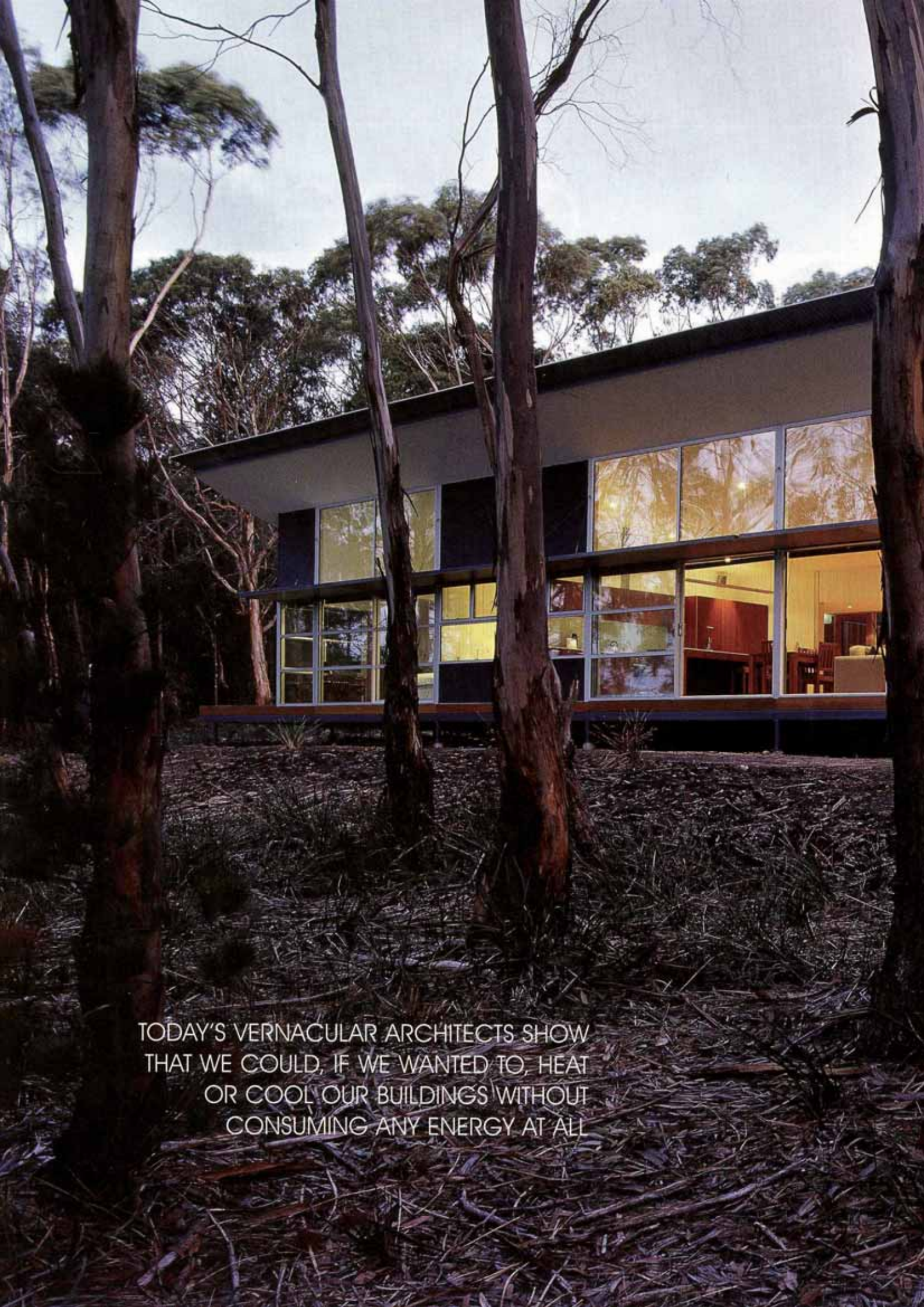
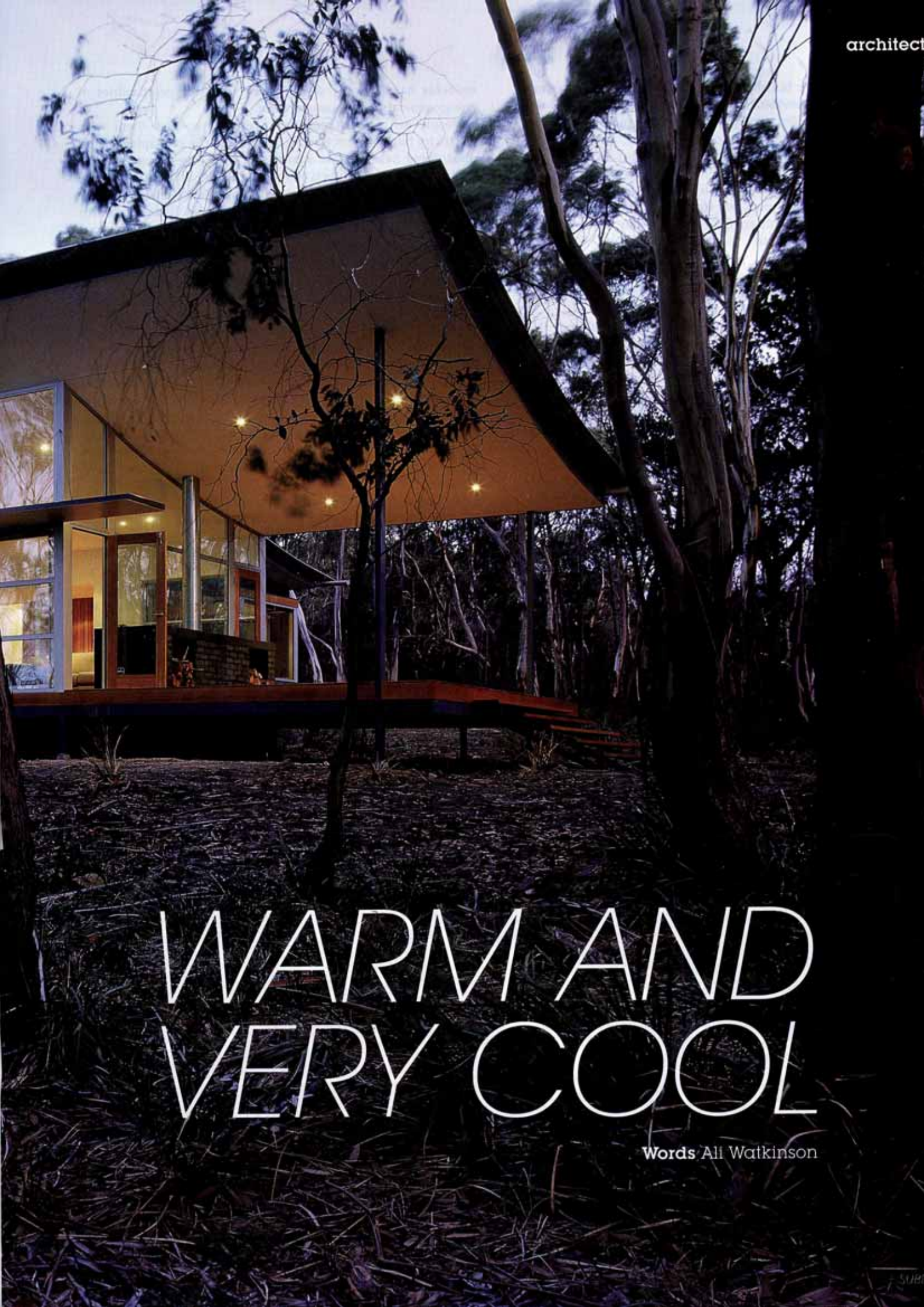


TODAY'S VERNACULAR ARCHITECTS SHOW
THAT WE COULD, IF WE WANTED TO, HEAT
OR COOL OUR BUILDINGS WITHOUT
CONSUMING ANY ENERGY AT ALL



WARM AND VERY COOL

Words Ali Watkinson

Given the hullabaloo about wind turbines, heat pumps and photovoltaics, you'd be forgiven for thinking that alternative energy in architecture is entirely dependent on gizmos and gadgets. But as Howard Liddell of Gaia Architects (www.gaiagroup.org) in Edinburgh, Scotland, bluntly puts it, 'True alternative energy is not to use it'.

This would seem obvious to our forbears. In the past, when respect for natural resources was instinctive, buildings and their occupants were necessarily energy-efficient. Today, as Piers Smerin of Eldridge Smerin Architects and Designers (www.eldridgesmerin.com) points out, 'with 30% of all UK delivered energy currently being used on domestic heating, this far outweighs other energy uses and makes producing a house with low energy the key environmental issue'.

'We can quite easily design houses and other buildings that require zero heating. I am currently designing a "Weetabix" School,' Liddell continues jokingly, meaning that, 'the heating system is the pupils via the energy they are giving off as a result of their hearty breakfast'. He estimates this to be 100W per child. 'The problem in a technical-fix society is that we look for technical-fix solutions – the opportunity to be a non-consumer gets lost in the rush for innovative technology,' he surmises.

'The first rule in an energy strategy for a building should be to remove the need for energy consumption as far as is reasonably possible. This may seem obvious but I have yet to see a building with a photovoltaic system in the UK, which has been super-insulated and was tested for airtightness. Then, the only energy supply home owners have to find is for hot water and, of course, electricity,' states Liddell.

He categorises his approach as 'eco-minimalism' or, more simply, 'good housekeeping'. It is a method also described as passive design or natural heating and cooling – creating buildings in which a comfortable indoor climate can be achieved in summer and winter without recourse to conventional heating or air-conditioning systems. Passive design has a role to play in every climate; utilises both ancient and modern materials, from argon-filled triple glazing to rammed earth walls; and is increasingly implemented, as a matter of course, in both new builds and refurbishments in many countries, but not yet in the UK where residents have become disconnected from the practicalities of energy generation and conservation.

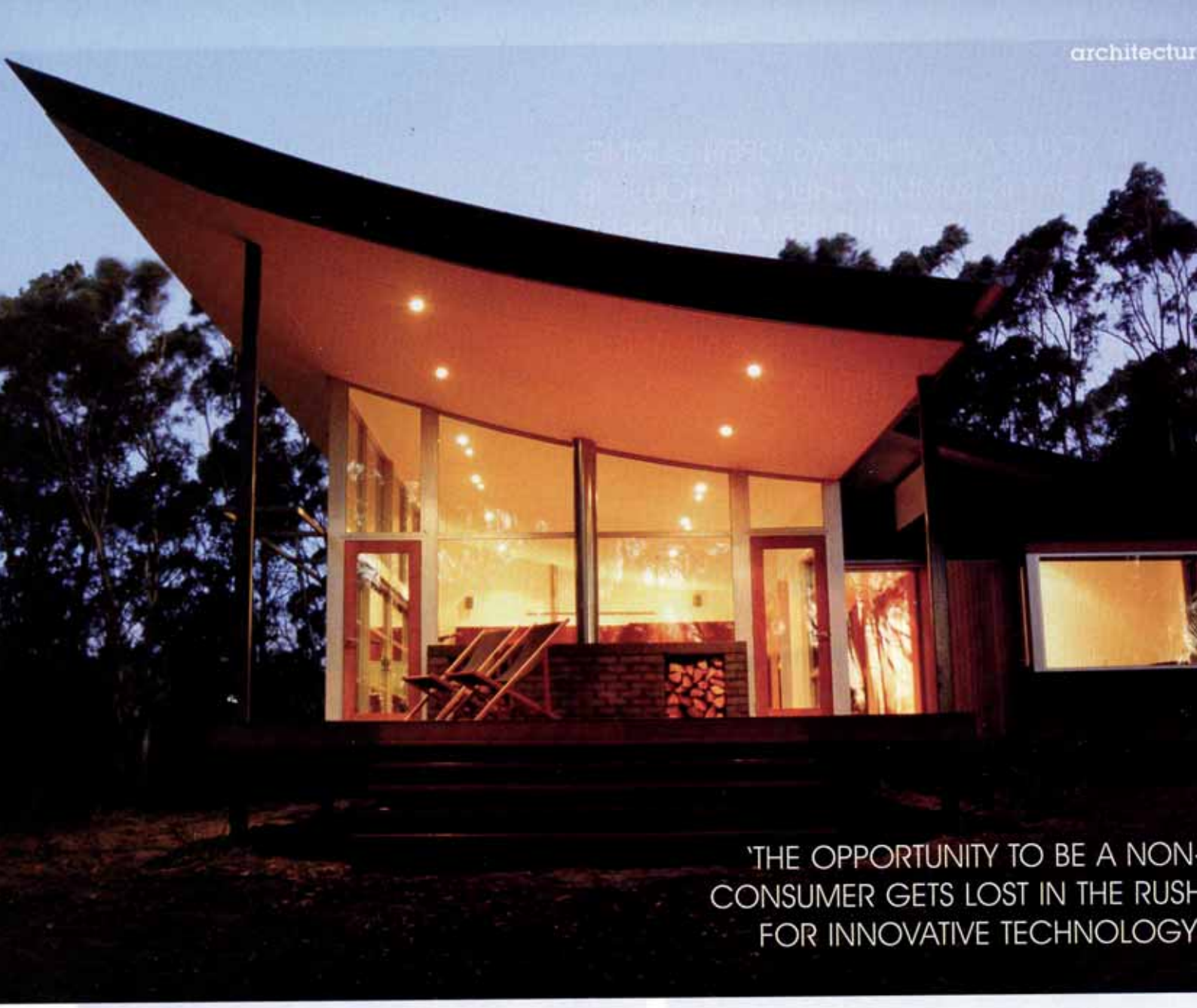
'People can understand that a gadget provides them with electricity but don't necessarily understand the principles behind maximising heat gains or minimising heat losses,' suggests Dan Gibbons of Bere Architects (www.bere.co.uk), a London practice that bucks the trend, even incorporating passive energy in their renovation projects, for instance at Sylvanus House in north London. 'Taking on board passive principles is more about lifestyle. If you leave windows open during the day in summer then the house is going to heat up. It seems anathema to us to close windows, or use shutters, although people on the continent have been doing that as a matter of course for centuries,' he continues.

The irony is, the finances of renewable energy often don't add up. 'Until a building is properly insulated and made airtight with ventilation heat recovery [to remedy the resultant humidity and pollution], eco-gimmicks are really looking like a very bad deal in terms of value for money,' states Liddell. 'An array of photovoltaic cells to supply 5kW of electricity [note a kettle uses 2kW; a power shower 7–9kW] will set you back at least £20,000 and take 50 years to pay back. With the snag that they lose efficiency at about 1–2% per annum so they never really last 50 years before they need replacing.'

Leaving aside the 'Weetabix' effect, the five key considerations in passive design are orientation, insulation, airtightness, shading and landscaping. Orientation boils down to positioning the building to maximise solar heating in winter and minimise overheating in summer. Insulation, predictably, comes down to reducing unwanted conductive heat loss. Airtightness, contrastingly, relates to infiltration losses that result from an inadequately sealed structure. (The infiltration rate on a typical house is around 1.5 air changes per hour; with care it can be reduced to just 0.2 air changes per hour.) Shading prevents overheating, while landscaping contributes to shading in the summer and wind protection in winter.

In Germany, as elsewhere in Europe, passive energy is old news. A search on the Built Passive House Projects (www.passivhausprojekte.de) website brings up 792 projects in

Previous page, this page and opposite. 1Plus2 Architecture's Walla Womba Guest House sits on a coastal site necessitating low visibility from the water. This has been achieved by orienting the roof pitch away from the sea, through judicious selection of materials, and by maintaining the landscape buffer zone between the house and the coast; woodwork and furniture are made from local recycled timbers; the property is set on a raised steel frame to minimise disturbance caused by excavation



'THE OPPORTUNITY TO BE A NON-CONSUMER GETS LOST IN THE RUSH FOR INNOVATIVE TECHNOLOGY

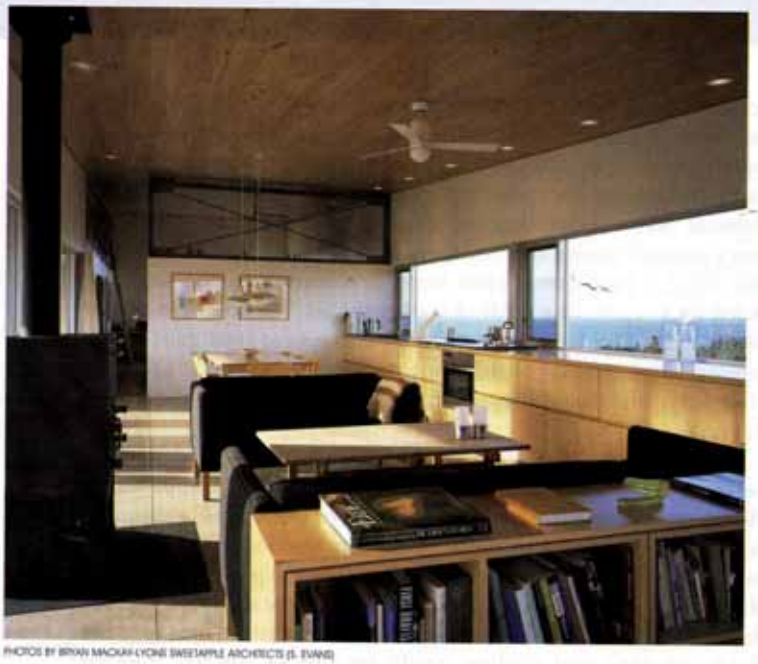
Germany, and German company WeberHaus (www.weberhaus.de) even manufacture a passive house in kit form for which the thermal energy requirement has been reduced to just under 15kW per metre square per year. 'In other words, this house requires 90% less energy than a conventional house,' posits the company. The remaining energy requirement of the house is covered by solar energy, the residents' body heat and heat generated by electrical appliances.

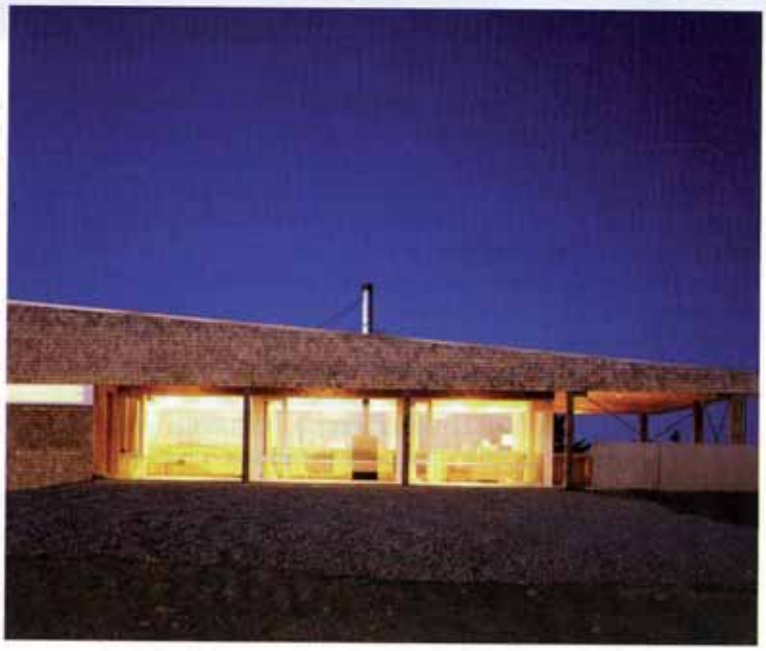
Rather than discussing passive energy, a number of architects, harking back to a more pragmatic age, speak of 'sustainable vernacular architecture' or 'a new vernacular'. David Arkin of Arkin Tilt Architects (www.arkintilt.com) in California reasons that, 'Sustainable architecture – in order to be that – needs to pay attention to climate and site and function on a fundamental level. That is why vernacular architecture is so site-specific. We're at a point where most of the excitingly experimental but arguably ugly solar projects of the late 70s and early 80s are largely forgotten. Today's designs are the second generation of ecological design, integrating water, energy and construction systems in artful ways. It needn't be of a particular style, and really could be any. But when designs evolve in response to their climate and circumstances, a style that is indigenous to place ultimately emerges.'

At Suzanne Johnson's home, on the eastern slope of the Sierra Nevada Mountains in Douglas County, Nevada, the practice combined alternative construction techniques – primarily straw bale with an earthen finish using soil from the site – with daylight, solar technologies and salvaged materials to create a house that is virtually energy-independent. Shading, high insulation and thermal mass – exploiting the ability of a material to absorb the sun's warmth during the day then slowly release that heat during the night – keeps the house from overheating in the summer, aided by a ventilating flush of cool night air. The southern corner of the main roof is lifted to enable passive solar heat gain in the winter, augmented with photovoltaic panels to generate electricity, and solar thermal panels to provide hot water and heating.

In Tasmania, Hobart practice 1Plus2 Architecture (www.1plus2architecture.com) designed the Walla Womba Guest House on Bruny Island 'to have a sense of place' and a minimal ecological footprint – in terms of its construction and long-term use. Sitting the house on an elevated steel frame preserved existing site drainage patterns while the alignment of the structure and the dramatic form of its roof take advantage of winter sun and summer shade. Heating and cooling needs are further limited through careful room placement and reliance on high-performance insulation and operable double-glazing. Taken together with on-site rainwater collection and waste management, and independent power generation using photovoltaic panels and a supplementary gas generator, the remote building is entirely self-sufficient.

'IF YOU LEAVE WINDOWS OPEN DURING THE DAY IN SUMMER THEN THE HOUSE IS GOING TO HEAT UP. IT SEEMS ANATHEMA TO US TO CLOSE WINDOWS, OR SHUTTERS, ALTHOUGH PEOPLE ON THE CONTINENT HAVE BEEN DOING THAT AS A MATTER OF COURSE FOR CENTURIES'





PHOTOS BY BRYAN MACKAY-LYONS SWEETAPPLE ARCHITECTS (S. EVANS)

This page Three views of MacKay-Lyons Sweetapple Architects' Hill House: the project consists of a main house and guesthouse/barn separated by a courtyard; ceilings are clad in untreated, rot-proof hemlock which provides a warming contrast to the concrete floors, white walls and large expanses of glass. Douglas fir posts have been used for the colonnaded porches. ***Opposite*** Eldridge Smerin's Swain's Lane perches on the edge of Highgate Cemetery. The concrete frame acts as an environmental modifier

Back in the UK, Gokay Devici of The Robert Gordon University, Aberdeen, Scotland (www.rgu.ac.uk) meanwhile reports 'the difficult challenge of using sustainable contemporary construction in a way that is in harmony with the local vernacular tradition' in his design for Burnett House, Aberdeenshire. 'One of the problems with sustainable buildings today is that they have acquired an aesthetic image of rather narrow appeal ... In the Burnett House we have sought to make a design statement ... that shows that living *la vida eco* can be vital and sexy rather than worthy and staid.'

Worthy and staid is not a label that can be applied to architect David Hertz's (www.syndesisinc.com) home in California, USA. Extending his already sizeable family house on to the adjacent 40 by 90 foot lot, the 'staunch proponent of green design' was mindful to maintain the eco-sensibility already established in the first phase of building. 'There's no getting around the fact,' he says somewhat apologetically, 'that on a purely ecological level, 4,400 square feet is a lot of house by most of the world's standards.' His riposte was to make the house the greenest house of its size he'd ever seen. 'I employ green techniques in all my work,' he says, 'but I've thought of my own house as a kind of case study, even a working laboratory, for me to live with environmental systems, materials and methodologies.'

Due to its proximity to the ocean in Venice, the project naturally makes good use of prevailing ocean breezes (during construction Hertz set off smoke bombs inside the structure to study the airflow and ventilation through the buildings). Materials were chosen for their environmental sustainability. Recycled and FSC-certified sustainable woods are used throughout the house. And much of the concrete is Syndecrete® (Hertz's own invention) containing 41% recycled content. The material acts as a 'solar sink' or thermal mass.

Across the national border, Brian MacKay-Lyons of MacKay-Lyons Sweetapple Architects (www.mlsarchitects.ca) in Halifax, Nova Scotia, faced a rather different coastal climate when building Hill House on the South Shore where the constant freeze–thaw cycle gives rise to huge temperature swings. His solution was insulation – the light timber framing has been clad in no less than four layers of cedar shingles, the local vernacular solution that allows the house to anticipate movement – and thermal mass via the concrete floor. Come summer, and the narrowness of the house facilitates cross-ventilation, with air passing over the concrete creating convection currents that help generate cross-breezes.

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The thermal mass of concrete is also being exploited by Eldridge Smerin at Swain's Lane, north London, where they are replacing a 1970s house, coincidentally adjacent to Bere Architects' remodelled Sylvanus House, which they report 'is difficult to keep warm in winter and suffers from excessive overheating in summer months'. The intention 'is to produce a house with a significantly lower energy usage than the current house even with an increased floor area' via 'a series of large glazed openings facing south coupled with the use of a heavyweight concrete structure [to] allow passive solar gain to be maximised during winter months. The high thermal mass of the reinforced concrete structure acts as a temperature stabiliser moderating temperature fluctuations. This is helped by the extent to which the house is set into the ground.' Historically, the environmental impact of using concrete has been a cause of concern, but here Eldridge Smerin argue 'the use of concrete as a structure and finish, when sourced from a local plant that utilises a proportion of recycled material, helps minimise the embodied energy in the envelope of the building'.

An altogether less high-tech thermal mass solution than concrete is earth. Surprisingly, this most ancient of building materials is as effective today as it ever was: it is estimated that about half the world's population are living in earth buildings and that's not restricted to the Third World – see the reference to Suzanne Johnson's house by Arkin Tilt Architects above. In some regions of Australia over 20% of the houses are constructed from walls of unfired earth, modern homes even, as illustrated by specialist house builder Rammed Earth Homes (www.rammedearthhomes.com.au) whose designs would not look out of place, visually or price-wise, in most First World suburbs.

In fact, cost could be a key factor in the growth of passive energy suggests David Arkin. 'I think the real mainstream grabber is value – isn't that the ultimate capitalist goal? I have to believe – in the context of rising energy prices – that homes with lower energy bills located in neighbourhoods that support lower-energy lifestyles would both have a market advantage and sell at a higher price.'

As the use of the word 'lifestyles' highlights, we should not overlook the role a building's inhabitants play in the success of passive-energy homes. 'We need to bear in mind that the most influential component of a house from an environmental point of view is the people living in it,' counsels Piers Smerin. 'Simply turning off the lights and running a bit less water are as important in curbing our impact on the planet as measures taken at the drawing-board stage.'

There's also a less tangible element to the lifestyle element, proposes Arkin, that arguably links back to what has been said about the relationship between sustainable and vernacular design. 'We firmly believe that in order for a building to be sustainable, it must be loved; it must touch the soul. People – not just the current owners, but future generations – must find enough value in a building to continue to occupy and maintain it. Some of this is aesthetic, some performance, and some economics. The Roman architect Vitruvius tells us that buildings must have "Firmness, Commodity and Delight". True today more than ever.' ■

Ali Watkinson *is a freelance writer with a long-standing interest in ethical and sustainable living. Her features appear in the* Telegraph Magazine, Coast, World of Interiors *and* Guardian Weekend *among others*