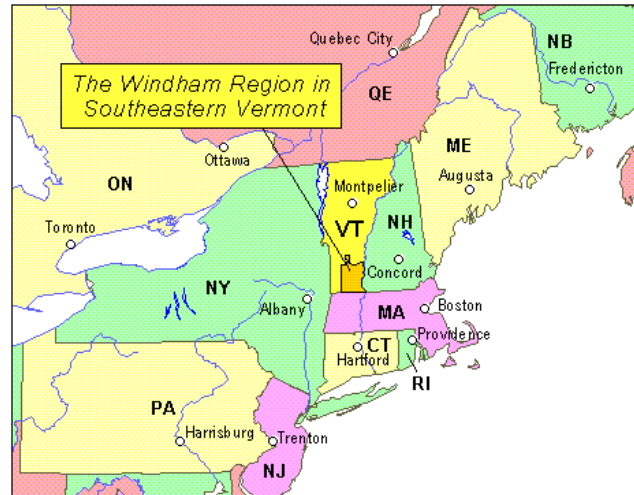


Preliminary Heat Supply Plan Windham Regional Commission



The Windham Regional Commission (WRC) is a voluntary association of 27 towns in southeastern Vermont operating under the authority of the Vermont Municipal and Regional Planning and Development Act (24 V.S.A. Chapter 117). The WRC assists member towns in providing effective local government and working cooperatively to address regional issues. The WRC population of 46,449 includes Windham County plus Readsboro, Searsburg and Winhall in Bennington County and Weston in Windsor County. The Windham Region is bordered by Bennington and Windsor Counties to the west and north, New Hampshire to the east, and Massachusetts to the south. The area included is approximately 920 square miles, or nearly 590,000 acres, of which about 86 percent is forested. The region averages about 25 miles east to west and 35 miles north to south. Formed in 1965, WRC is the oldest and one of the largest regional planning commissions in Vermont.



The October 2006 Windham Regional Plan clearly states the significant energy issues facing the region. Vermont is almost completely dependent on imported fossil fuels for building heating and recent price increases make it imperative to identify and implement technically and economically feasible solutions to reduce and eventually eliminate this dependency. One striking fact will be sufficient to illustrate this point: The most recent Vermont Fuel Price Report (December 2007) shows that heating with propane is now more expensive than electric heat.

Local and regional heat supply planning has played a key role in reducing energy consumption and imports in Scandinavian countries since the oil shocks of the 1970s. This preliminary heat supply plan will identify basic opportunities that can be implemented throughout the Windham region to achieve three separate but closely interrelated goals:

- Increase efficiency of energy production, distribution, and consumption
- Begin the process of migrating from imported fossil fuels to local renewable resources
- Reduce demand on the strained electric networks by shifting electric heating and cooling apparatus to thermally-driven technologies.

Although the region's ample biomass resources appear to be the most suitable fuel for new heating infrastructures, several other resources are available and could be employed where appropriate and cost effective. These include solar thermal, methane gas recovery from landfills and water treatment plants, and ground source heat pumps. Although the latter would increase electric consumption, they could be suitable for smaller isolated buildings that may not be efficiently served by a biomass fuel supply network. One additional energy resource commonly used in Europe is waste-to-energy plants, which would probably face significant local opposition without extensive source separation and emissions control. If such a project was successfully developed in the region it could certainly contribute heat to the local community, but for the purposes of this plan it will be assumed that this is unlikely in the near future.

Biomass from forest resources will be provided in three forms to accommodate various sizes of heating apparatus:

- Whole tree chips require the least processing, have the lowest cost, and highest moisture content (40 to 60%). Although these will be the preferred fuel, they can only be burned cleanly and efficiently in boilers with a heat output greater than 1 million btu/hr (1 mmbtu/hr) with larger units being better.
- Dried whole tree chips with a moisture content no greater than 30%. These chips can be burned in a wide variety of modular apparatus ranging in size from 300,000 btu/hr up to several million btu/hr. The additional handling required to dry these chips results in a higher price.
- Pellets are generally completely dry and have been processed to a uniform size. These are the most expensive form of wood fuel but can be burned cleanly in small residential scale systems.

Utilizing these renewable fuels to produce useful energy requires installation of new apparatus, which will vary with the size of the application:

- Combined Heat and Power (CHP or cogeneration) plants can deliver the highest thermal efficiency, which can exceed 90% with flue gas heat recovery installed. Although biomass CHP systems as small as 200 kWe have been installed in Vermont, experience suggests that a 600 to 900 HP boiler producing 20,000 to 30,000 pounds of steam will operate much more efficiently and reliably than smaller units. A 900 HP boiler producing steam at 600 psig/750°F will cogenerate 2 MW of power while exhausting steam at 10 psia to produce 30 mmbtu/hr of 190°F hot water, with an additional 5 to 6 mmbtu/hr of hot water available from flue gas heat recovery if hot water return temperatures are low enough. Multiple units would be installed to provide additional heat to meet thermal demand where required and air cooled heat exchangers would be included to allow the full output of the generator to be available at any time to maximize participate in ISO-NE Forward Capacity Markets.
- Heat-only hot water generators can be installed in biomass CHP plants to provide backup and peaking thermal production, and can also be installed as stand-alone units in applications which are not large enough to support cogeneration. The size of the unit will determine the type of wood fuel that is required (wet wood chips, dry wood chips or pellets).

Except for systems serving a single building, heat would be distributed as low temperature hot water to participating consumers in each community from one or more plants sited in appropriate locations. From the above analysis, it is possible to determine the application of each fuel and technology option based on the potential heat load, which is shown here as “Equivalent Housing Units” representing a peak heating demand of 50,000 btu/hr which is roughly equivalent to an actual heat demand of about 40,000 btu/hr (roughly what one small single-family house would need on a cold winter day). One house by itself, for instance, would represent one unit, a small elementary school approximately 10 to 15 housing units, and so on.

Equivalent Housing Units	Fuel and Heating Options (Note: Solar thermal can be used with all options)
1	Pellets in wood stove, insert, or boiler; or ground source heat pump
2-25	Pellets in hot water generator
10-100	Dry (<30% moisture) wood chips in heat-only plant
50-750	Wet (40-60% moisture) wood chips in heat-only plant
500+	Wet (40-60% moisture) wood chips in combined heat & power

Implementation Strategy

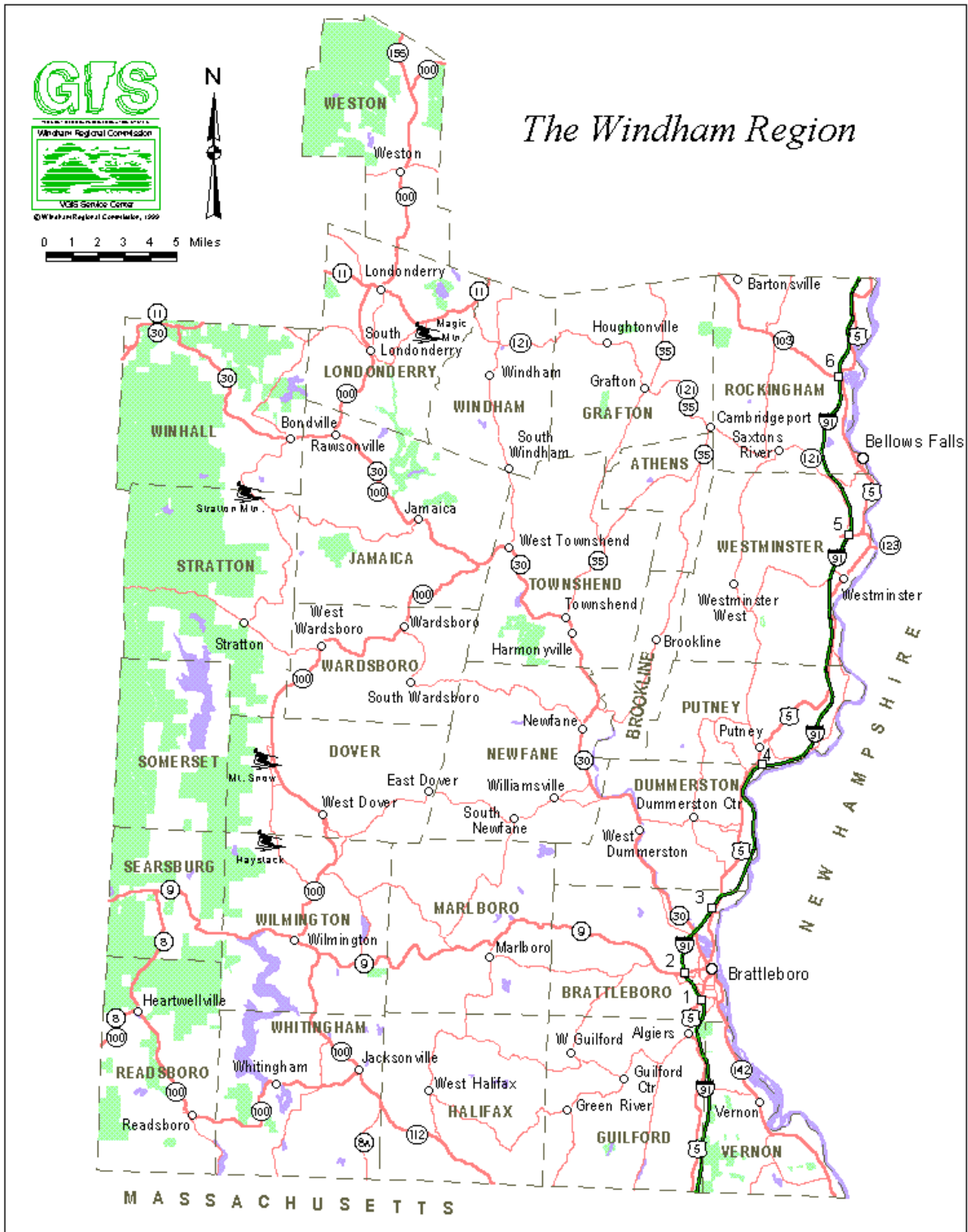
Significant progress has been made on establishing district energy networks in Brattleboro, the largest community in WRC. A new biomass combined heat and power plant would be sited at the FiberMark plant to serve new heating networks in the Putney Road/Exit 3 area and also the School for International Training World Learning Campus. A larger biomass combined heat and power plant could be developed at the Riverside Industrial Complex to provide heat in the downtown Brattleboro area, which would be supported by existing plants owned by Cersosimo Lumber and Retreat Healthcare. Heat-only systems appear to be suitable for West Brattleboro and the Westgate area along Route 9.

Another combined heat and power plant would be sited at Putney Paper to displace oil used at that facility and also provide heat to other consumers including Landmark College. The Village of Bellows Falls in the town of Rockingham also appears to be a suitable site for combined heat and power and perhaps also the Village of Westminster. Seasonal housing units at the four larger ski areas (Haystack, Mt. Snow, Stratton Mountain, and Magic Mountain) may also be sufficient to support local CHP systems, although the logistics of biomass fuel delivery and plant siting in these communities will require further study.

Every built-up area that has been visited appears to be suitable for a heat-only system of appropriate size, although the economics of these are not as clear cut as the larger CHP installations. Marlboro College, for instance, appears to be very suitable for a heat-only plant, but the Marlboro Elementary School appears to offer only marginal economics, although rising oil prices and potential funding assistance could positively impact that evaluation.

Larger (and eventually smaller) heat-only networks will also become ideal candidates for demonstration of smaller scale biomass CHP technology as it becomes available.

Successful development of these systems will require a strong commitment from local communities and potential consumers, which could be achieved by educating appropriate individuals in each community on the technology, benefits, and application.



The following table shows the number of housing units in each structure for each WRC town, using data from the 2000 Census. A large number of households shown for Dover, Londonderry, Stratton and Wilmington are associated with ski areas in those communities.

Units in Structure	Housing Units	1, detached	1, attached	2	3 or 4	5 to 9	10 to 19	20 to 49	50 or more	Mobile home
Athens	202	156	2	0	0	0	0	0	0	44
Brattleboro	5,686	2,406	199	577	931	726	148	195	129	375
Brookline	283	244	6	2	0	0	0	0	0	31
Dover	2,749	1,291	1,102	90	58	93	53	14	7	39
Dummerston	893	765	6	27	8	0	14	1	0	72
Grafton	408	332	9	9	0	2	0	0	0	54
Guilford	931	741	23	45	10	4	0	0	0	103
Halifax	495	436	4	2	0	0	0	0	0	47
Jamaica	967	771	15	45	51	0	0	0	2	83
Londonderry	1,317	1,052	34	56	26	22	4	27	41	55
Marlboro	495	420	17	11	2	2	0	0	0	38
Newfane	977	848	10	33	17	4	1	0	0	58
Putney	1,049	699	27	58	61	18	12	25	2	143
Rockingham	2,425	1,179	4	405	396	106	21	67	72	167
Somerset	28	24	0	0	0	0	0	0	0	0
Stratton	1,093	257	128	51	114	108	167	137	129	2
Townshend	668	587	12	32	10	2	0	0	0	25
Vernon	784	646	7	16	15	21	13	0	0	66
Wardsboro	764	666	6	27	4	2	0	3	0	54
Westminster	1,412	1,075	20	61	23	22	0	0	4	195
Whitingham	802	693	10	22	7	17	3	0	0	46
Wilmington	2,232	1,692	51	139	180	75	0	5	3	83
Windham	379	349	8	7	0	0	0	0	0	15
Weston	534	462	19	9	7	10	2	0	0	23
Readsboro	464	349	4	29	24	7	3	28	0	20
Searsburg	65	49	2	0	0	0	0	0	0	14
Winhall	1,723	1,181	224	91	9	196	16	0	0	6
Total	29,825	19,370	1,949	1,844	1,953	1,437	457	502	389	1,858
Percent		64.9%	6.5%	6.2%	6.5%	4.8%	1.5%	1.7%	1.3%	6.2%