Issues in Biomass Thermal

An Overview

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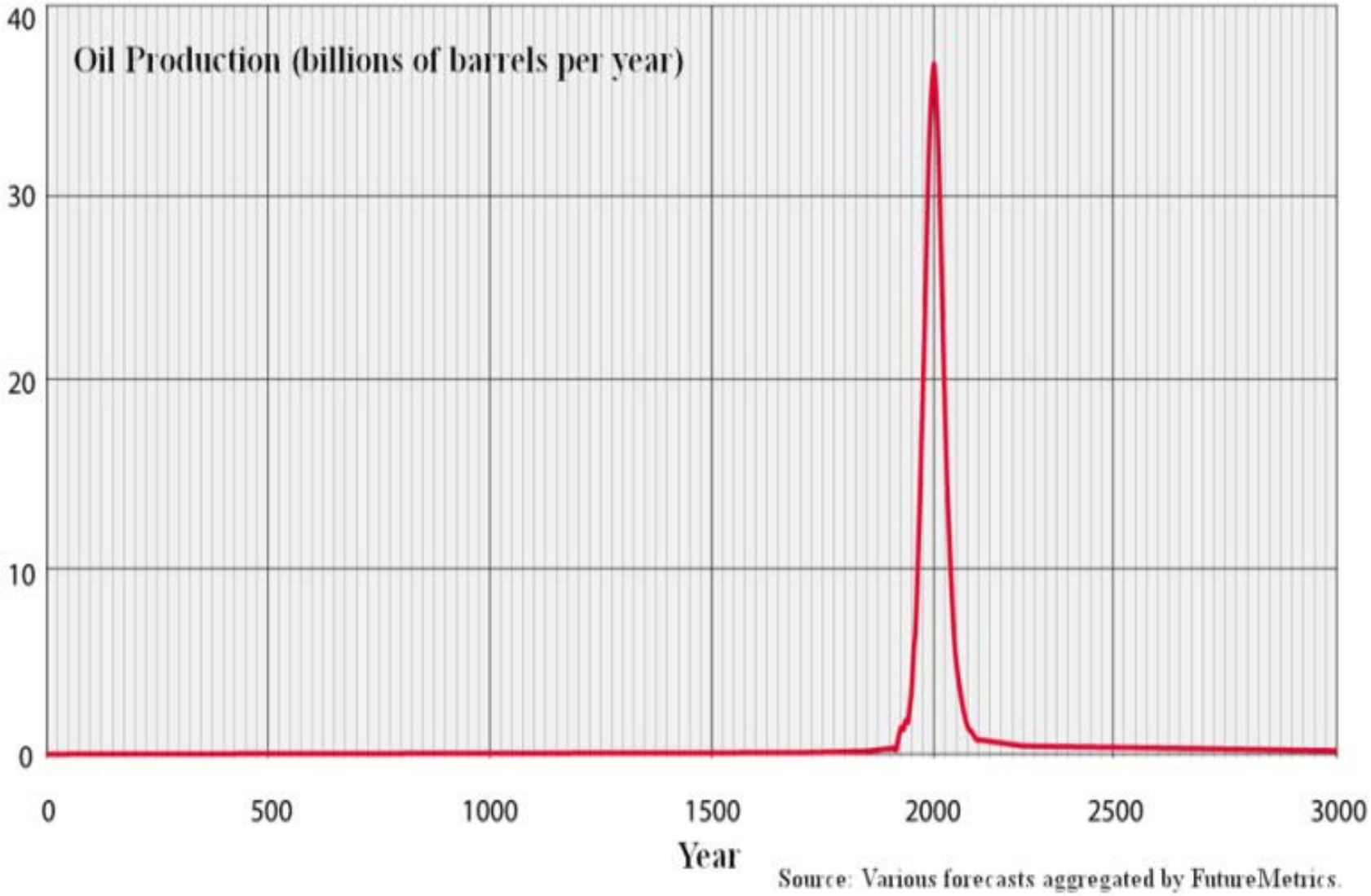
Wood to Energy Across the Northern Tier and Beyond
January 12, 2012
Manchester, New Hampshire

Why should we care about renewable energy?



United States' "Energy Policy"

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 not 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**

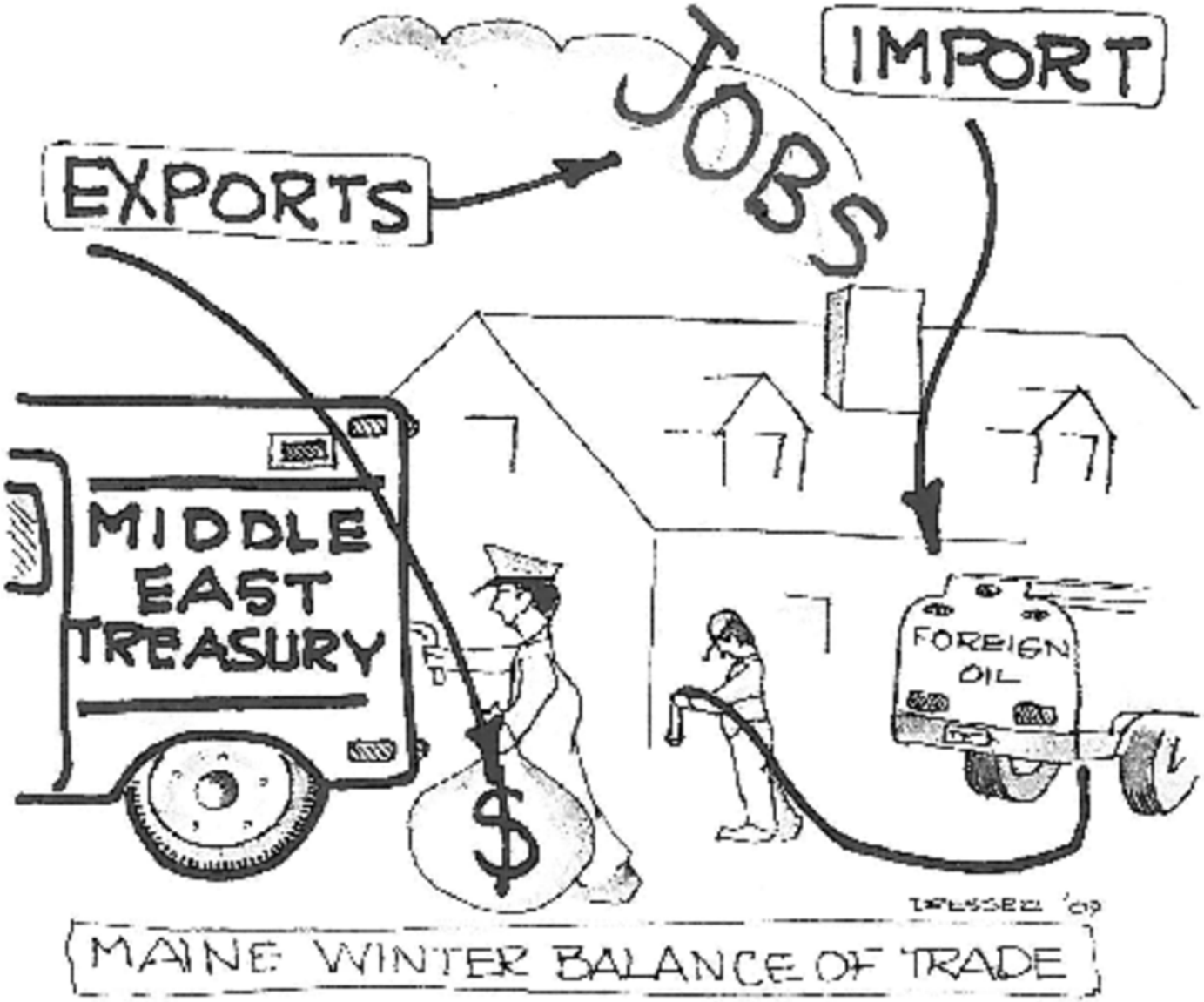
Source: US Energy Information Administration, 2010, US Census, analysis by FutureMetrics

*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


EXPORTS
JOBS
IMPORT
MIDDLE EAST TREASURY
FOREIGN OIL
$
MAINE WINTER BALANCE OF TRADE

Biomass Thermal

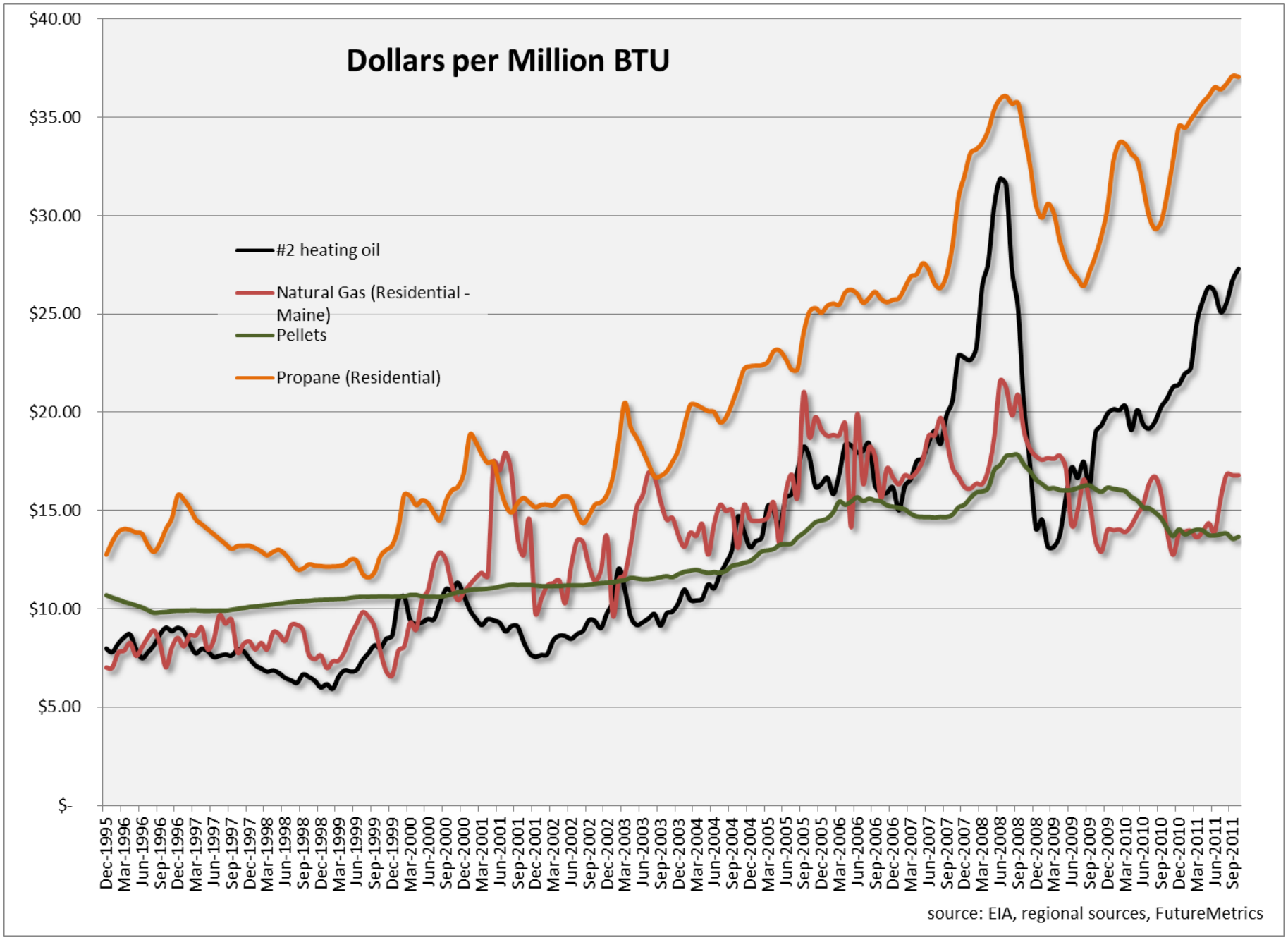
- Using wood to meet space heat and process heat needs a highly efficient use of wood fuels
- Long established practice in forest products industry; is cordwood and chips – now moving beyond (pellets, densified wood, torrefaction)
- Residential, commercial, institutional, industrial
- National "Fuels for Schools" Program
- New business models emerging
- ***An area with major growth potential***
- Real issues with emissions, particularly PM
- Fuel specifications / delivery requirements often more restrictive than biomass electric (no secondary screening)

Biomass Thermal Fuels

- Tend to be modest volumes
  - Price takers, not market makers
  - Can utilize infrastructure built to serve others (e.g. pulp mills or biomass electric)
- Can have specialized delivery requirements
  - Self-unloading trucks, high fuel spec
- No “single source” for biomass fuel information – developing industry
- Can be forest-derived, sawmill residue, urban wood, processed fuel (e.g., pellets), etc.

Biomass Thermal Beats Oil…

- On a BTU basis, biomass thermal competes well with oil (and propane and even reesidential natural gas!)
- The following charts show wood pellets as a cost-effective alternative to traditional fuels; the savings can be even greater for chips
- Often <u>the barrier to biomass thermal use is capital</u> – the expense associated with putting in a new boiler or other heating system


Dollars per Million BTU
$40.00
$35.00
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00
$-
#2 heating oil
Natural Gas (Residential - Maine)
Pellets
Propane (Residential)
Dec-1995
Mar-1996
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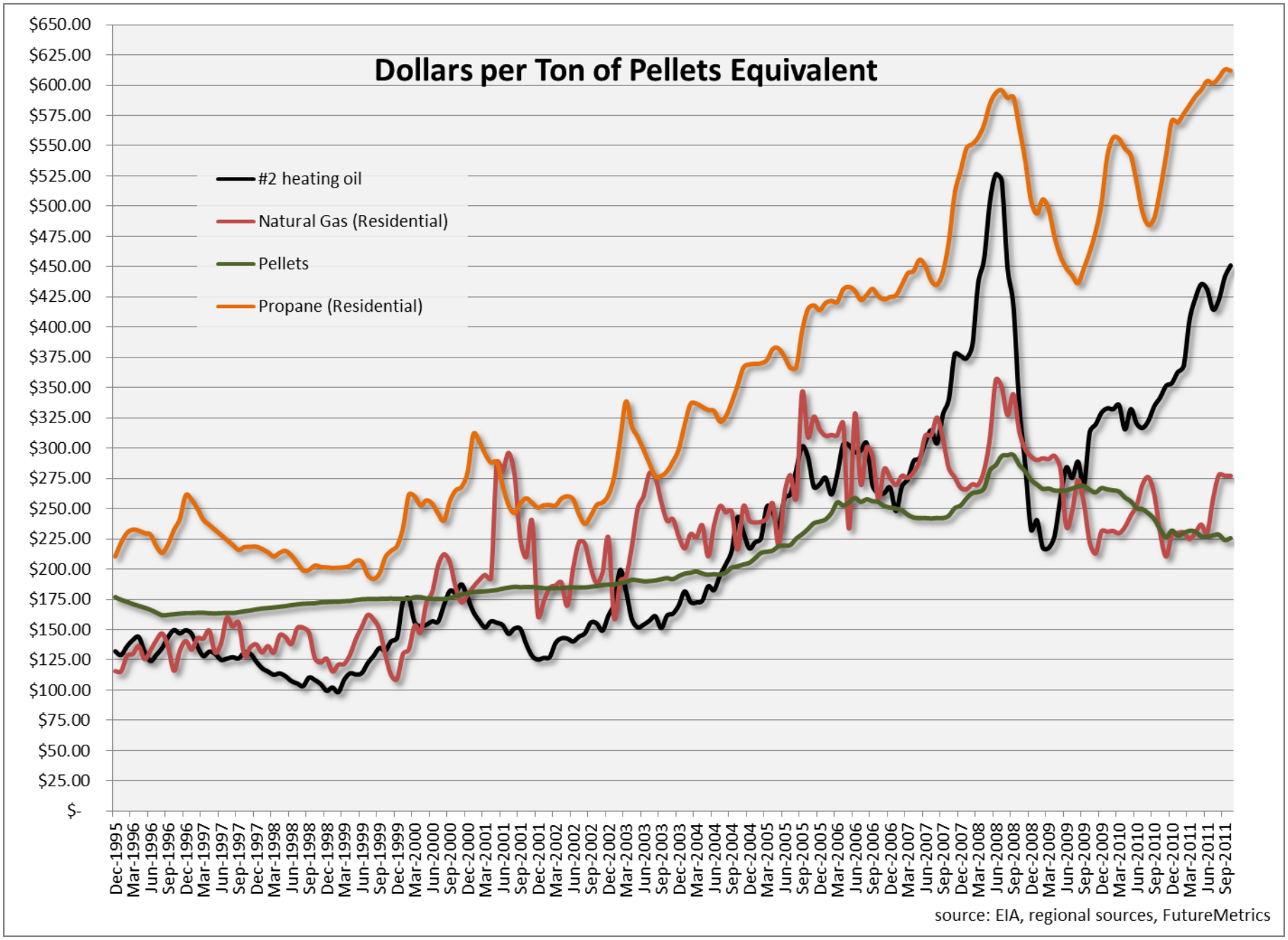
Dec-2010
Mar-2011
Jun-2011
Sep-2011
source: EIA, regional sources, FutureMetrics


Dollars per Ton of Pellets Equivalent
#2 heating oil
Natural Gas (Residential)
Pellets
Propane (Residential)
$650.00
$625.00
$600.00
$575.00
$550.00
$525.00
$500.00
$475.00
$450.00
$425.00
$400.00
$375.00
$350.00
$325.00
$300.00
$275.00
$250.00
$225.00
$200.00
$175.00
$150.00
$125.00
$100.00
$75.00
$50.00
$25.00
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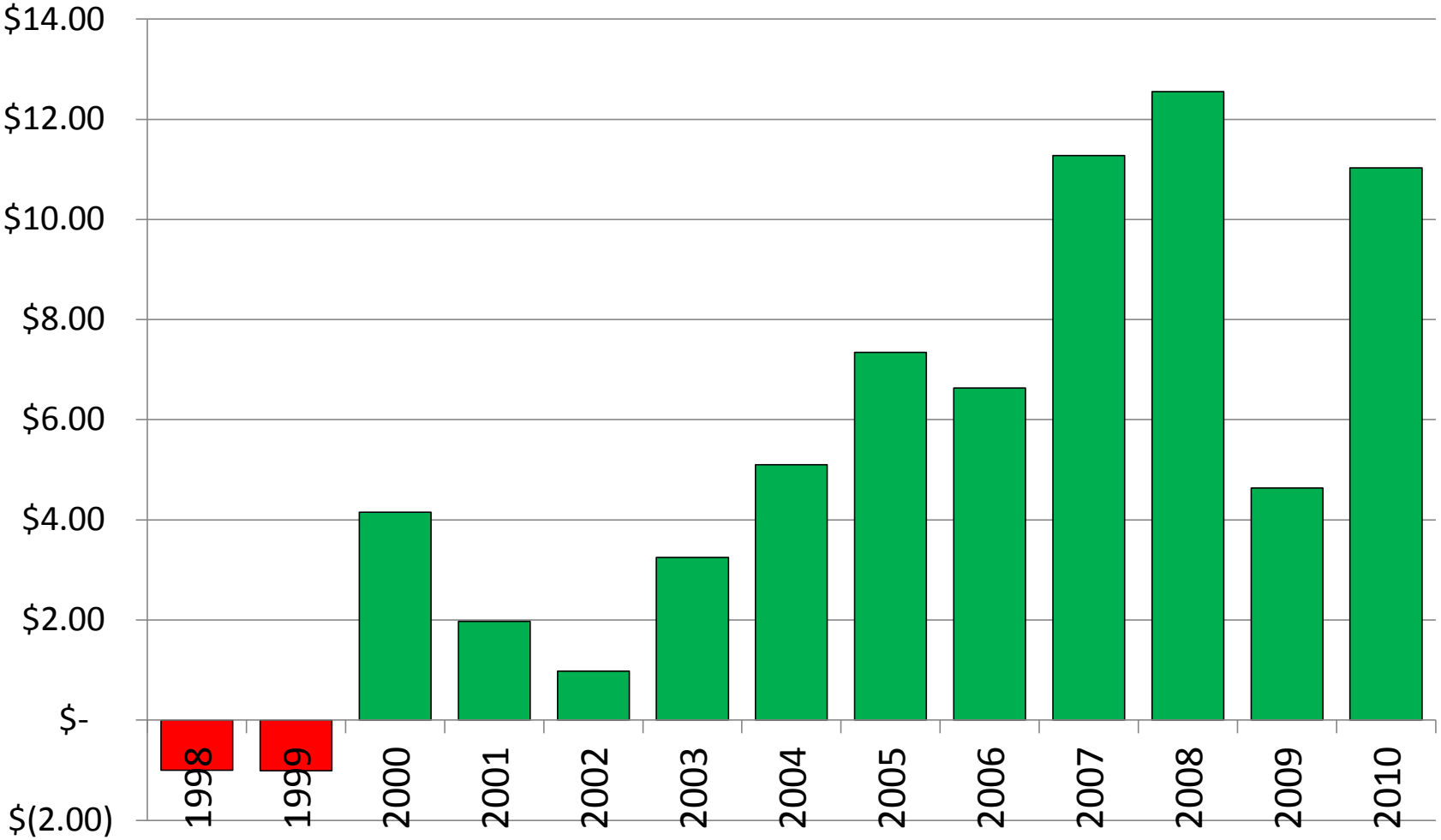
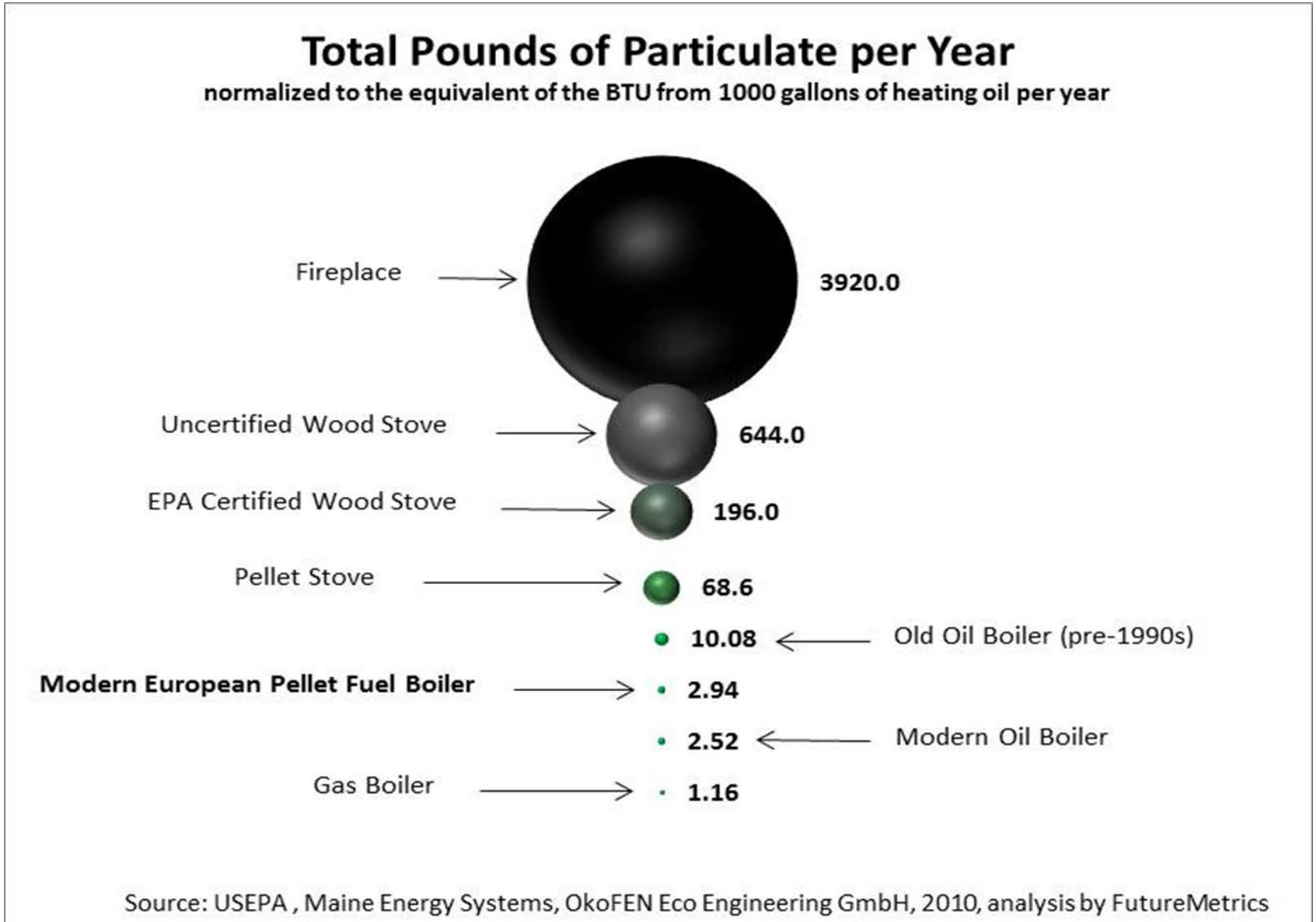
Sep-2011
source: EIA, regional sources, FutureMetrics

Wood Pellets Provide Cost Savings Compared to Home Heating Oil
Cost Savings per MMBTU



Modern Wood Pellet Boilers are CLEAN and completely automatic



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

375 pounds

Particulate emissions (SMOKE!)

0.28 pound

Biomass Thermal Geography

- The following maps show
  - Percent of homes using oil as a primary heating source
  - Homes with oil or propane as primary heat per square mile (for bulk delivery economics)

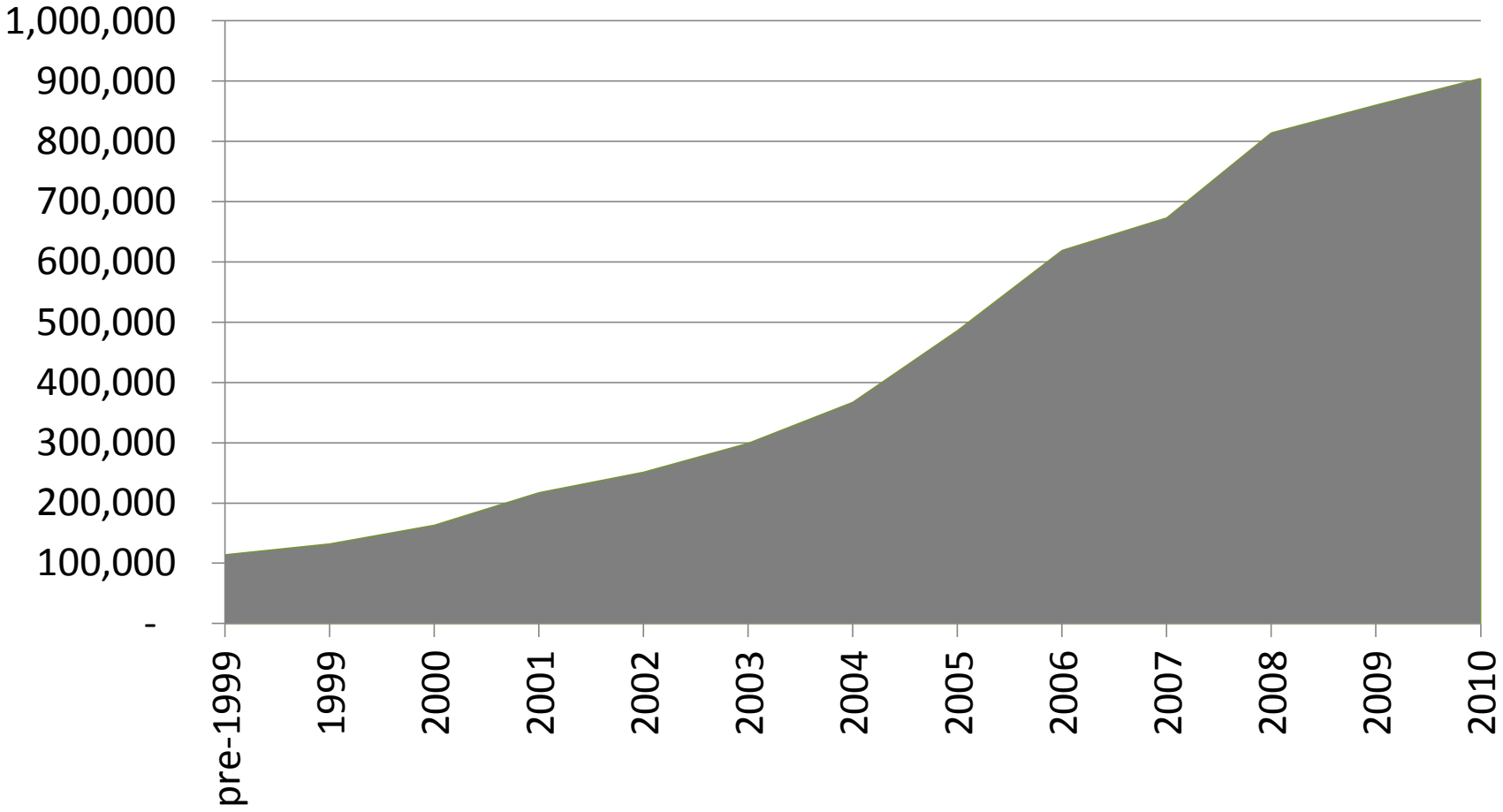
Percent of Homes Using Oil as a Primary Heat Source

Homes with Oil or Propane as Primary Heat Source Units per Square Mile

Pellets are Simple Way to Access and Use Biomass Fuel

- Heating options include boilers (whole home) and stoves (supplemental heat)
- Moving from residential to commercial and larger applications
- Provides a refined fuel with modest consumer involvement
- Potential for bulk delivery (or bagged for small scale consumers)

Stoves in Use (Cumulative) United States, 1999 - 2010



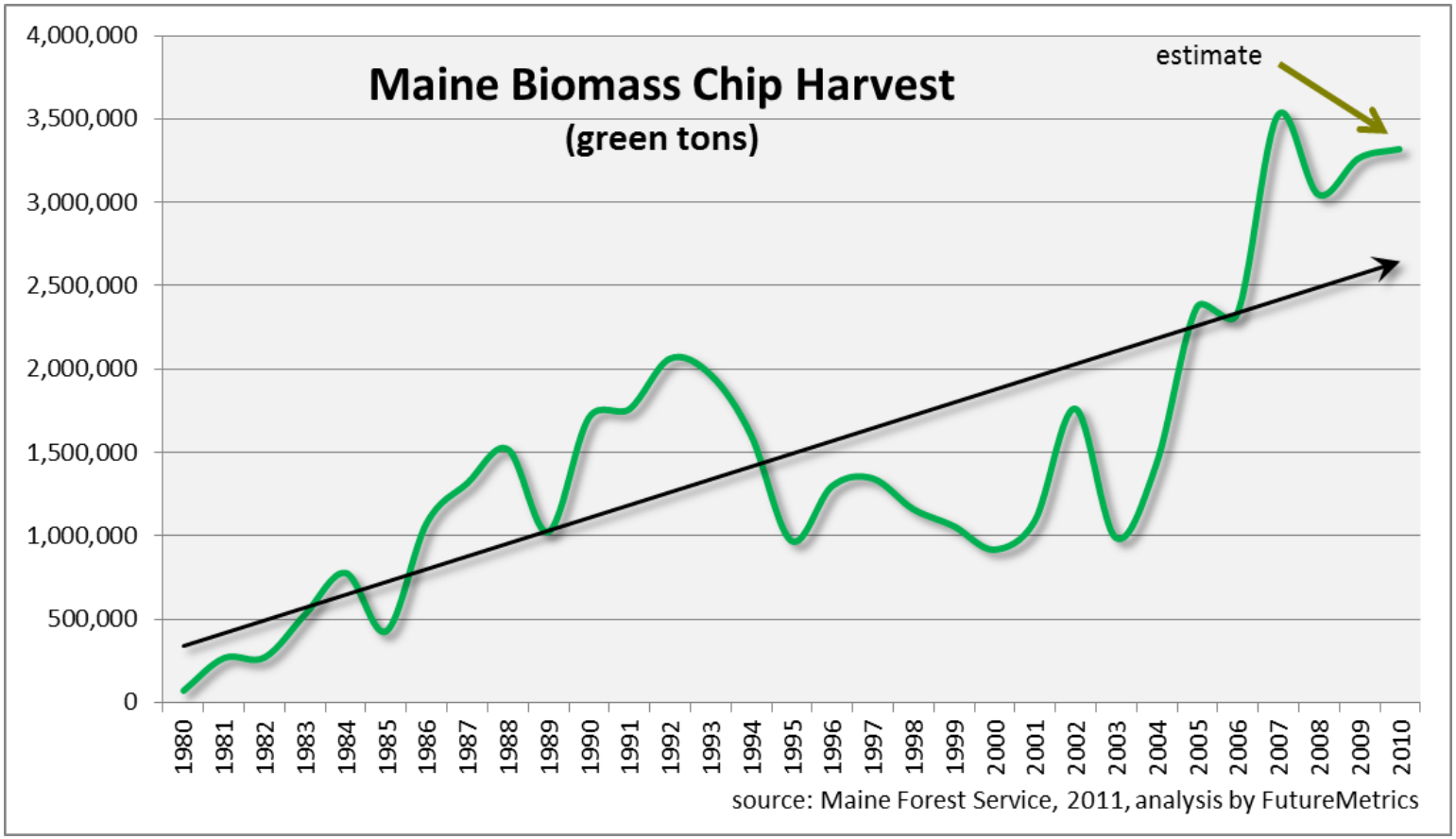
Using very conservative estimates for the quantity of sustainable biomass, if we assume that each state provides biomass for its own needs, the table below shows the conversion rates.

Maine is highest proportionally with 32.33% of its homes and businesses converting.

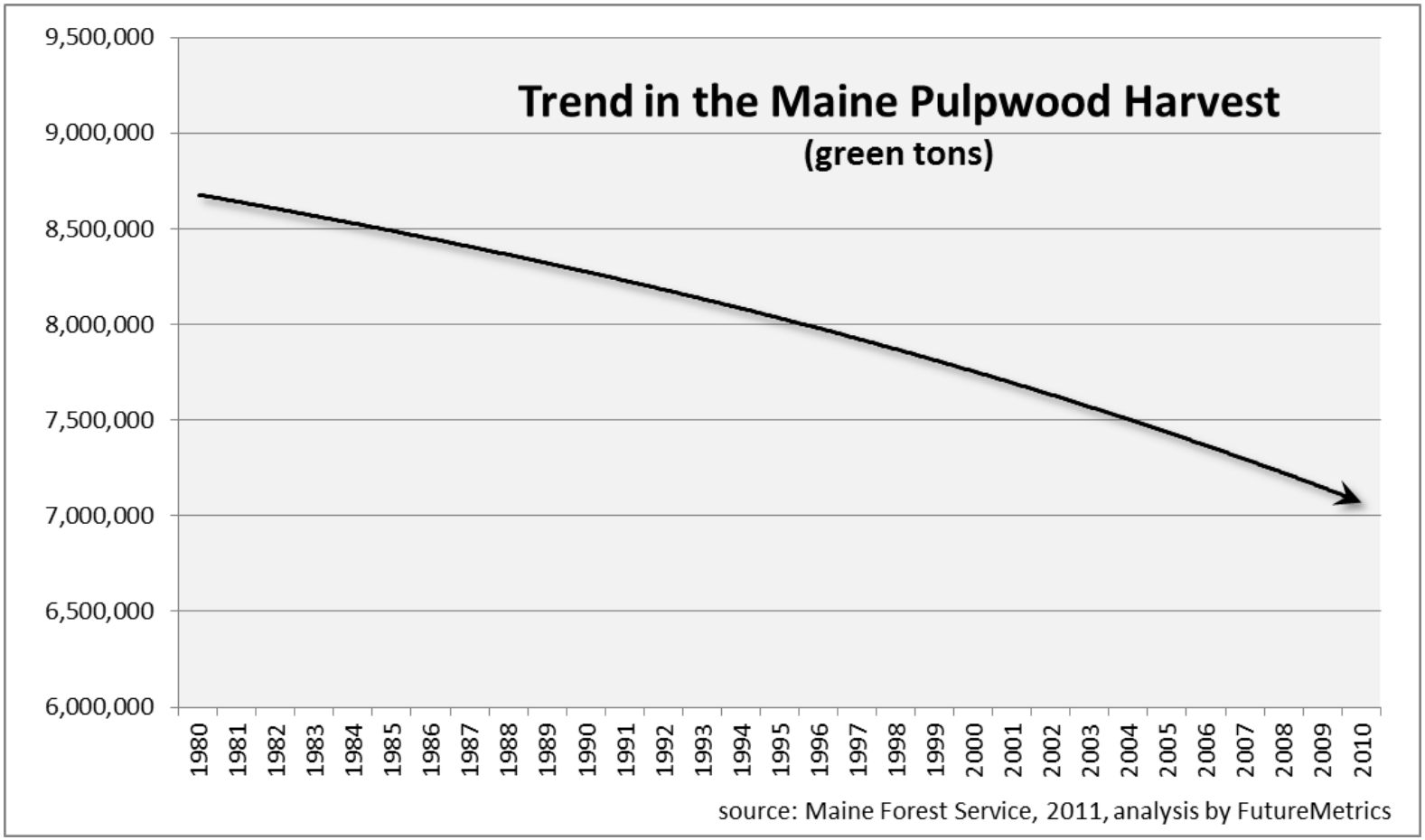
New York is highest in absolute numbers with 756,000 homes and businesses converting.

	Occupied Households	Number of Businesses	Total Number of Households and Businesses	Total Biomass Production per Year (green tons)	Total Number Converting in each State if there is NO Interstate Transport of Pellets (based on 8 tons per user per year average)	
Connecticut	1,323,000	394,651	1,717,651	454,000	1.65%	28,400
Maine	542,000	161,679	703,679	3,640,000	32.33%	227,500
Massachusetts	2,449,000	730,537	3,179,537	608,000	1.20%	38,000
New Hampshire	501,000	149,448	650,448	694,000	6.67%	43,400
New York	7,907,420	2,358,783	10,266,203	12,096,000	7.36%	756,000
Pennsylvania	4,877,735	1,455,028	6,332,763	6,694,000	6.61%	418,400
Rhode Island	405,000	120,812	525,812	166,000	1.97%	10,400
Vermont	251,000	74,873	325,873	1,434,000	27.50%	89,600
	18,256,155	5,445,811	23,701,966	25,786,000		1,611,700
					analysis by FutureMetrics	

The biomass for fuel harvest already is more than 3 million tons per year in Maine



Maine Pulpwood Harvest is Declining



New Solutions Coming to Market

This “Energy Box” from Maine Energy Systems can House Multiple Boilers and Bulk Pellet Storage, Providing a New Product for Schools, Mid-Size Commercial, etc.

Pneumatic Tankers Deliver Wood Pellets

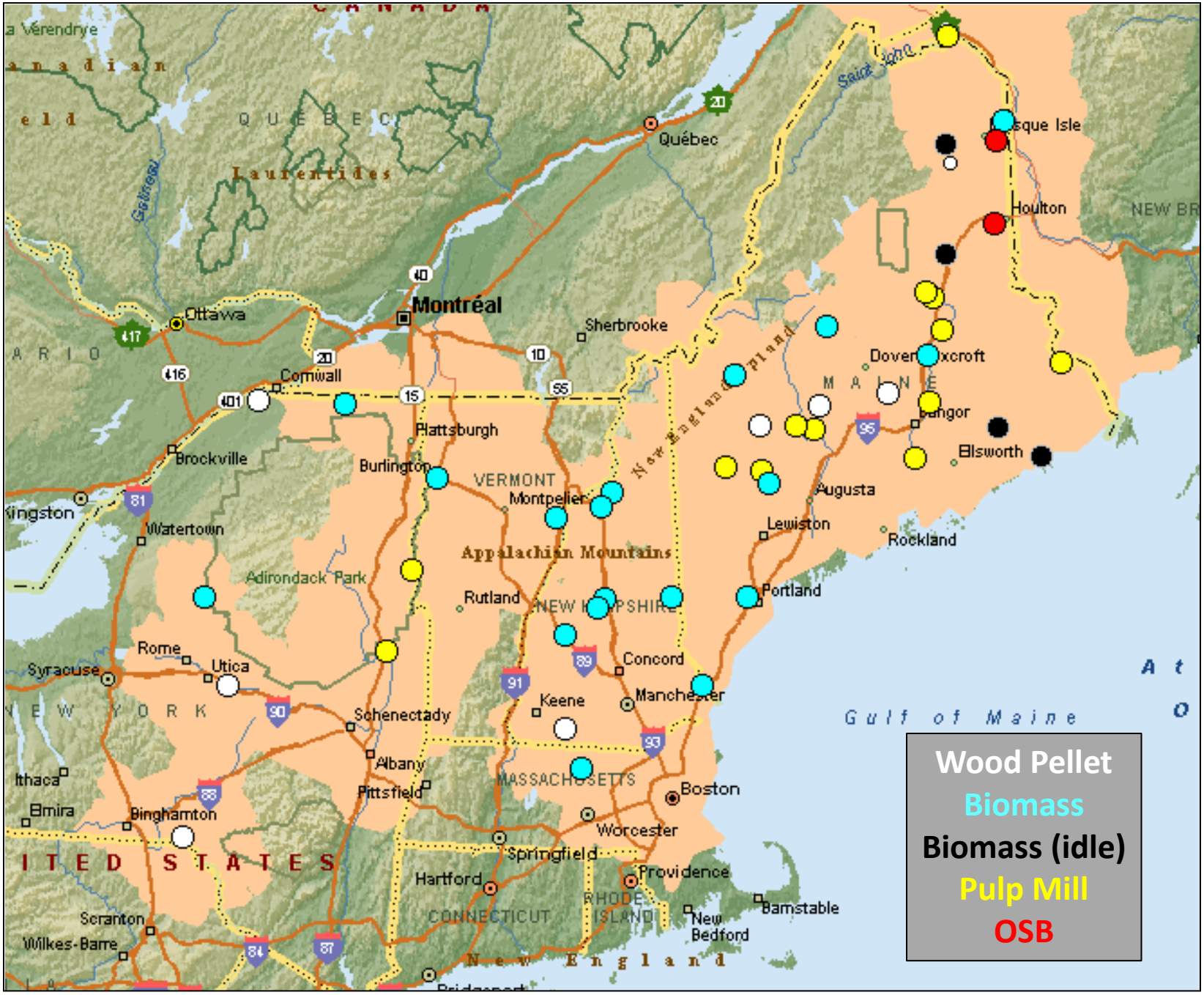
Pellet Handling at Jackson Lab (Bar Harbor, Maine)

Largest Single User of Wood Pellets in the United States

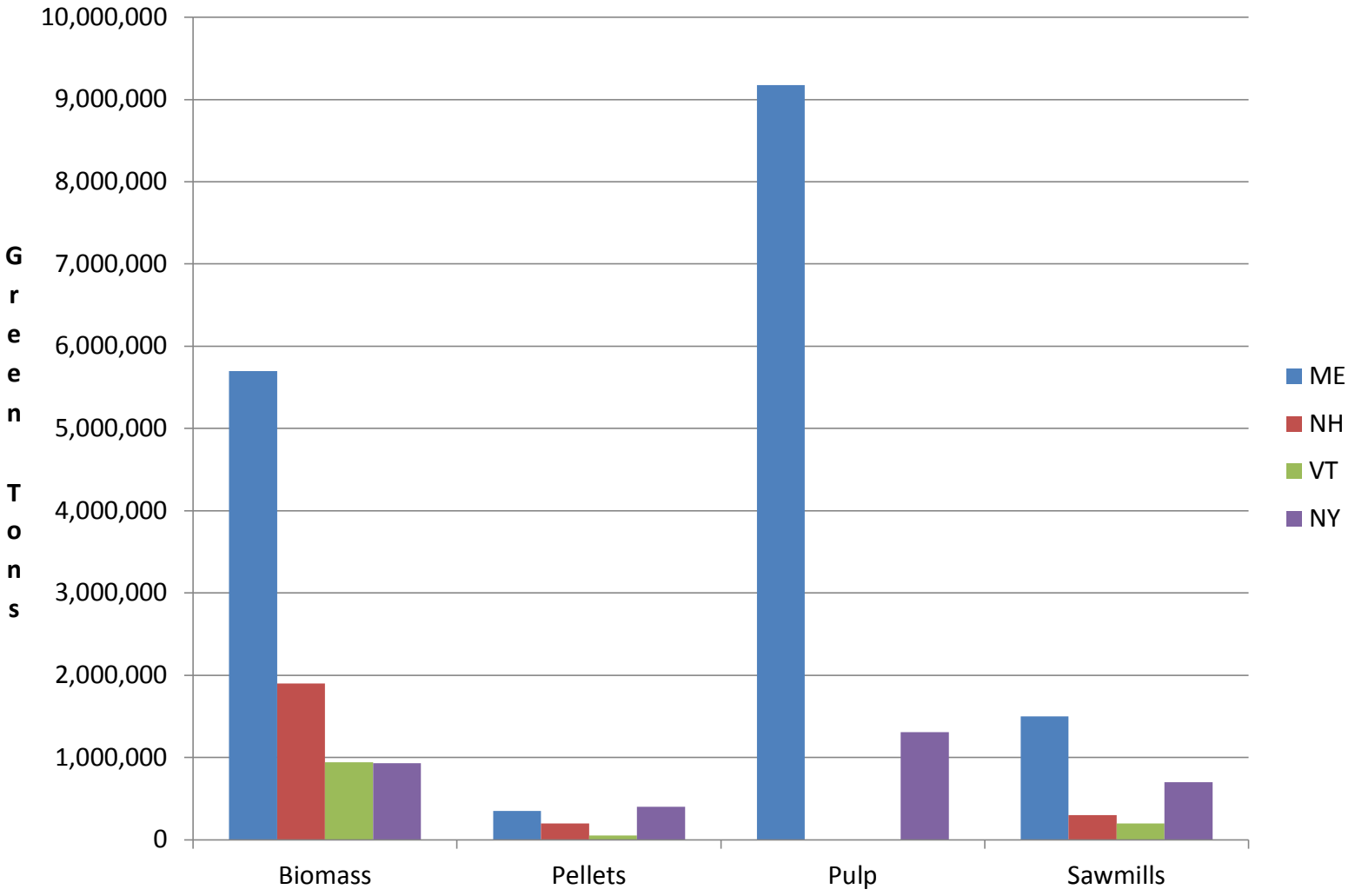
Fuel Unloading

Site mounted blower pressurizes tanker driving pellets through a flexible hose and up into the storage silo

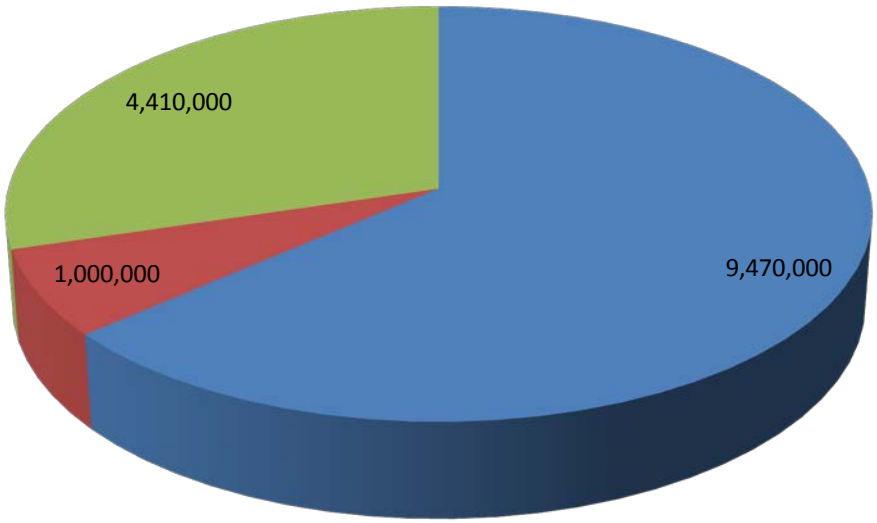
Biomass – for electric and thermal – is an important part of the New England forest economy


Wood Pellet
Biomass
Biomass (idle)
Pulp Mill
OSB
Montréal
Québec
Ottawa
Cornwall
Brockville
Watertown
Kingston
Plattsburgh
Burlington
Sherbrooke
VERMONT
Montpelier
Rutland
Appalachian Mountains
Adirondack Park
Rome
Utica
Syracuse
Schenectady
Albany
Pittsfield
Binghamton
Ithaca
Elmira
Scranton
Wilkes-Barre
Keene
Concord
Manchester
Portland
Lewiston
Augusta
Rockland
Bangor
Ellsworth
Houlton
Dover
Boston
Worcester
Springfield
Hartford
Providence
Barnstable
New Bedford
Gulf of Maine
Saint John
Laurentides
QUEBEC
MAINE
NEW YORK
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
New England

Wood Use in Maine, New Hampshire, New York and Vermont 2010



Energy Wood Use in Maine, New Hampshire, New York and Vermont 2010



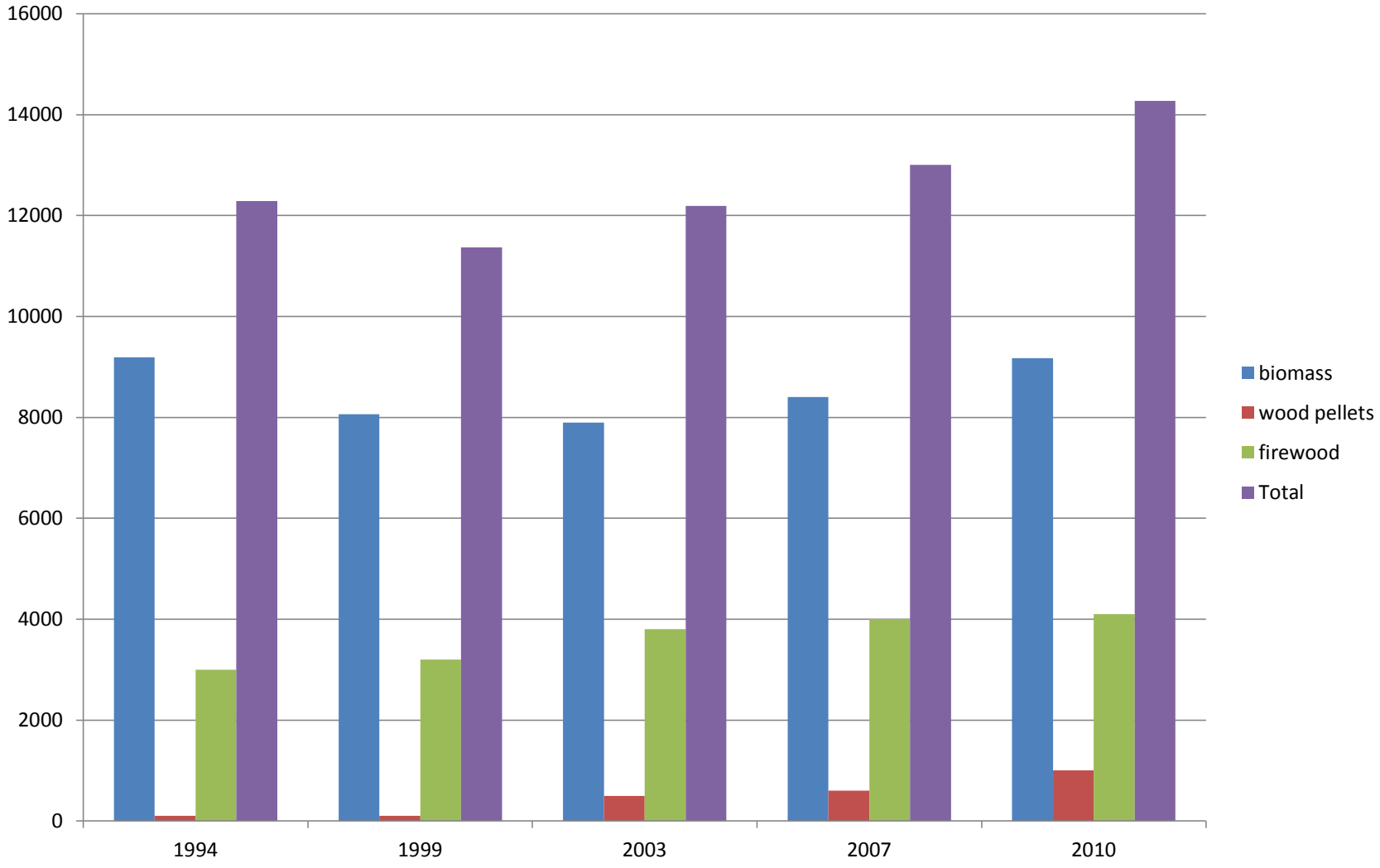
Biomass

Wood Pellets

Firewood

Green Tons

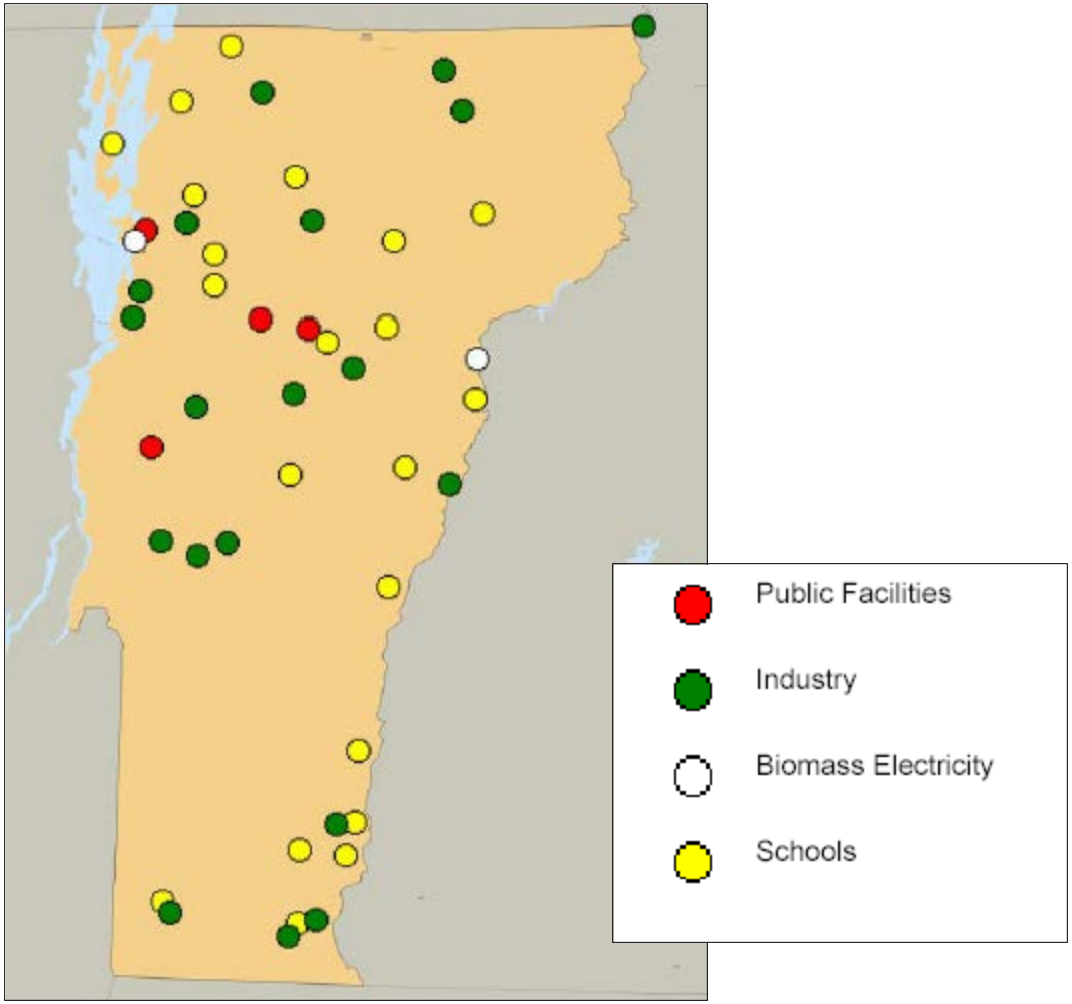
Energy Wood Use/Production in Maine, New Hampshire, New York and Vermont 2010



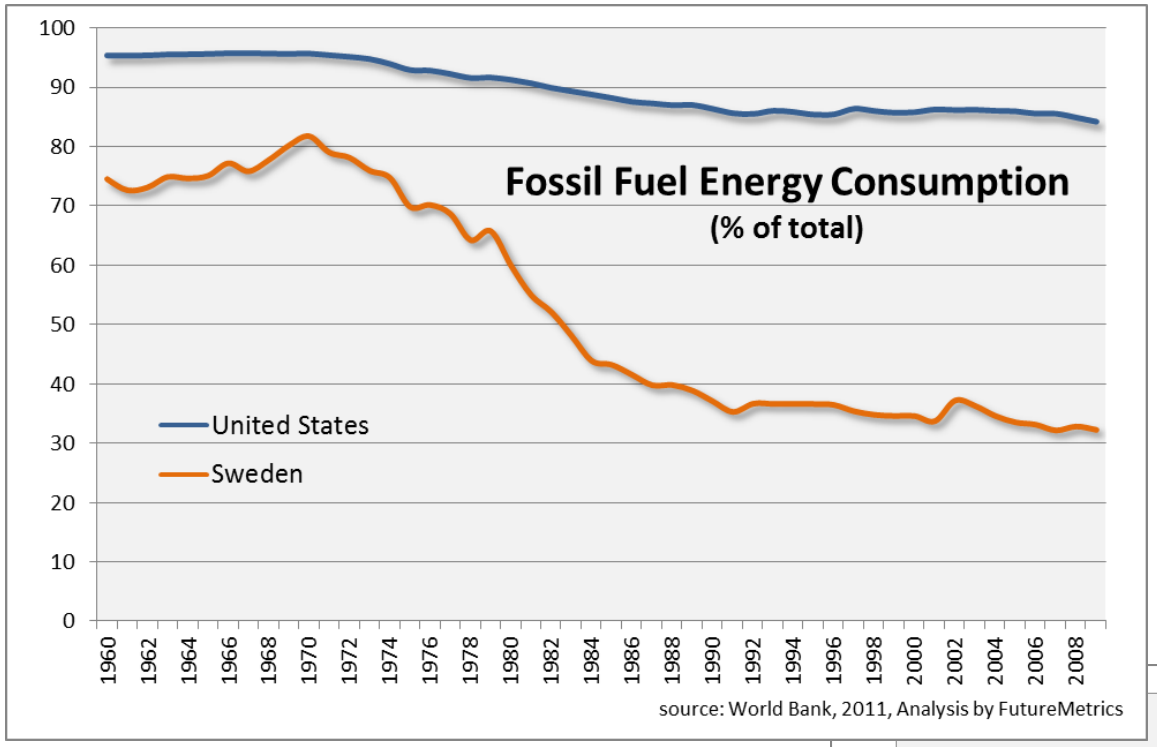
Biomass Chips are an Important Source of Fuel for Thermal Applications

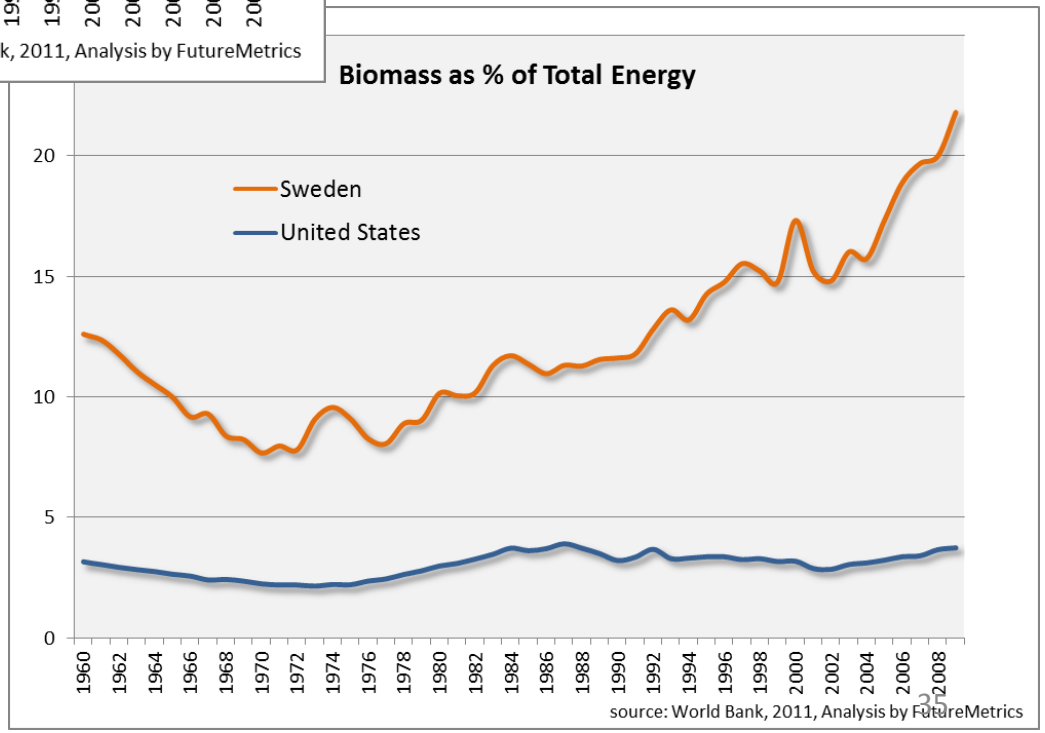
Biomass Facilities in Vermont

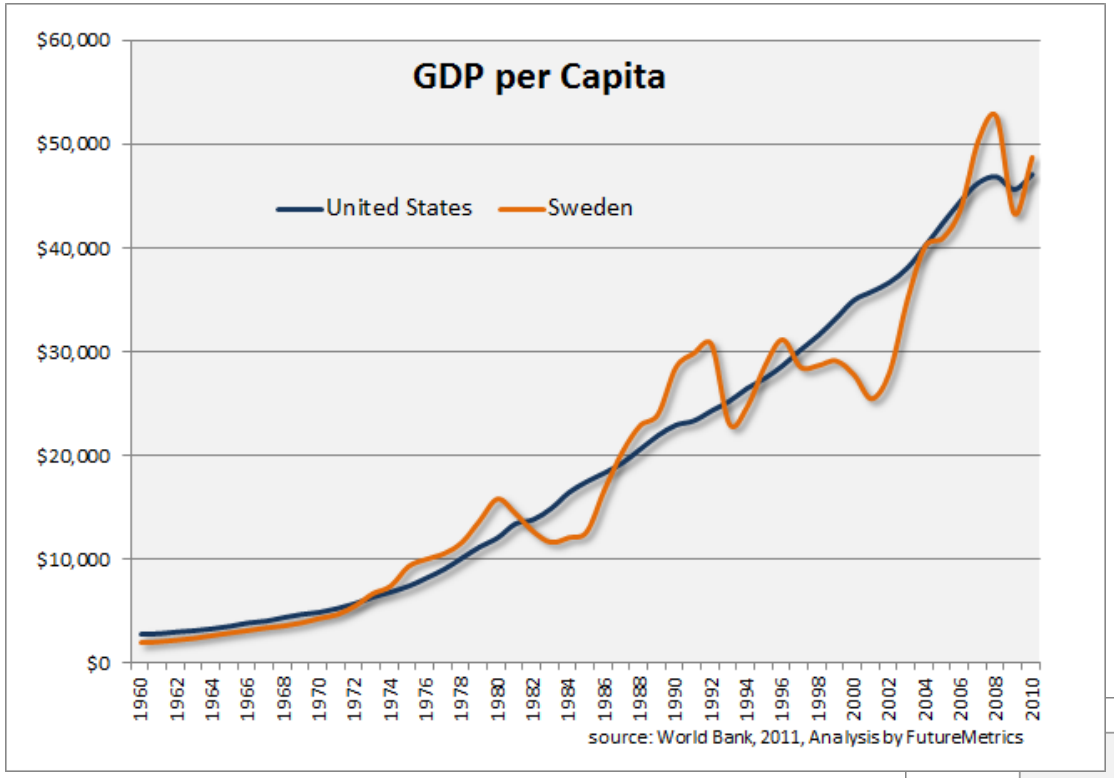
A Success Story for Community-Scale Projects



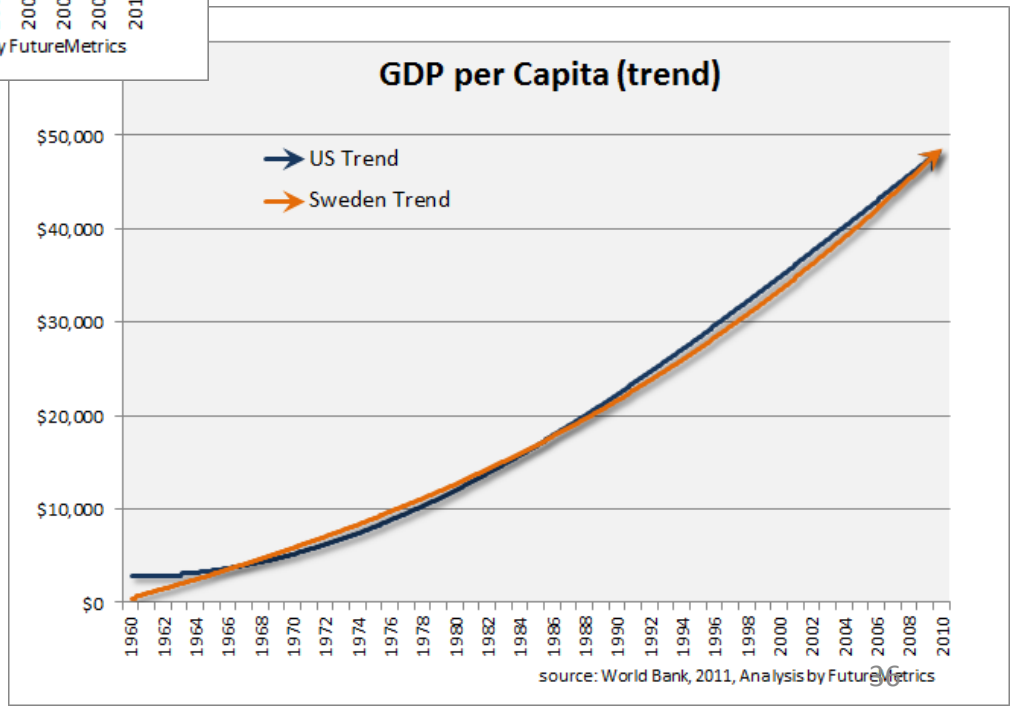
A case study – Sweden



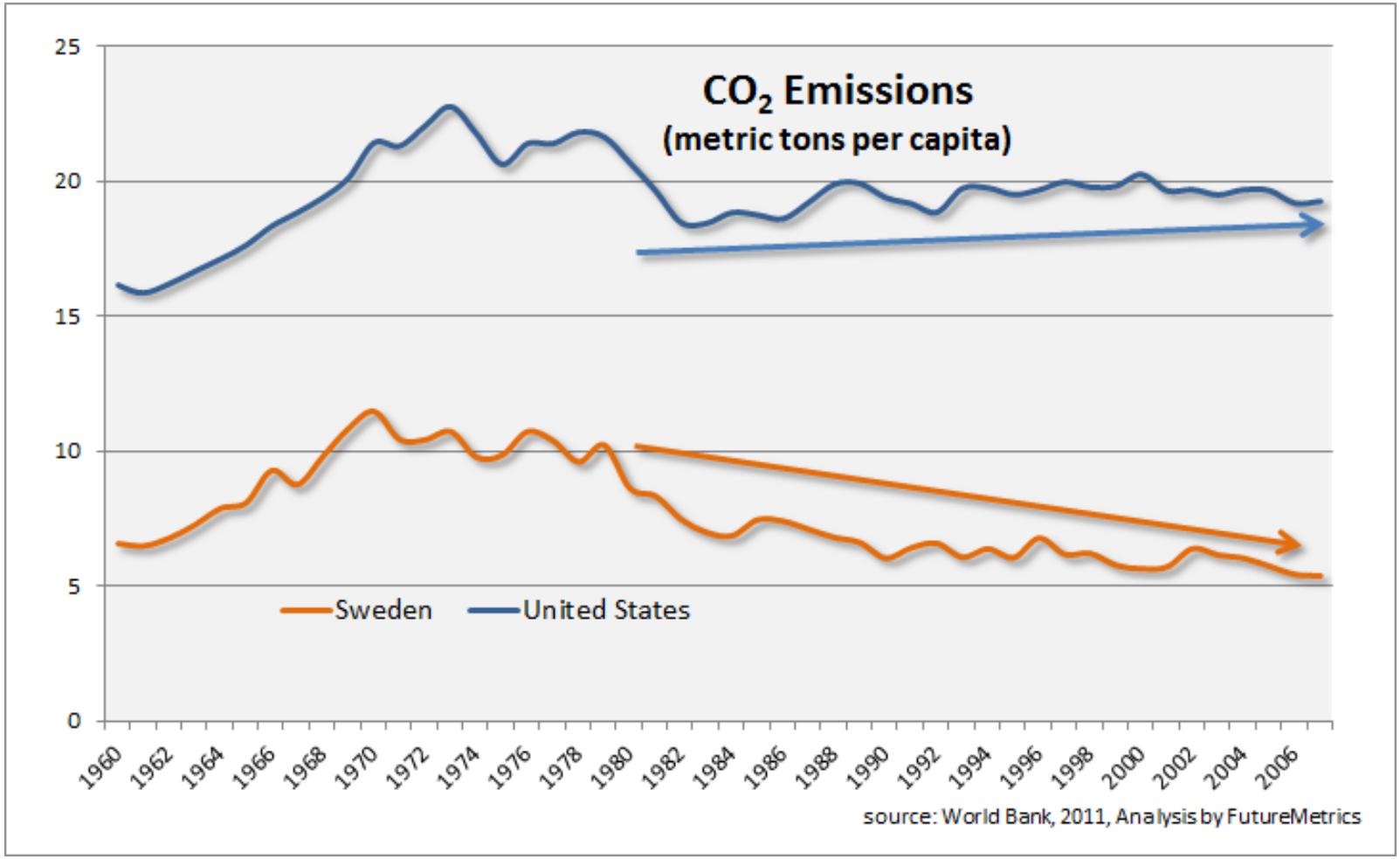




The smoothed trend in GDP per capita is virtually identical.



And as an added benefit….



What is the Future for Renewable Energy?

Europe is more than a decade ahead.

Note the role of biomass in the European renewable energy portfolio.

Solar and wind are less than 10% while biomass makes up 67% in the most recent year's data.

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


CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.