Vermont’s Energy Challenge

Public Energy Forum
Liz Miller, Commissioner
Department of Public Service
Comprehensive Energy Plan: What is it?

- Title 30, Section 202b – the CEP must include:
  - (1) A comprehensive analysis and projections regarding the use, cost, supply and environmental effects of all forms of energy resources used within Vermont.
  - (2) Recommendations for state implementation actions, regulation, legislation, and other public and private action to carry out the comprehensive energy plan.

- Title 30, Section 202 – Also our updated Electric Plan
Why do we create a CEP?

• Title 30, Section 202a:
  • To assure, to the greatest extent practicable, that Vermont can meet its energy service needs in a manner that is adequate, reliable, secure and sustainable; that assures affordability and encourages the state's economic vitality, the efficient use of energy resources and cost effective demand side management; and that is environmentally sound.

• Recommendations based upon all state law on the subject: e.g., GHG reduction goals, SPEED goals, Standard Offer
Overarching Goals of CEP:

- Address All Energy Sectors, not just electricity
- Strive for lower GHG footprint, toward state law targets
- Support in-state energy solutions and economic growth
- At a cost that keeps Vermont regionally competitive
Vermont Energy End-Use By Source, 2008

(Percent of Total BTU's Consumed)

Transportation 33%
- MoGas 80%
- Diesel 17%
- Jet Fuel 3%

Residential 29%
- Electric 49%
- Fuel Oil 26%
- Other Petro 16%
- Natural Gas 7%
- Renewables 2%

Commercial & Industrial 37%
- Electric 66%
- Natural Gas 11%
- Renewables 11%
- Fuel Oil 9%
- Other Petro 3%
2009 Total Energy Consumed

- ~48% of electricity is from renewable sources
- ~5% of non-electrical energy is from renewable sources
- ~23% of total energy is renewable energy overall, including HQ
- Legislated goal is 25% by 2025 from farms and forests
Vermont Energy Consumption by Selected Categories 1960–2005
Energy Sectors

- Electricity
- Transportation
- Land Use
- Efficiency
Figure 1.7 Committed Resources, in GWH (as of December 2010)*

[Graph showing committed resources for different years and sources, including STD Offer, SPEED, Wind, Wood, IPP Wood, VT Hydro, VT PPAs, HQ New, HQ, and VY.]
Biomass
Biomass

- ~6.5% of current electric load
- 81 MW of utility-scale generation
- CHP plants at several institutional and commercial sites
- Wood Heat
  - Many primary/secondary schools, several colleges, many state buildings, some large commercial enterprises
  - 315,000 cords used for residential heating
  - Possibility of district heating projects – Montpelier, Burlington
- Farm Methane
  - 9 farm digesters in operation (~3MW), more to come
Biomass -continued

- Biodiesel – Actions to promote locally grown seed-oil crops for thermal and/or off-road transportation (farm) uses are underway

- Landfill Methane (11.5MW)
  - Coventry (8MW), Moretown (3.2MW) and Brattleboro (.3MW)
Geothermal

• <1% of thermal load

• Dozens of residential and commercial systems in operation for heating & cooling

Examples:
• Bennington Office Bldg
• Champlain College
• NRG Systems
Solar

**PV:**
- ~.1% of electric load
- 719 net metered PV systems = ~4MW
  - ~1MW additional by 2012.
- Utility-scale systems installed = 1MW
  - ~4.4MW to be installed in 2011.

**Thermal:**
- ~500 solar thermal systems installed
### No. Net Metered Systems

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar PV</th>
<th>Methane</th>
<th>Wind</th>
<th>Total</th>
<th>Percent</th>
</tr>
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<tbody>
<tr>
<td>1999</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
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<tr>
<td>2000</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2001</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2003</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
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<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
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<tr>
<td>2007</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
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<tr>
<td>2008</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

### Percent of Total Systems

<table>
<thead>
<tr>
<th>Source</th>
<th>Wind</th>
<th>Solar PV</th>
<th>Methane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>25.2%</td>
<td>72.5%</td>
<td>2.2%</td>
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<tr>
<td>PV</td>
<td>16.7%</td>
<td>82.8%</td>
<td>0.5%</td>
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<tr>
<td>Methane</td>
<td>0</td>
<td>0.5%</td>
<td>99.5%</td>
</tr>
</tbody>
</table>

### Summary

- **No. Systems**: 867 Solar PV, 145 Methane, 718 Wind, 4 total
- **Total KW Approved**: 5,515 Solar PV, 1,391 Methane, 4,001 Wind, 123 total
- **Average Capacity (kw)**: 6.4 Solar PV, 9.6 Methane, 5.6 Wind, 30.8 total

Source: VT DPS 2010 Utility Facts
Hydro Power

- 43% of electrical consumption (2009)
  - ~17% of total energy

- 85 operating hydro dams in VT
  - In-state production ~12% of electrical consumption

- ~6 MW of capacity (8 projects) currently under development
Wind

~.2% of load on line

Current Utility-Scale Plants:
  Searsburg = 6MW

CPGs Conditionally Granted for:
  Sheffield = 40MW
  Deerfield = 30MW
  Georgia Mtn = 11MW
  Lowell = 63MW

145 net metered wind turbines = 1.4 MW

If everything above gets built wind power could produce ~6% of total electricity consumed in state.
Average Electricity Rates, New England, Vermont, (Cents/kWh)

2011 Data is YTD Feb

Source: U.S. Energy Information Administration
Average Retail Price of Electricity Cents/kwh
(1991 $)

Cents/kWh

New England
VT

VERMONT
DEPARTMENT OF PUBLIC SERVICE
Vermont’s Regional Placement…

- Vermont has more utilities per customer, but also currently has lowest overall prices.

<table>
<thead>
<tr>
<th>2009</th>
<th># of Utilities</th>
<th># of Customers</th>
<th>Cust per Util</th>
<th>Sales</th>
<th>Revenue(000)</th>
<th>Ave Price</th>
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<tbody>
<tr>
<td>CT</td>
<td>10</td>
<td>1,423,377</td>
<td>142,338</td>
<td>16,660,567</td>
<td>3,188,120</td>
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<td>MA</td>
<td>45</td>
<td>2,678,233</td>
<td>59,516</td>
<td>29,424,777</td>
<td>4,741,857</td>
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<td>NH</td>
<td>9</td>
<td>684,216</td>
<td>76,024</td>
<td>8,806,376</td>
<td>1,329,505</td>
<td>15.10</td>
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<tr>
<td>NY</td>
<td>60</td>
<td>6,761,198</td>
<td>112,687</td>
<td>77,326,047</td>
<td>12,582,835</td>
<td>16.27</td>
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<tr>
<td>RI</td>
<td>3</td>
<td>484,234</td>
<td>161,411</td>
<td>5,677,262</td>
<td>838,784</td>
<td>14.77</td>
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<tr>
<td>VT</td>
<td>19</td>
<td>357,225</td>
<td>18,801</td>
<td>5,496,513</td>
<td>701,055</td>
<td>12.75</td>
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## Illustrative Prices for Various Supply Types for 2016

Cents per kWh; Shown w/ REC Credits

<table>
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<tr>
<th>Capacity</th>
<th>Energy</th>
<th>REC</th>
<th>Total</th>
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<tr>
<td>NYPA</td>
<td>1.13</td>
<td>0.57</td>
<td>1.70</td>
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<tr>
<td>Utility Hydro</td>
<td>5.80</td>
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<td>5.80</td>
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<tr>
<td>HQ PPA II</td>
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<td>6.47</td>
<td>6.47</td>
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<tr>
<td>Large hydro</td>
<td>0.69</td>
<td>6.47</td>
<td>7.16</td>
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<tr>
<td>HQ VJO</td>
<td>3.67</td>
<td>3.53</td>
<td>7.20</td>
</tr>
<tr>
<td>Methane (landfill)</td>
<td>8.98</td>
<td>(1.75)</td>
<td>7.23</td>
</tr>
<tr>
<td>Gas CC</td>
<td>1.69</td>
<td>5.78</td>
<td>7.46</td>
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<tr>
<td>Millstone</td>
<td>7.64</td>
<td>0.61</td>
<td>8.25</td>
</tr>
<tr>
<td>McNeil Biomass</td>
<td>4.62</td>
<td>5.77</td>
<td>(1.64)</td>
</tr>
<tr>
<td>New Biomass</td>
<td>5.19</td>
<td>5.99</td>
<td>(1.64)</td>
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<tr>
<td>Gilman Hydro</td>
<td>1.15</td>
<td>11.03</td>
<td>(1.64)</td>
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<tr>
<td>Wind</td>
<td>12.79</td>
<td></td>
<td>(1.75)</td>
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<tr>
<td>Standard Offer</td>
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<td>13.52</td>
<td>(1.64)</td>
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<tr>
<td>Other IPP hydro</td>
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<td>12.19</td>
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<td>VEPPI hydro</td>
<td>1.84</td>
<td>11.19</td>
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<tr>
<td>Net Metering</td>
<td>(1.13)</td>
<td>15.50</td>
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<tr>
<td>Gas CT</td>
<td>16.86</td>
<td>8.86</td>
<td>25.72</td>
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<tr>
<td>Intermediate Oil</td>
<td>17.54</td>
<td>9.42</td>
<td>26.96</td>
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<tr>
<td>Solar PV</td>
<td>33.61</td>
<td></td>
<td>(1.75)</td>
</tr>
<tr>
<td>Peaker (Oil)</td>
<td>60.98</td>
<td>11.78</td>
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</tbody>
</table>
Vermont’s Renewable Energy Future

Questions: Where Should We Be?

• Should renewable energy (RE) be promoted?
  • If yes, what technologies? In what locations? What about cost/price compared to non-renewables?
  • Are there technologies that should be added to the list of RE?

• Should in-state RE be given preference to out of state RE? Small distributed RE vs. utility-scale centralized RE plants? RE electricity vs. RE thermal energy?
Efficiency in the CEP

• “Societal” Benefits
  • Address Greenhouse Gases
  • Potential to alleviate T&D Constraints
  • Less risk associated with energy efficiency than power supply
• Potential to meet many of the CEP objectives
Maximum Achievable Electric Efficiency Potential....Plenty more to go!

Vermont Maximum Achievable Energy Efficiency Potential as a Percent of Forecasted Vermont kWh Sales in 2031

- Energy kWh: 25.4%
- Winter kW: 22.9%
- Summer kW: 19.9%

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Possible Methods for Encouraging EE

- Building Codes
  - Res/Commercial Codes in effect soon based on IECC 2009
  - Contractors must certify compliance with code
- Voluntary Codes/Standards
- Act 250
  - Res – meeting code meets Act 250 requirements
  - Com – best available technology
- Property Assessed Clean Energy District
- Time of Sale Disclosure
- Smart Grid
  - Advanced Metering Infrastructure enabled measures
Transportation & Energy Use

The Transportation GHG Emissions and Energy Challenge

GHG Reductions from Transportation

Vehicles
Fuels
VMT
Vehicle/System Operations
Total Annual Spending on Gasoline and Diesel in Vermont, 2005-2009

- **2005**: $400
- **2006**: $800
- **2007**: $1,200
- **2008**: $1,600
- **2009**: $800

# Transportation & Energy Use

## Vehicle Class of New Vehicle Purchased in Vermont, 2009

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>% of New Vehicle Purchases in 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy (i.e. Honda Civic, VW Rabbit)</td>
<td>35%</td>
</tr>
<tr>
<td>Midsize &amp; Large Sedan (i.e. Toyota Camry, Ford Fusion)</td>
<td>24%</td>
</tr>
<tr>
<td>S.U.V., Pick-up Trucks, Minivan &amp; Van</td>
<td>40%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
</tr>
</tbody>
</table>


Energy Use per Passenger-Mile by Transport Mode and Occupancy

- SUV - solo driver: 6,831 Btu/passenger-mile
- Car - solo driver: 5,465 Btu/passenger-mile
- Transit bus (av. Occupancy): 4,434 Btu/passenger-mile
- Rail (Amtrak): 3,011 Btu/passenger-mile
- Airplane: 2,996 Btu/passenger-mile
- Car - 1 passenger: 2,733 Btu/passenger-mile
- Car - 2 passengers: 1,822 Btu/passenger-mile
- Transit bus (at capacity): 570 Btu/passenger-mile

Transportation & Energy Use

Vermont Annual Vehicle Miles Traveled (in millions), 1975-2005

- Vermont Annual Vehicle Miles Traveled (in millions), 2006-2009

Source: Vermont Agency of Transportation Highway Research VMT Report

Increasing fuel prices
Economic Decline
Overall, vehicle miles traveled declined as accessibility, density and/or land-use mixing increased.

- Ewing and Cervero, 2001
Drive to Work?

- Nationally, transportation costs account for 21% of all household expenses.
- Most families spend more on driving than health care, education, or food.
- Driving is Vermont’s single largest contribution to greenhouse gas emissions (more than 40%).

How we grow matters
State Land Use Programs

Municipal and Regional Planning Development Act
Supports mixed-use development through comprehensive planning and implementation

Programs are intended to help . . .
- Develop a comprehensive local or regional plan that implements the State’s land use goals
- Implement regulatory and non-regulatory tools to guide growth
- Support development in appropriate places
- Integrate various land use needs
State Smart Growth Incentives

1st Generation Programs  
Designates Downtowns / Villages  
   Target resources to fix what we have

2nd Generation Programs  
Growth Center / Vermont Neighborhoods  
   Plan for compact growth in and adjacent to designated areas

Programs are intended to help . . .  
  • Preserve rural character and the working landscape  
  • Conserve natural and historic resources  
  • Support development in appropriate places  
  • Invest efficiently in public infrastructure
Everyone plays an important part...

- Directing limited funding (infrastructure, grants…)
- Location of buildings
- Clear goals and strategies in regional and local plans
- Local energy committees
- Developing for community energy systems
- Designing for transportation alternatives
- Site orientation – for renewable
- Location – near homes/services/transit
- Incentives for employees
Thank you for inviting me today...

For more information regarding the energy plan, go to:

http://publicservice.vermont.gov

Coming soon: http://vtenergyplan.vermont.gov

Thanks to Vtrans and Agency of Commerce and Community Development for Slides and Data...

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