GREEN BUILDINGS AND NEW TECHNOLOGIES

Recent years have seen a moderation of domestic energy costs as a result of the collapse of international oil markets and the increase in domestic natural gas production. However, moderate energy prices may prove to be temporary; the price of crude oil has been volatile since the late 1970s.

In response to increased costs of fuel oil and natural gas in first decade of the 21st Century, the federal and state governments (and utility companies) introduced initiatives to encourage domestic energy conservation and the use of energy-producing technologies. Despite the moderation of prices for home heating oil and natural gas, there has been an explosion of interest and action in energy-efficiency to reduce waste, manage costs, and address greenhouse gas emissions. Massachusetts has become a national leader in the attempt to address energy efficiency despite its relatively old and inefficient housing stock and commercial property inventory. In 2008, the Commonwealth enacted the "Green Communities Act", which focused various state and municipal government agencies on investment in energy efficiency programs.

The Massachusetts "Stretch Code"

The Green Communities Act required that a "Green Community" (municipalities opt into the program) adopt an advanced energy conservation code for buildings dubbed the "Stretch Code." http://www.mass.gov/eea/energy-utilities-clean-tech/green-communities/ The residential Stretch Code was based on the pre-existing EPA/Energy Department "Energy Star for Homes" program customized for Massachusetts. This program utilizes a new metric: the "Home Energy Rating System" or "HERS". The goal of the Stretch Code is to achieve at least 20% greater energy efficiency in home energy use compared to homes built to the conventional building code. The Stretch Code applies to major renovations of homes as well as new construction. The fundamental approach of the stretch code is to use building techniques that minimize "air leakage" and increase the use of energy efficient technologies (such as multi-pane windows and high performance insulating materials) to reduce energy use. Energy efficient heating and cooling systems, hot water heaters and lighting systems (using LED and other high efficiency lighting sources) are part of the Stretch Code protocols as well.

New homes built under the Stretch Code are required to be reviewed and obtain a "HERS rating" by a qualified "HERS Rater." HERS Raters are individuals (generally persons already in the construction industry) who receive specialized training and certification by an industry sponsored training company qualifying them to complete the HERS rating checklist . The HERS Rater uses the "Energy Star Qualified Homes Thermal Bypass Checklist" to "score" a house. For a new house greater than 3,000 ft, the maximum HERS score is 65. For houses less than 3,000 ft. the maximum HERS score is 70. As part of a HERS rating, a house is tested for air leakage and under both the Conventional and the Stretch Code houses with heating and cooling ducts may also have those facilities tested for leakage.

The HERS Rater produces a report detailing the energy systems in the building and will provide a HERS index score, together with proof of whether the home qualifies for any federal tax credits. Submission of the HERS report, together with a completed Energy Star Qualified Homes Thermal Bypass Checklist, are required by the Stretch Code to demonstrate compliance with the energy portions of the Code and must be submitted to the municipal building inspector prior to

receiving a Certificate of Occupancy. As a consequence, the building inspector retains an oversight role over the house construction process.

The federal government has also established standards for construction technologies, building materials, and appliances designed to promote energy efficiency. The installation and use of such practices, materials, and appliances qualify a dwelling for the "Energy Star" designation. *See* http://www.energystar.gov. Energy Star products, like products that meet the "Stretch Code" may have a higher initial cost but will allow the consumer to recover the investment in lower energy costs over time. Recent publications by the Commonwealth predict that, by including the various tax and other financial incentives for being Energy Star (or Stretch Code) compliant – the return on investment ("ROI") for compliant energy efficiency expenditures will be from 1 to 2 years. These predictions are based on fluctuating costs of energy, of course. But even considering energy costs at a relatively low level, the ROI for using energy saving construction techniques and appliances is "short term".

Property owners have multiple resources to research the options available to encourage the efficient use of energy in homes and commercial buildings. For example, federal and state tax credits are available from time to time for homeowners who install "qualified energy property expenditures" and "qualified energy efficiency improvements." Such "improvements" include the installation of major fixtures such as furnaces, water heaters, and energy-efficient windows that meet the most current International Energy Conservation Code. Tax credits are also available for the installation of photovoltaic (PV) technologies, such as solar panels, and other qualifying technologies, such as fuel cells and wind turbines.

The U.S. Green Building Council and 'LEED'

The *Leadership in Energy and Environmental Design* (LEED) Green Building Rating System is a nationally accepted benchmark for the design, construction, and operation of high-performance "green buildings," including commercial, industrial, and residential structures. The LEED system was established by the U.S. Green Building Council (USGBC), a nonprofit organization that serves the construction industry and real estate development stakeholders. The USGBC's mission is to "transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life." USGBC Statement of Core Purpose, *available at* http://www.usgbc.org.

The LEED program promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health. These areas are

- sustainable site development,
- water savings,
- energy efficiency,
- materials selection, and
- indoor environmental quality.

LEED provides standards for measuring and documenting success for every building type, including residential dwellings. These standards are expressed as "LEED Platinum," "LEED Gold," "LEED Silver," etc. Various federal and state government agencies have adopted the LEED standards by incorporating the design and siting standards into building codes, tax credits,

and other incentive programs. As of this writing, Massachusetts is considering, but has not formally adopted, LEED as a standard for use in constructing commercial or residential buildings. A LEED project checklist is available in the resources section of the organization's Web site at http://www.usgbc.org.

Generally LEED certification is accomplished for new construction at no charge to the purchaser. Larger utility companies such as Eversource and National Grid compensate contractors via funds collected through the customer's electric utility bills. The collection of funds by electric generation utility companies for energy conservation efforts was mandated by the Commonwealth as a consequence of the 1998 electric utility deregulation legislation. The cost of LEED certification for existing houses and houses in towns served by municipal electric utility companies is approximately $500 per house.

Zero Net Energy Buildings

Commercial and residential buildings are major contributors of greenhouse gas emissions. Buildings consume 40 percent of energy used annually in the United States and 54 percent of energy used annually in Massachusetts. Through the Green Communities initiatives, the Commonwealth is attempting to substantially reduce energy use in old and new buildings and to move toward super-efficiency and zero net energy use in renovation and construction of both commercial and residential buildings. The Federal Department of Energy also encourages a "holistic" approach to home design and remodeling to save energy. http://energy.gov/public-services/homes/home-design-remodeling A zero net energy building (ZNEB) is one that, over the course of a year, generates energy onsite using clean, renewable resources, in a quantity equal to or greater than the total amount of energy consumed onsite. Zero net energy buildings may use high-efficiency equipment such as water conservation fixtures; heat recovery units on waste water; solar water heating; and high-efficiency water heating and domestic heating, cooling, and ventilation (HVAC) equipment; superinsulation of walls and ceilings; high-efficiency windows; and other "hard" techniques to generate energy efficiencies. "Soft" techniques, such as the use of three-dimensional computer simulation tools, are used to model how a house or commercial building will perform by addressing seemingly simple changes like orientation on a lot (relative to the sun's daily and seasonal position); window and door type and placement; overhang depth; insulation type and air tightness; and the choice of heating, cooling, lighting, and other equipment, as well as the typical local climate. Geographic Information System (GIS) and three-dimensional modeling help state and local planners, project designers, and developers predict how buildings will perform and suggest how greater efficiency can be achieved through relatively "low tech" means. New 'technical terms' such as "deep energy retrofit" and "whole house systems approach" are now in circulation both in the building trades and in the public sector. See http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/zero-net-energy-bldgs/zero-net-energy-buildings-information-resources.html

It is important to recognize and sift through the hype surrounding the installation of energy-saving facilities and devices. The care and maintenance of certain technologies and products may exceed the ability of some homeowners to appropriately use such products. Moreover, the ability of local contractors to correctly install energy saving devices and train homeowners in the use of these new technologies is a "work in progress." Nonetheless, Massachusetts has taken a leading role in promoting the deploying of such technologies through tax credits and other incentives.