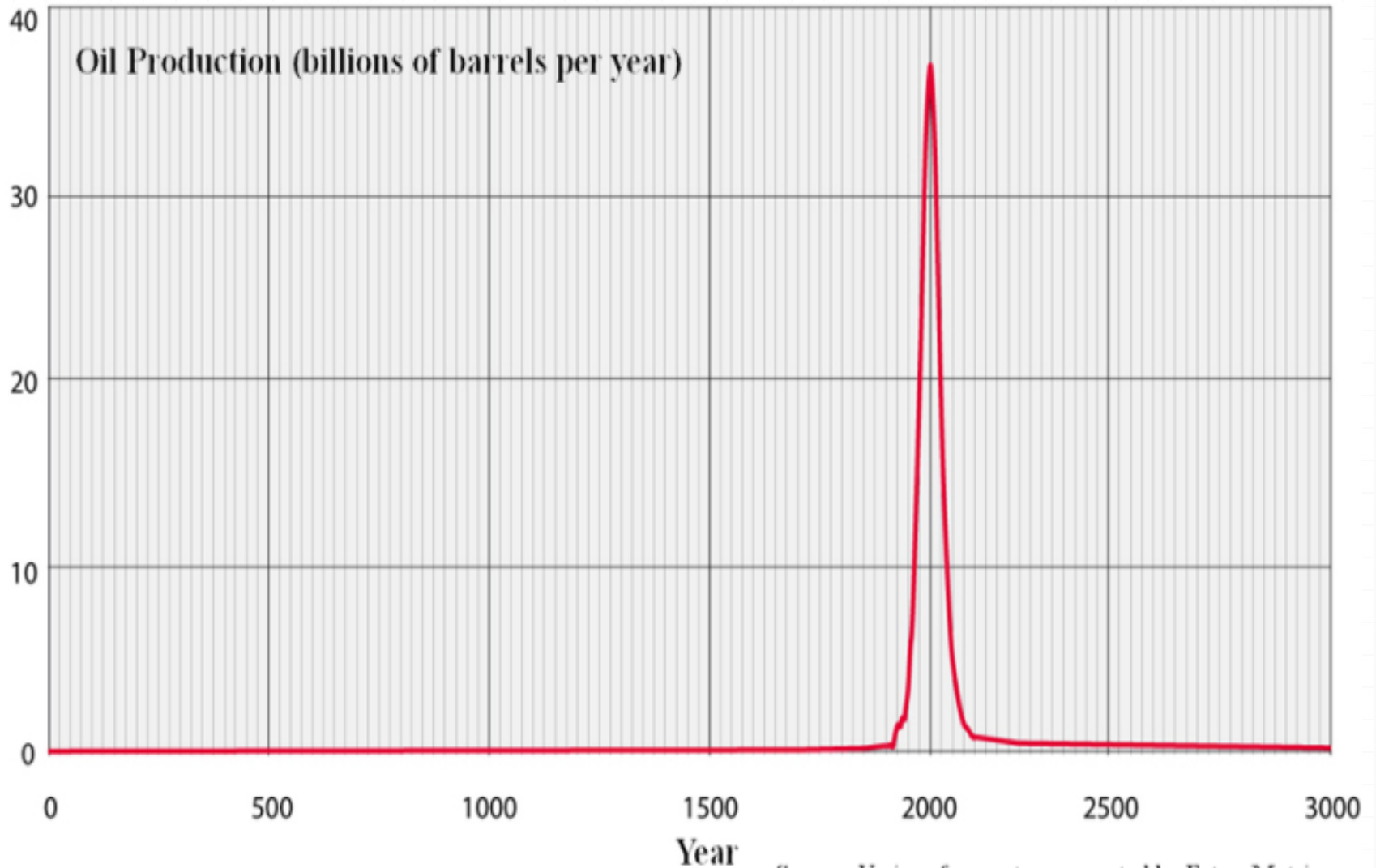


Biomass Thermal in the Northeast: *Economic Growth and Energy Independence*

**Presented by Dr. William Strauss,
President, FutureMetrics
Director, Maine Energy Systems**

November 16, 2011

Why should we care about renewable energy?

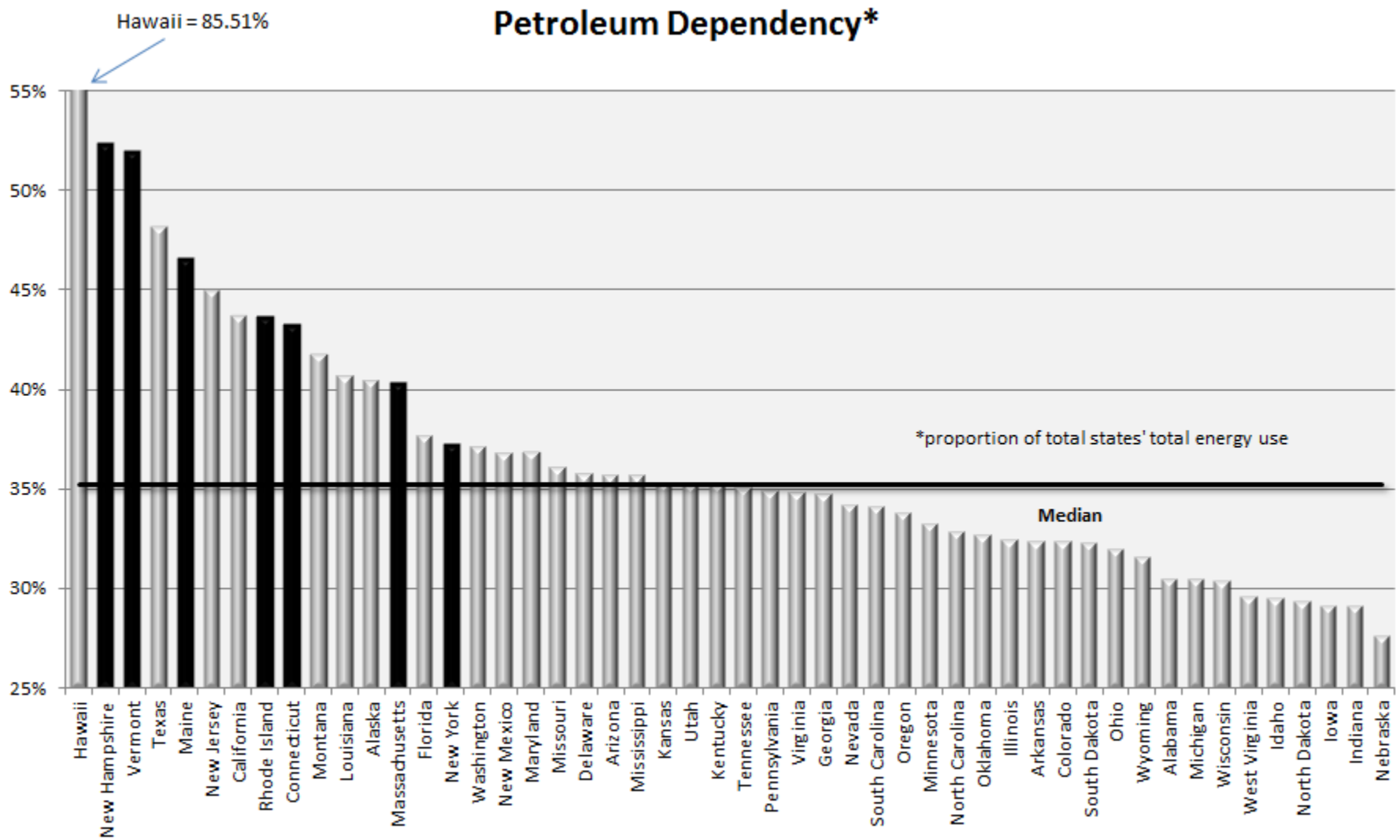


Source: Various forecasts aggregated by FutureMetrics.

United States' "Energy Policy"



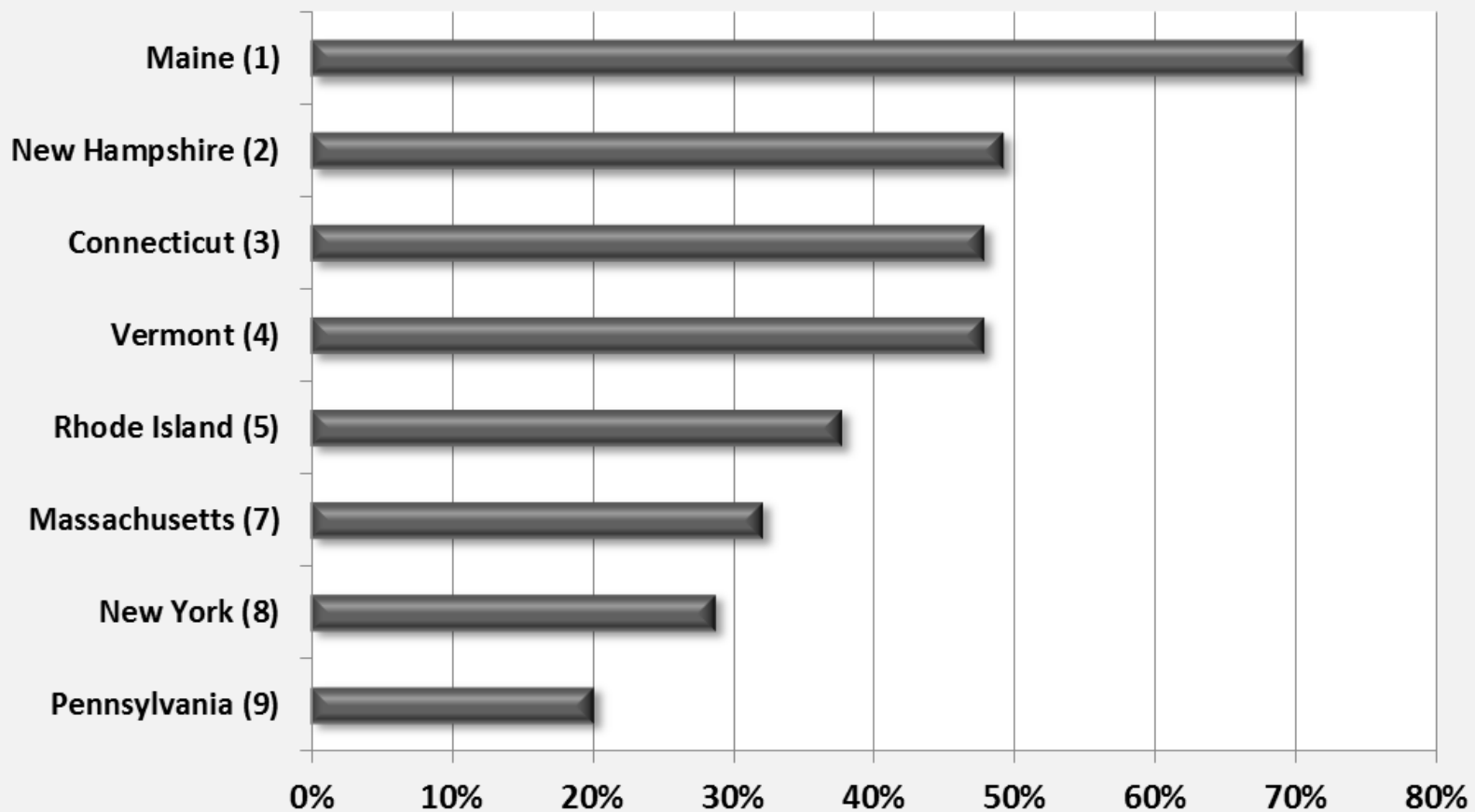
The NE states, due to a reliance on heating oil, are very dependent on petroleum.



source: EIA, Energy Consumption by Source and End Use Sector, Table S1, 2009, Analysis by FutureMetrics

Percent of Households using Heating Oil (rank in US)

(excluding Alaska)



(Source: US Energy Information Administration, 2011), Analysis by FutureMetrics.

At current heating oil prices, the NE states
 “export” more than **20 BILLION** dollars per year*

	Number of Households that use Heating Oil	Average Gallons Used per Year by all Users	Average Total Expenditure Per Year (#2 at \$3.65/gal)	Amount that Does <u>not</u> Stay in the State (EXPORTED)
Connecticut	873,000	720,225,000	\$ 2,628,821,250	\$ 2,050,481,000
Maine	418,000	376,200,000	\$ 1,373,130,000	\$ 1,071,041,000
Massachusetts	1,110,000	915,750,000	\$ 3,342,487,500	\$ 2,607,140,000
New Hampshire	409,000	368,100,000	\$ 1,343,565,000	\$ 1,047,981,000
New York	3,275,000	2,947,500,000	\$ 10,758,375,000	8,391,533,000
Pennsylvania	1,837,000	1,377,750,000	\$ 5,028,787,500	3,922,454,000
Rhode Island	208,000	166,400,000	\$ 607,360,000	473,741,000
Vermont	201,000	180,900,000	\$ 660,285,000	\$ 515,022,000
Total	8,331,000	7,052,825,000	\$ 25,742,811,250	\$ 20,079,393,000

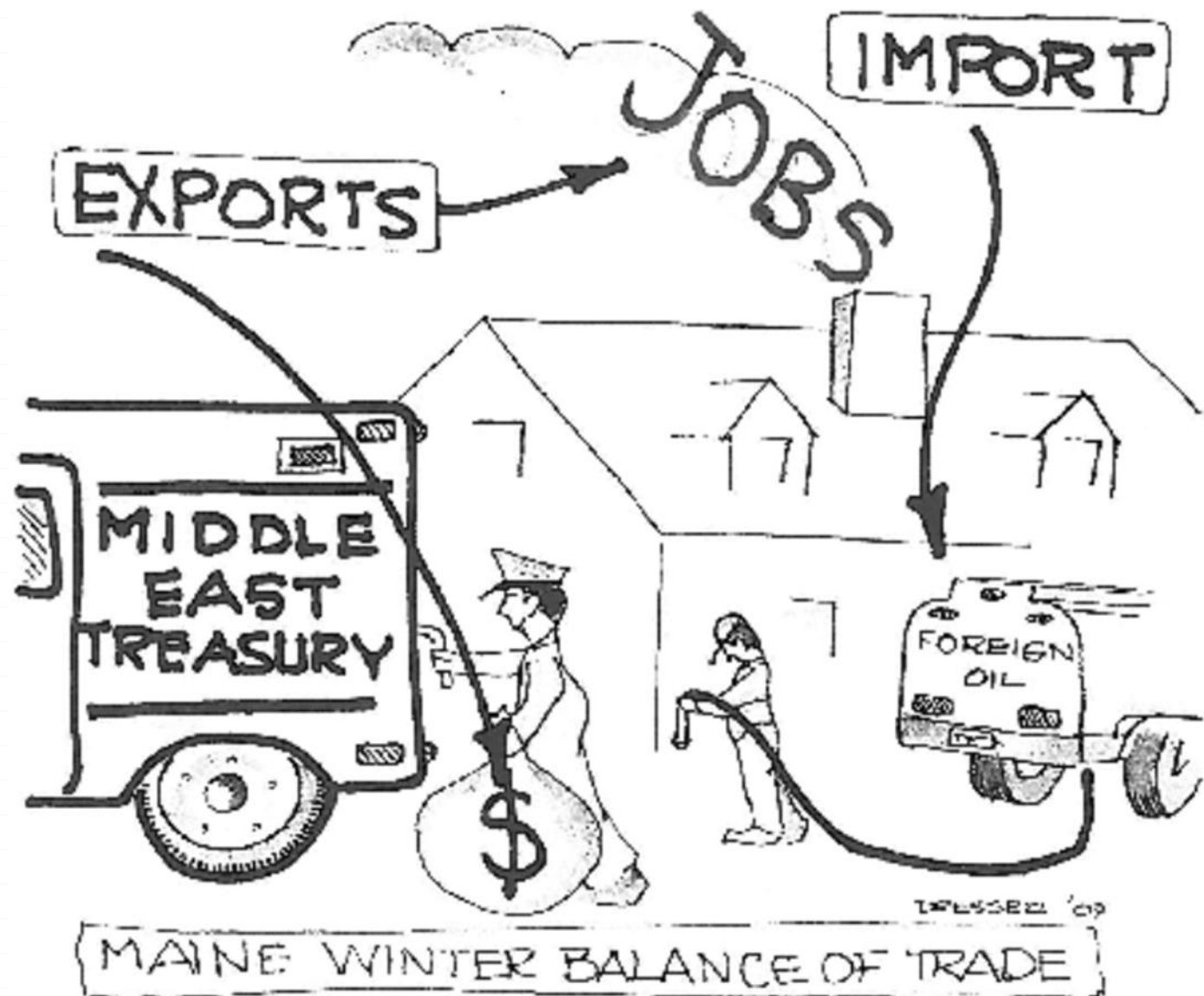
Source: US Energy Information Administration, 2010, US Census, analysis by FutureMetrics

*The US EIA data shows that 78% of every dollar spent on heating oil leaves the region and most of those dollars leave the country.

At current heating oil prices, **about ONE MILLION jobs are destroyed** as money is drained from those states' economies and sent to other places.

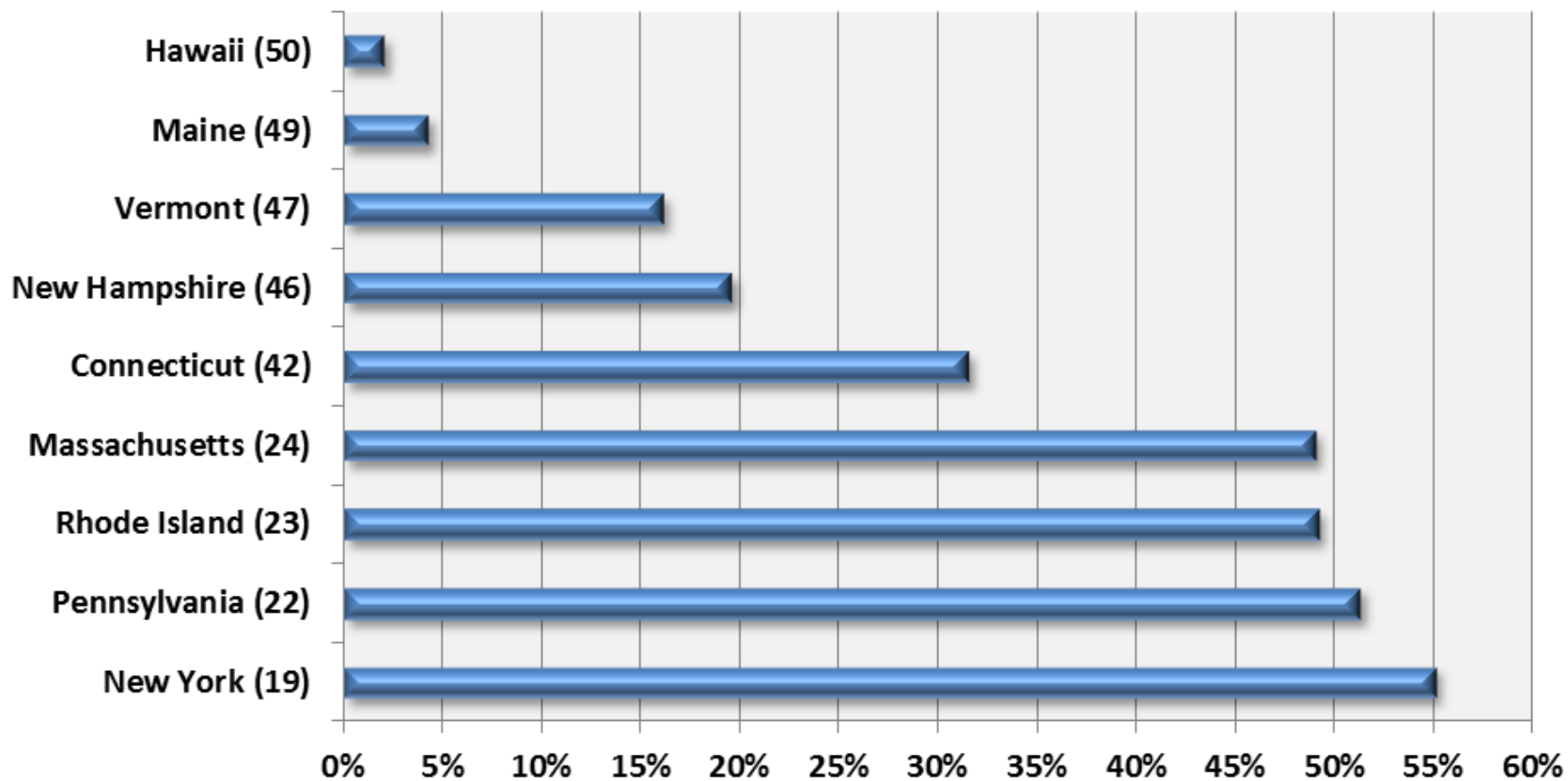
#2 Distillate Fuel use in Residential, Commercial, and Industrial (not Transportation)	Average Gallons per Year	Money Exported from Regional Economy at \$3.65/gal	Permanent Job Destruction
Connecticut	720,225,000	(\$2,050,480,575)	-98,300
Maine	376,200,000	(\$1,071,041,400)	-64,189
Massachusetts	915,750,000	(\$2,607,140,250)	-133,194
New Hampshire	368,100,000	(\$1,047,980,700)	-58,773
New York	2,947,500,000	(\$8,391,532,500)	-415,023
Pennsylvania	1,377,750,000	(\$3,922,454,250)	-198,084
Rhode Island	166,400,000	(\$473,740,800)	-23,575
Vermont	180,900,000	(\$515,022,300)	-30,219
	7,052,825,000	(\$20,079,392,775)	-1,021,357

analysis by FutureMetrics



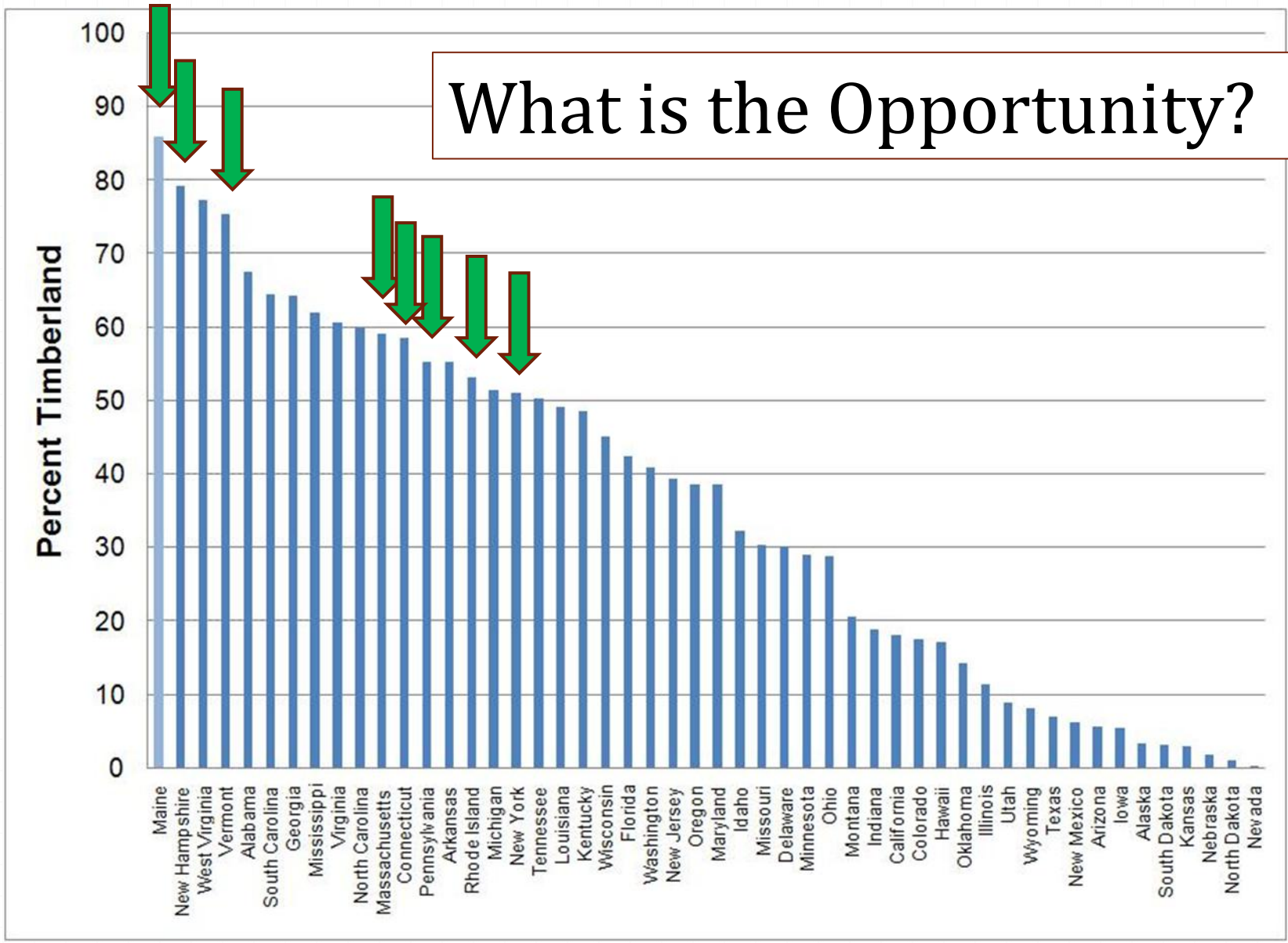
IMPRESSED '09

Natural Gas Use by Households (rank)



(Source: US Energy Information Administration, 2011), Analysis by FutureMetrics.

What is the Opportunity?



Source: *The State of Maine's Environment 2010*, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine

What if some of that dependence on heating oil were converted to biomass?

Job Destruction would become Job Creation.

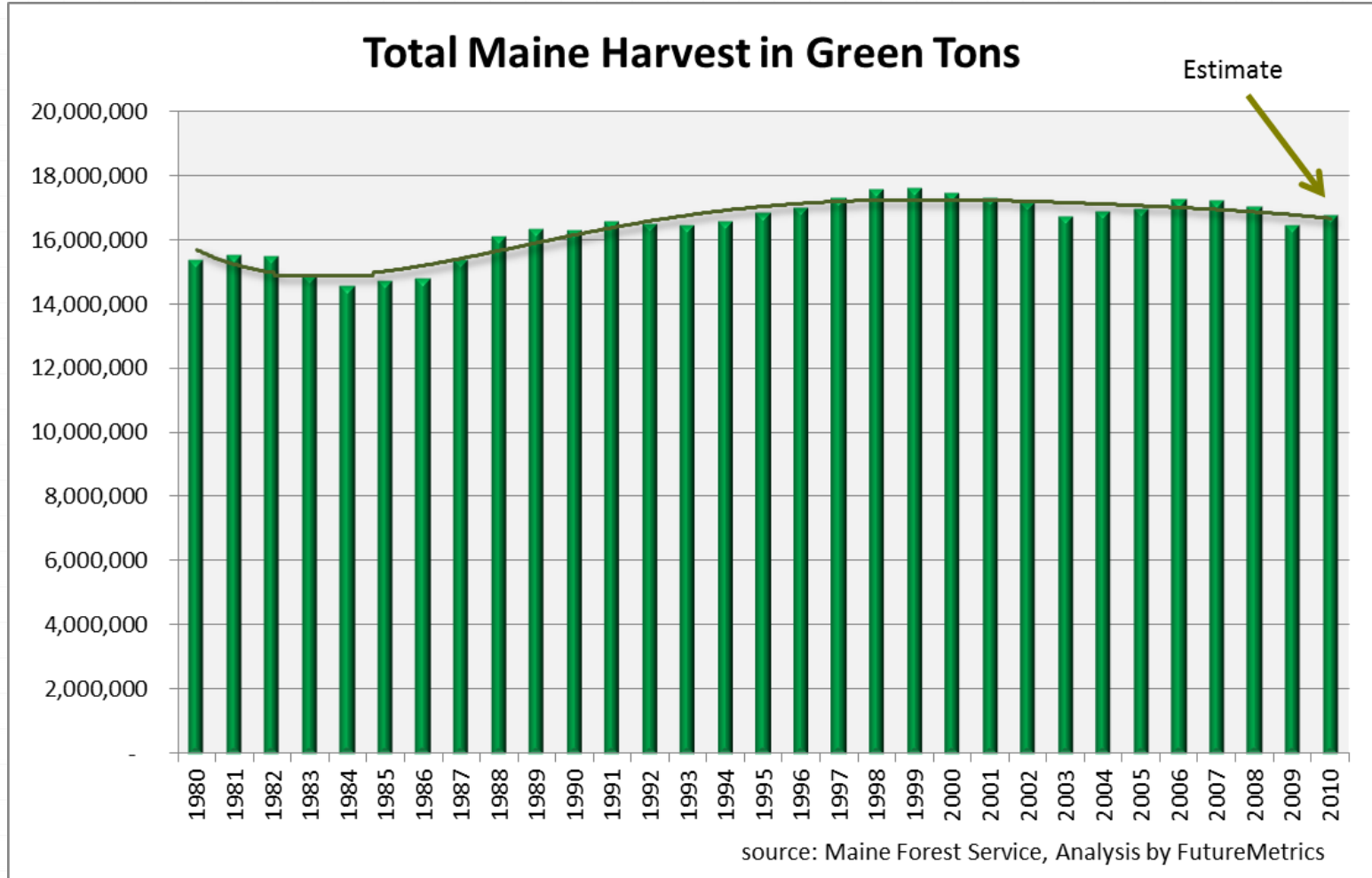
This is due to three effects (they all have direct and multiplier effects):

- Money spent on fuel stays in the regional economy,
- Lower cost fuel releases money for investment and consumption,
- The supply chain for regionally produced fuels will create jobs.

How much of the Northeast can be converted depends on the **SUSTAINABLE** quantity of biomass.

- What is the SUSTAINABLE annual harvest from timberland?
- How much idle cropland and pastureland could be used for energy crops?
- What uses other than biomass thermal applications of the sustainable harvest have a higher value added for the forest products industry?

Biomass harvest for heating MUST be sustainable



Wood pellet production for domestic use in the northern states to replace heating oil.

Modern wood pellet boilers are common in Europe and are growing in the use in the US.

They are fully automatic, clean, and reliable.



The image shows a screenshot of the Maine Energy Systems (MESYS) website. The header includes the MESYS logo and navigation links for HOME, PRODUCTS, PELLETS, PLANNING, and PR. The main content area features a green forest background with the text: "Wood Pellet Boilers", "Maine Energy Systems offers wood pellet boiler systems for homes, businesses and institutions that will save you money over heating oil and propane while reducing your carbon footprint and our dependence on foreign oil.", "Renewable. Efficient. Environmentally Sound.", and "FEATURED: AutoPellet Series Boilers >>". Two AutoPellet Series Boilers are displayed in the foreground, one green and one white.



What is a Wood Pellet?

Wood pellets are refined and highly densified wood in a uniform pellet shape.

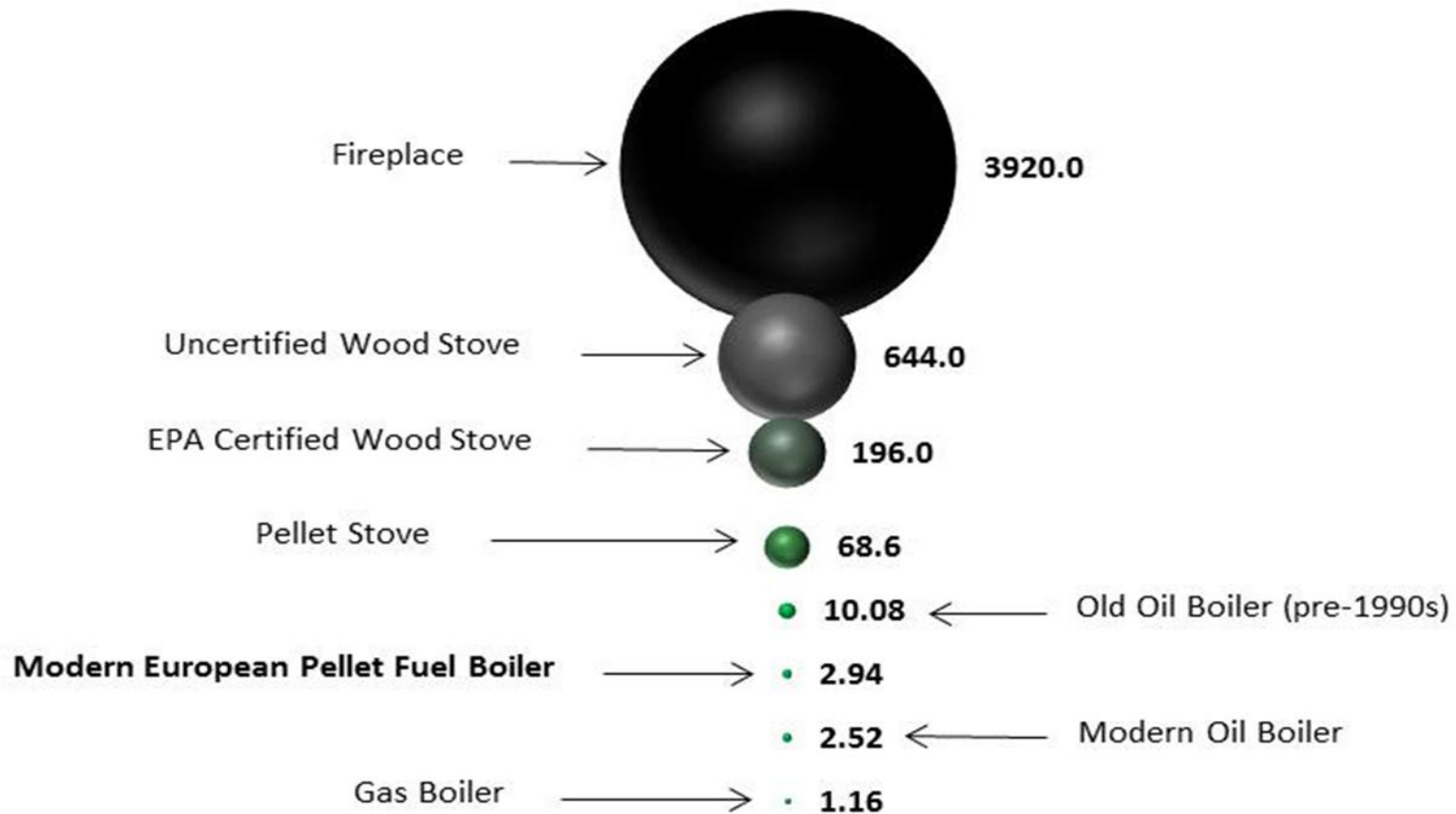
Their use is common in Europe where hundreds of thousands of homes have home heating systems fueled with wood pellets.



Modern Wood Pellet Boilers are CLEAN and completely automatic

Total Pounds of Particulate per Year

normalized to the equivalent of the BTU from 1000 gallons of heating oil per year



Source: USEPA , Maine Energy Systems, OkoFEN Eco Engineering GmbH, 2010, analysis by FutureMetrics

To put this into perspective, let's compare using one cord of wood in a fireplace and one cord of wood's worth of energy from wood pellets in a modern pellet boiler.

375 pounds



Particulate emissions (SMOKE!)



0.28 pound



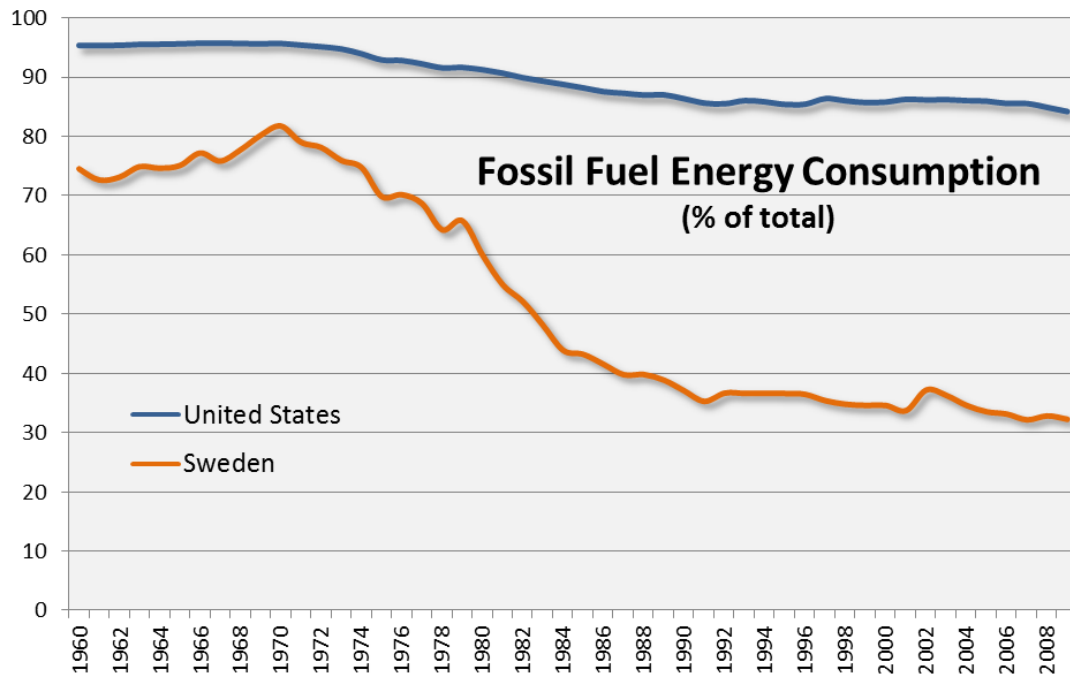
What is the Future?

Europe is more than a decade ahead

Total Renewable Energy Production in Europe in 1000's of tons of oil equivalent (TOE)												
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Solar energy	0.4%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.7%	0.8%	0.9%	1.2%	1.6%
Biomass	60.7%	60.5%	60.1%	59.2%	62.3%	64.1%	63.8%	65.4%	66.0%	66.8%	66.6%	66.8%
Geothermal Energy	4.5%	4.7%	4.8%	4.5%	4.8%	5.0%	4.8%	4.6%	4.5%	4.3%	4.0%	3.9%
Hydro power	31.3%	30.9%	30.8%	31.5%	27.2%	24.8%	24.5%	22.4%	21.4%	19.8%	19.6%	18.7%
Wind power	1.0%	1.3%	1.9%	2.3%	3.1%	3.6%	4.5%	5.2%	5.7%	6.7%	7.2%	7.6%

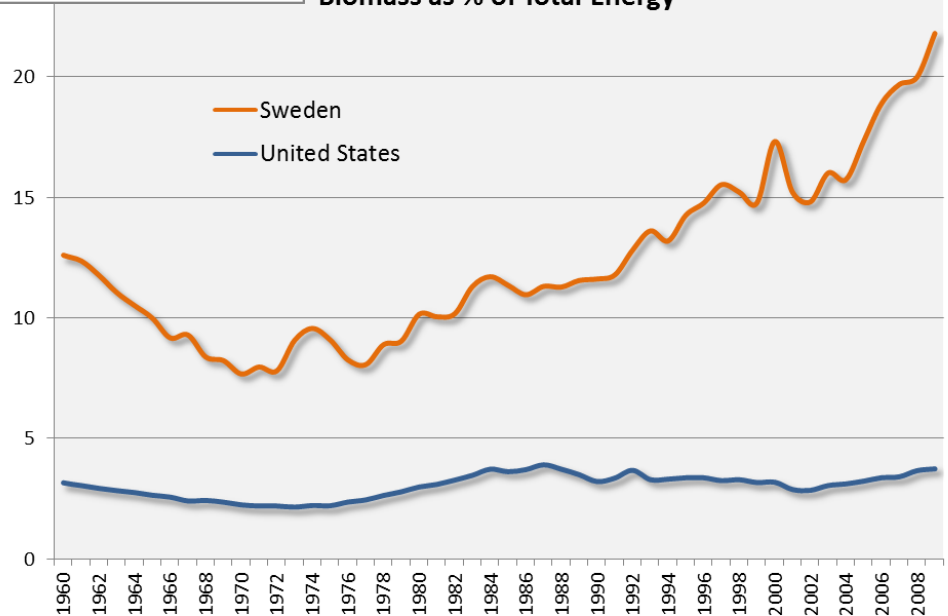
source: Eurostat Energy Statistics, 2011

A case study - Sweden

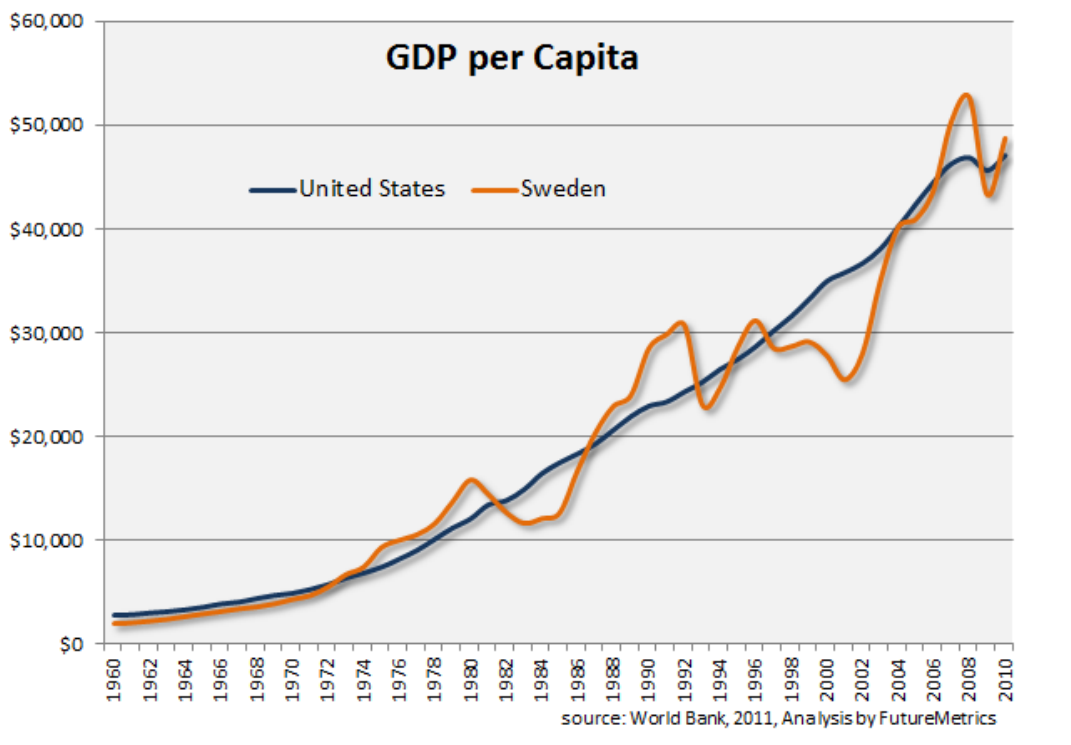


source: World Bank, 2011, Analysis by FutureMetrics

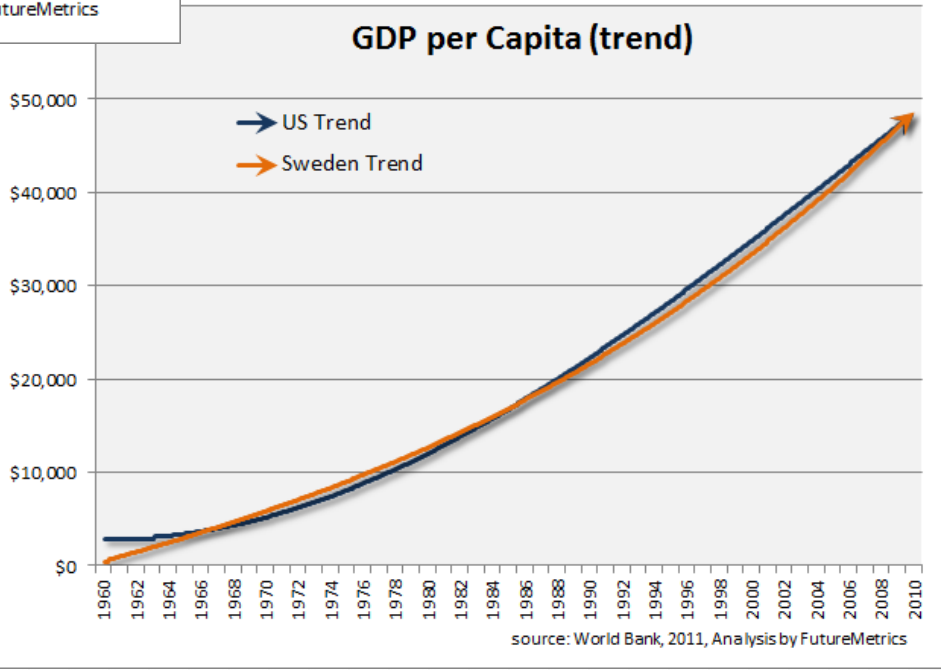
Biomass as % of Total Energy



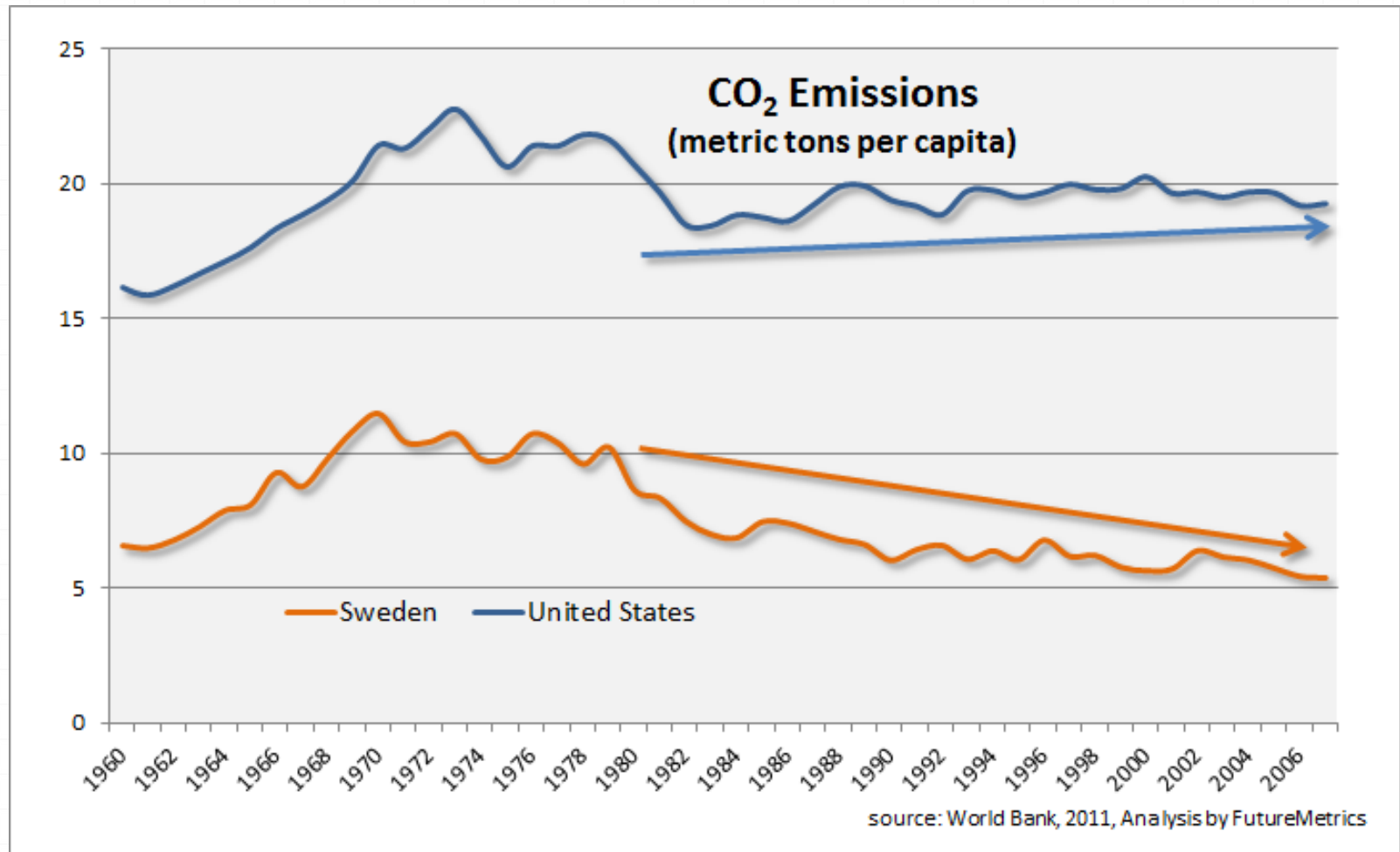
source: World Bank, 2011, Analysis by FutureMetrics



The smoothed trend in GDP per capita is virtually identical.

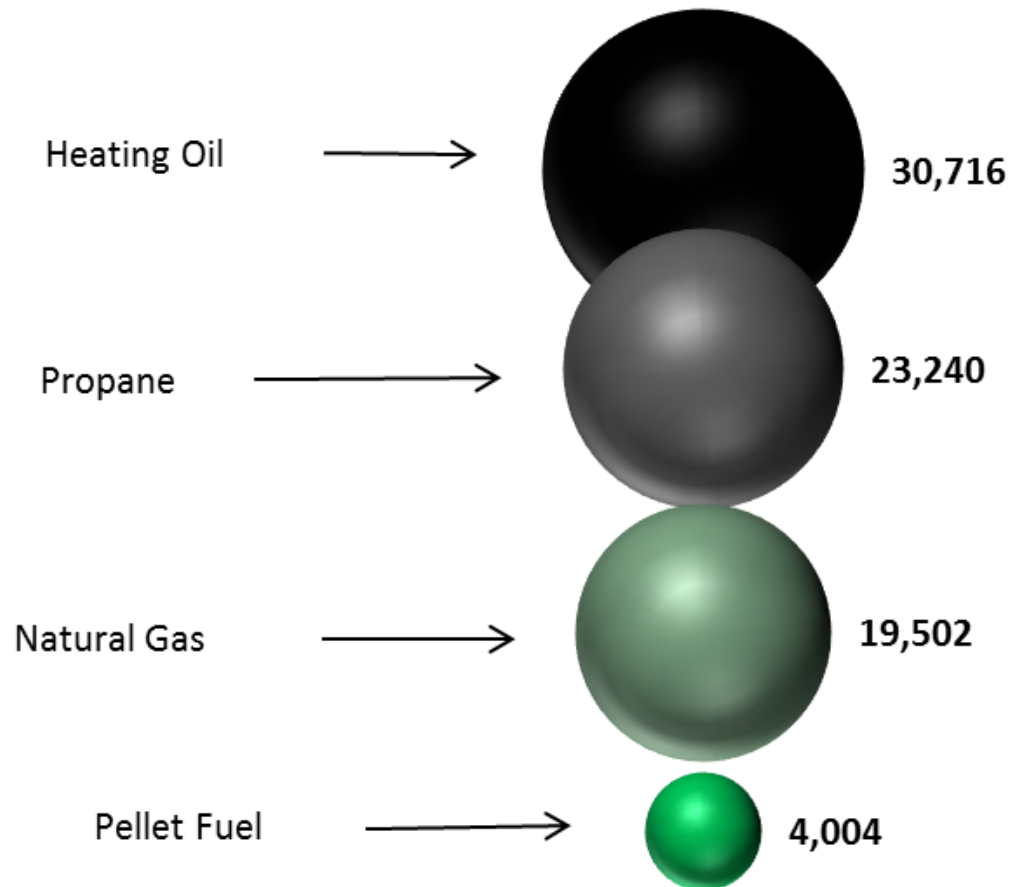


And as an added benefit....



Total Pounds of CO₂ per Year

normalized to the equivalent of the BTU from 1000 gallons of heating oil per year



Life Cycle Assessment of Pellet Burning Technologies, Thomas Willem de Haan, Univ. of Amsterdam, June 2010.- Wood pellets are not entirely carbon neutral because some fossil fuel is required for the harvesting of trees and shipment. Extraction, refining, and transport emissions are included for each of the four fuel sources.

The Northeast has all the right stuff to emulate the European nations that already use biomass for heating and combined heat and power.

We have the potential to sustainably make our fuel in sufficient quantities to heat a significant proportion of our homes, schools, and businesses with pellet or chip boilers; either as stand alone systems or in district heating systems.

The foundations for an energy independent future are in place:

- Fuel refineries exist (some call them pellet factories) and more can be built;
- European style pellet boilers and bulk fuel delivery are here now (see www.MaineEnergySystems.com);
- Many schools, buildings, and homes have already converted to pellet or chip systems and many more will;
- The forest products sector has a long history in the NE and can, as pulp and paper declines, supply the raw materials for fuel from our own region;
- There are hundreds of thousands of acres of fallow agricultural land that can grow fast rotation fuel crops.

The penalty for failure is dire!

When oil prices rise and push heating oil from the current \$3.65/gallon to \$4.50/gallon, massive numbers of jobs will be lost if the northeast does not end its heating oil addiction.

#2 Distillate Fuel use in Residential, Commercial, and Industrial (not Transportation)	Average Gallons per Year	Money Exported from Regional Economy at \$3.65/gal	Money Exported from Regional Economy at \$4.50/gal	Annual Increased Loss of Money if Heating Oil goes to \$4.50/gal	Permanent Job Destruction
Connecticut	720,225,000	\$2,050,480,575	\$2,527,989,750	(\$477,509,175)	-22,892
Maine	376,200,000	\$1,071,041,400	\$1,320,462,000	(\$249,420,600)	-14,948
Massachusetts	915,750,000	\$2,607,140,250	\$3,214,282,500	(\$607,142,250)	-31,018
New Hampshire	368,100,000	\$1,047,980,700	\$1,292,031,000	(\$244,050,300)	-13,687
New York	2,947,500,000	\$8,391,532,500	\$10,345,725,000	(\$1,954,192,500)	-96,649
Pennsylvania	1,377,750,000	\$3,922,454,250	\$4,835,902,500	(\$913,448,250)	-46,129
Rhode Island	166,400,000	\$473,740,800	\$584,064,000	(\$110,323,200)	-5,490
Vermont	180,900,000	\$515,022,300	\$634,959,000	(\$119,936,700)	-7,037
	7,052,825,000	\$20,079,392,775	\$24,755,415,750	(\$4,676,022,975)	-237,850



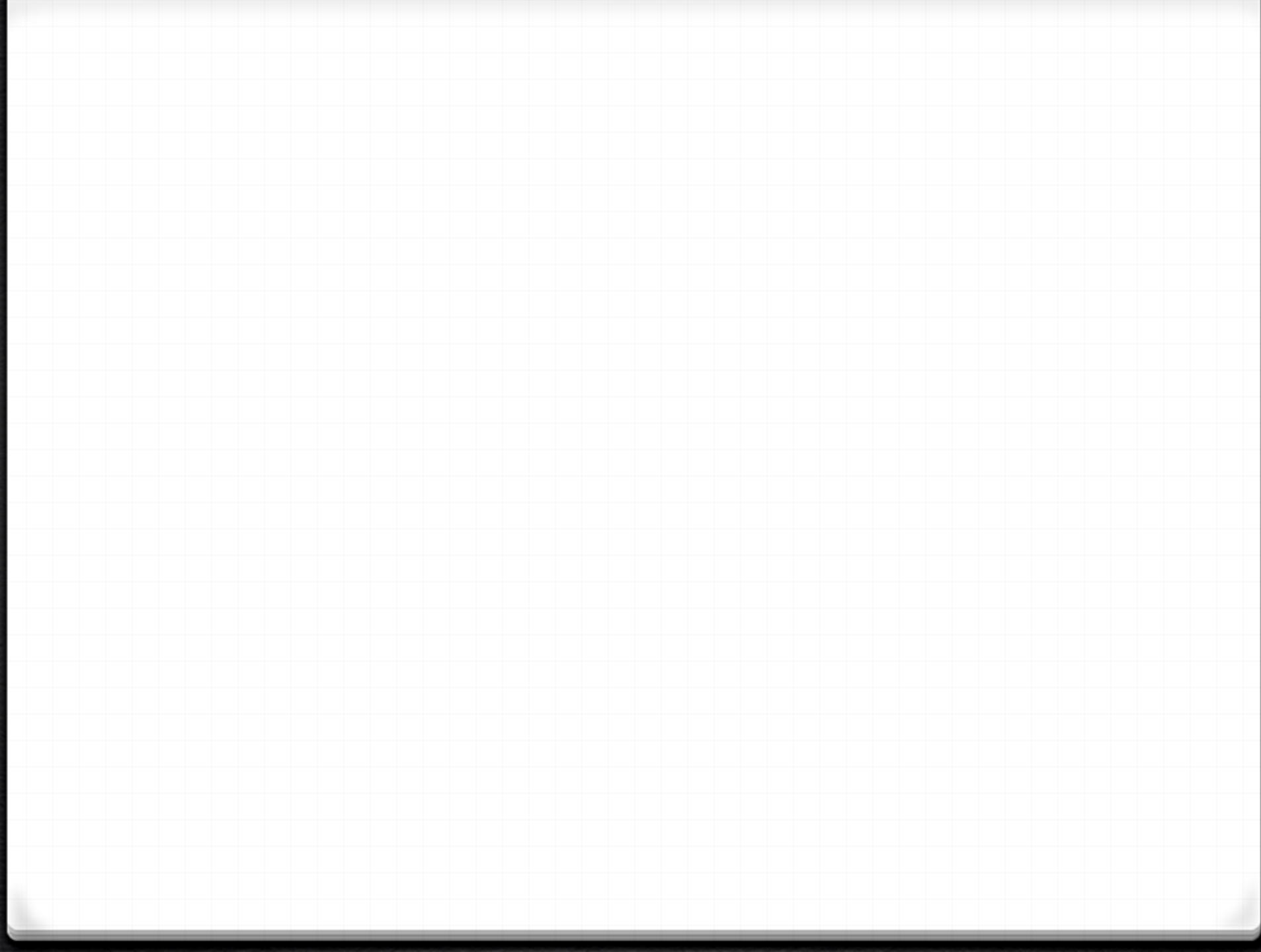
Using renewable *sustainable* biomass for
heat is
a *triple-E solution*.

Economic Growth
Energy Independence
Environmental Stewardship

Thank you – William Strauss

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Why the Combustion of Wood from Sustainably Managed Forests is Carbon Neutral

Suppose we have a biomass fueled central heating plant for which 3650 tons per year are needed. That is 10 tons per day every day of the year.

But suppose that we impose a very important constraint on the use of biomass for energy: all feedstock has to come from forests that are managed sustainably.

Granted, the term “sustainable” is open to a range of interpretations. But in this case let’s follow FSC or SFI guidelines; amongst which is the requirement that that the net stock of biomass on the certified landscape is not depleted.

(The majority of Maine’s 18 million acres of managed forestland is certified by either SFI or FSC or both.)

See <http://www.fsc.org/> or <http://www.sfiprogram.org/>

A rule of thumb is that a northeastern forest can sustainably produce about one ton of new growth per acre per year. That means that the 3650 tons per year of biomass needed to fuel our CHP plant will need 3650 acres of forestland if we require that the forest does not shrink over time.

It is important to realize that our 3650 ton per year CHP plant does not receive 3650 tons in one delivery and does not release 3650 tons of wood's worth of carbon in one lump either. In fact, the forest products industry can be characterized as a just-in-time manufacturing system.

For our CHP plant, 10 tons per day are sustainably harvested and delivered off of our 3650 acre FSC or SFI certified forest.

So the carbon released into the atmosphere that day is from 10 tons of wood. The atmosphere “sees” new carbon.

But during that same day on our 3650 acre plot, 10 new tons of wood grow and sequester the amount of carbon that was just released.

Combustion of wood from a sustainably managed forest is carbon neutral.