

A Vermont Sustainable Jobs Fund Project: in Partnership with VCGI, Fountains Spatial & overit media



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Sr. GIS Prj. Manager



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- ✦ U.S. Department of Energy via U.S. Senator Patrick Leahy
- ✦ Green Mountain Coffee Roasters
- ✦ Vermont Clean Energy Development Fund
- ✦ Vermont Community Foundation

Project Team



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Federal: Carolyn Alves & Reed Simms - USDA Natural Resources Conservation Service; National Renewable Energy Laboratory.

Non-Profit - Adam Sherman & Sarah Galbraith - Biomass Energy Resource Center; Andy Perchlik & Anne Margolis - VT Clean Energy Development Fund; Bethany Deyo - Efficiency VT; Brian Shupe, Johanna Miller & Jamey Fidel - VT Natural Resources Council; Carole Hakstian - Efficiency VT; Central VT Public Service; Jeremy McMullen, -VT Emergency 9-1-1 Board; Netaka White – VSJF: Scott Merriam - Renewable Energy VT.

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State - Dan Scruton - VT Agency of Agriculture, Farms and Markets; Brian Fitzgerald, Lawrence Becker, Peter Telep , Rob Achilles , Ryan Knox - VT Agency of Natural Resources; Vermont Department of Forests, Parks, and Recreation; Vermont Department of Public Service (Clean Energy Development Fund); Vermont Geological Survey and Vermont's 25 by '25 Initiative

Project Overview

The Client:



Vermont Sustainable Jobs Fund

VSJF is a 501(c)(3) nonprofit in Montpelier, Vermont. VSJF's mission is to **'accelerate the development of Vermont's green economy.'**

VSJF provides early stage **grant funding** and **technical assistance** to entrepreneurs, businesses, farmers, networks and others interested in developing sustainably produced goods and services.

The Problem: Fossil fuel dependency, peak oil, climate change, and ripples in the global economy pose unprecedented risks to Vermont.

The key to accomplishing our mission is **transitioning away from fossil fuels & non-renewable energy** as quickly as possible, & **re-localizing production**- food production, energy production, etc.

Hence...

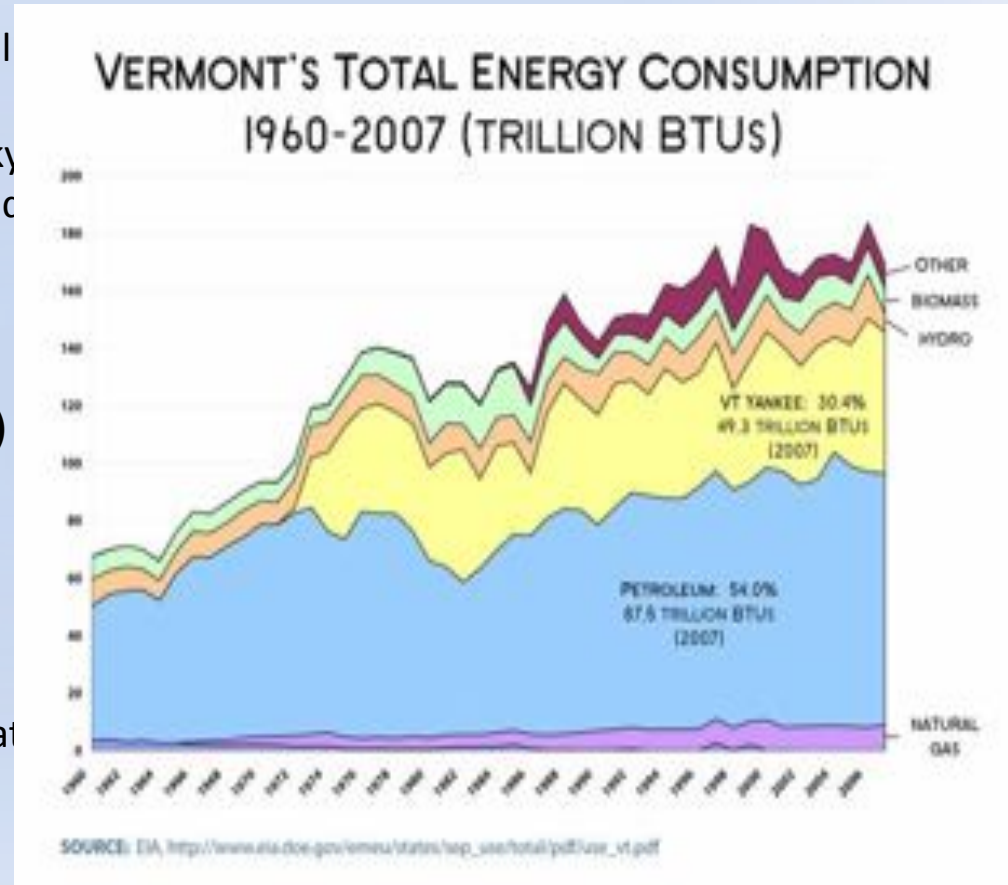
Why Renewables in VT?: Peak Oil, Climate Change & Sustainable Development

The Need: Approx. 90% of Vermont's total energy consumption currently generated from non-renewable energy sources...a risky position in an environment of peaking world oil production, global financial instability, climate change, and other factors.

- VT Yankee Contract (exp. 2012)
- Hydro Quebec (exp. 2010 – Renewed)

The Opportunity:

To create a tool for identifying, analyzing, and visualizing existing and promising locations for renewable energy projects that supports current related efforts such as town energy committees now in over 90 towns and cities.



Driving Forces Behind The Tool



To:

- “Promote re-localization of energy production by showing potential RE
- Foster transition away from non-renewable energy
- Retain energy dollars within the state (The money multiplier)
- Improve energy literacy by showing Vermonters how energy flows through their communities
- Provide a clearinghouse of useful renewable energy information, including technical assistance providers and financing options;
- Assist other statewide efforts of expanding renewable energy production and energy efficiency (e.g., the Vermont Clean Energy Development Fund and Efficiency Vermont)”

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Covers These Renewables...



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Biomass: Cropland (Ag land Suitability classes: Oilseeds & Grass Biodiesel); Woody (Woody Biomass)

Efficiency: Sites reported by Efficiency Vermont

Geothermal: Wells (Cat. 1 - High Yield wells & Deep, low-mid yield wells); Soils (Cat. 2 - Soil Horizontal Loops); (Cat. 3 - Pond/Lake Horizontal Loops)

Hydro: Commercial Hydro Electric dams (Existing Micro, Community & Commercial); DamPotential (Potential Micro, Community & Commercial)

Solar: FixedPV (E 9-1-1 points (~302k); SurfacePV (Surface Area ground mount solar)

Wind: Residential (30m “hub height” data); Community Scale (50m data); Commercial Scale (70m data).

Existing Sites: Algae (Algae based Biodiesel); Biodiesel; Digesters (Methane Digestors); Efficiency (Energy savings, efficiency projects); Geothermal; Industry (Consultants, Installers); Landfill (Landfill methane sites); Solar; Wind; Woody (Wdy bio electric or thermal); WVO (Waste Vegetable Oil based Biodiesel)

...Enable Town Level Focus

Illustration of Atlas Concept

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Data Layers



Composite Image for each Area

- NOAA-CSC: 2006 Land Cover Data
- VDOT Road Line Features
- Existing Sites
- 9-1-1 Building Point Features
- Rare, Threatened and Endangered Species
- Deer Wintering Areas



Montpelier

Mozilla Firefox
<http://www.vtenergyatlas.com/#>

RENEWABLE ENERGY ATLAS OF VERMONT

Biomass Efficiency Geothermal Hydro Solar Wind

What's New Contact

STATEWIDE SUMMARIES

Waitsfield

400 m
1000 ft

FIND AN ADDRESS
START ANALYSIS

LEGEND

- Potential Geothermal Site
- Existing Geothermal Site
- Geothermal Installer
- Fonds
- Soils

Waitsfield - Geothermal

Open Close Background Methods Next?

Town: Waitsfield County: Washington

Population: 1678 • % of Total Pop: 0.27% • Pop. Rank: 105 • Pop. Density: 62.4 • Pop. Density Rank: 73

Area: 26.9 Square Miles • 69.7 Square Kilometers • 17216 Acres • % of Total Area: 0.28% • Area Rank: 209

Number of Buildings: 991 • % of Total: 0.34% • Rank: 91 • Number of Households: 1160

Electricity Consumption : 2004-2008 (MWh)

Type	2004	2005	2006	2007	2008	TOTAL
Commercial & Industrial						

Transferring data from www.globehosting.com...

start Mozilla Firefox Microsoft Windows XP SP3 Ultra de Town Lev 8:32 AM

Benefits

Citizens

- Clearinghouse of information: Existing and potential sites;
- Ready access for “kicking the tires” & self education
- Resource for “green activists” (neighbors, volunteer groups, committees etc.)

Business

- Clearinghouse of businesses, by industry, for prospective clients
- Better educated clients = shorter prospecting times;
- Free tool for business development
 - Integrate w/internal work flows
 - Provide maps/links to prospective clients

Government

- Support Sustainable Economic Development not typically addressed by traditional economic development entities

Whole Cost Accounting of Energy: Example - MRV Current Energy Use

Electricity Consumption (Commercial, Industrial & Residential - 2008) Total 57,911 MWh

- Fayston: 5,660 Mwh/yr
- Waitsfield: 16,038 Mwh/yr
- Warren: 36,213 Mwh/yr

Transportation Fuels

Total 97,186 MWh equivalent

- Fayston: 1,245 (Population) * 625g = 778,125 gallons
- Waitsfield: 1,678 (Population) * 625g = 1,048,750 gallons
- Warren: 1,731 (Population) * 625g = 1,081,875 gallons

Heating Fuels Consumption (To be developed)

- Fayston:
- Waitsfield:
- Warren:

NOTE: Existing Solar PV in MRV from a recent 10/10/10 inventory - 352kW including off grid systems (.006% of total electrical use). Atlas showed 124kW based on CEDF data.

Electrical Offset : Ground Mount Solar Example

Disclaimers: Does not address issues of:

- baseload, intermittency, access to electric transmission etc.
- And many, many others...

Town: Warren County: Washington

- Population: 1731 • % of Total Pop: 0.28% • Pop. Rank: 100 • Pop. Density: 43.2 • Pop. Density Rank: 105
- Area: 40.1 Square Miles • 103.8 Square Kilometers • 25664 Acres • % of Total Area: 0.42% • Area Rank: 117
- Number of Buildings: 1470 • % of Total: 0.5% • Rank: 58 • Number of Households: 2216

Electricity Consumption : 2004-2008 (MWh)

Type	2004	2005	2006	2007	2008	TOTAL
Commercial & Industrial Consumption	17,577	20,394	19,685	25,805	20,919	104,411
Residential Consumption	16,457	16,298	15,394	15,381	15,293	78,827
TOTAL	34,034	36,692	35,079	41,218	36,213	183,238

Ground Mounted Solar Offset:

1 Mw array requires ~ 6 acres of land producing 1 Mw x 4.3h/day x 365 days/yr x 0.8 D.F. = **1,250 Mwh/yr**

100% Electrical offset = (###,### Mwh/1,250 Mwh/yr) * 6 acres/Mw

- Fayston: 5,660 Mwh = **27 acres**
- Waitsfield: 16,038 Mwh = **77 acres**
- Warren: 36,213 Mwh = **174 acres**

Total = 278 acres.

Town: Fayston County: Washington

- Population: 1245 • % of Total Pop: 0.2% • Pop. Rank: 129 • Pop. Density: 34.1 • Pop. Density Rank: 125
- Area: 36.5 Square Miles • 94.5 Square Kilometers • 23360 Acres • % of Total Area: 0.38% • Area Rank: 172
- Number of Buildings: 943 • % of Total: 0.32% • Rank: 99 • Number of Households: 550

Electricity Consumption : 2004-2008 (MWh)

Type	2004	2005	2006	2007	2008	TOTAL
Commercial & Industrial Consumption	1,389	1,215	1,381	1,542	1,495	6,861
Residential Consumption	4,285	4,133	4,046	4,292	4,364	20,925
TOTAL	5,674	5,348	5,427	5,834	5,859	27,786

Town: Waitsfield County: Washington

- Population: 1678 • % of Total Pop: 0.27% • Pop. Rank: 105 • Pop. Density: 62.4 • Pop. Density Rank: 75
- Area: 26.9 Square Miles • 69.7 Square Kilometers • 17216 Acres • % of Total Area: 0.28% • Area Rank: 209
- Number of Buildings: 991 • % of Total: 0.34% • Rank: 91 • Number of Households: 1160

Electricity Consumption : 2004-2008 (MWh)

Type	2004	2005	2006	2007	2008	TOTAL
Commercial & Industrial Consumption	8,094	8,384	8,301	8,156	7,854	40,752
Residential Consumption	8,382	8,238	8,175	8,305	8,523	41,227
TOTAL	16,476	16,622	16,476	16,461	16,377	81,979

Trans Fuels Offset: Ground Mount Solar Example

Transportation Fuels

Assumptions:

- ~12,500 miles/capita/year¹
- 500 gallons/capita/year (@20mpg²)
- 1 US gallon Gas = 114,000 BTU/gal³
- 3,412 BTU's/kWh²
- 4.3kWh/day in VT

Total transportation fuel

- Fayston: 1,245⁴ (Population) * 625g = 778,125 gallons
- Waitsfield: 1,678⁴ (Population) * 625g = 1,048,750 gallons
- Warren: 1,731⁴ (Population) * 625g = 1,081,875 gallons

Total kWh Equivalent (###,### gallons * 114,000btu)/3412btu/kWh =

- Fayston: 25,998,315 kWh (25,998 Mwh)
- Waitsfield: 35,040,299 kWh (35,040 Mwh)
- Warren: 36,147,055 kWh (36,147 Mwh)

Ground Mounted Solar Offset:

1 Mw array requires ~ 6 acres of land producing 1 Mw x 4.3h/day x 365 days/yr x 0.8 Derate Factor = **1,250 Mwh/yr**

100% liquid fuel offset = (###,### Mwh/1,250 Mwh/yr) * 6 acres/Mw. **Total of 467 acres.**

- Fayston: = **125 acres**
- Waitsfield: = **168 acres**
- Warren: = **174 acres**

Disclaimers: Analysis doesn't address:

- Greater economy of hybrids and EV's (MPG vs MPGe)
- Does not differentiate between passenger vehicles and heavy trucks (that will likely remain carbon based for foreseeable future)
- And many, many others...

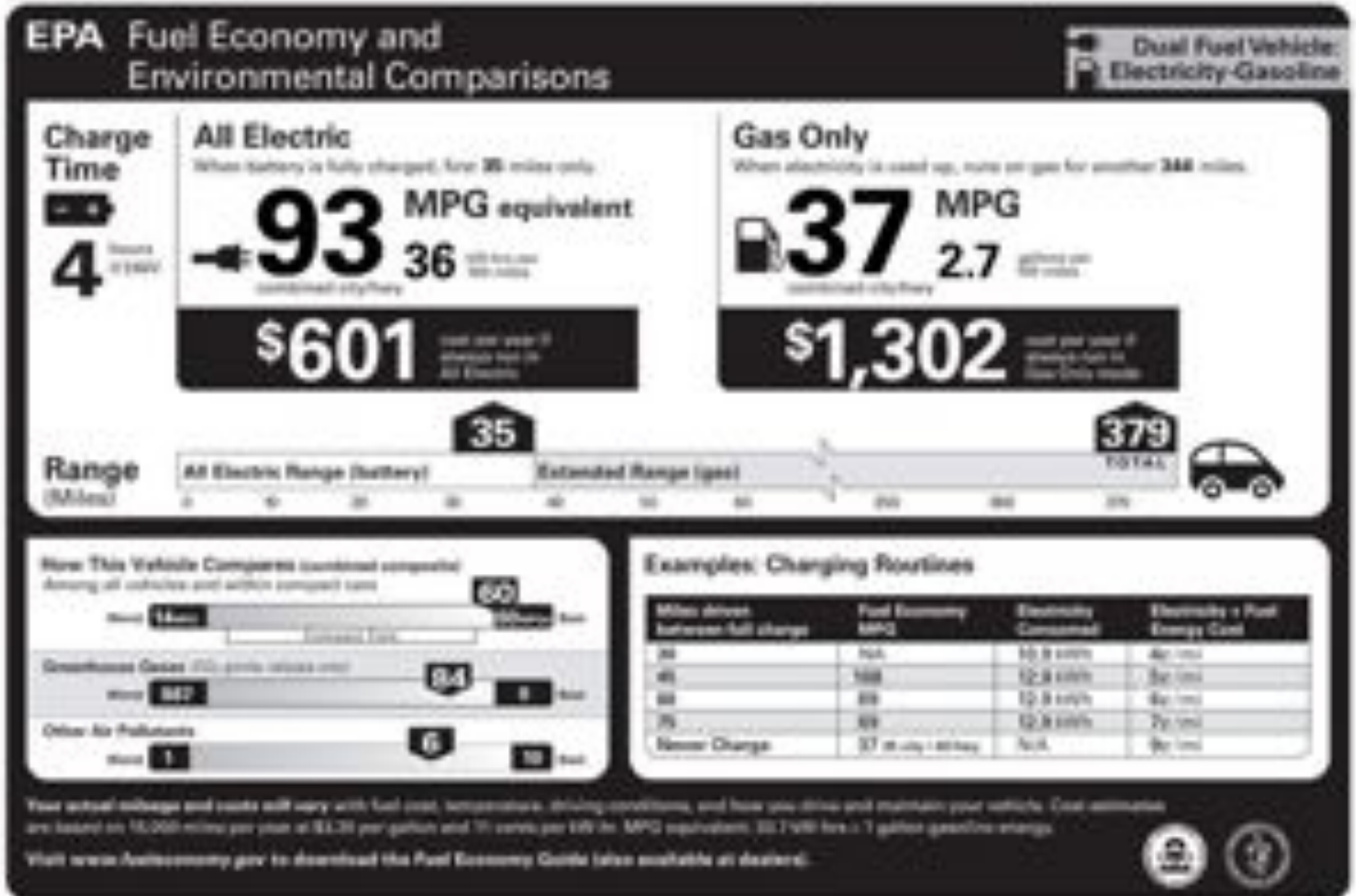
¹ Town of Waitsfield, VT. Town Plan, Draft 2009; ² RITA http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html

³ Wikipedia; ⁴ Renewable Energy Atlas of Vermont

Electrical + Trans Fuels Offset: Ground Mount Solar Example

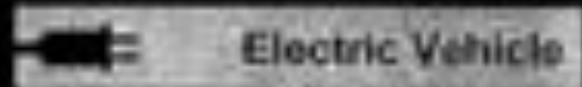
MRV Energy Consumption Comparison (2008)		
	Electrical¹ (MWh)	Transportation² (MWh)
Fayston	5,660	25,998
Waitsfield	16,038	35,040
Warren	36,213	36,147
Total	57,911	97,185

Chevy Volt



Nissan Leaf

EPA Fuel Economy and Environmental Comparisons



99

MPG_{Equivalent}

combined city/hwy

106

city

92

highway

34 kW-hrs per 100 miles

Charge & Range

Full Battery Charge Time



7 hours

at 240V

on a fully charged battery, vehicle can travel about...



73

miles

Annual Electric Cost

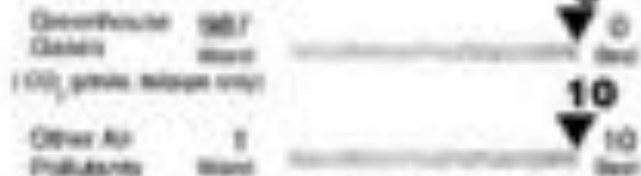
\$561

How This Vehicle Compares

Among all vehicles and within midsize car



Environment



Your actual mileage and costs will vary with electricity cost, temperature, driving conditions, and how you drive and maintain your vehicle. Cost estimates are based on 15,000 miles per year at 12 cents per kW-hr, MPG_{Equivalent}, 33.7 kW-hrs = 1 gallon gasoline energy.



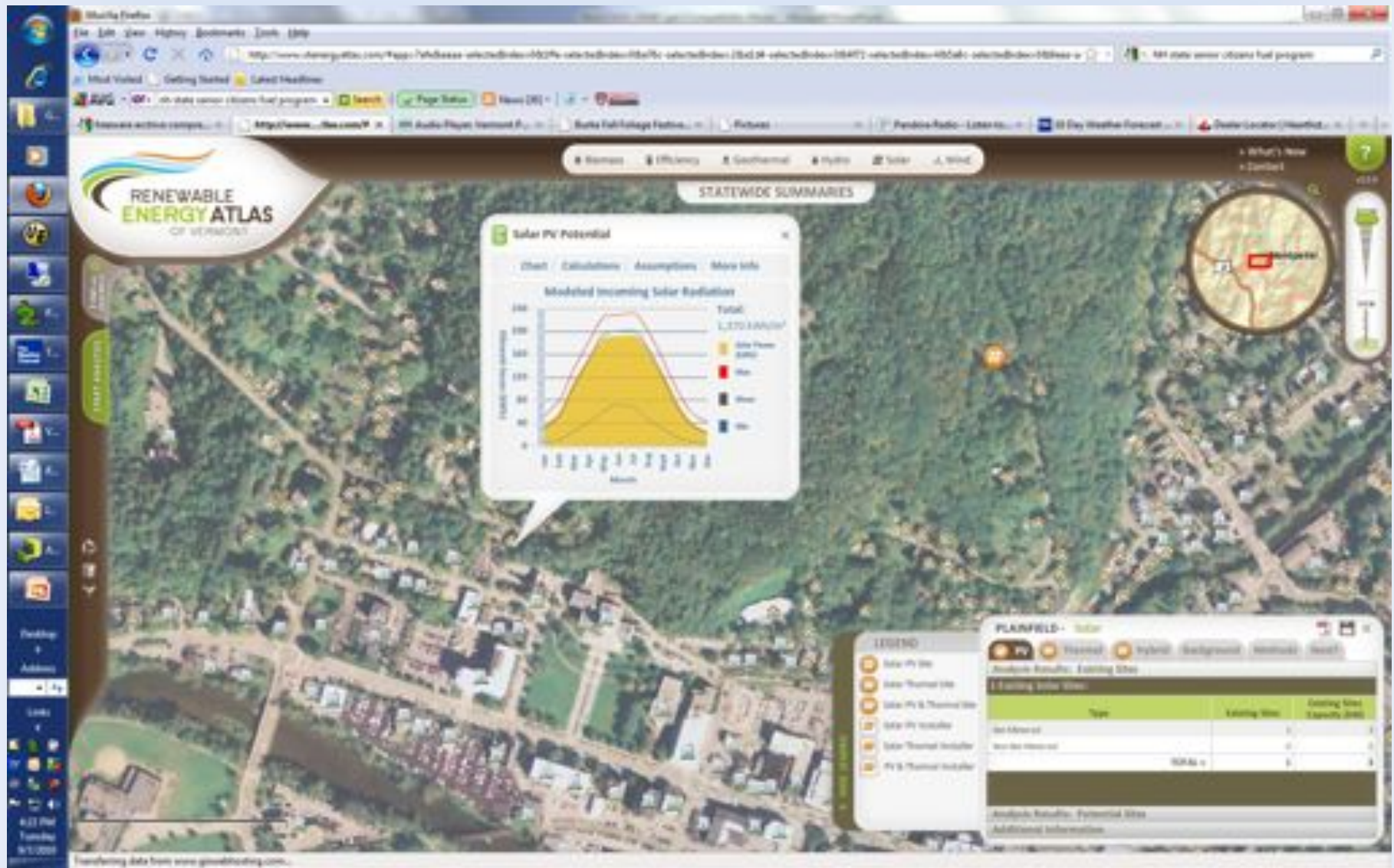
See the **FREE** Fuel Economy Guide at dealers or www.fueleconomy.gov



Heating Fuels Offset

(To be developed – researching good data sources)

Demo – www.vtenergyatlas.com



For More Information

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Questions?

