Daan Santa Barbara Gardens
Zero Energy Ready Houses
Shanghai, China

Description

Daan Santa Barbara Gardens is a large community of new housing in Shanghai, China. Over 20 Super E® houses, including the first Super E® house built in China, are currently built and occupied. Small changes in the designs of these building are being made to upgrade new units in the development to zero energy ready.

A zero energy ready house is defined as, “A highly energy efficient house that is prepared for the easy retrofit of alternative (renewable) energy sources to create a house that produces as much energy as it uses.”

Setting

Shanghai is the largest city in the world by population, and large track housing developments such as Santa Barbara Gardens, are common. The city is located on the Yangtze River delta on China’s eastern coast and has a humid sub-tropical climate. Winters are chilly and damp, with cold Siberian winds sometimes dropping the temperatures down below zero. Summers are hot and humid, with frequent sudden thunderstorms.

Super E® Chinese Member

Shanghai Daan was one of the original Chinese companies that committed to building Super E® projects in China. The overall developer of the giant Santa Barbara Gardens (also known as Daan Gardens) in Shanghai, Daan has built over 20 Super E® homes, including single-family and terrace housing projects.

Super E® Canadian Member

Insightful Healthy Homes Inc. is a Vancouver-based builder/designer of energy efficient and healthy homes. The first Canadian Super E® member to be active in China, Insightful is led by Arthur Lo, a house designer and project manager.

Member Commentary

The idea of building a house to later accommodate renewable energy (particularly rooftop solar water systems which require piping to the roof) is not new. But the concept of making a house easily retrofitted for zero energy is new.

Super E® Member Arthur Lo preparing a ventilation balancing test with a newly-installed ERV.

“The real question is how ‘ready’ does zero energy ready have to be,” said Arthur Lo of Insightful.

To answer the question, Insightful, assisted by Daan, the Asia Pacific Partnership, the Super E® Office, Environment Canada and CMHC International, drew together experts in Canada and China for a full-day round table discussion, better known by architects as an Integrated Design Charrette.

“Basically, at the design stage, you start at zero energy and work backwards,” he said. “It is a matter of taking things out to bring the features of the house in line with the budget. At some point in the future, the assumption is, the homeowner will add the renewable energy systems to bring the house to zero energy. Zero energy ready gives the homeowner the plan in advance.”

House Performance

In theory, the house will someday have an energy footprint of 0 kWh/m2/yr. With the features added to the house, total house energy consumption was slightly less than 7,000 kWh/yr. This prescribes the size of solar panel that will be required by the house down the road when the system is added.

The Super E® homes in the same neighbourhood with the same layout consume slightly more than this.

Most of the Super E® homes in Daan Gardens are terraced housing. The zero energy ready homes will look much like the Super E® homes pictured above, but the roof lines will be different to take advantage of solar shading and natural ventilation.

Unique Features

The designers of the house started by putting everything into the design required to have the house attain zero energy. Then, these features were divided into: things that the house must have; things that are optional, but a zero energy house should have; and, things it would be nice to have.

The “nice to have” list, which the house does not contain, are: drain water heat recovery, a central thermal solar storage system, and electricity storage – either a fuel cell or a battery.

In many markets, it is correct to speak of “net” zero houses, where solar electricity generated during the day is sold to the electricity grid, and electricity is drawn from the grid at night. This is not possible in China, where there is no two-way grid. Some kind of electricity storage would be required for this home, but it was not economical to add it.

The “should list” items which were included were a solar water heater and motion sensor controlled lighting. The “should” item that was not included was a green roof.

“Must haves” included architectural design changes to take full advantage of the sun for interior daytime lighting, and a house design maximizing natural ventilation. Increased air tightness measures mean this house should test at 1.0 air changes per hour. Higher levels of insulation and high performance windows were also added. There is an energy recovery ventilator installed, which uses a low-energy motor. Low flow toilets, shower heads and faucets are installed. The home also comes with Energy Star rated appliances and a whole-house electricity kill switch. The home is also equipped with a “centralized utility facility,” which includes provision for installation of equipment required if a two-way grid system became available, pre-wiring for a rooftop PV system, and a ground source heat pump, primarily for house cooling.

Services Provided by Super E®

Significant funding assistance was provided by the Asia Pacific Partnership through Environment Canada. This paid for some of the design work involved. CMHC International participated in the Integrated Design Charrette and the Super E® Office facilitated the charrette. As a result of this project, zero energy ready housing is much better defined. The steps to building a net zero house are:

1. Site assessment
2. Preliminary design
3. Model energy performance
4. Optimize envelope
5. Optimize passive solar
6. Reduce DHW load
7. Reduce lighting and appliance loads. Examine, model renewable options
8. Choose renewable options (if any)
9. Size PV to meet remaining demand
10. Develop an energy management strategy
11. Finish detailed architectural and system design