

3.5 Energy Efficient Development

BACKGROUND AND PURPOSE

Familiarity with energy efficient design and project planning has been steadily increasing in recent years. Site design techniques that take advantage of sun exposure, differences in microclimate, and landscaping reduce a development's demand for fossil fuel derived energy sources and overall reduce energy consumption. These planning techniques can be used in designing housing and non-residential developments, deciding on density levels, integrating different land uses, and designing transportation and circulation systems. Energy efficient planning principles can be implemented and upheld through subdivision and site plan review regulations, zoning ordinance, and building codes.

Current building codes represent the minimum legal energy efficiency for structures. These standards are not uniformly enforced, and baseline studies in Massachusetts and other states with similar codes indicate many structures are not built to code. Furthermore, these standards focus on the building envelope and mechanical systems and disregard natural and renewable means of reducing a building's environmental impacts. By applying passive solar design in conjunction with building codes, energy utility bills can be decreased by 30 percent. Add to that "well insulated and tightly constructed building shells" and the savings can reach 75 percent. (Urban Land Institute, 2000)

As with most provisions that may be initially opposed by developers or builders, providing a set of incentives may draw interest that would not otherwise exist. While the return on the initial, more costly investment of energy efficient systems is usually seen in less than ten years, and as fast as only a few years, incentives can help lessen the initial cost burden. Incentives may essentially offer a subsidy to the development through possible tax deferments, deductions, credits, or abatements. Other incentives may include awarding developments a special certification status or the provision of technical and design assistance from the town. Traditional incentives such as density bonuses or reduced standards found in other ordinances may also be used. Additionally, there is the prospect of net metering or receiving a refund for excess power generated on site and pumped back into "the grid."

APPROPRIATE CIRCUMSTANCES AND CONTEXT FOR USE

For energy efficient development to be realized, it needs to first be outlined as a critical element in a community's master plan, similar to all other innovative land

RELATED TOOLS:

- Landscaping
- Dark Skies
- Conservation Subdivision

use controls adopted into local ordinances. The master plan should identify energy efficient development as a need and a priority in the community.

Voluntary energy efficient development regulations will be most effectively implemented in communities, regions or states that have a system of incentives in place encouraging the private sector to move from traditional development systems to high performance models. This could include property tax credits or density bonuses.

LEGAL BASIS AND CONSIDERATIONS FOR NEW HAMPSHIRE

There are several ways communities can incorporate energy efficiency into their municipal ordinances. If a community has adopted zoning and declared energy efficiency a priority in its master plan, then simple provisions related to the construction orientation and building siting can be incorporated into site plan and subdivision regulations as part of the design standards. If the municipality has a building inspector, additional building codes may be adopted that are more stringent than state codes and will produce greater energy savings. Lastly, if the community has a building inspector and feels confident they have ample code enforcement support staff, a comprehensive zoning ordinance may be adopted.

Energy efficient development ordinances are permitted in New Hampshire as a means of carrying forth the purposes of zoning ordinances established in RSA 674:17. Section I (j) of that statute encourages the uses of solar, wind, or other renewable energy systems. The law also gives zoning ordinances the power to establish buffer zones or other zoning districts that overlap any existing districts. When these zoning provisions, promoting renewable energy and efficiency, are combined with enabling legislation for performance standards under RSA 674:21 I (h), communities can develop a comprehensive zoning article that provides incentives to developers in exchange for meeting a number of energy efficiency performance standards.

Communities can implement energy efficiency standards into their subdivision regulations through power granted in RSA 674:36 II (k), which establishes the groundwork for the protection of energy sources through the establishment of lot standards, street orientation, and other requirements. These provisions are similar in their intent as is provided for zoning ordinances, under RSA 674:17 I (j), as described above. When supported by the master plan communities may also include energy efficiency language in their site plan review regulations as allowed as an innovative land use control per RSA 674:44 II (i).

RSA155-D requires that all new construction comply with State energy efficiency codes and receive a permit certifying compliance. While the Public Utilities Commission (PUC) is charged with administering the code, it is the responsibility of the local building code official to “review plans and specifications to determine if all pertinent data and features of the structure and the equipment systems conform with the provisions of the code.” In communities with a part-time building official, the PUC may provide support through application review and compliance certification. Additionally, if there is no local building code, the contractor or owner-builder is responsible for submitting plans and specifications to the PUC for review.

RSA 155-A:2 VI allows municipalities to adopt more stringent building codes than the state codes. This chapter presents some examples of more stringent standards a

community may adopt to achieve desired energy savings.

RSA 72:61-72 allows municipalities to adopt property tax exemptions for property owners that have installed solar, wind-powered, or central wood heating energy systems on their property. Only 56 New Hampshire communities offered exemptions as of 2003. The southernmost three counties in the state contained the most communities offering tax exemptions. Hillsborough County had the most communities with 10, while Cheshire and Rockingham Counties each had eight.

Another incentive offered by the state is backward or net metering allowed through PUC Rule 900. Net metering focuses on how much energy a household produces and consumes through the use of a solar, wind, or water-powered generators. Whenever the household is generating more electricity than it is consuming, the meter runs backward, and the homeowner is billed only for the net meter reading. Additionally, under RSA 477:49-51 a landowner can guarantee solar access for an abutter's solar installation through a solar skyspace easement.

Amendments to RSA 198:15-b, effective July 22, 2005, increase support to school districts building high performance schools. Additional state financial support is available to districts building high performance schools. The School Building Aid formula can be augmented by up to 3 percent, or \$100,000 per year, for districts that design and construct a facility consistent with the high performance school standards published by the State Department of Education. The revised statute also requires districts building to these standards to apply to their utility companies (electric and gas, when available) for the appropriate rebate payments offered on high performance energy equipment.

EXAMPLES AND OUTCOMES

There are currently no energy efficient development ordinances in New Hampshire. To date, the only efforts regarding energy efficient development are a result of the Cities for Climate Protection programs in Keene and Nashua. Many communities have examples of developers voluntarily undertaking energy efficient measures in their individual endeavors.

Peterborough's, Union Mill project is a prime example of voluntary energy efficient development. The project uses a combination of geoexchange heat pumps and solar thermal panels for heating and cooling; and a wood-pellet backup furnace will assist in heating when necessary. The building will use Energy Star windows and R-49 insulation. In addition, natural building materials will be used in place of more conventional ones. Cotton insulation, soy based urethane foam insulation, formaldehyde free plywood, and natural paints and recycled materials are a few examples of the materials specified for the building.

Elsewhere in New England, Burlington, Vermont's "Guidelines for Energy Efficient Construction" is a series of amendments to the International Energy Conservation Code 2000, which is the same code utilized by the State of New Hampshire. The amendments customize the code to Burlington's climatic conditions and other local needs. These requirements are more oriented toward building codes than zoning ordinance provisions. The ordinance covers administration and enforcement, as well as defining terminology. It goes into depth on design conditions, including details on residential building design. The ordinance also touches upon lot standards.

Model Language and Guidance for Implementation

To successfully implement regulations to promote energy efficiency there are three ordinance components a community may adopt, dependent on the availability of building inspection and code enforcement personnel and support staff. The more comprehensive the regulatory approach, the greater the level of staff capability is required. The most effective way for a community to generate change and see positive results from their energy efficiency regulations is to adopt a combination of all three regulatory approaches.

For communities just beginning, the easiest and least burdensome on municipal staff is to simply adopt language into development regulations such as **subdivision or site plan review regulations** that requires site development to occur in a fashion that optimizes the passive solar heating and cooling opportunities. A second level is to adopt additional **building codes** that exceed the state energy codes for residential and non-residential construction. This however requires an established building inspector and code enforcement system. The third and most comprehensive method is to adopt a performance **zoning ordinance** encouraging the voluntary implementation of energy efficient practices for new construction in exchange for a set of incentives or bonuses. This however, requires the most staff time of any of the three options. When all three alternatives are used in combination the greatest energy savings results will be achieved.

Alternatively, rather than implementing a set of energy efficient development regulations as are proposed here, communities may choose to require all new development and renovations meet the requirements of the various US Green Building Council Leadership in Energy and Environmental Design (LEED) programs including:

- LEED-NC: New commercial construction and major renovation projects
- LEED-EB: Existing building operations
- LEED-CI: Commercial interiors projects
- LEED-CS: Core and shell projects
- LEED-H: Homes
- LEED-ND: Neighborhood development

Another alternative is for communities to adopt the Energy Star standards for all new construction and renovations.

SUBDIVISION AND SITE PLAN REVIEW REGULATIONS (DEVELOPMENT REGULATIONS)

The following should be incorporated as a new subsection within the local development regulations' design standards section.

I. ENERGY EFFICIENCY

All buildings are to be sited and developed in such a way as to maximize the benefits of the site for solar heating and passive cooling through the following:

- A. Buildings are to be oriented on the site to optimize passive solar heating and cooling opportunities.
- B. Buildings are to be oriented so as to minimize wind loads on the structure.
- C. Windows are to be placed, and appropriately shaded, to maximize solar penetration during the winter months and minimize solar penetration during the summer months.
- D. Landscaping is to be designed to provide shading and cooling during the summer months while minimizing reduction of solar heat penetration during the winter months.
- E. Landscaping is to be environmentally sensitive and should include native drought resistant plants and designs, and a reduced need for chemical fertilizers and pest control.
- F. Building design features are to discourage pest infestation, such as sloped roofs to minimize pigeons roosting.

BUILDING CODES

The following provisions may be adopted in addition to, or used to revise, the Statewide Energy Codes including the International Energy Conservation Code 2000 for residential construction and ASHRAE 99 for commercial and industrial development. They may be utilized in their entirety, or in part, as desired. The provisions should be reviewed by the community's building inspector, code enforcement officer, planning board and/or staff, and municipal legal counsel prior to adoption.

Alternatively, communities may directly reference and require that construction meet the standards of Energy Star for Homes or the U.S. Green Building Council's LEED program. Additionally, communities may wish to review the ASHRAE Advanced Energy Design Guide for Small Office Buildings (2004) to guide the establishment of energy efficient building codes for non-residential construction.

While it may not be practical or feasible to require that permit applicants provide an on-site renewable energy source, it is something that can be recommended or encouraged during the review process.

The building codes presented here have predominantly relied on research derived from the New Hampshire Public Utilities Commission, the Environmental Protection Agency's Energy Star fact sheets, LEED-NC and LEED-H standards, and Guidelines for Energy Efficient Construction for the City of Burlington, Vt.

This is not a fixed list of requirements, but instead a list of the fundamentals. Planning boards can and should review this list prior to implementation. This list can be expanded upon, but should not be reduced.

Before putting energy efficiency provisions into development regulations, Planning boards should review some of the references identified at the end of this chapter to better understand how an applicant can meet these standards.

I. ENERGY EFFICIENCY

A. Applicability

Wherever the following standards conflict with other building code requirements, those that are more restrictive, and with the greater energy efficiency savings, shall prevail.

II. GENERAL CONSTRUCTION STANDARDS

For all new construction and substantial improvements, buildings must comply with the following:

- A. A minimum of 50 percent of all non-hazardous construction or demolition debris materials must be either recycled or salvaged. Calculation of the percent recycled or salvaged can be based on either weight or volume, but the measure used must be consistent for all calculations under this provision.
- B. Seventy-five percent of the existing building structure and envelope, based on surface area and including the structural components of the building's walls, floors, and roof, and the building's exterior skin, shall be maintained in the case of substantial improvements to existing buildings. The following building components are exempted from the calculation of maintained materials: hazardous materials remedied or removed, window assemblies, and non-structural roofing materials.
- C. Re-use existing interior non-structural components or other recycled building materials such as the interior walls, doors, floor coverings, and ceilings in at least 50 percent of the completed building, as calculated by area, in substantial improvements to existing buildings.
- D. A minimum of 5 percent of the total project material costs must be for salvaged, refurbished, or reused materials. Additionally, another 5 percent of the total material costs must be for products with post-consumer recycled content.
- E. The project must use building materials that provide long-term durability and decreased maintenance costs; are extracted, processed and manufactured within 500 miles of the project site; and are made from renewable resources or materials wherever possible.
- F. The project must provide adequate storage and collection of recyclables both during and post construction. Post construction recyclable areas must be easily accessible to all building occupants/users and be sufficiently sized for storage and collection of non-hazardous materials including at a minimum paper, corrugated cardboard, glass, plastics, and metals.
- G. The project must reduce the building's heat load by either using roofing materials with a minimum Solar Reflectance Index (SRI) of 78 for roof slopes less than or equal to 2:12 or a minimum SRI of 29 for slopes greater than 2:12; or install a vegetated roof for at least 50 percent of the roof area.
- H. Air ventilation rates, calculated by the Breathing Zone Outdoor Airflow Ventilation Rate Procedure, must be exceed the State/Local Building Codes' minimum standards for all mechanically ventilated spaces by at least 30 percent.

Each community will need to define **substantial improvement** in their regulations. A standard definition: "Substantial Improvement" means any combination of repairs, reconstruction, alteration, or improvements to a structure in which the cumulative cost equals or exceeds 50 percent of the market value of the structure. The market value of the structure should equal either the appraised value prior to the start of the initial repair or improvement, or in the case of damage, the appraised value of the structure prior to the damage occurring.

- I. Within all naturally ventilated spaces the permit applicant must demonstrate that the room-by-room air flows will effectively ventilate at least 90 percent of the occupied area based on the minimum ventilation rates established in the State/Local building codes.

III. RESIDENTIAL CONSTRUCTION STANDARDS

For all residential new construction and substantial improvements, buildings must comply with the following:

- A. Covered and secure bicycle storage facilities must be provided on site allowing sufficient capacity for a minimum of one bicycle per dwelling unit. This may be provided as a separate storage facility or as individual carports or garages if part of the proposed design.
- B. Wood framed construction must use “Value-Engineered Framing” to improve the building envelope’s energy efficiency (see Figure 3.5.1).
 1. All exterior wall framing to be 2x6 stud framing, 24 inches on center.
 2. Align window openings with stud spacing to minimize narrow openings between studs that are difficult to insulate.
 3. Utilize plywood box beam or insulated headers with a minimum R-10 value.
 4. Arrange wall studs in corners to minimize uninsulated or difficult to insulate small pockets.
- C. Either provide insulation for flat ceilings at an R-Value of 49 for standard truss construction or an R-Value of 38 with a minimum six inch raised heel or energy truss (see Figure 3.5.2).

Since energy efficiency is highly dependent on restricting air leakage from conditioned to unconditioned spaces, careful attention needs to be given to the supply of fresh air and to monitoring the indoor air quality.

Figure 3.5.1 Ideal Corner Stud Configurations

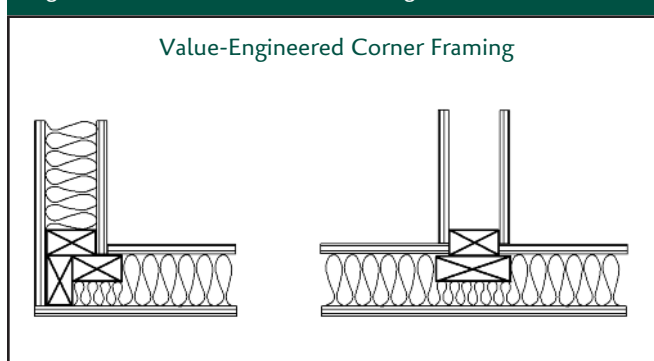
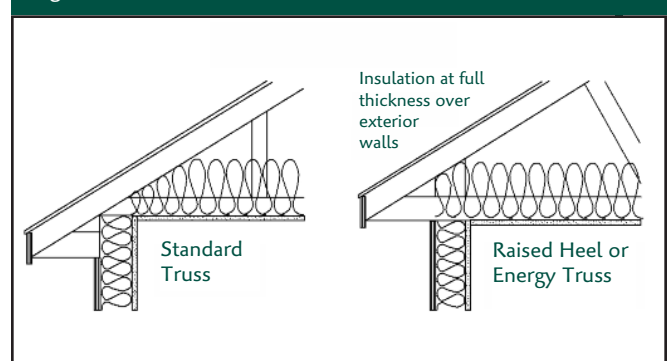


Figure 3.5.2 Roof Truss Insulation



- D. Windows must meet or exceed Energy Star criteria for Windows by 10 percent or more.
- E. Window air leakage shall not exceed 0.2 cubic feet per minute of air leakage per linear foot of window pane (CFM/FT).
- F. Air leakage tested to less than or equal to 0.25 air changes per hour (ACH).
- G. Duct leakage is tested to less than or equal to 3.0 CFM25 per 100 square feet to the outdoors.

- H. All ductwork must be insulated to a minimum of R-6 if located in an unconditioned space, including attics, basements, and exterior walls. Exceptions include insulation for exhaust air ducts or ducts within HVAC equipment. In addition, instances where the design temperature difference between the air in the duct and surrounding air is 15 degrees or less at the most extreme temperature differential are exempt from this provision.
- I. HVAC piping in unconditioned spaces conveying fluids at temperatures above 120 degrees or chilled fluids at less than 55 degrees must be insulated to a minimum of R-5.
- J. Circulating hot water systems flowing through unconditioned areas must be insulated to a minimum of R-4.
- K. All heating and cooling distribution systems must be designed to minimize their total run or length of ductwork, be as compact as possible, and minimize direction and size changes.
- L. Heating and cooling systems, including boilers, furnaces, heat pumps, programmable thermostats, and air conditioners, must meet or exceed Energy Star labeled product standards.
- M. Range hoods must be provided and vented to the outdoors.
- N. Mechanical rooms must be enclosed and insulated to a minimum of R-11.
- O. Ventilation must at a minimum be provided through a bath fan rated for continuous use and set on an independent timer.
- P. Insulation values throughout new construction must meet the following minimum standards based on the planned glazing percentage.
1. The Planned Glazing Percentage equals:

$$100 \times \frac{\text{The Glazing Area (square feet)}}{\text{Gross Wall Area}}$$

Performance Standards	Planned Glazing Percentage				
	10%	13%	15%	18%	25%
Window U-Value	0.35	0.33	0.31	0.30	0.27
Ceiling R-Value	38	38	38	38	38
Above Grade Wall R-Value	19	19	21	21	21
Floor R-Value	30	30	30	30	30
Door U-Value	0.35	0.35	0.35	0.35	0.35
% AFUE Efficiency	85	84	86	90	87
Basement Wall R-Value	13	19	19	19	19
Slab R-Value	10	10	10	10	13
Standard Roof Assembly R-Value	49	49	49	49	49
Raised Truss Roof	38	38	38	38	38
Cathedral Ceiling: up to 500 S.F.	30	30	30	30	30

IV. NON-RESIDENTIAL CONSTRUCTION STANDARDS

For all non-residential new construction and substantial improvements, buildings must comply with the following:

- A. Whenever possible the building must incorporate high-efficiency mechanical equipment that meets or exceeds Energy Star ratings, for those products rated by the EPA Energy Star Program. Products that are not reviewed by the EPA should be selected from the most energy efficient available.
- B. All insulation R-values must exceed [*State/Local*] building code standards by at least 15 percent.
- C. All new buildings must demonstrate a 20 percent improvement of the proposed building performance rating over the baseline building performance rating per State Building Codes/ASHRAE 99 by a whole building project simulation using Appendix G, Building Performance Rating Method, of ASRAE/IESNA Standard 90.1-2004. Existing building renovations must demonstrate a minimum 15 percent improvement of the overall building performance rating.
- D. Cargo doors and loading docks must have weather seals to minimize air infiltration when vehicles are parked in the doorway.
- E. Vestibules must be provided as a buffer between the interior conditioned air and the outdoors. Interior and exterior doors must be a minimum of seven feet apart when both sets of doors are closed.
- F. Recessed lighting fixtures must be Type IC rated and sealed, prohibiting air infiltration between conditioned and unconditioned air spaces. OR Type IC or non-IC rated fixtures must be installed inside a sealed box constructed with ½ inch gypsum wall board, or other air tight assembly, with a minimum ½ inch clearance from combustible materials and a minimum 3 inch clearance from insulation material.
- G. All windows must have a U-Value of .35 or lower.
- H. The applicant must demonstrate (through either computer simulation or other manual computation of indoor light measurements that the proposed building provides a minimum daylight illumination level of 25 horizontal footcandles in 75 percent of the occupied areas. Measurements shall be based on clear sky conditions, at noon, on the equinox, 30 inches above the finished floor. Measurements must be taken on a 10-foot grid and documented on the building floor plans. Exception: This provision may be waived if the applicant can demonstrate that the indoor area use would be hindered or impeded by the introduction of daylight.
- I. The building's lighting design must provide individual lighting controls for 90 percent of the building occupants/users (either as individuals or groups) to make adjustments to suit their individual (or group) needs and preferences.
- J. The building's thermal comfort design must provide controls so that 50 percent of the building's occupants/users (either as individuals or groups) may make adjustments to suit their individual (or group) needs and preferences.

- K. Design all HVAC systems to meet the requirements of ASHRAE's Thermal Comfort Conditions for Human Occupancy.
- L. Building HVAC ductwork must be placed in insulated or conditioned spaces or must be insulated to exceed the R-values specified in the *State/Local* building code standards by at least 15 percent. Exception: Dust insulation is not required on ducts located within equipment or when the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15 degrees.
- M. There shall be no use of CFC-based refrigerants in new building construction for heating, ventilation, air conditioning, and refrigeration systems or CFCs as found in fire suppression systems. For conversions or renovations to existing building, there must be a complete CFC phase out prior to building completion.
- N. All non-residential new construction or major renovations must provide bicycle racks for 5 percent of the building's occupants or users within 200 yards of the building entrance and separate shower facilities for men and women.
- O. Window air leakage shall not exceed 0.2 cubic feet per minute of air leakage per linear foot of window pane (CFM/FT)
- P. Air leakage tested to less than or equal to 0.25 air changes per hour (ACH).
- Q. Duct leakage is tested to less than or equal to 3.0 CFM25 per 100 square feet to the outdoors.

ZONING ORDINANCE ARTICLE

I. PURPOSE

The purpose of this Article is to encourage and provide for energy efficient development within [Community] for both new and substantially improved buildings. It is intended to reduce energy consumption and promote the use of alternative fuel sources. This Article was established in order to meet the goals related to energy efficiency set forth in the [Community] Master Plan.

II. AUTHORITY

The provisions of this Article are adopted pursuant to RSA 674:17 I (j) and are for the purpose of promoting the use of solar, wind, or other renewable energy systems and to protect access to energy sources by the regulation of orientation of streets, lots, and buildings, establishment of maximum building height, minimum set back requirements, and limitations on type, height, and placement of vegetation.

III. APPLICABILITY

The provisions of this Article are permitted as a conditional use within *all zoning districts* defined in this ordinance. Any building constructed to meet the energy efficiency standards of this Article shall be certified by the *Community Zoning Department/Planning Department/Building Inspector* as an Energy Efficient Building.

IV. DEFINITIONS

Demand: The rate at which energy is delivered to loads and scheduling points by generation, transmission or distribution facilities. It is the produce of voltage and the in phase component of alternating current measured in units of watts or standard multipliers thereof, e.g., 1,000 W=1kW.

Energy Efficient Building: Any building that is proven to exceed the minimum legal efficiency standards provided by the Statewide Energy Codes, including the International Energy Conservation Code 2000 for residential construction and ASHRAE 99, or any subsequent revisions adopted by the State, for commercial and industrial development.

Load Profiling: The process of graphing a customer's demand for energy over a period of time, typically a day, season or year.

Renewable Energy Generation: The energy generation from renewable resources including, but not necessarily limited to, biomass, solar thermal, photovoltaic, wind, geothermal, small hydropower of 30 megawatts or less, digester gas, landfill gas and municipal solid waste generation technologies.

Substantial Improvement: Any combination of repairs, reconstruction, alteration, or improvements to a structure in which the cumulative cost equals or exceeds 50 percent of the market value of the structure. The market value of the structure should equal either the appraised value prior to the start of the initial repair or improvement.

Utility Distribution Companies: The entities which will continue to provide regulated services for the distribution of electricity to customers and serve customers who do not choose direct access.

V. CONFORMANCE AND INCENTIVES

Applications under this *Article* are eligible for status as an Energy Efficient Building and density bonuses based on their energy efficiency performance as demonstrated by completion of the checklists provided in section VI of this *Article*; and computation of their energy efficiency score as provided below.

Communities can modify the minimum score provision, provided in section V.B, to earn a bonus. The density bonus proposed in section V.C is also malleable and should be reviewed to ensure the bonus is sufficient within the local market. Alternatively, density bonuses could instead be based on how much an application exceeds the State Energy Codes' baseline building performance rating standards. The standards provided in section VI could then serve as an educational piece to help applicants achieve efficiency levels beyond existing code requirements.

Communities should also inform applicants of other incentives to creating an energy efficient building, such as the State's local option property tax exemption program, the Energy Policy Act of 2005 tax credits, net metering, and others that may become available in New Hampshire.

A. An applicant's score is calculated as follows:

For residential applications: Add the score earned in section VI.A to the score earned in VI.B, divide by a maximum possible score of *[insert the total number of checklist items in sections VI.A and VI.B]* and multiply by 100.

For non-residential applications: Add the score earned in section VI.A to the score earned in VI.C, divide by a maximum possible score of *[insert the total number of checklist items in sections VI.A and VI.C]* and multiply by 100.

B. To earn the status of an Energy Efficient Building, an application under this *Article* must earn a minimum score of 50 out of a maximum 100.

C. All applications that earn the status of an Energy Efficient Building under this *Article* are eligible for a density bonus of 15 percent.

VI. ENERGY EFFICIENCY STANDARDS

The following standards should serve as a check list for applicants. All applicants under this *Article* shall complete section VI.A and then either section VI.B for residential applications or section VI.C for non-residential applications.

A. All applicants under this *Article*, both residential and non-residential applicants for new construction and substantial improvements to existing structures, should consider the following methods to achieve energy efficiency. Applicants should check off all energy efficient principles on this list that are utilized in the proposal. All subdivision and site plan review applications must document that these check points have been included in the design, and be certified by a registered architect or engineer or other qualified third party testing entity.

Check all those that have been incorporated in this application:

- The proposal represents an optimized resource efficient design and minimizes the building materials to be consumed.
- Buildings have been oriented on the site to maximize passive solar heating and cooling opportunities and to minimize wind loads on the structure.
- Windows have been placed, and appropriately shaded, to maximize solar penetration during the winter months and minimize solar impacts during the summer months.
- Utilize additional passive cooling and heating systems.
- All insulation R-values exceed code standards by at least 5 percent.
- Building HVAC duct work is placed in insulated spaces.
- Building materials will be reused by recycling demolition materials and seeking used materials for new construction or rehabilitation.
- The project uses building materials that provide long-term durability or decreased maintenance costs.
- The project provides for adequate storage and collection of recyclables both during and post construction.
- Landscaping is designed to provide shading and cooling during the summer months while minimizing reduction of solar heat penetration during the winter months.
- Environmentally sensitive landscaping, which should include native drought resistant plants and designs and a reduced need for chemical pest control.
- Building design features have been employed to discourage pest infestation, such as sloped roofs to minimize pigeons roosting.
- Includes onsite renewable energy generation. Type: _____

Score: the total number of checkmarks out of a possible [*insert the total number of checklist items in sections VI.A*].

B. All residential construction applicants for new construction and substantial improvements to existing structures should consider the following additional methods to achieve energy efficiency. Applicants should check off all energy efficient principles on this list that are utilized in the proposal. All subdivision plan and site plan applications must document that these check points have been included in the design, and be certified by a registered architect or engineer or other qualified third party testing entity.

Check all those that have been incorporated in this application:

- Meets Energy Star criteria for Homes or LEED-R.
- Wood framed construction utilizes “value-engineered framing” to improve the building envelope’s energy efficiency.

- Air leakage tested to less than or equal to 0.25 ACH.
- Windows exceed Energy Star criteria for Windows by at least 5 percent.
- Duct leakage is tested to less than or equal to 3.0 CFM25/100 square feet to the outdoors.
- Heating and cooling systems meet or exceed Energy Star standards for HVAC systems.
- All appliances are certified Energy Star appliances.
- All installed lighting fixtures use energy efficient fixtures and controls.
- The house perimeter and gross area are smaller than the local averages as determined by the [Community Building Inspector/Code Enforcement Officer].

Score: the total number of checkmarks out of a possible [insert the total number of checklist items in sections VI.B].

- C. All non-residential construction applicants for new construction and substantial improvements to existing structures should consider the following additional methods to achieve energy efficiency. Applicants should check off all energy efficient principles on this list that are utilized in the proposal. All subdivision plan and site plan applications must document that these check points have been included in the design, and be certified by a registered architect or engineer or other qualified third party testing entity.

Check all those that have been incorporated in this application:

- Incorporate day lighting as much as possible based on the structure typology to reduce demand for electric lighting fixtures.
- Utilize appropriate window glazings with low-E coatings and high R-value or low U-factor ratings.
- Optimizes the electrical lighting design to minimize the need for artificial lighting.
- Utilize full cutoff lighting fixtures outdoors to eliminate light pollution.
- Lighting fixtures are energy efficient.
- Incorporate high-efficiency mechanical equipment.
- Optimize HVAC systems.
- Utilize energy efficient appliances and office equipment that meet or exceed Energy Star ratings whenever possible.
- Provide bicycle racks for five percent of the building's occupants or users within 200 yards of the building entrance and separate shower facilities for men and women.

Score: the total number of checkmarks out of a possible [insert the total number of checklist items in sections VI.C].

The lists of performance standards in section VI are not fixed lists, but instead suggestions of ideal content, and can be modified by the planning board after careful review. Once a fixed list is established, the total number of items on each list needs to be inserted into the score calculation text in this section and in section V.

VII. CERTIFICATION OF COMPLIANCE

- A. Written confirmation of energy efficient system performance shall be provided by the applicant from an independent licensed engineer or architect, or other agency certified to perform energy efficiency audits. Additional independent third party testing of the projects energy efficiency shall be conducted upon completion of construction and submitted to the [*Community Building Inspector/Code Enforcement Officer.*] The [*building inspector/code enforcement officer*] shall verify that each of the energy saving systems is installed and functions properly.
- B. No certificate of occupancy shall be issued for an Energy Efficient Building without written confirmation of the building's energy efficiency performance as required in section 7.1 above.

Municipalities may also elect to require a performance guarantee, similar to a road bond, based on the percent of the total building value to ensure compliance. The guarantee may be structured to designate a specified number of years to bring the efficiency performance up to the permitted level or the town will utilize the funds to carry it out.

VII. MONITORING AND ENFORCEMENT

- A. This article shall be administered by the [*Planning Board/Local Planning Department/ Building Inspector/Code Enforcement Officer*]. Applications for the provisions provided under this *Article* shall be made to the planning board and shall be part of the submission of an application for site plan or subdivision plan approval.
- B. The applicant or building owner is required to monitor the energy saving systems and document their performance over time, through tracking and documenting the number of energy units from either their electrical, oil, natural gas monthly bills or in the case of on site power generation the units of energy produced by those sources, to certify that they are in fact achieving the energy savings that approval of the project was based on. This documentation should be provided to the [*Community Building Inspector/Code Enforcement Officer*] semi-annually following issuance of a certificate of occupancy.

REFERENCES

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- US Green Building Council. 2005. "LEED-NC: Green Building Rating System for New Construction and Major Renovations, Version 2.2." www.usgbc.org/FileHandling/show_general_file.asp?DocumentID=1095, March 29, 2006.
- Vermont Builds Greener. 2005. "Vermont Builds Greener." www.bsr-vt.org/vermontbuiltgreenprogram.html, January 27, 2006.

The following are links to many of the existing energy efficiency programs offered by the State of New Hampshire or by the U.S. Government. These programs can serve as valuable incentives to developers and communities. Many provide financial or planning support.

Database of State Incentives for Renewable Energy. www.dsireusa.org, October 26, 2005.

National Association of Home Builders Research Center. 2002. *Summary of Existing Green Building Programs*. Colorado: National Renewable Energy Laboratory. www.nahbrc.org/Docs/MainNav/GreenBuilding/3643_Summarycomplete.pdf, October 24, 2005.

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State of New Hampshire Office of the Governor. 2005. "Governor Signs Executive Order Directing State Agencies to Cut Energy Use by 10 Percent." www.nh.gov/governor/news/071405SaveEnergy.htm, October 24, 2005.

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The following organizations and websites provide a wealth of information on energy efficiency.

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BuildingGreen, Inc. www.buildinggreen.com

Building Science Corporation. www.buildingscience.com

Efficiency Vermont. www.encyvermont.com

Energy Federation, Inc. www.efi.org

Energy Star. energystar.gov

Healthy Building Network. www.healthybuilding.net

McDonough Braungart Design Chemistry. www.mbdc.com

New Hampshire Sustainable Energy Association. www.nhsea.org

Northeast Sustainable Energy Association. www.nesea.org

Sustainable by Design. www.susdesign.com

The Jordan Institute. www.thejordaninstitute.org

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