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How Maine can Transition to a More Energy Self-sufficient Future and Significantly Increase Employment

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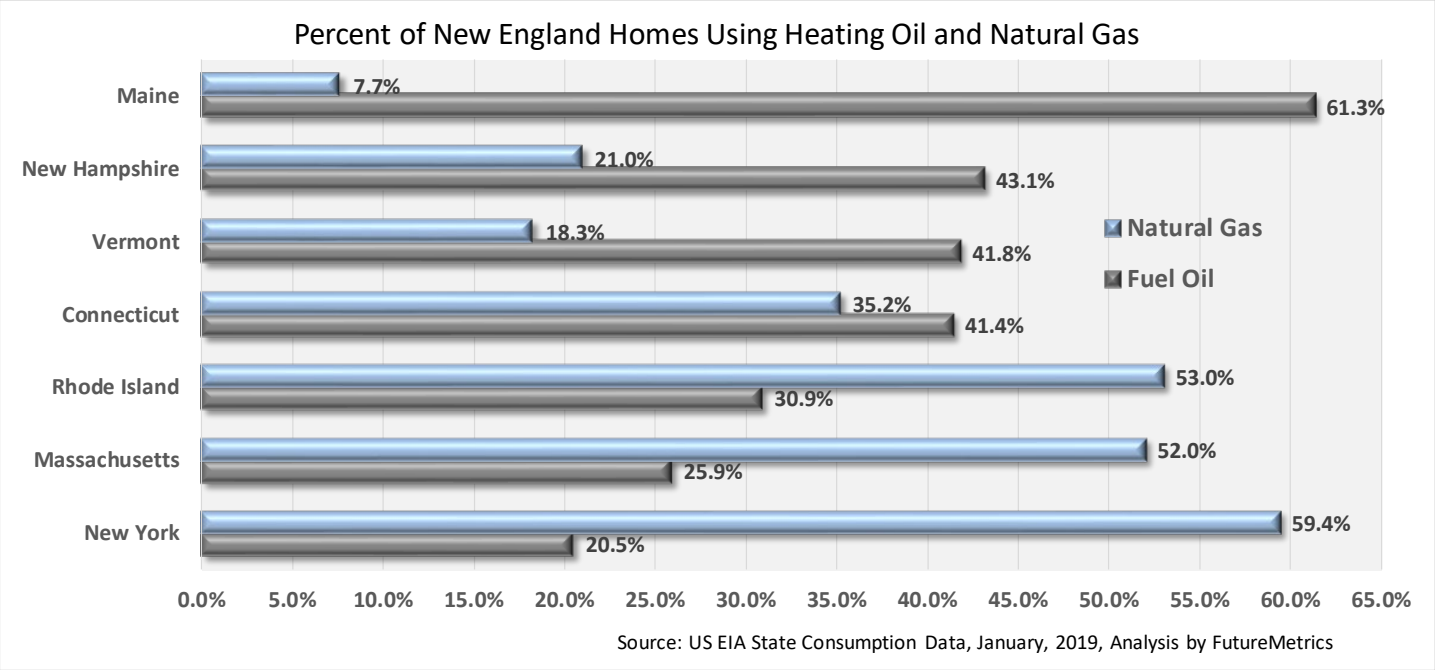
Maine has an opportunity to dramatically improve its economy by changing how it heats some of the 541,000 households and 41,000 business establishments in the state[1]. This short paper discusses the benefits to Maine's residents and to the state's economy if Maine does what many western European nations have done[2]: Formulate a policy that supports a transition from heavy dependence on heating oil to the use of locally produced heating fuel in modern, fully automatic, highly efficient, and environmentally beneficial pellet fueled boilers.

The US northeast states consume about 84% of all heating oil used in the US. Of those states, Maine is the most heating oil dependent state in the United States. As the chart below shows, Maine has the highest proportion of households that use heating oil in the US. Maine also has a very low use of natural gas for heating due to the high proportion of homes in rural areas[3].



[1] US Census https://www.census.gov/quickfacts/me.
[2] The European nations produce about 15 million metric tonnes of wood pellets from 656 pellet plants. The pellets are used primarily for heating. Germany and Austria haves over 385,000 residential pellet boilers installed. Source: Eurostat.
[3] Maine is the least densely populated state east of the Mississippi.
https://www.statista.com/statistics/183588/population-density-in-the-federal-states-of-the-us/

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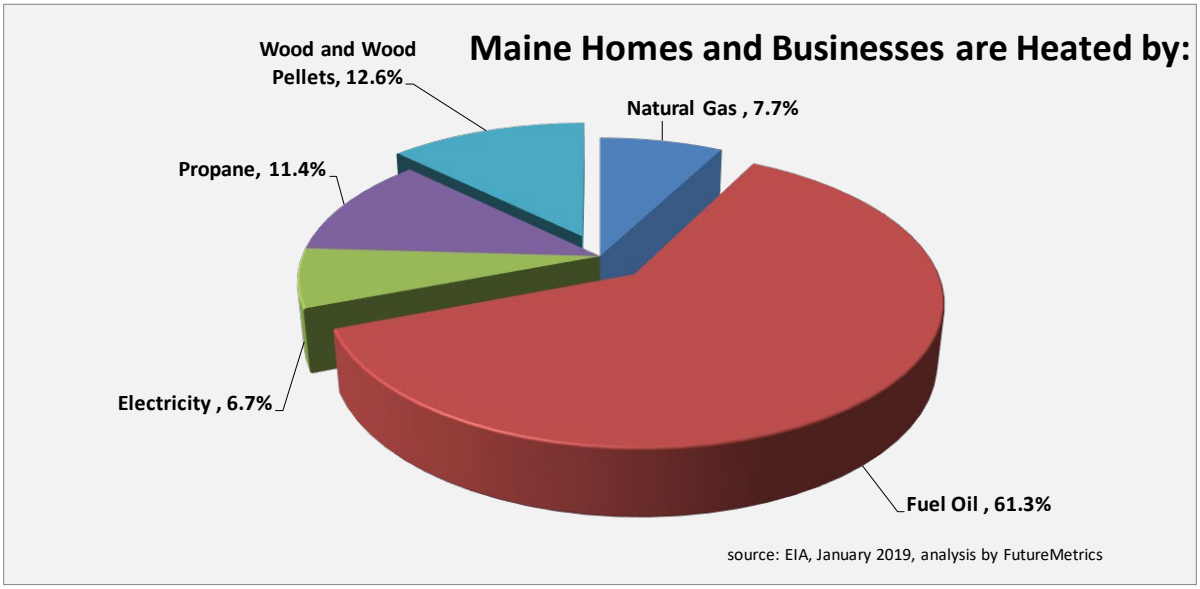
The chart below shows how Maine homes and businesses are heated.



The US Energy Information Administration (EIA) show that on average about 68% of every dollar spent on heating oil does not remain in the state's economy[4]. In other words, when Mainers buy heating oil, $68 of every $100 spent leaves Maine and takes with it the commerce and the associated Maine tax revenues that would otherwise accrue if that money circulated in the Maine economy.

The average Maine consumer of heating oil uses about 890 gallons per year of heating oil[5]. That means that the 358,000 businesses and households in Maine spend an average of about $956 million per year on heating oil.

	Number of Households and Businesses that use Heating Oil	Average Gallons Used per Year	Average Total Expenditure Per Year (at $3.00/gal)	Amount that Does not Stay in the State	**Job Losses**
Maine	358,000	318,620,000	$ (955,860,000)	**$ 649,984,800**	**-38,955**

The 68% of the $956 million that leaves the state (about $650 million) drains the Maine economy of potential commerce. The multiplier effect of that loss of commerce is the loss of about 39,000 potential jobs[6] in a state that has a total of 680,000 people employed[7].

[4] "From the winter of 2008–09 through the winter of 2017–18, the cost of crude oil accounted for 53% of the average price of a gallon of heating oil during the winter months (October through March). Distribution and marketing accounted for approximately 32% of the cost of a gallon of heating oil, and refinery processing costs accounted for 15% of the price". https://www.eia.gov/energyexplained/index.php?page=heating_oil_prices
[5] Based on EIA consumption data https://www.eia.gov/state/print.php?sid=ME
[6] FutureMetrics uses IMPLAN to derive the multipliers. http://www.implan.com/ . See footnote #8 for an explanation of the direct, indirect, and induced effects that determine the multipliers.
[7] Bureau of Labor Statistics, https://www.bls.gov/eag/eag.me.htm

What is the alternative?

Natural gas pipelines will not be built to service low population density rural areas. Heat pumps are a viable solution in some applications. But heat pumps become less efficient and need supplemental heat when the outside temperature falls below about 25 degrees[8]. For most Mainers, for heat and hot water, a boiler in the basement is necessary.

In the colder western European nations modern high-efficiency fully automatic and ultra clean burning boilers fueled with wood pellets are the solution for lowering, and in some countries, eliminating dependency on heating oil for heat and hot water.

While it is not feasible in the near term to replace every heating oil fueled boiler in Maine with a pellet fueled boiler, it is feasible to consider a transition over time to a lowered dependency on heating oil. Because heating oil is produced in distant refineries made from petroleum from distant oil wells, and pellet fuel is made in Maine, 100%, not 32%, of every dollar spent on pellet heating fuel stays in the state.

Suppose the goal is to change 15% of those homes and business that use heating oil to pellets over the next decade. That would mean that about 46,000 Maine homes and 4,000 businesses would use heating fuel made in Maine. **By keeping an additional $133 million circulating in the Maine economy, the multiplier effects would result in about 8,000 new jobs being created.** The increased tax revenues from those new jobs are discussed later in this paper.

The economic benefits are not just due to the heating fuel money staying in Maine. The savings in annual heating costs from pellets versus heating oil will result in an increase in household disposable income. At the current prices for heating oil and pellets, an additional $31.5 million in increased disposable income will be spent in Maine resulting in the creation of an additional 1,280 jobs.

Spending on Heating Oil at $3.00 per Gallon	Amount that Will be Spent on Pellet Fuel at $265.00 per Ton	Annual Savings	**Total Jobs Due to Heating Cost Savings**
$ 133,500,000	$ 102,025,000	$ 31,475,000	1,283

The chart below shows that at current prices, the typical home in Maine that switches from heating oil to pellet fuel will have an additional $500 per year of disposable income. Note also that the cost to heat a home with heating oil is highly volatile whereas the cost with pellets is much less variable. Since 2004 pellets have almost always been the lower cost heating fuel.

[8] https://www.e-education.psu.edu/egee102/node/2090

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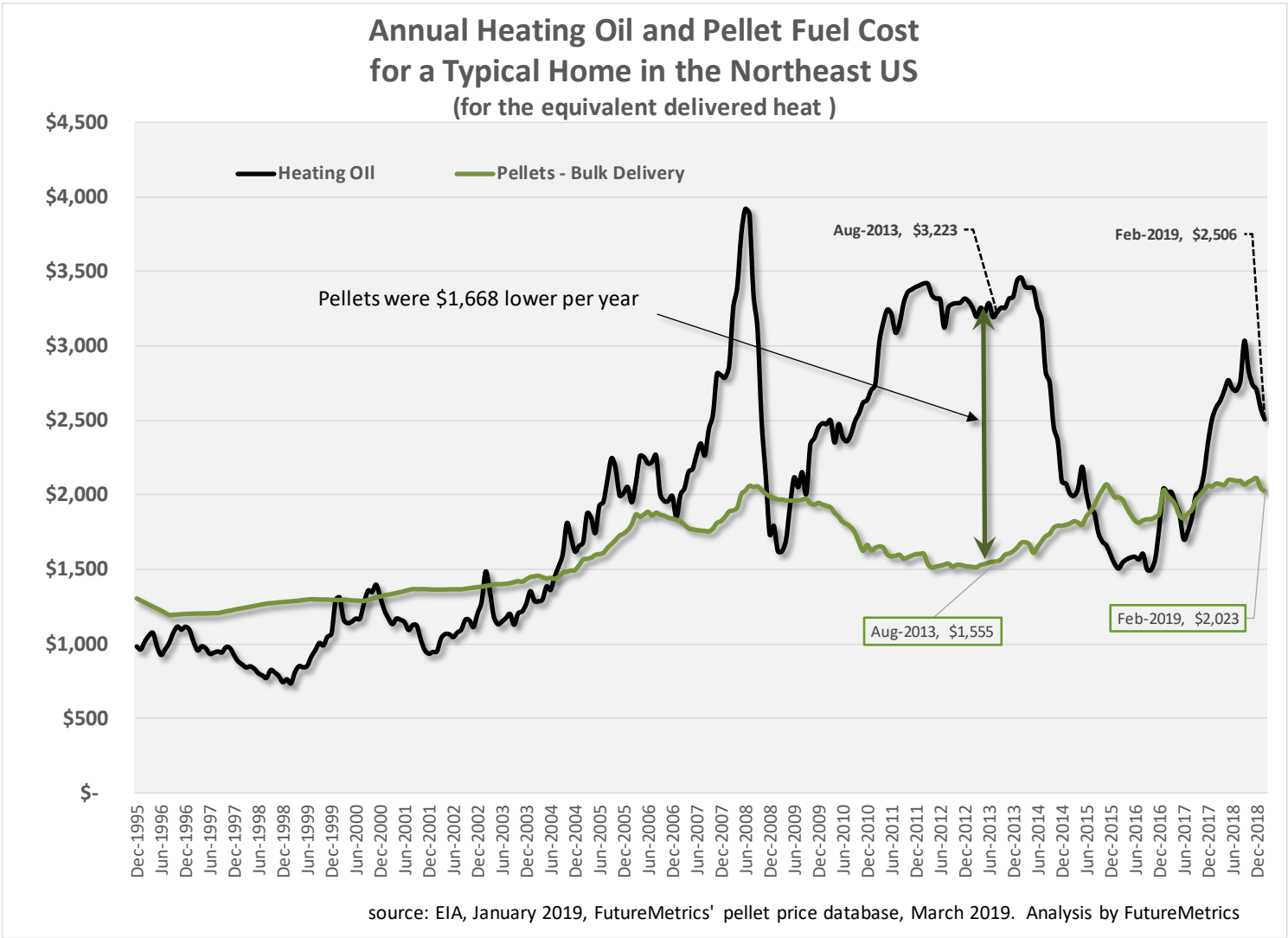

source: EIA, January 2019, FutureMetrics' pellet price database, March 2019. Analysis by FutureMetrics

The 50,000 homes and businesses that transition from heating oil to pellet fuel would use about 380,000 tons per year of wood pellets instead of about 44.5 million gallons of heating oil. The construction and operation of new pellet production plants in Maine will yield significant economic benefits.

The economic impacts (jobs, income, and tax revenues) from the construction and operation of new wood pellet production factories in Maine are substantial and will bring needed support to Maine's forest products sector. The demand for wood, labor, power, and equipment will create new commerce in Maine. The new commerce will create and sustain jobs and generate new and sustainable tax revenues.

FutureMetrics has estimated the number of new jobs, labor income, and value added that will be created by the construction of new pellet production capacity and by the ongoing operations of pellet plants in Maine

that matches the demand of 50,000 homes and businesses with pellet fueled boilers. The tables below summarize the analysis[9].

Permanent jobs and **annual** impact from the operation of the pellet plants.

Pellet Plant Impact - Annual for the Life of the Project - 2020 dollars				
	Employment	Labor Income	Total Value Added	Output
Direct Effect	149.2	$ 10,502,011	$ 17,262,811	$ 70,886,012
Indirect Effect	160.4	$ 7,874,816	$ 12,447,094	$ 28,530,902
Induced Effect	122.0	$ 4,935,885	$ 9,187,885	$ 15,950,070
Total Effect	**431.6**	**$ 23,312,713**	**$ 38,897,790**	**$ 115,366,985**

The largest indirect job effect is in commercial logging.

Construction jobs and impact while plants are being built (assumes major equipment made in US)

Pellet Plant Impact - Construction over Two Years - 2020 dollars				
	Employment	Labor Income	Total Value Added	Output
Direct Effect	1,001.6	$ 50,417,460	$ 50,535,254	$ 99,126,745
Indirect Effect	114.7	$ 6,005,084	$ 10,440,199	$ 20,566,533
Induced Effect	374.7	$ 15,145,858	$ 28,197,601	$ 48,943,481
Total Effect	**1,491.0**	**$ 71,568,401**	**$ 89,173,054**	**$ 168,636,759**

In addition to all of the above, a new pellet fuel delivery infrastructure has to be built. There are already a few custom-built fuel delivery trucks delivering pellet fuel to homes with pellet boilers in Maine; but hundreds more will be needed. At least some of the value added for the construction of new pellet fuel delivery trucks will be accrued in Maine, further adding to the net economic benefits. In addition, several pellet fuel distribution centers will be needed.

The positive impacts on the state of Maine's economy from keeping money spent on heating fuel in the state, from increased disposable income, and from the new production and distribution infrastructure are significant.

[9] The direct effect are the jobs created by the pellet mill and workers that directly supply goods and services to the mill. These include the pellet plant workers, loggers, truckers, and many others. Indirect effects are the changes in sales, income and jobs in sectors within the region that support the suppliers of goods and services to pellet mill. Induced effects are the increased sales within the region from households and businesses spending the income earned from the direct and indirect job income and profits on commerce unrelated to the pellet mill.

Value added is the gross output of an industry or a sector minus the industry or sector's intermediate inputs (inputs purchased from outside of the business). It is the contribution of an industry or sector to gross domestic state (GSP). For a pellet factory, the intermediate inputs are relatively large compared to many industries. Intermediate inputs include the wood fiber supplied to the plant. Wood fiber comprises about 68% of the cost of goods of pellets and about 52% of the total cost of operations. The direct effect value added for a pellet factory reflects the large cost of intermediate inputs. The indirect and induced value added shows an increasing shift to services. Services require relatively lower intermediate input purchases.

The median annual income in Maine is about $56,000 per year[10]. The effective tax rate in Maine for an earner at that level is about 4.4%.

By transitioning 15% of Maine from heating oil to pellet fuel, the state will see an <u>increase in income tax revenues of about $22.9 million per year</u>.

FutureMetrics has also estimated the new tax revenues that would be generated by the new pellet fuel production in Maine.

Tax impacts from new jobs created by the operation and construction of the new pellet factories are shown in the tables below. The operations tax revenues are annual. The construction tax revenues are over the period during which the plants are being built (approximately 18 – 24 months).

Pellet Plant Operations - Annual for the Life of the Project					
	Employee Compensation	Tax on Production	Households	Corporations	TOTAL
Social Ins Tax- Employee Contribution	$2,116				$2,116
Social Ins Tax- Employer Contribution	$4,432				$4,432
Sales Tax		$1,704,095			$1,704,095
Property Tax		$2,188,956			$2,188,956
Motor Vehicle Lic		$35,628			$35,628
Other Taxes		$164,872			$164,872
Corporate Profits Tax				$91,443	$91,443
Income Tax			$495,792		$495,792
Fees			$62,279		$62,279
Motor Vehicle License			$23,998		$23,998
Property Taxes			$14,498		$14,498
Other Fees(Fish/Hunt etc.)			$27,187		$27,187
Total State and Local Income	$6,547	$4,099,825	$623,753	$100,939	**$4,831,064**

Pellet Plant Construction						
	Employee Compensation	Proprietor Income	Tax on Production and Imports	Households	Corporations	TOTAL
Social Ins Tax- Employee Contribution	$6,090					$6,090
Social Ins Tax- Employer Contribution	$12,757					$12,757
Sales Tax			$1,900,027			$1,900,027
Property Tax			$2,440,637			$2,440,637
Motor Vehicle Lic			$39,724			$39,724
Other Taxes			$183,828			$183,828
Corporate Profits Tax					$103,846	$103,846
Income Tax				$1,530,414		$1,530,414
Fees				$192,242		$192,242
Motor Vehicle License				$74,077		$74,077
Property Taxes				$44,752		$44,752
Other Fees (Fish/Hunt, etc.)				$83,922		$83,922
Total State and Local Tax	**$18,846**		**$4,571,213**	**$1,925,408**	**$114,631**	**$6,630,098**

The net <u>annual</u> estimated increase in state and local tax income is about $27.7 million. Not accounting for inflation, over ten years an additional $280 million will be accrued by the Maine treasury.

[10] https://www.deptofnumbers.com/income/maine/

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Can Maine sustainably supply 380,000 tons per year of pellets?

Maine is the most forested state in the United States. About 90% of the land in Maine is forestland and the vast majority are "working forests". Maine has a long history of good forest management for the sustainable production of raw materials for the forest products industry. But some of Maine's traditional forest products industry has suffered in recent years.

In recent years, the permanent closures of pulp and paper mills in Maine has lowered demand for wood by at least 2 million tons per year[11] and by some estimates[12], as much as 3 million tons per year. The reopening of a pulp mill near Old Towne, Maine will return about one million tons per year of demand. But there are no other prospects for softwood pulpwood demand. The production of 380,000 tons per year of wood pellets for 50,000 Maine homes and businesses will require about 830,000 tons per year of wood from Maine's working forests. Maine's landowners and loggers will welcome the return of at least part of the demand for raw materials that has been lost with the loss of pulp and paper production.

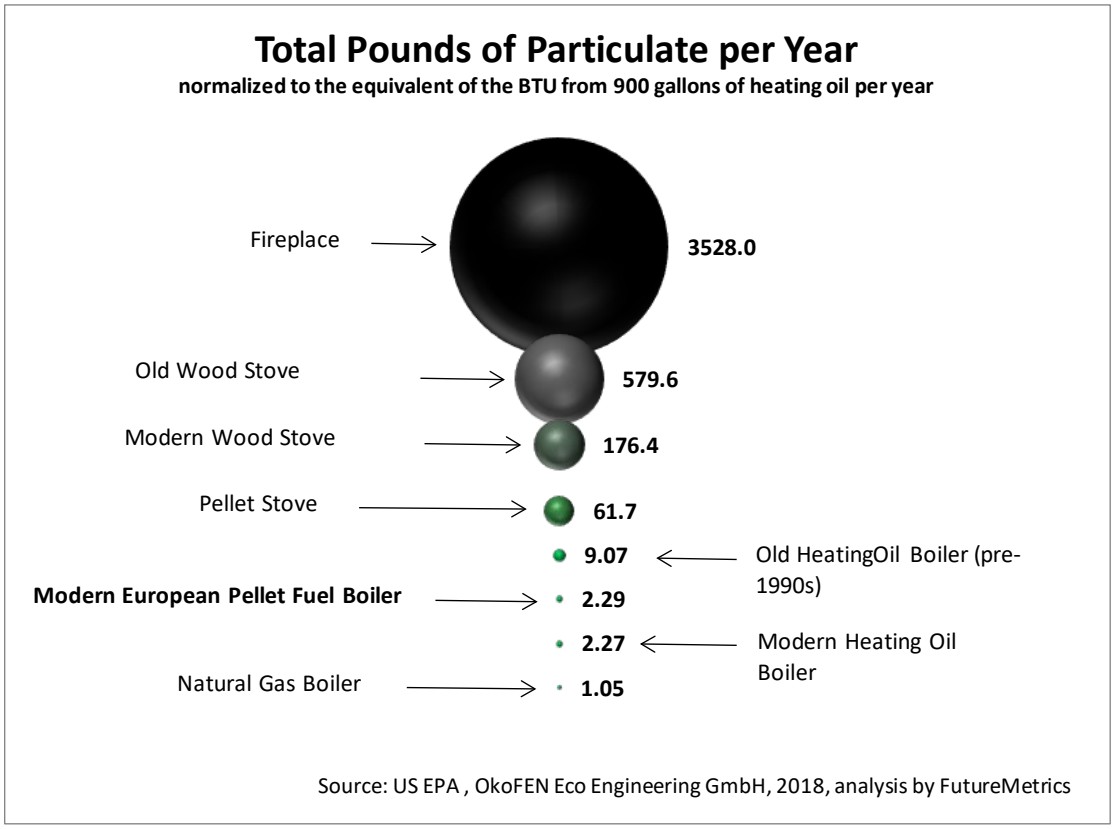
Is this an environmentally sound idea?

FutureMetrics has published several papers on the carbon emissions benefits of using wood pellets instead of fossil fuels. Those papers can be freely downloaded from www.FutureMetrics.com. In brief, if the harvest rate from Maine's working forests does not exceed the growth rate, the stock of trees in Maine's forests will remain constant or will grow. That means that every ton of CO_2 that is emitted by the combustion of pellets for heating is absorbed contemporaneously by the new growth. Maine's timberland is growing 40% faster than it is being harvested[13]. As long as the growth to removal ratio is greater than one, even with the use of Maine made pellet fuel for heat, Maine is a net carbon sink. However the forest products industry evolves, policy should regulate the maximum annual harvest to make sure that Maine's forest inventories never decline. Maintaining Maine's forest resources for perpetuity is essential for environmental, ecological, and economic reasons.

[11] Click HERE for an accounting by the Maine Forest Service for FutureMetrics from 2016.
[12] https://www.inrsllc.com/Northeast%20Pulp%20and%20Paper%20Northern%20Logger%20Feb%202017.pdf
[13] Maine contains an estimated 17.6 million acres of forest land. The acreage of forest land has not changed substantially since 2011 and currently covers 89 percent of the land area in the State. Ninety-five percent of the forest land is classified as timberland, meaning that it exceeds a minimum level of productivity and is not legislatively reserved from timber harvesting. On the forest land in Maine, there are an estimated 24.0 billion live trees that are at least 1 inch in diameter. The ratio of net growth to removals of growing-stock trees is 1.4:1.
https://www.fs.fed.us/nrs/pubs/ru/ru_fs128.pdf

Given the carbon benefits of Maine made pellet fuel, accounting for the carbon footprint from the transportation and production of wood pellets, pellet boilers reduce net carbon emissions by at least 85% compared to heating oil.

Modern ultra-efficient pellet boilers also have very low particulate emissions. They do not produce smoke. The charts below illustrate these environmental characteristics.



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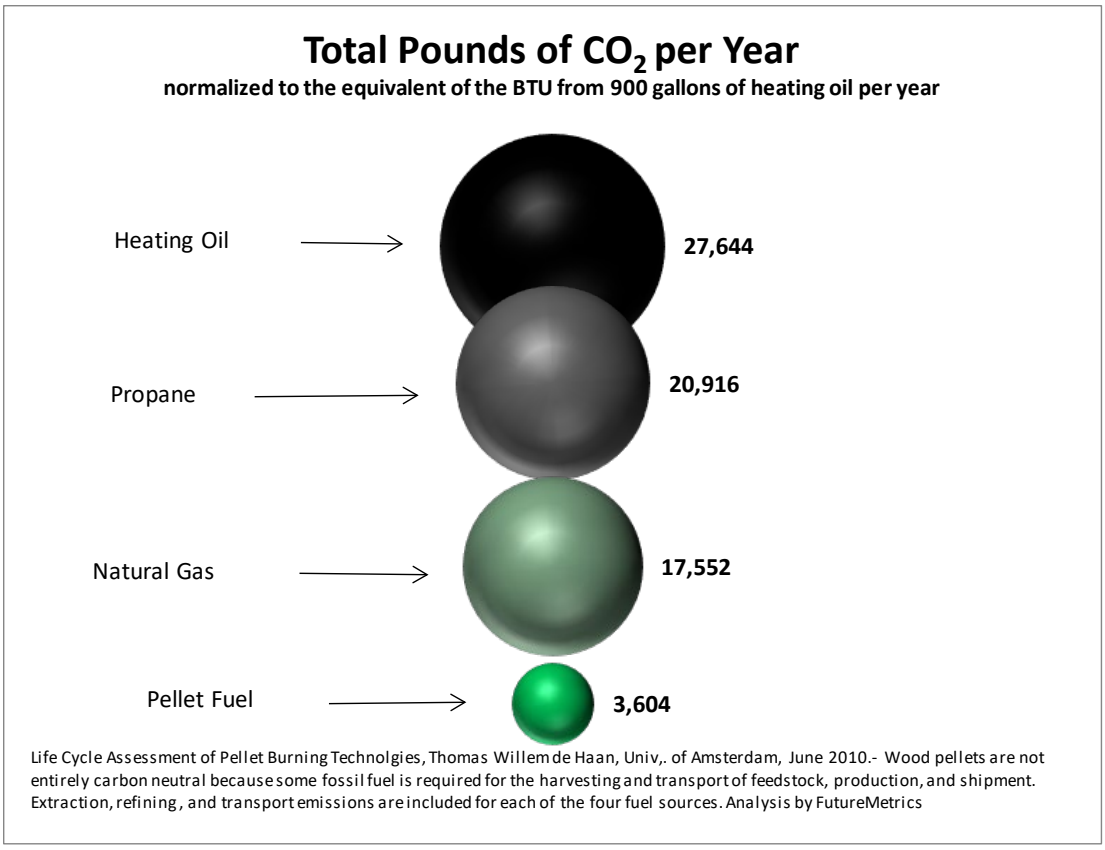

Conclusion

Every year about three or four percent of homes and businesses need a new central heating system boiler. Every year about 13,000 homes and businesses in Maine that have heating oil fueled boilers need them to be replaced. Only a few will have the option for natural gas. If the state of Maine can encourage a proportion of them to choose to install a modern pellet boiler that will use Maine-made fuel, many very significant positive economic and environmental benefits will accrue.

As the market grows and as pellet boilers can be produced in larger batches, the cost for those systems will come down. But when the market is new and small, the cost of pellet boilers it higher than the cost of a similarly sized heating oil boiler. So, as was done in those European countries where pellet boilers have become a common part of how homes and businesses are heated, a strategy is needed to encourage home and business owners to choose pellets over heating oil when the market is new.

A common strategy to get the market seeded is to provide homeowners with a rebate that makes the net cost of a new pellet fueled boiler closer to the cost of a heating oil boiler.

There are several ways to calculate the size of the rebate. In all schemes, the rebate should decline and eventually phase out as the cost of pellet boilers declines and as the savings from using pellets versus heating oil increases.

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At current prices for heating oil, heating oil consumers would already get an annual boost in disposable income of about $500 if they were using pellet fuel. In 2013 when heating oil prices were high, the annual savings were more than $1,600 (see chart on page 4). As heating oil prices increase relative to pellet fuel in coming years, the incentive to switch to lower cost pellet fuels systems will also increase.

As heating oil prices increase, the amount of money drained from the Maine economy also increases. If heating oil goes from $3.00 to $4.50 per gallon, an additional $325 million will leave the state taking away another 19,500 jobs.

There are very good reasons for the state of Maine to promulgate policy that will support the beginning of the transition away from being the most heating oil dependent state in the nation. The outcome of a successful transition will be a state that is more energy self-sufficient, has significantly higher and more stable employment and tax revenues, and is a leader in lowering overall carbon emissions.