

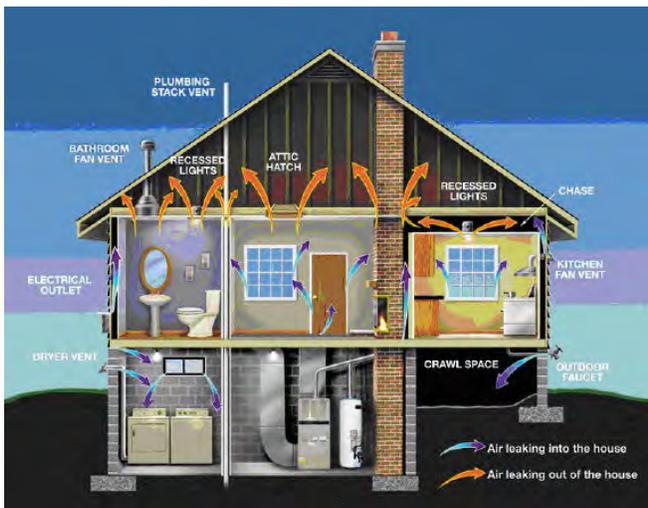
energy tips
FOR RESIDENTIAL

energy tips FOR LOWELL

Home Owners

Home owners have the most personal control over reducing their escalating fuel and power costs. They stand to gain the most by lowering their future energy costs while increasing the value of their property.

After evaluating the various materials and methods available to them, the home owner can proceed in order of time of payback, but one should always remember that a slow rate of return can be offset by a payback to the community and your children.



Go to energy.gov to find out how to save in each of your rooms

Conservation and efficiency measures provide the quickest payback to the homeowner and these measures should be taken immediately.

- The attic, exterior walls, and basement should be insulated to the maximum possible and any air leaks sealed. All pipes, ducts, and water heaters should be wrapped and the fireplace damper closed.
- All drafty single pane windows should be replaced with double or triple pane low-e windows.
- All HVAC equipment i.e. furnaces, boilers, air conditioning, heat pumps, fans should be ENERGY STAR® together with all appliances including, refrigerator, dishwasher, clothes washer and dryer.
- All lighting should be fitted with energy efficient florescent bulbs.
- Your thermostat should be programmable and the lights should have sensors/timers on them.

How do I start? Who can help me out?

UTILITIES

National Grid - www.nationalgrid.com
GOVERNMENT- Mass. Division of Energy Resources - www.mass.gov/doer
ENERGY STAR® - www.energystar.gov
Home Energy Saver- hes.lbl.gov/HES

AGENCIES

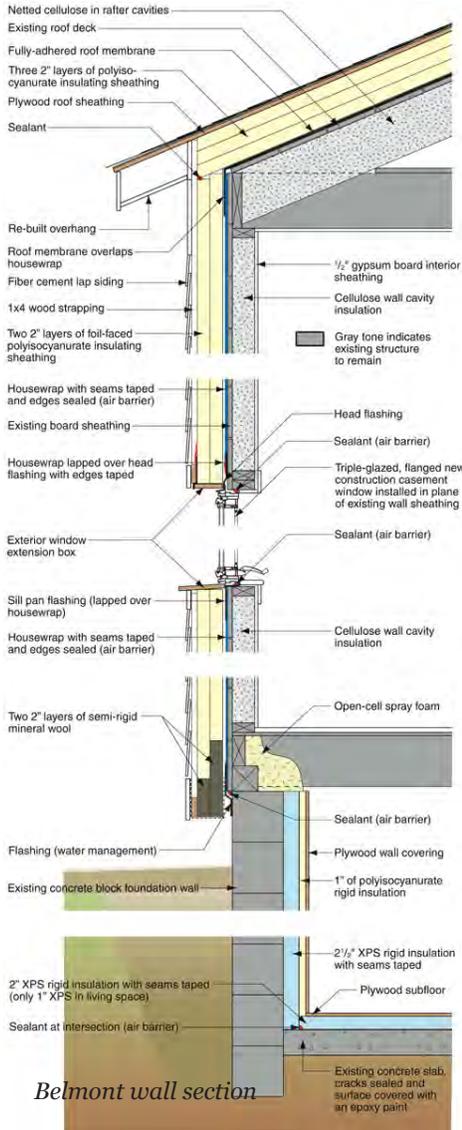
American Council for Energy Efficient Economy - www.aceee.org
Northeast Sustainable Energy Association- www.nesea.org
Partnership for Advancing Housing Technology - www.pathnet.org
Alliance to Save Energy - ase.org

PUBLICATIONS

www.homeenergy.com
www.finehomebuilding.com

Homeowners should start out with an energy audit to assess their situation. Two techniques that a professional auditor will utilize are the blower door test to measure the extent of leaks in the building and infrared cameras to reveal areas of air infiltration and missing insulation.





Belmont 2 family deep energy retrofit to 10kwh per year with exterior insulation (R40 walls, R60 roof), hi efficient gas boiler, heat recover ventilator, triple pane windows, 4kw PV array. Byggmeister, Contractor with Building Science, Designer. National Grid Deep Energy Reduction Pilot



Foam in attic interior



Insulation in basement



Applying spray foam in exterior walls.

SUPER INSULATION

Superinsulating a home can enable deep energy cuts and a smaller heating system. Typically walls reach R-40 and roofs, R-60. Insulation continuity and air sealing become critical. A heat recovery ventilator becomes necessary to provide fresh air.



The Somerville retrofit was unique in that it retained the existing siding & windows under the new insulation & windows.



HVAC & WATER

A central boiler's efficiency is rated by its AFUE (the ratio of the heat output to the energy consumed). Older, low-efficiency heating systems tended to have a natural draft that created a flow of combustion gases, a continuous pilot light, and a heavy heat exchanger which resulted in a 70% AFUE. Today's high efficiency heating systems can condense flue gases in a second heat exchanger for extra efficiency and have sealed combustions which can result in a 93% AFUE.

Options for hot water heating include:

- A stand alone tank. Gas should be sealed combustion with an EF of .67 and electric should be .93EF.
- An indirect model which is heated by your boiler
- A tankless, indirect model which heats the water as needed.
- An integrated system (provides space heat) or a
- Heat pump hot water heater.

Before installing any air conditioning, home owners should implement all of the shading and venting options that are available to them. If they determine that air conditioning is required, they might want to look into the new mini-split options that are available.

Some innovative housing

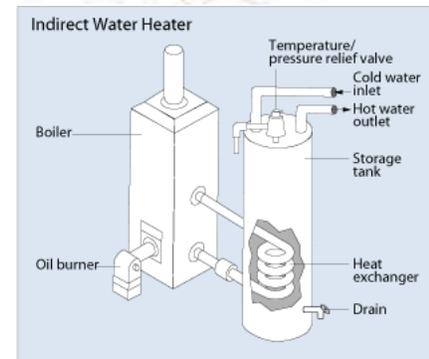
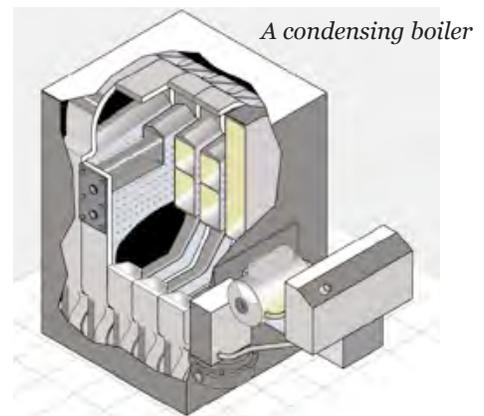
Bindley home on Squam Lake, Holderness N.H.
1970s ranch; Urethane foam panels on exterior, (walls 52R, roof 73R), Closed loop ground heat pump. Design/build Ben Southworth. Energy Neutral.

Concord Square Village, 1915 Sears Roebuck home;
Exterior rigid insulation on walls & roof; foam insulation, basement; condensing boiler space & water heat; PVs. 83% reduction.
Building Science with Synergy Companies

Belmont, 2 family on 118 Gilbert Rd. Exterior insulation, R40 walls & R60 roof; hi efficiency combustion gas furnaces; triple pane windows, 4kwh PV array. HERS from 197 to 23. Byggmeister, contractor; Synergy, construction. National Grid Deep Energy pilot.

Somerville duplex. Exterior foam insulation over existing siding & new double windows in front of exist. windows. Gas condensing boiler, indirect hot water tank, 5.25 kw DC PVs. HERS 119 to 37 Byggmeister, remodeler. Baczek, Architect.

Quincy House - 2nd floor addition. Wrapped in 4" of exterior insulation, energy efficient boiler, heat exchange; PVs on roof, uses 11kwh/year. Timeless Architecture; National Grid Deep Energy pilot



Arlington 2 family Deep Energy Cut with exterior insulation by DOER & NStar Building Science; Synergy Construction



Medford 2 family has 5" exterior out-board Insulation, Heat Recover Ventilator National Grid's Deep Energy Cuts Energy Efficiency Assocs.

ALTERNATIVES

After your home envelope is sealed, you could consider the ultimate efficient heating system, a geothermal heat pump. When appliances have been upgraded, look into solar thermal and/or PVs.

*PV array on a Lowell home
Lowell's Getting to Zero Program*



PHOTOVOLTAIC

550 Sq Ft Panel to generate
12kW/year for family
for 5K system (MTC max.)

Installation	\$35,000
CEC rebate	\$4,252
Feds	\$10,500
State	\$1,000
NetCost	\$19,248

*Solar Thermal System in Lowell, MA
bobgagnon.com*



SOLAR THERMAL

60 Sq Ft Panel for 4 person household;
100 gallon tank with connecting
plumbing & controls.

Need a glycol or draindown system to
prevent freezing. 60 degree tilt.

System cost	\$6000
CEC	\$1500
Feds credit 30%	\$1800
State credit 15%	\$900
Net cost	\$1800

*Geothermal Heat Pump for NYC
Townhouse ecrtech.com*



GEO THERMAL HEAT PUMP

Usually, standing column well
system best for Lowell.

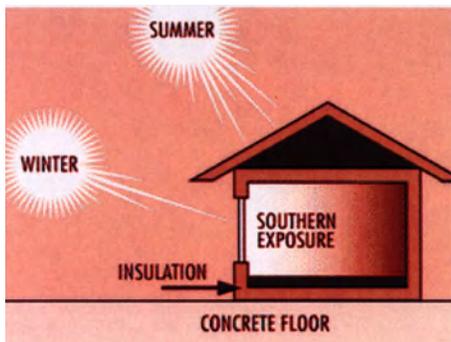
Average house requires 4 Tons.
(depends on size & tightness)
100' of hole = 1Ton.

Cost	\$4000/Ton
(depends on well depth & use of existing distribution system)	
Credits: Fed	\$4800 (30%)
Net Cost	\$11,200

COSTS & PAYBACKS

Average Lowell Fuel Bill - **\$2400**
Average Lowell Power Bill - **\$1500**

Maximum Potential Savings
Conservation 50%
Alternative & Conservation 100%



Homes can take advantage of passive thermal conditioning by keeping larger expanses of glass to the south and shading this same glass in the summer with overhangs and/or deciduous trees.

Grants, Refunds, Credits

FEDERAL (Tax Credit) for Renewable Installation
Solar Thermal & Solar PVs; Geothermal- 30%

STATE (Credit) Lesser of 15% or \$1000 for
Renewable Installation.

COMMONWEALTH SOLAR
to .85/watt to \$4250 for Solar PVs
25%, Solar thermal. masscec.com

NGRID 75% to \$2000 Weatherization (1-4 DUs),
AC, Heat pumps, Lighting, Equipment.
(1-800-632-8300) <http://masssave.org>
to \$1500,Boiler; \$800, Furnace; \$800,Tankless
hot water; \$500, Condensing hot water; \$400,
Indirect hot water; \$500, Heat recover vent;
(1-800-232-0672) www.gasnetworks.com
Major renovations- 75% TO \$2K for envelope.
1-800-628-8413

FEDERAL HOUSING ADMINISTRATION
Energy Efficient Mortgage

Multi-Family

Multifamily buildings come in a wide variety of types from low rise townhouses to hi rise apartments, from public housing to luxury condos, from new construction to old and sometimes historic structures.

Advantages they all have in common when addressing energy issues are centralized heating and utility systems, a larger thermal mass, and a smaller part of the building envelope exposed to the weather.

Many technologies and methods are available to the building landlord or the condo association to get a handle on escalating energy and fuel costs.

The first step with the quickest payback is conservation: insulation, sealing air leaks, installing energy rated windows. Many older apartments and public housing complexes have antiquated and inefficient heating and hot water systems. Controls, sensors, programmable thermostats, and other electronic control devices can be crucial, particularly if motivation is lacking because energy bills not absorbed by the individual occupant.

Condo associations can organize bulk buying packages to encourage individual owners to upgrade their windows, unit convectors, etc.

Usually unit owners are picking up the electric tab so they should be motivated to engage in ENERGY STAR® programs. Microturbines with their cogeneration capabilities can create large savings. Photovoltaics are the most prevalent of the alternative energy resources utilized in multifamily housing. When used in conjunction with insulation and a geothermal heat pump, zero energy status can be reached.



Pine Street Cohousing in Amherst, MA. has a geothermal heat pump for heating & cooling. www.ColdhamArchitects.com



PVs on the roof and a gas fired cogeneration boiler in the Maverick Landing East Boston project. ICON, Architects Photos by Lucy Chen Group



Saint Polycarp village apartments on a former church site in Somerville provides 24 affordable and 3 retail units with PVs, a vegetated roof, foam insulation, and triple pane widows. Davis Square Architects

RESOURCES & INFORMATION

DOE - Department of Energy
Building Technologies Program
eren.doe.gov

HUD - Dept. of Housing & Urban Development
Energy Efficient Rehab Advisor
hud.gov/offices/cpd/library/energy/index.cfm

HUD - rehabadvisor.pathnet.org

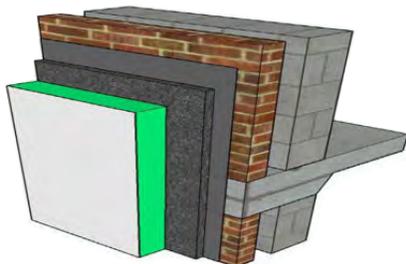
Consortium for Energy Efficiency -
Multi Family Housing cee1.org

Association for Energy Affordability Inc.
aeany.org

Mass. Dept. of Housing & Community
Development - www.mass.gov/dhcd



Castle Square low income housing in Boston got down to 25% of previous energy use with exterior insulation, double pane windows, efficient boilers and PVs. Elton&Hampton, Architects; Peterson Engineering; Building Science



Some innovative multifamily housing

Maverick Landing, East Boston
Crystalline PVs, gas fired geothermal, absorption air conditioning.

Johnson Square Village, Brockton - 26 town houses. Crystalline PVs provide 60% of each unit's power. Energy Star rated.

Castle Square Housing Block in Boston
got down to 25% with efficient heating, exterior insulation, new windows, and PVs.

360 State St, Newhaven Conn.
400 kw fuel cell powers 500 DUs , common space, & retail.
First platinum LEED under ND program.

Drake Landing, Okotoks, Alberta
52 home subdivision with garage mounted solar thermal panels connected to a central energy center that contains short term storage in the summer (for nights & cloudy days) in water tanks, and seasonal storage with a borehole in-ground heat sink system. This solar system meets 90% of the homes' heating needs.
sterlinghomesgroup.com/drake/

Grants, Rebates, Tax Credits

NATIONAL GRID - 5 or more units including condos.
Multifamily Program provides Hi efficiency heating & cooling, Hot water upgrades, Lighting, Thermostats & sensors
to 75% of insulation for electric heated buildings:
1-800-594-7277
Low Income Multi: 1-617-348-6425
to \$750/kilowatt of Cogeneration.

COMMONWEALTH SOLAR provides .45/W DC to \$2250 for solar PVs

FEDERAL \$1.80/sq ft in +4 story multifamily for 50% savings over ASHREA 90.1 model code

HUD has an extensive weatherization rebate program for low income units.

energy tips

FOR LOWELL

Renters & Condo Owners

Condo owners and especially renters can make few decisions regarding capital improvements to conserve energy. However, they can make a sizable dent in their electric and/or fuel bills. Moreover, they can influence their landlords and/or condo associations to make wise energy related investments.

Controlling electrical use is their first line of defense. Any appliances that they own should be ENERGYSTAR®. Light bulbs should be florescent & task lighting should be utilized. Clean the coils in your fridge and any air/vent filters frequently. Install power saving software on your computer.

Rebates, Interest Discount

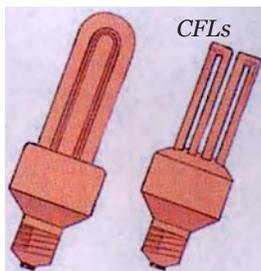
NATIONAL GRID - Rebates on Energy Efficient Appliances, Florescent Bulbs www.nationalgridus.com

FHA - Energy Efficient Mortgage for condo buyers www.hud.gov

MTC - Opportunities to purchase clean energy for your town. www.cleanenergychoice.org

EFFICIENT APPLIANCES

Highly efficient washer/dryer by Thor Appliance. Ventless model available



Computer power save



RESOURCES & INFORMATION

American Council for Energy Efficient Economy www.aceee.org

DOE Consumer Guide to Energy Efficiency & Renewable Energy www.eere.gov

www.masssave.com

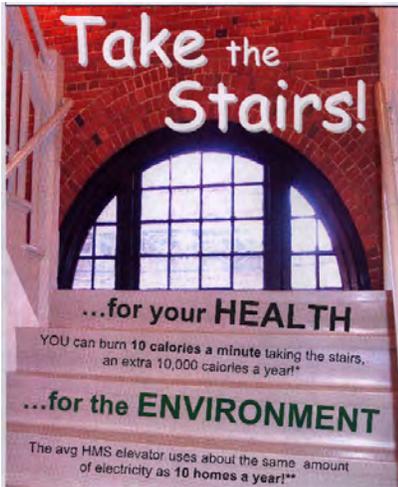
www.energystar.gov

EPA Home Energy Advisor www.advisor.lbl.gov/hit/Controller

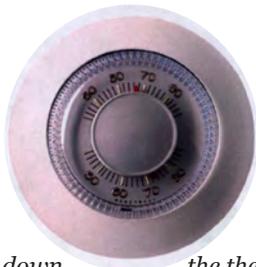
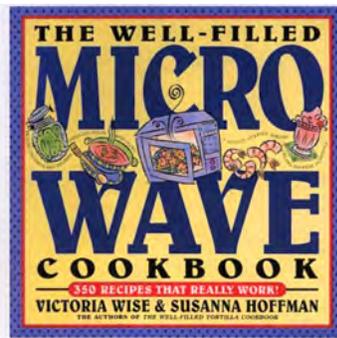


Keep those coils and vents CLEAN





Harvard Green Campus
Harvard Longwood Campus



Turn down the thermostat @ nite and when you leave or have a programmable one installed.



frostyfan packs



LIFESTYLE

Lifestyles can be adjusted to conserve: showers instead of baths; microwaves instead of ovens. Solar clothes dryers are amazing. If on an upper floor, use the stairs when going down.



Kohler Master Shower® Eco showerhead



thunderboltsocks.com



windowquilts.com

THERMAL COMFORT

To save on fuel bills, the thermostat should be utilized frequently; adjust the temperature when you retire or leave the unit. In the winter electric rugs and socks can make more sense than heating a huge space; while in the summer a fan and an ice collar can do the job of an energy hogging air conditioner. Address the high conductance of windows with insulated drapes and/or shades. Let the sun shine in on winter days and block it in the summer.

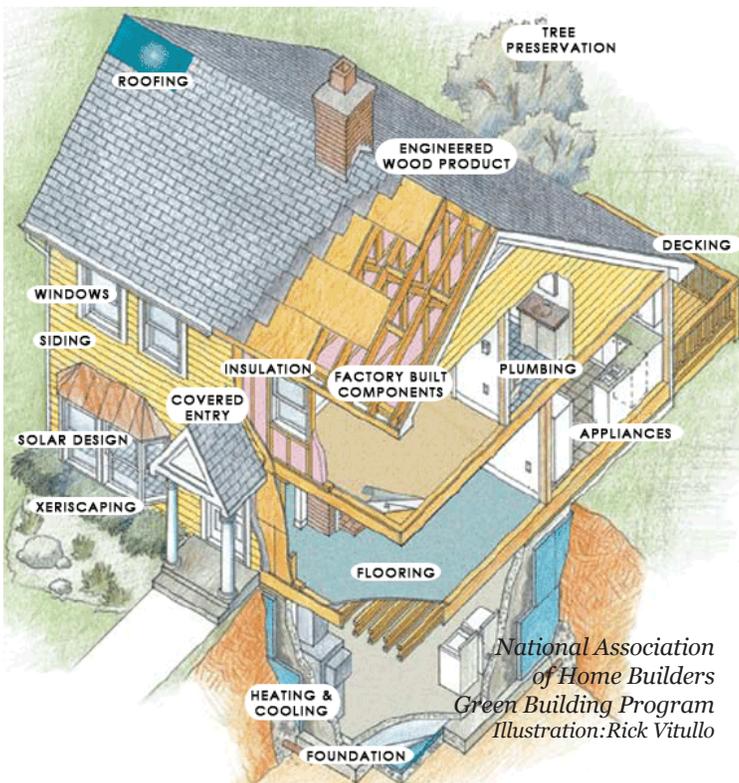
energy tips FOR LOWELL

Contractors

Builders and contractors play a critical role in changing our lifestyle of fuel dependency.

Builders have the best opportunity when doing new construction to incorporate many of the newer techniques and materials which are often not an option in retrofits. These might include building orientation, roof angle and orientation, interior chimney location, 2x6 framing, exterior or interior rigid insulation, exterior basement insulation, air & vapor barriers.

Contractors can help the building owner handle the many challenges in a rehab, including choosing the appropriate HVAC system and increasing the R factor of the building envelope.



National Association
of Home Builders
Green Building Program
Illustration: Rick Vitullo

Lowell has adopted the **Massachusetts Stretch Code** which requires:

for RESIDENTIAL

- HERS of 60 or less for all new single & multi homes
- HERS of 70 or less for major renovations. (85 or less when retaining existing heating systems)
- for renovations under 600 sq ft or less than 30% of conditioned space; Energy Star codes for zone 5A

for COMMERCIAL

- Buildings over 100K sq ft - 20% below ASHRAE 90.1 2007 code
- Medium buildings (4 or more stories less than 100K sq ft) can use large building requirement or Energy Code 780 CMR based on chap 5, IECC 2009 energy code.

ENERGY STAR REBATES

ENERGY STAR for new homes Improvement over 2011 Massachusetts Reference Home and compliance with sections 3 & 5 of the Energy Star Thermal enclosure system rater checklist. Call 1-800-628-8413

	SINGLE	2-99 Units	100- 199 DUs	200 DUs & over
+ 15%	\$750	\$650	\$500	\$350
+ 30%	\$1250	\$1150	\$850	\$550
+45%	\$8000	\$4000	\$3000	\$2000

massenergystarhomes@icfi.com

How can you begin to apply these new technologies to your current projects?

Here is a list of contacts & resources to get you started.

TRAINING

Northeast Sustainable Energy Association
413-774-6051 www.nesea.com

National Association of Home Builders
www.nahb.org

Yestermorrow Design Build School
www.yestermorrow.com

SOFTWARE & VIDEOS

Sustainable Buildings Industry Council
www.sbicouncil.org

CERTIFICATION

North American Board of Certified Energy Practitioners www.nacep.org

Building Performance Institute Inc.
www.bpi.org

Renewable Electric Certificate Program
www.green-e.org

MAGAZINES

Fine Home Building
Home Energy Magazine

WEB SITES

Partnership for Advancing Housing Technology www.pathnet.org

DOE Energy Efficiency & Renewable Energy Network www.eere.energy.gov

Environmental Building News
www.buildinggreen.com
advancedbuildings.org

*Affordable ZEH in Edmond, Oklahoma
Built by Ideal Home Builders; 1650 sq ft. & priced under \$200K
Solar Hot Water, PVs, Geothermal Heat Pump; Tankless Hot Water, Cellulose Insulation, Vinyl Framed Low-e Windows
www.idealinnovation.com*



With a combination of efficiency, insulation, PVs, and geothermal heating & cooling, it is now possible to build affordable homes with a zero net energy consumption.

Rebates & Credits

*The IRS will credit \$2000 for each unit that cuts energy by 50% over the '04 international code
NATIONAL GRID Energy Star \$8K/Unit in 3 tiers.*



*Wisdom Way Village Affordable housing, 10 duplexes, in Greenfield MA, with \$300 energy bills/year.
Steve Winter, Architect; Rural Development, Builder*



Bread & Roses Housing for low income residents in Lawrence, National Grid's Mass Zero Energy Challenge program.



One Massachusetts builder, Transformations, has built many energy neutral homes in the affordable price range.