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Zero-energy building

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Zero Energy Buildings

A **zero energy building** (ZEB) or net zero energy building is a general term applied to a building with zero net energy consumption and zero carbon emissions, calculated over a period of time. Zero energy buildings usually use less energy than traditional buildings, as well as generating their own energy on site to use in the building, hence many are independent from the national (electricity) grid. They are in response to ever more stringent environmental standards, both regulatory and voluntary, introduced to address the increasingly significant environmental issues around such as climate change, resources, pollution, ecology and population. Many people in developing countries (and elsewhere) already live in zero-energy buildings out of necessity, including huts, tents and caves exposed to temperature extremes and without access to electricity. The energy in the building can be measured in many ways (e.g. cost, energy, or carbon emissions) and different views exist on the relative importance of energy production and energy conservation in achieving a net energy balance.

In the UK, the government set out a target for all new homes to be zero carbon (i.e. energy) from 2016, with a progressive tightening of the energy efficiency building regulations by 25% in 2010 and by 44% in 2013. Wide debate still exists however, regarding the definition of zero carbon, particularly around the eligibility of 'off-site renewables'. The UK Code for Sustainable Homes (CfSH) was launched in 2006, which has since become the most significant policy framework for reducing energy and environmental sustainability in housebuilding. The method is based on BRE's EcoHomes version of the BREEAM methodology adapted to relate closely to Building Regulations and government policy (see www.breeam.org). The method sets mandatory minimum standards against energy, water, construction and household waste, materials and lifetime homes that relate to key government targets and policies. It has six levels, and since 2007, Level 6 has required a net zero carbon (energy) solution. The CfSH assesses the sustainability of a home by awarding points in nine design categories, including:

- energy and carbon dioxide (including insulation, electric lighting, heating, domestic appliances)
- materials (responsible sourcing of construction and finishing elements)
- ecology (protection or enhancement of site habitats)
- waste (household recycling facilities, site waste management, composting facilities)
- pollution
- health (specific room daylight factors, sound insulation, Lifetime Homes)
- water (internal and external potable water consumption)
- surface water run-off
- management (Home User Guide, site information, Considerate Constructors Scheme).

The UK government recommends a three step approach to reaching the zero carbon homes standard, based on:

- a high level of energy efficiency in the fabric and design of the dwelling
- 'carbon compliance' – a minimum level of carbon reduction to be achieved from on-site technologies (including directly connected heat networks) and
- 'allowable solutions' – a range of measures available for achieving zero carbon beyond the minimum carbon compliance requirements

Energy generation for ZEBs

ZEBs need to produce their own energy on site to meet their electricity and heating or cooling needs. Various microgeneration technologies may be used to provide heat and electricity to the building, including:

- solar: solar hot water, photovoltaics (PV),
- wind: wind turbines,
- biomass: heaters/stoves, boilers, and community heating schemes,
- combined heat and power (CHP) and micro CHP for use with the following fuels: natural gas biomass sewerage gas and other biogases,
- community heating, including utilising waste heat from large scale power generation,
- heat pumps: Air source (ASHPs) and ground source (GSHP), and geothermal heating systems,
- water: Small scale hydro power,
- other e.g. fuel cells using hydrogen generated from any of the above ‘renewable’ sources.

Many housebuilders have serious concerns about whether microgeneration and renewable energy technologies can deliver the energy generation requirements to produce adequate working, cost-effective ZEBs. Builders fear that owners and occupiers may not accept the required new technologies and could choose to retrofit energy intensive appliances and systems, which would ultimately undermine the zero energy objectives. There are further concerns that failure to maintain the new systems and technologies adequately may expose owners and occupiers to health and safety risks.

Home Energy Rating

A Home Energy Rating (or HERS) is a measurement of a home’s energy efficiency, used primarily in the United States. HERS Ratings make use of a relative energy-use index called the HERS Index – a HERS Index of 100 represents the energy use of the “American Standard Building” and an Index of zero indicates that the proposed building uses no net purchased energy (a Zero Energy Building). Other countries also have similar schemes -in Australia it is known as the House Energy Rating and is based upon a 5 star rating and in the UK the Energy Performance Certificates have a rating from A to G. HERS provide a standardized evaluation of a home's energy efficiency and expected energy costs. The evaluation is conducted in accordance with uniform standards and includes a detailed home energy use assessment, conducted by a state-certified assessor, using a suite of nationally-accredited procedures and software tools. The rating can be used to judge the current energy efficiency of a home or to estimate the efficiency of a home that is being built or refurbished. The U.S. Department of Energy recommended Home Energy Ratings report will typically contain:

- *Overall Rating Score* of the house
- Recommended cost-effective energy modifications
- Estimates of the cost, annual savings, and useful projected life of the modifications
- The potential *Improved Rating Score* after the installation of recommended modifications
- The estimated projected annual energy costs for the existing home, before and after the modifications

The UK Energy Performance Certificates (EPC) Scheme

EPCs are required in England and Wales for domestic properties with three or more bedrooms. Rental properties, which have a certificate valid for 10 years, have been required on new tenancies after 2008. Display Energy Certificates (DECs) are also required for larger public buildings, thus enabling everyone to see how energy efficient the countries public buildings are. The DEC has to be displayed at all times in a prominent place clearly visible to the public - and they are accompanied by an Advisory Report that lists cost effective measures to improve the energy rating of the building. The introduction of EPCs has been controversial however, and has been opposed by many in the UK housing industry, such as the Royal Institute of Chartered Surveyors.

See Also:

Appliances (Energy Efficient), Green building materials, Micro-generation, Sustainable design

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