


# MICHIGAN WOOD ENERGY

a smart fuel choice 



## WHAT IS ENERGY COSTING YOU?

An overview of the Michigan Wood Energy Calculator

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April 30, 2014

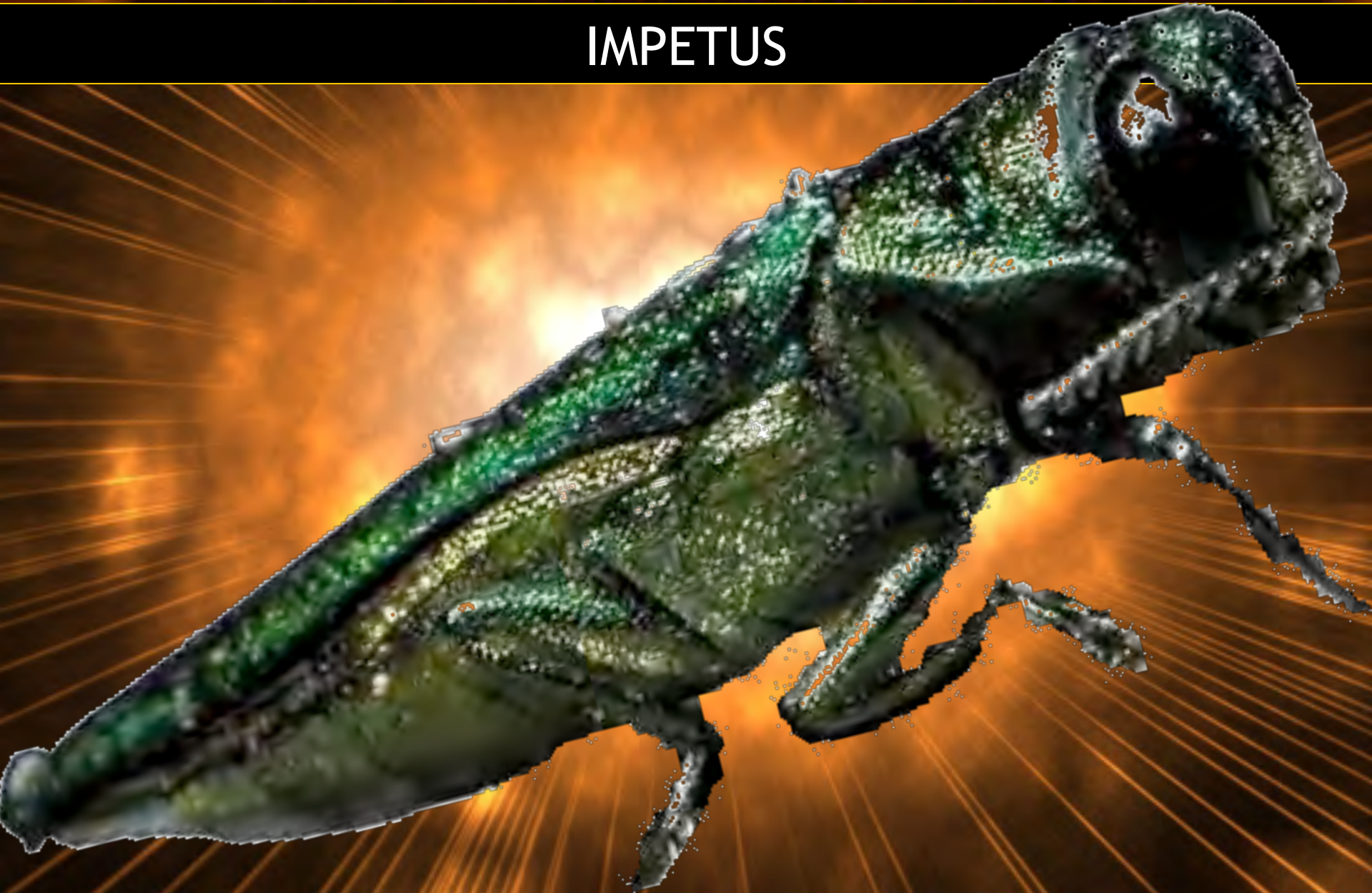
Heating the Midwest Conference - Green Bay, WI

Southeast Michigan  
Resource Conservation  
& Development Council



MICHIGAN WOOD ENERGY

IMPETUS



# MICHIGAN WOOD ENERGY

## PREVIOUS WORK



### 2005 SE MICHIGAN WOOD RESIDUE STUDY

*(Sherrill and MacFarlane 2007)*

2,600 companies

7.5 M cu yd/yr

=354 football fields 10 ft deep

Disposal cost = \$8.8 M

28% landfilled

### 2009 SE MICHIGAN WOOD YARD SURVEY

*(Nzokou 2009)*

180 yards = \$40M/yr

Only 30% recycled

# MICHIGAN WOOD ENERGY

## PROJECT BACKGROUND



**Project Lead:**  
**CTA Architects & Engineers**

**2007 GOALS:**

- Explored small institutional/commercial biomass conversion projects
- Identified 2,300 MI boilers w/est payback <20 yrs
- Conducted feasibility studies

**Project Lead:**  
**Wilson Engineering Systems**

**2012-2014 GOALS:**

- Revisited Michigan boiler list; called priority sites
  - Used same methodology across 35 states
  - In process of conducting feasibility studies

[www.michiganwoodenergy.org](http://www.michiganwoodenergy.org)

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Is wood fuel right  
for your boiler?

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WOOD

The local, clean, renewable,  
affordable, **sustainable**  
fuel choice. 

# MICHIGAN WOOD ENERGY

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## Exploring Woody Biomass Retrofit Opportunities In Michigan Boiler Operations

9/28/2007

The [Southeast Michigan RC&D Council](#) selected a team of experts ([CTA Architects Engineers](#), [Emergent Solutions](#), [Christopher Allen + Associates](#), [Loracs Creations](#), and [Geodata](#)) to provide a statewide assessment of the potential to integrate wood-fired boiler systems into existing facilities throughout the State of Michigan.

Their final report, *Exploring Woody Biomass Retrofit Opportunities In Michigan Boiler Operations*, includes analysis and conclusions that may help guide strategic wood energy developments statewide. Key features of the report include discussions of the following:

- Recent biomass utilization studies and successful retrofit projects
- Probable costs, savings, and simple payback scenarios for

### Download the Report

All are PDF files.

[Final Report](#) (1.31 MB)

[Appendix A: Statewide Summaries](#) (58 KB)

[Appendix B: County Summaries](#) (595 KB)

Appendix C: Figures  
[Figures 1 - 5](#) (3.05 MB)

[Figures 6 - 10](#) (3.11 MB)

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# MICHIGAN WOOD ENERGY

## CALCULATOR: PRIMARY TARGETS



- Beginner-level exploration:
  - Simple
  - Few data points
  - Accessible
- Small commercial or institutional retrofit
- Intended as first step, prior to using engineers

## CALCULATOR LIMITATIONS

- Designed for retrofit of traditional systems oversized for peak loads
- Estimates on costs and savings are based on slightly older technology (2007) than currently available
- No thermal storage options are included
- Very large or small systems can have less reliable results



# MICHIGAN WOOD ENERGY

## EXAMPLE 1: USFS-WERC STUDY SITE - PA SCHOOL

### Wood Energy Calculator

#### Contact Information

E-mail

jessica.simons@semircd.org

County

Out of State

#### Facility Type

- Office/Retail
- Detention
- Education
- Healthcare
- Industry
- Power Production
- Residential
- Not Applicable

#### Boiler Size

Combined Input of Boilers Current Facility

8,400,000 (in BTUs)

#### Current Fuel Type

- Coal
- Electrical
- Fuel Oil
- Natural Gas
- Propane

### Calculator Continued

#### Fuel Information

Price of Current Fuel

2.95 (\$ per gallon)

Annual Use of Current Fuel

63,500 (in gallons)

Projected Price of Wood Fuel

40 (\$ per green ton)

#### Financing

Projected Interest Rate

5 (%)

# MICHIGAN WOOD ENERGY

## EXAMPLE 1: USFS-WERC STUDY SITE - PA SCHOOL

### Michigan Wood Energy Report

**Estimated Total Project Cost: \$936,600.00**

**Simple Payback: 6.8 years**

Project Financing Information	
Percent Financed	100%
Amount Financed	\$936,600.00
Amount of Grants	\$0.00
Interest Rate	5%
Term	10 Years
Annual Finance Cost - Principal and Interest	\$121,294.00

Annual Project Costs					
Cash Flow Descriptions	Unit Costs	Fuel Source Proportion	Annual Fuel Quantities	Fuel Units	Year 1 Costs
<b>Estimated Existing Annual Costs</b>					
Existing Fuel (fuel oil)	\$2.95		63,500.00	gallon	\$187,325.00
<b>Estimated Proposed Wood-Fired System Annual Costs</b>					
Wood Fuel (chips)	\$40.00	95%	953	ton	\$38,120.00
Existing Fuel	\$2.95	5%	3,175.00	gallon	\$9,366.00
Additional Operation and Maintenance Costs					\$3,000.00
<b>Total Proposed Annual Costs</b>					\$50,486.00
<b>Annual Cost Savings</b>					<b>\$136,839.00</b>
<b>Annual Finance Cost - Principal and Interest</b>					\$121,294.00
<b>Net Annual Cash Flow</b>					\$15,545.00

# MICHIGAN WOOD ENERGY

## EXAMPLE 1: USFS-WERC STUDY SITE - PA SCHOOL

<b>SITE DETAILS:</b> 8.4 mm BTU boiler 63.5K gal fuel oil/yr \$2.95/gal oil - \$40/ton wood	<b>Preliminary Feasibility Report*</b>	<b>MWE Calculator Results</b>
Total Project Cost	\$1.3 M	\$936K
Simple Payback	10.8 years	6.8 years
Existing Fuel Cost	\$187K	\$187K
Proposed Annual Fuel Cost	\$75K	\$50.5K
Annual Savings	\$122K	\$137K
Annual Cash Flow	\$3K	\$15.5K

Data from: USDA Forest Service Preliminary Feasibility Report  
Penns Manor Area School District - November 2011  
Yellow Wood Associates, Inc.  
[http://na.fs.fed.us/werc/woody\\_biomass/](http://na.fs.fed.us/werc/woody_biomass/)

# MICHIGAN WOOD ENERGY

## ASSUMPTIONS

### Assumptions

Some standard values were used to make this calculation. These figures are likely to be suitable for your project; however, a site with different values may have a less reliable report. The following assumptions were used:

- Amount of grants: \$0.00
- Term of financing: 10 years
- Wood fuel type = chips for systems > 3,000,000.00 btu
- Wood fuel type = pellets for systems <= 3,000,000.00 btu
- Proportion of wood fuel use in new system: 95%
- Proportion of existing fuel use in new system: 5%

*[Note: Wood boiler sizes are assumed to be half of the size of existing boilers to maximize efficiency. This size is optimal for meeting the needs of 90-95% of a typical heat load. Existing fossil fuel boilers, which are generally oversized, can still be used to meet infrequent peak load conditions.]*

The information provided by the Wood Energy Calculator is a preliminary assessment and should not be used to develop actual project plans. Projected costs and savings are only estimates; no guarantee of actual expenses or benefits is implied.

Projects in Livingston, Macomb, Monroe, Oakland, Saint Clair, Washtenaw, and Wayne Counties are subject to PM-2.5 EPA non-attainment area standards. In most cases, additional air quality measures are required in this region and will likely result in higher costs.

**Please see the [FAQs](#) and [Interpreting Your Results](#) for more information.**

## INTERPRETING RESULTS

A guide is included in all reports to assist users with interpreting results and understanding definitions, such as:

**SIMPLE PAYBACK** =

*(Time needed to pay off system through cost savings alone.)*

Estimated total project cost

Annual cost savings

**NET CASH FLOW** =

Annual cost savings - Annual finance cost

# MICHIGAN WOOD ENERGY

## EXAMPLE 2: Pharma Facility - Ann Arbor, MI

### Wood Energy Calculator

#### Contact Information

E-mail

County

#### Facility Type

- Office/Retail
- Detention
- Education
- Healthcare
- Industry
- Power Production
- Residential
- Not Applicable

#### Boiler Size

Combined Input of Boilers Currently in Your Facility

(in BTUs)

#### Current Fuel Type

- Coal
- Electrical
- Fuel Oil
- Natural Gas
- Propane

### Calculator Continued

#### Fuel Information

Price of Current Fuel

(\$ per decatherm)

Annual Use of Current Fuel

(in decatherms)

Projected Price of Wood Fuel

(\$ per green ton)

#### Financing

Projected Interest Rate

(%)

### Calculator Continued

#### Fuel Information

Price of Current Fuel

(\$ per decatherm)

Annual Use of Current Fuel

(in decatherms)

Projected Price of Wood Fuel

(\$ per green ton)

### Calculator Continued

#### Fuel Information

Price of Current Fuel

(\$ per decatherm)

Annual Use of Current Fuel

(in decatherms)

Projected Price of Wood Fuel

(\$ per green ton)

# MICHIGAN WOOD ENERGY

## EXAMPLE 2: Pharma Facility - Ann Arbor, MI

<b>SITE DETAILS:</b> 48.5 mm BTU boiler 42.5K dth natural gas \$35/ton wood	<b>\$4.50/dth</b>	<b>\$6/dth</b>	<b>\$13/dth</b>
Total Project Cost	\$2.1 M	\$2.1 M	\$2.1 M
Simple Payback	203 years	30 years	6 years
Existing Fuel Cost	\$191K	\$255K	\$552.5K
Proposed Annual Fuel Cost	\$181K	\$184K	\$199K
Annual Savings	\$10.5K	\$71K	\$354K
Annual Cash Flow	(\$267K)	(\$207K)	\$76K

# MICHIGAN WOOD ENERGY

## EXAMPLE 3: Auto Plant - Warren, MI

### Wood Energy Calculator

#### Contact Information

E-mail

jessica.simons@semircd.org

County

Wayne

#### Facility Type

- Office/Retail
- Detention
- Education
- Healthcare
- Industry
- Power Production
- Residential
- Not Applicable

#### Boiler Size

Combined Input of Boilers Currently in Your Facility

80,000,000 (in BTUs)

#### Current Fuel Type

- Coal
- Electrical
- Fuel Oil
- Natural Gas
- Propane

Continue

### Calculator Continued

#### Fuel Information

Price of Current Fuel

3 (\$ per gallon)

Annual Use of Current Fuel

500,000 (in gallons)

Projected Price of Wood Fuel

35 (\$ per green ton)

#### Financing

Projected Interest Rate

5 (%)

Finish



# MICHIGAN WOOD ENERGY

## EXAMPLE 3: Auto Plant - Warren, MI

### Michigan Wood Energy Report

Estimated Total Project Cost: \$4,800,000.00

Simple Payback: 4.2 years

Project Financing Information	
Percent Financed	100%
Amount Financed	\$4,800,000.00
Amount of Grants	\$0.00
Interest Rate	5%
Term	10 Years
Annual Finance Cost - Principal and Interest	\$621,622.00

Annual Project Costs					
Cash Flow Descriptions	Unit Costs	Fuel Source Proportion	Annual Fuel Quantities	Fuel Units	Year 1 Costs
<b>Estimated Existing Annual Costs</b>					
Existing Fuel (fuel oil)	\$3.00		500,000.00	gallon	\$1,500,000.00
<b>Estimated Proposed Wood-Fired System Annual Costs</b>					
Wood Fuel (chips)	\$35.00	95%	7505	ton	\$262,675.00
Existing Fuel	\$3.00	5%	25,000.00	gallon	\$75,000.00
Additional Operation and Maintenance Costs					\$10,000.00
<b>Total Proposed Annual Costs</b>					\$347,675.00
<b>Annual Cost Savings</b>					\$1,152,325.00
<b>Annual Finance Cost - Principal and Interest</b>					\$621,622.00
<b>Net Annual Cash Flow</b>					\$530,703.00

### Your Current Information

This is the information you submitted via the calculator:

- E-mail: jessica.simons@semircd.org
- County: Wayne
- Facility type: Industry
- Combined boiler size: 80,000,000.00 btu
- Current fuel type: Fuel Oil
- Current fuel price: \$3.00
- Annual use of current fuel: 500,000.00 gallons
- Projected wood fuel cost: \$35.00 / ton chips
- Projected interest rate: 5%

### Michigan Wood Energy Report

Estimated Total Project Cost: \$4,800,000.00

Simple Payback: 2.3 years

Project Financing Information	
Percent Financed	100%
Amount Financed	\$4,800,000.00
Amount of Grants	\$0.00
Interest Rate	5%
Term	10 Years
Annual Finance Cost - Principal and Interest	\$621,622.00

Annual Project Costs					
Cash Flow Descriptions	Unit Costs	Fuel Source Proportion	Annual Fuel Quantities	Fuel Units	Year 1 Costs
<b>Estimated Existing Annual Costs</b>					
Existing Fuel (fuel oil)	\$5.00		500,000.00	gallon	\$2,500,000.00
<b>Estimated Proposed Wood-Fired System Annual Costs</b>					
Wood Fuel (chips)	\$35.00	95%	7505	ton	\$262,675.00
Existing Fuel	\$5.00	5%	25,000.00	gallon	\$125,000.00
Additional Operation and Maintenance Costs					\$10,000.00
<b>Total Proposed Annual Costs</b>					\$397,675.00
<b>Annual Cost Savings</b>					\$2,102,325.00
<b>Annual Finance Cost - Principal and Interest</b>					\$621,622.00
<b>Net Annual Cash Flow</b>					\$1,480,703.00

### Your Current Information

This is the information you submitted via the calculator:

- E-mail: jessica.simons@semircd.org
- County: Wayne
- Facility type: Industry
- Combined boiler size: 80,000,000.00 btu
- Current fuel type: Fuel Oil
- Current fuel price: \$5.00
- Annual use of current fuel: 500,000.00 gallons
- Projected wood fuel cost: \$35.00 / ton chips
- Projected interest rate: 5%

# MICHIGAN WOOD ENERGY

a smart fuel choice 

## What is energy costing you?

Energy costs are a huge burden to Michigan's communities. Most of the fuels used in the state are imported — 100% of the coal, 96% of the oil, and 75% of the natural gas — at a cost of \$18 billion each year to our local economy.

Using wood as a biomass energy fuel source, especially where wood chips are plentiful and cheap, can be one answer for some public and private institutions. In Vermont and several Western states, many schools and public buildings use local wood wastes to fuel their facilities, lowering their fuel costs by as much as 50% while boosting the local economy in the process. Why can't Michigan do the same?



WOOD

The local, clean, renewable, affordable, **sustainable** fuel choice.

For more information about the Michigan Wood Energy project and/or energy grant opportunities for public institutions, please contact the Southeast MI RC&D Council at 734-761-6722 x 105.

## michiganwoodenergy.org

- Learn more about wood energy
- Use the Wood Energy Calculator to estimate costs and benefits of switching to wood fuel
- See successful projects
- Find technical assistance and funding

See the 2007 report,  
*Exploring Woody Biomass Retrofit Opportunities in Michigan Boiler Operations*,  
which names over 2,000 institutions and industries likely to save money by switching to wood fuel. Your facility may be on the list!

Michigan's wood resources are a smart choice for affordable, renewable, & sustainable energy.

Is wood fuel right for your boiler?

FACILITY MANAGER  
BIG THREE CORP.  
123 AUTO LANE  
DETROIT, MI

## WHAT MAKES A GOOD SITE FOR A PROJECT?

1. ↑ energy demand / ↑ fuel costs
2. Appropriate fuel selection: chips, pellets, or cordwood
3. System sized correctly for thermal load
4. Centralized heating system
5. Effective back-up heating system
6. Hot water thermal storage
7. Local sources for affordable wood fuels
8. Space for larger boiler system and fuel storage
9. Other ongoing construction or renovation plans
10. Adequate staffing for ongoing maintenance
11. Potential options for Combined Heat and Power (CHP)
12. Potential options for cooling with biomass
13. Other energy efficiency activities on site
14. Institutional support

# MICHIGAN WOOD ENERGY

## QUESTIONS?

Please contact:  
Jessica Simons  
[jessica.simons@semircd.org](mailto:jessica.simons@semircd.org)



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