

REDUCING ENERGY USE IN THE BUILT ENVIRONMENT

EAST CENTRAL VERMONT: WHAT WE WANT
MOVING TOWARD SUSTAINABILITY: WHERE WE LIVE AND HOW



"I believe that the average guy in the street will give up a great deal, if he really understands the cost of not giving it up. In fact, we may find that, while we're drastically cutting our energy consumption, we're actually raising our standard of living."

~David R. Brower



A VIBRANT, HEALTHY, AND EQUITABLE REGION.

REDUCING ENERGY USE IN THE BUILT ENVIRONMENT

VISION: An engaged Vermont community that sources and consumes energy in a way that is economically secure and environmentally sound.

“Vermont is the second most petroleum dependent state in the country due to its high use of heating oil.”¹ *~Northeast Biomass Working Group*

We must reduce our energy use through changes to our transportation system, land use development

patterns, and built environment.

Energy use in East Central Vermont (ECV), like all of Vermont, continues to be a major challenge in the pursuit of a sustainable future. Nationwide concern about oil dependence has grown since the 1970s oil and energy crises.² In the mid-2000s, the price of oil-based fuels rose dramatically, which highlighted the risks of oil dependency. Vermont, like some New England states (but unlike most of the country), is dependent on oil for heating as well as transportation. High fuel costs persist, and the following question remains: How can Vermont reduce its dependence on energy produced beyond its borders?

The CEP promotes efficiency and



Blower door test during a home energy audit

In 2011, the Vermont Public Service Department produced the Vermont Comprehensive Energy Plan (CEP), which aimed to have 90% of Vermont’s energy produced through renewable energy sources by 2050.³ This is a lofty goal, and the CEP recognizes that many pieces of Vermont’s energy profile must be put into place in order to reach it. In addition to changing the source of Vermont’s energy, energy use must be reduced.

The advantage of energy conservation has been quantified on the local level as tons of air pollutants avoided and dollars saved.³



Livability Principles Addressed

- Promote equitable, affordable housing.
- Enhance economic competitiveness.
- Support existing communities.
- Coordinate policies and leverage investment.
- Value communities and neighborhoods.

conservation as top priorities in all energy sectors. It recommended creating a whole-buildings efficiency road map—including program delivery, consumer outreach, funding and finance mechanisms, and progress metrics—by the end of 2012.⁴ This goal was not met.

The CEP supports Vermont’s thermal efficiency goals, which were

established in 2007 and 2008 under Act 92 (10 V.S.A. § 581):

- Improve 20% of housing by 2017 (more than 60,000 units), and improve 25% of housing by 2020 (about 80,000 units).
- Reduce fuel needs by 25% in building units served.
- Reduce fossil fuel consumption across all buildings by 0.5% per year, leading to reductions of 6% by 2017, and 10% by 2025.
- Save \$1.5 billion on fuel bills through improvements installed between 2008 and 2017.

As of 2013, the state has fallen short of

reaching these goals.*

In support of these priorities, and recognizing the broad scope of issues relating to a sustainable energy future, this plan element focuses on issues related to energy use in the built environment.

THE ECONOMIC IMPORTANCE OF REDUCING ENERGY

The economic importance in this case is quite simple. The money our residents pay to heat and power our homes, impacts the discretionary** spending that is left, especially for those of low- and moderate-incomes. If building owners and renters took advantage of utilizing more efficient products and took steps to improve building efficiency, they could save 10 to 30 percent on their energy bills,⁵ and in Vermont that can mean saving



Vermont’s housing stock is among the oldest in the United States.⁶

*The Public Service department unveiled a progress report in December 2013 titled “Total Energy Study.” Based on this report, a road map for meeting the state’s energy needs with renewables is scheduled for release in the summer of 2014.⁷

**Discretionary income is what’s left once necessities such as food and shelter are deducted from disposable income.⁸



hundreds of dollars a year. While there are many reasons to improve energy efficiency—reducing carbon dioxide emissions, increasing energy security, and relying less on fossil fuels—one of the most important reasons is to reduce the cost of energy. The money saved on energy, which was mostly going out of state, can then resonate throughout our local economy instead, through spending on goods and services.

CHALLENGES

Barriers to reaching the CEP’s goals do exist. The purpose of this plan element is to identify these barriers, and to provide solutions through policy and action steps that will effectively remove these barriers when properly implemented.

- **AGING BUILDING STOCK:** Residential homes constitute the majority of Vermont’s built environment. As such, residential energy represents 30% of Vermont’s total energy consumption (second only to transportation), with heating being the largest energy consumer.⁹ Vermont’s climate demands heating. However, the state’s housing stock is among the oldest in the United States, and the substantial portion of Vermont’s housing stock (33%) that was built prior to 1950 is responsible for much of the total heat consumption.¹⁰ These older homes were constructed before high energy costs made many energy conservation practices a priority

What is zero net?

“A zero net energy building is one that is optimally efficient and, 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.”¹¹

~Massachusetts Zero Net Energy Buildings Task Force



SmartHomze 560: Net Zero Energy Living

in the built environment. As a result, a substantial number of homes utilize wasteful amounts of energy and are expensive to maintain. According to the Massachusetts Zero Net Energy Buildings Task Force: “With buildings contributing close to 40 percent of greenhouse gas* emissions and consuming 40 percent of energy in the United States, energy efficiency and renewable energy technologies must become central to the way we design and build.”¹²

- **INEFFICIENT ENERGY EFFICIENCY STANDARDS:** The owners of the region’s buildings (both new and old structures) must be guided toward the goal of zero net energy use. The challenge is that even though the state code is modeled after the

*Greenhouse gases help capture and maintain the temperature of the Earth’s surface. They include water vapor, carbon dioxide, methane, nitrous oxide, and a variety of manufactured chemicals. Some are emitted from natural sources; others are a result of human activities. Over the past several decades, rising concentrations of greenhouse gases have been detected in the Earth’s atmosphere, which leads to an increase in the average temperature of the Earth’s surface.¹³



IECC* (International Energy Conservation Code) for both commercial and residential buildings, the state code is consistently behind the most current IECC code. Zero net energy use cannot be achieved using current efficiency standards. In addition, there are compliance issues with the Vermont residential building energy code, which is not effectively enforced by the Public Service Department.

To move toward zero net energy use in the built environment, the code must be substantially improved, and enforced, and people must be educated about the code's existence and purpose.

- **COST OF IMPROVEMENTS:**

The up-front cost of energy efficiency improvements and building-scale renewable energy generation remains a challenge. Despite the demonstrated long-term savings benefits, the cost

necessary to significantly reduce energy consumption and add renewables can be a significant barrier to implementation.¹⁴ This is an issue for all homeowners, but especially for low- and moderate-income homeowners—an issue of social equity that transcends the spectrum of energy use. At the commercial and public sector levels, where capital budgets and operating



Vermont's Act 183.

“Vermont communities face increasing pressure to meet the seemingly incompatible planning objectives of encouraging growth and preserving the state’s rural character. The approval of Public Act 1833 in May of 2006 is the most recent step in Vermont’s response to that challenge. Act 183 codifies detailed guiding principles for local and regional land use decisions and encourages centralized development through economic and regulatory incentives.”¹⁵

~Vermont law Review

**Introduced in 1998, the IECC addresses energy efficiency on several fronts including cost savings, reduced energy usage, conservation of natural resources, and the impact of energy usage on the environment.¹⁶*



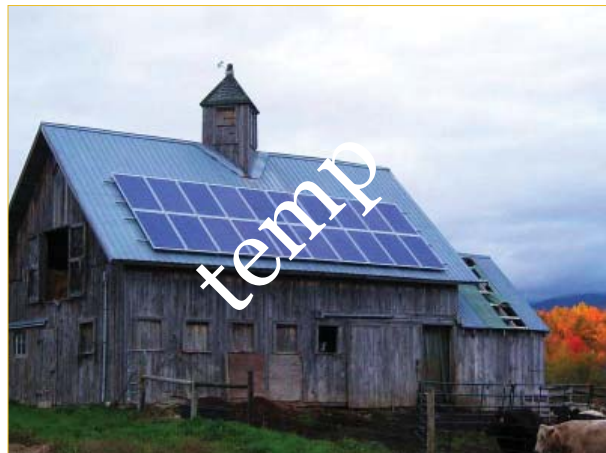
budgets are often set independently of each other, there is no opportunity to use the savings from the latter to defray the former, thus removing the incentive to implement energy improvements. To meet this challenge, existing programs (such as PACE*), funding, and incentives must be improved and expanded. New avenues for funding energy efficiency improvements will need to be developed by both the private and public sectors.

- **UNSUSTAINABLE DEVELOPMENT PATTERNS:** In the early 1800s, Vermont's settlements were located in the most favorable places and concentrated to make commerce and transportation more convenient. Scattered residential developments did exist, but these were not the homes of commuters—these were hill farms that had little daily traffic.¹⁷ The pattern of development that has occurred in the ECV region over the past 50 years has diverged from the early settlement patterns.

The current sprawl development pattern—characterized by dispersed, automobile-dependent development outside of population centers, along highways, and in rural areas—is not conducive to energy use reduction. We continue to construct the majority of our new buildings (primarily residences) in a low-density pattern, contributing to our

continued reliance on private automobiles for most travel and limiting fuel options. A building located within a densely developed village might be able to utilize renewably generated combined heat and power, whereas a building in a rural area would not.

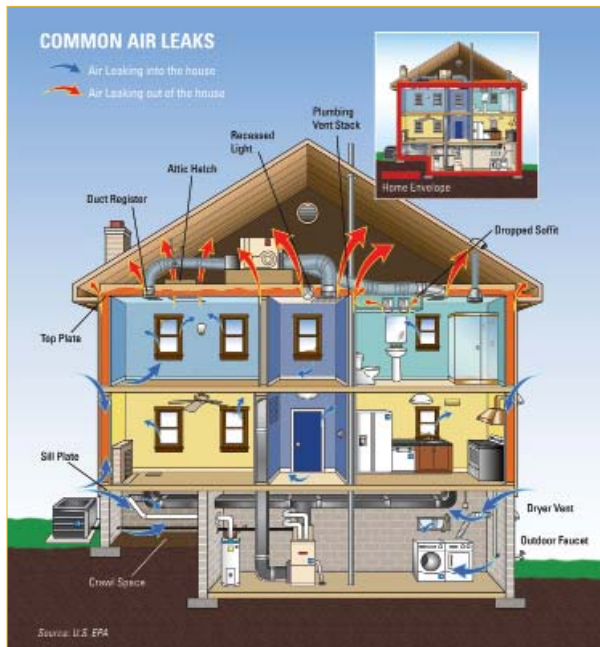
In order to achieve the plan's goals, transportation energy use cannot be ignored as we strive to create more energy-efficient buildings. Essentially, "location matters!" The region should embrace Smart Growth* which, if properly implemented, "can help communities



Buildings in the U.S. consume 41% of energy and contribute 40% to greenhouse gas emissions. These percentages prove we've got to improve building energy use if we hope to curb climate change.¹⁸

**Property Assessed Clean Energy (PACE) financing is designed to encourage the installation of renewable-energy systems and improve energy efficiency by helping property owners overcome the barrier of high up-front costs. PACE financing effectively allows property owners to borrow money from a local government to pay for renewable-energy systems and/or energy-efficiency improvements. The amount borrowed is typically repaid via a special assessment on property taxes, or another tax or bill, such as a utility bill. The repayment is spread over a long period of time.¹⁹*

***Smart Growth is a more sustainable way to build and maintain our towns and cities. With Smart Growth, urban, suburban, and rural communities are built with housing and transportation choices near jobs, shops, and schools.²⁰*



Building owners often have a limited understanding of the connections between their energy use and potential building problems such as drafts, air quality, and ice dams.²¹

supporting the rural landscape, helping existing places thrive, and creating great new places.”²² In other words, embracing Smart Growth reduces energy use, which leads to cost savings for both households and municipalities, while creating vibrant communities and taking pressure off our natural resources.

Development that is more effectively directed within and adjacent to historic downtowns, villages, and neighborhoods will reduce the need for motorized transportation. In 2006, via Act 183, Vermont codified its own detailed guiding principles for local and regional land use decisions

based upon the Smart Growth Principles. Although communities are not required to plan, those that do are encouraged to uphold planning and development goals that reinforce Smart Growth Principles.

Given the limitations of municipal infrastructure in the ECV region (that is, wastewater systems and water supplies), the state must provide financial assistance, incentives, streamlined permitting, and new technology education to communities to develop or expand public sewer and water systems in order to facilitate greater density and improve the energy efficiency of land use development patterns. Further, communities will need to develop regulations (zoning and subdivision) that require buildings to be sited in a manner that reduces energy use and improves energy conservation.

- **EDUCATION:** Building owners often have a limited understanding of the connections between their energy use and potential building problems such as drafts, air quality, and ice dams.²³

When making energy decisions regarding their buildings, owners frequently do not realize or factor in the non-energy benefits that result from weatherization and energy efficiency improvements, such as increased comfort, safety and financial savings. They may also lack confidence in the return on investment that these improvements can provide.

Another issue is starting and following through with the improvement process,



which can be daunting. Owners may not be sure how to start or where to get objective information. If this information is too difficult to find or understand, building owners can get frustrated and give up.²⁴

To increase energy literacy, stakeholders at the state, regional, and municipal levels should implement a coordinated educational effort targeting both the public and private sectors. Many towns have energy committees that work toward these efforts; however, a state-wide, coordinated force of energy committees could help the state reach its energy goals.

To create a future for the ECV region in which energy use in the built environment is sustainable, this plan sets the following goals, policies, and actions.



VERMONT SMART GROWTH PRINCIPLES

24 V.S.A. § 2791. Definitions

“Smart growth principles” means growth that:




- (A) Maintains the historic development pattern of compact village and urban centers separated by rural countryside.
- (B) Develops compact mixed-use centers at a scale appropriate for the community and the region.
- (C) Enables choice in modes of transportation.
- (D) Protects the State’s important environmental, natural and historic features, including natural areas, water quality, scenic resources, and historic sites and districts.
- (E) Serves to strengthen agricultural and forest industries and minimizes conflicts of development with these industries.
- (F) Balances growth with the availability of economic and efficient public utilities and services.
- (G) Supports a diversity of viable businesses in downtowns and villages.
- (H) Provides for housing that meets the needs of a diversity of social and income groups in each community.
- (I) Reflects a settlement pattern that, at full build-out, is not characterized by:
 - ▶ Scattered development located outside of compact urban and village centers that is excessively land consumptive;
 - ▶ Development that limits transportation options, especially for pedestrians;
 - ▶ The fragmentation of farm- and forest-land;
 - ▶ Development that is not serviced by municipal infrastructure or that requires the extension of municipal infrastructure across undeveloped lands in a manner that would extend service to lands located outside compact village and urban centers;
 - ▶ Linear development along well-traveled roads and highways that lacks depth, as measured from the highway.






GOAL A: Create a built environment that supports the transition to 90% renewables and reduced net GHG emissions by 90% (below 1990 levels) by 2050.

GOAL B: Reduce the long-term economic impact of rising energy costs.

Policy A.1 & B.1: Promote tax changes that incentivize energy efficiency and the use of renewable energy in buildings and commercial processes.

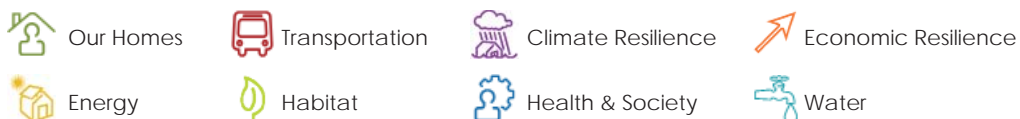
Actions:	Responsible Parties:
1. Create a system of taxes or fees on non-renewable energy that are used to support the development of energy efficiency and renewable energy at all levels. 	State and federal entities
2. Eliminate state sales taxes for the next five years on the purchase and installation of renewable energy systems. 	State
3. Create an efficiency tax credit process similar to the low-income tax credit, providing funding for community energy projects such as combined heat and power, municipal energy efficiency improvements, or school improvements. 	State and federal entities

Policy A.2 & B.2: Advocate for the introduction of legislation that mandates the steady increase of efficiency in the built environment with the ultimate goal of achieving carbon neutrality by 2050.

Actions:	Responsible Parties:
1. Require the inclusion of annual building energy use and cost in individual properties' Vermont Property Disclosure Forms. 	State
2. Require third-party certification for Residential Building Energy Standards. 	State
3. Increase Vermont's Residential Building Energy Standards to meet zero net energy use by 2050. 	State

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FOCUS AREA ICONS: Some of the actions outlined in the Reducing Energy Use in the Built Environment plan element also serve to further other goals within the ECV Sustainability Plan. Use of these icons indicates those focus areas.





4. Mandate zero net energy use in all new state building construction.	State
5. Enforce the Vermont Residential Building Energy Standards	State

Policy A.3 & B.3: Support the development of funding and financing mechanisms that encourage energy efficiency and renewable energy programs as well as reduced greenhouse gas emissions.





Actions:	Responsible Parties:
1. Increase available funding for the weatherization of residential, municipal, and school buildings.	Federal and state entities
2. Provide funding for building energy audits (consider carbon tax as a funding sources).	Federal and state entities
3. Increase funding (consider using funding from energy tax) to support energy efficiency and renewable energy programs that reduce the financial burden of home ownership for lower-income Vermonters.	Federal and state entities
4. Promote financing mechanisms that are based on life-cycle cost analysis (LCCA)* to ensure that energy efficiency and renewable energy projects are cash-flow positive.	Federal and state entities and private sector
5. Create funding or financing mechanisms to enable municipalities and schools to more easily invest in renewable energy generation and energy- efficient systems.	Federal and state entities and private sector
6. Encourage the building inspection industry to include energy performance evaluation as part of building inspections, and encourage banks to use this information when underwriting financing.	Private Sector

Policy A.4 & B.4: Develop local and regional land use plans and regulations that reduce energy consumption in the built environment and transportation.



Actions:	Responsible Parties:
1. Revise regional and town plans' future land use elements to ensure that most development takes place in core areas as required by state law.	Regional planning commissions and towns

[more](#) →



<p>2. Review (and revise when necessary) policies and regulations that may create obstacles for developers to more easily build compact, walkable, mixed-use* places.</p> 	<p>Federal and state entities, regional planning commissions, and towns</p>
<p>3. Ensure subdivision designers take reasonable steps to site development so as to maximize energy efficiency and access to renewable energy.</p> 	<p>State, regional planning commissions, and towns</p>
<p>4. Encourage the development of municipal energy codes that are equivalent to or more stringent than state building energy standards.</p> 	<p>Regional planning commissions and towns</p>
<p>5. Mandate life-cycle, cost-effective energy improvements in all projects subject to Act 250.</p> 	<p>State and regional planning commissions</p>

Policy A.5 & B.5: Support the development of educational tools and programs that engage the public and related stakeholders about the importance and advantages of energy improvements in the built environment.

Actions:	Responsible Parties:
<p>1. Create outreach programs/materials for the public and private sector (including mortgage companies and Realtors) that discuss life-cycle costing and the economic advantages of energy efficiency in buildings.</p> 	<p>State, regional planning commissions, and private sector</p>
<p>2. Create programs for the public and private sector that educate people (including K-12 students) about renewable energy, energy efficiency, and the dangers that GHGs and non-renewable energy sources pose to our future.</p>	<p>State, regional planning commissions, Supervisory Union, and non-profits</p>
<p>3. Support the formation, coordination, and activities of local energy committees.</p> 	<p>State, regional planning commissions, and towns</p>

* Mixed use development combines two or more different types of land uses.



MAKING CONNECTIONS: FROM OUR ENERGY TO TRANSPORTATION!

Buildings account for 41% of total energy use in the United States. This is more than the transportation and industry sectors combined.²⁵ With this in mind, the goals, policies, and recommendations in this chapter strive to support the Vermont 2011 Comprehensive Energy Plan's vision of obtaining most of our energy through renewable sources by 2050. We believe the most important steps toward reaching this goal are supporting and implementing building energy efficiencies, and designing and using a smarter transportation network.

Although we are historically set up to drive long distances, often times alone, our next plan element, "Regional Transportation," focuses on policies and actions to achieve a more sustainable transportation system that relies on land use planning to support Smart Growth Principles.



ENDNOTES

- ¹ "Building Vermont's Local Thermal Energy Economy." *Northeast Biomass Thermal Working Group*. (2012).
- ² *Energy Crisis (1970s)*. History.com. (2010). Accessed August 2014 from <http://www.history.com/topics/energy-crisis>.
- ³ "Energy Conservation Action Plan." *Green Communities*. U.S. Environmental Protection Agency (May 2013) Accessed January 2014 from http://www.epa.gov/greenkit/q5_energ.htm
- ⁴ "Facts, Analysis, and Recommendations." *Comprehensive Energy Plan 2011*. Volume 2. Vermont Public Service Department. (December 2011).
- ⁵ "Energy Efficiency: Reduce Energy Bills, Protect the Environment." National Action Plan for Energy Efficiency. United States Environmental Protection Agency.
- ⁶ Black-Plumeau, Leslie and Maura Collins. *2010 Vermont Housing Needs Assessment*. Vermont Housing Finance Agency. (December 2009).
- ⁷ "Renewable Energy Vermont." Building Our Renewable Energy Future: Clean Sustainable, Secure. *Energy Study Maps Path to 90 Percent Renewables*. (December 17, 2013) Accessed December 2013 from <http://www.revermont.org/blog/energy-study-maps-path-to-90-percent-renewables/>
- ⁸ Tanya Robertson. "What is Consumer Discretionary Income?" Finance by Demand Media. Accessed August 2014 from <http://finance.zacks.com/consumer-discretionary-income-5784.html>.
- ⁹ "Profile Overview." Vermont. Independent Statistics & Analysis. *U.S. Energy Information Administration*. (July 2012). Accessed December 2013 from <http://www.eia.gov/state/?sid=VT>.
- ¹⁰ See Note 6.
- ¹¹ *Getting to Zero*. Massachusetts Zero Net Energy Buildings Task Force. (March 11, 2009).
- ¹² See note 11.
- ¹³ "The Greenhouse Gas Effect." *Infoplease*. (2012). Accessed January 2014 from <http://www.infoplease.com/ipa/A0004686.html>.
- ¹⁴ See Note 11.
- ¹⁵ Kraichmnan, Jack. "Vermont's Act 183: Smart Growth Takes root in the Green Mountain State." *Vermont Law Review*. (2008). [Vol. 32:583].
- ¹⁶ "2012 International Energy Conservation Code." *International Code Council*. (2013). Accessed January 2014 from <http://shop.iccsafe.org/2012-international-energy-conservation-code-soft-cover.html>
- ¹⁷ McCarthy, Kate. "Downtowns, Villages, and Historic Settlements: An Idea from the Past that Strengthens our Future." East Central Vermont: What We Want. *Vermont Natural Resources Council*. (2013).
- ¹⁸ Ewing, Reid, Keith Bartholomew, Steve Winkelman, Jerry Winkelman, Jerry Walters. Don Chen. "Growing Cooler." Urban Land Institute.
- ¹⁹ "PACE Financing." *DSIRESOLAR*. U.S. Department of Energy. (2013-2014). Accessed January 2014 from <http://www.dsireusa.org/solar/solarpolicyguide/?id=26>.
- ²⁰ "What is 'smart growth'?" *Smart Growth America: Making Neighborhoods Great Together*. (2010) Accessed January 2014 from <http://www.smartgrowthamerica.org/what-is-smart-growth>
- ²¹ See Note 4.



²² Mishkovsky, Nadejda, Matthew Dalbey, Stephanie Bertaina, Anna Read and TadMcGalliard. "Putting Smart Growth to Work in Rural Communities." *International City/County Management Association (ICMA) and U.S. Environmental Protection Agency (EPA)*. (2010).

²³ See Note 4.

²⁴ See note 4.

²⁵ *Chapter 1: Building Sector*. Buildings Energy Data Book. U.S. Department of Energy. (March 2012). Accessed August 2014 from <http://buildingsdatabook.eren.doe.gov/ChapterIntro1.aspx>