

# Woody Biomass for Energy in Michigan

## TOPICS FOR DISCUSSION AND INQUIRY

BILL COOK, MICHIGAN STATE UNIVERSITY EXTENSION FORESTER

EXTENSION BULLETIN E-3093

JANUARY 2010

### *What is a CHP Plant?*



*CHP plant with electric capacity of 19 MW and heat capacity of 83 MW.*

A **C**ombined **H**eat and **P**ower (CHP) plant processes *heating, cooling, and electricity* from a feedstock such as coal, biomass, etc. An alternative definition is **C**ooling, **H**eating, and **P**ower. Conventional power plants typically utilize feedstocks for electricity generation alone. The boilers that turn the electricity-generating turbines produce a lot of heat, but that heat energy is typically vented up the smokestacks. Since 1960, the average efficiency of conventional power plants has run about 33 percent.<sup>1</sup> Of course, technology upgrades can increase the efficiency of coal-fired power plants.

CHP plants capture much more of the energy in a feedstock. Conversion efficiencies can approach 90 percent.<sup>2</sup> Most Michigan CHP plants are fueled by natural gas. The chemical industry has the largest CHP capacity.<sup>3</sup>

Biomass-based CHP plants are carbon neutral (or negative) and displace energy that was otherwise generated from fossil fuels, usually coal. Biomass feedstocks might be wood, agricultural products, or municipal solid waste. A “co-gen” plant is sometimes the same as a CHP plant in terms of distributing heat and generating electricity.

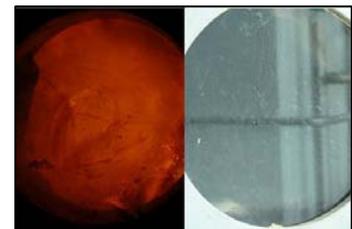
Electricity from a CHP plant is distributed along transmission lines in the same way that electricity is from any other power plant.

Power is sold onto a grid and then sold to customers. It's the heat utilization aspect of a CHP plant that sets apart these generating stations. CHP plants can generate several hundred megawatts or less than a megawatt of energy.

In the process of generating electricity, additional technology captures the energy in the heat by-product. This heat is transferred to water, which is then pumped through a system of underground pipelines. Both large and small buildings can be economically heated from the hot water grid. This hot water grid is called “district energy” and can be used with or without the electricity generating component. CHP plants can also be used to drive “chillers” so that buildings can be air conditioned.

CHP plants include emissions control systems appropriate to the feedstock and permitting requirements of federal and state agencies.

*Viewports to a high-temperature boiler (left) and a wet-scrub unit (right), part of an emissions control system.*



As an example, downtown St. Paul, Minnesota is cooled, heated, and powered by a CHP plant that burns municipal solid waste. Efficient recycling programs extract valuable materials before such waste is shipped to a CHP plant. Northern European countries are increasingly building CHP plants and using the biomass feedstocks that are most available in their area.

Wood has proven to be quite advantageous where it is available. A wood-based CHP plant will expand local markets, allowing more forest management practices to be implemented. This, in turn, can enhance the health, quality, and productivity of area forests.

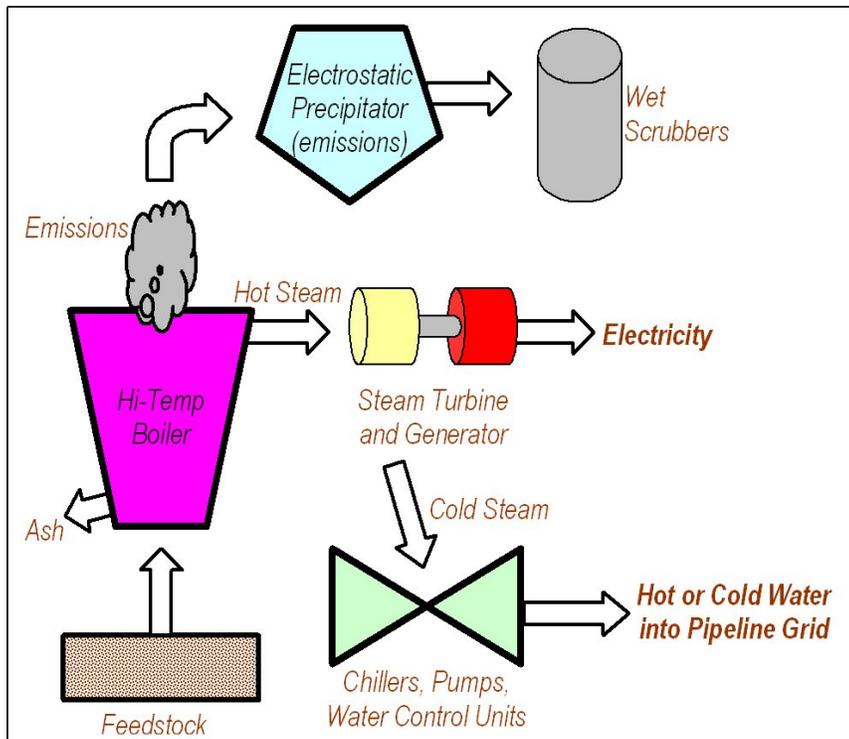
Wood has less ash content than agricultural products and none of the hazardous wastes that may appear in municipal solid waste, so wood-fired plants require a lower investment in environmental quality technology than plants using these other feedstocks.

In some regions, retired farmland can be used to produce energy plantations of willow, hybrid poplar, switchgrass, *Miscanthus*, and other biomass materials. Such energy-specific plantations provide economic benefit to local communities and reduce feedstock costs for CHP and district energy plants. Long-standing efforts in countries such as Sweden have shown that these systems can be effective in reducing dependency on fossil fuels and supporting local economies.

CHP plants that use biomass feedstocks can sell carbon credits or “green” credits in financial markets where such systems are developed. These credits can be an additional and important revenue stream for the energy company. In states with renewable energy portfolios, electric utilities are required to produce a percentage of their power from “green” sources. For states that define wood as a “green” energy source, wood can be an excellent sustainable and environmentally-friendly feedstock.



*Woody feedstock supply conveyor into a biomass powered CHP plant.*



Feedstock supply sources for a CHP plant must be well understood as part of a feasibility study. Michigan has an abundant annual accumulation of wood -- about 21 million green tons per year.<sup>4</sup> However, accessibility, landowner willingness to sell, and competing uses will limit availability. Furthermore, purchase agreements will likely be needed in large quantities through some sort of aggregator. Large wood-using energy facilities will not likely purchase wood from a large number of individual logging contractors as the current forest industry does.

<sup>1</sup> CHP Basics & Benefits. 2008. Midwest CHP Application Center. Available at: [www.chpcentermw.org/03-00\\_chp.html#consumption](http://www.chpcentermw.org/03-00_chp.html#consumption).

<sup>2</sup> The Renewable Energy Centre. 2008. At: [www.renewableenergycentre.co.uk/combined-heat-and-power-chp](http://www.renewableenergycentre.co.uk/combined-heat-and-power-chp).

<sup>3</sup> Midwest CHP Application Center. 2003. BChP Baseline Analysis for the Michigan Market 2003 Update. Where published: University of Illinois at Chicago Energy Resources Center. 69 p.

<sup>4</sup> Conversion factors used: 80 cubic feet/cord, 2.3 green tons/cord. Pugh, Scott, et al. 2008. Michigan's Forest Resources, 2007. Research Note NRS-28. Where published: U.S. Department of Agriculture, Forest Service, Northern Research Station, 2 p.



MICHIGAN STATE UNIVERSITY EXTENSION

Prepared by Michigan State University Extension

Upper Peninsula Tree Improvement Center, 6005 J Road, Escanaba, MI 49829 906-786-1575

For more information on MSU initiatives, visit the Office of Biobased Technologies at [www.bioeconomy.msu.edu](http://www.bioeconomy.msu.edu)

MSU is an affirmative-action, equal-opportunity employer. Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, gender identity, religion, age, height, weight, disability, political beliefs, sexual orientation, marital status, family status or veteran status.