An Overview of Biomass Power in Michigan

Michigan Biomass

Baseload renewable

Local resources, local jobs, local communities

Data and perspectives on, and characterizations about, biomass power generation in the state of Michigan.

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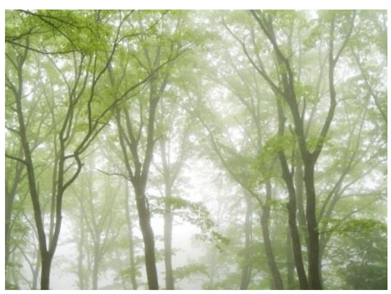
Table of contents


Biomass power is not like other sources of energy. It is an alternative to electricity produced by fossil fuels and nuclear power, and provides attributes not found in other types of renewable power, such as solar and wind. It is the only energy source amongst the leading renewables in Michigan that can be produced and stored on a meaningful scale.

This document presents data, information and perspectives on biomass power generation in the state of Michigan, with the intent of providing a starting point for discussions on how to ensure the viability of this important industry now and into the future.

Independently produced biomass power has been operating in Michigan for 30 years, providing economic, wildlife, environmental and technical benefits. Initial power purchase agreements were obtained under the Public Utility Regulatory Policies Act (PURPA) in the 1980s, providing all of its benefits before adoption of renewable portfolio standards (RPS) in 2008. Despite the apparent success of the RPS, biomass is confronted with new challenges in the emerging energy landscape, which may present potential for significant negative impacts to these existing facilities, in the short and near term, and the mostly rural communities where they are located.

Background

Michigan Biomass was formed in 2007 to represent the biomass power industry's interests in legislative efforts to establish renewable portfolio standards. The coalition represents six of the state's wood-firing power facilities, which provide the bulk of the state's grid connected biomass power. Member companies total 162 MW of installed capacity, all under long-term contracts.

Table 1: Michigan biomass facilities

Member facilities	Location	Size (MW eq.)	Start date	Type	PPA
1. Cadillac Renewable Energy	Cadillac	36	1992	Dispatched	CECo.
2. Genesee Power Station	Flint	36	1994	Dispatched	CECo.
3. Grayling Generating Station	Grayling	36	1992	Dispatched	CECo.
4. Hillman Power Co.	Hillman	18	1986	Baseload	CECo.
5. Viking Energy of Lincoln	Lincoln	18	1987	Baseload	CECo.
6. Viking Energy of McBain	McBain	18	1988	Baseload	CECo.
Non-member facility					
1. L'Anse Warden Electric[1]	L'Anse	18	2008	Baseload	DTE
2. TES Filer City	Manistee	9	1990	Baseload	CECo.
3. Northern Michigan University	Marquette	3	2013	CHP	n/a
4. Central Michigan University[2]	Mt. Pleasant	3	1987	CHP	n/a
5. Michigan State University	E. Lansing	n/a	2013	CHP	n/a
6. Verso Paper	Quinnessec	25	2012	CHP	n/a
7. Fremont Community Digester	Fremont	n/a	2012	CHP	CECo.

[1] CHP, process heat and steam sold for forest products manufacturing
[2] Idle as of July 2013

Biomass is organic gases, liquids and solids.[3] In energy terms it includes landfill gas, anaerobic digestion, and combustion or gasification of organic solids. By these definitions Michigan ranked fifth in the nation in 2012 in total biomass energy production; fourth in grid-connect power from wood and wood-derived sources alone, behind California, Florida and New Hampshire, respectively. Michigan's wood resources are an important part of those numbers. Wood-based energy accounted for 63% of total biomass energy in the state, with grid-connected wood-fired power plants responsible for 57% of that figure; the balance produced by forest products industries for internal energy needs.[4] Biomass power made up 39% of the renewable energy credits in the MIRECS system in 2012.[5]

Table 2: 2012 Production (MWh)

State	Total Biomass	Nat'l. Rank	Wood/Grid	Nat'l. Rank
CA	6,327,004	1	2,648,107	1
FL	4,478,263	2	303,548	10
ME	3,910,648	3	1,112,222	2
AL	3,258,369	4	0	--
MI	2,447,934	5	880,557	4

NH third in grid connected power @ 1,001,094 MWh

Biomass fuels

Michigan's grid-connected biomass power industry relies almost exclusively on wood fuel.[6] These wood-fired power plants have provided the forest products industry and generators of wood wastes and byproducts with an economical, environmentally-wise disposal option since 1986, wringing the last bit of value from forest resources by extracting the energy value from:

- Timber harvest residues that would otherwise be left in the forest, posing fire risks and decomposing into methane, a potent greenhouse gas.
- Mill wastes that would be landfilled or open burned.
- Clean "recycled" wood diverted from landfills, such as crates and pallets.
- Urban "green wood," such as storm and landscape debris and right-of-way maintenance.

In addition to residues from virgin wood, many of these facilities are permitted to co-fire small portions of other materials, or alternative fuels, such as tire-derived fuel (scrap tire chips, or TDF) and non-virgin wood such as railroad ties. These supplemental fuels improve combustion efficiency, reducing total air emissions, and providing a market for materials that would

[3] Energy Information Administration; "Other Biomass" includes biogenic municipal solid waste, landfill gas, sludge waste, agricultural byproducts, other biomass solids, other biomass liquids, and other biomass gases (including digester gases and methane). "Wood and Wood Derived Fuels" includes paper pellets, railroad ties, utility poles, wood chips, bark, red liquor, sludge wood, spent sulfite liquor, and black liquor, with other wood waste solids and wood-based liquids

[4] Energy Information Administration, *Net Generation by State by Type of Producer by Energy Source*, includes IPPs, utilities and commercial and industrial CHP.

[5] MPSC *Report on the Implementation of the PA 295 Renewable Energy Standard and the Cost-effectiveness of the Energy Standards,* February 2013

[6] Excludes landfill gas and anaerobic digestion

otherwise be considered wastes. Whole tires are specifically banned from Michigan landfills and are an on-going solid waste management issue mitigated almost entirely by TDF users. In 2011 they consumed 90% of the nearly 14 million tires collected under the Michigan Department of Environmental Quality's scrap tire management program. Biomass plants alone consumed 8 million tires that year, or 60% of all TDF use; more than half (54%) of all the tires collected under the program.[7]

Fuel economics

Biomass power is a significant economic force in rural Michigan, due largely to the procurement and purchase of locally-sourced fuel. In 2011 the six Michigan Biomass plants spent more than $30 million[8] in fuel alone, supporting more than 400 direct, full-time fuel-related jobs.[9] Payroll tops $11 million annually, in addition to millions of dollars paid in local taxes and the purchase of local goods and services.

These are mostly rural communities where these facilities are often one of the largest employers and taxpayers. In fact, four counties with biomass power facilities are among the five counties with the highest unemployment rate in the state.[10]

Power benefits

Biomass power generation also has multiple technical benefits unrecognized in Michigan's RPS. First, power from biomass is stored energy. Unlike intermittent power that relies on unpredictable wind and solar resources, biomass energy is stored in its fuel, making it available to meet demand 24-7. And because it is baseload capable, biomass power plants help stabilize the state's transmission grid in rural areas, unlike intermittent power sources that complicate grid stability and require backup generation when not producing. For example, biomass plants must closely coordinate outages with the system operator because of the loss of grid support when they go off line. They also provide regional power and support during service interruptions caused by grid failures or outages in other parts of the state.

Baseload biomass also provides an important power characteristic that intermittent sources cannot. Baseload power is AC generation that includes volt-ampere reactive power (VARs), a physical property of power required by large load factors such as industrial motors. Wind and solar power is DC generated and converted to AC power and do not have the ability to generate VARs that are needed to support industrial loads.

[7] *Scrap Tire End-Use; Estimated Usage and Capacity,* Michigan Department of Environmental Quality, 2011. Other TDF users are principally pulp & paper mills.

[8] MPSC case U-16432-R, http://efile.mpsc.state.mi.us/efile/docs/16432-R/0095.pdf

[9] Source: 2.3 FTEs per 13,000 green tons annually (industry standard) x 162 MW of capacity

[10] July 2013, LARA: Wexford, 13.9% (79th); Alcona, 14.8% (80th); Montmorency, 14.9% (81st); and Baraga, 17.5% (83rd)

Biomass power is dispatchable renewable power that offers firm backup to intermittent renewable energy systems. It is stored renewable energy, unlike wind and solar, which are neither dispatchable nor on demand. Baseload power is vital to heavy industry.

Critical fuel factors

Today the biomass power industry maintains its critical role in the state's energy mix through a history of sound management, efficient operation, and reliable long-standing relationships with fuel suppliers. Fuel cost and availability are the most critical factors in the success of any steam electric generating plant. Biomass is no exception. However, because our fuel supplies are derived from the economic activity of other industries, i.e. timber management, forest products manufacturing and agriculture, biomass plant operators must manage their fuel amid the ups and downs of these local and regional industries, and their related economic factors. With fuel availability dictating a region's capacity for biomass power, the dynamics of fuel pricing and supply are at the center of this industry's viability. While "biomass" spans a broad spectrum of potential feedstock, i.e. agriculture residues and dedicated energy crops, in Michigan wood fiber byproducts have been and will continue to be the most commonly used and available source of biomass power here and across the country.

With fuel constituting up to 80% of operational costs, a strong fuel management program is vital to the success of biomass power plants, whether it's a pre-RPS facility, a coal-to-biomass conversion, or a green field development. Fuel studies and contracts are the first critical component in developing a biomass project, and a significant factor to secure financing. The availability of raw or natural resources, the sustainability of the industries that use them, *and* the markets those industries serve are critical factors in biomass economics. In other words, if consumers are not buying plywood, board, lumber and paper, then the forest products industry is not producing the residues and byproducts that make up the economical fuel supply needed to succeed in the energy marketplace. Therefore, the volume of biomass energy produced in the state is first determined by the volume of biomass fuel that these markets can affordably, reliably and sustainably provide.

PURPA & fuel market dynamics

While there is a lot of research into growing and procuring biomass specifically for energy production, the economics of biomass power generation in Michigan and around the country over the past 30 years has been built on low- or no-value wood fiber, sometimes referred to as "unmerchantable." Biomass prices at the power plant gate are driven by processing and transportation costs, and therefore, are heavily driven by diesel prices. Over the past few years diesel prices have been stable, but like most energy costs are trending higher, putting upward pressure on biomass prices. On the other side of this equation is the utility cost of coal power. As the PURPA plants make up the bulk of biomass power in the state, they drive the biomass fuel market under the avoided cost structures of these contracts. Therefore, the cost of coal represents a kind of cost cap "proxy" on wood fuel prices. Like biomass, coal prices have been trending upward because of increased transportation costs. That has not always been the case. Beginning around 1993 coal prices dropped dramatically with the discovery of vast western coal deposits, lowering energy payments under PURPA that did not recover until 2005.[11] At the same time, fuel availability dropped because of the economic downturn in the forest products industry, reducing fuel supply and driving prices up. Biomass fuel sources shifted dramatically during that time, from predominantly mill byproducts to "stump" sources, such as forest thinning and timber harvests residues.

Supply chain

Biomass power also depends on a reliable supply chain infrastructure. An oversupply in the fuel market limits the need for fuel operators; under supply increases costs and jeopardizes biomass plant viability. Over the past ten years the erosion of the pulp and paper industry has destabilized this infrastructure. Even today, as the broader forest products industry begins to recover, attrition within the logging community is stressing the cost and availability of wood fiber, which subsequently impacts biomass fuel cost and availability. These are short-term and long-term implications. Additionally, many timber harvesting contracts now stipulate that the residuals be removed from the site. Without the biomass power industry to pay for these residuals, loggers would have to landfill or otherwise dispose of the material, incurring higher costs. Biomass power turns this operational expense into a revenue stream.

The take away from these fuel dynamics is that successful biomass power production is a balancing act between unrelated forces: the ebbs and flows of the forest products industry and its supply chain infrastructure, and the utilities' cost of production that establishes revenues. This makes biomass power fundamentally different from other renewable energy systems, particularly wind, that are driving Michigan's renewable energy marketplace. Biomass power must compete with other forces in the fiber market, and with other renewable energy sources within the RPS, most having enjoyed federal subsidies not afforded to biomass.[12]

The complexities inherent to this biomass fuel model explain why there has been little new biomass power developed in the past 15 years or under Michigan's RPS since 2008. These often unique limitations on affordable, reliable fuel for power are hard to understand and make financiers reluctant to capitalize these projects, and utilities reluctant to enter power purchase agreements. Since enactment of the RPS in 2008 more than 1000 MW of capacity has been proposed but only 35 MW has been built or is under construction (Table 4).

Biomass and energy policy

Biomass clearly has played an important role in the state's past and present energy portfolio. At a bare minimum, sound energy policy will ensure the continued operation of existing biomass

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[11] Source: Actual variable energy payments under Michigan PURPA contracts, 1993-2005.
[12] Source: Biomass Power Association testimony, U.S. House Ways & Means Committee, 2012. Federal renewable energy tax credits expire 12/31/2013. See Joint Committee on Taxation for detail.

capacity. Biomass power provides grid support, and economic and environmental benefits that are simply too valuable to surrender to the creation of a renewable energy market that does not recognize and support these benefits.

Preserve existing capacity

While the intrinsic values of biomass power bring net benefit to the State of Michigan, these benefits come with complexities that present economic challenges for projects operating without the benefit of an RPS-supported contract, such as the existing biomass plants. Coal-based energy rates under these contracts often do not support actual plant operating expenses. These PURPA contracts will expire over the next 16 years, the first in 2016, which could lead to plant closures, the loss of jobs and the significant economic benefit these facilities have on rural communities, and the loss of environmental and forest health benefits this industry provides.

Given the complexities of biomass power generation – fuel cost and availability and the incongruity of existing PURPA contracts and new renewable energy policy – solutions may not be simple or easy. However, Michigan Biomass and its member facilities are eager to engage policy makers to provide specific data and information, and explore options.

Understanding biomass potential

While preserving and fully utilizing existing biomass capacity constitutes prudent energy policy, state lawmakers and the industry must make a concerted effort to assess the state's potential for biomass energy production. In fact, some steps have already been taken. The Department of Natural Resources, at the direction of Gov. Snyder through the Timber Advisory Council (TAC), conducted a forest products summit on April 23, 2013 to look at ways to expand the state's forest products industry, which is crucial for the continued viability of traditional biomass power resources. Biomass energy, and the synergy and services it brings to this industry, have been established as a high priority by the administration. Still, concrete action is needed to help ensure the viability of this industry.

Knowing where potential biomass feedstocks are available is critical to the sustainability of biomass energy production. Federal Forest Inventory Analysis (FIA) data indicate Michigan's forest growth exceeds withdrawals, and even though the Forest Resource Division has better information regarding its forests than most states, real-time regional data to identify energy feedstock opportunities are lacking. The TAC has recommended that the state add forest resource utilization and marketing expertise to appropriate state departments.

Michigan Technological University and Michigan State University have developed advanced biomass inventory systems that are incomplete and have not been fully utilized in the broad sense of attracting development. Both systems are worthy of appropriate public investment and implementation to form a foundation from which biomass energy potential can be assessed.

While forest residues and byproducts continue to be the bulwark of biomass energy production, research and investigation into dedicated energy crops continues. In its most applicable sense purposely grown energy crops are viewed as a hedge against fluctuating prices from traditional fuel sources.[13] Research into the cultivation of dedicated woody biomass crops is ongoing.

Concluding statements

- Biomass power produced from forest residue and industrial wood byproducts has and can continue to "carry the freight" for Michigan's renewable energy future. It is power produced from local resources, providing local jobs and supporting local communities. The economics of biomass power support forest health and stewardship and creates markets for materials that would otherwise be considered waste.

- Biomass power is "stored" renewable energy that supports the operation and stability of the transmission grid, and generates VARs needed by industry and provides backup for intermittent power supplies: traits that cannot be claimed by wind and solar power that dominate the new renewable energy landscape.

- Sound energy policy includes the preservation of, and full utilization of existing biomass capacity, as well as efforts to fully explore and assess Michigan's biomass potential.

- Biomass power relies on the economic vitality of other industries and natural resources to provide a fuel that meets current contract structures and economic models. These industries need to be revitalized on their own accord, and the dynamics of their utilization of natural resources and energy's role within those dynamics need to be fully understood and assessed to determine how to maximize their potential for energy production.

- Public investment is needed to restore and maintain critical resource data and information systems needed to quantify Michigan's biomass feedstock potential.

[13] MSUE is also conducting other dedicated energy crop research involving switchgrass and similar materials.

Table 4: Biomass power projects announced, 2008 to present[14]

Project	MW eq. Cap	MWh eq.	Wood tons	2013 status
CMU	17	134,028	227,848	Terminated
DTE	400	3,153,600	5,361,120	Terminated[15]
Escanaba	25	197,100	335,070	Under development
Gwinn	20	157,680	268,056	Pending
LBW&L	300	2,365,200	4,020,840	Terminated
Mancelona	36	283,824	482,501	Terminated
Dow Corning	40	315,360	536,112	Terminated
Newberry	24	189,216	321,667	Terminated
NMU	10	78,840	134,028	Completed
TCL&P	20	157,680	268,056	Terminated
Verso	25	197,100	335,070	Complete
White Pine	50	394,200	670,140	Pending
Wolverine	120	946,080	1,608,336	Terminated
Totals	**1,087**	**8,569,908**	**14,568,844**	

[14] "Pending" status indicates completion of at least one major project component, i.e. permitting, financing, negotiations, power purchase agreement, etc.

[15] Seven coal plant conversions. Only one project, the Pontiac Assembly Plant coal conversion, remains pending