# How to Cure Maine's Addiction to Heating Oil:

## A roadmap to avoiding economic disaster in Maine and the other regional states

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(Brief bio at the end of this report)

January, 2011

**This year, Maine will "export" about $720,000,000 because Maine homes use about 300 million gallons per year of heating oil and 78% of every dollar spent on heating oil leaves the Maine economy.**

**If that money were to stay in the Maine economy it would produce about <u>41,000 new jobs</u> that do not currently exist.**

**With an enlightened energy policy focused on how we heat our homes and businesses, we could stop exporting hundreds of millions of dollars per year and thereby put tens of thousands of Mainers back to work. The economic impacts are not confined to Maine. Other states in the region are exposed to significant risk because they share with Maine a unique and disproportionate reliance on heating oil.**

## Introduction

The future prosperity of Maine and its neighbor states is the subject of this paper. There are many components to building a prosperous future for our region. But, as this paper will show, if one very large issue is not solved soon, all strategies for growth will falter.

That issue is our unique and overwhelming dependence on home heating oil for heat. It may sound like a trivial issue compared with many of the other pressing concerns; not the least of which are the budget issues that the northeastern states face. But after reading this paper and seeing how our dependence on heating oil drains money and jobs and tax revenues from Maine and its sister states, it will become clear that this one issue is a constant and growing cancer on our economy. As this paper will show, our dependence on heating oil has already eroded our economy; and that dependence has the potential to destroy our foundations for growth and prosperity as we export more and more of our disposable income to places that are far away.

Those sentences may sound overly alarmist. But after reading this paper, the reader will understand the depth and the degree to which this problem can affect all sectors of our economy and therefore our social wellbeing.

This paper has <u>four main sections</u>.

The <u>first section</u> shows the degree to which Maine and the nearby states are dependent on heating oil. It also shows the magnitude of the cost to our region in both lost income and foregone jobs. The first section also discusses how our dependence makes us directly reliant on OPEC for our economic stability.

The <u>second section</u> is a discussion of future oil prices. Although no one can be certain of precisely what future prices will do, that section shows why the risk is strongly on the side of increasing cost.

The <u>third section</u> shows the effects of higher heating oil prices on Maine and the region. If heating oil prices rise, there is an increased loss of income and jobs. There will also a significant deterioration in the health of the state's balance sheet as job destruction takes away tax revenue while at the same time placing a greater burden on social services.

The <u>final section</u> discusses a way to change the future. Maine and the other nearby states have the resources and the infrastructure to convert most homes from heating oil to clean renewable fuel from our forests. This is not a pipe dream. Many European countries have already achieved significant conversions guided by enlightened policy that recognized that addiction to heating oil, which is business as usual in Maine and its neighboring states, was an economic vulnerability that had to be fixed. The final section also discusses how the conversion of Maine's homes can sustain and even grow the traditional forest products sector.

## The Dependence of Maine and the Region on Heating Oil

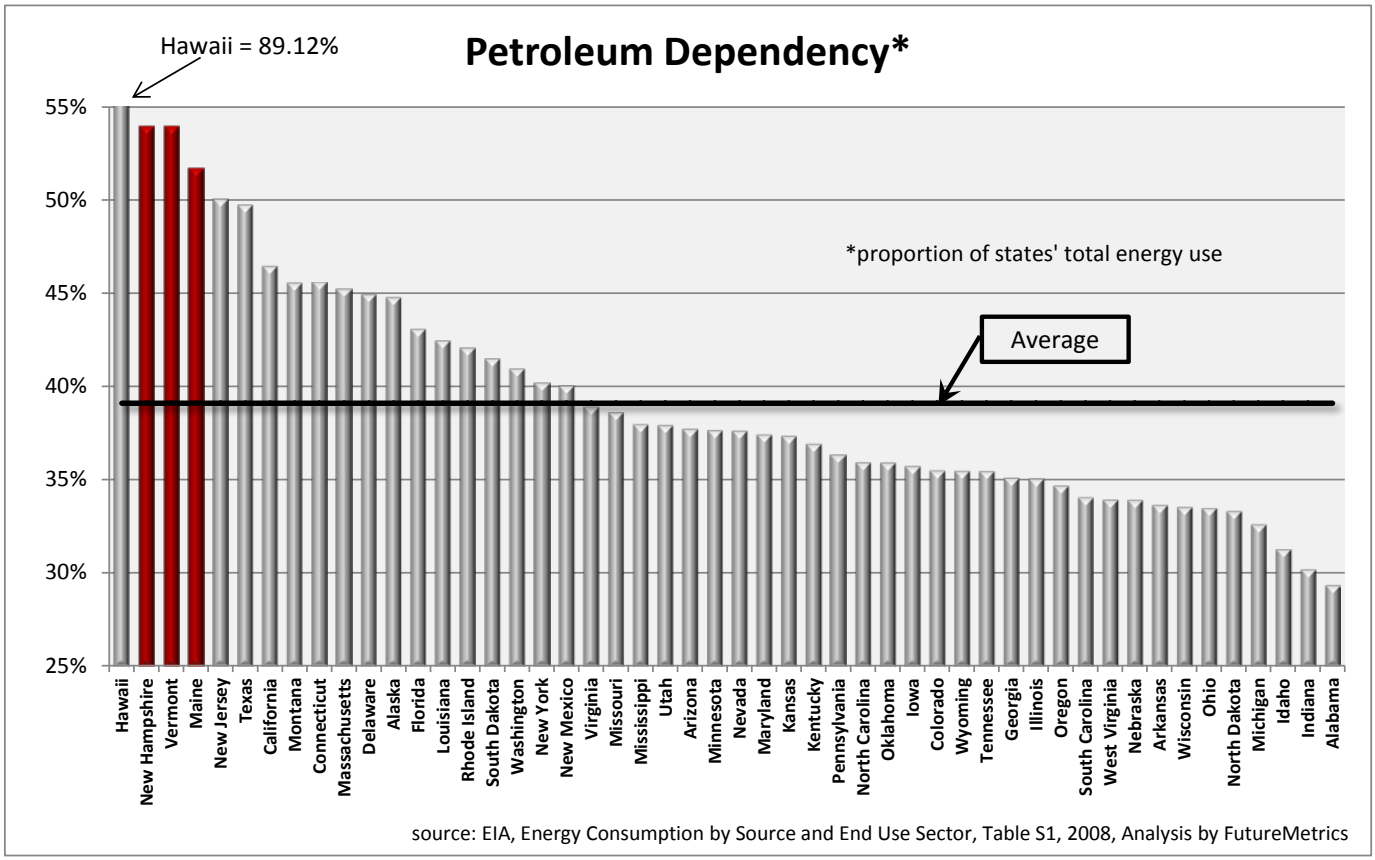
It is a well-known fact that Maine is heavily dependent on #2 heating oil. Recent data from the US Census shows that 75.61% of Maine's homes use #2 heating oil. This remains by far the highest proportion of heating oil dependency of any state. The table below shows this fact and also shows that Maine has very limited access to natural gas (3.68% of homes). The data also shows that whereas solar thermal systems have a place in solving

Maine's home heating needs, they make up a very small proportion of Maine's home heating solutions (0.04% or 236 homes out of 542,617).

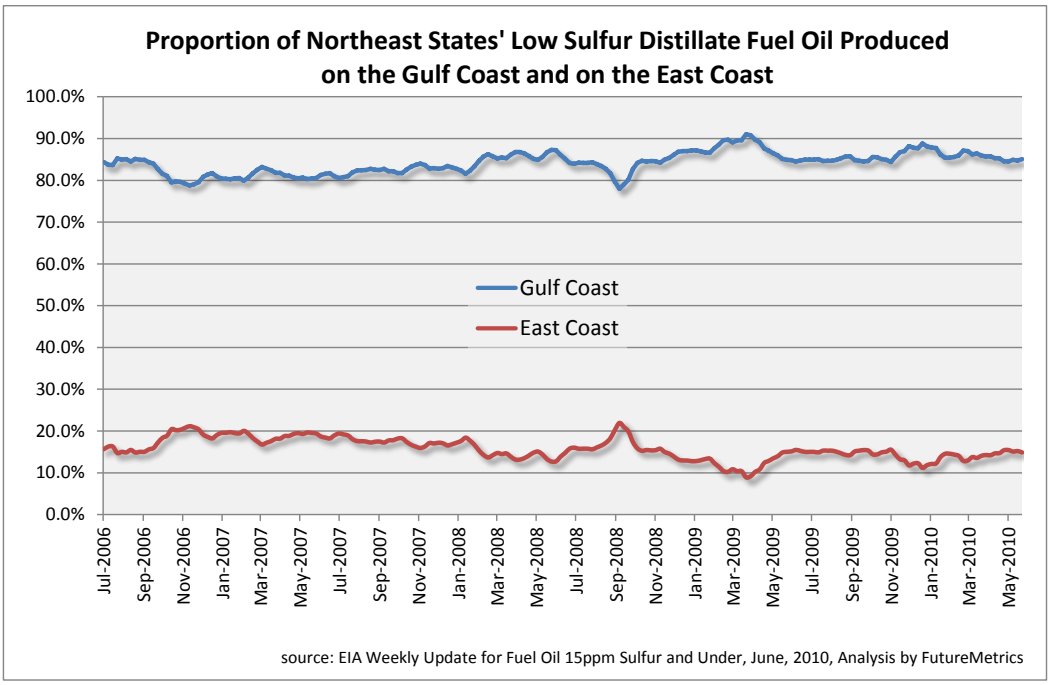
| How Homes are Heated | | | | | | |
|---|---|---|---|---|---|---|
| | Maine | | New Hampshire | | Vermont | |
| | Households | | Households | | Households | |
| Total: | 542,617 | 100.00% | 502,201 | 100.00% | 250,375 | 100.00% |
| Utility natural gas | 19,957 | 3.68% | 98,276 | 19.57% | 35,478 | 14.17% |
| Bottled, tank, or LP gas | 33,948 | 6.26% | 63,624 | 12.67% | 37,569 | 15.01% |
| Electricity | 25,474 | 4.69% | 37,807 | 7.53% | 10,321 | 4.12% |
| **Fuel oil, kerosene, etc.** | 410,296 | **75.61%** | 269,329 | **53.63%** | 134,100 | **53.56%** |
| Coal or coke | 1,074 | 0.20% | 735 | 0.15% | 434 | 0.17% |
| Wood | 47,475 | 8.75% | 26,098 | 5.20% | 29,603 | 11.82% |
| Solar energy | 236 | 0.04% | 99 | 0.02% | 102 | 0.04% |
| Other fuel | 3,129 | 0.58% | 4,039 | 0.80% | 1,744 | 0.70% |
| No fuel used | 1,028 | 0.19% | 2,194 | 0.44% | 1,024 | 0.41% |

Source: U.S. Census Bureau, 2005-2009 American Community Survey

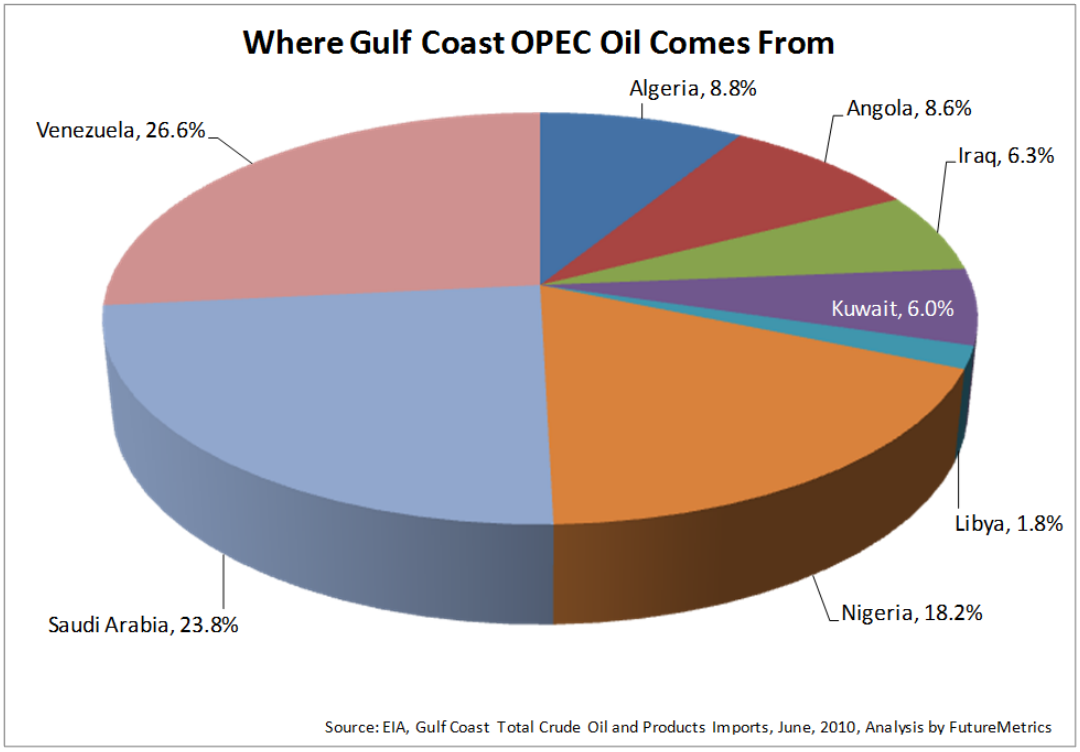
Because of these states' heavy reliance on heating oil, these states are the most petroleum dependent states in the United States (with the exception of Hawaii). The chart below illustrates this fact.




Maine, New Hampshire, and Vermont's dependency on heating oil creates a direct connection to dependency on foreign crude oil. The chart below illustrates that most of the region's heating oil is refined in the Gulf States.




Only about 21% of the crude oil refined in the Gulf Coast area is from domestic offshore production in the Gulf of Mexico (48 million barrels per month of a total of 228 million barrels per month entering Gulf coast refineries)[1]. The rest is imported. About 60% of the imports are from OPEC nations, about 19% are from Mexico, and the rest of the imports are from a variety of nations in South America, Europe, Africa, and also Canada. The chart below shows where the OPEC oil that is refined into the heating oil that is used in Maine and the other states in the northeast region comes from.




[1] EIA, Special Report, Gulf of Mexico Fact Sheet, June 15, 2010.

Maine and its neighboring states, being the most dependent on heating oil, are also the most vulnerable states to any disturbance in the flow of oil from OPEC.

**Already, Maine "exports" about $720,000,000 per year because Maine homes use about 300 million gallons per year of heating oil and 78% of every dollar spent on heating oil leaves the Maine economy[2]. If that money were to stay in the Maine economy it would produce about 41,000 new jobs that do not currently exist[3]. Maine's labor force is 691,000 with 50,800 unemployed and an unemployment rate of 7.3%[4]. Keeping that money in the state would have a dramatic impact on state employment and on improving the state's tax base.**

Because of this heating oil "tax", it is important to consider where heating oil prices will be in 3 to 5 years so that Maine and its neighboring states can plan to mitigate the current and potential negative economic impacts that accrue from this addiction to heating oil.

## What will Heating Oil Prices do?

Forecasting energy prices with any precision is impossible. However, trends in price movements over time can be estimated.

Heating oil is distilled from crude oil and therefore crude prices, along with domestic demand characteristics for distillate fuels (which include heating oil, diesel fuel, and jet fuel), strongly effect heating oil prices.

Crude oil prices are strongly influenced by global demand. Global demand is strongly influenced by the rate of economic growth. Crude's dollar price is also influenced by the dollar's value in global foreign exchange markets. If the dollar weakens, the dollar price of crude oil rises. FutureMetrics has developed an index that captures economic growth expectations (via global equity prices) and exchange rate influences (see the chart below).

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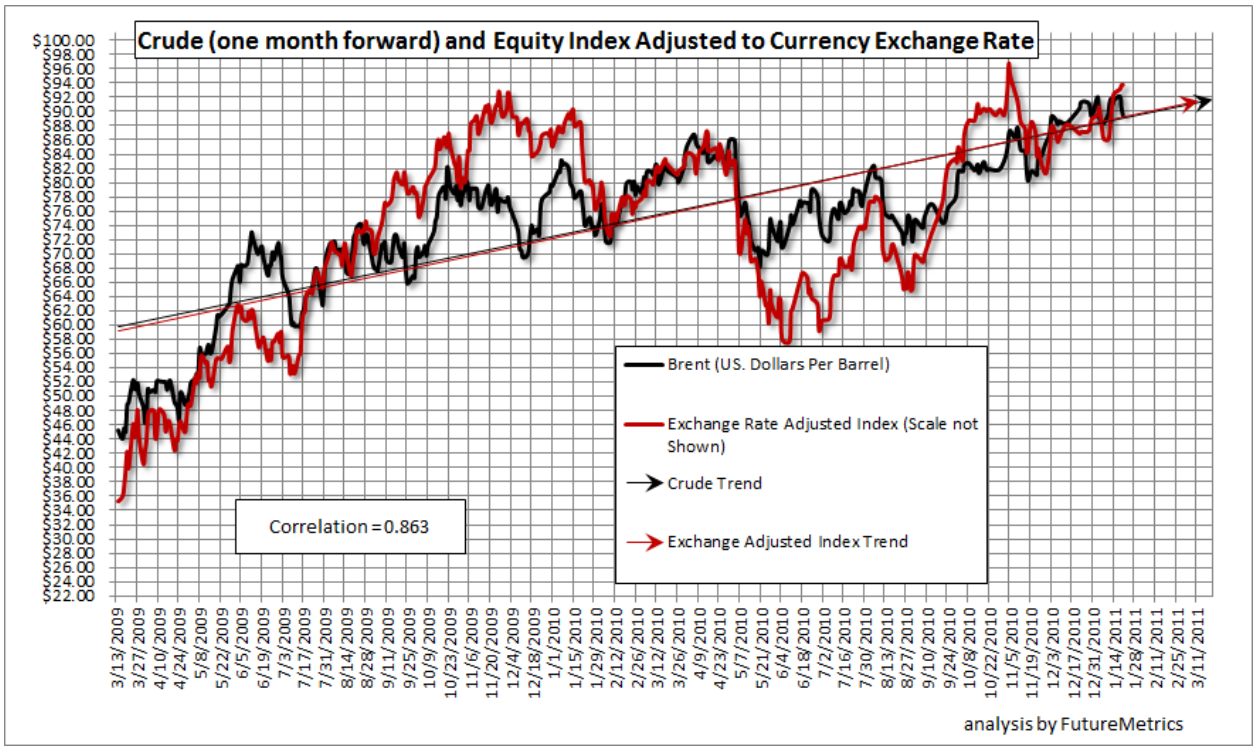
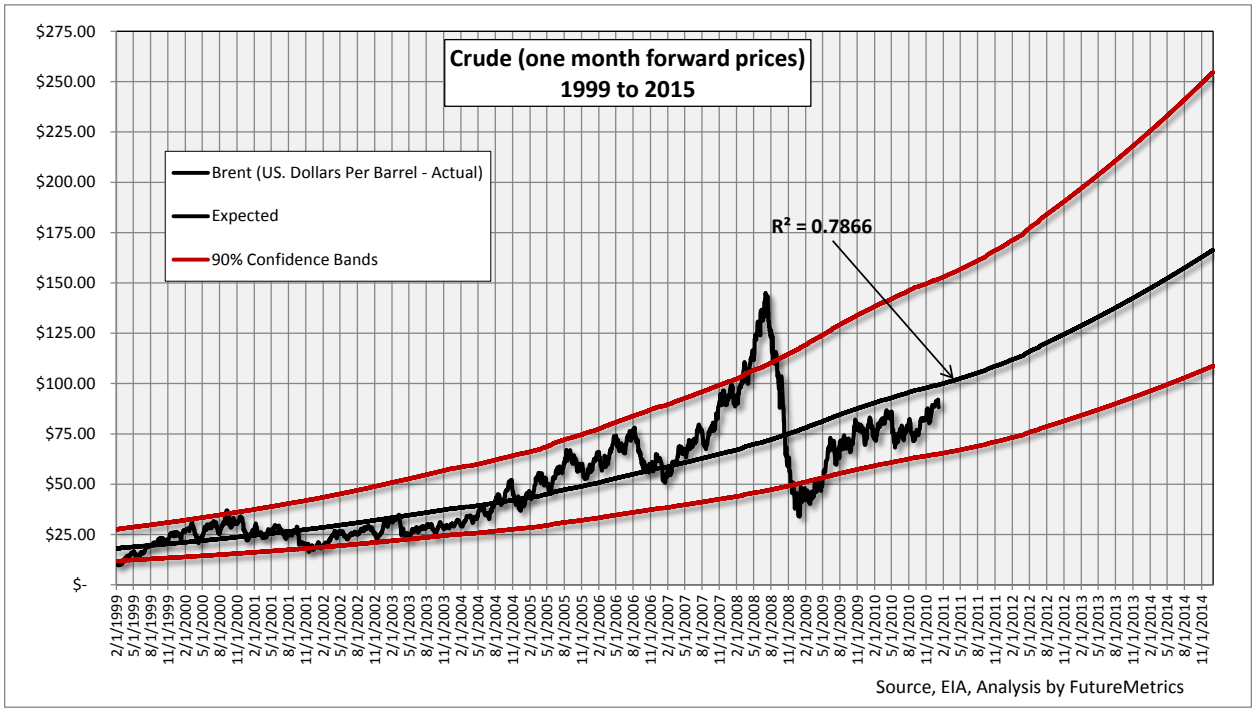
[2] EIA, Home Heating Oil Report, 2010, shows that 78% of every dollar spent on heating oil leaves the region. 62% pays for the crude oil and 16% pays for refining mostly in the Gulf Coast states.

[3] Based on an average annual pay and benefits of $37,000 and multiplier effects estimated by FutureMetrics. Job multipliers are based on detailed multiplier tables, by state, from the National Renewable Energy Laboratory, The Jobs and Economic Development Impact (JEDI) Model, revised in 2009. The multipliers' aggregate increase in final demand is also modified by an assumed 35% tax rate. The median income of $37,000 is from the US Census, 2008. The 35% tax rate is an assumption that includes all taxes that reduce consumption (including but not limited to real estate, sales, income, and excise taxes). **This job number does not include any new jobs created by the production of regionally produced fuel such as wood pellets.**

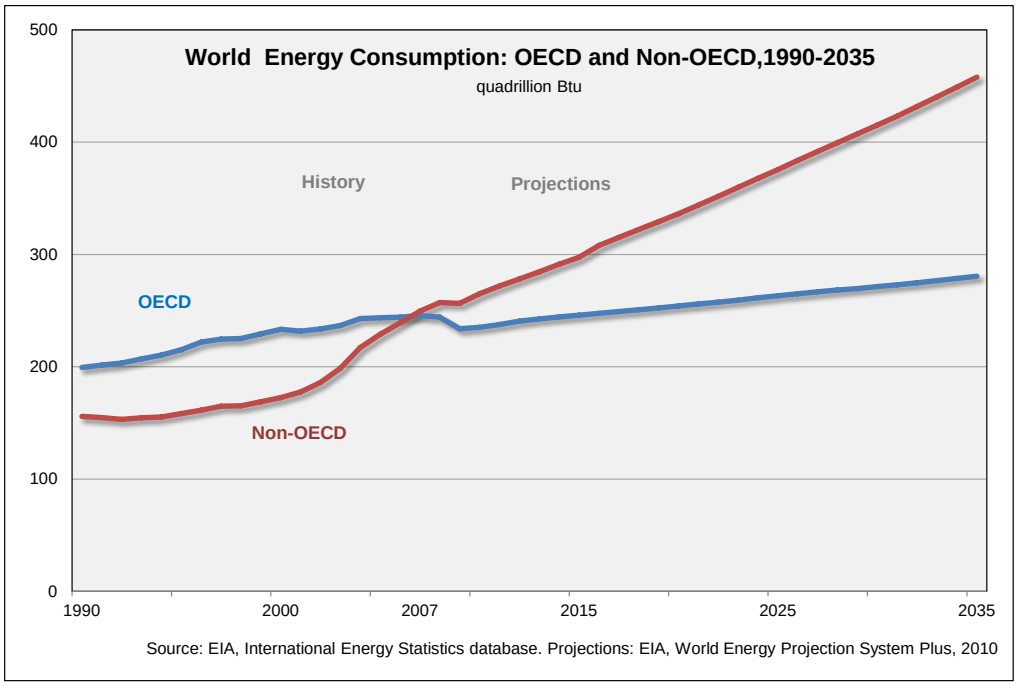
[4] From Bureau of Labor Statistics data, November, 2010.



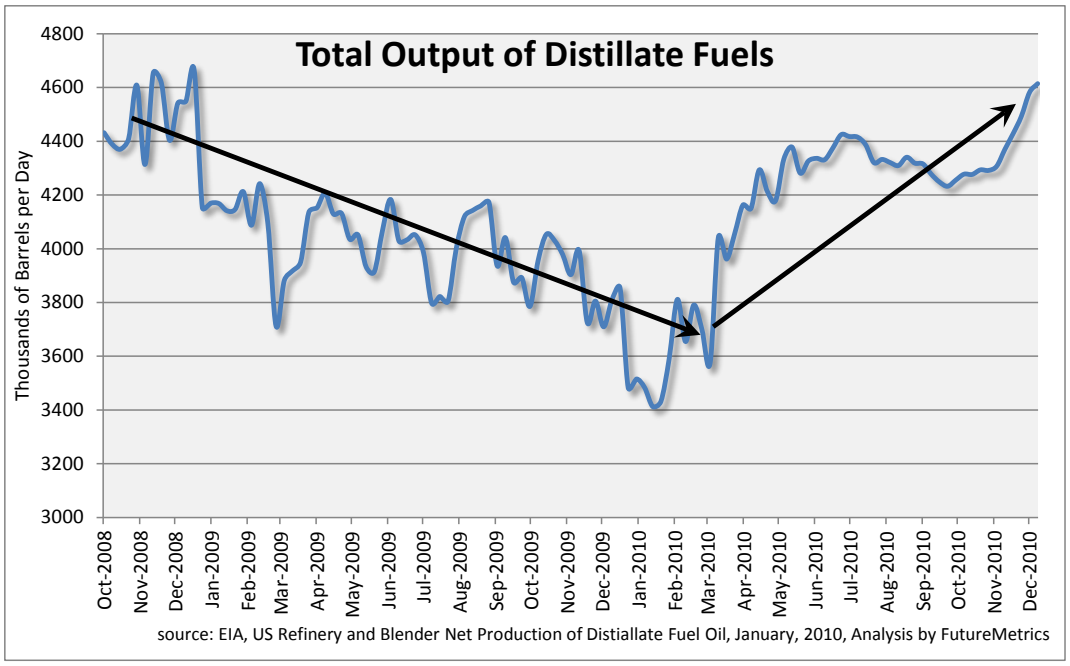

This relationship between economic growth and oil prices can be used to estimate future price trends. Based on expected growth rates for global gross economic product, FutureMetrics has estimated the expected crude oil price from 1999 to 2015. The chart below shows this estimation.




This analysis is strongly influenced by the expected growth of China and India's demand for transportation liquid fuels refined from crude oil, and the developing world's growing demand for energy in general. The chart below illustrates the expected growth in world energy demand.

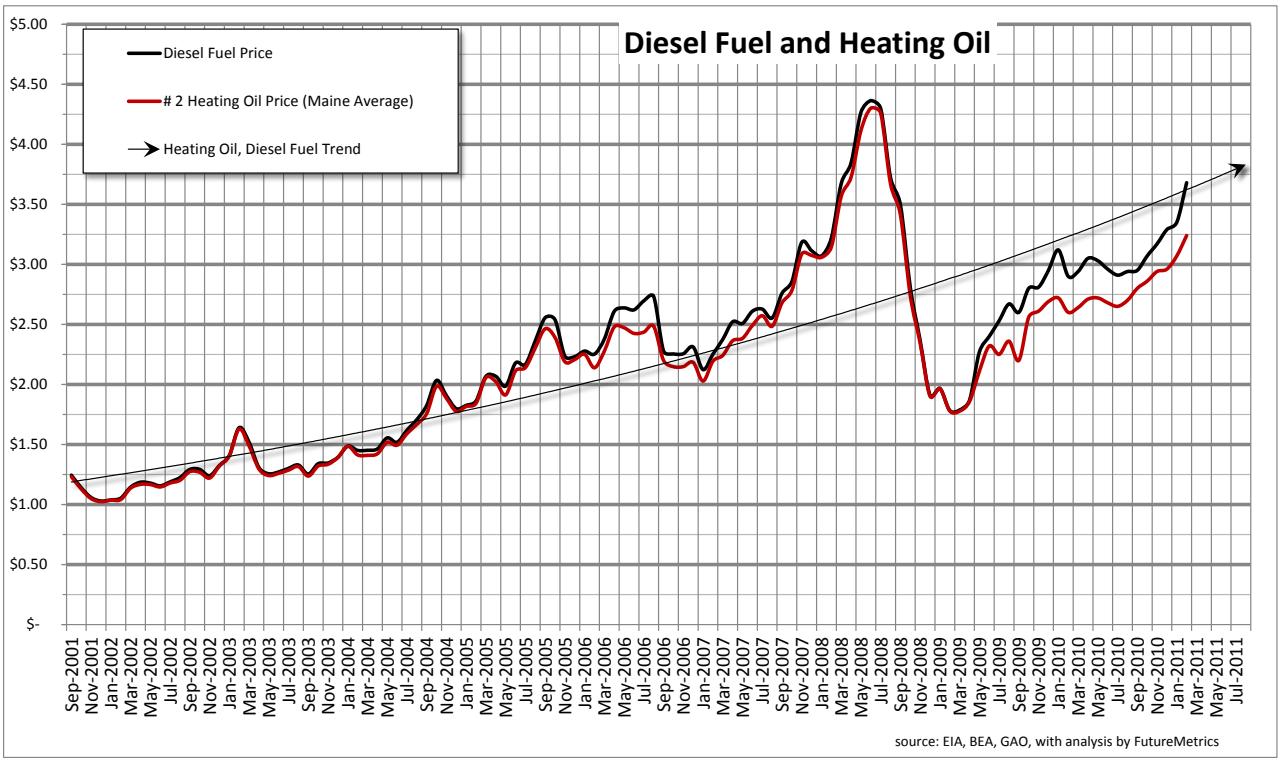



Another price risk is due to the essentially identical characteristics of low sulfur diesel fuel and heating oil. #2 heating oil production and diesel fuel production come from the same fraction in the crude oil cracking process. The quantities of heating oil, diesel fuel, jet fuel (kerosene), and gasoline made from a barrel of crude are determined by the refiner responding to market pressures. As the US economy rebounds from the recession, demand for transportation fuels (gasoline, jet fuel and diesel fuel) will increase as the chart below suggests is occurring. This will also put upward pressure on heating oil prices[5].

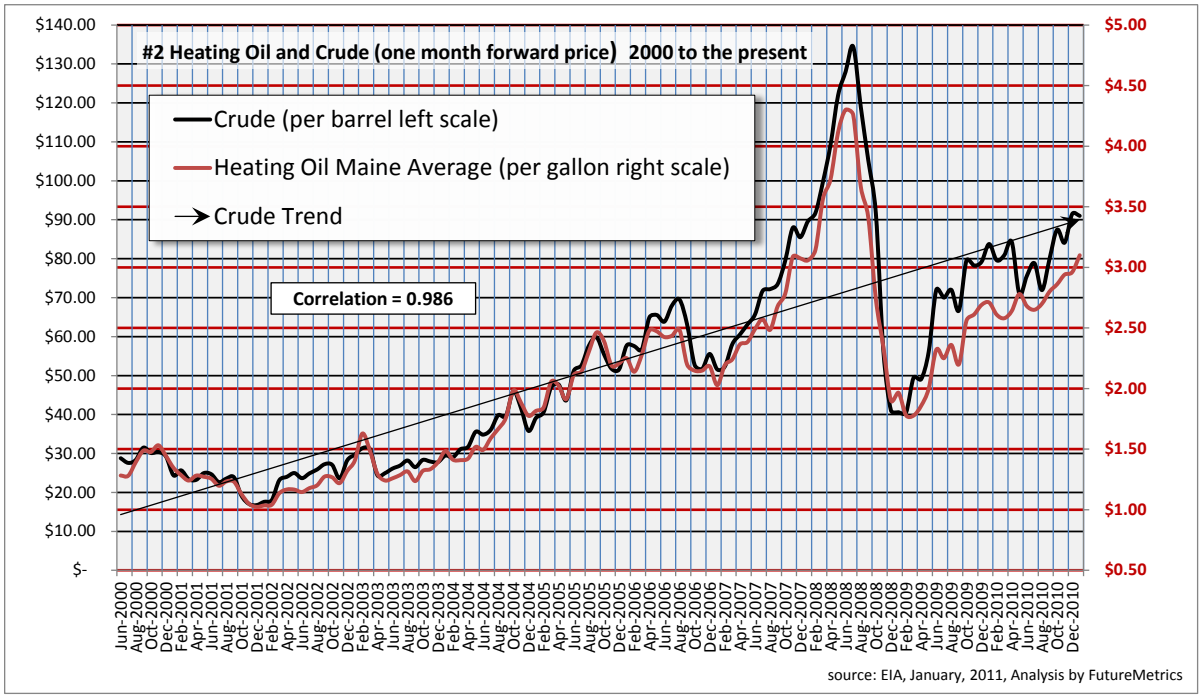



[5] Heating oil production as a proportion of all distillate fuels has remained relatively stable between 3% and 5% (EIA, Refiners Sales Volumes to End Users, June, 2010).

Heating oil may be currently underpriced. Heating oil and diesel fuel have historically followed very similar price pattern. As the 10 year history in the chart below shows, based on diesel fuel, heating oil prices are about $0.40 below diesel.




This potential underpricing of heating oil is also supported by the historical relationship between crude oil prices and heating oil prices as the chart below illustrates.



Heating oil prices may fluctuate over time but the trend will be for increasing prices. The expected price of crude suggests that Maine could see $4.50/gallon heating oil over the winter of 2012-13. Maine and the other states that are very dependent on heating oil, unless changes are made in how homes are heated, will see the "oil tax" rob the region of more and more jobs as more and more our disposable income gets allocated into supporting distant economies including the OPEC countries.

## What is the Effect of Higher Heating Oil Prices on Maine and the Region?

As a starting point, we repeat the fact mentioned earlier in this paper. Maine "exports" about $720,000,000 per year because Maine homes use about 300 million gallons per year of heating oil and 78% of every dollar spent on heating oil leaves the Maine economy. If that money were to stay in the Maine economy it would produce about 41,000 new jobs that do not currently exist.

So we begin with a 41,000 job deficit due to our dollars leaving the state. What would happen if heating oil reaches prices seen in 2008 (about $4.50/gallon)? The previous section's forecasts for crude oil prices suggest that Maine could again see those prices in the winter of 2012-2013. A $1.50 per gallon increase in heating oil prices from today's $3.00 per gallon price may seem small, but that increase adds another $358,000,000 to Maine's "oil tax". That loss of disposable income will destroy another 20,700 jobs and would raise the current unemployment rate of 7.29% to 10.26%[6].

The table below shows the impact of a $1.50/gallon increase on Maine, Vermont, and New Hampshire.

| | Heating Oil use by Households | Average Gallons per Year | Money Exported from Regional Economy Every Year at $3.00/gal | Money Exported from Regional Economy Every Year at $4.50/gal | Annual Increased Loss of Money if Heating Oil goes to $4.50/gal | Permanent Change in Jobs |
|---|---|---|---|---|---|---|
| Maine | **76%** | 305,797,000 | $715,564,980 | $1,073,347,470 | ($357,782,490) | -20,727 |
| Vermont | **54%** | 91,304,000 | $213,651,360 | $320,477,040 | ($106,825,680) | -6,054 |
| New Hampshire | **54%** | 171,739,000 | $401,869,260 | $602,803,890 | ($200,934,630) | -10,867 |
| | | **568,840,000** | $1,331,085,600 | $1,996,628,400 | ($665,542,800) | **-37,648** |

Jobs and the businesses will suffer; but so will the governments of these states. The loss of more than 20,000 jobs in Maine will lower tax revenues. The state of Maine averages about $5,200 in total tax income per employed resident[7]. The loss of 20,700 jobs would lower tax revenues and, using that aggregate revenue per employed resident value, that loss would reduce state tax revenue by almost $106 million annually. That would be a 3.21% drop in annual tax revenues. At the same time, the demand for services would increase as the increase in heating oil costs disproportionally burdens the poor.

The charts below show the impact of $4.50/gallon heating oil on the poorest to the wealthiest Maine households.

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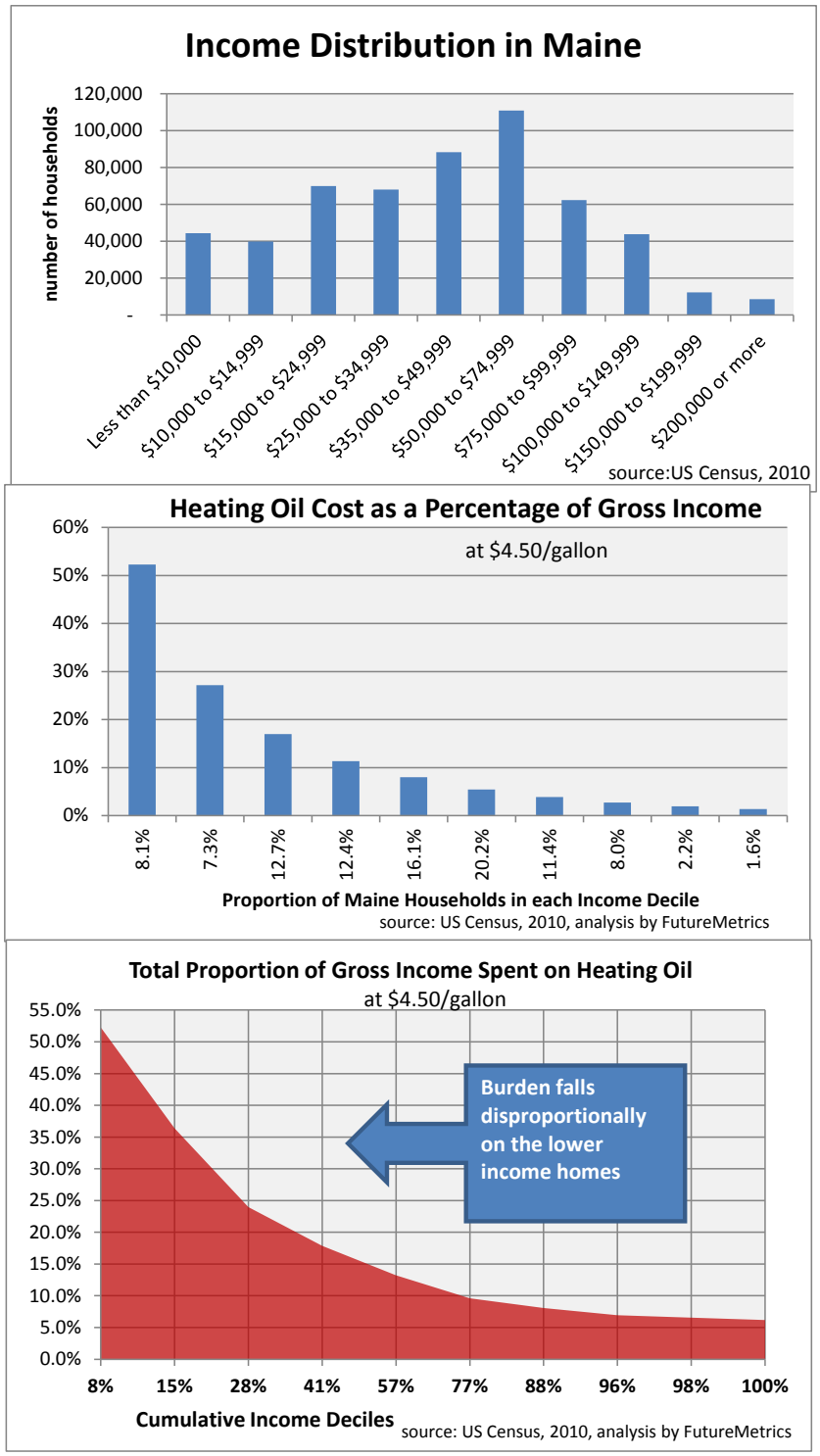
[6] Employment data if from the Maine Department of Labor, November 2010. The increase in the unemployment rate assumes that the civilian labor force remains at the November 2010 level of 696,360. Maine's labor force has been falling slightly since 2007 (2008 average was 705,258, 2009 average was 704,134, and the 2010 average through November was 699,596.

[7] Maine Department of Labor and the Maine Budget Office (2010 budgeted tax revenues).




The top chart shows Maine's income distribution divided into 10 cohorts (deciles). The middle chart shows that the poorest 8.1% of Mainers, or 44,318 households, would spend about 52% of their gross annual income just on heating oil. The next poorest decile would spend about 27% of their income on heating oil. The bottom chart shows the cumulative burden that heating oil would have. For example, the average amount spent on heating oil for 57% of Maine's households would be 13.2% of their income.

The lower income households in Maine will literally be facing the choice in winter of being cold or being hungry.

The net effect on the state's fiscal position will be dire as the loss of tax revenues is compounded with the increase in the demand for social services.

But the net effect for the people and the businesses of Maine (and the regional states) is more direct. As each household's disposable income shrinks because more is spent on heating oil, the result is that more money is not spent in local businesses. The multiplier effects will spread the pain across all business sectors but will be most acute for very small local businesses. The loss of 20,700 jobs will come at the cost of many small businesses; many of which will close.

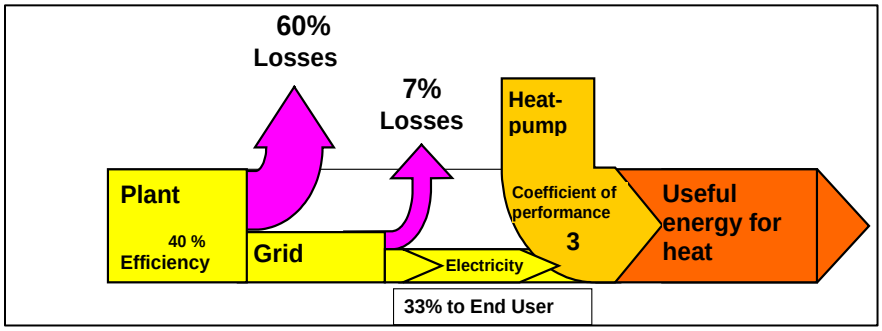
## Is there a Policy to Help Maine and the Region Transition off of Heating Oil?

The problem for Maine and the regional states is clear: heating homes and businesses with heating oil creates not only a dependency on foreign oil, but also causes hundreds of millions of dollars per year to drain from the economy.

Another heating solution has to be implemented and it needs to happen soon before tens of thousands more jobs in Maine are destroyed by the "oil tax".

There has been a lot of attention paid to developing sources of renewable and locally produced electricity. The potential for wind power generation from offshore sites in Maine may someday make Maine, as some have said, the "Saudi Arabia" of wind power. Notwithstanding the cost of that electricity, heating homes and businesses will not be achieved with new sources of electricity[8].

Geothermal heat pump systems are very costly due to the cost of the wells necessary for heat transfer; but they can be solution for some proportion of the homes in Maine. However, geothermal heat pumps, which rely on electricity generated from fossil fuel combustion, cannot recover the lost energy from power plants that run, at best, at 55% efficiency. A power plant that is 55% efficient still loses 45% of the energy in the fuel in the combustion and steam cycle[9]. The illustration below shows the net energy for a typical utility generation portfolio and a very efficient heat pump. Those losses are permanent.




[8] It takes about a kilowatt-hour (kWh) to make 3400 BTU with resistance heating. If power is $0.16/kWh, it costs $47.06 per million BTU. Currently heating oil prices are about $25.00 per million BTU assuming 85% efficiency with the boiler. In other words, heating with electricity with baseboards or an electric furnace is almost twice as costly as heating with heating oil. Heating with wood pellets at the current delivered price, assuming 85% efficiency, is about $14.00 per million BTU.

[9] Based on a gas turbine combined cycle facility. More tradition power plant boilers are at best 40% efficient.

Solar thermal systems which capture solar energy and directly heat water should complement every home's heating system. They are relatively low cost and can offset some of the BTU's needed from heating and domestic hot water. But they cannot provide nearly enough energy to heat a typical Maine home in a typical Maine winter.

As was shown earlier in this paper, only 3.68% of homes in Maine have natural gas. Access to natural gas infrastructure for home heating in the largely rural areas of Maine is very limited. Natural gas will not solve this problem.

There is a solution to the problem that can not only lower heating costs dramatically but can also eliminate our dependence on heating oil; and that solution can also keep the money spent on fuel in the local economy and stop our exporting hundreds of millions of dollars and destroying tens of thousands of jobs. The solution is to use fuel from our own forests and from dedicated energy crops grown on fallow land.

Maine could be characterized as the "Saudi Arabia" of sustainable biomass. Maine is the most forested state in the United States and Maine sustainably harvests more than 16 million tons per year of wood from our forests[10]. New Hampshire and Vermont have less forested land but Vermont has enough non-cultivated cropland that is idle from the decline of the dairy farm sector to grow more than 1.5 million tons per year of woody biomass from dedicated fuel crops[11].

Using wood for fuel is not a revolutionary idea but it is traditionally considered labor intensive and polluting. Using the raw material (cordwood) for fuel is labor intensive and generally is polluting. However, using that raw material to make a refined fuel product to be used in a modern boiler can yield heat without labor by the end user and without pollution.

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[10] Maine Forest Service Assessment of Sustainable Biomass Availability, July, 2008.

[11] While an important share of the non-cultivated cropland produces hay that is important to livestock agriculture, and some of the pasture supports pasture-based beef and dairy production, as well as the equine industry, a significant part of both these land categories is used only lightly, frequently only mowed every year or two to keep it open. Assuming that 25% the non-cultivated cropland and pasture is converted to energy crops, and assuming that the average yield per acre is 4 dry tons per year, the table below shows the potential for additional feedstock (assuming 50% moisture to convert from green to dry tons).

| (acres) | cultivated cropland | non-cultivated | pasture | Acres for Dedicated Energy Crops | Annual "Green" Tons Equivalent |
|---|---|---|---|---|---|
| ME | 123,700 | 260,800 | 37,400 | 75,000 | 600,000 |
| NH | 18,800 | 105,800 | 89,300 | 49,000 | 392,000 |
| VT | 143,300 | 443,200 | 314,400 | 189,000 | 1,512,000 |
| Total | 285,800 | 809,800 | 441,100 | 313,000 | 2,504,000 |
| assumptions: | | | | | |
| non-cultivated and pasture land use | | 25% | 4 | dry tons per year per acre | |

Data is from the National Resources Inventory, managed by USDA's Natural Resource Conservation Service. Data is derived from a statistical sample of plots of land, based on observation of land cover from satellite and ground data.

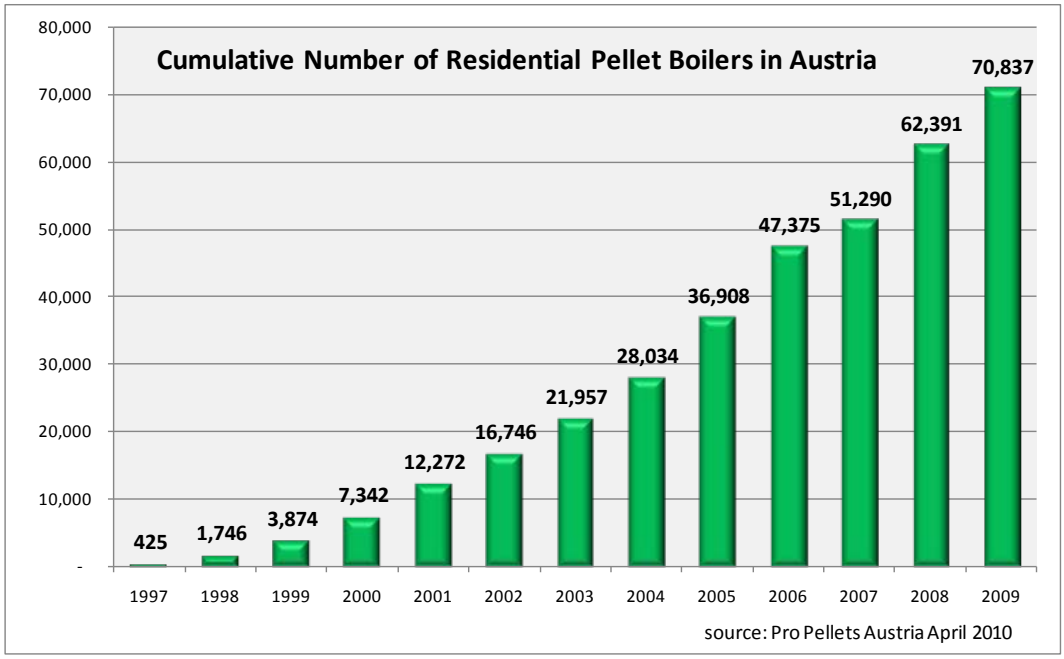
In Europe, using wood for energy is a mature and well established market. The table below shows that energy from wood makes up more than half of all of the energy from renewables in Europe. Although wind and solar get most of the attention, the "workhorse" of renewable energy is wood fuel.

| Total Renewable Energy Production in Europe (EU-25) in 1000's of tons of oil equivalent | | | | | | |
|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Hydro (excl. pumping) | 30,613 | 25,551 | 24,932 | 26,135 | 24,284 | 24,572 |
| Wind | 2,320 | 3,071 | 3,815 | 5,057 | 6,060 | 7,045 |
| Solar | 483 | 532 | 594 | 675 | 807 | 987 |
| Geothermal | 3,616 | 3,946 | 5,287 | 5,384 | 5,280 | 5,526 |
| **Biomass (wood)** | **49,081** | **49,837** | **54,638** | **57,588** | **58,922** | **61,905** |
| Municipal Solid Waste | 7,947 | 8,120 | 8,588 | 8,964 | 9,858 | 10,399 |
| Biogas | 2,670 | 3,292 | 3,274 | 3,747 | 4,267 | 4,750 |
| Total | 96,730 | 94,349 | 101,128 | 107,550 | 109,478 | 115,184 |
| | | | | source: Eurostat, Energy Statistics, 2008 | | |

The woody biomass is used in Europe in a variety of applications from wood chips in large combined heat and power plants to using wood pellets in residential boilers.

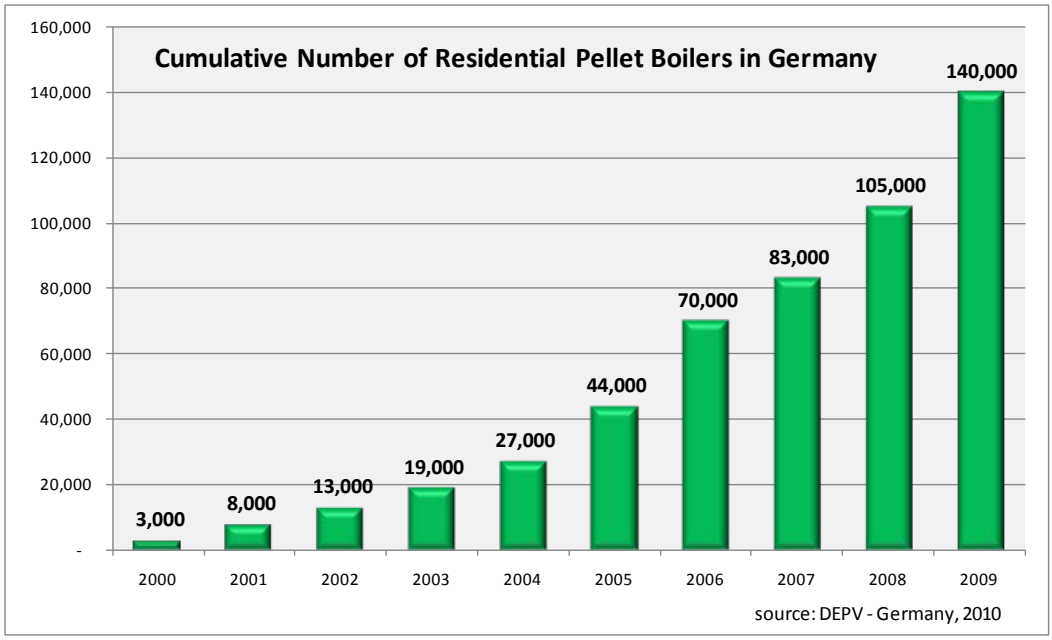
It is the residential wood pellet fueled boiler experience in Europe that can guide Maine and its sister states away from their dependence on heating oil. Pellet fueled boilers are different than pellet stoves. They are fully automatic (fuel and ash handling) and comparable to any modern home heating system for emissions. Whereas most homes in the U.S. that use pellets have stoves, most homes in Europe that use pellets have boilers.

For example, Austria has about 9.4 million acres of forest land (compared to Maine's 17.7 million acres[12]) and Austrian pellet production capacity exceeds 1.1 million tons per[13]. At the end of 2009, Austria had almost 71,000 residential pellet boilers (that is the equivalent of about 17.4% of Maine homes that use heating oil).




Germany has an even larger installed base of pellet boilers.

[12] "Maine's Forest Area, Review of Available Estimates", Lloyd Irland, February 1998.
[13] ProPellets Austria, "Wood Use for Energy", April, 2010.




The combined number of modern and efficient pellet boilers in Austria and Germany if installed in Maine would replace about half of the heating oil boilers in Maine.

Can Maine and the region produce enough wood pellets to convert a significant number of its homes from heating oil boilers to European style pellet boilers[14]?

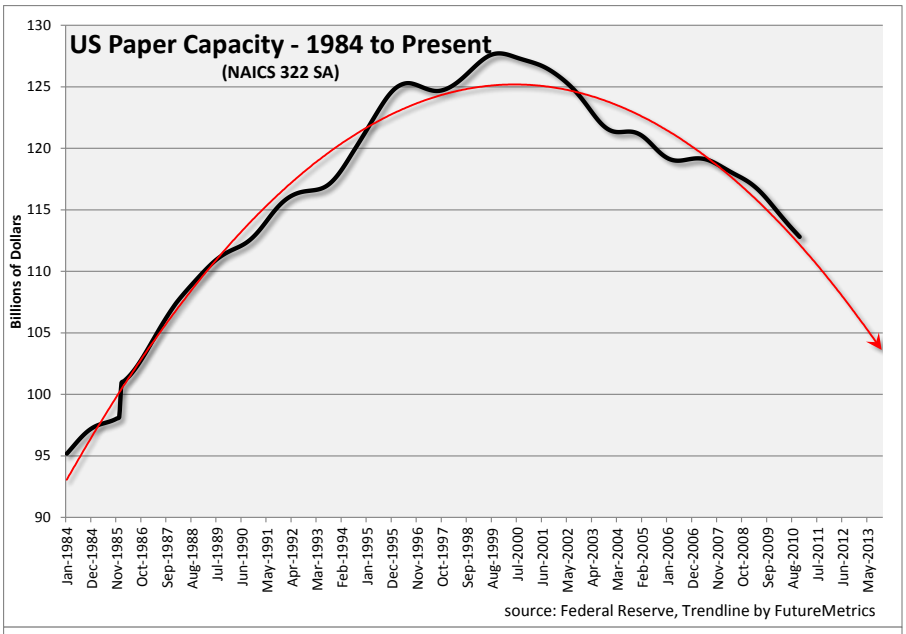
The Biomass Thermal Energy Council says yes using a very conservative analysis in determining the quantity of woody biomass that is available[15].

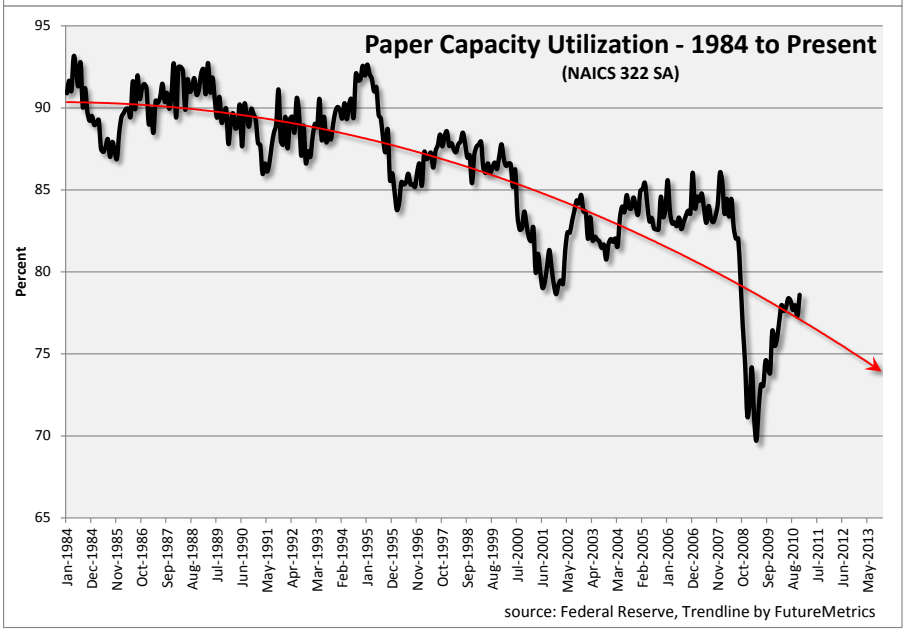
Their analysis assumes that the pulp and paper sector will remain as active in Maine over the next 15 years as it is today. This assumption may prove to be incorrect as "readily available and relatively inexpensive supply in South America, Africa and Eastern Europe has positioned these regions as the new leaders in wood pulp supply, with China experiencing astonishing demand growth for paper and pulp alike".[16]

The forest products sector has been the mainstay of the Maine manufacturing sector for more than a century and no one in Maine or the region wishes to see the logging, trucking, and processing supply chain disappear. But the global paper demand on a per capita basis in the developed world is likely to decline in coming years and, with the proliferation of ebooks and tablets combined with new generations of people that prefer looking at a screen to looking at a sheet of paper, the industry is likely to become more challenged in the coming years.

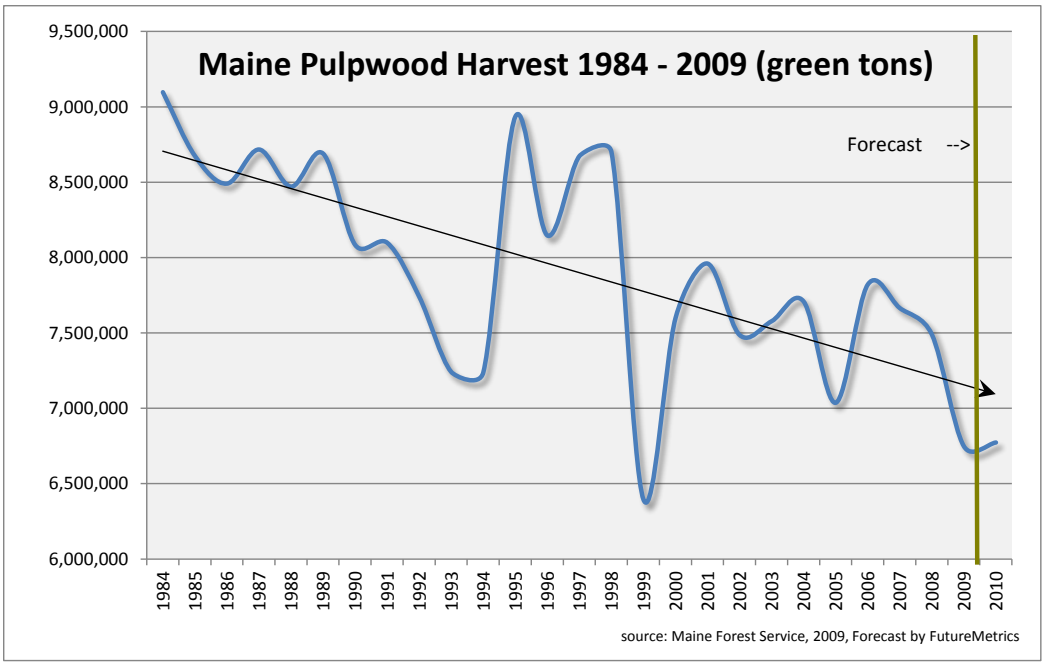
The two charts on the next page show trends that will continue to challenge Maine's traditional forest products value chain.

[14] Although the boilers are referred to as "European style", some are fabricated in Maine. Maine Energy Systems, under license from Okofen of Austria, is building systems in Maine.
[15] See "Heating the Northeast with Renewable Biomass" at http://www.biomassthermal.org/resource/2025vision.asp
[16] Acccenture, "Trends in Manufacturing Paper Products", 2008.




Maine is well positioned with certain specialty papers, but even in Maine demand for pulpwood has declined as the next chart shows.




Exports have helped to sustain activity in Maine's forest products sector but many of the trends are not encouraging and export volumes are vulnerable to changes in the terms of trade (exchange rate differentials[17]) and rapidly rising non-domestic capacity in the pulp and paper sector[18].

| Forest Products in the Top 25 Export Commodities - Maine | | | | | | |
|---|---|---|---|---|---|---|
| | (source: Federal Reserve) ranked by 2009 values | | values in $millions | | | |
| Rank | Description | 2006 | 2007 | 2008 | 2009 | Trend |
| 3 | Paper for writing and printing; Clay content <= 10% | 83 | 96 | 117 | 141 | |
| 4 | Pulp | 251 | 236 | 222 | 134 | |
| 7 | Whole softwood trees | 158 | 114 | 98 | 104 | |
| 8 | Coated paper | 90 | 82 | 120 | 93 | |
| 12 | Whole hardwood trees | 40 | 27 | 27 | 35 | |
| 18 | Softwood lumber | 26 | 43 | 27 | 23 | |
| 20 | Softwood chips | 20 | 39 | 35 | 20 | |
| 25 | Paper for writing and printing: Clay content > 10% | 8 | 17 | 22 | 15 | |

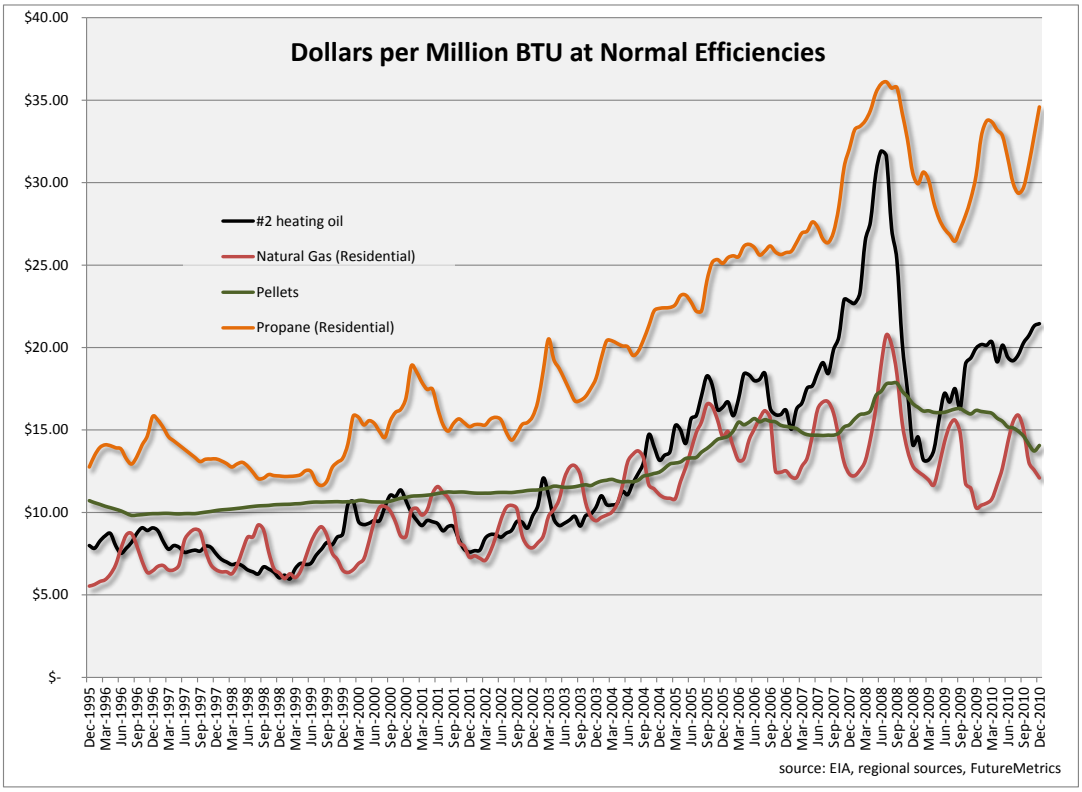
The forest products sector can remain the mainstay of Maine's manufacturing sector if value added refined fuel gradually replaces some or perhaps eventually all of the pulp production.

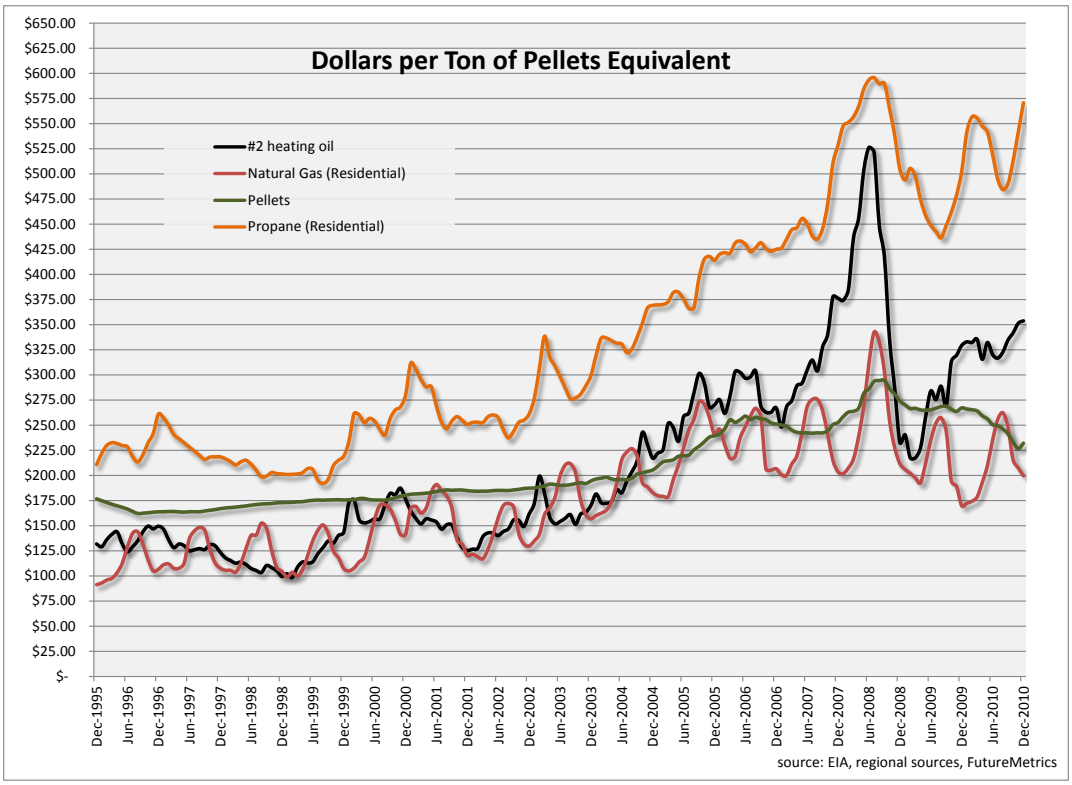
The value added (and the jobs and income) from making wood pellet fuel is not just in the production of the pellets from roundwood. The value also accrues, as shown above in this report, by offsetting the export of heating oil money and creating new commerce from that increased disposable income. There is also value gained because wood pellet fuel costs less per BTU than heating oil. The charts below show the price

[17] It is interesting to note that exchange rate movements that help the pulp and paper export sector harm Maine's homeowners that use heating oil. A weaker dollar makes our exports cheaper for foreign nations to purchase and supports pulp and paper exports. But a weaker dollar also makes crude oil, all other factors held constant, more expensive which increases the cost of home heating oil.

[18] Data from RISI, www.risiinfo.com, 2009.

comparison of buying one million BTUs from different fuels as well as the comparable price of the fuels in terms of tons of wood pellet fuel[19].




[19] The data is for total BTU per unit of fuel. Boiler efficiencies will alter those numbers to be slightly higher. European style pellet boilers and oil boilers are typically around 85% efficient.

Only natural gas is lower cost but, as was shown earlier in this report, very few Mainers have access to natural gas.

There is also a natural price ceiling on wood pellet fuel. That ceiling is due to an inherent limitation on wood prices in Maine. If wood costs were to rise above about $70/ton (equivalent to about $310/ton wood pellets or $20.00 per million BTU – which is less than current heating oil prices), then some pulp mills would have to close as their pulp prices would no longer be competitive; and some of the millions of tons per year they demand would become excess supply thereby holding prices down. In other words, the cost of wood for manufacturing pellets will never exceed the breakeven cost of wood for pulp mills unless pellet mills demand more than 6.5 million tons per year[20].

But going head to head with pulp and paper for wood supply does not have to happen to make the wood pellet sector a viable and significant supplier of fuel from the Maine forests. Both sectors can coexist.

Maine already has the pellet making capacity to manufacture about 300,000 tons per year of wood pellets (those mills demand about 600,000 tons per year of wood). The Maine Forest Service has publicly stated that there are an additional 5.86 million tons per year of wood that could be sustainably harvested in Maine[21]. That would be enough without impacting the pulpwood market to produce almost 3 million tons per year of refined pellet fuel. That would be enough to fuel 375,000 Maine homes (83% of Maine's homes that use heating oil).

Pursuing the development of a wood derived fuel infrastructure in Maine[22] will not only sustain and possibly grow the forest products sector, but it will also bring very significant positive economic benefits. The net value added from wood pellet manufacturing varies depending on the price differential between heating oil and pellet fuel. The savings on heating costs are part of the positive economic advantage. But the significant part of the advantage comes from keeping all that money spent on fuel in the state.

On a ton per ton basis of raw (green) wood the value added of manufacturing pellet fuel is shown below (assuming a per ton price for pellet fuel of $250[23]).

[20] The most recent data on total pulpwood demand in Maine, Maine Forest Service.
[21] Maine Forest Service, "Maine Forest Service Assessment of Sustainable Biomass Availability," July, 2008.
[22] That infrastructure would encompass the entire supply chain from landowners, to loggers, to truckers, to chippers, to pellet makers, to the companies that deliver bulk pellets in delivery trucks very similar to the oil trucks that currently deliver heating oil to Maine's homes.
[23] Estimated by FutureMetrics. The analysis does not include any job multiplier effects for either industry.

| | | $250.00 |
|---|---|---|
| Heating Oil Prices per Gallon | $2.80 | $180.47 |
| | $2.90 | $189.70 |
| | $3.00 | $198.93 |
| | $3.10 | $208.16 |
| | $3.20 | $217.38 |
| | $3.30 | $226.61 |
| | $3.40 | $235.84 |
| | $3.50 | $245.07 |
| | $3.60 | $254.30 |
| | $3.70 | $263.53 |
| | $3.80 | $272.76 |
| | $3.90 | $281.99 |
| | $4.00 | $291.22 |
| | $4.10 | $300.45 |
| | $4.20 | $309.67 |
| | $4.30 | $318.90 |
| | $4.40 | $328.13 |
| | $4.50 | $337.36 |

By way of comparison, the value added from pulp and paper manufacturing in Maine was estimated at $1.8 billion dollars in 2006[24]. The pulp and paper sector processed approximately 8.49 million tons of green wood that year[25] to generate the $1.8 billion in value added. That works out to a value added of about $212/ton of green wood. The actual value added per ton will vary over time with the prices of wood, pulp, and paper (and other costs).

At current delivered wood pellet prices (about $250/ton) and heating oil prices (about $3.07/gallon), making pulp and paper has a higher value added ($212/ton for pulp and paper versus about $205/ton for pellet fuel). But if heating oil prices rise to $4.50/gallon in the winter of 2012-2013, then the net benefit to the state of Maine from converting a ton of wood to refined pellet fuel is greater by more than $135 than the value added from making a ton of wood into pulp and paper. But one does not have to supplant the other. Maine has the potential to do both.

The potential advantages of harnessing the region's woody biomass fuel potential for heating homes and businesses are many; but job creation tops the list. Tens of thousands of jobs will be created by making the fuel locally, using cheaper fuel, and by eliminating the heating oil "tax" and thereby not permanently sending a billion dollars away every year (which Maine will do when heating oil hits $4.19/gallon).

This first table below shows the direct, indirect, and induced jobs that would be created or sustained[26] in the wood derived fuel supply chain if 75% of Maine's homes were converted from heating oil boilers to modern

[24] From "The Economic Importance and Wood Flows from Maine's Forests, 2007", North East State Foresters Association; with the original data from the US Dept. of Commerce, Bureau of Economic Analysis, 2006. http://www.nefainfo.org/publications/2007%20Publications/NEFAEconomicImportME.pdf, Note that the value in the publication differs from the value added for Maine pulp and paper manufacturing reported by the BEA. The value reported by the BEA in 2006 is $1.1 billion http://www.bea.gov/regional/gsp/. This analysis uses the higher number.

[25] Maine Forest Service data.

[26] "Created or sustained," refers to the fact that some forest projects jobs that may be lost to a declining demand in the traditional sectors would be saved. Also, some of the heating oil delivery jobs that bring heating oil to homes would transfer to delivery jobs for filling pellet fuel storage tanks.

European style wood pellet boilers. In Maine, almost 17,000 jobs would be created or sustained. In the region, about 840 million dollars in annual income would be permanently created or sustained.

| | Economic Impact of Producing Heating Fuel Regionally - 75% Conversion | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Required Forest or Crop Biomass Production per Year (green tons) | Direct Jobs | Income at $37,000 per Year per job | Indirect and Induced Job Multipliers per $1,000,000 Increase in Final Demand | Indirect and Induced Jobs | Multiplier Income at $37,000 per Year - Tax Rate 35% | Total NEW or Sustained ANNUAL Income |
| ME | 4,917,674 | **8,409** | $ 311,141,000 | 27.19 | **8,459** | $ 109,545,000 | **$ 420,686,000** |
| NH | 3,220,027 | 5,506 | $ 203,731,000 | 25.99 | 5,295 | $ 68,570,000 | $ 272,301,000 |
| VT | 1,615,336 | 2,762 | $ 102,202,000 | 33.52 | 3,426 | $ 44,366,000 | $ 146,568,000 |
| | 9,753,037 | 16,678 | $ 617,074,000 | | **17,180** | $ 222,481,000 | **$ 839,555,000** |

The next table shows how the saving generated by a lower cost heating fuel would circulate in the local economies. The commerce created from the extra disposable income would generate jobs. In Maine, if heating oil were $4.50/gallon and wood pellet fuel were $250/ton, almost 23,950 jobs could be created from the $574 million dollars that Mainers would not spend on heating their homes. Over the region, more than 46,000 jobs would be created.

| | **Savings and Jobs from Using Pellet Fuel vs. Heating Oil** | | | | |
|---|---|---|---|---|---|
| | Spending on Heating Oil at $4.50/gallon | Amount that Would be Spent on Pellet Fuel at $250.00/ton for equivalent heat | Annual Savings | Job Multipliers per $1,000,000 Increase in Final Demand | **Total Jobs Due to Heating Cost Savings** |
| ME | $ 1,188,090,000 | $ 614,000,000 | $ 574,090,000 | 57.93 | **23,946** |
| NH | $ 777,870,000 | $ 402,000,000 | $ 375,870,000 | 54.08 | 14,636 |
| VT | $ 390,870,000 | $ 202,000,000 | $ 188,870,000 | 56.68 | 7,707 |
| | $ 2,356,830,000 | $ 1,218,000,000 | **$ 1,138,830,000** | | **46,289** |

The final part of the job creation equation is due to the facts that have already been discussed in this paper: 78% of every dollar spent on heating oil leaves our region forever. Not spending $4.50/gallon on heating oil will keep more than a billion dollars a year in the Maine economy and create more than 62,000 jobs.

The net effect is to create or sustain 79,000 jobs in Maine[27] and almost 147,000 jobs in the three states most addicted to heating oil.

| | Total Permanent Jobs Created or Sustained at $250/ton and $4.50/gallon |
|---|---|
| ME | 79,049 |
| NH | 28,964 |
| VT | 38,789 |
| | **146,802** |

[27] Note that the fuel cost savings are not double counted.

## Conclusion

We are facing a crisis in our region due to our addiction to heating oil. We saw a preview of this crisis in 2008 but, as with most addictions, the past pain is quickly forgotten and denial takes over.

This paper, hopefully, will help everyone including our policymakers see the serious risk that our states face because of our unique and profound dependence on a product that is made thousands of miles away from raw materials mostly imported from unstable areas of the world.

That risk is compounded by the growth in global demand for liquid transportation fuels made from crude oil. Gasoline, diesel fuel, and jet fuel all come from the same starting point. As China, India, and Brazil (the growth leaders in the developing world) build roads and therefore trucks and cars, their growth in demand will put continuous pressure on supply and prices.

If we continue with business as usual, we will get what we got in 2008. That year saw the creation of the Governor's Wood-to-Energy Task Force in response to the crisis our citizen's faced with heating oil rising through the $3.00/gallon range reaching almost $4.50/gallon. After the crisis passed, the report that the task force created found a place to gather dust rather than become a roadmap to undoing business as usual.

The benefits of converting a significant number of homes off of heating oil are significant. The risks to our economy if we do not convert are also significant. Can we afford to sit on our hands and hope that oil prices do not rise? Inaction can only be a product of denial. Prices will rise. They may not rise next year but the consequences of inaction would suggest that a proactive strategy would be wise. That is what they have done in Europe. We need a clear and well-crafted home heating energy policy for Maine and the other states that face the same vulnerability.

Somehow, we have to change our job destroying heating oil habits.

We have to change soon or we will face a crisis that will reach into every corner of our society.

## William Strauss, PhD

Dr. William Strauss and his consultancy, FutureMetrics, have become recognized as the leading domestic expert in the economics of the production and use of biomass fuels. FutureMetrics is also recognized for its expertise in quantifying the financial feasibility of renewable energy projects and quantifying the economic impacts of those projects (jobs, growth, tax revenues, etc.).

William Strauss is the President and founder of FutureMetrics, LLC, a Maine-based firm. He is the Managing Partner of FutureEnergy Partners, LLC. FutureEnergy specializes in enabling inventors of cutting edge technology in the energy sector to move from idea to commercial product. He is also a Director of Maine Energy Systems, a renewable energy firm. Bill is also the chief economist for the Biomass Thermal Energy Council (Washington, DC) and the chief economist for the Maine Pellet Fuels Association. Bill served as the chief economist on the Maine Governor's Wood-to-Energy Task force in 2008-2009.

Bill has more than thirty-five years of strategic and policy planning, project management, data analysis, and modeling experience. Bill's professional history includes executive positions as director, president, and senior vice president, as well as positions as a senior analyst, field coordinator, and operations manager. He has an MBA (specializing in Finance) and a PhD (Economics, Earth Systems Science).

Bill is a member of the Biomass Thermal Energy Council, the Northeast Sustainable Energy Association, the Maine Pellet Fuels Association, is a member the New England Complex Systems Institute, and is a member of the American Society of Mechanical Engineers. Bill also serves on the Sunday River ski area Advisory Committee and he is a member of the Board of Trustees and is the Vice President of the Bethel Maine Historical Society. Bill also serves on the board of the Bethel, Maine Regional Chamber of Commerce.

Bill also teaches business and economics classes at the White Mountains College in Berlin, NH where he has the position of full professor.

Bill has published a book titled *The Myth of Endless Growth: Exposing Capitalism's Unsustainability* (ISBN 978-0-557-62496-6).

Bill enjoys mountain biking in the summer and skiing in the winter. He has logged more than one million vertical feet helicopter skiing in British Columbia, Canada.