

MODERN GREEN HOMES

# Sanctuary

ISSUE  
51

CLIMATE RESILIENT  
DESIGN SPECIAL

Collaborative housing; Passive House for schools;  
clean air at home; garden design for bushfire

## Design for a changing climate

FLOOD, FIRE & STORM

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## Inside issue 51

### HOUSE PROFILES

We visit houses across Australia designed for resilience to our changing climate, including flood, fire, storm and heatwave.

### 16 Flood-fast

This small house and studio in flood-prone Newcastle provides flexible, climate-resilient living for three generations.

### 22 Right as rain

A Brisbane couple renovated their home and business to better weather Queensland's storms.

### 28 Fair share

When Deb Shand downsized to a new eco home in central Victoria, she got a ready-made community too.

### 34 Phoenix house

This fire-resilient off-grid house in the Grampians is a modern replacement for a loved family weekend retreat lost to bushfire six years ago.

### 40 Village green

Built to Passive House standards, this 'micro-village' on a single Canberra block offers flexible multi-generational living.

### 46 Renovated delight

A sustainable renovation full of character and recycled materials provides a Tassie family with their desired indoor-outdoor lifestyle.

### 52 Going above and beyond

A love of gardening and a close encounter with bushfire were key factors in the creation of this home in the Adelaide Hills, which also features clever cooling for heatwaves.

### 58 Trial by fire

This modest modern beach shack survived a devastating bushfire on the New South Wales south coast.



Image: Architype/Dennis Gilbert/VIEW

**IDEAS & ADVICE**

**62**  
**Better together**

We explore collaborative housing in Australia, the social, financial and environmental benefits it offers, and how to get involved.

**68**  
**On the drawing board**

Architect Oliver Steele tells the story behind building the first Passive House apartments in the southern hemisphere, in Sydney's Redfern, and what he learned.

**74**  
**Design Workshop**

Architect Sven Maxa advises a family in riverside Melbourne who plan an updated, more sustainable home that's flood-resilient.

**78**  
**Where there's smoke**

Building scientist Jenny Edwards delves into what you can do to protect yourself from air pollution at home when outdoor air quality plummets.

**82**  
**Passive House for schools**

A growing movement of architects believes Passive House could help deliver high-performance school buildings in Australia.

**86**  
**Garden design for bushfire**

Increased risk of bushfire may be the new normal in many parts of Australia. We look at what you can do in your garden to reduce the threat to your home.

**REGULARS**

**8**  
**Subscribe**

**10**  
**Products**

**14**  
**Reviews**

**57**  
**Renew update**

**92**  
**Ask our experts**

**94**  
**Marketplace**

**96**  
**Designers in profile**

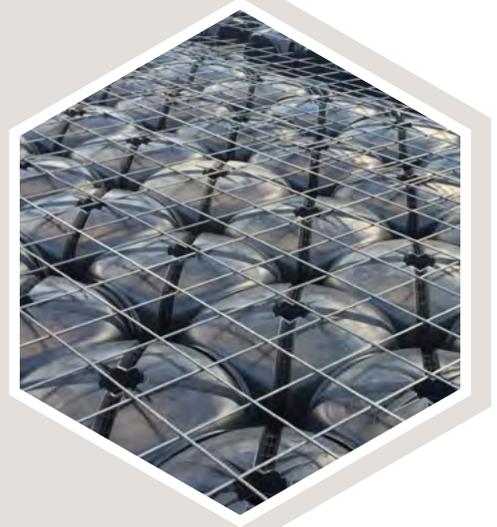
## PRODUCTS

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### Recycled plastic domes for concrete slabs

Featured in our 'Suburban beach house' profile in *Sanctuary 50*, Cupolex domes are a win-win from an environmental perspective. Made in Australia, the recycled plastic interlocking domes take the place of waffle pods or other similar materials in your slab, cutting down on the amount of concrete required, one of the most emission-intensive building materials. They are also a cost-effective option, saving money on concrete, steel and labour and often eliminating the need for fill. The domes are also recyclable at the end of the building's life. There are other benefits of ensuring there is air space in your slab, including limiting dampness, protecting against high alkalinity or salinity in soil and introducing the possibility of venting heat from under your foundation. Prices vary depending on the size and type of build but Cupolex says they are comparable to other slab void systems.

[www.cupolex.com.au](http://www.cupolex.com.au)



### Handmade felted homewares

These charming felted wool baskets and bowls from Oon (which means wool in Nepali) have a whimsical feel that makes them a perfect sustainable storage option for your child's stuffed animals, a stack of blankets, a pot plant or whatever needs containing. Founded by Sydney-based Nepali Sumnima Moktan, Oon's products are designed in Australia and handcrafted in Nepal using traditional techniques and a commitment to fair work and trade practices for the women who make them. The range includes a variety of other homewares at affordable prices, including cushions, wall hangings and rugs. Storage baskets range from \$85 to \$139 depending on size and style; bowls start at just \$22.

[www.oon.net.au](http://www.oon.net.au)

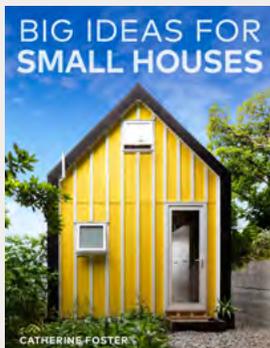


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## REVIEWS

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### BOOKS



## Big ideas for small houses

Catherine Foster

Penguin, 2019

\$45

It's probably not surprising that this book was a hit at *Sanctuary*, with its focus on small, budget-friendly builds and clever ways to achieve a lovely, liveable first home.

Featuring 20 well-designed homes around New Zealand, *Big ideas for small houses* is packed with photos and, for readers interested in digging into the detail, each profile includes design notes and a useful cost breakdown along with a written commentary and floor plans.

Each project's overarching strategy is front and centre. For example, the creators of the Madras Street Duplex in central Christchurch set out to build two small homes on one site, one as a home and the other as a long-term income stream. At the Lanham-Potter Cottage in Auckland, the strategy was to extend and renovate an existing secondary dwelling on family land, while in Lyttelton, the future occupants of a 39-square-metre cabin exchanged the 'sweat equity' of building it for the opportunity to live in it rent-free on completion, allowing them to save for a home of their own.

The cheery yellow house on the cover is the prototype by Wellington architect Wayne Lightfoot for a small permanent dwelling that can be built on pockets of land too small for full-sized houses – as small as 90 square metres. It has a footprint of just 24 square metres, not much bigger than a Tiny House.

Which one is your favourite?



## How to raise a plant and make it love you back

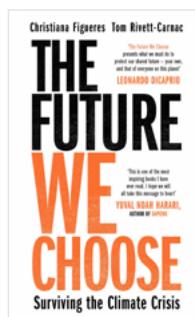
Morgan Doane & Erin Harding

Laurence King Publishing, 2018

\$25

As we all hunkered down at home this autumn in the midst of the coronavirus response, there was a sudden collective rediscovery of gardening and a rush on seeds and garden supplies. If being at home every day has made you keen for more greenery around your house too, this unassuming little pink book is a great place to start. Written by two American indoor plant enthusiasts who run the online community House Plant Club, *How to raise a plant and make it love you back* is a very accessible and attractively illustrated guide suitable for beginners, with tips and projects that will be useful for more seasoned plant owners too.

The main sections are on choosing and maintaining your plants, including propagation, repotting and holiday plant care, and a chapter that introduces a dozen of the authors' favourite plants and how to care for them (most are common indoor plant choices in Australia too). There is also information on tools you'll need, containers and pest control and, for those with more time on their hands, a list of DIY projects including making a terrarium and creating a peg board for a green wall display. If you've never managed to keep an indoor plant alive – or if you are simply looking for ideas to grow your collection – this book can help.



## The future we choose: Surviving the climate crisis

Christiana Figueres & Tom Rivett-Carnac

Allen & Unwin, 2020

\$28

Penned by a formidable duo, the principle creators of the 2015 Paris Agreement, this book is a sobering and yet optimistic read. It outlines two scenarios for our future – the world we are creating, and the carbon neutral, regenerative world we must create – and challenges us: how can we change the story of the world?

Delving into the importance of mindset and “who we choose to be” with a focus on abundance, optimism and empowerment, the authors go on to present ten things we can do today to make a difference. These include letting go of the old world, defending the truth and building gender equality as well as the perhaps more obvious tasks of reforesting the earth and moving beyond fossil fuels. As one commentator writes, *The future we choose* is a powerful warning and a hopeful guidebook for us all.



# Flood-fast

LOCATION Newcastle, NSW • WORDS Rebecca Gross • PHOTOGRAPHY Katherine Lu



## At a glance

- Designed for flood resilience
- Two-dwelling residence for flexibility of use and communal living
- Small project on a moderate budget
- Low-maintenance materials with minimal finishes

←

The living spaces are built above the 1.6-metre flood level, with garage, laundry and storage below. Inside, bedrooms are screened with bamboo blinds and finishes are minimal.

**With living zones above the high water level and water-resistant materials below, this small house and studio in flood-prone Newcastle provides flexible, comfortable and climate-resilient living for three generations of a family.**

In Newcastle, NSW, the risk of flooding affects around one third of all properties, and the situation is expected to worsen due to our changing climate. The ABC recently reported that the number of addresses in the regional city that are uninsurable due to flood risk will rise to nearly one in seven by 2100, including more than 99 per cent of addresses in the waterfront suburbs of Carrington and Wickham.

One Wickham landowner engaged local architecture operation Curious Practice to design a new house with the flood risk in mind. Vikki travels a lot and loves to observe the way other cultures live: she wanted a house that offered a way of life she had experienced in villages in India and the South Pacific. “For the locals there, a house is a place to sleep, that provides protection and shelter from the weather and where life spills out into the open air,” Vikki describes. In this spirit, she wanted her home to be a sanctuary for her “tribe” of grandchildren to visit, stay and play in the garden.

Warren Haasnoot, co-founder of Curious Practice, designed a two-storey building comprising a self-contained studio (where Vikki lives) and a two-bedroom dwelling (where her son and his family currently live) – just 105 square metres altogether. He created openness and a village-like feel by weaving external spaces through the building and focusing on flexibility of use and the connection and sharing of inside and outside living spaces. The flood level and Vikki’s modest budget also informed the design, as did her preference for honest, hardwearing and maintenance-free materials.

A two-storey house increases resilience to flooding, with living areas and most possessions elevated. The flood level for Vikki’s house is 1.6 metres above ground, so the first floor is raised above this height with a masonry foundation, enclosing the garage, laundry and storage area on the ground level. Concrete blockwork is suitable for load-bearing walls in flood-prone areas as it is stable when saturated, and readily dried again by good ventilation. Combining this flood-resistant ground floor with a less expensive timber frame construction upstairs enabled a more economical design.

The garage is open to the back garden, allowing any floodwater to flow through and creating an undercroft space for the kids to play. The raised floor under the main living space has a lower head

# Phoenix house

LOCATION Grampians, VIC • WORDS Sophie Weiner • PHOTOGRAPHY Dan Farrar



## At a glance

- Designed for fire resilience in a BAL-40 zone
- Off-grid holiday home for a large extended family
- Simple, passive solar design
- Custom steel mesh ember and insect screens

**Built to stringent bushfire resistance requirements, this off-grid house in the Grampians, Victoria, is a modern replacement for a loved family weekend retreat lost to fire six years ago.**

In January 2014, a bushfire swept through the northern section of the Grampians (Gariwerd), one of Victoria's most-loved natural areas. When the blaze was out, 32 houses had burned, including a humble log cabin holiday home belonging to the Somers family.

"The fire went through on a Saturday night," says Jamie Somers, whose parents bought the prefab cottage with views of the ranges in 1980. "The place was indefensible. The CFA [local fire authority] said not to go into the area whatsoever. We found out the next day that we'd lost it."

In the wake of the fire, Jamie and his eight siblings got to work filing an insurance claim to secure funds to rebuild the house. The land where the original cabin had stood was rated BAL-40, the second highest category in the Bushfire Attack Level system, the construction

regulations put in place in areas prone to bushfires after the devastating Victorian Black Saturday fires in 2009. The restrictions for building in such zones are onerous, and often expensive. But the family was determined to rebuild.

"Our parents bought the house 40 years ago with the intention of it being available for their kids and grandkids," says Jamie. "We never considered selling the land; the challenge was just figuring out what to do with it."

Luckily, Jamie's brother Matt had some experience dealing with high BAL-rated designs. He works for a company that imports building materials, and had previously collaborated with Chris Barnes of Melbourne studio Field Office Architecture to construct his own home at fire-prone Mount Macedon. Also built to BAL-40, that house – a modern building with a long, narrow footprint, clad with Corten steel and with fold-away metal mesh protecting the windows from embers – became the model on which Chris and the Somers siblings based their new project.

Working with nine siblings could have been a challenge, but Chris says the planning phase of the project



# Trial by fire

LOCATION Rosedale, NSW • WORDS Sophie Weiner • PHOTOGRAPHY Ross Caddaye



## At a glance

- Designed for bushfire resilience in a BAL-FZ zone
- Small, space-efficient floor plan and simple design
- Fire-resistant, low-maintenance materials
- Step-free to aid ageing in place

**After a painstaking design process, this modest and energy-efficient modern beach shack survived a devastating bushfire on the New South Wales south coast.**

For more than 40 years, a small block of land in the coastal village of Rosedale, NSW, had sat vacant. Owners Carol Behm and Ron Weir had other things to do, and never got around to developing the property. But when Ron retired, he decided it was finally time to put something on the tree-covered block.

The couple, who live in Canberra, made plans to build a retreat where they could spend several months each year. In 2014 Ron came into contact with Tom Caddaye, an architect who works in the region. Tom helped the couple develop a plan for a simple and efficient small home that he describes as “a contemporary version of a traditional Australian beach shack”.

In addition to their desire for minimalist design, the couple wanted to make sure the house would remain accessible as they age, so although it would be built on a slope, they requested the design avoid any steps.

As the design was taking shape, Tom discovered that the site would be rated BAL-FZ (Flame Zone), the highest Bushfire Attack Level in the building standards aimed at making homes more fire-resilient. Luckily, the house’s pared-

down design was already in line with what the stringent regulations required. “Every time you have a change in direction, or material, or an overhang, you have to throw lots of money at it to make sure it meets the BAL regulations,” Tom says. “The simpler the design could be, the better.”

The rating did have a profound impact on the materials Tom used for the house. To meet BAL-FZ requirements, no exterior timber or other flammable materials are allowed. Tom chose fibre cement for the exterior cladding: fire-resistant and also a reference to the classic fibro beach houses of the area. He partnered with builder TLC Constructions early in the process, and many decisions about detailing were made collaboratively. It was the builder who recommended using Hebel panels for the floor structure to enable the elevated timber floor, rather than cladding the underside of the floor structure with an extra fire-resilient material.

Windows were the most challenging and expensive part of the build. Tom ended up getting a pass from the Rural Fire Service to use windows and roll-down shutters both rated for BAL-40, since no similar BAL-FZ rated shutters were on the market at the time. This is no longer true, and Tom says exceptions like these are not allowed today.

The result of this careful planning – the house took nearly four years from the start of the design process to completion – is a simple and functional house, with a striking view of the ocean through the

# HOUSE SPECIFICATIONS

## HOT WATER

- Rinnai instantaneous hot water system using bottled gas (see Insights)

## WATER SAVING

- 4,500L corrugated metal rainwater tank, connected to garden taps

## PASSIVE DESIGN, HEATING & COOLING

- Main glazing to north-east for solar gain in winter
- Large eave overhang to north-east for summer shading
- Minimal glazing to west and south
- Cross ventilation to all rooms

## ACTIVE HEATING & COOLING

- Airfusion Airlie 122cm ceiling fan to living room

## BUILDING MATERIALS

- Timber frame construction
- Spantec Ezipier steel pier subfloor system
- CSR Cemintel Barestone external cladding
- Lysaght Custom Orb metal roofing
- Floor: mixed Australian hardwood timber flooring over CSR Hebel PowerFloor
- Ubiq Inex compressed fibre cement decking boards

- Insulation: Bradford Gold ceiling batts (R4) with 70mm Anticon blanket (R1.5) to ceiling and roof; HardieFire mineral wool batts (R2.5) to walls; Hebel PowerFloor with 19mm hardwood floorboards (nominal total R1.3) to floor

## WINDOWS & GLAZING

- AWS Magnum BAL-40 rated aluminium-framed windows, single glazed with 6mm glass for bushfire resistance
- CW Products FireSafe BAL-40 rated roller shutters

## LIGHTING

- LED lighting throughout

## PAINTS, FINISHES & FLOOR COVERINGS

- Dulux low-VOC interior paints

## OTHER ESD FEATURES

- Small footprint, space-efficient floor plan with minimal circulation spaces
- Step-free design for ageing in place
- Low-maintenance, durable materials

## DESIGNER

Thomas Caddaye

## BUILDER

TLC Constructions

## PROJECT TYPE

New build

## LOCATION

Rosedale, NSW

## COST

\$500,000

## SIZE

House 88m<sup>2</sup>

Land 640m<sup>2</sup>

## BUSHFIRE ATTACK

### LEVEL

BAL-FZ



## INSIGHTS

"Perhaps surprisingly, domestic gas bottles generally don't pose a significant threat during a bushfire. The bottles are designed to withstand fire for a very long time; if exposed to a prolonged and intense building fire they may eventually explode, but bushfires usually pass over much faster than this. The building regulations for BAL-FZ zones only mention that "above ground gas supply pipes shall be metal", which is normally the case anyway. The gas bottles at Carol and Ron's house were actually undamaged after the fire, though the Rinnai hot water heater itself was destroyed."

Tom Caddaye  
Architect

## BETTER TOGETHER: Exploring collaborative housing in Australia

WORDS Anna Cumming



↑  
Having worked on community-focused multi-residential developments including the 20-apartment Nightingale 2 in Melbourne's Fairfield, Liam Wallis was keen to test out collaborative development on a more manageable scale. With two friends, he has created and recently moved into Davison Collaborative, a three-townhouse development with shared back courtyards and top sustainability specifications in Brunswick. "For us, part of it is about using existing resources more efficiently," Liam says. "In an existing suburb serviced by infrastructure, we've turned one post-war dwelling into three family homes for the future." Image: Tess Kelly

**From a couple of households to large ecovillages with a raft of shared facilities, collaborative housing projects come in many sizes and types, but they all offer the social, financial and environmental benefits of sharing resources and building community. We look at what's involved in setting one up, and get advice from people around the country already doing it.**

## CLOSING THE PERFORMANCE GAP: Passive House for schools

WORDS Sophie Weiner



← ↑

Designed by Architype, Oak Meadow Primary School in Wolverhampton was one of the first certified Passive House schools in the UK. “The children are more alert and attentive because the air is so fresh and comfortable. The daylight is just fantastic. It has raised our spirits; the children and teachers love our Passive House school,” says head teacher Sara Morris. Images: Architype/Leigh Simpson Photographer

**Australian schools are underperforming in terms of energy efficiency and indoor environment quality. We talk to some architects who believe that the rigorous Passive House standard could help turn that around.**

After years of designing sustainable school buildings in the UK, Kiwi architect Elrond Burrell began to suspect that his buildings weren't performing as well as he expected. Post-occupancy evaluation (POE) and building performance research funded by the architecture firm Elrond worked for, Architype, and Oxford Brookes University revealed some shortcomings. Despite the firm's focus on sustainability and energy efficient design, the award-winning buildings they were designing weren't quite measuring up in terms of indoor air quality and thermal comfort.

“We realised that what we were doing was not quite as good as what we thought,” Elrond says.

The schools saw erratic indoor temperatures and higher-than-recommended CO<sub>2</sub> levels in classrooms, among other issues. This ‘performance gap’ between design expectations and the reality of how the buildings performed was one of the factors that drove Architype to explore the use of the Passive

House standard for school buildings. “A director and some of our consultants went over to Germany and visited some schools there. They came to the conclusion that out of all the standards and tools, Passive House was the most successful in closing that energy efficiency and thermal performance gap,” he says.

Passive House is an energy efficiency building standard developed in Germany during the early 1990s (see ‘Mind the gaps: Passive House from the inside’ in *Sanctuary 45* for more). Certified Passive House buildings utilise a combination of airtight construction, mechanical ventilation and carefully chosen insulation to keep their energy use extremely low. Elrond believes that the greatest benefit of Passive House is the scientific approach it requires: to meet the standard, a building's projected energy use must be modelled accurately at the design stage, it must undergo an independent quality assurance process, and the finished building must be tested to ensure it meets stringent construction quality requirements. It's in this rigour that the standard goes further than classic passive solar design, a set of design principles that can certainly be applied to produce a high-performing building but are not expected to result in consistent or defined outcomes. Simply applying sustainable principles, Elrond found, can fall short if designers don't have defined performance goals and associated quality assurance processes for construction.

## DESIGNERS IN PROFILE

How should we be designing our homes for resilience in a changing climate?



**JOANNA BEST**

Architect, Troppo Architects  
troppo.com.au  
Works in NT and around Australia

**What kind of house did you grow up in?**

A weatherboard two-bedder at Tamworth in rural NSW with Mum and Dad and two brothers. We didn't really spend that much time in it, other than to eat and sleep: most of our days were spent roaming the streets on our bikes.

**What was the first design project you were really proud of?**

A collaboration with Melba Gunjarrwanga and James Iyuna (who is sadly no longer with us) for a sculpture that ultimately became a generative design element for a public verandah in Darwin. Learning from them on their country near Mumeke in Arnhem Land, collecting jungle vine from the bush that has been used for making fish traps for countless generations, preparing, weaving, smoking, talking, laughing ... it was an amazing experience.

**What is your favourite sustainable building, and why?**

The Murtoa Stick Shed near Horsham in Victoria. This mighty agricultural structure built in 1941 for wheat storage was constructed by hand out of 560 mountain ash poles. It is enormous – covering four acres – and has an inspiring minimalist aesthetic. It is a great example of pragmatic building.

**How to design our homes for resilience in a changing climate?**

Easy – build less. Most homes in this country are shamefully large for the number of occupants. There should be a maximum internal area per person in every planning scheme and anyone who designs and builds a house larger should perhaps be obliged to take in a climate refugee.

**What are the most pressing issues in architecture in the NT?**

Legislation and bureaucratic reasoning around Aboriginal housing, especially in the NT, is in disarray. A generic design approach for new homes across the Territory ignores regional differences in climate conditions, and by extension, sustainability. Remote communities, which are 'out-of-sight, out-of-mind' for most Australians, reveal a glaringly obvious failure of political rigour in their buildings. Coupled with cursory attempts at consultation and ignorance of culturally appropriate design, first nations people are being left behind. I have been buoyed by recent examples of Aboriginal Communities and organisations who are taking back control of housing, health, education and justice to envisage a new paradigm, one specific to individual family group needs and determined by those for whom it is relevant.



**RIC BUTT**

Architect, Strine Environments  
strineenvironments.com.au  
Based in Queanbeyan, works around Australia

**What kind of house did you grow up in?**

A large old 1890s Riverina version of a Queen Anne-style brick house, with a huge spreading corrugated roof that covered the verandahs as well. Our grandparents and great-grandparents all had even older (heritage) brick and stone houses that needed lots of maintenance. You learn lots from old buildings and their problems; also what does and doesn't work.

**What was the first design project you were really proud of?**

The first real building I designed, when I was about ten years old, was a grand racing pigeon 'house' in the back paddock. It had four separate 'rooms' with a big elevated flight deck out the front. Dad and I built it with a recycled brick plinth and a bush sapling frame clad in galvanised mini orb. It was the only new building on the block, and looked modernist, shiny and new in stark contrast to all the old buildings we frequented.

**What is your favourite sustainable building, and why?**

Adelaide House in Alice Springs, NT: the town's first hospital, designed by Rev John Flynn (founder of the Royal Flying Doctor Service) and built in 1920. It has extraordinary features that make it the earliest climatically appropriate and sustainable Australian building that I know of. The building has a stone basement, a heavy stone-walled ground floor and upstairs a timber-framed, flyscreened room, with a verandah all around. It was designed to be cool in summer, warm in winter and comfortable in a dust storm. Flynn incorporated unique cooling systems: ground-source heat exchange coupled with evaporative cooling using wet hessian in air tunnels (the Coolgardie safe principle).

**What's on your drawing board right now?**

Continuing to develop our ECubed modular housing system, some bushfire rebuilds and some new climate-responsive passive solar houses. Also a factory that requires a stable thermal interior and low-energy operation in the Canberra climate.

**How to design our homes for resilience in a changing climate?**

I am a firm believer in thermal mass as an aid to resilience. However, it must be thermally isolated from the exterior and well-insulated. And with climate change creating a warming planet, we can no longer depend solely on passive design: we now need to consider active cooling, like high-efficiency air conditioning powered by rooftop solar.

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