Wood-based Heating and Cooling?

Not fossil fuels? Might be worth another look.

Bill Cook, Michigan State University Extension, 2016

Michigan Wood Energy Team

Using wood to heat (and cool) buildings may not be the first thought when the time comes to replace a heating system. Over the lifespan of a new boiler and other capital costs, wood heat can be quite cost-competitive with conventional systems. However, many contractors, builders, and HVAC professionals are not as familiar with modern wood systems as they are with fossil fuel systems. In addition to substantial cost-savings, there are a number of environmental and economic reasons to use wood fuels. These benefits may interest economic developers, facility managers, decision-makers, business owners, and others.

Chips
Pellets
Cordwood

Potential Benefits From Wood?

- Lower cost fuels
- Stable pricing
- Renewable energy
- Many design options
- Automatic
- Low noise
- Low emissions
- Local jobs
- Economic benefits
- Keep energy dollars local
- Sustainable communities
- Degree of energy independence
- Carbon smart
- Ample feedstock supply
- Better forest management

Wood-based thermal energy is all about space heating and cooling, not the generation of electricity or replacements for transportation fuels. Replacing fossil fuel thermal energy with wood is easy. Wood-based thermal technologies offer the lowest-hanging fruit among the suite of renewable choices. They can be combined with other renewable technologies, such as passive solar or geothermal, and measures such as better insulation and energy conservation.

Boiler and chip storage for a school wood thermal energy system.

Lower costs frequently occur over the life of a heating system. Capital costs are often higher, which can cause some initial sticker-shock. However, in the long-term, especially considering the price of various fuels and their price instability, wood comes out favorably in many situations. Fossil fuel prices are currently low, but both history and projections show a high level of volatility, making budget planning a more difficult task. Wood prices, on the other hand, have been remarkably consistent and are likely to remain so.

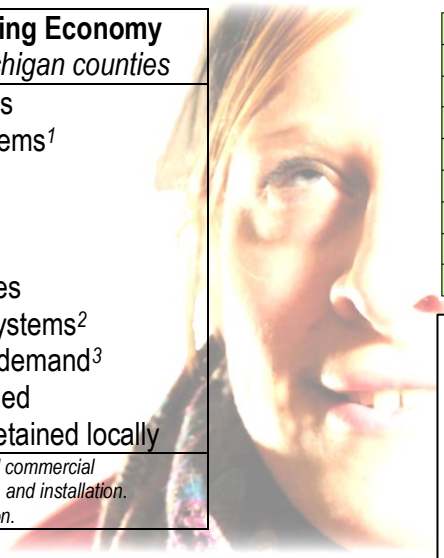
Wood-based system designs have **many forms and various applications;** from a single home to a district energy system connecting many buildings. Fuels include cordwood, chips, and pellets. Each fuel has different characteristics. Wood-based systems are automatic, low noise, and have low emissions.

Environmental benefits come largely in two ways; 1) displacement of fossil fuels and increased carbon sequestration in managed forests result in climate change mitigation and, possibly, increased forest adaptation options; and 2) expanded markets for low quality wood offers a wider range of forest management choices that can result in higher outputs of non-monetary values, such as visual quality, water quality, habitat quality, forest health, exotic species removal, and forest restoration. While wood combustion can result in slightly higher carbon emissions than fossil fuels, the wood-derived carbon is already a part of the carbon cycle. The buried carbon from fossil fuels represents artificial inputs to the carbon cycle.

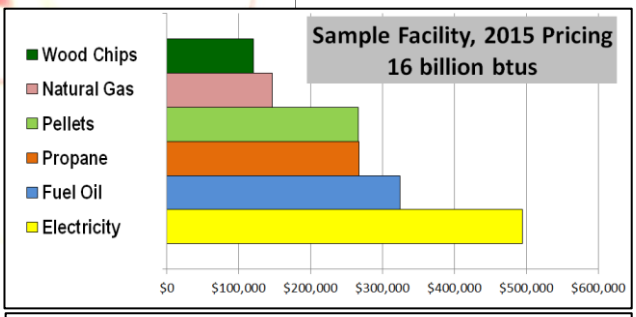
Boiler and water thermal storage tank for a chip-fed microgrid heating system.

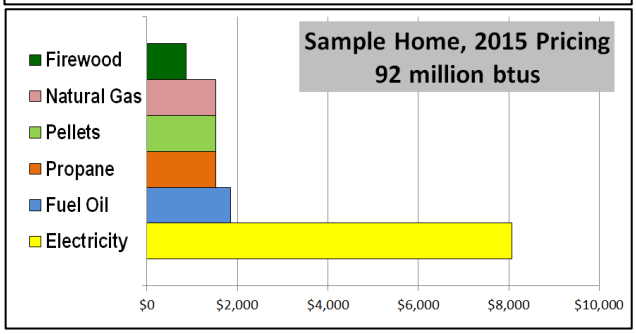
Upper Austria Wood Heating Economy
About the size of seven Michigan counties
300+ district energy systems
50,000 fully-auto small systems[1]
6300 customers
5300 farmer-producers
4500+ jobs
$260 million wood fuels sales
$730 million from heating systems[2]
16% of state's total energy demand[3]
~1.7 million tons CO2 avoided
$1.5 billion energy dollars retained locally

1 – Boiler systems from homes and small commercial
2 – Heating system manufacturing, sales, and installation.
3 – Total = heat, power, and transportation.



Heating Source Base Prices 2015-2016	
Natural Gas	$9.33 / 1000 cuft
Wood Chips	$43 / green ton
Firewood	$145 / cord
Pellets	$225 / ton
Propane	$1.18 / gallon
Fuel Oil	$2.50 / gallon
Electricity, residential	$87.92 / million btu
Electricity, commercial	$30.77 / million btu





Note: Values used in the graphics are sourced from the U.S. Energy Information Administration (for Michigan), spot prices from the central Upper Peninsula, actual wood consumption figures, and conversions made with [http://nepacrossroads.com/fuel-comparison-calculator.php]. The balance of costs will vary among regions and conditions.

Economic benefits come largely from retaining energy dollars at the local level and supporting both existing and new jobs and businesses. The benefits to local communities contribute to community sustainability and cohesion. Michigan schools and businesses that heat/cool with wood have a proven track-record. To a certain degree, these facilities and communities have a bit more energy independence. Each year, Michigan adds enough wood to its standing forest inventory to run a cord pile from the Mackinac Bridge to Anchorage, Alaska . . . and back again. A portion of that annual increase could be harvested and then used for economic gain, including wood-based thermal energy. Wood is a renewable resource; a remarkable advantage when considering sustainability.

As with all technologies and major decisions, there are some **cautions** to consider. While wood heat system capital costs may be higher, they are often recouped within a five to seven year payback period when compared to conventional systems. These calculations need to be done carefully, as financing needs to account for the lower operating costs. Wood-based systems often take more monitoring and a person must be trained, especially for district energy operations. These costs are included in the financial plan. Wood-based thermal energy may not be the best option in all circumstances. All the component pieces must be available, such as suppliers, designers, and installers. Decisions need to consider land use regulations, building codes, insurance, and local ordinances. Public perception is regularly a barrier to bringing a wood-based thermal energy proposal alive. However, failure to consider these systems may result in higher expenses to the homeowner, business owner, and community. Resources are available to help make well-informed decisions.

Wood-based heating and cooling? It just might be worth a second look.

For more information try the following.

Michigan Wood Energy – Statewide Wood Energy Team
http://msue.anr.msu.edu/program/info/wood_energy?a=l

Heating the Midwest
http://heatingthemidwest.org

Biomass Energy Resource Center
http://www.biomasscenter.org

International District Energy Association
http://www.districtenergy.org

MICHIGAN STATE UNIVERSITY | Extension