# Fueling Vermont's Future

## Comprehensive Energy Plan
## and
## Greenhouse Gas Action Plan

Pursuant to 30 V.S.A. §202b

**Overview**
**July 1998**

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## Acknowledgements

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Department of Public Service also appreciates the comments that were made in response to public hearings and the Public Review Draft of this Plan. We heard from about 40 businesses, professional organizations, public interest groups, and public spirited Vermonters.

# Overview: Fueling Vermont's Future
# Comprehensive Energy Plan and Greenhouse Gas Action Plan

## Planning for Vermont's Energy Future

Policies and actions discussed in this Plan show a variety of ways that Vermont can make fundamental changes and progress toward meeting our energy and environmental goals. Department of Public Service, with input from the Agency of Natural Resources and the Agency of Transportation, prepared this Plan.

The purpose is to provide a resource for citizens and policy makers as we face today's complicated private and public energy decisions. With *Fueling Vermont's Future* as our guidebook, we can continue our efforts to maximize the benefits from energy use and explore how to best fuel Vermont's future.

This Plan is available in 2 versions: Volume 1 - Summary and Recommendations (200 pgs.) and in full detail as Volume 2 (500 pgs.). See our Web site **www.state.vt.us/psd** or contact the Department of Public Service.

The ultimate message that *Fueling Vermont's Future* presents is that Vermont could lead the nation in sound energy use if bold new policies, researched, modeled, and recommended in this Plan, were implemented. Substantial policy changes are needed now to move Vermont expeditiously toward the state's energy and environmental goals. To make serious progress, the state should take action first in the areas that can produce the greatest impacts. These primary actions are:

- **Capturing more energy savings in new and existing homes and multi-family low income housing**. Although the residential sector has experienced the smallest growth in energy use since the early 1980s compared to the commercial, industrial and transportation sectors, there are energy savings to capture particularly with implementation of Vermont's newly enacted residential building energy standards for new construction and improving and standardizing demand side management (DSM) programs. Energy efficiency is key to reducing the energy burden on low income households, and the Vermont Weatherization Program can greatly improve this group's access to energy efficiency services.

- **Increasing the use of renewable energy sources**. Replacing some of our non-renewable fuel use with renewables is another important step that deserves immediate action. Opportunities that benefit society as a whole by replacing non-renewable energy sources with renewable ones should be developed, particularly when new energy sources are needed as a result of increased demand or the retirement of older sources. Expiration of Vermont Yankee Nuclear Station's license in 2012 offers an important opportunity to substantially increase our use of renewables. If the state's power from Vermont Yankee is not replaced with non-emitting renewable energy sources, the state's greenhouse gas emissions will increase dramatically. By contrast, replacing nuclear power with wind power and the sustainable use of wood energy would not increase net carbon dioxide emissions. It is critical that we start now to put renewable technologies in place so the state will have choices for how to avoid increased emissions when Vermont Yankee's license expires and significant progress can be made toward improved sustainability and security.

- **Improving transportation energy use**. As indicated throughout this Plan, transportation is the largest energy use in Vermont. Transportation offers the greatest opportunities for more efficient energy use, reduced emissions, and reduced reliance on oil. Giant steps can be taken toward the goals of this Plan through bold actions such as increasing the efficiency of vehicles through higher CAFE standards and a variety of state polices to maximize fuel efficiency and to minimize safety risks and associated emergency service costs. Continued implementation of vapor recovery at gas stations and adoption of a low emissions vehicle standard will support reductions in transportation-related emissions. Efforts to shift travel to more efficient modes (buses, vanpools, trains) and greater focus on non-motorized transportation and telecommuting will also contribute to reductions in transportation energy use and emissions.

- **Reviewing energy policy and taxation at the state and federal levels to assure that energy goals are promoted**. A major theme of this Plan is making the operation of the marketplace more efficient by internalizing costs associated with energy use into the market price. Some energy costs are now hidden from consumers and not included in the price of fuel. In addition, some policies give tax breaks and funding to particular fuel sources, lowering total costs for these and distorting marketplace price signals. Internalizing more of the costs of energy in its price and eliminating advantages for some fuels would be significant in meeting energy goals at state and federal levels.

Progress in these areas, along with progress toward the potential benefits of opening Vermont's electric industry to retail competition while preserving societal benefits are important steps on the path to improved energy use, reduced greenhouse gas emissions, and better quality of life and well-being for all Vermonters - those alive today and our descendants living in Vermont in the future.

*Fueling Vermont's Future: Comprehensive Energy Plan and Greenhouse Gas Action Plan* confirms that energy supply and use are critical to Vermont and to Vermonters' well-being because energy has and continues to sustain and enrich our lives. The purpose and justification for this two volume document is to help Vermonters ensure that the benefits of energy use *continue and are maximized*. Progress toward our state energy goals is the path to this end. By working toward an adequate, reliable, secure, and sustainable energy supply, Vermont ensures that the benefits of energy use *continue into the future*. By working toward safe and environmentally sound energy sources and use, Vermont ensures that individuals are not directly or indirectly harmed, but actually *benefit.* Finally, by working toward energy sources and use that are efficient, affordable, and supportive of economic vitality, Vermont *maximizes the benefits* from energy use.

This Plan is available in several formats. Volume 1 - Summary and Recommendations (200 pages) is being distributed widely. Volume 2 (500 pages) has the same organization as Volume 1, with more detail particularly in policy analysis and modeling. Volume 2 is available on request from the Department of Public Service (see cover for contact information). *Fueling Vermont's Future* is also available to download from the DPS web site at **www.state.vt.us/psd**. Volume 1 is there now, and Volume 2 will soon be there.

This Plan is an updated edition of the *Vermont Comprehensive Energy Plan*, in accordance with state statute 30 V.S.A. §202b, and a first edition of the *Vermont Greenhouse Gas Action Plan*. This final version of Fueling Vermont's Future includes changes that reflect public input made on the draft document.

## What is *Fueling Vermont's Future* All About?

Volumes 1 and 2 of this Plan both follow the organization described below. Volume 1 is a summarized version, with selected tables and figures, 120 recommendations, a glossary and index (totaling about 200 pages). Volume 2 is unabridged and includes a full set of about 100 tables and 100 figures (totaling about 500 pages). In addition to length, there are two distinctions between the two volumes; in Volume 1, Chapter 4 has specific recommendations for most of the policies. In Volume 2, there is a Chapter 5, which presents a set of policies called the "composite case," and its modeled impacts are compared to the base case or business as usual scenario. The organization and content of both volumes is outlined below.

**Organization and Contents of Volume 1 and Volume 2**

**Chapter 1 - Introduction**

**Chapter 2 - Energy Use and Human Well-Being: Energy Goals for Vermont's Future** focuses on defining and discussing the nine energy goals that are part of Vermont's state energy policy. State policy provides that energy supply and energy use should promote these goals:

Safety
Reliability
Sustainability
Efficiency
Economic vitality.
Adequacy
Security
Environmental soundness
Affordability, and

**Chapter 3 - Vermont's Energy Use: Past, Present, and Future** has three major sections: Section I. HISTORY AND BACKGROUND begins with a history of Vermont's energy use, tracing the major changes in fuel sources and uses from the time of the Native Americans to the present. Recent energy planning efforts are reviewed, including international energy planning efforts by the U.N. at 1992 Earth Summit in Rio de Janiero and the 1997 Kyoto Conference as well as work by the Intergovernmental Panel on Climate Change (IPCC), a group of several hundred climate scientists from 25 countries. Key energy planning efforts at the national level are discussed; they are the Clean Air Act Amendments (1990), State Energy Efficiency Programs Improvement Act (1990), Intermodal Surface Transportation Efficiency Act-ISTEA (1991), Energy Policy Act (1992), and Climate Change Action Plan (1993).

Highlights of energy legislation and planning in Vermont include; accounting for environmental costs in long term planning (1990), state energy policy for regulated and non-regulated energy services (1992), least cost integrated planning (LCIP) required for gas and electric companies (1992), work-in-progress on reforming the state's regulatory system, and Act 200 and coordinated planning for state agencies, Regional and Municipal Planning Commissions.

Key players in state government who define and direct Vermont's energy and environmental planning and their roles are discussed briefly. They are the Department of Public Service, the Public Service Board, the Agency of Transportation, and the Agency of Natural Resources.

Section II. CURRENT ENERGY USE describes and illustrates Vermont's recent and current energy use. Vermont's energy use is analyzed from several perspectives:

- Vermont's energy among sectors - showing the portions used for residential, commercial, industrial and transportation purposes.

- Vermont's energy use among end uses - what portion is used for road transportation, space heating, water heating, lighting, refrigeration, etc.

- Vermont's energy use by fuel - how much oil, electricity, natural gas, wood, propane, coal, and solar energy is consumed.

Fuel sources used in Vermont are reviewed individually, with descriptions of trends and issues associated with each fuel. The state's electricity use is discussed from two perspectives; first, by considering electricity as a single fuel and then by investigating the individual fuel sources that are used to produce electric power used in Vermont. Resources for the state's electricity needs are hydroelectric power, nuclear power, coal, oil, natural gas, renewable resources such as wood and wind, and utility efficiency programs. These demand side management (DSM) programs help consumers in all sectors use less electricity and avoid the need to use fuel to generate electricity.

Potential energy sources and technologies that are not extensively used now, but are likely to be used more in the future, are explored. These include:

- Renewable resources - wind power, solar power, and hydrogen;
- Alternative transportation fuels - reformulated gas, gasohol, natural gas, LPG, electricity, etc;
- Energy technologies - cogeneration, combustion turbines, combined-cycle plants, distributed generation, energy storage technologies, and fuel cells.

Finally, two key issues in current and future energy use are discussed:

- Reflecting the full cost of energy use in energy prices, including external costs, and
- Increasing competition and reforming the electric industry while preserving societal benefits.

Section III. FUTURE ENERGY USE presents baseline projections for energy use in Vermont over the long term. These baseline or base case projections represent the business-as-usual scenario, illustrating the long term impacts of current trends in energy use with no changes in state and national energy policy. The base case forecast provides a basis of comparison for impacts of various policies in Chapters 4 and 5.

Key characteristics of Vermont's energy use as presented in the base case or business-as-usual forecast are:

> **Energy expenditures** have been rising slowly since the mid-1980s. Future expenditures are projected to rise more quickly, at just under 2% per year or 54% between 1990 and 2015, due to rising energy prices and increasing consumption levels. Energy expenditures by the transportation sector increase much faster than any other sector. Residential use increases slowly in the future partly as a result of gains made by appliance efficiency standards and the fact that new homes are usually more efficient than old ones. (See Chapter 3 and Figures 3.III.7 and 3.III.8.)

**Energy use** increases faster for transportation than for any other major end use. Road transportation energy rises 72% between 1990 and 2015. In contrast, energy consumption for the next largest end use, space heating, rises 30% during the same period. (See Chapter 3 and Figure 3.III.12.)

**Energy use among fuels** shows the dominance of oil in our energy consumption. Oil consumption is projected to increase 52% between 1990 and 2015. Use of other fuels (electricity, natural gas, and LPG) is also expected to increase, but their total usage is small compared to oil. (See Fig. 3.III.13.)

**Non-renewable and renewable energy use** Although Vermont uses more hydroelectric power and wood energy than many other states, our total use of renewable energy sources is much smaller than our use of non-renewables. Use of renewables is not growing as fast as our use of non-renewables. Unless a significant change is made, the gap between non-renewable and renewable sources in Vermont's energy supply will widen. (See Chapter 3 and Figure 3.III.14)

**Chapter 4 - Energy Strategies, Policies, and Recommendations** Eighteen strategies and nearly 70 policies are presented as actions Vermont could take, or promote for implementation at a regional or national level, to move toward meeting one or more of the state's energy and environmental goals.

Each strategy and policy is described in a summarized version with recommended actions in Volume 1 Chapter 4. In Volume 2 Chapter 4, strategies and policies are discussed in detail, relying on computer modeling that projects the impacts of selected policies over the long term, usually through 2020. Each modeled policy is presented with several tables and figures that show its impacts in contrast to the base case or business-as-usual forecast. Modeling offers the opportunity to test assumptions about the effects of the policies and refine program designs prior to implementation.

Five major sections in Chapter 4 are:

I. ENERGY SOURCES AND SUPPLY presents strategies and sets of policies related to wood, wind, solar, hydroelectric, and methane energy sources, as well as traditional fuel sources. In addition, there are strategies and policies related to increasing efficiency in the production and distribution of energy, increased competition in the electric industry, and proposals to clarify and strengthen the alignment between Vermont's energy goals and current energy taxes.

II. TRANSPORTATION proposes strategies and policies that would implement least cost transportation planning (LCTP) and broaden the focus of transportation planning to "access" using a wide variety resources that can provide "access" at the lowest societal cost. There are strategies and policies that target increasing the efficiency of vehicles, reducing vehicle miles traveled, and reducing transportation-related emissions. A key strategy for transportation is removing market distortions from energy prices and "internalizing" more transportation-related costs into transportation fuel prices using transportation energy taxation. Finally, a "Feebates" program is proposed that recognizes that efficient vehicles impose lower costs and impacts than less efficient gas-guzzler-type vehicles do.

III. BUILDINGS AND EQUIPMENT contains strategies and policies that seek to improve energy use in both new and existing homes, commercial buildings,

and industrial facilities. Policies associated with the strategy Improve Efficiency and Indoor Air Quality in New Homes are been implemented through the Residential Building Energy Standards (RBES), which now apply to all residential new construction. Policies to coordinate and standardize demand side management programs and create market value for efficient construction are also assessed.

IV. AFFORDABILITY focuses on ways to make energy use more efficient in low income housing and a few key actions that will promote affordability as the electric utility industry becomes more competitive. Policies on energy standards for multi-family rental housing better coordination of energy efficiency services with the Fuel Assistance Program are presented, as well as promoting the Weatherization Program as a bridge to link low income household with energy efficiency services. Policies to encourage development of an energy consumers' cooperative and establishing a statewide affordability program to take effect with retail competition are also explored. Affordability issues are also addressed in other sections of this chapter. In the Energy Sources and Supply Section, the strategy to Use Energy Taxation to Meet Vermont's Energy Goals includes a policy that explores affordability, as does the Transportation Section strategy on Internalizing Costs of Transportation More Fully through Transportation Energy Taxation.

V. GOVERNMENT ENERGY USE AND ENERGY POLICY outlines policies to improve government's energy use, energy planning, and public education and information about energy.

See the list of Recommended Energy Strategies and Policies for the complete contents of Chapter 4. Note that only Volume 1 has specific recommended actions for each policy, except a few policies that are flagged with (RUD) indicating that specific recommendations are still under development.

**Chapter 5 - Charting Vermont's Energy Future: The Composite Policy Case.** This chapter, which appears in Volume 2 and has no summarized version in Volume 1, identifies a set of policies selected from the inventory presented in Chapter 4. These selected policies are only an "illustrative sampling" related to energy sources and supply, transportation, and buildings and equipment that enable Vermont to make progress toward the state's energy and environmental goals (presented in Chapter 2).

## Recommended Energy Strategies and Policies

I. ENERGY SOURCES AND SUPPLY

Strategy A: Promote Sustainable Use of Wood and Wind Energy
- Policy 1: Promote Clean, Efficient Wood Burning with New Stoves
- Policy 2: Promote Commercial and Industrial Use of Wood Energy
- Policy 3: Develop Wood and Wind Power for Replacing Nuclear Power
- Policy 4: Promote Renewable Resources and New Technologies with a Renewable Portfolio Standard

Strategy B: Promote Use of Solar Energy
- Policy 1: Shift Clocks Toward the Solar Day (RUD)
- Policy 2: Increase Solar Lighting and Heating Applications
- Policy 3: Increase Solar Water Heating Installations
- Policy 4: Promote Development of Photovoltaics and Encourage Their Use

Strategy C: Support Appropriate Uses of Hydroelectric Power and Methane Sources
- Policy 1: Support Appropriate Use of Hydroelectric Energy
- Policy 2: Increase Appropriate Use of Landfill Methane Energy
- Policy 3: Increase Appropriate Use of Farm Methane Energy

Strategy D: Reduce, Monitor, and Support Selected Uses of Traditional Fuels
- Policy 1: Reduce Use of Petroleum Energy and Establish Emissions Standards
- Policy 2: Reduce Use of Coal Energy
- Policy 3: Support Appropriate Use of Natural Gas Energy
- Policy 4: Monitor the Use of Nuclear Energy

Strategy E: Encourage Efficient Production and Distribution Technologies/ Infrastructure
- Policy 1: Encourage Cogeneration
- Policy 2: Encourage District Heating and Cooling
- Policy 3: Encourage Distributed Utility Services
- Policy 4: Be Prepared to Act on Proposed Projects to Expand Gas Pipelines and Storage to Unserved Areas
- Policy 5: Investigate Feasibility of Rehabilitating and Reactivating Old City Gas Distribution Systems
- Policy 6: Promote Integrated Electric Utility Broadband Communication Networks (RUD)

Strategy F: Increase Competition in the Electric Utility Industry
- Policy 1: Move Toward Greater Retail Competition While Maintaining Societal Benefits

Strategy G: Use Energy Taxation to Meet Vermont's Energy Goals
- Policy 1: Review Current Energy Goals and Energy Taxes and Assess their Consistency

II. TRANSPORTATION

Strategy A: Least Cost Transportation Planning
- Policy 1: Consider Adopting the Principles of Least Cost Transportation Planning
- Policy 2: Consider Studying the Full Cost of Transportation in Vermont
- Policy 3: Develop a Demonstration Project for Green Parking/Transportation Vouchers

Strategy B: Increase the Efficiency of Vehicles
- Policy 1: Increase Federal CAFE Standards
- Policy 2: Consider Adopting a 55 MPH Interstate Speed Limit (RUD)
- Policy 3: Consider Stricter Enforcement of Highway Speed Limits
- Policy 4: Encourage Hypercar Development

Strategy C: Reduce Vehicle Miles Traveled
- Policy 1: Encourage the Use of Commuter Lots
- Policy 2: Shift VMT to More Efficient Modes - Bus, Vanpool, and Train
- Policy 3: Encourage Non-Motorized Transportation
- Policy 4: Encourage Telecommuting
- Policy 5: Encourage High-Density, Mixed-Use Land Use Planning and Curtail Sprawl
- Policy 6: Pay-at-the-Pump Auto Liability Insurance (RUD)

## Recommended Energy Strategies and Policies (continued)

II. TRANSPORTATION (continued)

Strategy D: Reduce Transportation Related Emissions
- Policy 1: Implement a Vehicle Emissions Check Program
- Policy 2: Continue Phased-In Implementation of Vapor Recovery at Gas Stations
- Policy 3: Adopt Low Emissions Vehicle Standards
- Policy 4: Promote Incentives for Alternative Transportation Fuels, Including Electric Vehicles

Strategy E: Internalize Costs of Transportation More Fully through Transportation Energy Taxation
- Policy 1: Review and Revise State Tax Policy to More Fully Internalize the Cost of Transportation
- Policy 2: Support Phase-Out of Federal Policies Giving Advantages to Traditional Fuels and Projects: Equalize Market Opportunities for New Technologies and Alternative Transportation Fuels
- Policy 3: Shift Registration and License Fees to Motor Fuels Taxes
- Policy 4: Support Commuter Buses with a Motor Fuels Tax
- Policy 5: Consider Establishing a Vermont Feebates Program

III. BUILDINGS AND EQUIPMENT

Strategy A. Improve Efficiency and Indoor Air Quality in New Homes
- Policy 1. Implement Residential Building Energy Standards for New Construction
- Policy 2. Statewide Residential New Construction DSM Program for Premium Homes
- Policy 3. Increase Efficiency of New Manufactured Housing
- Policy 4. Expand the Vermont Home Energy Rating System

Strategy B. Improve the Efficiency of Vermont's Existing Housing Stock
- Policy 1. Time-of-Sale Energy Efficiency Requirement
- Policy 2. DSM Program Support for a Time-of-Sale Standard
- Policy 3. Discount Mortgage Rates for Energy Efficient Homes
- Policy 4. Promote Energy Efficient Products Through a Statewide Trade Ally Program
- Policy 5. Diversify the Vermont Weatherization Program

Strategy C. Increase Efficiency in Commercial and Industrial New Construction
- Policy 1. Adopt a Commercial New Construction Energy Efficiency Code
- Policy 2. Statewide Commercial and Industrial DSM Programs
- Policy 3. Establish Energy Efficiency Partnership and Information Clearinghouse

Strategy D. Improve Efficiency in Commercial & Industrial Facilities by Targeting Retrofits & Lost Opportunities
- Policy 1. Adopt a Statewide Energy Code For C & I Remodeling, Renovations, and Additions
- Policy 2. Statewide DSM Programs for C&I Equipment Replacement, Remodeling, and Renovation
- Policy 3. DSM Retrofit Programs in Transmission and Distribution Constrained Areas
- Policy 4. Financing Mechanisms for Cost–Effective Energy Efficiency and Renewable Energy: Performance Contracting and ESCOs

IV. AFFORDABILITY

Strategy A. Promote Efficiency for Low Income Housing and Affordability in an Increasingly Competitive Marketplace
- Policy 1. Energy Efficiency Standards for Multi-Family Rental Housing
- Policy 2. Energy Efficiency Services Integrated with the Fuel Assistance Program
- Policy 3. Reinvent Weatherization Services Delivery to Low Income, Multi-Family Housing
- Policy 4. Encourage Development of an Energy Consumers' Cooperative or Consumerco
- Policy 5. Establish a Statewide Affordability Program to Take Effect When Vermont Initiates Retail Competition

V. GOVERNMENT ENERGY USE AND ENERGY POLICY

Strategy A. Improve Government's Energy Use, Programs, and Policy
- Policy 1. Government Energy Use in Buildings, Equipment, and Vehicles
- Policy 2. Government Energy Planning
- Policy 3. Public Education and Information

(RUD) means specific recommendations for this policy are still under development.

The selected policies are modeled together, and their combined impacts are presented. Throughout the chapter, impacts of this composite policy case are compared to the base case or business-as-usual scenario that shows what is likely to happen without bold initiatives. Implemented as a group, policies in the composite case represent a transition in energy supply choices and end uses, enabling Vermont to take a leading role in moving to a sustainable and environmentally sound energy future with economic benefits.

Chapter 5 concludes that over the long term, the following savings can be achieved if a comprehensive set of policies (such as the composite policy case) is implemented as compared to continuing our current energy trends and practices (illustrated by the baseline or business-as-usual case).

- Vermont's *Total energy use* is reduced by 552 TBTU (trillion BTUs) or 16%.
- Vermont's *Oil use* is reduced by 483 TBTU or 30%.
- Vermont's *Non-renewable energy use* is reduced by 750 TBTU or 26%.
- Vermont's *Energy costs (net of policy taxes)* are reduced by $6.2 billion or 15%.
- The costs imposed on the environment by air emissions from Vermont's energy use (*Air emission costs*) are reduced by about $5.0 billion or 26%.
- Vermont's *Total costs* (including energy costs, related costs, and the environmental costs of air emissions) are reduced by $12.2 billion or 20%.
- Vermont's *Greenhouse gas emissions* decrease by 53.3 million $CO_2$ equivalent tons or 21%.

## Highlights from the Research and Findings of this Plan

Policies presented in Chapter 4 show that there are 70 well- researched ways that Vermont can take action to improve energy use and reduce greenhouse gas emissions. Some of the strategies and policies in Chapter 4 identify areas where the greatest opportunities for energy savings and environmental improvements are waiting to be captured, some show how steady progress has been initiated and can have significant impacts with continued efforts, and for some policies major issues need resolution before any implementation can be planned. Computer modeling impacts indicate that many creative actions presented in this Plan can lead to dramatic changes and progress toward state and federal energy and environmental goals. Furthermore, selections can be made from the policy inventory for coordinated and phased implementation of a comprehensive set of policies that interact and amplify their positive impacts. The illustrative composite policy set presented in Chapter 5 is one example of what can be achieved. Dramatic improvements in energy use and reductions in greenhouse gases, comparable to the achievements of the composite case, can be reached with another comprehensive set of policies selected from the inventory in Chapter 4.

What computer modeling shows is we can change our current energy use patterns and the quantity of emissions that are polluting our environment if we implement a comprehensive set of policies rather than continuing the current trends that are represented in the base case. We need to proceed with selecting and implementing a set of policies so that we are actually achieving improvements and reductions that are projected by computer modeling.

Computer modeling of the illustrative set of policies (the composite policy case presented in Chapter 5) shows what can be achieved with the implementation of a creative new policy set in stead of continuing our established patterns of energy use (as represented by the baseline case or business-as-usual projections).

- *Total energy use* decreases 16.2%. (See Figures 5.II.1 and 5.II.2 that follow.) Modeling results also show that renewable energy use increases 38.67% over the long term in the composite policy case. (See Figure 5.III.1.) *Greenhouse gas emissions* decrease by 53 million $CO_2$ equivalent tons or 21.37% if bold policies, as proposed in the composite policy case are implemented. (See Figure 5.VIII.1.) In addition, employment could improve by 100,000 job-years or 1% cumulatively through 2020 compared to the base case. (Chapter 3 has a full discussion of the base case or business-as-usual scenario. Chapter 5 has a full discussion of impacts and achievements that could be made with the implementation of new policies referred to as the composite policy case.)

- Transportation is the largest energy end use in Vermont, accounting for about 44% of our total energy use in 1995. (See Chapter 3 of the Plan, Section II. Current Energy Use, Figure 3.II.6.) The transportation sector offers the greatest opportunity for energy savings, reduced emissions, and decreased reliance on oil. Under the composite policy case presented in Chapter 5, *Transportation energy use* could be cut by 29.8% cumulatively through 2020 compared to the base case projections.

- *Oil use* is cut by 22.9% cumulatively compared to the base case, over the life of the forecast. (See Figure 5.III.1.) This reduction is due to transportation policies that increase vehicle efficiency, reduce vehicle miles traveled, and internalize the costs of driving into the price of motor fuels.

- Use of *Renewable energy sources* (wind, solar, wood, hydro power, etc.) increases under the composite policy case by a cumulative 38.7% over the life of the forecast compared to the base case. The policy that proposes developing renewable wood and wind generation to replace the state's power from Vt. Yankee Nuclear Station when its operating license expires in 2012 is a key factor contributing to this increase. Figure 5.III.1 shows the first wood and wind plants coming on-line in 2009, with more added through 2013. The decrease in *Renewable energy sources* in 2016 reflects the expiration of Hydro-Québec contracts.

- The composite policies result in a significantly improved energy affordability picture. A key economic indicator, *Per capita disposable income,* grows slightly faster in the composite policy case compared to the base case over the life of the forecast. (See Figure 5.I.1.) As consumers choose conservation and energy efficiency, *Total energy use* decreases 16.2% and *Total costs of energy*, including related costs and emissions costs, shows a cumulative savings of about $12 billion or 20% over the life of the forecast. (See Figure 5.I.1.) *Per household residential energy expenditure* and *Per household residential energy expenditure as a percent of poverty level income* also decrease about 1.4% cumulatively under the composite policy case compared to the base case, benefitting low income consumers. (See Figure 5.I.1.)

- With implementation of policies selected for the composite policy case, cumulative *Acid rain precursors* and *Ground level ozone precursors* could be significantly reduced (by 24.16% and 29.87% respectively) through 2020 compared to base case projections. (See Figure 5.VIII.1.)

- *Greenhouse gas emissions* in the state are projected to grow significantly over 1990 levels. Strong policies at the state, national, and international levels are needed if we are to control these emissions. Figure 5.VIII.1 shows the projected average annual growth rate for *Greenhouse gas emissions* for 1995-2020 could be

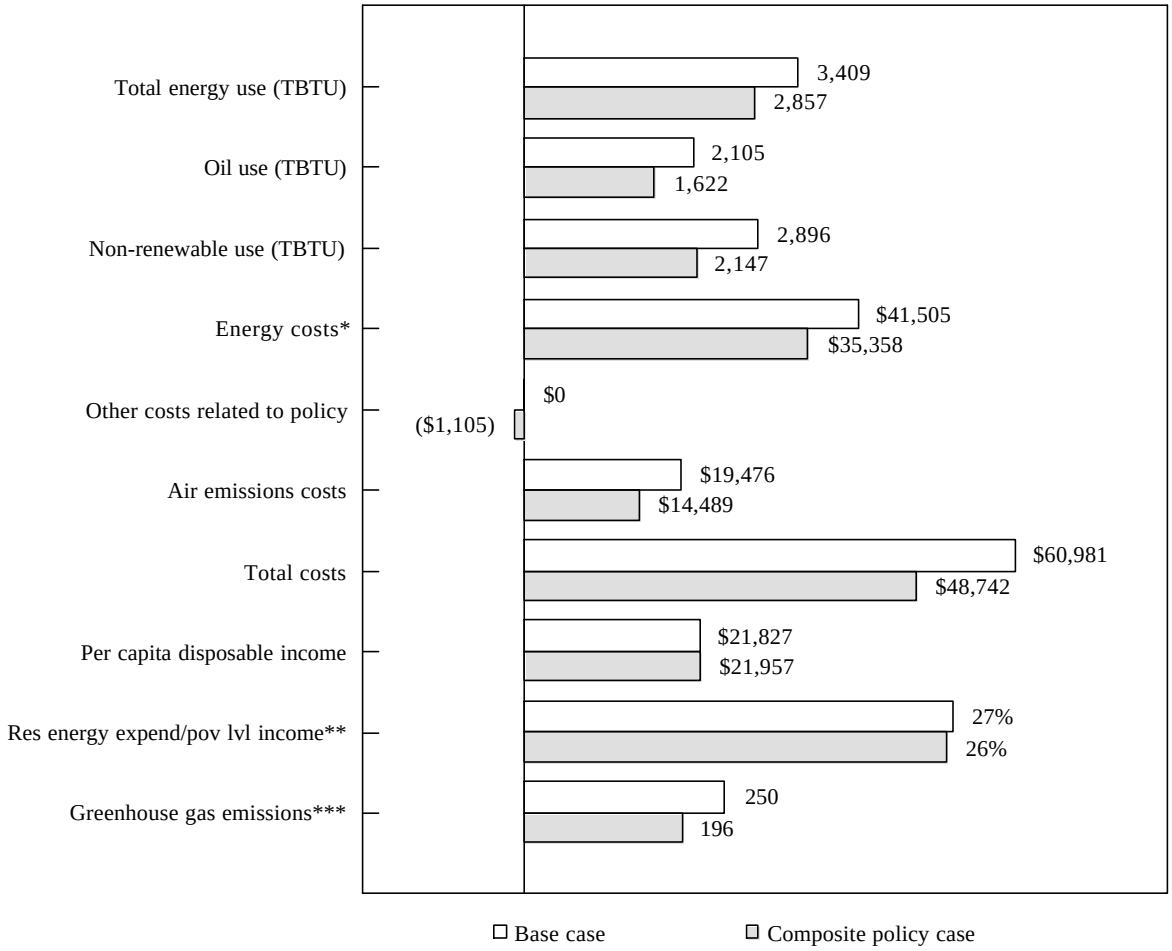
reduced from 2% under the base case to 0.5% under the composite policy case.

## Conclusion

*Fueling Vermont's Future: Comprehensive Energy Plan and Greenhouse Gas Action Plan* confirms that energy supply and use are critical to Vermont and to Vermonters' well-being because energy has and continues to sustain and enrich our lives. The purpose and justification for this two volume document is to help Vermonters ensure that the benefits of energy use *continue and are maximized*. Progress toward our state energy goals is the path to this end. By working toward an adequate, reliable, secure, and sustainable energy supply, Vermont ensures that the benefits of energy use *continue into the future*. By working toward safe and environmentally sound energy sources and use, Vermont ensures that individuals are not directly or indirectly harmed, but actually *benefit.* Finally, by working toward energy sources and use that are efficient, affordable, and supportive of economic vitality, Vermont *maximizes the benefits* from energy use.

**Figure 5.I.1 Cumulative Impacts of Base Case and Composite Policy Case**

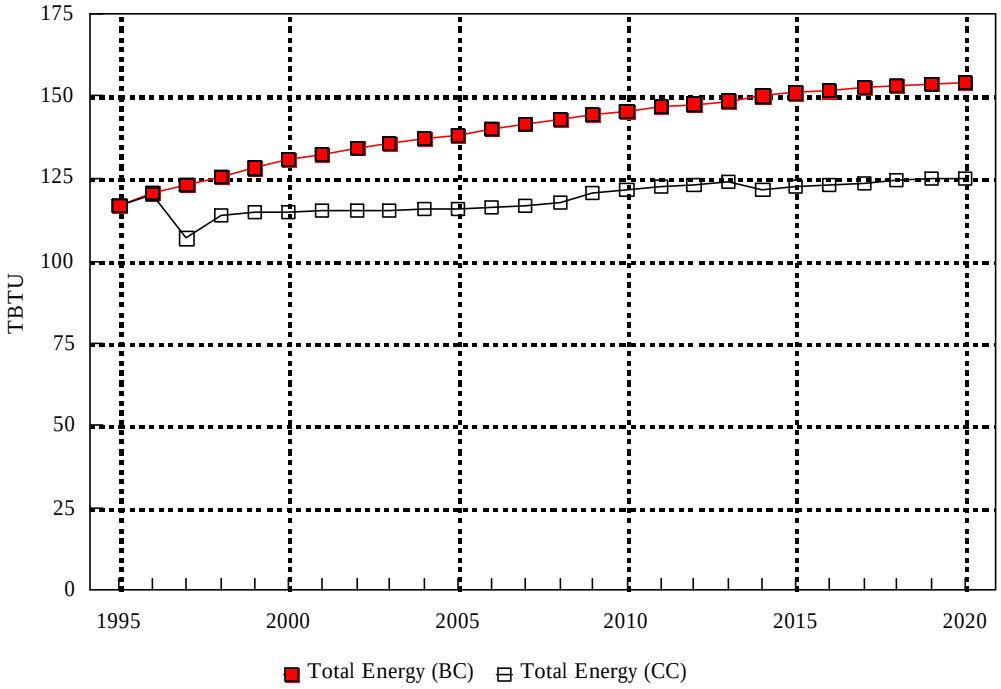
1997-2020




Source: VT DPS
Note: All dollars are millions of 1995$, except "Per Capita Disposable Income" which is 1995$. *Net of policy taxes **Per household residental energy expenditure as a % of poverty level income ***GHG emissions in millions of tons of CO2 equivalent

## Figure 5.II.1 Vermont Total Energy Use

Base Case (BC) and Composite Case (CC)

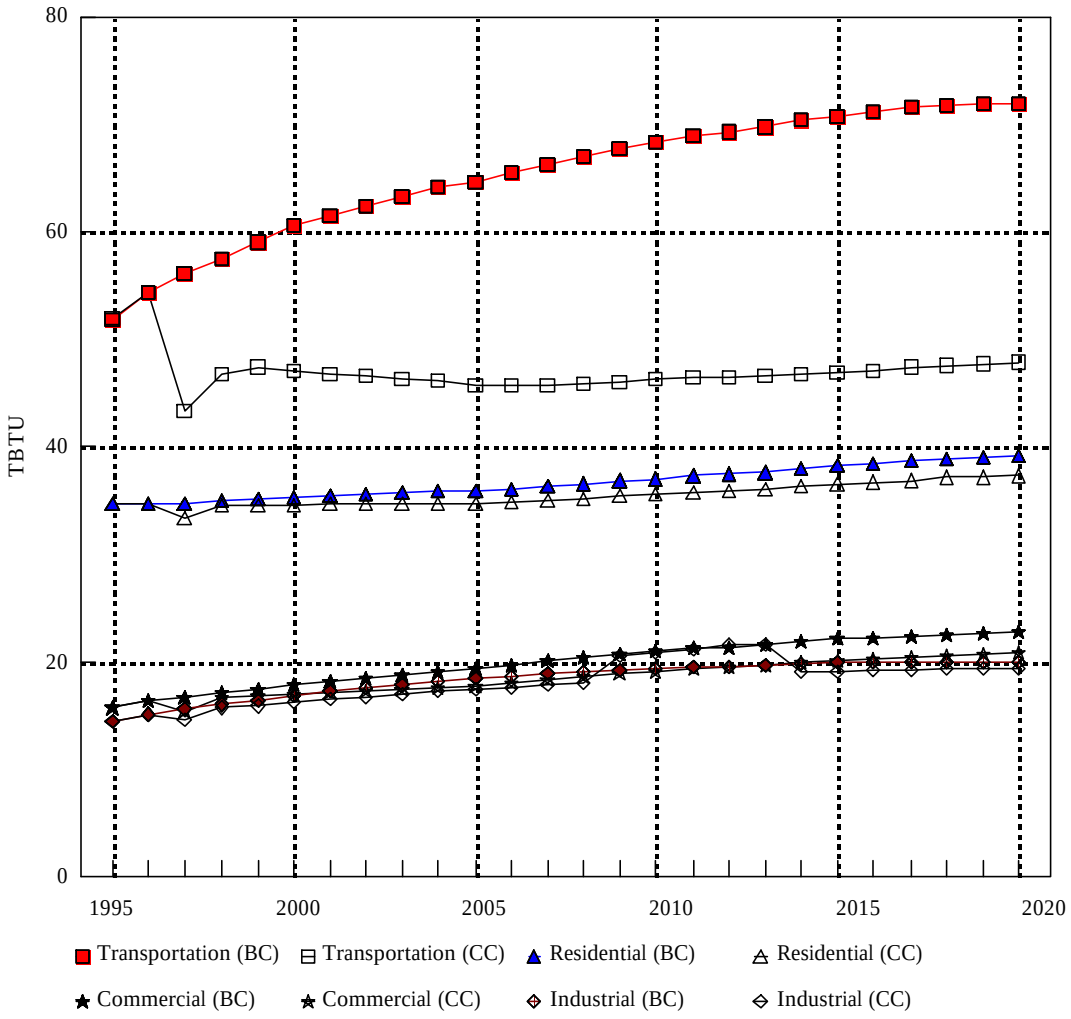



| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | '95-2020 Avg Ann Growth | '97-2020 Cum % Change |
|---|---|---|---|---|---|---|---|---|---|
| Total Energy (BC) | 98.0 | 116.7 | 130.5 | 138.4 | 145.7 | 150.9 | 153.9 | 1.11% | |
| Total Energy (CC) | 98.0 | 116.7 | 114.8 | 115.7 | 121.8 | 122.6 | 125.4 | 0.29% | -16.2% |

Note: 1995 and 1996 values are estimates. Source: VT DPS

## Figure 5.II.2 Vermont Energy Use by Sector

Base Case (BC) and Composite Case (CC)

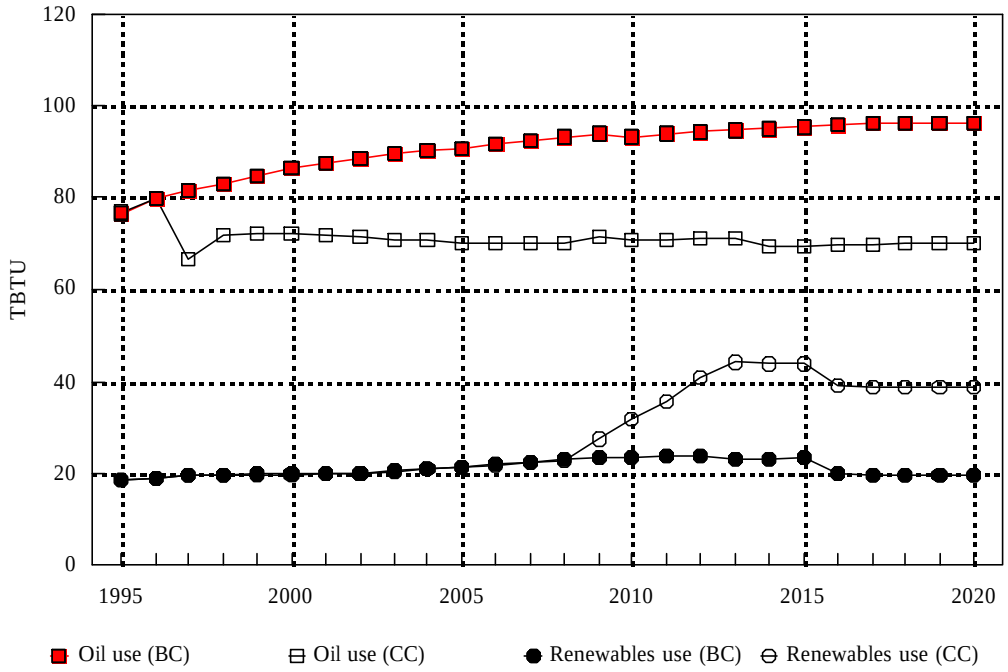



| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | '95-2020 Avg Ann Growth | '97-2020 Cum % Change |
|---|---|---|---|---|---|---|---|---|---|
| Transportation (BC) | 42.1 | 51.9 | 60.5 | 64.7 | 68.3 | 70.7 | 71.9 | 1.32% | |
| Transportation (CC) | 42.1 | 51.9 | 47.1 | 45.8 | 46.3 | 46.9 | 47.9 | -0.32% | -29.8% |
| Residential (BC) | 31.5 | 34.7 | 35.4 | 36.0 | 37.0 | 38.2 | 39.2 | 0.49% | |
| Residential (CC) | 31.5 | 34.7 | 34.6 | 34.8 | 35.6 | 36.5 | 37.4 | 0.30% | -3.6% |
| Commercial (BC) | 12.0 | 15.7 | 17.8 | 19.3 | 21.0 | 22.1 | 22.8 | 1.51% | |
| Commercial (CC) | 12.0 | 15.7 | 16.9 | 17.7 | 19.1 | 20.1 | 20.8 | 1.13% | -8.1% |
| Industrial (BC) | 12.4 | 14.5 | 16.8 | 18.4 | 19.3 | 19.9 | 20.0 | 1.30% | |
| Industrial (CC) | 12.4 | 14.5 | 16.2 | 17.4 | 20.8 | 19.1 | 19.4 | 1.17% | -1.4% |
| Total (BC) | 98.0 | 116.7 | 130.5 | 138.4 | 145.7 | 150.9 | 153.9 | 1.11% | |
| Total (CC) | 98.0 | 116.7 | 114.8 | 115.7 | 121.8 | 122.6 | 125.4 | 0.29% | -16.2% |

Note: 1995 and 1996 values are estimates. Source: VT DPS

## Figure 5.III.1 Vermont Oil Use and Renewables Use

Base Case (BC) and Composite Case (CC)

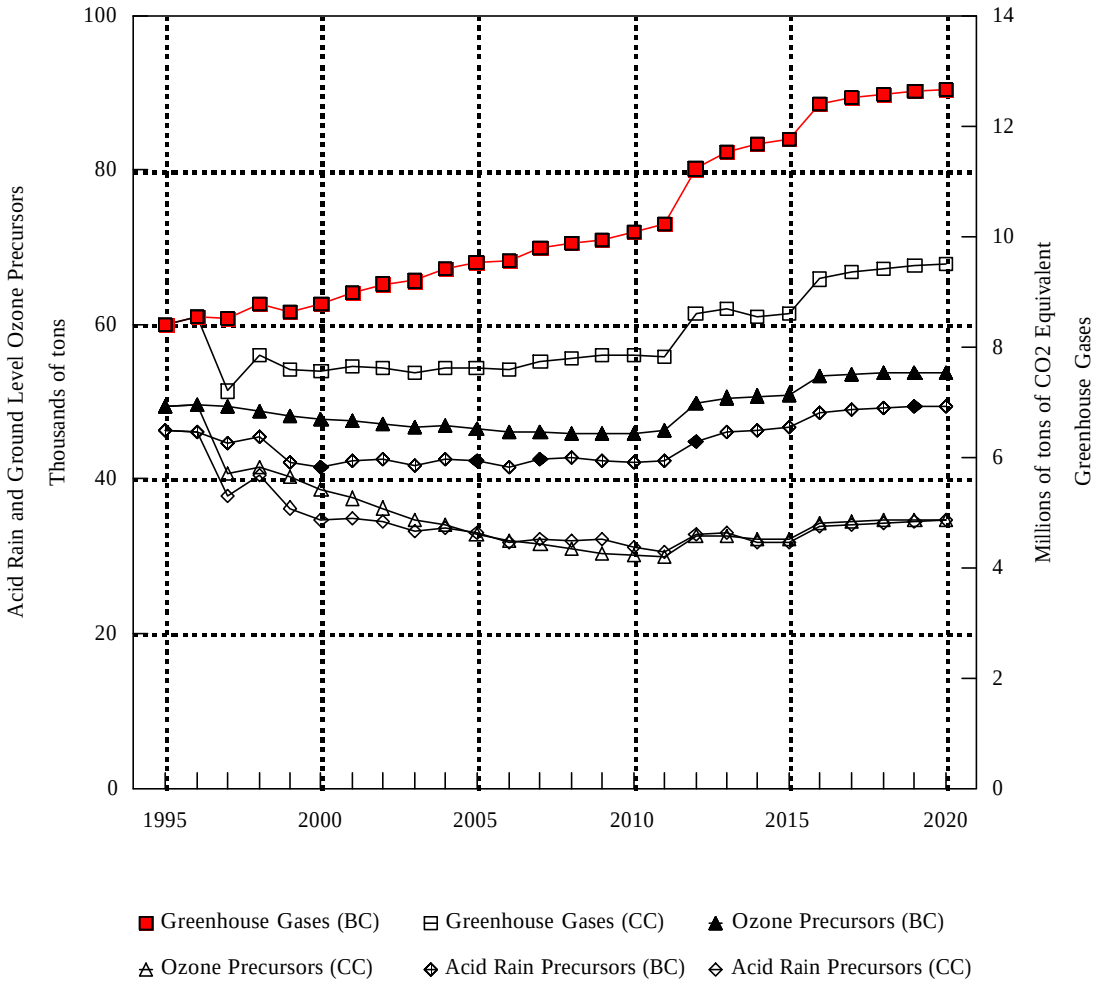



| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | '95-2020 Avg Ann Growth | '97-2020 Cum % Change |
|---|---|---|---|---|---|---|---|---|---|
| Oil use (BC) | 64.3 | 76.7 | 86.6 | 90.9 | 93.4 | 95.4 | 96.1 | 0.91% | |
| Oil use (CC) | 64.3 | 76.7 | 72.1 | 70.2 | 70.8 | 69.4 | 70.2 | -0.35% | -22.93% |
| Renewables use (BC) | 15.7 | 18.4 | 19.8 | 21.5 | 23.7 | 23.3 | 19.7 | 0.27% | |
| Renewables use (CC) | 15.7 | 18.4 | 19.7 | 21.4 | 31.6 | 43.7 | 38.9 | 3.04% | 38.67% |

Note: 1995 and 1996 values are estimates. Source: VT DPS

## Figure 5.VIII.1 Vermont Emissions from Energy Use

Base Case (BC) and Composite Case (CC)




| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | '95-2020 Avg Ann Growth | '97-2020 Cum % Change |
|---|---|---|---|---|---|---|---|---|---|
| GHG (BC) | 7,120,000 | 8,420,000 | 8,780,000 | 9,520,000 | 10,080,000 | 11,750,000 | 12,680,000 | 1.65% | |
| GHG (CC) | 7,120,000 | 8,420,000 | 7,540,000 | 7,610,000 | 7,840,000 | 8,610,000 | 9,500,000 | 0.48% | -21.37% |
| Ozone precsr (BC) | 46,900 | 49,600 | 47,800 | 46,600 | 46,000 | 51,000 | 53,700 | 0.32% | |
| Ozone precsr (CC) | 46,900 | 49,600 | 38,600 | 33,000 | 30,200 | 32,400 | 34,700 | -1.42% | -29.87% |
| Acid R precsr(BC) | 42,400 | 46,500 | 41,500 | 42,300 | 42,200 | 46,700 | 49,500 | 0.25% | |
| Acid R precsr(CC) | 42,400 | 46,500 | 34,900 | 33,100 | 31,300 | 31,900 | 34,800 | -1.15% | -24.16% |

Note: 1995 and 1996 values are estimates. CO2 emissions from wood are assumed to be zero (sustainable harvest).
Source: VT DPS