

Transformations, Inc.
Devens Sustainable Energy Housing
Custom 32' x 38' Saltbox
(1,887 first/second floor conditioned space)
Lot 7

What is a Zero-Net-Energy attainable home?

Zero-Net-Energy homes produce as much energy as they use on an annual basis. Determining whether a home will be Zero-Net-Energy is based on computer modeling of the construction plans and the specifications for materials, mechanicals, and appliances that will be used in the home.

The home must minimize the need for energy through design, insulation, and a careful choice of materials. A renewable source of energy, such as Photovoltaics, must generate the remaining energy requirements. The renewable energy source should provide enough energy over the course of a year to meet the home's energy requirements.

Why zero-net-energy homes?

According to the U.S. Department of Energy Data Book, the United States consumed the most energy in 2008 of any country. Buildings accounted for 40 percent of primary U.S. energy consumption, a level about 50 percent higher than consumption in 1980. In 2008, homes accounted for 54 percent of the primary energy consumed by buildings.

Super-insulating structures by increasing reliance on renewable energy sources can make a meaningful difference. Most of the consumption increase in the United States from 1980 to 2008 occurred before 2002. From 2002 to 2008, U.S. energy consumption has increased by less than one half of 1 percent. In the same period, China, the second largest consumer of power, more than doubled its energy consumption, according to the U.S. Department of Energy.

Development Team:

Developer/Builder	Transformations, Inc.	R. Carter Scott – President
Architect		Benjamin Nickerson
Site Coordinator	Jason Cowan Construction	Jason Cowan
Civil Engineer	Hancock Associates	John Boardman, P.E.
Energy Consultants	Building Science Corporation	Betsy Pettit, Honorata Wytrykowska, Daniel Bergey, Kohta Ueno
HERS Verification	Conservation Services Group	Matthew Root
Landscape Design	Places Associates	Sue Carter/William Murray
Legal Services		Patricia Nelson, Esq.
Property Sales	RE/MAX Prestige	Mark Tavenner

Home Information:

Location	Cavite Street, Devens, MA
Home Size	1,887 square feet of living area on first and second floors
Construction Cost	Typical base specifications cost about \$105 psf for the full two story homes; customizations of more spread-out homes (ranches and saltboxes) add to this price.
HERS Rating	- 16
Foundation	Foundation frost walls are 10" thick poured concrete. Garage floor is 4" thick poured concrete. Main Floor is 4" thick poured concrete on top of 2" of rigid insulation on top of the grade. Interior basement walls will have 3 1/2" of High Density Foam insulation and fire protective coating.
Roof Materials	30-year architectural shingles with 3' of ice and water shield
Exterior Cladding	Vinyl siding
Exterior Construction	Exterior 12" walls are constructed using advanced framing techniques with double studded 2x4 walls. The window wells are flared out with drywall returns and sills. The exterior sheathing uses a Zip wall system with the joints taped with the Zip material.
Insulation	Above grade exterior walls are 12" of low density foam for a minimum of R-46.8 wall cavity. Attic floor is 18" of cellulose for an insulation value of R-67.
Windows	Vinyl triple-pane, low E with Krypton blend gas, Energy Star rated windows. Harvey Tribute Premium double hung windows.
Exterior Doors	Insulated vinyl panel doors
HVAC	Two mini-split Mitsubishi Model wall mounted units (#MSZFE12NA) with two outdoor units (MUZFE12NA)
Water Heater	Navien instantaneous propane water heater
Ventilation System	Panasonic Whisper Green bathroom ceiling fan and Model #FV08VKS1; other systems will be evaluated on other lots
Appliances	Recommend Energy Star products rated below 750kWh per year for all three energy star rated appliances: dishwasher, washing machine, and refrigerator.
Paints	All paint has low or no amounts of Volatile Organic Compounds (VOC's)
Flooring	Pre-finished oak hardwood and vinyl
Carpet	Recycled PET (recycled soda bottles)
Water Saving Fixtures	Dual flush toilets
Lighting	Florescent light bulbs
Phone/Data	High performance cables installed
Electric Vehicles	Optional plug in station available
Photovoltaics	17.94 kW system will be installed on the south side roof. This turnkey installation will benefit from a 30% federal tax credit at the time of installation. The main roof will have 66 Canadian solar panels (CS6P-230P) for 15.18 kW. The screen porch roof will have 12 panels for an additional 2.76 kW. The buyers will own the system, and will receive all available federal and state tax credits, S-RECs and energy generated.

Zero-Net and Near Zero-Net Homes in Massachusetts - Summary Findings

- 60 percent of energy use for a typical home in Massachusetts can be eliminated by super-insulating the building enclosure.
- A super-insulated home is more comfortable because the architecture eliminates drafts and minimizes temperature changes.
- Building science is critical when creating a super-insulated home to insure that the insulation is correctly installed and the home is properly ventilated. The home, built correctly, can provide a healthier environment than traditional construction methods can.
- The cost of the additional insulation for a home between 1,600 and 1,800 square feet is approximately \$10,000 in 2011. Total cost per square foot for the home can be as low as \$105 per square foot, which includes additional insulation and typical Energy Star incentives. Reducing the mechanical requirements for heating and cooling helps keep this marginal cost low.
- Photovoltaics (PV) can offset the remaining 40 percent of energy use for a home to achieve Zero Net Energy. PV requires construction considerations. The home must be built so that the roof area has the best possible solar orientation and there are few, or no, sun obstructions for the PV panels. The cost of installing PV is high, but federal, state, and sometimes local financial incentives can reduce the initial costs. Another financial incentive, annual payments from Solar Renewable Energy Credits (SRECs), can make the payback period reasonable for homeowners. Transformations will provide “one-stop” shopping for homeowners and other contractors by installing and providing financing alternatives for PV.

Getting to Zero

Each home constructed by Transformations, Inc is designed and built to maximize energy efficiency by minimizing air leakage in the structure and maximizing appropriate and extensive insulation in the home. With little fresh air able to enter the home through infiltration of the building structure, fresh air is provided mechanically with a ventilation system in the second floor bathroom or hallway. Construction methods, materials, and super-efficient windows all bring Transformations homes to a Home Energy Rating System (HERS) rating of about 40 before a renewable energy system is added, which compares to a HERS rating of about 91, the base for an average new home built to the most recent code.

To get to zero, the homes will each include state-of-art Solar Electric systems on the roof. The systems will be sized to bring the home to a HERS rating of 10 to -28. The PV systems will provide excess power during sunny periods and insufficient power during less sunny periods. The excess power will go to Devens Utilities, the electric company for Devens, for use or storage. The homeowner will be provided with any electricity needs not met during the year by Devens Utilities. Once a year, the homeowner and Devens Utilities will reconcile the electric meter to determine if any funds are owed by a process called “Net Metering.”

Net Metering is a policy that the Public Utilities Commission has adopted and that Devens, as a Municipal Light District, has also adopted. The policy allows homeowners to buy and sell energy at the same cost throughout the year so that their cost for energy bought from the utility during the less sunny months equals the cost of the energy produced by solar systems to be stored by the utility for use later by the homeowner.

Currently, more than 2,000 solar installations in Massachusetts generate 22 Megawatts of power per year. Massachusetts has set a goal of 400 Megawatts generated by solar power per year by 2020. To reach this goal, the Commonwealth has created a “trading” mechanism called Solar Renewable Energy Credits (SRECs). Power utilities in Massachusetts must provide a certain percentage of their electricity through solar power to help the Commonwealth achieve the 2020 goal. They can install solar power, pay a set fee to the Commonwealth, or make a 10-year commitment to buy SRECs from others who have installed solar power. One SREC is created for every megawatt hour of electricity produced by a solar system. The Commonwealth sets a floor for the price of the SRECs and a ceiling with the alternative fee choice. Currently, the floor SREC rate is \$285 per SREC and the alternative fee is \$550 per megawatt hour. Public utilities are incentivized to purchase the SRECs as long as the cost is below the alternative fee. In September 2011, SRECs traded in the \$525 per SREC range.

This SREC market provides a subsidy for the installation of home solar energy systems through a guarantee that the public utilities have to provide solar power for the Commonwealth. Assuming an average SREC value of \$400 per year for the next 10 years for the 17.94 kW (17.94 SRECs) system proposed for the Saltbox on Cavite Street, either the annual cash flow from the SRECs would be \$7,176 per year or \$71,760 for 10 years for that installation.

In addition, a 30 percent federal tax credit and a Massachusetts state tax credit can reduce the initial cost of installing a solar system. While all of these tax credits and incentives exist, the installation of the solar system, combined with applying for the tax credits and finding a buyer for the SRECs, is more than most new homeowners want to tackle. Transformations, Inc. intends to provide the systems and offer affordable purchase or lease alternatives to buyers so homeowners can live in a sustainable manner and benefit from the savings without having to become solar tax credit experts.

Other green sustainable options offered to homeowners include an electric vehicle charging station and an electricity monitoring system for the house.