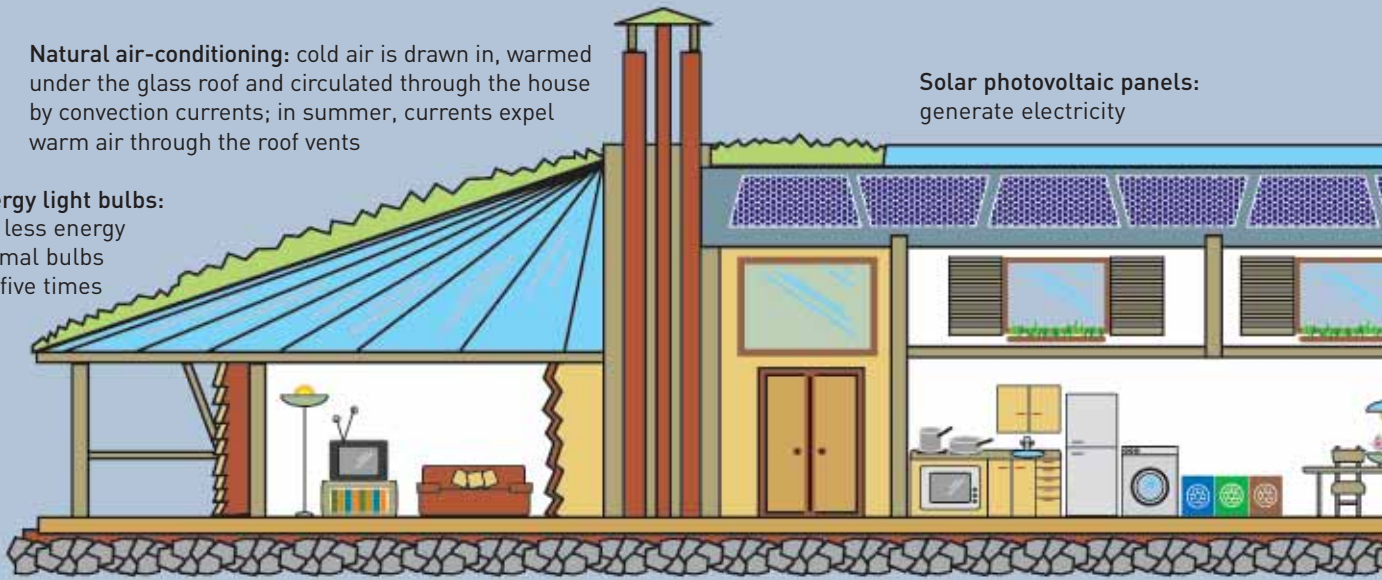


**Natural air-conditioning:** cold air is drawn in, warmed under the glass roof and circulated through the house by convection currents; in summer, currents expel warm air through the roof vents

**Solar photovoltaic panels:** generate electricity

**Low-energy light bulbs:** use 70% less energy than normal bulbs and last five times as long



**Drystone foundations:** save tonnes of sand, gravel and cement

**Wooden furniture:** sourced from sustainably managed forests

**Non-toxic paints:** environmentally benign in production and use

**Self-closing aerating taps:** to reduce water use and soften incoming water

**Low-energy kitchen appliances:** especially important for fridges because they are in constant use

## From energy eater to green machine

**Homes guzzle energy. But they could produce it. They are now the consumers of up to a quarter of all the energy used in developed countries – and even more in developing ones – but can instead become generators of green power, effectively becoming mini power stations.**

Architects are designing more sustainable buildings all over the world, while governments are demanding

better energy performance. In Sweden the Government intends to phase out the use of fossil fuels in home heating completely by 2020, while one of the first measures taken by the new German Government was to announce that all old housing was to be systematically brought up to modern standards of energy efficiency. And in many African and Asian communities, sustainable housing is the norm.

This house – designed by Jiří Vaculík from the Czech Republic – is carbon positive because it produces more energy than it consumes. And an increasing number of designs are doing the same thing worldwide, getting their energy from such sources as solar photovoltaic panels, wind turbines, ground source heat pumps and biogas digesters.

A ground source heat pump delivers 5 to 10 times as much energy

**Wind turbine generates electricity:** surplus energy can be fed into the electricity grid for use by others

**Skylights:** to make use of natural light

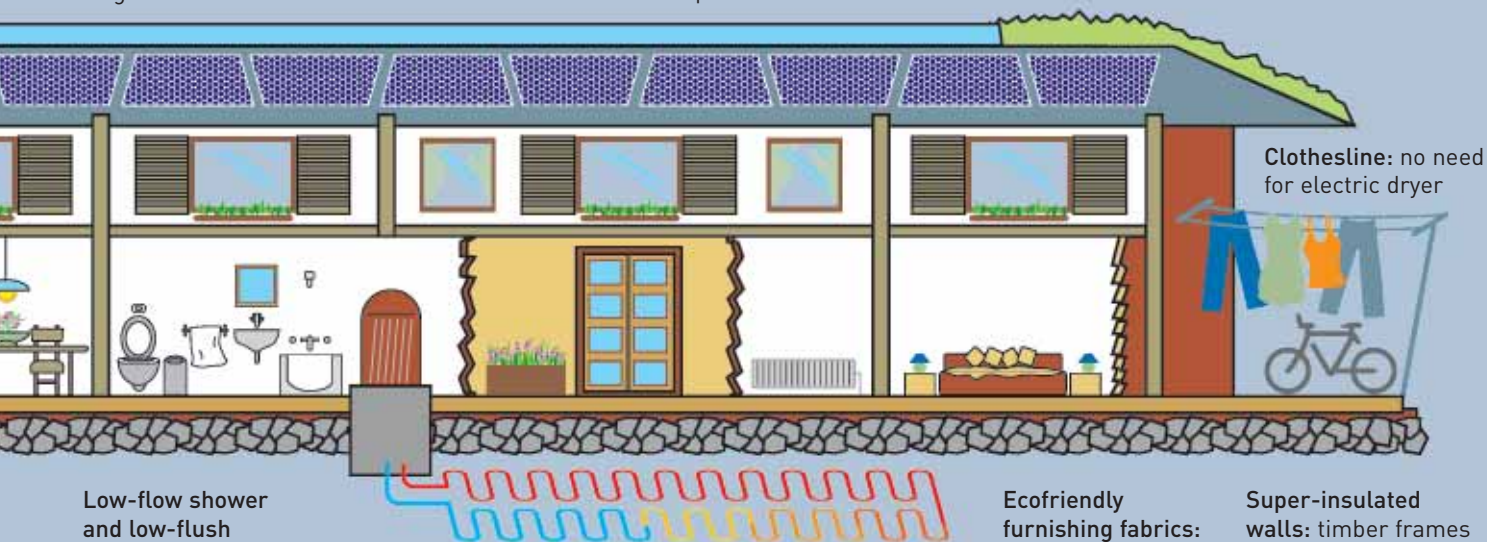
**Compost heaps:** to break down organic waste from the house

**Reed bed:** for organic treatment of sewage and waste water

**Garden:** fruits and vegetables for household

**Rainwater harvesting:** water from roof collects in a large tank for household and garden use

**Triple-glazed windows:** prevent heat loss



**Low-flow shower and low-flush lavatory:** reduce water consumption

**Ground source heat pump:** pipes filled with liquid make use of constant underground temperatures, drawing warmth in winter and cooling the house in summer

**Ecofriendly furnishing fabrics:** sustainably produced organic cotton

**Super-insulated walls:** timber frames infilled with straw to minimize heat loss

as the compressor needs to create it – energy freely available from just a metre underground. A biogas digester makes use of organic waste: 20 cows produce enough manure to cook a family's food and heat their water. Wind turbines and solar panels are not cheap to install, but they can pay for themselves in a decade, especially if, as in many countries, the extra electricity generated can be sold back to the grid, running meters backwards. And as more are produced and installed, they will become cheaper.

But the most important thing – for both carbon-positive and conventional homes – is to make sure that as little energy is wasted as possible. That means insulating roofs, walls and windows. Millions upon millions of families waste money heating the sky, because they do not have enough insulation in their lofts: efficient and environmentally friendly insulating materials include recycled newspapers, straw and sheep's wool. Cavity wall insulation is the next most important measure for houses that require it, while

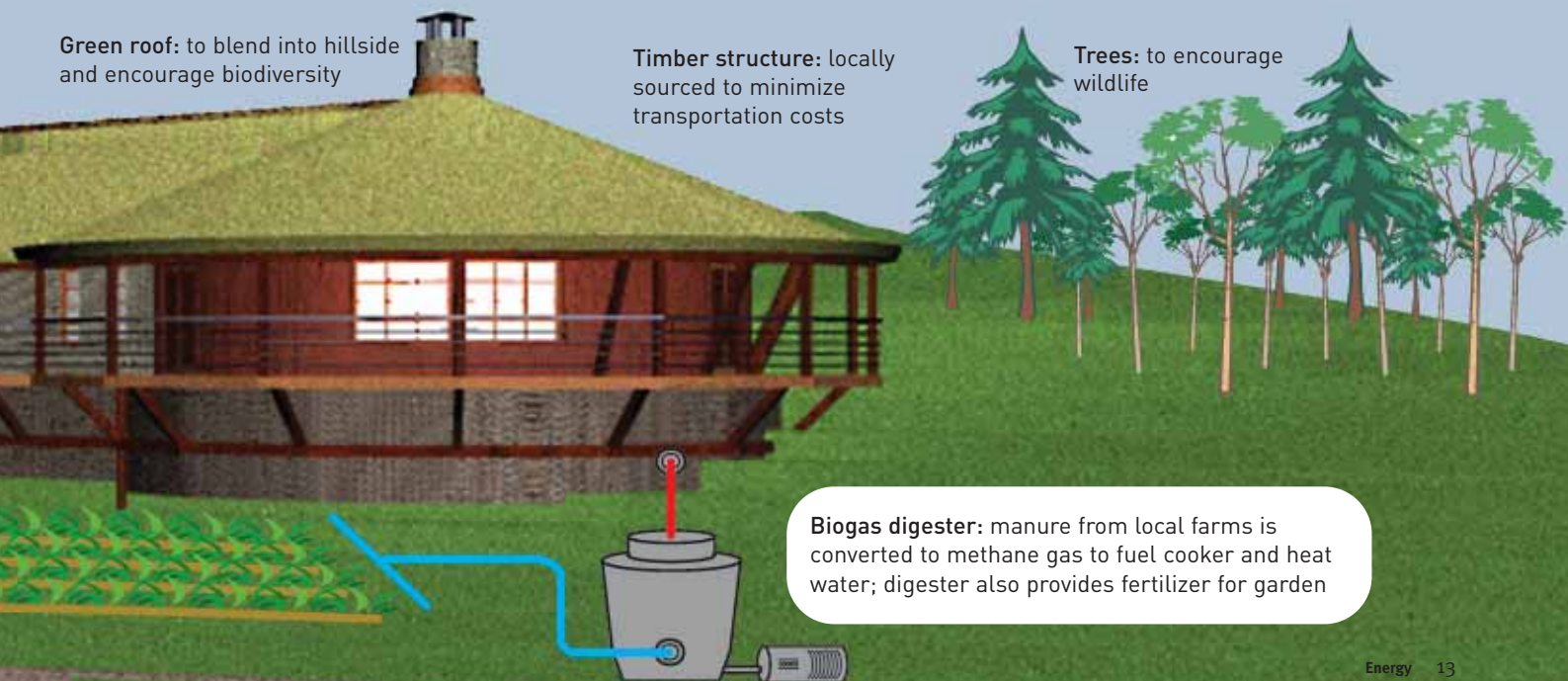
double or triple glazing can reduce heat loss from windows and skylights by as much as 50 per cent. And new combined heat and power boilers will generate electricity and heat the house and its water from the same fuel at the same time, making great savings.

Not everyone can live in the growing numbers of carbon-positive homes. But everyone can make a contribution by cutting back heavily on energy waste and, increasingly, by getting both heat and electricity from renewable sources.

**Green roof:** to blend into hillside and encourage biodiversity

**Timber structure:** locally sourced to minimize transportation costs

**Trees:** to encourage wildlife



**Biogas digester:** manure from local farms is converted to methane gas to fuel cooker and heat water; digester also provides fertilizer for garden