Adding Thermal Renewable Energy to the Maine Renewable Portfolio Standard

This brief paper outlines the significant positive benefits to the state of Maine if the state were to add renewable thermal energy to the Maine RPS. Currently the Maine RPS applies only to renewable electric technologies.

Thermal RECs are a pathway to lowering RPS compliance costs, lowering ratepayer and generating costs, and, adding significant jobs and commerce to the state of Maine. **It is estimated that this strategy will add about almost 9,000 new permanent jobs in Maine**[1].

Heat energy can be (and is throughout the world) metered and measured in kilowatt-hours or megawatt-hours; just like electricity. This makes the extension of the RPS to include thermal straight forward.

Following the example of New Hampshire, Maine can establish a modest incentive for renewable thermal energy (solar thermal, geothermal, biomass thermal) in Class I (new renewable energy projects) of the Maine RPS. The mechanism is a "carve-out" that incorporates 2.6% of thermal RECs into the current Class I obligation of 10% by 2025. The 2.6% thermal carve-out would be implemented at a rate of 0.2% per year for 12 years, starting in 2013. This gradual implementation would not disrupt the markets.

The legislation could set the alternative compliance payment (ACP) for renewable thermal energy at $28/MWh (which would be the lowest level of any existing class). It is likely that thermal RECs will sell for less than the $28/MWh ACP since the carve out is very low relative to the total heat used in Maine; so the expectation is for an oversupply of RECs. At an assumed $14/MWh value for the thermal RECs, the total compliance cost on a residential ratepayer's bill for the thermal portion is estimated to be about $0.105/month or about $1.265/year[2]. But this modest increase in cost is expected to be offset by the benefits of the higher efficiency of using biomass for direct thermal. Table 1 below shows the potential for more than $46 million in net savings to Maine by when the full 2.6% carve out is achieved in 2025.

At the aggregate level, the conversion of homes, schools, businesses, etc. from heating oil to geothermal, solar thermal, or biomass thermal will benefit those users and the state. Money not spent on heating oil will remain in the Maine Economy and provide a significant net positive benefit.

For example, in the first year of this program, if the REC price is $14/MWh and the carve out is 0.20% of the Class I cohort, the total cost is estimated to be $344,000 (see table 1 below). However, the 24,000 thermal RECs would mean that about 593,000 gallons of heating oil would not be used in Maine[3] resulting in $1,748,000 not being exported out of the Maine economy. The reduction in annual heating costs would add $874,000to the disposable incomes of Maine's homes and businesses. By 2025, Maine will have not used 54 million gallons of heating oil and will have a retained an estimated $214 million that would have otherwise been exported to Gulf Coast refineries and OPEC.

The legislation will have to require that the Maine PUC establish procedures for metering, verifying and reporting thermal energy output from qualifying systems on a quarterly basis. The PUC will then certify this energy output for Renewable Energy Certificates which are completely fungible and can then be

[1] Based on direct, indirect, and induced jobs. Analysis by FutureMetrics.
[2] This is based on an average compliance cost of $0.0007/KWh from 2008-2010 (ME PUC) and an incremental increase of $0.00017/KWh assuming a use of 600KWh/month.
[3] 1 MWH = 3,412,000 btu, 1 gallon heating oil = 138,000 btu

bought and sold in regional REC markets, just like electricity RECs. Systems will require internet connected BTU meters, a widely available technology. This technology is proven and adds only a marginal amount to the full system cost.

For example, a typical home in Maine that uses 1000 gallons of heating oil could instead use a Maine-made pellet boiler burning Maine-made pellet fuel. The annual cost of heating that home at $3.65/gallon would be $3,650. Using pellet fuel at $220/ton the cost would be about $1,760. However, each ton of pellets contains about 4.7 MWh of energy (assuming 8000 BTU/lb). Assuming 85% efficiency, the user would be qualified to receive about 4.0 thermal RECs per ton of pellets. If the REC price is $14/MWh, then the user would receive about $56/ton for the eight tons used per year, or about $450/year of added income (or lowered cost).

Examples of qualifying thermal systems include:

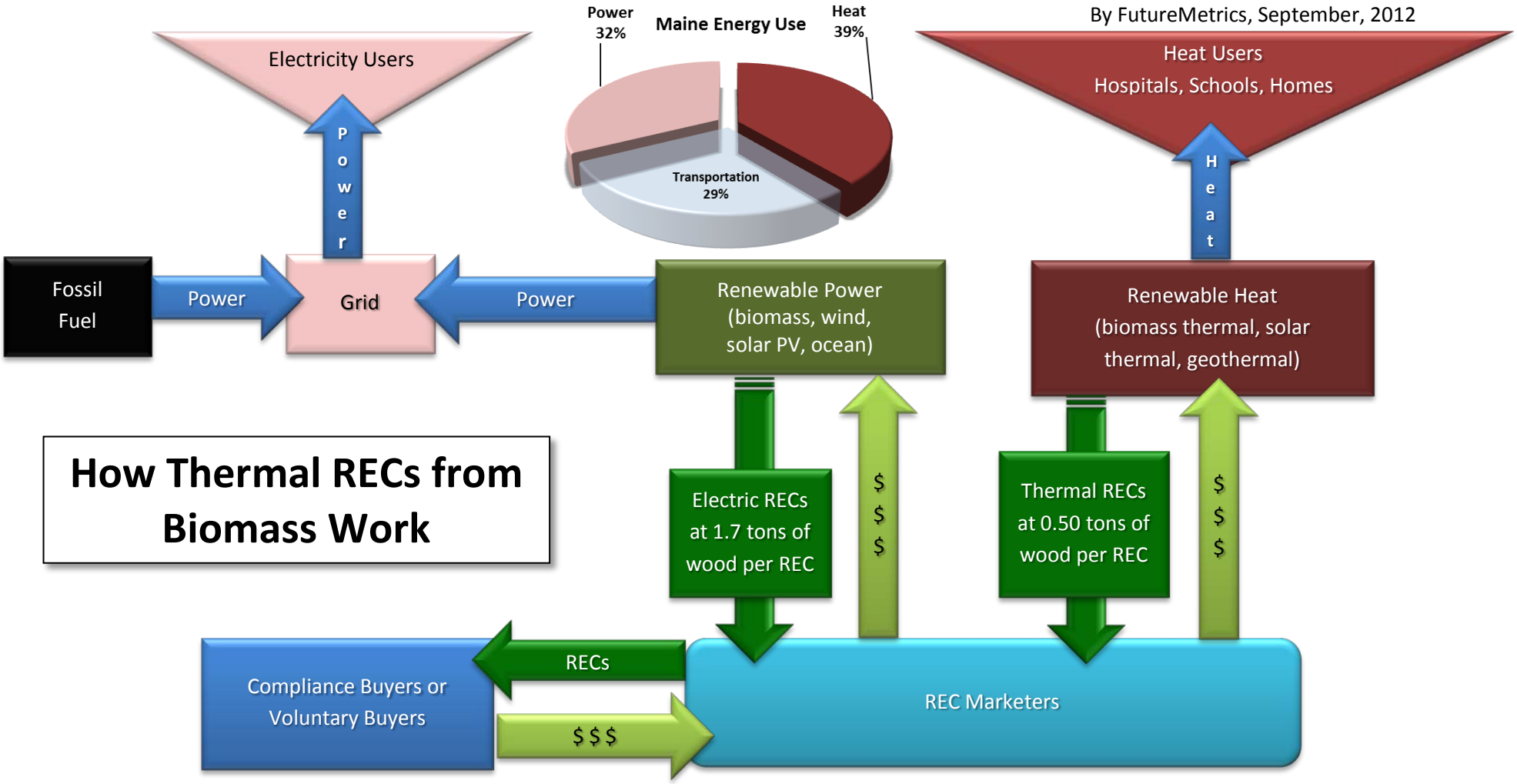
- A rooftop solar thermal array providing domestic hot water for a hospital
- A wood chip or pellet boiler heating a school or office building or home, or providing central heating for a district thermal energy grid (e.g. for a school campus or industrial park)
- A geothermal array providing space heating for a county nursing home or correctional facility

The economic benefits of the thermal provision for RECs are significant. Maine is heavily dependent on imported fossil heating fuels. Maine consumers export over $1 billion from our economy annually for heating oil alone. Benefits include:

- Reduction in imported heating oil estimated at 54,000,000 gallons over 12 years.
- Retention of wealth in Maine economy by investment in the local economy rather than purchasing imported fuel estimated at more than $214,000,000 over 12 years.
- Homeowner, government and business savings on cost of heating buildings estimated at more than $107,000,000 over 12 years.
- In addition, the incentives provided by thermal RECs will create significant numbers of permanent jobs and economic development in the biomass heating (pellet, wood chip), solar thermal, and geothermal industries in Maine.
- The majority of new Class I RECs will come from wind power generators. The permanent jobs created per REC/year are many orders of magnitude higher for thermal RECs as compared to electric RECs from wind power. **Wind produces 0.066 jobs per 1000 RECs/year. Biomass thermal from pellet fuel produces 21.17 jobs per 1000 RECs/year.**

This strategy has many benefits. The utilities lower their cost of compliance. The ratepayers, from industrial users to homeowners, will have lower rates. The state, with no cost, incentivizes via a small change to the RPS statue, switching from imported heating oil to locally produced pellet or chip fuel or geothermal heat pumps which results in heating costs being lowered significantly.

The job created in the wood fuel supply chain, by keeping money in the state rather than sending it away, and the increase in disposable incomes for the owners of renewable thermal energy systems will improve the economy and increase tax revenues to the state's treasury.



Each Megawatt-hour of renewable energy also generates a Renewable Energy Credit (REC).

Biomass thermal can produce RECS

For biomass power at 30% efficiency, it takes about 1.7 tons of green wood to generate a megawatt-hour (MWh) of electricity. That same 1.7 tons of wood used to make pellets used in an 85% efficient pellet boiler will produce 4.0 MWh's of useful thermal energy. In a 65% efficient biomass thermal application using wood chips, 1.7 tons of green wood chips will produce 2.9 MWh's of useful thermal energy.

Table 1.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTALS
Class I Thermal Carve Out %	0.20%	0.40%	0.60%	0.80%	1.00%	1.20%	1.40%	1.60%	1.80%	2.00%	2.20%	2.40%	2.60%	
MWH of thermal energy[1]	24,000	48,000	72,001	96,001	120,001	144,001	168,001	192,002	216,002	240,002	264,002	288,002	312,003	
Projected Cost @ $14/MWh[2]	$344,403	$706,026	$1,059,039	$1,447,353	$1,854,421	$2,280,938	$2,727,622	$3,195,214	$3,684,482	$4,196,215	$4,731,233	$5,290,378	$5,874,524	$37,391,850
Worst Case Projected Cost with ACP @ $28/MWh	$688,806	$1,344,011	$2,016,017	$2,688,023	$3,360,029	$4,032,034	$4,704,040	$5,376,046	$6,048,051	$6,720,057	$7,392,063	$8,064,069	$8,736,074	$61,169,320
Reduced Heating Oil (Gallons)[3]	593,396	1,186,793	1,780,189	2,373,585	2,966,982	3,560,378	4,153,774	4,747,171	5,340,567	5,933,963	6,527,360	7,120,756	7,714,153	53,999,068
Retention of Heating Oil Expenditures in Maine Economy[4]	$1,748,528	$3,688,676	$5,726,670	$7,902,805	$10,224,253	$12,698,523	$15,333,466	$18,137,300	$21,118,619	$24,286,412	$27,650,080	$31,219,453	$35,004,812	$214,739,597
Direct Savings on Heating Bills to Maine Homes and Businesses[5]	$874,264	$1,844,338	$2,863,335	$3,951,402	$5,112,127	$6,349,261	$7,666,733	$9,068,650	$10,559,309	$12,143,206	$13,825,040	$15,609,727	$17,502,406	$107,369,798
Net Savings to Maine (@$14/MWh)	$2,278,390	$4,826,988	$7,530,966	$10,406,854	$13,481,959	$16,766,846	$20,272,577	$24,010,736	$27,993,446	$32,233,402	$36,743,887	$41,538,802	$46,632,694	$284,717,546
Net Savings to Maine (@$28/MWh)	$1,933,987	$4,189,003	$6,573,988	$9,166,184	$11,976,352	$15,015,750	$18,296,159	$21,829,904	$25,629,877	$29,709,560	$34,083,056	$38,765,112	$43,771,144	$260,940,075
Number of Homes Converted from Oil to Pellet Fuel at 900 gallons per year per home	659	1,319	1,978	2,637	3,297	3,956	4,615	5,275	5,934	6,593	7,253	7,912	8,571	59,999
Percentage of Homes in Maine that use Heating Oil that are Converted	0.17%	0.34%	0.51%	0.69%	0.86%	1.03%	1.20%	1.37%	1.54%	1.71%	1.88%	2.06%	2.23%	15.58%
Jobs Created (for biomass supply and using IMPLAN multipiers for indirect and induced jobs)	17	34	51	68	85	102	118	135	152	169	186	203	220	1,540
Jobs not "Exported" + multiplers	186	373	559	746	932	1,119	1,305	1,491	1,678	1,864	2,051	2,237	2,423	16,964
Jobs from increased disposable income + multiplers	88	186	289	399	516	641	774	916	1,066	1,226	1,396	1,577	1,768	10,844
Net Jobs Created	292	593	899	1,212	1,533	1,861	2,198	2,543	2,897	3,260	3,633	4,017	4,411	29,349
Heating Oil Price (increasing at 3.5% per year)	$ 3.85	$ 3.98	$ 4.12	$ 4.27	$ 4.42	$ 4.57	$ 4.73	$ 4.90	$ 5.07	$ 5.25	$ 5.43	$ 5.62	$ 5.82	
	analysis by FutureMetrics												analysis by FutureMetrics	

[1]Assumes 1% of REC Qualified ME Load ≈ 12 GWh

[2]Since 2.6% is very small relative to the total heat used in ME, this assumes an oversupply of thermal RECs and thus a REC value significantly below the ACP value

[3]1 MWH = 3,412,000 btu, 1 gallon heating oil = 138,000 btu

[4]Using ME statewide average retail delivered price as of 2/20/2012 of $3.35/gallon; EIA estimates $0.78 of every $1.00 in heating oil expenditure leaves the ME economy

[5]Assumes that geothermal, solar thermal, and biomass thermal reduce the annual heating bill by 1/2