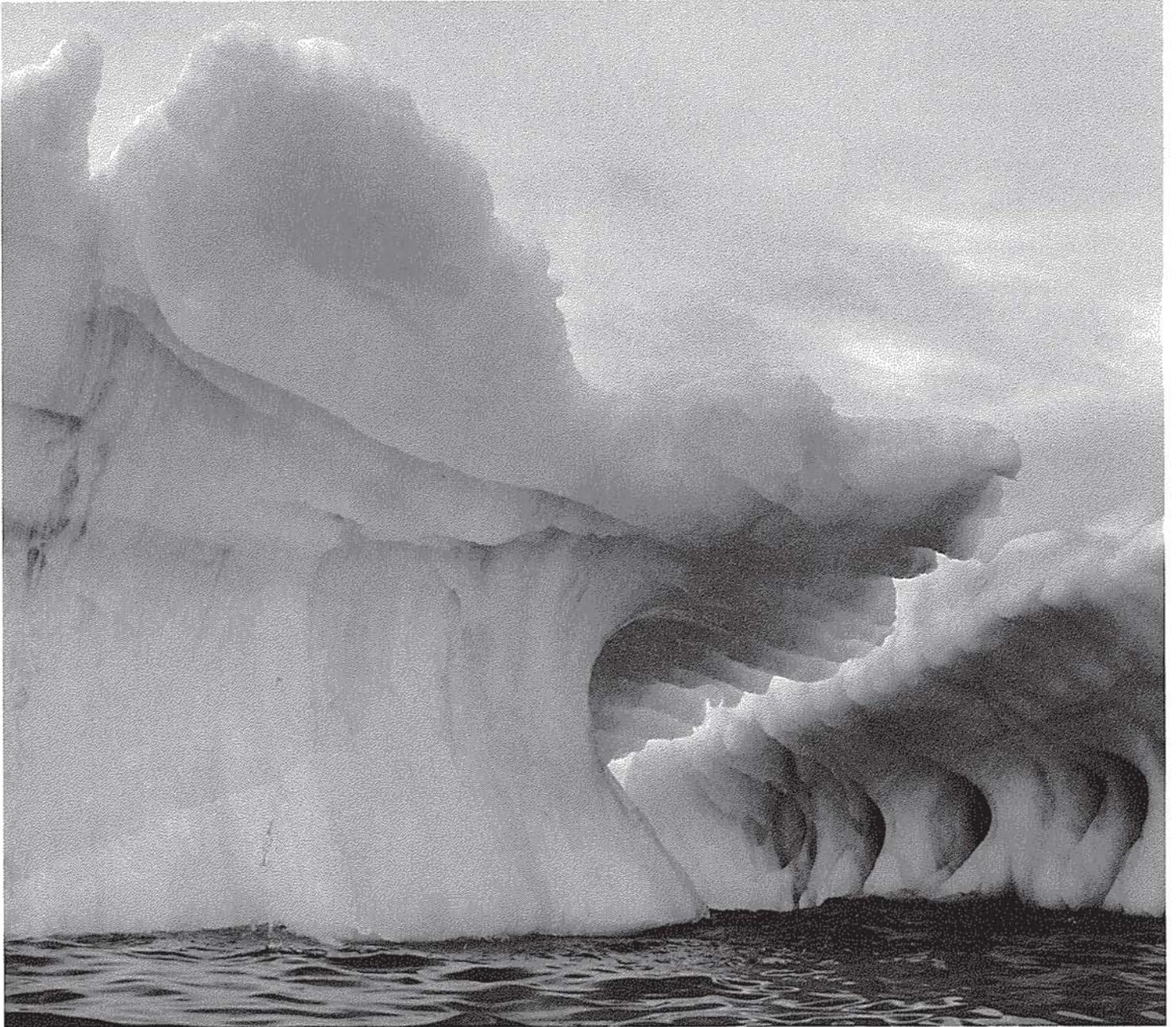


BILLIONAIRE



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BEDROOM, BATHROOM AND EXTERIOR OF THE EGGHOMES HINCASTER DEVELOPMENT NEAR THE LAKE DISTRICT



LIVING

Flash Forward

Soon, the house you live in could produce the energy that powers your life.

by Tara Loader Wilkinson

IMAGINE A TIME WHEN YOUR house could operate entirely off the grid. Energy bills would be a thing of the past; your water, gas and electricity would all be homemade. In fact, your home would be so efficient it would produce surplus energy — effectively becoming a mini-power station. It would go from being carbon neutral, to carbon negative.

That time is sooner than you think.

The first carbon-negative homes are now being constructed. These super-sustainable properties, which generate more energy than they consume, can be powered via onsite renewable energy sources such as solar cells on the roof, or wind energy in the garden. Optimising natural light and natural ventilation reduces energy consumption, while the homes are constructed with recycled or recyclable materials. They produce more energy than they take to run, and are set up to channel the surplus back to governments.

The term ‘carbon negative’ was coined by architect Jason Pomeroy in 2008. He built his carbon-negative prototype B House in Singapore two years ago. He came up with the idea after realising that as fossil fuels continue to deplete, pressure to seek alternative renewable energy sources will increase. Coupled with government legislation and global

climate-change conferences such as COP21, an increasingly greener-built environment is a ‘when,’ not an ‘if.’ “Half of our global carbon emissions come from the built environment,” says Pomeroy. “It is those who are embracing the concept early who are reaping the benefits.”

Constructing carbon-negative homes is no more expensive than standard ones, says Pomeroy. In the Philippines, Pomeroy Studio is creating a large zero-carbon community. The average construction cost of a three-bedroom detached house there is US\$30,000.

Of course, for a home to be carbon negative it also means a change in behaviour of inhabitants’ day-to-day existence. A carbon-negative home run by a family who don’t recycle and use three diesel-powered cars, is not carbon negative. But, in practical terms, solar energy can easily power a low-energy home, while efficient heating and insulation can substantially reduce the need for energy.

Here, *Billionaire* looks at the pioneers creating the carbon-negative home of the future.

Heating

The heating systems of our homes are often the biggest drain of energy. Last year Huf Haus, a British sustainable

Eat Your Greens

If you live in the countryside or have access to a fertile plot of land, keeping your food's carbon footprint down is relatively straightforward. But with more than half the world living in urban areas, food consumption is one of the biggest problems facing the planet's future. Around 38 percent of the world's land mass is arable land, much of which was previously forests. Loss of trees to soak up CO₂ is one of the major factors in global warming, while just 1kg of garden vegetables takes 300 litres of water to grow. Food from supermarkets may have flown thousands of miles to get to your shopping basket. Then there is food wastage in restaurants, homes and shops, which some estimates put as high as a heart-breaking 50 percent.

Beijing-based startup Alesca Life is addressing these problems by developing an urban farming solution for homes. The EDN Fresh is the height of a narrow fridge with a dozen closely stacked shelves, designed to fit into most kitchens. In a streamlined metal, acrylic and glass fridge you can grow salad vegetables such as tomatoes, cucumbers, kale and microgreens, strawberries, herbs and wheatgrass, using a hydroponic nutrient solution, free from chemicals and pesticides. Grown under LED lights using an automated app, city dwellers can harvest their fresh fruit and vegetables as and when they wish, reducing food wastage and carbon footprint.

construction company, built a prototype house in Surrey to operate off the grid. The house is powered by its surroundings, drawing on sunlight, air and soil, dispensing with the need for fossil fuels. Its pièce de résistance is the heating system that uses ice to heat the house with an underground ice-storage tank. By harvesting the energy generated when ice turns to water, the house can be heated and cooled on demand, and will never receive an energy bill.

Insulation

Superinsulation, which dramatically reduces heat loss by using much higher levels of insulation and airtightness than normal, is a major factor in making a home carbon negative, says architect Alex Michaelis, a founding member of the Energy Island Group and co-founder of Michaelis Boyd. "Superinsulation combined with very low-power lighting can make carbon negative achievable," he explains. He recently built a revolutionary holiday home for himself in Cornwall, using superinsulation, solar panels and low-wattage lighting powered by the sun. To harness natural energy from the bottom up, there is a source heat pump built into the ground. He planted a living grass roof — effectively a wild meadow — over the top of the house for insulation and aesthetics.

Solar power

Photovoltaic panels, if positioned on a south-facing roof in a sunny climate, are guaranteed to generate more electricity than a low energy-consuming house requires, according to Huf Haus. And now, even your windows can be energy producers. In 2014, researchers at Michigan State University

created a fully transparent solar concentrator, which could turn any window or sheet of glass (even a smartphone's screen) into a photovoltaic solar cell. The surplus energy credit could be used to power anything from fridges to phones to an electric car. An MIT start-up called Ubiquitous Energy is currently producing prototypes for first applications in mobile and distributed electronics.

Water

In the UK, not-for-profit housing provider Four Housing Group created the UK's first carbon-negative community: Sinclair Meadows. Among other zero-carbon features, the 21 timber houses have a rainwater harvesting system, channelling rain from roofs of properties to be stored in underground tanks. This water is then used in the toilets, as well as for gardening, to reduce the amount of mains water used.

Construction

Eco-cynics argue that even if a home has no carbon footprint, it still takes a lot of energy and waste to construct. But if builders were incentivised to reuse old materials and banned from demolition, this would be substantially reduced, says Michaelis. "Some developers are concerned with the environmental impact of development, which is great to see. However, I think it should be enforced through regulations and encouraged through grants, subsidies and money-back systems, as opposed to the half-baked measures that have made governments look good in the past."

EggHomes is one UK developer which is making its build process green, making sure that it recycles as much waste as possible. When it sends waste away it brings something back on the same run in order to reduce unnecessary trips. Car share opportunities have been created with local tradesman and as a result - and also due to the high efficiency of the build — eggHomes says it will save thousands of tonnes of CO₂ emissions. ◇

THE CARBON NEGATIVE B HOUSE IN SINGAPORE, BY POMEROY STUDIO (PHOTO CREDIT: ROBERT SUCH)

