

Vermont's Hydroelectric Opportunity

Testimony on H70 to the
Vermont House Committee On Agriculture
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Redevelopment of Vermont's Hydroelectric Opportunity

The Current State of Affairs

Vermont has an abundance of the two principle components for cheap, local hydroelectric power – hills and water. Indeed, the state has up to 400 megawatts of undeveloped hydroelectric potential at 1194 sites and potentially an additional 420 MW of undeveloped hydro potential at 149 sites with varying amounts of infrastructure.¹ Despite its being among the most affordable of renewable technologies (water flows 24 hours a day), no new hydro site has been developed or re-developed in Vermont for 20 years. Run of River hydroelectric is not a consumptive use. Water is returned to the stream within minutes of making power. Permitting is the major obstacle.

Unlike solar or wind, hydroelectric power is the only renewable energy source required to gain approval from numerous state and federal agencies. These include: Vermont Public Service Board; Vermont Department of Environmental Conservation - both the Facilities Division and Water Quality Division; Hydrology, Wetlands, Lakes, River Corridor Management; Vermont Department of Fish and Wildlife; Vermont Non-game and Natural Heritage Program; Vermont Division of Historic Preservation; U.S. Fish and Wildlife Service; and the Federal Energy Regulatory Commission (FERC).

The Solution

FERC estimates that permitting and environmental studies for typical small-scale hydro more than double the project cost.² Typical permitting costs-regardless of the size of the project in Vermont are often in the \$250,000 - \$500,000 range. For example, The Vermont Agency of Natural Resources (ANR) has been in the process of issuing 401 Water Quality Certificates for existing hydroelectric sites (Silver Lake, Carvers Falls, and Waterbury) for between 10 –13 years. These delays increase costs.

Vermont should promote a simplified state and federal permitting process for local, small-scale, environmentally sound, hydroelectric projects. This would include:

- A simple, predictable Certificate of Public Good from the Public Service Board.
- A simple, predictable 401 Water Quality Certificate from the Vermont Agency of Natural Resources.
- Support from the Clean Energy Fund on a KW installed basis to help communities and schools install environmentally sound small hydro.

ANR could make this change tomorrow by changing the default flow guidelines in their Agency Procedure for Determining Acceptable Minimum Stream Flows (July 14, 1993). ANR has a body of issued 401 Water Quality Certificates that can be built on to develop an easier procedure. Expensive, site-specific fish and flow studies for each site should not be required.

Coming before the Vermont Legislature this year, bill H-70 will accomplish these goals.

¹ *Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants*. January 2006. DOE-ID-11263. 68 pp. US Department of Energy, 2006; Department of Energy. 1998. US Hydropower Resource Assessment Final Report. December 1998. 48 pp. Vermont Hydropower Resource Assessment by River Basin.

² *Report on Hydroelectric Licensing Policies, Procedures and Regulations Comprehensive Review and Recommendations Pursuant to Section 603 of the Energy Act of 2000*, FERC, 2001.

Vermont has over 1000 dams: Department of Fish and Wildlife (DFW) owns 54 of the 83 state-owned dams including dams on the mainstems or tributaries of Dead Creek, East Creek, Otter Creek, the Lemon Fair, Clyde, Castleton, Poultney and the White River. Some of these have power potential. These can be used to generate income either through lease fees or developing and selling the power. 45 towns own 107 dams.

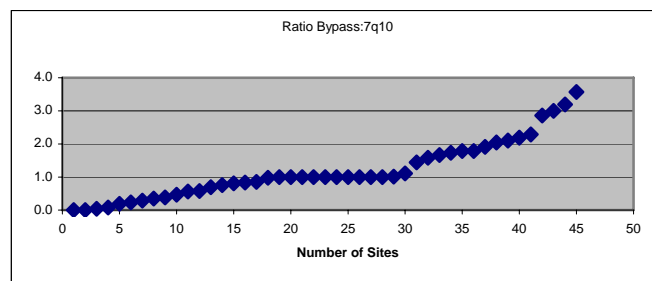
Dams have benefits: Flood control; Recreation; Water supply; Fish and Wildlife; Historic resource; Keep native fish population discrete from stocked population. Many dams are not likely to be removed. Good fishing above and below dams.

Dams have liabilities: Block fish passage-fish can't get upstream. Many fish ladders don't work; Fish can get entrained in turbine downstream-need screening; Engineered, can breach; Store and release hydro can change flows dramatically; Backwater effects-no longer free flowing river.

Fish passage: No state-owned dam has upstream or downstream fish passage installed at the dam. *The same standards should apply to all dams, i.e. if habitat connectivity is a goal, apply it to all dams - and not just hydroelectric.* Funding sources could be: tax on docks, mooring, marine supplies for those who live or use lakes, tax on water supply for those who get the water; tax on flood control dams for those who live downstream; increased cost of fishing license for those who use DFW dams to pay for fish passage. ANR has only required downstream fish passage at 8 of 45 ROR hydro projects. ANR has required upstream fish passage at three sites on the Passumpsic (out of 7); two on the Connecticut River; and 1 at the mouth of the Winooski.

No documented Water Quality Problems by ANR: No run of river hydroelectric project has documented water quality problems such as fish kills, temperature impacts or dissolved oxygen deficits - true at DFW dams too.

ANR 401 Water Quality Certificates: The "7Q10" standard is the lowest average 7 day flow in ten years. In theory a full ANR review process should insure safe bypass flow levels better than a fixed standard. Historically, the flows allowed by the ANR regulatory process have had no discernable connection to the size of a watershed, flow data, or other relevant quantifiable factors (see last 2 pages). The deciding factor for allowable flows is often not the water resource of the river, but possibly the financial resources of the applicant.



Ratio of Permitted Bypass Flows at run of river hydroelectric plants with 401 Water Quality Certificates. Values equal to – or less than one indicate sites where ANR permitted 7Q10 flows (or less) in the bypass. In some cases, ANR has permitted no flow in bypass. The super-majority of the time, ANR permits flows equal to or less than the 7Q10 in the bypassed section.

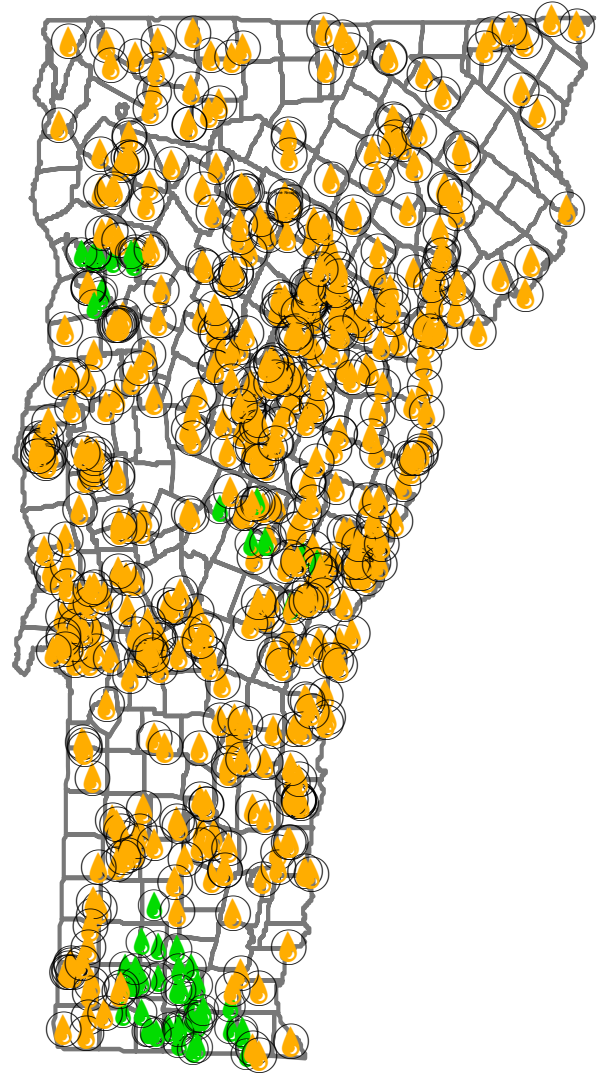
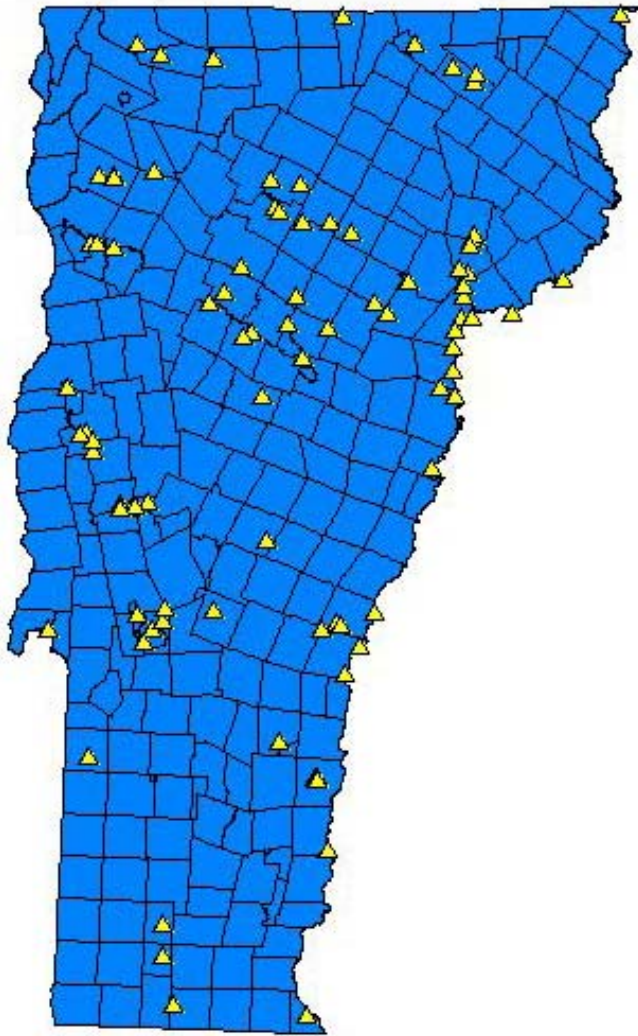
The Benefits

Besides its potential to generate jobs in Vermont, small-scale hydro power can generate income or offset electric costs through group net-metering and purchase power contracts. Many farms, schools and municipalities can similarly benefit. Vermont Governor John A. Mead put it this way in 1912:

“This white coal from hydro-electric development, free from smoke, soot and cinders ... (is) today producing power sufficient to displace the use of a million tons of black coal annually, and this power can readily be distributed to every small and large town ... and thus revive the hundreds of small factories, which were formerly the hives of industry in so many of our small villages...Again how differently, financially, for our people and state, if this \$5,000,000 now paid annually to the coal producers of Pennsylvania and Ohio should be produced and kept within our borders.”

Working Landscape: Farms are part of Vermont’s working landscape, as is hydroelectric generation. Over 2000 mill-sites once were the economic and industrial backbone of Vermont. In 1941, hydropower provided over 90% of Vermont’s electric needs. Many farms have stock ponds, gravity-fed springs, rivers and dams flowing on or nearby the farm. A simplified process that still protects the aquatic environment can help a farmer to reduce their electric costs and potentially provide an additional income source as well. Hydroelectric is the most efficient of all the renewable energy technologies.

Vermont has only 95 hydroelectric sites –ANR 2003 (left), but over 1000 existing dams (right) Vermont Center for Geographic Information (2005).



Vermont has over 400 MW of feasible undeveloped capacity at over 1000 sites (Department of Energy, 2006)

http://hydro2.inel.gov/resourceassessment/pdfs/main_report_appendix_a_final.pdf
http://hydro2.inel.gov/resourceassessment/pdfs/appendix_b_2_final.pdf

(Please note that 217 MW of feasible undeveloped potential equals 434 MW of feasible undeveloped hydroelectric capacity.)

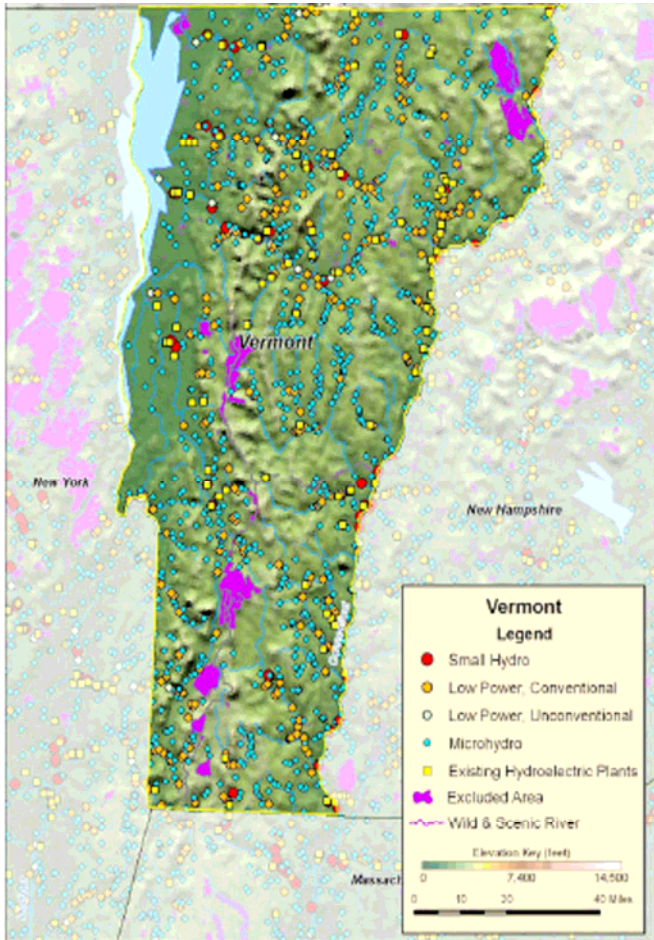


Figure B-225. Low power and small hydro feasible projects, and existing hydroelectric plants in Vermont.

Table B-92. Summary of results of feasibility assessment of water energy resources in Vermont.

Power Class	Available (MWa)	Feasible Sites (MWa)	Feasible Projects (MWa)
Total Power	1,022	812	217
Total High Power	606	552	112
Large Hydro	43	43	0
Small Hydro	564	509	112
Total Low Power	416	260	105
Conventional Turbines	373	233	65
Unconventional Systems	11	10	6
Microhydro	32	16	34

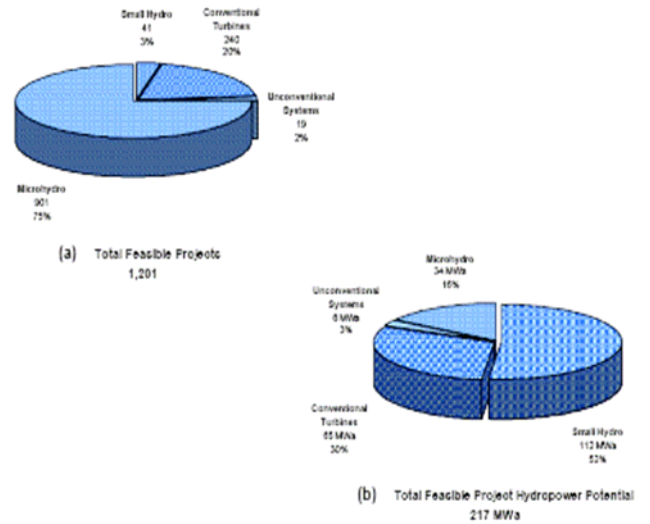


Figure B-222. Distribution of the (a) number and (b) total hydropower potential of the low power and small hydro feasible projects in Vermont with the low power projects divided into technology classes.

Flow Requirements in Bypassed sections of river from Run-of-River Hydro Projects with ANR 401 Water Quality Certificates

Project Name ROR w/401	Stream	401 Certification Date	FERC Enforcement?	Length bypass section-ft	Drainage Area (Sq. Mi)	Required bypass flow CFS	Ratio Bypass:7q10	7q10 (cfs)	Fish Passage Required?
Baldin Brook	Baldin Brook-winter	4/29/1982		1200	2.4	2.4	76.9	0.03	
Baldin Brook	Baldin Brook-summer	4/29/1982		1200	2.4	1.2	38.5	0.03	
Killington		8/15/1984		400	5	2	2.9	0.7	
Arlon Warner Hydro	Potter Brook	11/17/1983		1200	6	3	12.5	0.24	
Flower Brook	Flower Brook	7/22/1982			19	5	6.6	0.76	
Martinsville	Lull Brook	11/28/1983	1985	440	21	2	1.0	2	
Ladds Mill	North Branch Winooski River	1/25/1985	1990	20	42	10	4.8	2	
Emerson Falls	Sleepers R.	9/17/1984			43	15			
Barnet	Stevens River	3/1/1982		700	48	15	3.0	5	
Woodside Hydro	Gihon River	3/28/1983			56	0	0.0	12	
Dog River-Nantana	Dog River	3/11/1985		130	62	5	1.0	5	
Leveille	Little River	6/2/1982			82	0	0.0	9	
Cavendish	Black R.	10/7/1993		1570	83	10	1.1	9	downstream
Wells River Hydroelectric	Wells River	2/29/1984	1985, 1986, 1987	600	94	5	0.4	13	
Newbury	Wells River-spring	12/12/1982	1991	380	98	50	3.6	14	
Newbury	Wells River-summer	12/12/1982			98	25	1.8	14	
Brockways Mills	Williams River-summer	12/1/1982	1989	400	103	13	2.1	6	
Brockways Mills	Williams River-winter	12/1/1982			103	5	0.8	6	
Barton Village	Clyde R	5/19/2003	2006	800	108	45	2.0	22	
Bethel Mills	Third Branch White River	7/21/1986		275	136	19	1.0	19	Downstream
Moretown No. 8	Mad River	7/29/1987	1990, 1993, 1995	40	142	25	1.7	15	Downstream
Fellows Dam	Black R.	3/23/1986			158	6	0.3	21	Downstream
Slack Dam	Black R.	1/31/1985			190	3	0.1	21	Downstream
Comtu Falls	Black R.	8/23/1982			190	4	0.2	23	
Lovejoy Dam	Black R.	3/23/1986			190	4	0.2	21	Downstream

Project Name ROR w/401	Stream	401 Certification Date	FERC Enforcement?	Length bypass section-ft	Drainage Area (Sq. Mi)	Required bypass flow CFS	Ratio Bypass:7q10	7q10 (cfs)	Fish Passage Required?
Winooski 8	Winooski River	12/29/1982		200	200	25	0.8	30	
Vail	Passumpsic River	9/13/2001	2007	120	200	31	0.8	41	u/s-d/s
Taftsville	Ottawaquechee River	9/29/1993			200	15	0.6	26	
Dewey's Mills	Ottawaquechee River	7/12/1982			207	22	1.0	22	
Downers Mill	Ottawaquechee River	5/11/1982			207	22	1.0	22	
Great Falls	Passumpsic River	2/26/1984			210	75	1.8	42	
Pierce Mills	Passumpsic River	6/16/1994		350	237	88	1.4	61	Downstream
Center Rutland	Otter Creek	4/13/1995		100	308	80	1.0	79	
Canaan	Conn. R.	5/10/1984		1600	381	50	1.0	51	
Gage	Passumpsic River-winter	6/16/1994		450	413	142	1.7	82	Downstream
Gage	Passumpsic River-summer	6/16/1994		450	413	82	1.0	82	
Passumpsic	Passumpsic River	6/16/1994		500	428	86	1.0	86	Downstream
Clyde River	Clyde R.-winter	7/11/2003		1622	465	67	3.2	21	
Clyde River	Clyde R. -summer	7/11/2003		1622	465	46	2.2	21	
East Barnet	Passumpsic River	3/19/1982			500	85	0.9	100	
Arnold Falls	Passumpsic River	6/16/1994			554	103	1.6	65	u/s-d/s
Middlebury Lower	Otter Creek	6/2/1999		750	629	157	1.0	157	
Otter Creek	Otter Creek-Beldens	5/27/1986			632	6	0.0	161	
Otter Creek	Otter Creek-Huntington	5/27/1986			749	15	0.1	191	
Vergennes No. 9	Otter Creek-summer day	4/15/1999		75	866	150	0.7	216	
Vergennes No. 9	Otter Creek-winter day	4/15/1999		75	866	100	0.5	216	
Vergennes No. 9	Otter Creek-summer night	4/15/1999		75	866	75	0.3	216	
Vergennes No. 9	Otter Creek-winter night	4/15/1999		75	866	50	0.2	216	
Chace Mill	Winooski River	5/5/1987			1081	168	1.0	168	u/s-d/s
Dodge Falls	Conn. R.	3/21/1986		2215	2644	530	1.0	530	u/s-d/s
Gilman	Conn. R.	7/28/1989			1514	210	0.6	373	u/s-d/s