ENERGY PLANNING & ACT 174
What we will be discussing:

- Overview of Energy Planning and Section 248
- Review of Municipal Energy Planning Standards
- Approaches and Support for Developing Municipal Plans

Not the focus of this discussion:

- State policy and plans and the assumptions that underlie them
- The BCRC draft Regional Energy Plan was presented at two recent public meetings. While noted as a potentially important resource document for municipalities, we will not go into it in great detail today.
Why and how are we here?

OVERVIEW
WHY PLAN?

- Environmental Reasons
- Economic Reasons
- Long-term Energy Security Reasons
HISTORY OF ENERGY PLANNING IN VT

- 2011 Comprehensive Energy Plan

- Pathways to Meeting State Goals: Total Energy Study - which informed the....

- 2016 Comprehensive Energy Plan

- New Regional Plans intended to provide information for the next CEP as well as support for municipal planning
VERMONT STATE ENERGY GOALS

Some statutory, some from the State Comprehensive Energy Plan. A few examples:

- 25% of all energy consumed in the state through in-state renewables by 2025
- Reduce greenhouse gas emissions resulting from energy use in Vermont by 50% (of 1990 levels) by 2028 and 75% by 2050
- Weatherize 60,000 Vermont housing units by 2017 and 80,000 by 2025
- 90% of Vermont’s total energy needs from renewable sources by 2050.
CONNECTING ENERGY AND PLANNING

- Act 174 (2016): Recognizes that energy is a fundamental consideration when planning for:
Transportation

Housing
Land Use
Regional Planning Pilot Projects - Statewide

- Evaluate current energy use

- Set regional targets for:
  - Energy conservation and alternative energy use
Energy generation
- Develop specific strategies for:
  - Conservation and efficiency in heating and cooling buildings
  - Reduced reliance on gas and diesel vehicles and more efficient land use and transportation systems
  - Electricity conservation and local distributed generation

- And, as part of the strategies related to electricity, identify energy resources and areas with the potential for renewable energy development
Any questions?
Act 174 establishes a set of **optional** municipal and regional energy planning standards.

- Standards developed by DPS in November 2016

- Communities that meet the standards will receive a “Determination of Energy Compliance” (a separate process and approval from the “plan approval” that we have been doing for many years) and

  - “**Substantial deference**” under Section 248
Due Consideration

Statute calls for “due consideration.” Does not define what “due consideration is” or assign whether the PSB or the Courts are the ultimate arbiter.

The SCOV indicated that the PSB only has to give “due consideration to the recommendations of the municipal and regional planning commissions in deciding [if] the project will not unduly interfere with the orderly development of the region.”

Substantial Deference

Defined in Statute:

“that a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy.”
Statutory Planning Goal: To make efficient use of energy, provide for the development of renewable energy resources, and reduce emissions of greenhouse gases.

(A) General strategies for achieving these goals include increasing the energy efficiency of new and existing buildings; identifying areas suitable for renewable energy generation; encouraging the use and development of renewable or lower emission energy sources for electricity, heat, and transportation; and reducing transportation energy demand and single occupancy vehicle use.

(B) Specific strategies and recommendations for achieving these goals are identified in the State energy plans prepared under 30 V.S.A. §§ 202 and 202b.

All sections of plan will be considered and policies must be consistent throughout the plan.

Determination Standards for energy compliance
BASIC REQUIREMENTS

- Locally adopted and regionally approved plan

- Energy Plan as defined in 24 V.S.A. §4348a(a)(3): can be an expansion of the existing section or a new energy plan formally incorporated by reference

- Key Components
  - Analysis and Targets
  - Pathways (Implementation Actions)
  - Siting Considerations and Mapping
ANALYSIS AND TARGET STANDARDS
Plan must contain an analysis of the following across all energy sectors (electric, thermal, transportation):

- Resources
- Needs
- Scarcities
- Costs
- Problems

DPS guidance available at their website (and through BCRC)

BCRC will have town-level estimates of current energy use and future projections across all sectors by May
**Sunderland**

- **Population**
  - Total Population (2014): 934
  - Population Density: *21 people per sq. mile*

- **Households**
  - Total Households (2014): 405
    - **OWNERS**
      - Total HHs Owned: 357
      - Avg. Owner HH Size: 2.3
      - 88% of HHs
    - **RENTERS**
      - Total HHs Rented: 48
      - Avg. Renter HH Size: 2.4
      - 12% of HHs

- **Businesses**
  - Total businesses in Sunderland (2014): 29
  - Total employees working in Sunderland (2014): 111
  - Total employed residents in Sunderland (2014): 519

- **Residential Transportation Fuel Use**
  - Number of vehicles (2014): 775
  - Mean vehicles per household: 1.9
  - Estimated miles traveled: **12.1 Million Miles**
  - Estimated gallons of fuels used: **0.5 Million Gallons**
  - Estimated total cost: **$1.8 Million**
  - Percent of resident employees driving alone to work: 71%
  - Average commute time: **18 Minutes**

**Space Heating For Households**
- Median Year Built for Housing Units: **1978**
- Percent of Housing Built Since 2000: **15%**
- Percent of Housing Built Before 1960: **31%**
- Median Annual Household Income: **$53,869**
- Total Energy Use: **43 Billion BTUs**
- Total Cost: **$774,000**
- Mean Cost per Household: **$1,800**

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Number of Households</th>
<th>Avg. Use (Annual)</th>
<th>Percent of Use (All HHs)</th>
<th>Percent of Use: Owner</th>
<th>Percent of Use: Renter</th>
<th>Percent of Cost (All HHs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank/LP/etc. Gas</td>
<td>63 HHs</td>
<td>73K Gal</td>
<td>16%</td>
<td>16%</td>
<td>15%</td>
<td>29%</td>
</tr>
<tr>
<td>Electricity</td>
<td>3 HHs</td>
<td>63 MWh</td>
<td>1%</td>
<td>0%</td>
<td>8%</td>
<td>1%</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>228 HHs</td>
<td>174K Gal</td>
<td>56%</td>
<td>57%</td>
<td>54%</td>
<td>48%</td>
</tr>
<tr>
<td>Wood</td>
<td>95 HHs</td>
<td>606 Tons</td>
<td>23%</td>
<td>23%</td>
<td>25%</td>
<td>21%</td>
</tr>
<tr>
<td>Other</td>
<td>16 HHs</td>
<td>-</td>
<td>4%</td>
<td>4%</td>
<td>0%</td>
<td>-</td>
</tr>
</tbody>
</table>

**Space Heating for Businesses**
- Mean Estimated Building Space for Businesses: **10,833 sq. ft**
- Total Energy Use: **19 Billion BTUs**
- Estimated Total Annual Cost: **$421,000**
- Average Annual Cost per Business: **$14,516**

Appendix A, Page 114
Establish targets:
- Thermal and electric conservation and efficiency
- Use of renewable energy for transportation, heating, and electricity.
- Electric generation

Evaluate needs/changes to occur over time:
- Conversion of heating sources
- Transportation system and land use planning
- Electric-sector conservation and efficiency
Communities can opt to collect and analyze data themselves, or they can utilize data provided by their RPC. Those that use the RPC data will be presumed to have met the standards in this section.
Data and targets should be aligned with state energy policy.
  - If not, must explain how the plan otherwise achieves the intent of the state goal or policy

Resources
  - BCRC Plan and Data
  - DPS Guidance
  - EAN Community Energy Dashboard
Example: Shaftsbury

- 2,930 household vehicles (ACS) * 14,000 average miles per vehicle (DPS Guidance) = 41 million miles/year

- 41 million miles/year / 25 MPG (DPS Guidance) = 1.64 million gallons

- 1.64 million gallons * $2.25/gallon = $3.7 million in gasoline expenditures per year

- Gas v. Ethanol (DPS = 10%)
  - 1.64 million gallons * .1 = 164,080 gallons of ethanol

- # Electric Vehicles
- Diesel Fuel Estimates
# Estimating Use: Single Family Home Heating

## Home Heating Estimates Methodology

This section outlines the data gathering and analysis process that the BCRC used to generate both regionwide and town estimates for home heating fuel source and costs. *This analysis does not include non-residential building data.

1. **Retrieve Fuel Type Data from US Census Bureau American Factfinder website.** To locate specific sets of data, use the ‘Guided Search’ feature of the American Factfinder data portal. Arlington town data, taken from ACS 2013 five year estimates:

<table>
<thead>
<tr>
<th></th>
<th>Avg. ppl per HH</th>
<th>Ntl. median square ft per person</th>
<th>Total HHs</th>
<th>Total estimated square ft</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Owner</strong></td>
<td>2.24</td>
<td>800</td>
<td>779</td>
<td>1,395,968</td>
</tr>
<tr>
<td><strong>Renter</strong></td>
<td>1.99</td>
<td>500</td>
<td>330</td>
<td>328,350</td>
</tr>
</tbody>
</table>

2. **Retrieve Household Size Data from American Factfinder and generate approximate square footage by household type.** *National square feet per person medians taken from the American Housing Survey for the United States: 2011, published in 2013 by the US Census Bureau. Arlington example:*

3. **Calculate Sq. Footage Heated by Fuel Type to estimate the amount of space being heated by each fuel.** BCRC combined ‘solar energy’ and ‘other fuel’ categories for this analysis. Arlington example for fuel oil in owner- and renter-occupied HH:

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Owner Occupied</th>
<th>Total</th>
<th>Percentage of housing</th>
<th>Approx. SqFt of Owner-occupied housing heated by fuel type:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total 779 HHs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fuel oil, kerosene, etc.</strong></td>
<td>521</td>
<td>(521 / 779) \approx 67%</td>
<td>Multiply by $\text{SqFt/HH}$: 1,395,968</td>
<td></td>
</tr>
<tr>
<td><strong>Coal or coke</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>933,632</td>
</tr>
<tr>
<td><strong>Wood</strong></td>
<td>181</td>
<td>(181 / 779) \approx 23%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solar energy</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>324,352</td>
</tr>
</tbody>
</table>
4. Calculate Energy Required for Heating with an assumed heating rate of 60,000 BTUs per sq.ft. of housing in VT. Assumed heating rate is a cautious estimate assuming generally low residential energy efficiency, and is based on a combination of federal and online sources. Other regions may use a lower (more efficient) rate closer to 50,000 BTUs.

**Arlington example:**

<table>
<thead>
<tr>
<th>Type of Fuel (Owner Occupied)</th>
<th>Total Sq. Feet of Housing</th>
<th>Approx. BTUs of Energy used Annually for Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel oil, kerosene, etc.</td>
<td>933,632</td>
<td>= 56,017,920,000</td>
</tr>
<tr>
<td>Wood</td>
<td>324,352</td>
<td>= 19,461,120,000</td>
</tr>
</tbody>
</table>

5. Calculate Quantities of Fuel Consumed with assumed rates of energy per unit of each fuel type.

Fuel efficiencies based on several federal and additional sources. Approximate efficiencies used in BCRC calculations:

- 1 Gallon Propane = 51,000 BTUs
- 1 kWh Electricity = 3,414 BTUs
- 1 Gallon Heating Oil = 140,000 BTUs
- 1 Pound Coal = 11,560 BTUs
- 1 Pound Wood Pellets = 8,750 BTUs

6. Calculate Cost of Fuel Consumed with assumed prices for each fuel types.

Prices for fuel inputs fluctuate often, so prices used here are estimates that can be adjusted over time.

Estimated prices used in BCRC calculations:

- Propane = $3.45/Gallon
- Electricity = $0.1471/kWh
- Heating Oil = $2.75/Gallon
- Coal = $0.16/Pound
- Wood Pellets = $0.16875/Pound

**Arlington example:**

| Fuel Oil Consumed in Owner Occupied Homes | 400,128 Gallons/Year | Multiplied by: $2.75/Gallon | = $1,100,352.00 per Year |

7. Calculations Done!

Time to compile final calculations and display them as tables and graphs in the corresponding sections of your plan.
FIGURE 2.8: BENNINGTON REGION ELECTRICITY USE BY ZIP, 2014
The data from Figure 2.7 on the previous page is broken down below by zip code area for the year 2014. The town of Bennington and its surrounding areas, where the majority of people and businesses in the region are located, are by far the largest consumers of electricity in the region.

<table>
<thead>
<tr>
<th>ZIP Code Area</th>
<th>Change in total use since 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington 05251 + 05252</td>
<td>12.5 GWh 6.211 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>+1% +18%</td>
</tr>
<tr>
<td>Peru 05152</td>
<td>6.3 GWh 8,926 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>+2% +92%</td>
</tr>
<tr>
<td>Bennington 05201</td>
<td>40.8 GWh 6,669 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>−1% +3%</td>
</tr>
<tr>
<td>Pownal 05260 + 05261</td>
<td>11.0 GWh 6,511 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>+3% +9%</td>
</tr>
<tr>
<td>Dorset 05251 + 05253</td>
<td>13.1 GWh 6,211 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>+0% −1%</td>
</tr>
<tr>
<td>Rupert 05776</td>
<td>5.3 GWh 7,270 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>−6% +17%</td>
</tr>
<tr>
<td>Manchester 05254 + 05255</td>
<td>22.3 GWh 7,510 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>−3% +30%</td>
</tr>
<tr>
<td>Shaftsbury 05262</td>
<td>13.0 GWh 7,358 kWh</td>
</tr>
<tr>
<td>Change in total use since 2007</td>
<td>−1% +7%</td>
</tr>
<tr>
<td>North Bennington 05257</td>
<td></td>
</tr>
<tr>
<td>Stamford 05352</td>
<td></td>
</tr>
</tbody>
</table>
**PROJECTING FUTURE FUEL USE**

### Regional Residential Energy Demand by Fuel Type 2015 - 2050

**Town Example:** *Shaftsbury Home Heating*

1,548 Households* - 10.5% of Region Total

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>2015</th>
<th>2025</th>
<th>2035</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodistillates</td>
<td>9</td>
<td>55</td>
<td>128</td>
<td>386</td>
</tr>
<tr>
<td>Cord Wood</td>
<td>353</td>
<td>350</td>
<td>363</td>
<td>452</td>
</tr>
<tr>
<td>Electric Resistance</td>
<td>67</td>
<td>71</td>
<td>53</td>
<td>25</td>
</tr>
<tr>
<td>Heat Pump</td>
<td>10</td>
<td>59</td>
<td>151</td>
<td>343</td>
</tr>
<tr>
<td>Kerosene</td>
<td>50</td>
<td>42</td>
<td>33</td>
<td>-</td>
</tr>
<tr>
<td>LPG</td>
<td>282</td>
<td>274</td>
<td>234</td>
<td>132</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oil</td>
<td>730</td>
<td>613</td>
<td>449</td>
<td>-</td>
</tr>
<tr>
<td>Wood pellets</td>
<td>54</td>
<td>86</td>
<td>120</td>
<td>213</td>
</tr>
</tbody>
</table>
ANALYSIS AND TARGET STANDARDS

Questions?
IMPLEMENTATION ACTIONS
Enhanced Energy Plans must:

- Include “pathways” and recommended actions to achieve energy targets
- Statements of policy
  - Conservation and Efficiency
  - Transportation
  - Land Use
  - Development and Siting of Renewables

Some actions may not be applicable or relevant
- Provide reasonable justification
THERMAL STRATEGIES

- Fuel Dealers → Energy Service Providers
- Building Weatherization Programs
- Biomass District Heating Systems (and CHP)
- Heat Pumps (primarily air source for existing buildings)
- Replace Oil and LPG/NG Residential Furnaces with Cordwood and Wood Pellet Fueled Systems
- Education/Incentives for Owners of Residential Rental Properties
- Enforcement of Building Energy Standards for All New Construction (Municipal Level)
- Geothermal Systems for New Construction
- Mapping is required
  - Use regional plan maps “as is” or add local details
  - Municipalities may choose to undertake their own mapping
Identify potential areas for renewable energy development:

- **Solar**
  Topography of land analyzed based on slope and direction (azimuth) conducted in GIS for ground-mounted solar.

- **Wind**
  Digitally modeled wind speed (based on topography) analyzed at 3 hub heights.

- **Hydro**
  Existing dams analyzed for potential capacity based on Community Hydro report. No new dams considered.

- **Biomass (wood)**
  Land coverage used to determine amount of harvestable wood.
# MAP POTENTIAL CONSTRAINTS

<table>
<thead>
<tr>
<th>Known Constraints</th>
<th>Possible Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions which would likely make development unfeasible.</td>
<td>Conditions which could impact development, but which would not necessarily prevent it.</td>
</tr>
</tbody>
</table>
This example shows solar potential.
Local Mapping Decisions

- **Preferred locations:**
  - Locally preferred locations
  - Statewide preferred locations
  - Have policies about specific sizes or type of generator

- **Unsuitable Areas:**
  - Areas (or criteria) where Town does not want a generator or a specific size/type of generator.
    - **Must have similar policies for other types of land development.**
  - Any regional or local constraints identified:
    - Supported through data or studies
    - Consistent with the remainder of the plan (and regional plan),
    - No arbitrary prohibition or interference
Individual towns can use the regional map to refine maps at the local level by adding areas preferred for solar development and important local resources that should be avoided.

This local analysis and mapping will be important in Section 248 proceedings.

Hypothetical Example:
G = Gravel Pit
R = Rooftop
X = Area to Avoid
NEXT STEPS

- Regional Energy Plans (BCRC Plan – potential adoption in February, 2017)

- Municipal Determination of Energy Compliance directly from DPS.
  - Submit to: PSD.PlanningStandards@vermont.gov

- BCRC will provide map and analysis of data by the end of April, 2017.

- Direct Municipal assistance
ADDITONAL RESOURCES

- Department of Public Service
  - http://publicservice.vermont.gov/
  - PSD.PlanningStandards@vermont.gov

- BCRC
  - www.bcrcvt.org
  - 802-442-0713 / jsullivan@bcrcvt.org

- EAN Community Energy Dashboard
  - http://www.vtenergydashboard.org/

- Vermont League of Cities and Towns
  - www vlct org