

BioEnergy in the Midwest:

*Economic growth, energy independence,
and environmental stewardship for
Wisconsin and its neighbors*

Presented at the Heating the Midwest Conference

By Dr. William Strauss

President, FutureMetrics

Co-founder and Director, Maine Energy Systems

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FutureMetrics – Award Winning Consultants in BioEnergy

The slides in this presentation are organized as follows:

First:

What is the sustainable amount of biomass that can be used for fuel?

Second:

How many homes and businesses will that allow to convert to pellet fueled boilers?

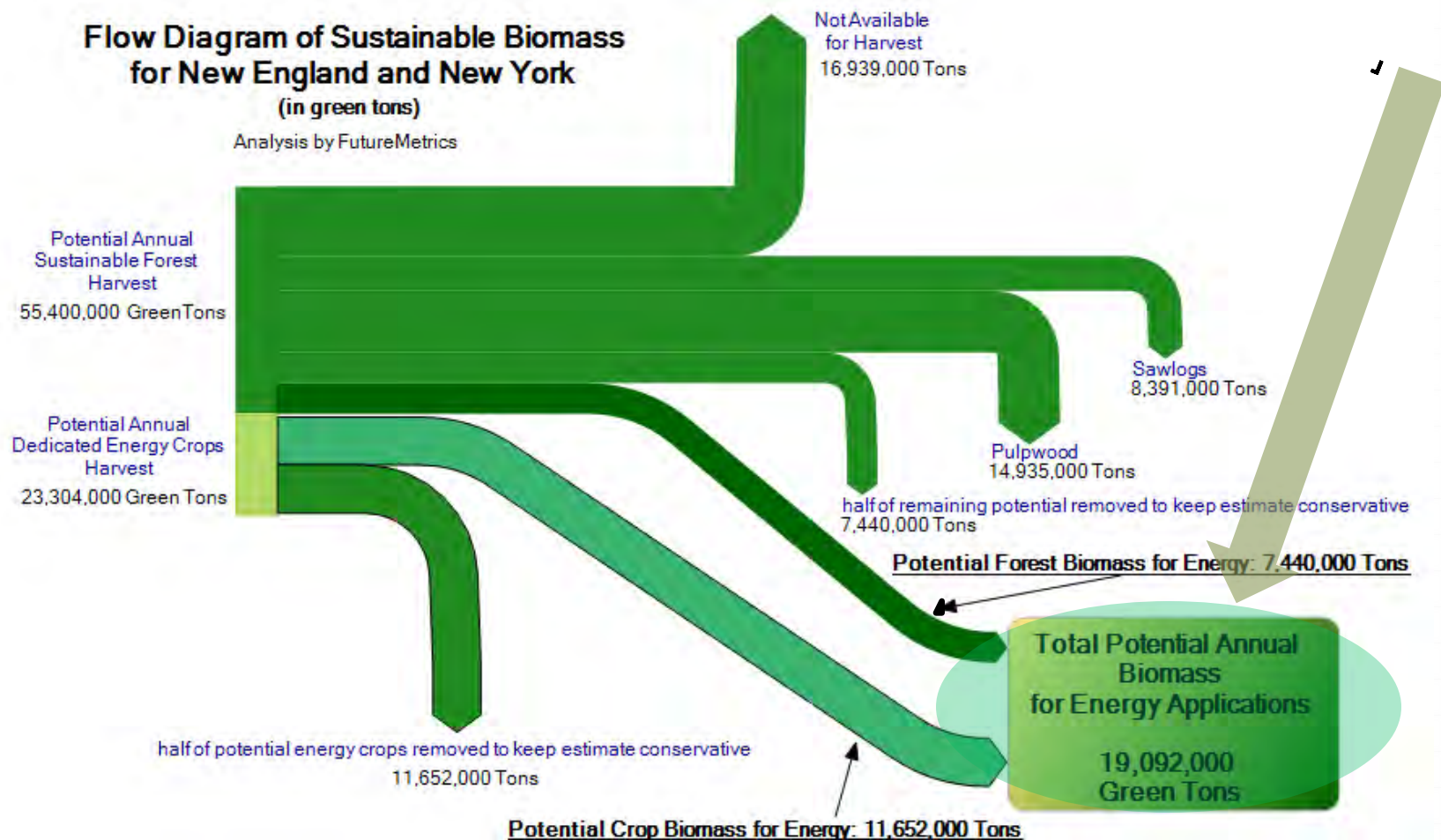
Third:

What are the potential profits and cash flows?

Last:

Lots of material on the economic and environmental impacts of bioenergy in the Midwest.

This analysis assumes that pulp and paper mills and sawmills will remain at current capacity.



Note: Does not include Pennsylvania

**Estimated Annual Sustainable Production
of Bioenergy Feedstock in green tons
(50% of estimate of total sustainable
wood harvest)**

State	
Wisconsin	4,964,000
Minnesota	2,494,000
Michigan	6,112,000
North Dakota	155,000
South Dakota	135,000
Iowa	1,195,000
Illinois	2,393,000
Indiana	2,675,000
Total	20,123,000

forestland (green tons). Merchantable biomass is the main stem of all species > 5" d.b.h. between a 1-foot stump height and a 4" top diameter (outside the bark), including rough and rotten culls.

<http://fiatools.fs.fed.us/Evalidator401/tmattribute.jsp>

analysis by FutureMetrics

A very rough estimate of sustainable biomass available for energy based on Forest Inventory Analysis (FIA) data.

**20.1 million tons of
green wood can make
enough pellets for about
1.26 million homes and
businesses.**

Note that these numbers do not include an analysis of the potential for dedicated energy crops

If we assume that each state provides biomass for its own needs, the table below shows the conversion rates.

Wisconsin is highest proportionally with 10.12% of its homes and businesses converting.

Michigan is highest in absolute numbers with 424,000 homes and businesses converting.

	Occupied Households	Equivalent Number of Businesses and Other	Total Number of Household Equivalents	Total Biomass for Pellets 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)	
Wisconsin	2,624,358	782,846	3,407,204	4,964,000	10.12%	344,722
Minnesota	2,347,201	700,170	3,047,371	2,494,000	5.68%	173,194
Michigan	4,532,233	1,351,965	5,884,198	6,112,000	7.21%	424,444
North Dakota	317,498	94,710	412,208	155,000	2.61%	10,764
South Dakota	363,438	108,414	471,852	135,000	1.99%	9,375
Iowa	1,336,417	398,653	1,735,070	1,195,000	4.78%	82,986
Illinois	5,296,715	1,580,010	6,876,725	2,393,000	2.42%	166,181
Indiana	2,795,541	833,910	3,629,451	2,675,000	5.12%	185,764
TOTAL	19,613,401	5,850,678	25,464,079	20,123,000		1,397,431

Given these levels of penetration and assuming \$20/ton profit for pellet manufacturing and \$20/ton profit for pellet fuel delivery, the annual profit for pellet flow is more than \$447 million.

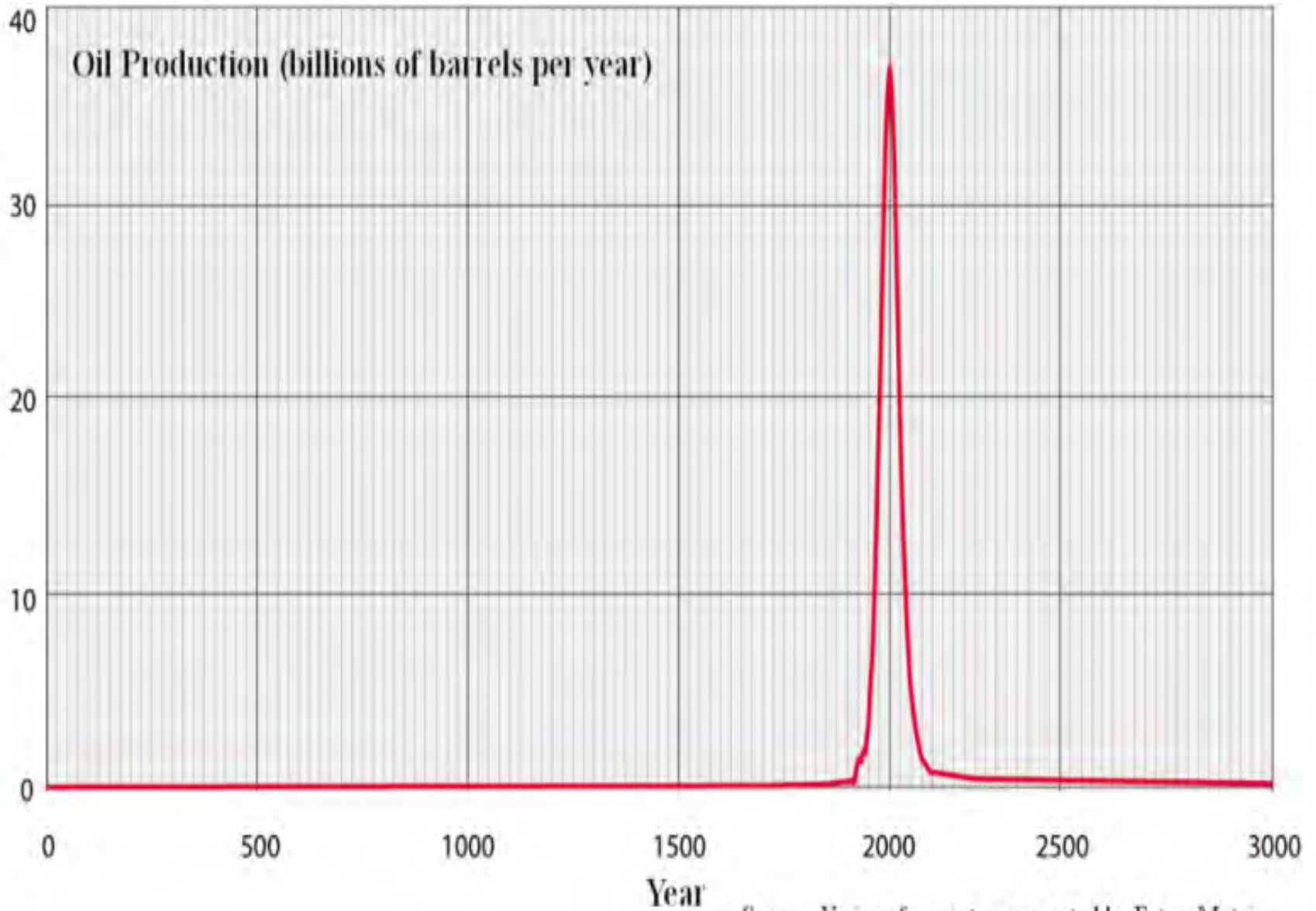
Installing 1.6 million pellet boilers with an assumed margin of \$3500 per unit yields a total gross margin on boiler sales of about \$4.9 billion.

	<u>Annual Profits from Pellet Sales</u>	<u>Total Gross Margin on Boiler Sales</u>
Wisconsin	\$110,311,111	\$1,206,527,778
Minnesota	\$55,422,222	\$606,180,556
Michigan	\$135,822,222	\$1,485,555,556
North Dakota	\$3,444,444	\$37,673,611
South Dakota	\$3,000,000	\$32,812,500
Iowa	\$26,555,556	\$290,451,389
Illinois	\$53,177,778	\$581,631,944
Indiana	\$59,444,444	\$650,173,611
	\$447,177,778	\$4,891,006,944

analysis by FutureMetrics

But why should we care about
conversion to this form of
renewable energy?

Economic Consequences and Energy Independence



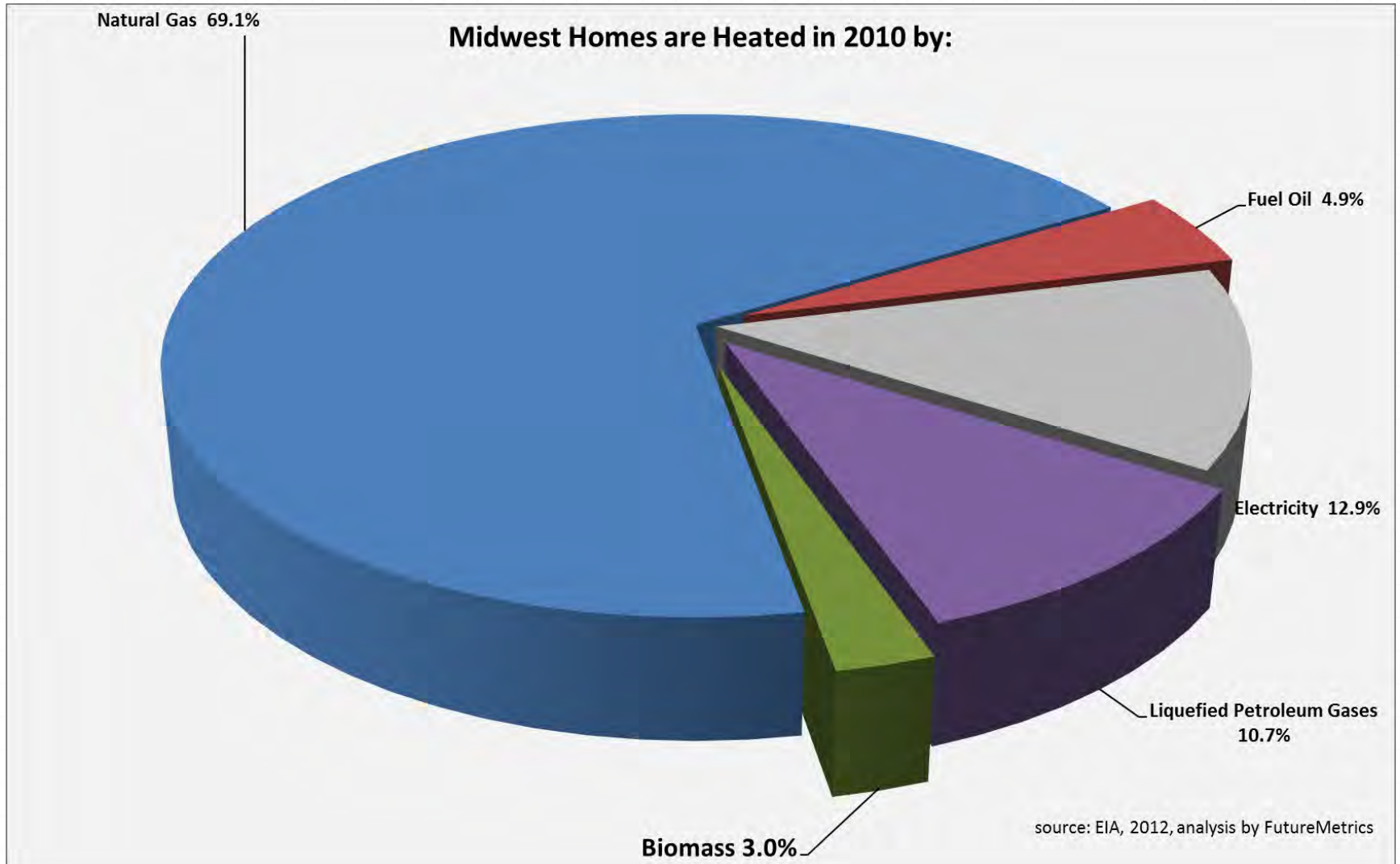
Source: Various forecasts aggregated by FutureMetrics

United States' "Energy Policy"?

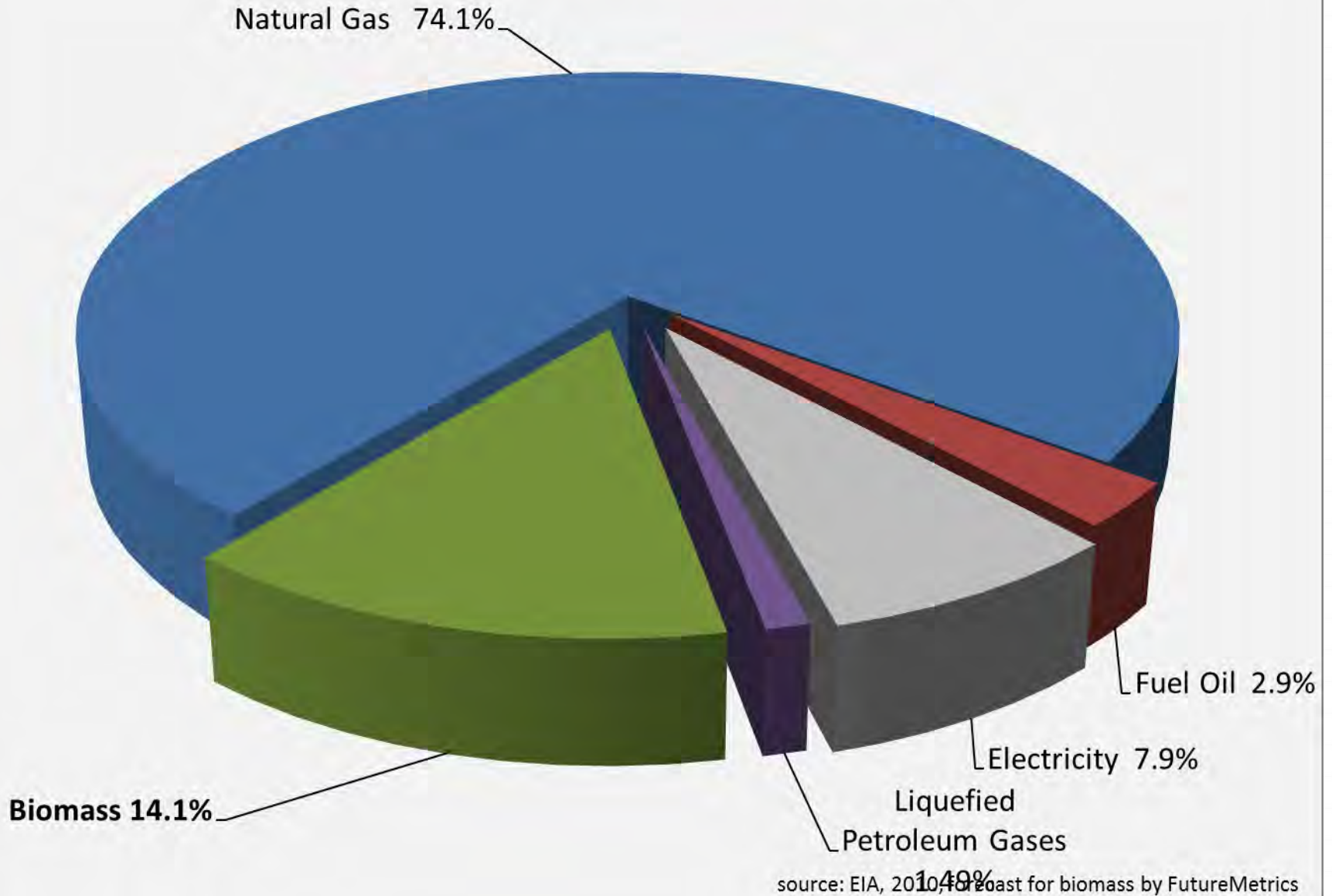


The Opportunity is to replace Fuel Oil, Propane, and Electricity

(glass half full = 30.9% not on natural gas)



Midwest Homes Could be Heated in 2025 by:



source: EIA, 2010, Forecast for biomass by FutureMetrics

At current heating oil prices, the Midwest states “export” more than **8 BILLION** dollars per year*

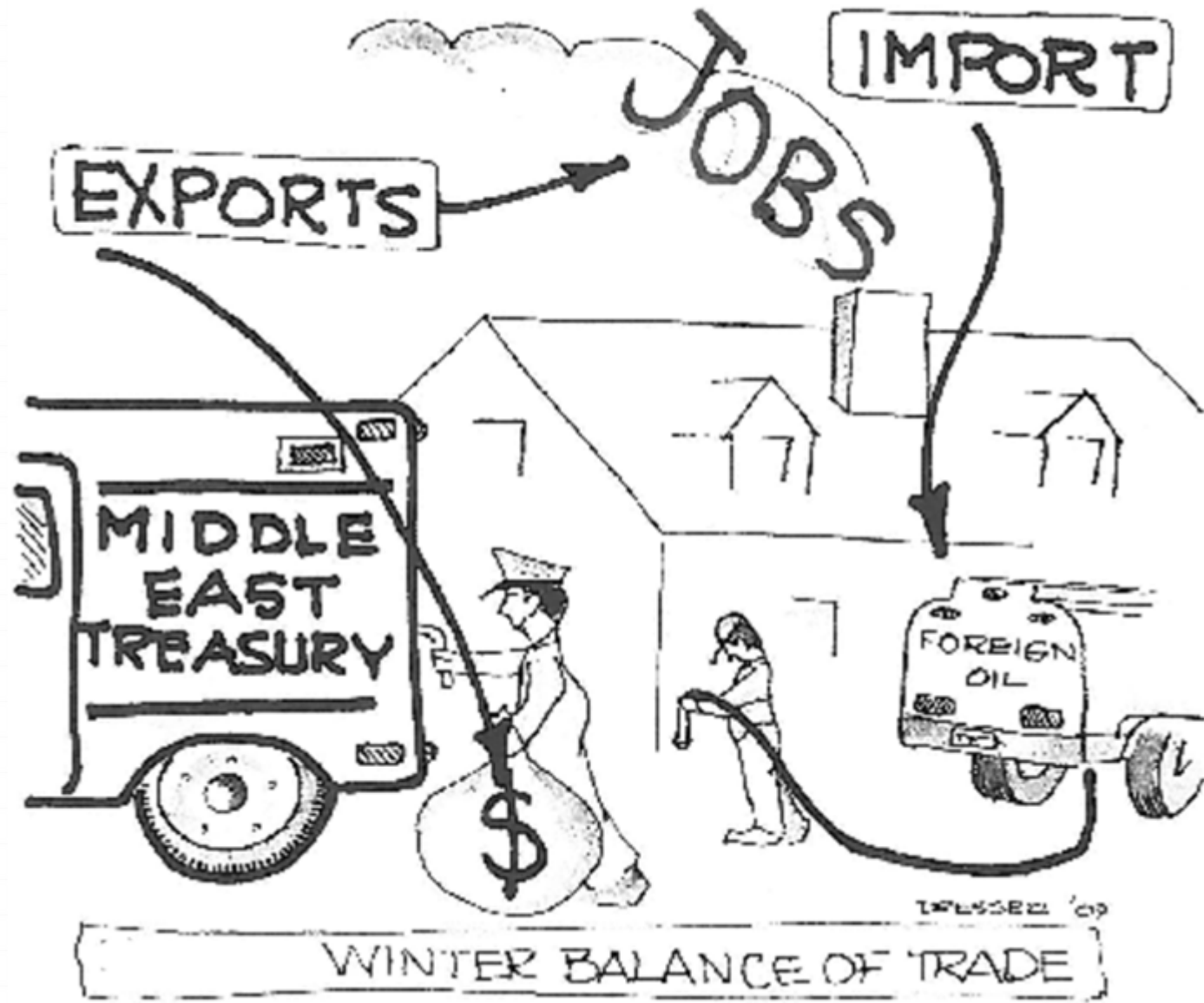
	Number of Households that use Heating Oil or Propane	Average Gallons Used per Year by all Users	Average Total Expenditure Per Year (#2 at \$3.80/gal)	Amount that Does not Stay in the State (EXPORTED)
Wisconsin	647,000	533,775,000	\$ 2,028,345,000	\$ 1,582,109,000
Minnesota	488,000	402,600,000	\$ 1,529,880,000	\$ 1,193,306,000
Michigan	765,000	631,125,000	\$ 2,398,275,000	\$ 1,870,655,000
North Dakota	103,000	84,975,000	\$ 322,905,000	\$ 251,866,000
South Dakota	137,000	113,025,000	\$ 429,495,000	335,006,000
Iowa	312,000	257,400,000	\$ 978,120,000	762,934,000
Illinois	413,000	340,725,000	\$ 1,294,755,000	1,009,909,000
Indiana	436,000	359,700,000	\$ 1,366,860,000 ^d	\$ 1,066,151,000
Total	3,301,000	2,723,325,000	\$ 10,348,635,000	\$ 8,071,936,000

Source: US Energy Information Administration, 2012, US Census, analysis by FutureMetrics

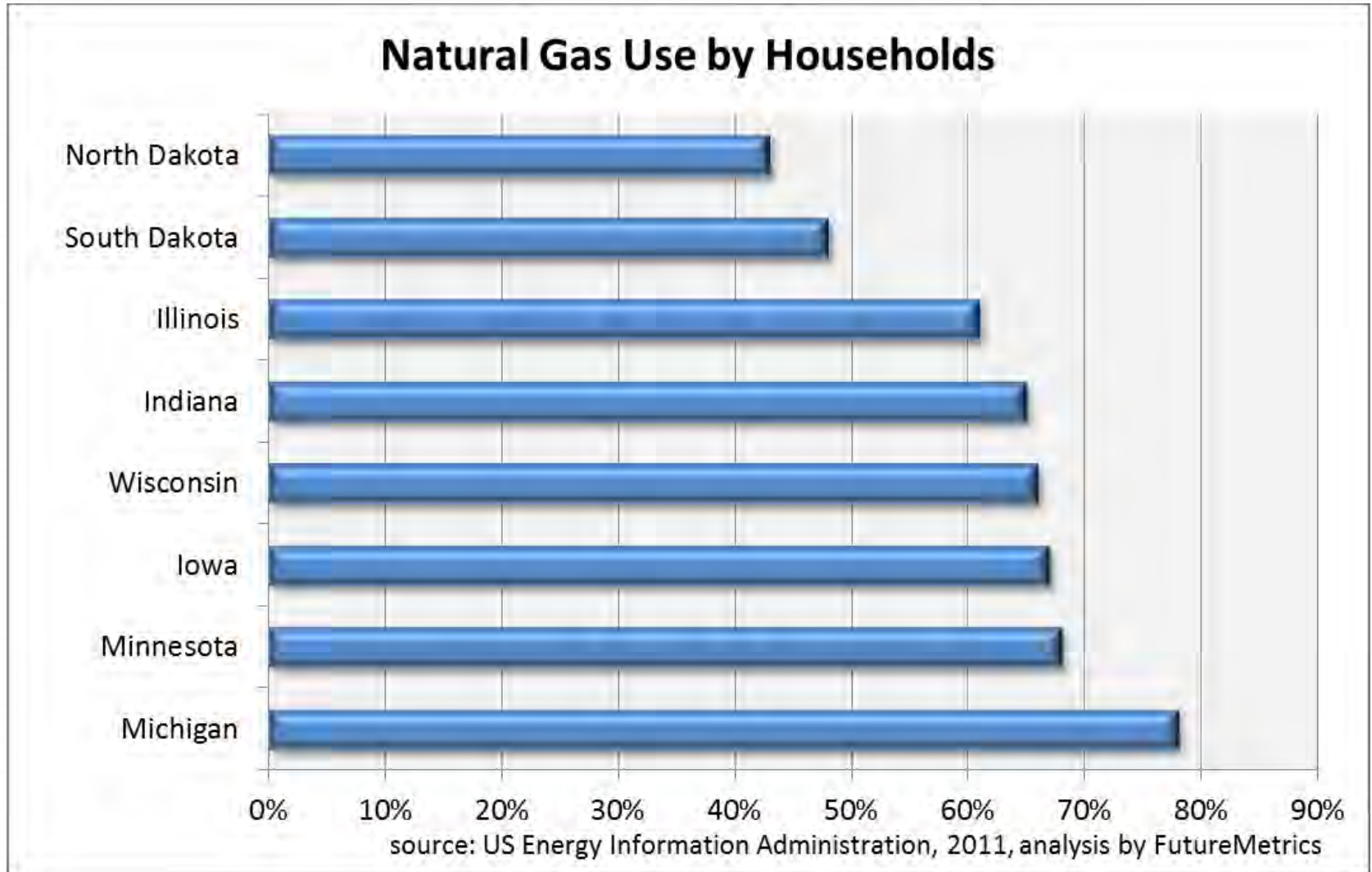
*The US EIA data shows that 78% of every dollar spent on heating oil leaves the region and most of those dollars leave the country. 13

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

#2 Distillate Fuel and Propane use in Residential, Commercial, and Industrial (not Transportation)	Average Gallons per Year	Money Exported from Regional Economy at \$3.80/gal	Permanent Job Destruction
Wisconsin	533,775,000	(\$1,582,109,100)	-106,285
Minnesota	402,600,000	(\$1,193,306,400)	-71,296
Michigan	631,125,000	(\$1,870,654,500)	-114,132
North Dakota	84,975,000	(\$251,865,900)	-16,142
South Dakota	113,025,000	(\$335,006,100)	-21,551
Iowa	257,400,000	(\$762,933,600)	-45,841
Illinois	340,725,000	(\$1,009,908,900)	-54,736
Indiana	359,700,000	(\$1,066,150,800)	-65,279
	2,723,325,000	(\$8,071,935,300)	-495,262

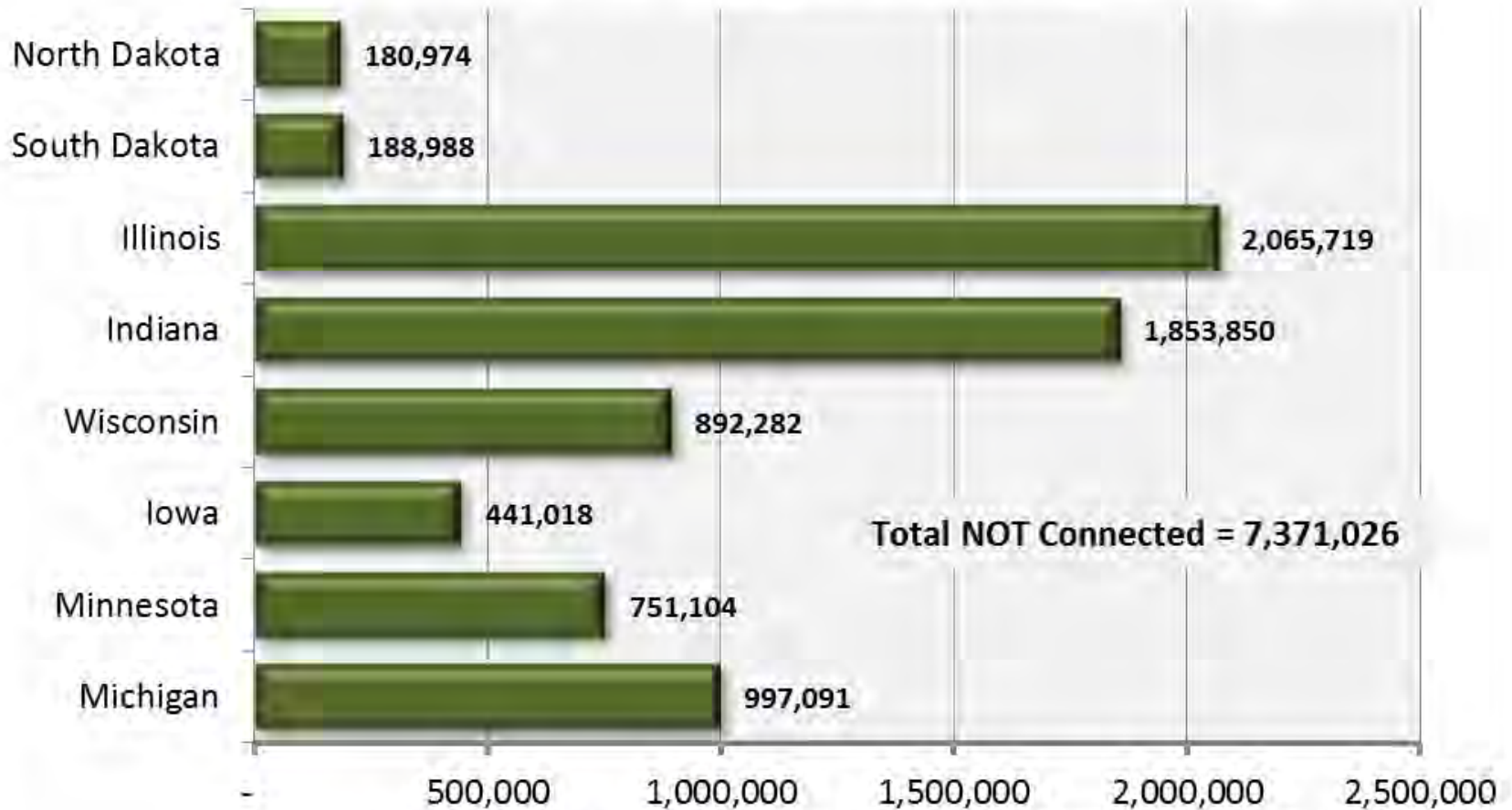


A lot of homes in the Midwest are connected to natural gas



But a significant number are not connected!

Number of Households NOT connected to Natural Gas



source: US Energy Information Administration, 2011, analysis by FutureMetrics

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

Job Destruction would become Job Creation.

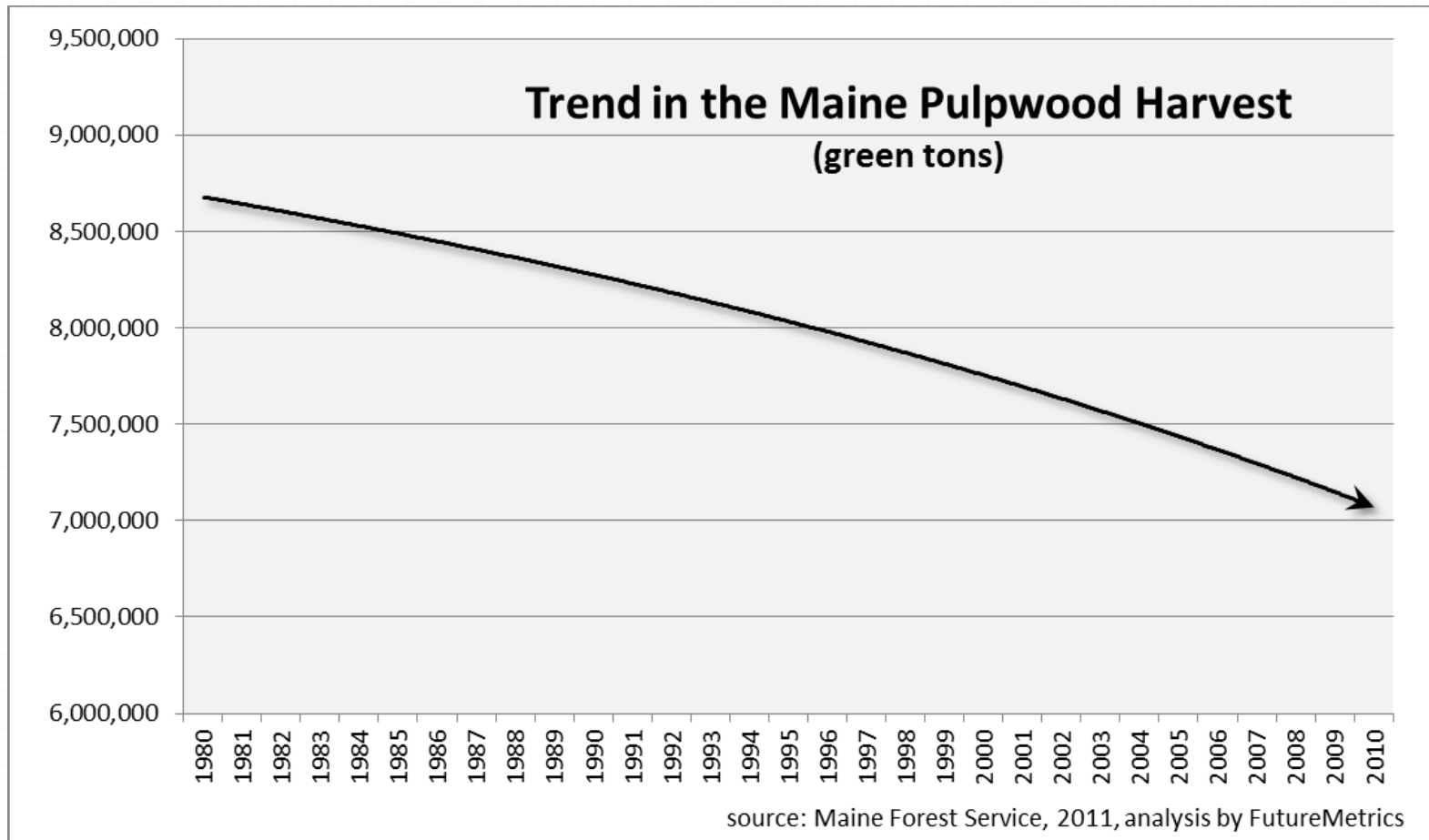
This is due to three effects (they all have direct and multiplier effects):

- 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 Midwest 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 (we have ignored this in this analysis)?
- What uses other than biomass thermal applications of the sustainable harvest have a higher value added for the forest products industry?

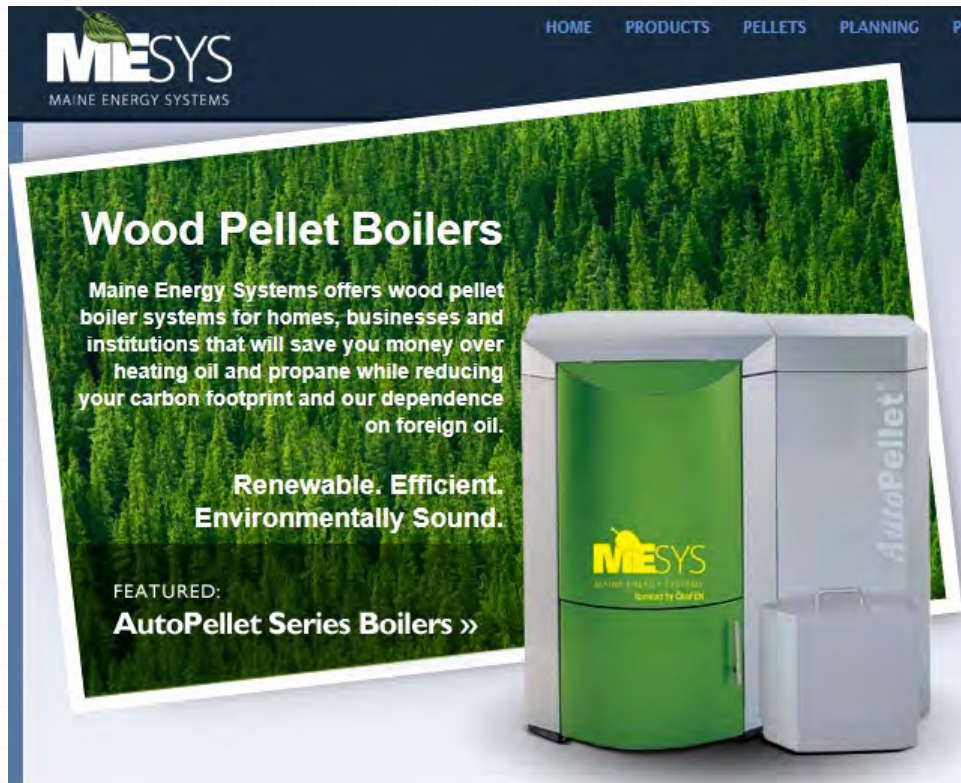
Pulpwood Demand is Declining. Wood-to-Energy will Replace the demand that has traditionally come from that sector.



Wood pellet production for domestic use in the Midwestern 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 ME SYS website. At the top, the logo "ME SYS MAINE ENERGY SYSTEMS" is visible. Navigation links include "HOME", "PRODUCTS", "PELLETS", "PLANNING", and "PR". The main content area has a green forest background and features the following 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.

FEATURED:
AutoPellet Series Boilers >>



Two wood pellet boilers are shown: a green one with the ME SYS logo and a white one labeled "AutoPellet".

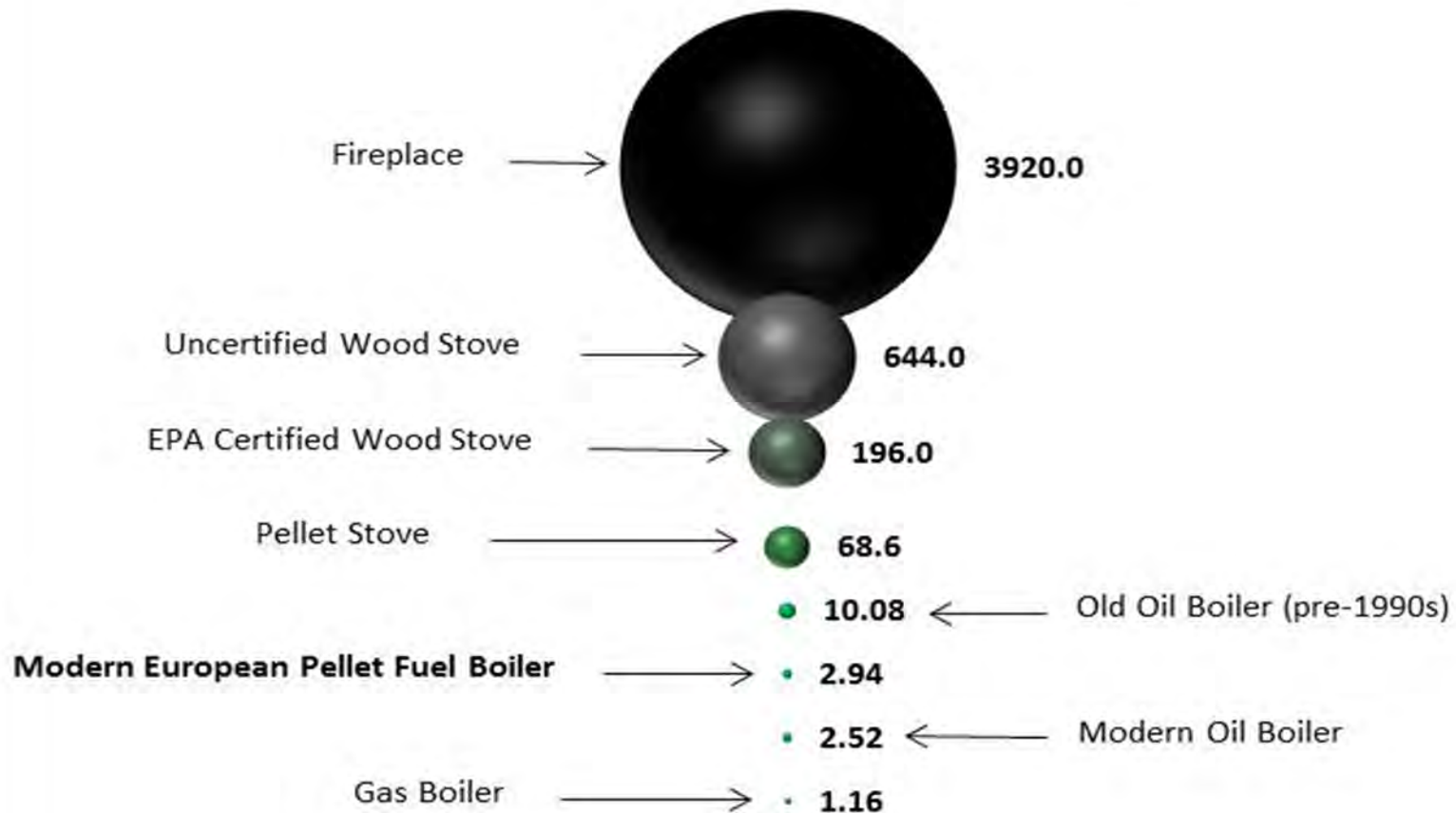


Wood pellet fuel is common in Europe where more than a million homes have home heating systems automatically fueled with wood pellets.



Modern Wood Pellet Boilers are CLEAN and completely automatic

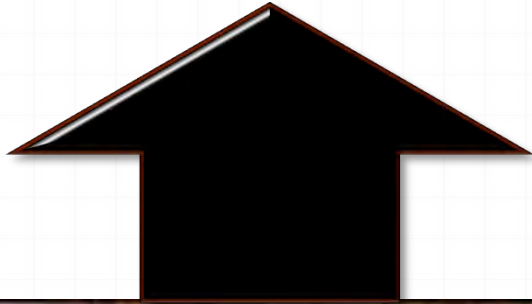
Total Pounds of Particulate per Year
normalized to the equivalent of the BTU from 1000 gallons of heating oil per year



Source: USEPA, Maine Energy Systems, OkoFEN Eco Engineering GmbH, 2010, analysis by FutureMetrics 23

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



Seriously...



YOUR HEATING SYSTEM HELPED BUILD THIS CITY


Switch to the world's finest fully-automated wood pellet boiler.
The boiler that saves more than it costs.



- **Automatic Operation**
Just Turn Your Existing Thermostat
- **No Fuel Handling**
Delivered in Bulk / Automatically Fed
- **Automatic Ash Removal**
No Ash to Touch
- **Clean Burning**
Exceeds all EPA Emission Standards
- **Reliable**
40,000+ Units in Service Worldwide
- **Affordable Fuel**
Lock-in at \$1.99 / Gallon Oil Equivalent

**MESYS**

MAINE ENERGY SYSTEMS

 877-917-2319
MESysHeat.com

Contact Us

Stop being held hostage
by your heating system.

Imagine...



TAKING A VACATION WITH YOUR FUEL SAVINGS

Switch to the world's finest fully-automated wood
pellet boiler. The boiler that saves more than it costs.



- **Automatic Operation**
Just Turn Your Existing Thermostat
- **No Fuel Handling**
Delivered in Bulk / Automatically Fed
- **Automatic Ash Removal**
No Ash to Touch
- **Clean Burning**
Exceeds all EPA Emission Standards
- **Reliable**
40,000+ Units in Service Worldwide
- **Affordable Fuel**
Lock-in at \$1.99 / Gallon Oil Equivalent

**MESYS**

MAINE ENERGY SYSTEMS

207.824.NRGY (6749)
MaineEnergySystems.com

What if 20% of those homes in the Midwest that are using heating oil or propane convert to pellet heating systems?

The three job creating effects and the multiplier effects will create or sustain more than 62,000 jobs.

Income and Jobs if 20% Convert	Total Permanent ANNUAL Income	Total Permanent Jobs
Wisconsin	\$ 52,859,986	9,154
Minnesota	\$ 132,184,725	11,484
Michigan	\$ 209,549,917	10,387
North Dakota	\$ 26,095,436	1,859
South Dakota	\$ 75,268,056	3,465
Iowa	\$ 164,607,776	7,359
Illinois	\$ 5,720,778	4,197
Indiana	\$ 416,385,723	14,723
	\$ 1,082,672,398	62,629

analysis by FutureMetrics

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.

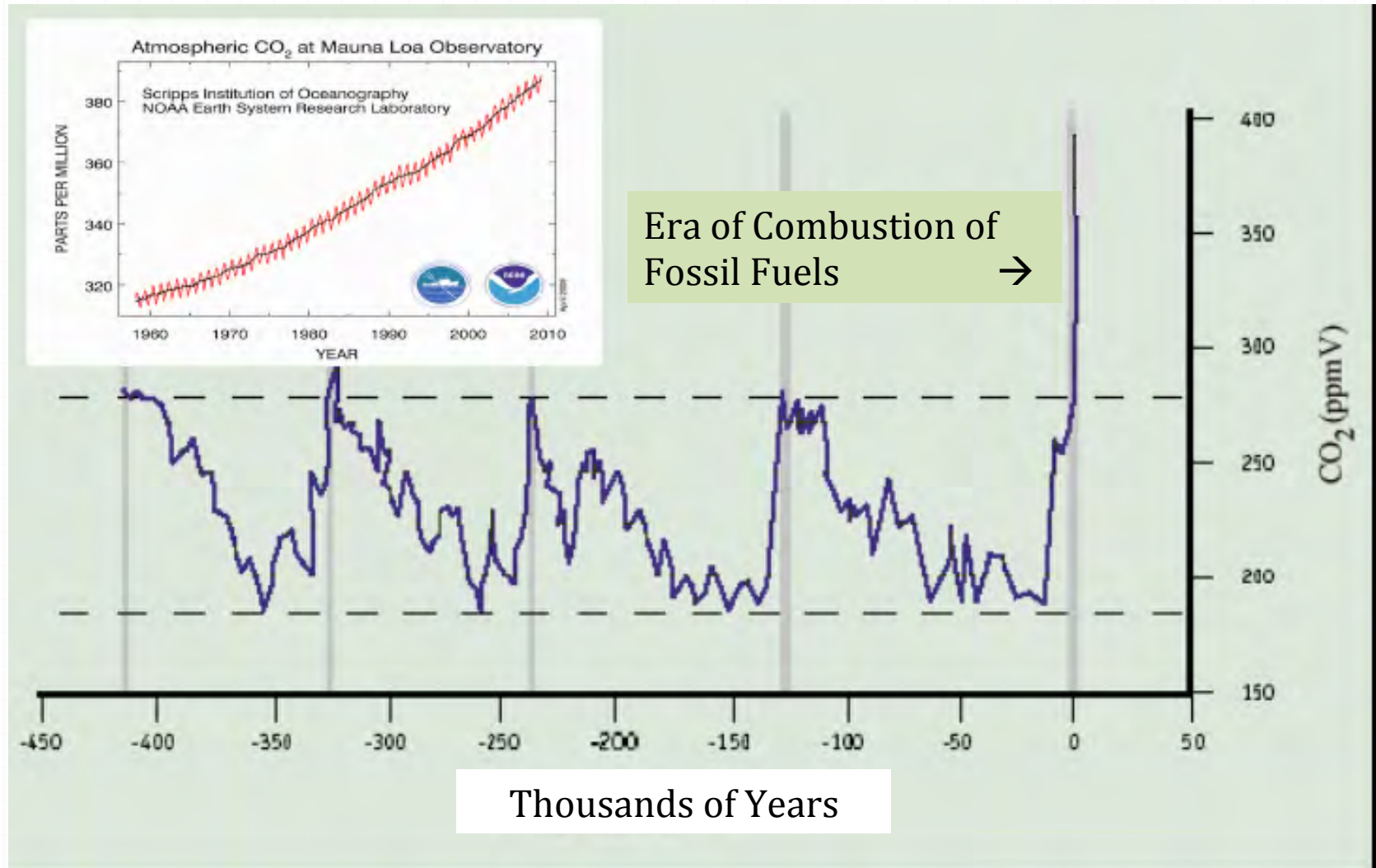
Total Renewable Energy Production in Europe in 1000's of tons of oil equivalent (TOE)												
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Solar energy	0.4%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.7%	0.8%	0.9%	1.2%	1.6%
Biomass	60.7%	60.5%	60.1%	59.2%	62.3%	64.1%	63.8%	65.4%	66.0%	66.8%	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

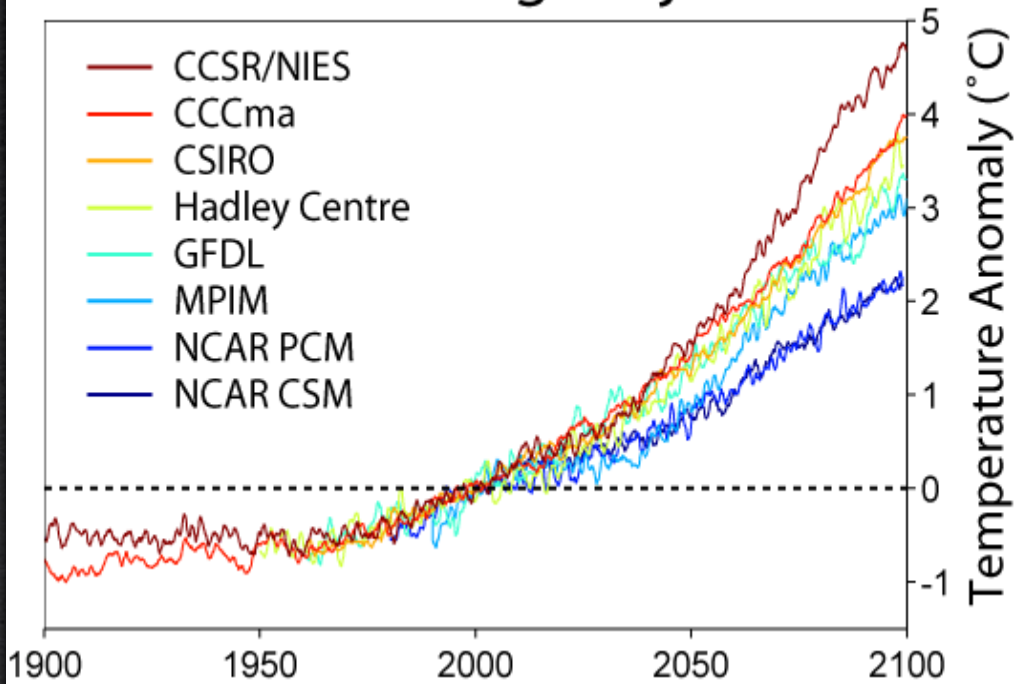
Environmental Advantages

Using biofuel like wood pellets made from sustainably managed forests are carbon neutral in combustion.

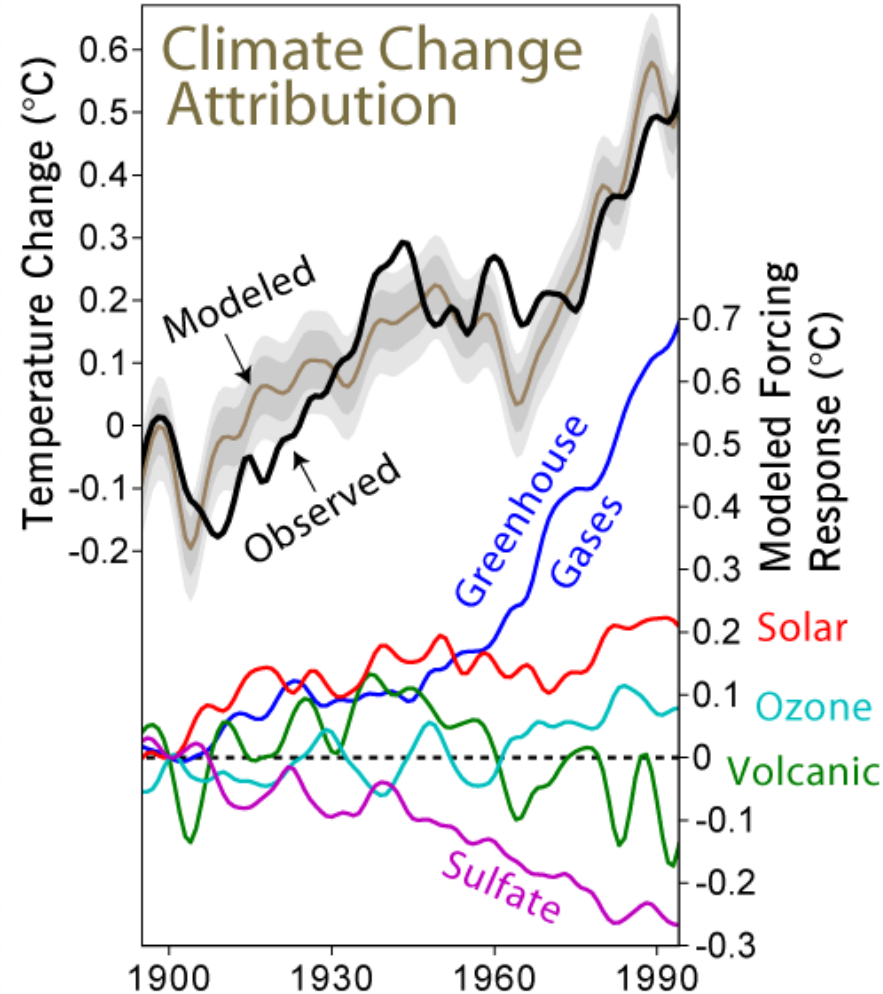
Why should we care about CO₂?



Global Warming Projections



CCSR/NIES: [Center for Climate System Research \[1\]](#) & [National Institute for Environmental Studies, \[2\]](#), CCSR/NIES AGCM + CCSR OGCM Models 1890-2100
 CCCma: [Canadian Center for Climate Modelling and Analysis \[3\]](#), CGM2 Model 1900-2100
 CSIRO: [Commonwealth Scientific and Industrial Research Organisation \[4\]](#), CSIRO-Mk2 model 1961-2100
 Hadley Centre: [Hadley Centre](#) for Climate Prediction and Research [5], HADCM3 model 1950-2099
 GFDL: [Geophysical Fluid Dynamics Laboratory \[6\]](#), R30 Model 1961-2100
 MPI-M: [Max Planck Institute für Meteorologie \[7\]](#), ECHAM4/OPYC coupled model 1990-2100
 NCAR PCM: [National Center for Atmospheric Research \[8\]](#), PCM model 1980-2099
 NCAR CSM: [National Center for Atmospheric Research \[9\]](#), CSM Model 2000-2099



“... an extensive dataset of 1,372 climate researchers and their publication and citation data show that 97% to 98% of the climate researchers most actively publishing in the field support the tenets of anthropogenic climate change...”

From “Expert credibility in climate change”, published in the Proceedings of the National Academy of Sciences of the United States of America, June 21, 2010.

It is Really this Simple:

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.

A northeastern forest can sustainably produce about one ton of new growth per acre per year.

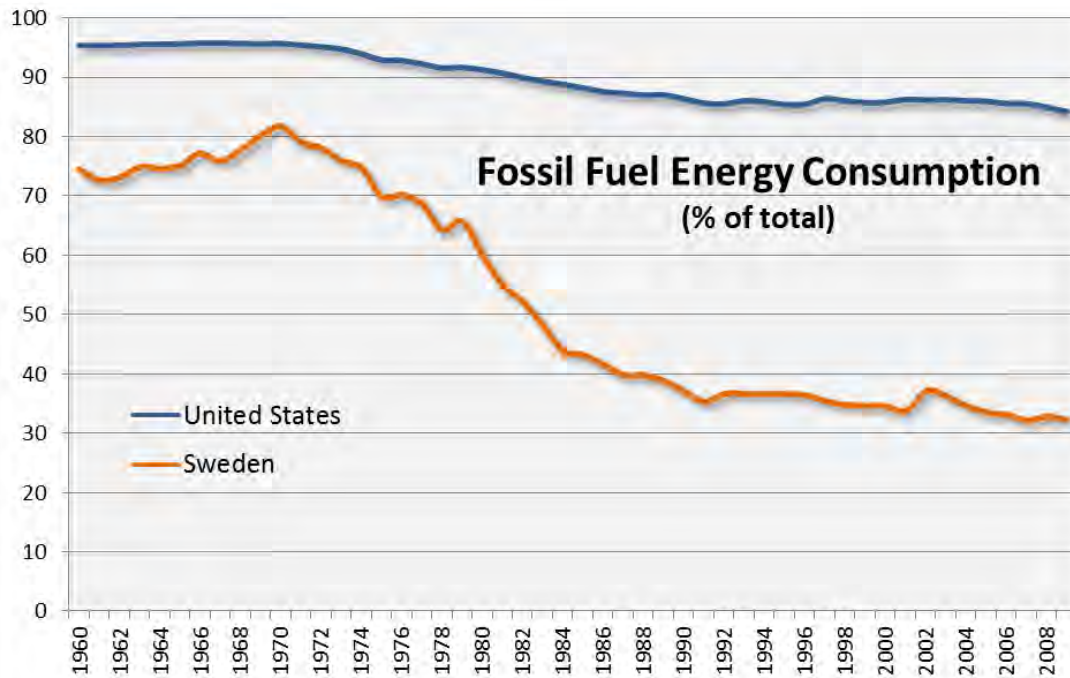
That means that the 3650 tons per year of biomass needed to fuel our CHP plant will need 3650 acres of forestland if we require that the forest does not shrink over time.

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

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.

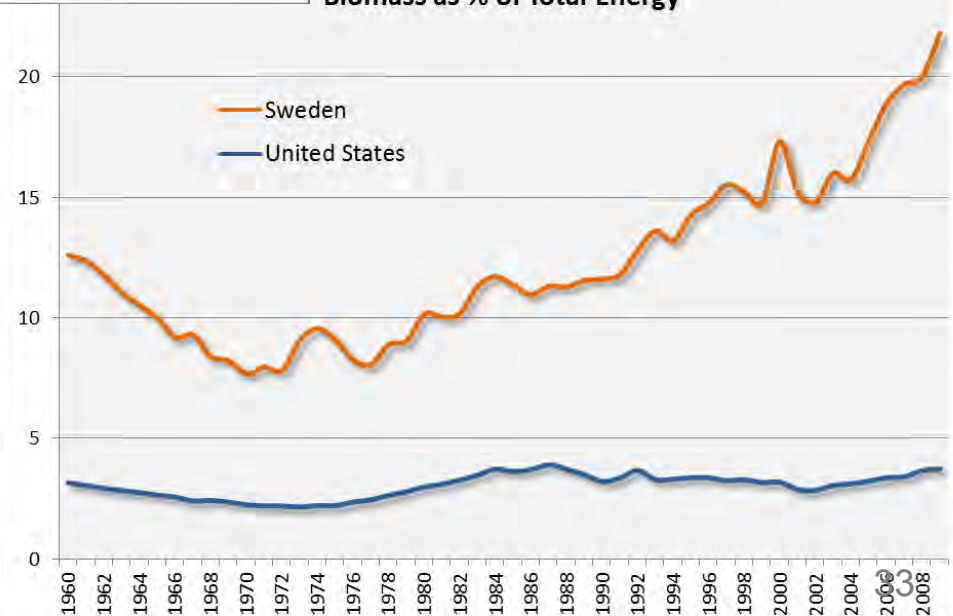
Combustion of wood from a sustainably managed forest is carbon neutral.

A case study - Sweden

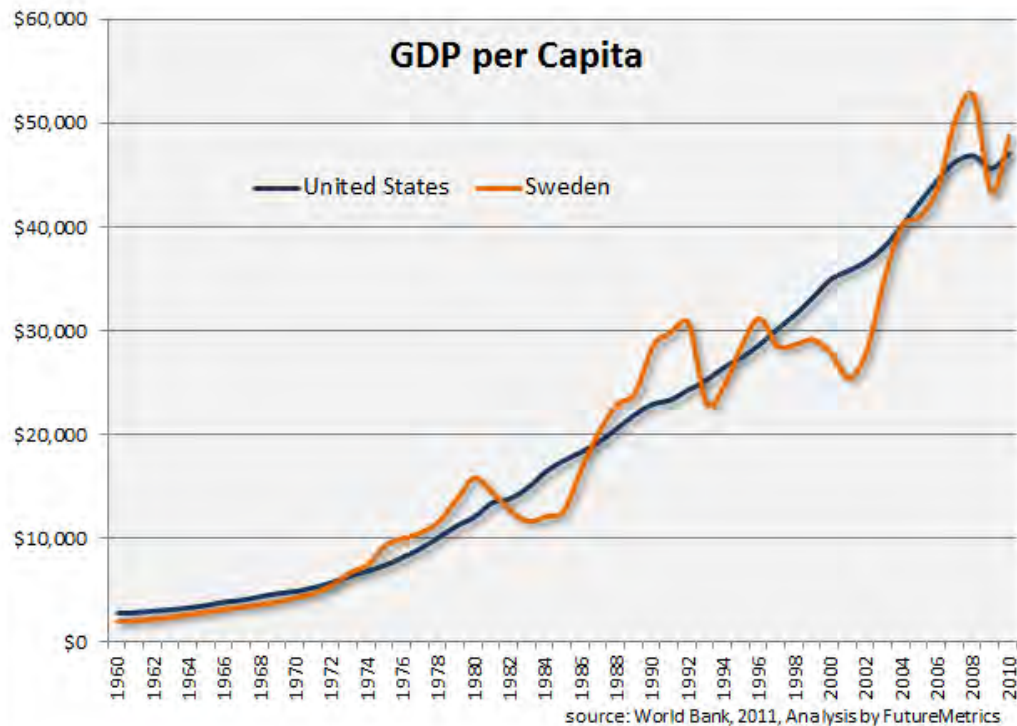


source: World Bank, 2011, Analysis by FutureMetrics

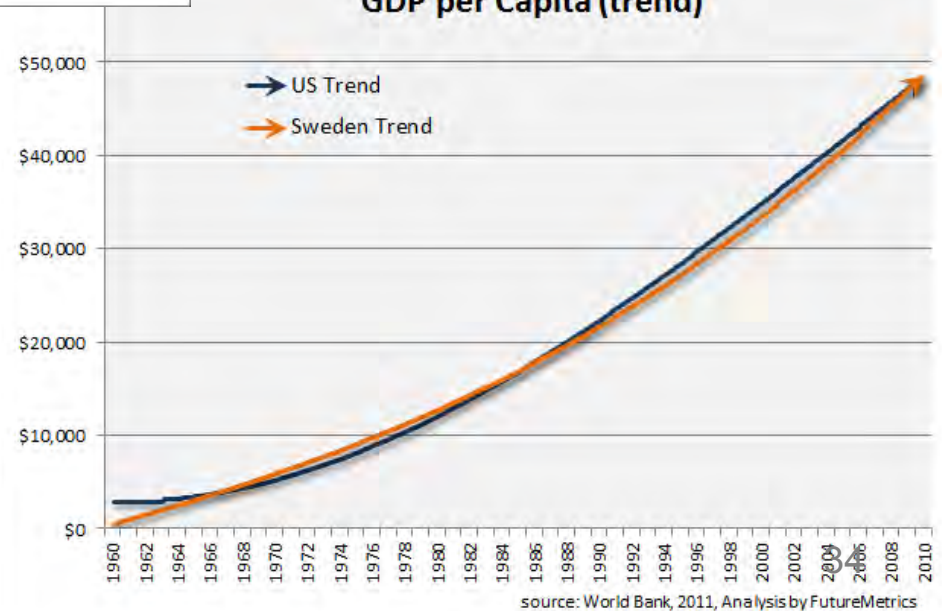
Biomass as % of Total Energy



source: World Bank, 2011, Analysis by FutureMetrics

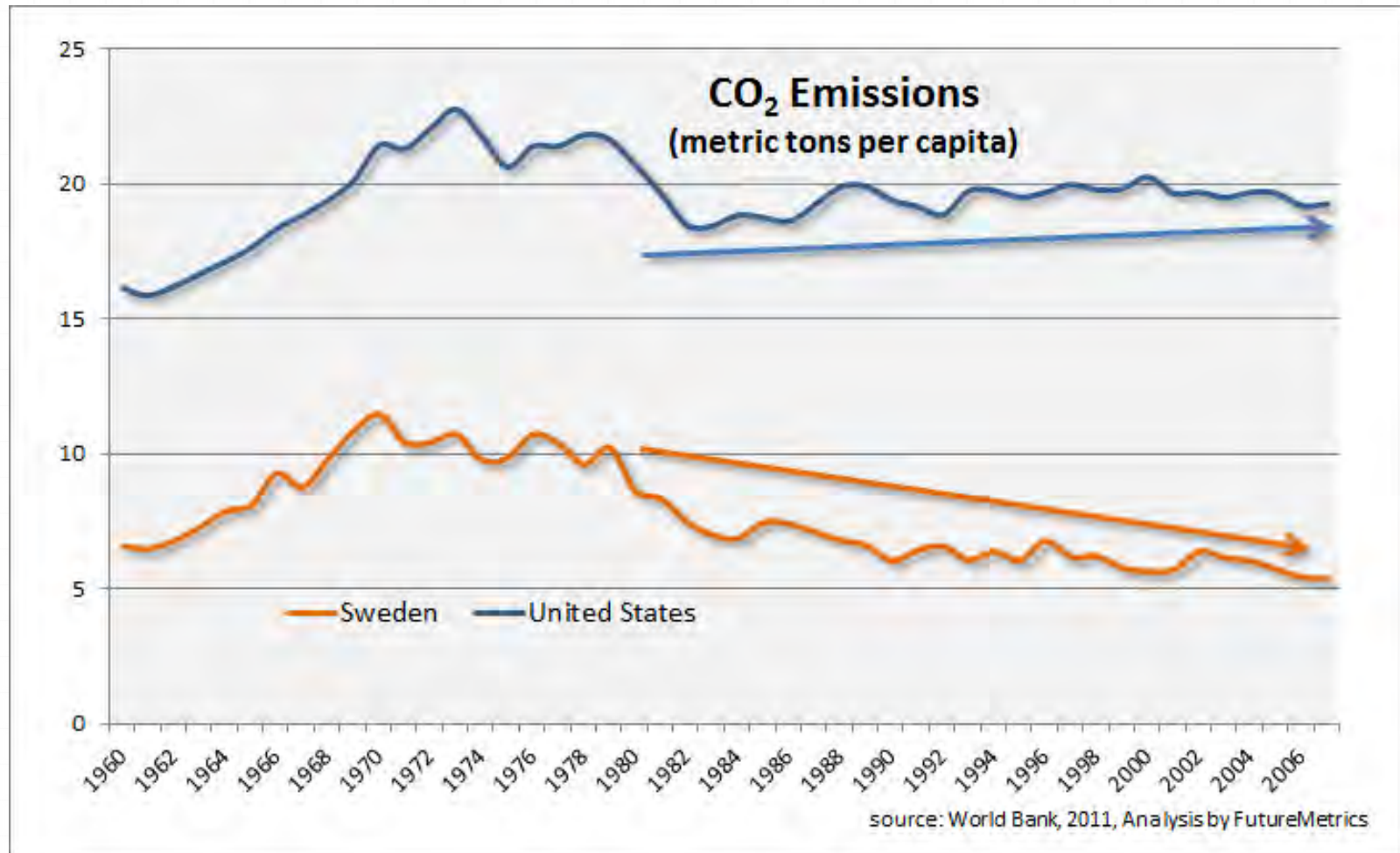


GDP per Capita (trend)



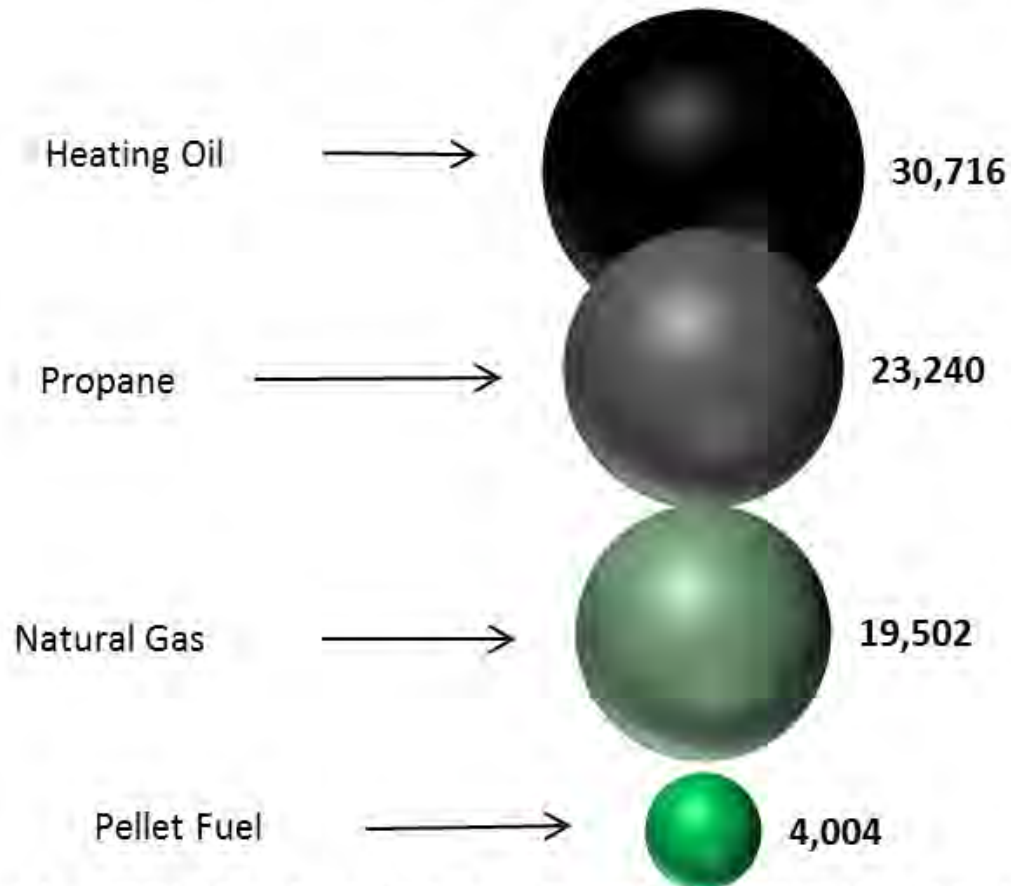
The smoothed trend in GDP per capita is virtually identical.

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 foundations for an energy independent low carbon future for heating our homes and businesses is in place:

- Fuel refineries exist (some call them pellet factories) and more can be built;
- European style pellet boilers and bulk fuel delivery are in the US now (see www.MaineEnergySystems.com);
- The forest products sector has a long history in the Midwest 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 \$3.80/gallon to \$5.00/gallon, massive numbers of jobs will be lost if the midwest does not curtail its use of heating oil and propane.

#2 Distillate Fuel and Propane use in Residential, Commercial, and Industrial (not Transportation)	Average Gallons per Year	Money Exported from Regional Economy at \$3.80/gal	Money Exported from Regional Economy at \$5.00/gal	Annual Increased Loss of Money if Heating Oil goes to \$5.00/gal	Permanent Job Destruction
Wisconsin	533,775,000	\$1,582,109,100	\$2,081,722,500	(\$499,613,400)	-33,564
Minnesota	402,600,000	\$1,193,306,400	\$1,570,140,000	(\$376,833,600)	-22,515
Michigan	631,125,000	\$1,870,654,500	\$2,461,387,500	(\$590,733,000)	-36,042
North Dakota	84,975,000	\$251,865,900	\$331,402,500	(\$79,536,600)	-5,098
South Dakota	113,025,000	\$335,006,100	\$440,797,500	(\$105,791,400)	-6,805
Iowa	257,400,000	\$762,933,600	\$1,003,860,000	(\$240,926,400)	-14,476
Illinois	340,725,000	\$1,009,908,900	\$1,328,827,500	(\$318,918,600)	-17,285
Indiana	359,700,000	\$1,066,150,800	\$1,402,830,000	(\$336,679,200)	-20,615
	2,723,325,000	\$8,071,935,300	\$10,620,967,500	(\$2,549,032,200)	-156,399



Table 6: Climate Change Performance Index for OECD Member Countries

Rank	Country	Score	Rank	Country	Score	Rank	Country	Score
5	Sweden	69.88	18	Slovak Republic	60.48	38	Japan	53.09
6	Norway	67.01	20	Ireland	59.78	40	Austria	52.86
7	Germany	66.98	24	Iceland	58.73	41	Italy	52.70
8	United Kingdom	65.92	27	Czech Republic	57.48	43	Greece	52.43
9	France	64.64	30	Netherlands	56.43	50	Turkey	49.02
11	Mexico	63.95	31	Finland	55.11	51	Luxembourg	48.25
13	Switzerland	63.63	33	Denmark	54.64	54	USA	46.49
14	Portugal	63.38	34	Korea, Rep.	54.54	55	Poland	46.33
16	Hungary	61.79	35	Spain	54.41	57	Canada	43.86
17	Belgium	61.49	37	New Zealand	53.73	58	Australia	42.86

© Germanwatch 2010

Rank Tendency	Country	Score**	Partial Score		
			Trend	Level	Policy
1*	-	-			
2*	-	-			
3*	-	-			
4 →	Brazil	70.5			
5 →	Sweden	69.9			
6 ↗	Norway	67.0			

54 ↘	USA	46.5	
55 ↘	Poland	46.3	
56 ↘	China	44.9	
57 ↗	Canada	43.9	
58 ↘	Australia	42.9	
59 ↘	Kazakhstan	42.5	
60 →	Saudi Arabia	25.8	

Index Categories

- Emissions Trend (50% weighting)
- Emissions Level (30% weighting)
- Climate Policy (20% weighting)

Rating

- Very good
- Good
- Moderate
- Poor
- Very poor

Thank you!

William Strauss, PhD

President, FutureMetrics

FutureMetrics – Globally Respected Consultants in BioEnergy