Smart energy management

The AusZEH demonstration house has been fitted with a unique Home Energy Management System (HEMS) which tracks energy and water use and supply.

The HEMS, developed by La Trobe University in partnership with CSIRO, reduces household GHG emission by empowering the occupants to become more aware of their energy use and take action to minimise their household carbon footprint.

All energy and water usage information is displayed in the house on a touch-screen that can be accessed remotely via the internet or a mobile phone.

Through the touch-screen, occupants can see at-a-glance how much energy is being used in different areas of the house, or by individual appliances

Lighting, air-conditioning and other appliances are also able to be controlled through the touch-screen.

Linked to the on-site weather systems, the HEMS also displays the local weather conditions and tracks the amount of energy generated by the rooftop solar panels and compares this against energy consumption.

The HEMS can also estimate and display energy, cost and emission savings from a range of energy-saving options, such as reducing stand-by power, or through more effective usage of heating, cooling and lighting systems in the house.

It can provide customised reports of power consumption for different timescales, household appliances and zones and transmit this information in regular updates to the householder's mobile phone..

Smart and Future-Ready

The system can intelligently control the main energy consuming devices in the home.

It is able to automatically switch devices on and off according to a variety of operating schedules. For example, the HEMS can automatically switch off stand-by power in different parts of the house at a specified time of the day.

Importantly, the system has been designed with the flexibility to allow future technology to be added. For example, it has the capacity to integrate a plug-in electric vehicle in to the home energy system.

It has also been designed to adapt to future innovations in Australian's evolving electricity network.

The system is 'smart grid' compatible and has been linked to smart meters to measure the energy flow into an out of the house.

The HEMS allows the occupants of the house to monitor and control:

- power used by individual appliances
- stand-by power usage
- power generated by the on-site solar panels
- power drawn from the grid
- water drawn from the mains
- water drawn from on-site rainwater storage
- greenhouse gas emission
- electricity costs and potential savings.

This information can also be viewed over the internet and/or sent to a mobile phone

A house, a home … and a laboratory

The AusZEH demonstration house will be occupied by an Australian family for a year and CSIRO will monitor the energy and water use, and GHG emissions over this time.

Through the HEMS, detailed information will be collected on energy generation, consumption and storage and will be used to follow the energy flows and actual emission performance of the occupied house.

The performance of the AusZEH will be evaluated against other homes within the Laurimar development to provide measurable, comparable information on the success of the project and help to identify key areas for further development.

The AusZEH Consortium

The AusZEH demonstration house is a collaborative demonstration project from the CSIRO, Delfin Lend Lease, Henley Property Group, Sustainability Victoria and the Victorian Department of Human Services.

This partnership has been forged through the AusZEH consortium, whose membership includes CSIRO, Delfin Lend Lease, Henley Property Group, Telstra, SP AusNet, La Trobe University, Sustainability Victoria and the Victorian Department of Human Services.

Visit the AusZEH demonstration house

The AusZEH demonstration house is located in the Harrisons View display village in the residential development of Laurimar in Doreen, 30 kilometres north of Melbourne CBD.

The house is open to the public for inspection from May - September 2010.

Street address: 40 Mable Street, Laurimar in Doreen, Victoria
Melways Ref: 391 C5
Approx 50 mins from the city.

Contact Us
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Zero Emission House

Energy Transformed Research Flagship

CSIRO's Zero Emission House project is researching ways to bring about a dramatic and significant reduction in greenhouse gas emissions in Australian housing and mitigate the adverse impacts of a changing climate.

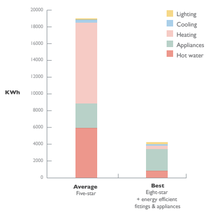
CSIRO is working with a consortium of industry and government partners, through the Australian Zero Emission House project to assess how significant cuts in greenhouse gas emissions can be achieved in residential housing.

Home energy and emissions

Energy use in buildings is responsible for 26 per cent of Australia's greenhouse gas (GHG) emissions and is the primary cause of peak energy demand on the electricity network. Nearly half of these emissions are produced from energy used in homes.

Most Australian households rely heavily on electricity for air conditioning, lighting and running other domestic appliances. This electricity is often generated from carbon intensive, high emission energy sources such as coal-fired power stations.

Annual Energy Consumption



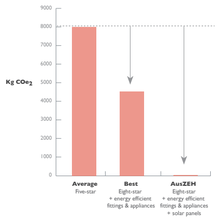
> The annual energy consumption for an average five-star rated house in Melbourne (left bar) compared to an highly energy efficient eight-star rated house (right bar) complete with energy efficient appliances and fittings, like the AusZEH, shows that smart building design and increased energy efficiency can reduce household energy use by more than 70 per cent.

Impact of zero emission housing

The residential housing market in Australia continues to grow. Between 1990 and 2020 the number of households is forecast to increase by 61 per cent, from six million to almost 10 million [1].

CSIRO scientists estimate that if all the new housing built in Australia between 2011 and 2020 were zero emission houses, 63 million tons of GHG emissions would be saved. This would be equivalent to taking all of Australia's private cars off the road for 2 years and 237 days[2] ; or closing all Australia's power stations for up to 100 days[3] .

Greenhouse Gas Emission



> Comparison of greenhouse gas emissions for an average five-star rated house in Melbourne (left bar), a highly energy efficient eight-star rated house complete with energy efficient appliances and fittings (centre bar) and the AusZEH demonstration house (right bar).

"Using less energy can significantly reduce GHG emissions and using energy from a clean, renewable energy source, such as solar or wind, can reduce GHG emissions to zero."

1 "Energy use in the Australian residential sector 1986-2020", (2008) Department of Environment, Water, Heritage and the Arts
2 Calculation based on fuel consumption of average Australian car (9.3L/100km) driven 20,000 km/year, producing 4,420 kg CO_2-e (source: Department of Transport and Regional Services 2009); and the total number of household car equalling 5,122,760 (source: ABS census data, 2006)
3 Calculation based on current estimate of total carbon emissions generated for all Australian power stations (223.88 Mt CO_2-e) annually (source: Carbon monitor for action, http://carma.org).

The Australian zero emission house project

CSIRO's Energy Transformed Flagship initiated the Australian Zero Emission House (AusZEH) project to demonstrate and evaluate how low carbon housing can be achieved in Australia to reduce GHG emissions from the housing sector and create a more sustainable future for the nation.

The AusZEH demonstration house

One of the aims of the project was to design and build an affordable zero emission house - a house that produces enough clean, 'zero emission' renewable energy to supply all the operating energy needs of a typical household – which is suited to the Australian climate, lifestyle and targeted to the volume housing market.

CSIRO, working alongside leading industry partners, Delfin-Lend Lease and Henley Property Group, and supported by the AusZEH consortium, have designed and built the first AusZEH demonstration house, 30 kilometres north of Melbourne CBD, in the community of Laurimar, Victoria.

The eight-star energy efficiency rated house showcases off-the-shelf building and renewable energy generation technologies, and new future-ready energy management technologies, matched to meet the design requirements for its location, and the budget of a typical middle income Australian family.

The operating house achieves zero GHG emission status through a combination of energy efficiency and demand reduction measures, on-site renewable energy supply from solar panels situated on the roof and the application of a home energy management system.

The 'embodied carbon' – or the amount of GHG emissions associated with the energy used in the manufacture of all the materials used in the house, including its construction – has been calculated and neutralised via carbon offsets.

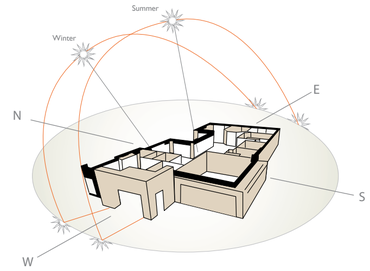
This approach ensures the AusZEH demonstration house is the first house of its kind in Australia to have a carbon-neutral life cycle footprint.

AusZEH
Australian Zero Emission House

AusZEH features

- 6 kW solar panel array mounted on the roof for on-site electricity generation
- optimised building envelope design specific for the Victorian climate
- high-efficiency appliances
- smart meters and an integrated energy management and monitoring system
- high efficiency reverse cycle heating and cooling system
- high efficiency solar hot water system
- rain water tanks for toilet flushing
- grey water recycling system.

Designing a zero emission house



The AusZEH demonstration house was designed by Henley Property Group, in consultation with CSIRO and Delfin Lend Lease.

The idea was to take an 'average' Australian house - four bedroom, two bathroom, double garage - and design and build it in such a way that it was highly energy efficient and capable of generating all the energy required on-site from a clean, zero emission, renewable energy source.

The design considered the orientation of the land, climate of the location, types of building materials available, and the appliances and fittings required to satisfy the lifestyle of a typical Australian family.

The overall specification considered:

- insulation levels
- window requirements
- lighting systems
- electrical layout
- heating/cooling system
- hot water system
- domestic appliances.

The initial design was further refined by CSIRO's AccuRate software, an energy rating system which uses computer simulations to assess the heating and cooling energy efficiency of residential building designs.

The choice of building material, the house orientation and the choice of fittings and appliances were modelled to determine the energy performance and cost of different design options.

The final house design reflects the optimal balance between energy performance and price.

From this design, the predicted total operating energy usage for the household was calculated using new AusZEH Design software. This determined the size of the solar panels required, which supply most of the electricity to meet the demand of the household.

AusZEH Design software

CSIRO has developed AusZEH Design software to help make informed design decisions towards a target GHG emissions reduction level before construction.

AusZEH Design incorporates an energy rating software system that uses computer simulations to assess the energy efficiency of residential building designs based on the orientation and choice of building envelope system and building materials.

The program is also able to model the heating and cooling system, the hot water system,and the fittings and appliances to determine the energy efficiency of different design options.

AusZEH Design software can then calculate how much energy the home will need and match this demand with the best renewable energy supply.

Three steps to a zero emission home

1. Design an energy efficient building

- Consider the orientation of the house and climate of the location.
- Choose a design which makes efficient use of space, and takes advantage of the natural environment yet shields from seasonal temperature variations.
- Decide the level of insulation required and evaluate the energy performance of different types of building envelope systems, including doors, windows and other openings.
- Chose energy efficient appliances and fittings.

2. Calculate energy usage

- Determine the total energy required to run the house during different seasons. This includes energy for heating and cooling, lighting, hot water and running appliances.
- Consider your particular household's occupancy pattern. For example, a house occupied by an adult and two children during the day plus an additional adult during the night will have a different energy profile than a house only occupied during the night and weekend.

3. Match energy needs with renewable, zero emission energy supply

- Match the total energy use from the house with the appropriate size renewable, zero emission energy generation system to meet your energy needs.