



AFFORDABLE ZERO ENERGY HOME CONSTRUCTION & DESIGN IN 12 Steps

Extremely Energy Efficient Homes

Building and designing affordable zero energy homes – the ultimate in energy efficiency – involves 12 integrated steps that utilize commonly available building materials and equipment along with easy-to-learn building strategies. By following these steps, you can build a new home that is [affordable to build](#) and [cost less to own](#).

1. Start with Smart Design

Cost-effective zero net energy homes begin with smart design. Designers and architects, as well as builders, should be familiar with all the steps involved in energy efficiency and building a net zero home, and should design the home so that builders and subcontractors can implement these steps as cost-effectively as possible. There are several design parameters to which builders should ask designers to pay special attention. Detailed communication between the builder and designer will ensure that these critical details don't fall through the cracks.

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2. Use Energy Modeling

During the design phase, the home's energy use should be estimated using energy modeling software to ensure that the goal of net zero energy can be achieved while keeping costs down. Based on the results, design choices can be made or modified to balance building performance and construction cost.

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3. Super-Seal the Building Envelope

Super-sealing the building envelope is the single most cost-effective measure builders can take to improve the energy efficiency of a zero energy home. Several proven, air-sealing approaches are available. Choose an approach that matches your climate, skills and budget.

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4. Super-Insulate the Building Envelope

After making the house airtight, super insulating the house may be the second most cost-effective strategy for creating a zero energy home. Energy modeling, as mentioned in step 2, above, can help you optimize the insulation levels for the ceiling, walls and floors. Select framing strategies that make it easier to insulate the building envelope and minimize thermal bridging.

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5. Heat Water Wisely

Water heating is often the largest energy expense in a zero energy home after heating and cooling. So it is important for designers and builders to select and locate efficient hot water heating technology, along with other measures, to minimize hot water use.

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6. Use Highly Insulated Windows and Doors

Windows and doors are like big energy holes in a well insulated, airtight building envelope and are the third most cost-effective strategy for making a home energy efficient. Control window and door heat loss and gain by selecting appropriate window and door products, carefully locating them, and optimizing their size and orientation.

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7. Use the Sun for Solar Tempering

Using the sun for heating through south facing windows during the winter lowers heating costs. Shading those same windows in summer lowers cooling costs. Solar tempering aims to optimize this passive use of the sun's heat, without incurring the added cost of thermal mass needed to achieve maximum passive solar heating.

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8. Create an Energy Efficient, Fresh Air Supply

Since zero energy homes are so airtight, a continuous source of fresh filtered air and moisture control are critical to its success. This need for ventilation has a silver lining: zero energy homes are healthier and more comfortable than standard homes. Highly energy efficient ventilation systems, known as heat recovery ventilation (HRV) systems or energy recovery ventilation (ERV) systems expel stale air while recovering its heat and returning that same heat to the home with the fresh air.

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9. Select an Energy Efficient Heating and Cooling System

Highly-efficient, cost-effective, heating and cooling systems are essential to meeting the net zero energy goal. One good choice is an air source ductless heat pump, also called a mini-split heat pump. These systems are highly energy efficient and don't have the shortcomings of central, forced-air systems or the high costs of thermal heat pumps.

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10. Install Energy Efficient Lighting

Minimizing energy use for lighting, while optimizing light for residents, is an important feature of zero energy homes. LED lights are the perfect match for these tasks. They are more energy efficient than CFLs, last many years longer, and contain no mercury. In addition, they can meet a variety of lighting needs from very bright white light to soft, warm light. Selecting the right LED lights for the task, locating lights strategically, and utilizing natural light as effectively as possible can drastically reduce a home's energy use.

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11. Select Energy Efficient Appliances and Electronics

In a typical zero energy home just over 40% of the home's energy use is accounted for by heating, cooling and hot water, while appliances and plug loads may account for up to 60% of the load. Thus, selecting energy efficient appliances and managing "phantom" plug loads for electronics is essential. "Phantom" loads are hard to find and continue to draw energy unseen, day and night whether or not the devices are being used. Several homes that were modeled and built to zero energy standards have ended up not meeting zero energy requirements in practice because of the unanticipated energy waste caused by "phantom" plug loads on electronics.

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12. Use the Sun for Renewable Energy

Grid-tied solar photovoltaic (PV) panels currently provide the most cost-effective form of renewable energy for a zero energy home. They can power all the energy needs of a home including lighting, heating and cooling systems, appliances and hot water. However, they are the most expensive component of a zero energy home and strategies for reducing or mitigating those costs are important to consider.

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Guidelines for Warmer Climates

While thick layers of insulation get most of the attention in cold climates, insulation needs less emphasis in warm climates. There are several other issues that would be treated differently in warm climates.

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