

# Zero Net Energy Policies and Programs

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**Definition: Zero Net Energy**

**Net-zero energy building** -- a residential or commercial building with greatly reduced needs for energy through efficiency gains (60% to 70% less than conventional practice), with the balance of energy needs supplied by renewable technologies.

**Zero net energy community** – a community designed to achieve net zero energy consumption. This is achieved by combining district heating and/or cooling from renewable sources with highly energy efficient buildings that also include on-site renewable energy, or by developing each building within the community as a zero net energy building.

## Policies

**Name: Zero Energy Homes Initiative**

Type: Residential – City Initiative

Location: Austin, TX

Summary: On August 10, 2006 the Austin City Council passed a resolution directing the City Manager to create a task force to develop a plan for “Zero Energy Capable Homes.” Following recommendations from the task force, in October 2007 the Austin City Council approved a Zero Energy Homes initiative. The initiative was the first in a series of code amendments that by 2015 will make all new single-family homes in Austin zero energy capable. Code changes will incrementally increase efficiency so that, on average, homes built in 2015 will require 65 percent less energy than those built today. The initiative is part of the Austin Climate Protection Plan unveiled in February 2007, which pledges to eliminate greenhouse gas emissions from all city activities by 2020, dramatically ramp up renewable power and reduce coal-burning practices at Austin Energy and implement the most energy efficient building codes in the nation.

Sources:

[http://www.ci.austin.tx.us/news/2007/downloads/zeh\\_fact\\_sheet.pdf](http://www.ci.austin.tx.us/news/2007/downloads/zeh_fact_sheet.pdf)

[http://www.ci.austin.tx.us/council/downloads/mw\\_zech\\_draft\\_res.pdf](http://www.ci.austin.tx.us/council/downloads/mw_zech_draft_res.pdf)

**Name: Zero Net Energy Task Force**

Type: Public and Private Industry Standard - State Task Force

Location: Massachusetts

Summary: On March 12, 2008, Governor Deval Patrick asked Energy and Environmental Affairs Secretary Ian Bowles to form a task force of industry professionals that would advise the state on raising “green building” standards in a way that would lead public and private construction toward a goal of Zero Net Energy buildings – commercial and residential structures that meet most of their energy needs by

efficiency and on-site renewable energy – by 2030. The task force is scheduled to report recommendations at the 2009 Northeast Sustainable Energy Association Conference.

Sources:

[http://www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&=080312\\_building\\_standards\\_task\\_force&csid=Agov3](http://www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&=080312_building_standards_task_force&csid=Agov3)

**Name:** California Long-Term Energy Efficiency Strategic Plan  
**Type:** State Energy Plan  
**Location:** California  
**Summary:** September 18, 2008 the California Public Utilities Commission adopted a long-term strategic plan for promoting energy efficiency across the state, including setting aggressive goals for reducing the amount of power drawn residential and commercial buildings draw from the grid. The blueprint, called the California Long-Term Energy Efficiency Strategic Plan, incorporates a number of strategies, including encouraging all new residential construction in the state to be "zero net energy" by 2020, and for commercial buildings to meet that same standard by 2030. It also calls for a re-shaping of the heating, ventilation and air conditioning industry and for improving the energy efficiency of housing for low-income residents.

Sources:

<http://www.climatelawupdate.com/2008/09/articles/california-utility-regulators-adopt-sweeping-energy-efficiency-blueprint/>

<http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf>

**Name:** House Bill No. 2200 (not Zero Net Energy but targets occupant responsibility and education)  
**Type:** State Legislation  
**Location:** Pennsylvania  
**Summary:** In October 2008 Pennsylvania governor Edward Rendell signed legislation that called for adoption of energy efficiency and energy conservation measures. Among the provisions of the bill is a requirement that every home and business in the state be equipped with smart meters by 2024. As part of the bill, utilities are directed to offer customers pricing plans rewarding ratepayers who shift their usage to off-peak hours. The bill is intended to cut electricity use by 1% in 2011 and by 3% in 2013.

Sources:

<http://www.climatelawupdate.com/2008/10/articles/pennsylvania-moves-to-boost-energy-efficiency/>

<http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=PDF&sessYr=2007&sessInd=0&billBody=H&billTyp=B&billNbr=2200&pn=4526>

**Name:** Net-Zero Energy Commercial Building Initiative (CBI)  
**Type:** Commercial – National (U.S.) Initiative  
**Location:** US DOE Energy Efficiency and Renewable Energy Building Technologies Program  
**Summary:** Launched in August 2008, the CBI encompasses an array of public and private partnerships to advance the development and adoption of net-

zero energy commercial buildings (NZEBS). NZEBs are grid-integrated buildings capable of generating as much energy as they consume through advanced efficiency technologies and on-site generation systems. Currently there are seven NZEBs in the DOE Database:

- Aldo Leopold Legacy Center, Baraboo, WI
- Audubon Center at Debs Park, Los Angeles, CA
- Challengers Tennis Club, Los Angeles, CA
- Environmental Tech Center, Sonoma State University (CA)
- Hawaii Gateway Energy Center, Kailua-Kona, HI
- Oberlin College Lewis Center, Oberlin, OH
- Science House, St. Paul, MN

Source: <http://www1.eere.energy.gov/buildings/initiative.html>

### **Zero Net Energy Projects & Communities/Subdivisions**

**Name:** GreenMax  
**Type:** Residential  
**Location:** Wisconsin (WPPI Energy service area)  
**Contact:** Kurt Pulvermacher, WPPI Energy  
608-834-4565

**Summary:** WPPI Energy solicits proposals from individuals, builders or architects interested in building a net zero home. One or more proposals are selected to receive funding from WPPI Energy to cover part of the incremental cost of designing and building a net zero energy home over the cost of constructing a conventional house. Since homeowners gain direct benefits from living in a GreenMax Home, they are expected to pay a portion of the incremental cost. Only homes built in the service area of one of WPPI Energy's member utilities are eligible for funding. WPPI Energy documents the building process, measures energy and environmental impacts and publicizes the findings.

The first GreenMax home is owned by Tom & Verona Chambers of Black River Falls. The 3100 sq ft home was scheduled for completion in January 2009. The Chambers' home is believed to be the first practical production in the region of a net zero energy residential home that can be reasonably and affordably replicated in a cold-climate region, and where the homeowners' energy-use will be measured to verify net zero energy status. Features of the home include: PV system, ground source heat pump, energy recovery ventilator, tight envelope, R-50 insulation in attic, R-10 below grade insulation.

RFPs for their net Zero Energy Home are accepted through April 2009. Grants are available for both new construction and remodeling of existing homes that are targeting net zero energy use when completed.

Source: <http://www.wppienergy.org/greenmaxhome>

**Name:** Enviro-Homes  
**Type:** Residential – Planned Communities  
**Location:** California  
**Builder:** Clarum Homes

**Summary:** Clarum Homes Enviro-Home was designed to minimize the use of resources, create a healthier, more comfortable living environment, and to greatly enhance the value of the home. Enviro-Homes are designated Zero Net Energy and designed to reduce homeowner bills by 90%. Features of Enviro-Homes include: Solar electric system, tankless water heater, radiant roof barrier, grey water system, water saving fixtures, increased insulation and use of green materials.

Clarum designed and built four Zero-Energy Enviro-Home communities:

**Vista Montana Community Watsonville, CA:**

- 177 single family homes, 80 town-homes, 132 apartments
- Opened August 2003. Sold out in 2004.
- Designated Zero Energy Home by US DOE NREL

**Shorebreeze Community East Palo Alto, CA:**

- 20 single family homes
- Completed in 2003
- Zero Energy Home status, funded by DOE

**Hanson Lane Estates Community Danville, CA:**

- 10 single family homes
- Completed in February 2009. 4 homes remain available for purchase.
- Zero Energy Home status and LEED Gold certified

**Liberty Pointe Community San Leandro, CA:**

- 24 single family town-homes
- Zero Energy Homes

Source: <http://www.clarum.com/ehome.html>

**Name:** Drake Landing  
**Type:** Residential – Planned Community  
**Location:** Alberta, Canada

**Summary:** The Drake Landing Solar Community (DLSC) is a master planned community located in Okotoks, Alberta, Canada. Construction was completed August 2007; homes were fully occupied October 2007. The unique feature of DLSC is that 90 percent of space heating needs for the community's 52 single-detached homes are met by solar thermal energy. DLSC is heated by a district system designed to store abundant solar energy underground during the summer months and distribute the energy to each home for space heating needs during winter months. Houses are 30% more energy efficient than conventional and each has PV and solar thermal on house and garage roofs in addition to the district solar. DLSC achieves a reduction of approximately 5 tons of greenhouse gas (GHG) emissions per home per year. The DLSC project was conceived by Natural Resources Canada (NRCan), a department of the Government of Canada.

Sources: <http://www.dlsc.ca/> <http://www.youtube.com/watch?v=WeRfaGQWwgg>

**Name:** zHome <http://z-home.org/>  
**Type:** Residential – Planned Neighborhood Project  
**Location:** Issaquah, Washington  
**Builder:** Howland Homes <http://www.howlandhomes.com/>  
**Architect:** David Vandervort Architects (Seattle)

**Summary:** 10-unit town home development 16 miles east of Seattle. The City of Issaquah approved \$50,000 to study the project in March 2007. The City Council unanimously approved the project in October 2007. Howland Homes, in partnership with Built Green, King County, Port Blakely Communities (donated the building site), Puget Sound Energy and the Washington State University Energy Program, broke ground Sept 29, 2008 and is scheduled to be complete zHome in October 2009. The homes (500-1750 sq ft) achieve zero net energy by combining advanced energy efficient construction with PV panels. Features of zHome construction: super-insulated 11-inch thick walls, double pane windows, extremely tight building envelope, ground source heat pump, heat recovery ventilator, hydronic heating, energy feedback monitors. Also, zHome will use 60% less water than the average home, incorporate healthy, non-toxic materials, and locally produced and recycled materials. The developers of zHome assembled all the pieces into a production-built design that could be scaled up and replicated elsewhere.

So far, Doug Howland, of Howland Homes, says he's surprised to find that the prospective buyers of his z-Home townhouses aren't Prius-driving, uber-green, sustainability-seeking Seattleites "seeking every extreme green trendy thing." "Rather," says Howland, "my waiting list seems to consist of the **more mainstream, move-down buyer** who has raised kids and is drawn to sustainability in the sense of saving money, walking around town, and sharing in the community."

Sources:

[http://seattletimes.nwsourc.com/html/localnews/2003628451\\_zeroenergy21e.html](http://seattletimes.nwsourc.com/html/localnews/2003628451_zeroenergy21e.html)  
<http://www.ci.issaquah.wa.us/News.asp?NewsID=975>  
<http://crosscut.com/2008/10/08/real-estate/18466/>

**Name:** Geos  
**Type:** Mixed-Use Planned Community  
**Location:** Arvada, CO  
**Developer:** Geos Development  
**Architect:** Michael Tavel <http://www.michaeltavelarchitects.com/>

**Summary:** Geos dubs itself the first fossil-free community in the U.S. The 25-acre development will include four neighborhoods, green space, playgrounds, mixed-use buildings, businesses, and common areas. There are housing options for people of all ages, incomes and lifestyles starting from the \$200s. Homes available from 850 to 3500+ square feet. Features of Geos construction: passive solar, super insulated building envelopes, high thermal mass, mobile window insulation, heat recovery ventilation (air quality and conservation of internally generated heat), Earth tube (cooling), district ground source heat pump (domestic hot water & back up

heat source), grid-tied PV, energy monitoring system. Scheduled to be completed in the 2<sup>nd</sup> quarter of 2009.

Sources:

<http://www.discovergeos.com/pdf/GeosCommunityDesignFactSheet.pdf>

<http://www.discovergeos.com/pdf/GeosEnergyTechnologyFactSheet.pdf>

**Name:** Sustainable Community Homes  
**Type:** Residential – Affordable Housing Project  
**Location:** Lopez Island, San Juan County, Washington  
**Developer:** Lopez Community Land Trust (LCLT)

**Summary:** Seven acre mixed income development of 11 homes, 2 rental units and an office/resource center. LCLT's goal is a zero net energy community. Building began 2007. Features of homes: small size (average 860 sq ft), large overhangs, super insulated roof & walls, straw bale walls, insulated and solar shades, concrete floor, energy star appliances, solar hot water, vegetated trellis for shading, rainwater catchment for toilet, washing machines and storm water control.

Sources:

[http://www.lopezclt.org/affordable\\_housing/scrapbookweb2006/ScrapbookWebVersion.pdf](http://www.lopezclt.org/affordable_housing/scrapbookweb2006/ScrapbookWebVersion.pdf)

[http://www.lopezclt.org/affordable\\_housing/sustainable%20community%20homes.htm](http://www.lopezclt.org/affordable_housing/sustainable%20community%20homes.htm)

[http://www.lopezclt.org/affordable\\_housing/Mithun\\_Aspects\\_12-2008.jpg](http://www.lopezclt.org/affordable_housing/Mithun_Aspects_12-2008.jpg)

**Name:** New Homes for Chicago  
**Type:** Residential – Nonprofit Affordable Housing Project  
**Location:** South Chicago, IL  
**Developer:** Claretian Associates  
**Builder:** South Chicago Workforce

**Summary:** 25 single family home (1700 sq ft) development project in South Chicago. Twelve of the homes will have 1 kW PV systems with the goal of achieving zero energy. The homes are being monitored by Steven Winter Associates, Inc. and are being funded through DOE's Zero Energy Homes program. It is the first urban affordable housing studied under the ZEH program. Construction features include: structural insulated panels, tight, well insulated envelopes, sealed combustion gas furnaces, grid-tied PV, heat recovery ventilators, florescent lighting.

Sources:

[http://www.eere.energy.gov/buildings/building\\_america/pdfs/db/36475.pdf](http://www.eere.energy.gov/buildings/building_america/pdfs/db/36475.pdf)

<http://www.claretianassociates.org/display.aspx?pointer=6577>

**Name:** Premier ProEnergy Homes <http://www.premierproenergy.com/>  
**Type:** Residential – Private Developer  
**Location:** Sacramento, CA  
**Builder:** Premier Homes

**Summary:** Premier Gardens (95 homes) in Sacramento, and Premier Oaks in Roseville, are the first ever completely standard solar communities in this

region. Both offer a "Zero Energy Home"(ZEH) as a standard feature. ZEH homes exceed California's strict Title 24 energy regulations by more than the 15% required to qualify your home for the U.S. Environmental Protection Agency's Energy Star® Homes program. Construction features: GE 2kW AC roof integrated solar electric system, tankless water heater, tightly sealed ducts, efficient appliances, ceiling fans, fluorescent lighting, foam wrapped envelope.

Source: [http://www.builtbypremier.com/P\\_gardens/news\\_zeroenergy.html](http://www.builtbypremier.com/P_gardens/news_zeroenergy.html)

**Name:** Zero Energy Home  
**Type:** Residential Case Study – Single Family Home  
**Location:** Denver, CO  
**Builder:** Habitat for Humanity and NREL

**Summary:** The National Renewable Energy Laboratory teamed with Habitat for Humanity of Metro Denver to build a 3 bedroom, 1200 sq. ft. zero energy home. The home combines passive and active (grid-tied PV and thermal) solar, tankless water heater, envelope efficiency, efficient equipment, appliances, and lighting, energy recovery ventilation, natural gas point-source direct furnace and small baseboard electric heaters.

Sources: <http://www.nrel.gov/docs/fy06osti/39678.pdf>

**Name:** Zero Energy Home  
**Type:** Single Family Residential  
**Location:** Dallas, TX  
**Builder:** AndersonSergant

**Summary:** 3800 sq. ft. two story home completed in fall of 2004. Features include: spray foam insulation in roof assembly, metal roof, efficient cooling & duct system, hydronic & radiant heating, solar thermal and grid-tied PV, fluorescent lighting, on-site rainwater cistern.

Source: <http://www.zeroenergyhomedallas.com/features.html>  
<http://www.nrel.gov/docs/fy05osti/36944.pdf>

**Name:** Grupe Green  
**Type:** Residential – Planned Community  
**Location:** Rocklin, CA  
**Builder:** Grupe Homes

**Summary:** Carsten Crossing, a single family home community, opened in May 2006. The community includes 144 homes, a community center with swimming pool and a 40-acre community park with recreational fields. The homes are LEED Certified and Grupe Green. Features of Grupe Green Homes include: SunPower™ Sun Tile roof-integrated solar electric system; tankless hot water heater; energy efficient windows; energy-efficient furnace & air conditioning system; tight ducts with improved insulation; "SmartVent" automatic night ventilation cooling; "FreshVent" continuous ventilation system (CVS); dual-zone equalizer; energy efficient lighting;



foam-wrapped building envelope; enhanced attic insulation; attic radiant barrier; water-saving plumbing fixtures.

Source: <http://www.grupe.com/communities/carsten/>

**Name:** Lennar SolarPlus  
**Type:** Residential – Planned Communities  
**Location:** California  
**Builder:** Lennar

**Summary:** Lennar built 16 SolarPlus subdivisions in Southern California. SolarPlus homes include a 2.3 KW roof integrated solar electric system and save 60% annually on electric bills. Other features of the homes include: energy efficient appliances, high efficiency windows, improved insulation and energy monitoring.

Source: <http://www.lennar.com/>

**Name:** Pinn Brothers  
**Type:** Residential – Planned Community  
**Location:** Brentwood, CA  
**Builder:** Pinn Brothers

**Summary:** The Palmilla community includes 455 single-family homes on more than 100 acres in the heart of Brentwood, and units are expected to range in size from 1,363 to 3,516 square feet. All homes will also exceed state energy efficiency standards by 35 percent or more thanks to tankless water heaters, high efficiency heating and cooling systems, additional insulation, and Solarban® high efficiency windows that block out 70% of UV rays. With the combination of both solar and energy efficiency, homebuyers are expected to save 50 - 70% on their electricity bills.

Source: <http://www.pinnbrothers.com>

**Name:** BedZed - Beddington Zero Energy Development  
**Type:** Mixed Use Development  
**Location:** Wallington, Surrey, England, 1999-2001  
**Designer:** Bill Dunster Architects

#### Building Details

**Client** Peabody Housing Trust, Bioregional Development Group

**Cost** US \$22,149,000

**Area** 111,904 sq. ft. (10,400 sq. m.)

**Stories** 3

**Other Details** Includes 92 dwellings and 26,900 sq. ft. (2,500 sq. m.) of workshop and office space, and community facilities.

Promotes community carpooling with a 109 kilowatt



photovoltaic array intended to support 40 electric cars.

A small-scale combined-heat-and-power plant (CHP) generates electricity and heats the building's water.

- Summary: Performance - Monitoring conducted in 2003 <sup>[1]</sup> found that BedZED had achieved these reductions in comparison to UK averages:
- Space-heating requirements were 88% less
  - Hot-water consumption was 57% less
  - The [electrical power](#) used, at 3 [kilowatt hours](#) per person per day, was 25% less than the UK average; 11% of this was produced by solar panels<sup>[2]</sup>. The remainder normally would be produced by a [combined-heat-and-power](#) plant fueled by wood chips, but the installation company's financial problems have delayed use of the plant.
  - [Mains-water](#) consumption has been reduced by 50%, or 67% compared to a power-shower household.
  - The residents' car mileage is 65% less.

Source:

[http://www.bioregional.com/programme\\_projects/ecohous\\_prog/bedzed/bedzed\\_hpg.htm](http://www.bioregional.com/programme_projects/ecohous_prog/bedzed/bedzed_hpg.htm)  
<http://en.wikipedia.org/wiki/BedZED>

## **Research & Development**

### **US DOE, Energy Efficiency and Renewable Energy**

The Building Technologies Program's strategic goal is to create technologies and design approaches that lead to marketable zero energy homes by 2020 and zero energy commercial buildings by 2025.

<http://www1.eere.energy.gov/buildings/goals.html>

The DOE announced, on October 19, 2008, that more than \$44 million would be invested in four Building America teams over the next five years. The funds will be used to develop **net-zero-energy homes** that consume 70% less energy than conventional homes.

[http://apps1.eere.energy.gov/news/news\\_detail.cfm/news\\_id=11372](http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=11372)

### **Borrego Springs Zero Energy Demonstration Homes**

Clarum Homes, in partnership with the U.S. Department of Energy's Building America Program, ConSol and Davis Energy Group, is building four zero-energy demonstration homes in Borrego Springs, California.

<http://clarumzeroenergy.com/index.php?nav=homes>

### **Florida Zero Energy Homes**

The **Florida Solar Energy Center** built seven Zero Energy Homes around the state. A primary aim in each of these projects is to collect detailed performance data that will allow refinement of the approach for integrating energy efficiency measures with PV and solar thermal systems. Each home has an information monitor web site, which is collecting data.

[http://www.fsec.ucf.edu/en/research/buildings/zero\\_energy/index.htm](http://www.fsec.ucf.edu/en/research/buildings/zero_energy/index.htm)

### **Commercial Building Initiative (CBI)**

The **CBI** is a public/private consortium, developing and delivering the technology, policies, and practices to achieve a market transition to Zero Net Energy Commercial Buildings by 2030. CBI's purpose is to bring together industries and all other relevant private sector parties, research institutions, and government entities to facilitate communication, provide a plan to make sure that zero-energy building technology is brought to the marketplace, and transform the entire commercial buildings sector.

<http://www.zeroenergycbi.org/>

### **National Renewable Energy Lab (NREL)**

NREL's research objectives are to develop integrated energy efficiency and onsite renewable energy power solutions that can be successfully used on a large production scale to reduce whole-house energy use in new homes by 50% in 2015 and by 90% in 2025.

NREL's primary research partner for residential buildings research is the U.S. Department of Energy's Building America Program, which works with some of the nation's most innovative production homebuilders. NREL is helping the Building America Program to document research results and to develop the case studies required to transform the top 3000 builders in the United States into **net-zero energy home** providers by the year 2020.

<http://www.nrel.gov/buildings/residential.html>

### **ZEBRAlliance**

The **Zero Energy Building Research Alliance**, or ZEBRAlliance, is a partnership between Oak Ridge National Laboratory and Schaad Companies, along with their architects BarberMcMurry, to develop and demonstrate new energy efficiency technologies for homes and help homeowners learn more about them. The goal is to eventually lay groundwork for a home that could generate more energy than it consumes over a year but cost the same to purchase and own as a typical house. The ZEBRAlliance demonstration homes will consist of about 2,800 square feet of living space.

<http://www.zebralliance.com/>    <http://www.seviercountynews.com/?p=1818>

**Northeast Sustainable Energy Association** is sponsoring a **Zero Energy Building Competition**. The deadline for submissions was January 15, 2009. There is a \$10,000 cash award.

<http://zeroenergybuilding.org/about.php>

### **Resource**

***A Renewable Energy Community: Key Elements*** *A reinvented community to meet untapped customer needs for shelter and transportation with minimal environmental impacts, stable energy costs, and a sense of belonging.* N. Carlisle, J. Elling, and T. Penney. *Technical Report* NREL/TP-540-42774. January 2008.

[http://www.nrel.gov/applying\\_technologies/pdfs/42774.pdf](http://www.nrel.gov/applying_technologies/pdfs/42774.pdf)