doesn't have answers, try another. In the absence of choice, telling the builder you want a blower door test at the end of the build will certainly get them to raise their care factor!

Choose heat pump technology for space heating

Whatever heat pump (reverse-cycle air conditioner) you choose – single split, multi split, ducted or hydronic – look for one with a Coefficient of Performance (COP) of at least 3 for heating, and an EER (Energy Efficiency Ratio) of at least 3 for cooling. This means for every kilowatt-hour the system uses to run, it shifts three kilowatt-hours or more of heat from or to the outside air. The best systems currently are single splits, which can have COPs and EERs greater than 5. They are also one of the most cost-effective ways of providing heating and cooling to a home.

By designing and building to a 7+ Star rating, and then choosing heat pump space conditioning with a COP of 3 or more, your house should use around 80 to 90 per cent less energy for heating and cooling than the average home. For the average Victorian house we're using as our example, that's about half the energy bill gone in one fell swoop.

2. MINIMISE HOT WATER ENERGY USE

From this point, the solutions to get to carbon zero are much more in the owner's hands, as they focus on appliances. It is important to make informed choices early and have the designer document them on the plans. This way they will be quoted on accurately and won't be substituted out later.

Minimise hot water needs

According to *Your Home,* in the average home half of the hot water is used in the bathroom and a third in the laundry, mostly through your shower and washing machine. The simple low-to-no-cost solution to minimise energy needs for hot water is to choose a 3 to 4 star WELS-rated water-efficient showerhead and a 4+ star washing machine.



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Completed in 2012, this 7.5-Star house in Altona North, Victoria, was the first Positive Footprints build to report large electricity credits with what would now be considered a reasonably small 3.5-kilowatt solar PV system. Image: Simon Black

Choose a heat pump hot water system with a COP of 3 or more

Just like space conditioners, this means they can shift 3 kilowatthours or more of heat into the water for every kilowatt-hour of energy use, effectively only using a third of the electricity of a resistive system. The best hot water heat pumps have a COP of over 4, even when the outside air temperature is at zero Celsius.

Initially a heat pump will cost more than standard electric or gas boosted hot water, but by choosing efficient showerheads, washing machine and heat pump, you effectively save about three-quarters of your hot water energy use. This investment usually pays itself back in savings in four to eight years depending on family size. An added benefit is that some systems can be set to turn on during the day to make use of any solar power generation (see step 6 below).

3. MINIMISE LIGHTING ENERGY REQUIREMENTS

Install energy-efficient LEDs throughout, and consider using pendant fittings as they light more space per fixture and minimise the size of the holes in your ceiling. Downlights require



bigger holes in the plaster, which in standard construction is part of the home's airtightness membrane (although there are now downlight fittings available with foam gaskets to seal them and that can be insulated over – choose carefully). Small energy savings are possible in the lighting area.

4. MINIMISE COOKING ENERGY REQUIREMENTS

Install an induction cooktop. According to BZE's *Zero Carbon Australia Building Plan* it's 50 per cent more efficient than gas and eliminates the need for a gas connection altogether! You'll save \$300 or so every year in gas connection fees for the life of the house. And with a single-source energy bill, it is much easier to see how much energy you use overall, and take back control.

5. MINIMISE APPLIANCE ENERGY USE

Before shopping for major appliances, go to energyrating.gov.au. This is the site for Australia's appliance energy efficiency star program, and has a database that allows you to rank appliances by star rating, helping to inform you on what brands to look for and what a good star rating is. You can expect to save over a third of the appliance energy 'wedge' just by purchasing models with higher stars.

6. OFFSET WITH SOLAR PV

The above strategies are key, together saving around two-thirds of the average home energy use 'pie'. The next step is to offset the remaining energy you consume with a solar PV system. If your home is around 200 square metres, with a family of four or less, and you have adopted the above strategies, you should start breaking even for energy consumption and generation with a system of 5 kilowatts or so (assuming good solar access; 6 kilowatts in Hobart). Systems of this size should, over the year, produce and export as much energy as you draw from the grid, thus achieving net zero for operational energy. Well done!

A quick online search will show that solar systems of that size and larger are extremely cost-effective at the moment: get the largest you can afford and that you have unshaded roofspace for. Payoffs are well under 10 years in most circumstances. [*Ed note:* to confirm the payback period, it's worth checking Renew's solar and battery advice calculator at renew.org.au/free-solar-and-battery-advice.]

For systems of this size it is a good rule of thumb for the designer to allow at least 40 square metres of roof, sloped to the north if possible. And set your appliances to run during the day, when the sun is shining.

7. BUY 100 PER CENT GREENPOWER

The above steps will put your home in the ballpark of operational carbon zero – that is, zero carbon emissions from your energy use. To take the final step, I suggest you subscribe to 100 per cent accredited GreenPower for your grid imports, to help increase the proportion of grid electricity generated renewably. At low energy use, any premium for GreenPower will hardly be noticed, and you will have the peace of mind of knowing that your house is running at carbon zero and you are supporting the growth of a renewably powered grid.

And what have you saved by achieving operational carbon zero? In Victoria, you're avoiding around eight tonnes of CO_2 being released into our atmosphere each year, and you can expect around \$2,000 in yearly energy savings. Win-win.

GOING FURTHER: MINIMISE AND OFFSET EMBODIED ENERGY

Any discussion of true carbon zero really needs to go beyond operational carbon emissions to include the energy embodied in the materials we use, and should definitely be front of mind when choosing materials for your home. While a discussion of the complex accounting for embodied energy is beyond the scope of this article, I suggest that one simple way to account for it is to increase your solar array size by 2 or more kilowatts, so that you produce a significant surplus of renewable energy to export to the grid, and slowly pay back the embodied energy 'debt' over the years.

DESTINATION REACHED

And that's it. Too pie in the sky? I believe not. At Positive Footprints we have built this way many times and achieved similar outcomes. What is needed is market demand, and builders ready to supply that demand. So if you are building, let your builder know you are aiming for carbon zero. And if you are a builder or trade professional who wants to learn or contribute, join Builders Declare, and successfully ride the wave of the change that is to come.

The best way to get the future you want is to build it. 9



ABOUT THE AUTHOR

Jeremy Spencer is a registered builder, thermal assessor and director at award-winning design and build company Positive Footprints, where he works to make sustainable construction a mainstream proposition. He is a founding member of Australian Builders Declare Climate & Biodiversity Emergency, established in August 2020 and part of the global hub Construction Declares. For further information see au.buildersdeclare.com or find them on Facebook and Instagram.