

# Wood-Based Electric Power Generation in Michigan: Wood Use and Policies

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## Abstract

A survey of six stand-alone wood-based electric power generation plants in Michigan assessed facility operating characteristics, fuel characteristics, sources of wood, and operators' views on wood supply and needed policy changes. Survey results provide insights regarding the role of these renewable energy plants in meeting Michigan's Renewable Portfolio Standard (RPS). The plants have long-term power supply agreements with Consumers Energy Company; they produced the bulk of renewable energy for Consumers in 2009. The six plants were the only wood-burning electric generating facilities operating in Michigan during 2008, the base year for the survey. Each plant employed 22 people, on average, to operate the facility. The three smaller plants generated 18.4 MW on average in 2008 and used 195,954 tons (177,766 metric tons) of wood fuel. Larger plants produced 27.7 MW on average and consumed 323,915 tons (293,851 metric tons) of wood fuel. Green wood from logging residues was the largest source of material. The second largest wood fuel source in 2008 was chips, but managers noted that this was an anomaly driven by depressed activity in the wood products industry. Given the economic downturn in 2008, more logs and chips were available for power generation. Most facilities supplemented their wood fuel with tire-derived fuel. Managers identified several policy changes that would encourage stability and growth in their industry, most related to wood fuel supply.

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A recent survey gathered the perspectives of state foresters, state energy biomass contacts, and members of the National Council of Forestry Association Executives on various aspects of the use of woody biomass for energy (Aguilar and Garrett 2009). Nationally, these survey participants indicated that the most significant opportunities for using woody biomass as a feedstock were to generate locally produced energy, which would lead to additional work opportunities for harvesters and loggers and provide more opportunities for commercial thinning in forests. These opportunities are well suited to Michigan and other states that have significant forest resources.

The Lake States regional outlook for bioenergy production is encouraging (Becker et al. 2009). Wood product sectors in Michigan, however, have experienced an overall decline in recent years; a number of sawmills, board mills, and pulp and paper mills have closed (Leefers and Vasievich 2010). The bright spots in related economic activity are proposed projects and in-progress projects associated with wood-based energy (e.g., new electric power generation, pellet plants). These facilities will stimulate rural economic development and new markets for wood. While there is promise for new development, Michigan's existing stand-alone wood-based power generation facilities provide ongoing rural employment and markets for wood. They supply a real-world benchmark for understanding potential implications of new facilities.

Existing and proposed facilities have been aided by national- and state-level renewable energy policies. Policy instruments take the form of rules and regulations, financial incentives, and public service programs (Aguilar and Saunders 2010). Development of existing stand-alone wood-based electric power plants in Michigan was promoted by the passage of the federal Public Utility Regulatory Policies Act of 1978 (PURPA), which was intended to promote and diversify independent domestic energy pro-

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duction. The legislation via regulation encouraged development of renewable energy facilities, especially cogeneration plants. Subsequently, six wood-based electric power plants with capability for cogeneration (electricity and steam) were built in northern Michigan during the 1980s and 1990s (Fig. 1). None of the facilities deliver steam to other companies.

In more recent times, a number of Michigan policies have contributed to the promotion and regulation of renewable energy. Notably, the Clean, Renewable, and Efficient Energy Act, Public Act 295, became state law in 2008 (Michigan Public Service Commission 2011a). The Act's Renewable Portfolio Standard (RPS) requires Michigan electric providers to supply at least 10 percent of their retail supply portfolio from Michigan-based renewable energy systems (i.e., wind, solar, hydro, and biomass) by 2015. Compliance is achieved through a system of tradable renewable energy credits, which can be purchased with or without the associated electricity. Public Act 286 was passed at the same time as Public Act 295, which reregulated the electric power industry. It allows seven biomass-using plants with PURPA contracts to recover up to a combined \$1.0 million per month in underrecovered fuel and variable operation and maintenance costs associated with power generation. In addition to these public acts, several policies provide financial incentives and otherwise promote bioenergy including Renewable Energy Renaissance Zones, the Michigan Biomass Energy Program, and other programs and incentives that are available to Michigan businesses and individuals (<http://www.dsireusa.org/>).

At the federal level, the Food, Conservation, and Energy Act of 2008 (P.L. 110-246), the so-called 2008 Farm Bill, created the US Department of Agriculture's Biomass Crop Assistance Program (BCAP). BCAP provides financial assistance for establishing herbaceous and woody bioenergy crops and for collecting, harvesting, transporting, and storing eligible feedstock for delivery to eligible facilities. Initial implementation of BCAP looked promising for existing and new biomass conversion facilities that create

heat, power, bio-based products, or biofuels. However, recent changes have made implementation of BCAP more restrictive by requiring that biomass supplied to facilities must come from certain forest health and silvicultural activities, such as fuel load reduction and disease sanitation. Materials that have existing regional market uses are not eligible (Simon and Kimmerer 2011). In a diverse forest products economy, which relies on existing forests, these may be challenging barriers.

Given the economic and policy setting for wood-based energy in Michigan, it is prudent to examine operating wood-based stand-alone electric power generating facilities. This article presents results of a survey of six existing plants in Michigan that was conducted in the summer and fall of 2009. The following sections describe the study objectives, the survey method, and survey results. The article ends with conclusions for future use of woody biomass as an energy source in Michigan.

## Objectives

The overall objective of this study was to assess the current status of the stand-alone wood-based electric power generation industry in Michigan. Specific survey questions addressed facility operating characteristics, fuel characteristics, sources of wood, and operators' views on wood supply and needed policy changes. This study is part of a broader set of studies on wood-based energy coordinated by the Michigan Economic Development Corporation in cooperation with Michigan State University and Michigan Technological University.

## Methods

A letter of introduction was sent in 2009 to managers of nine wood-based electric power plants in Michigan requesting a face-to-face meeting with the purpose of completing a survey and answering questions regarding the study and the survey instrument. The survey focus was on questions regarding their operations during 2008. Two power plants in Michigan's Upper Peninsula were not fully operational during 2008 and were dropped from the study (Traxys facilities in L'Anse and White Pine). Another plant, a cogeneration facility located at Central Michigan University, generated only 1 MW of electrical power as a by-product of their campus steam heating and cooling systems; it was dropped as well. One wood-using plant with a PURPA contract was not surveyed because the plant burned mostly coal. Other facilities that burned wood or by-products such as black liquor and were part of integrated wood products facilities were excluded from the survey (e.g., NewPage Corporation in Escanaba, Verso Paper Corporation in Quinnesec). These integrated facilities are examples of combined heat and power plants that use the heat as part of their production processes; they are not credited as renewable energy under existing policies. A census was completed of the remaining six facilities.

The survey instrument had 20 confidential questions regarding various aspects of their facility operations. Five broad questions were asked with respect to number of employees, operating hours, gross energy production, and by-products. Eight questions addressed different aspects related to fuel use: characteristics, types of wood, geographic sources of wood, source of wood by type of facility or forest land ownership, delivery method, and haul

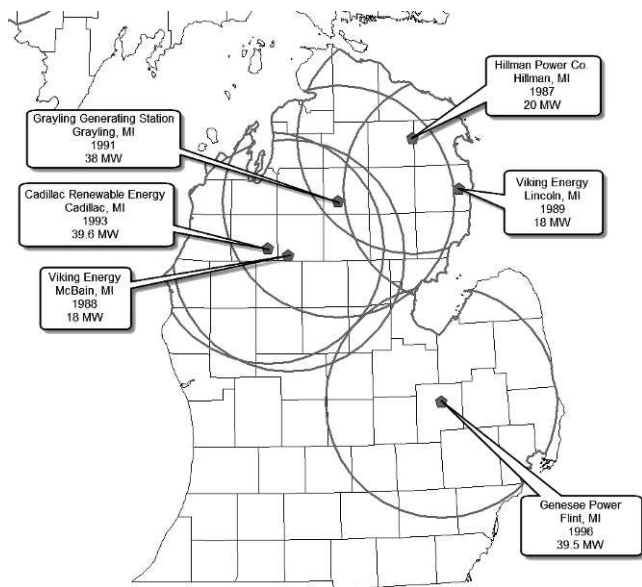


Figure 1.—Existing wood-based electric power plants in Michigan, 2008: plant name, location, year of commissioning, capacity, and a 60-mile (97-km) radius.

distances. Three questions used a Likert scale to assess plant managers' views related to wood supply, new types of desirable firms for their region, and the types of wood they would like to see used by new wood-using facilities. Four open-ended questions were posed about strategies they might use to improve their wood supplies or reduce costs, factors that affect their wood supply, effects of recent mill closures, and potential policy changes at the state level that would help them sustain their industry.

Means, medians, ranges, and distributions were generated for quantitative survey responses given the census nature of the survey. Qualitative responses were summarized and presented in the section on perspectives on wood supply and needed policy changes.

## Survey Results and Discussion

### Facility operations

Including the manager, the six facilities had 21 to 23 (mean = 22) employees operating their plants in 2008 (Fig. 1). Fuel procurement was typically handled with independent contractors rather than employees. The facilities located in Hillman, Lincoln, and McBain are base-load plants and essentially operate continuously at full output. The Cadillac, Flint, and Grayling plants are dispatchable and operate when required at the level prescribed by Consumers Energy Company. Reduced dispatch agreements were established for these three plants as a result of concerns regarding fuel availability and cost (G. Melow, personal communication, May 26, 2011). All sell their power to Consumers Energy Company under long-term contracts and help address the company's RPS requirements. In 2009, 4.7 percent of consumer's total power was from renewable sources; the bulk was from wood waste and biomass (Michigan Public Service Commission 2011b).

On average, the plants operated 8,306 hours or 94.8 percent of the year. Operating hours ranged from 7,988 to 8,536 hours per year. Two of the dispatchable plants operated at less than full capacity for part of the year. Gross energy production in 2008 (including power used by the plant) averaged 191,289 megawatt hours (MWh). This was 1.8 percent less than the 2007 level of 194,807 MWh. Average output for base-load plants was 18.4 MW, whereas average output for the larger dispatchable plants was 27.7 MW. The dispatchable plants produced 50 percent more power than the smaller base-load plants during 2008.

All facilities are capable of steam cogeneration, and several were located in "industrial parks," but steam customers were not present. Only one facility noted a by-product, wood ash. Wood ash is used as a fertilizer in this case. Several facilities that mix tire-derived fuel (TDF) with wood chips before combustion do not have "clean" ash and cannot access this market.

### Fuel description and use

Three of the facilities used 2-inch and smaller wood chips; the other three used 3-inch and smaller wood chips. Four of the facilities used TDF chipped to the same size as wood. TDF comprised between 2 and 8 percent of the fuel by weight (7% to 20% by Btu). One facility reported use of chipped railroad ties. Reported moisture contents varied considerably, ranging from 37 to 55 percent. None of the plants sampled moisture content at the time of delivery.

The six facilities used a total of 1.6 million tons (1.5 million metric tons) of wood fuels in 2008. Base-load plants averaged 195,954 tons (177,766 metric tons), and dispatchable plants averaged 323,915 tons (293,851 metric tons). Respondents were asked for the amount of material delivered in cords or tons; all responded with tonnage. Green wood from logging residues comprised the largest amount of material, followed by chips (Fig. 2). Several managers noted that the large portion of material from chips was an anomaly brought on by recession-driven declines in mill operations and the need for loggers to complete sales operations. As a consequence, plants were receiving chips that had higher and better uses during normal economic times. In some cases, pulp logs were stacked at the plants, waiting to be chipped. Logging residues and sawmill and other mill residues (e.g., sawdust, bark, slabs) would normally comprise a larger proportion of the wood fuels.

Managers were asked to estimate the percentage of wood delivered from different facilities (i.e., outlying wood yards and forest products mills) and from different land ownership classes (i.e., nonindustrial private lands, real estate or timber management organizations, state forests, and national forests). They could also indicate that they did not know the source or that it came from a variety of other sources. Two managers indicated that they did not know the source of their wood fuel. Only one plant used outlying wood yards and various other sources for wood fuel. For the other three plants, state forests (42%), nonindustrial private lands (31%), and forest products mills (19%) provided the bulk of the material. Seven percent of the wood fuel came from national forests, and real estate or timber management organizations accounted for less than 2 percent. Based on the US Department of Agriculture (USDA) Forest Service's 2009 Forest Inventory and Analysis records for the Northern Lower Peninsula where these plants are located, almost 60 percent of the forest land is privately owned. State forests are the next largest ownership, with approximately 27 percent of the region, followed by the national forests with about 12 percent. The large proportion of state forest fuel wood relative to area reflects the very active nature of timber management on state forests. At the other end of the spectrum, national forests tend to be less actively managed for timber, and this is reflected in the survey results.

Five of six managers provided delivered price data for wood fuel (dollars per ton). One facility provided a range of

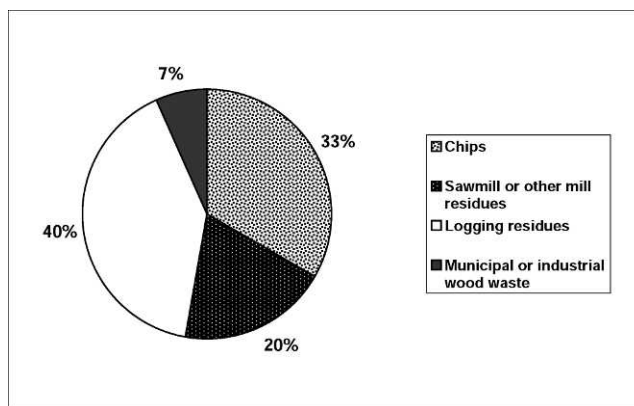


Figure 2.—Percentage of wood fuels delivered to facilities by type, 2008. Note: percentages are based on five of six responses that provided a breakdown of fuel type.



prices. The midpoint of the range was used to calculate mean prices, but the range endpoints were used to report price ranges. Power plants differentiated chips from stumpage and chipped material from logging residues. The former tend to be cleaner and more uniform in size, whereas the latter tend to be dirtier and have a larger bark content with less uniformity. The mean (range) delivered price per ton for chips was \$21.50 (\$18 to \$24). For sawmill and other mill residues, the price was \$17.90 (\$16 to \$20), and for logging residues, the price was \$21.60 (\$18 to \$24). So chipped material was fairly uniform in price.

Power plants negotiate delivered prices with various suppliers. Typically, material is delivered for an agreed upon price per ton. Individual negotiations may account for differences in delivery distance and other factors, but this is simplified to a delivered price per ton for the contract. All of the facilities have wood fuel delivered by contractors who have their own trucks. Rail is not used for wood delivery in this region of Michigan. Managers reported that almost 80 percent of the wood fuel comes from a distance of 60 miles or less from the facility (Fig. 3). Half of the plants reported that they receive 100 percent of their wood fuel within 60 miles of the facility (see Fig. 1 for 60-mi [97-km] radii around each plant).

### Perspectives on wood supply and needed policy changes

Managers were given nine statements regarding wood supply and asked to use a Likert scale (from 1 = strongly disagree to 5 = strongly agree) to note their agreement or disagreement with each statement. They also had the option of indicating that they had no opinion or that it was not applicable to them. Means and medians were calculated for each statement (Fig. 4).

Five of six managers strongly agreed with the statement “Loggers are having a hard time with the current economic conditions.” As highlighted previously, the economic downturn contributed to the use of chips and logs for power generation that typically would be used for other purposes. This reflected a challenge faced by loggers at the time of the survey. There was also agreement to strong agreement on the negative effects of higher transportation costs and competition for wood fuel. Concern about the negative effects of recent mill closures reflected the importance of mill residues for electric power generation. Managers expressed views that there was a shortage of qualified loggers and that not enough timber was being offered for harvest as well.

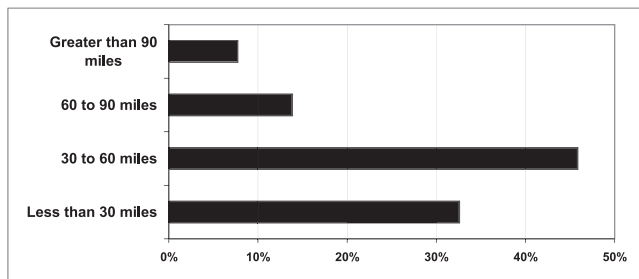


Figure 3.—Percentage of wood fuel delivered various distances from the wood-using electric power facility.

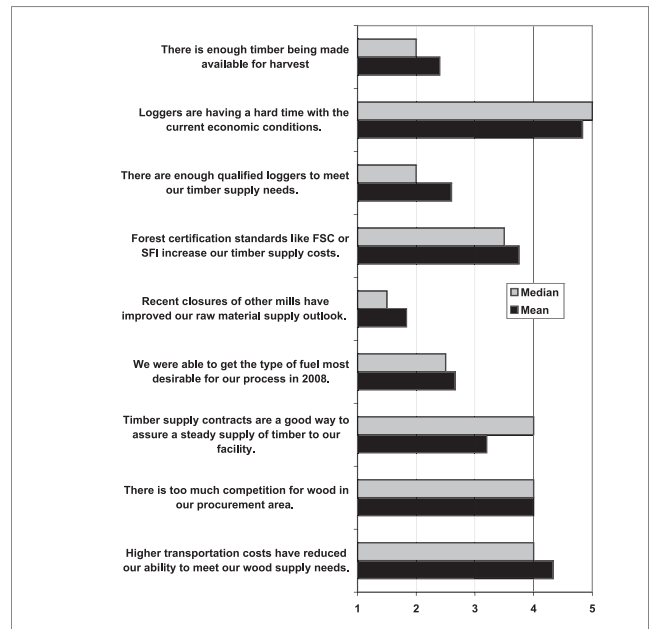


Figure 4.—Managers' responses (n = 6) to nine statements regarding fuel wood supply (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree).

Managers were also asked to rate their preferences for the type of wood-using firms they think would be most desirable in their geographic area (from 1 = very undesirable to 5 = very desirable). Direct-fired wood power generation, wood-based biofuel manufacturing, and wood pellet fuels were viewed as very undesirable to undesirable (Fig. 5). These firms would most likely compete for the same types of wood fuel as the existing power generation facilities, so they were viewed unfavorably. Sawmills and other traditional wood-using industries were viewed positively because they are potential sources of residues for power generation. Managers also preferred firms that would use roundwood rather than mill residue, forest residue, and nonmerchantable timber.

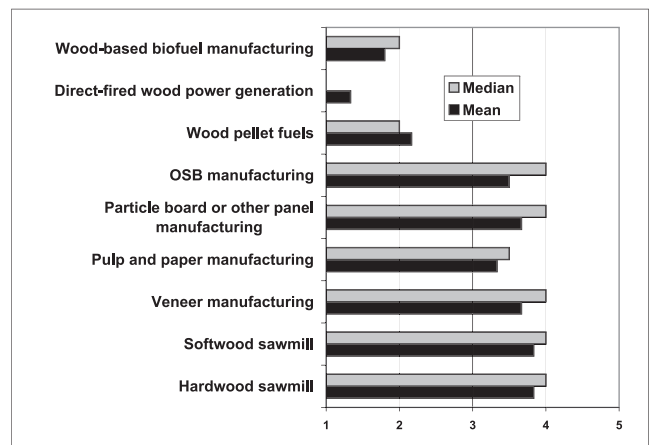


Figure 5.—Managers' responses (n = 6) regarding the desirability of types of new firms in their geographic area (1 = very undesirable; 2 = undesirable; 3 = neutral; 4 = desirable; and 5 = very desirable).

One manager noted “[b]ecause of the recent emphasis on biofuels, wood waste has become a commodity resulting in wood shortages and higher prices. Increases in the cost of fuel oil also contributed to higher costs of transportation and processing. Lastly, the downturn in Michigan’s manufacturing economy has exacerbated the shortage of scrap wood.” Given increasing competition for raw material, managers are trying to identify more wood fuel suppliers and attempting to secure and permit alternative fuels (e.g., TDF).

According to managers, recent closures of wood processing mills have led to less volume of industrial “waste wood” available for power plants and higher fuel costs. Overall, the wood supply infrastructure has been negatively affected. This is illustrated by one manager who wrote “There is an abundance of wood on the market being turned into fuel that should be going elsewhere [loggers have sales and it has to go somewhere].” And another summed up the situation by noting that “Our wood supply is a byproduct of other industries. We need these industries to be healthy.” So, the industry is hoping for an economic recovery and looking for policies that can help them survive in the short run and thrive in the longer run.

Managers suggested several policy changes that would help sustain the wood-based electric generation industry. Most were targeted at the Michigan Department of Natural Resources’ (MiDNR) timber sales process and at legislative changes. These included

1. changing the way timber sales are structured by the MiDNR to include more fuel wood,
2. re-advertising MiDNR no-bid sales immediately at a reduced price or eliminating the minimum bid price for sales,
3. removing MiDNR obstacles (e.g., forest certification standards) that require leaving logging residues on-site rather than using this low-value material as wood fuel,
4. offering considerably more timber for sale from MiDNR lands at affordable stumpage prices to increase supply for the expansion of the wood products industry and consequently production of wood residues for energy production,
5. providing tax abatements and incentives for all wood-based electric generators rather than only for new enterprises, and
6. removing the \$1.0 million monthly cap on wood-based electric power production cost recovery enacted as part of Michigan Public Act 286.

The MiDNR structures timber sales around silvicultural needs determined through their compartment examination process. For calendar year 2010, the MiDNR had 546 timber sales that were put up for bid and sold (unpublished MiDNR data). There were eight no-bid sales, and six were withdrawn for other reasons. For comparison, the MiDNR had 607 sales between March 1, 2004, and March 1, 2005; six sales were no bid (Leefers and Potter-Witter 2006). Sales could be restructured to provide more small-diameter material (e.g., thinning of oak stands) for the electric power industry, but this would likely require some coordination so that wood fuel specifications are well understood by MiDNR managers. These sales may be less competitive and yield much lower sales revenues due to a narrower focus on species-products for specific sales.

No-bid sales were a larger issue during the recent economic downturn (251 during the 2007 to 2009 period; unpublished MiDNR data), but sales have rebounded, and no-bid sales are much less common. Re-advertising and/or reconfiguring sales were the protocols that were adopted for no-bid sales in recent years. No-bid sales may not benefit the wood-based electric power industry directly because the species-product mix may be targeted at traditional markets (e.g., pulpwood and sawtimber). However, if the species-product mix yields residues, then the wood fuel would be a useful by-product. Elimination of minimum sale bids would be a major policy shift for any public forestry agency; it is used by public agencies throughout the Lake States region (Leefers and Potter-Witter 2006). But state government determines hunting and fishing license fees and charges for other goods and services and could potentially change the stumpage pricing process.

MiDNR state forests are managed under Sustainable Forestry Initiative and Forest Stewardship Council standards and guidelines. Both require the MiDNR to consider leaving some logging residues on-site to satisfy concerns for long-term sustainability. Under most conditions in Michigan, it is advisable to retain approximately one-sixth to one-third of the harvested tree residues at the logging sites (Michigan Department of Natural Resources and Environment 2010). If the agency is following this guidance, it is unlikely that additional residues would be available. If the MiDNR is leaving more material, then there is opportunity for expanded wood fuel from logging residues.

The overall level of timber harvesting by the MiDNR is set in its annual appropriations bill (State of Michigan 2011). For example, section 802 of the fiscal year 2011 to 2012 act noted that the MiDNR “shall, subject to the forest certification process, prescribe treatment on 63,000 acres, prepare appropriate treatment for not less than 58,000 acres at the current average rate of 12.5 to 15 cords per acre, and offer those cords for sale in 2011. . . .” So, any expansion in sales would likely come via legislative direction. However, another approach to expanding sales could be through the use of stewardship contracting. The USDA Forest Service and the US Department of Interior Bureau of Land Management have been using stewardship contracting as an approach to thin small-diameter stands and provide a source of wood for bioenergy (Neary and Zieroth 2007). Among other features of stewardship contracting is the authority of the agencies to exchange goods for services. So, private firms and other organizations can provide needed services for management of forests (e.g., reducing fuels, timber stand improvement) in exchange for the timber goods they harvest. This may be a potential approach for targeting stewardship activities on state lands for bioenergy and increasing opportunities on federal lands as well, but new state policies would be needed to create this opportunity.

Managers voiced concerns that tax abatements and incentives are targeted at development of new bioenergy investments and that these programs may put existing facilities at a competitive disadvantage. New electric power generation facilities have not been built in Lower Michigan since the 1990s, although several have been proposed in recent years. However, other investments, based on state programs, have moved forward (Leefers and Vasievich 2010). One clear policy targeted at the existing industry was inclusion of the \$1.0 million monthly cost recovery program

on wood-based electric power production enacted as part of Michigan Public Act 286. Initial accounting for the program determined that the cap covered most fuel and related costs but that there were additional nonreimbursed expenditures (Michigan Public Service Commission 2011c). The overall effectiveness of this program has not been assessed, so removal or adjustment to the cost recovery level is not likely in the short run.

## Conclusions

Wood-based stand-alone electric power generation has been the mainstay of Michigan's renewable electricity sector for decades. This article presents results of a census/survey of six existing plants concerning plant operating characteristics, fuel characteristics, sources of wood, and operators' views on wood supply and needed policy changes. Public agencies that supply wood to the plants, policy makers, and plant managers can use this information to better manage forest resources and electric power, especially if stand-alone wood-based electric power is to play a larger role in meeting the RPS. And it provides a benchmark for discussions regarding future wood-based electric power plants.

Existing facilities in Lower Michigan were built in the late 1980s and 1990s. They rely mostly on locally produced wood and mill residues with supplements from waste wood and TDF. On average, 265,000 green tons (240,000 metric tons) of wood are used annually per plant. The smaller plants are base-load plants. The potential for increasing renewable electric power from dispatchable plants exists but will likely hinge on a resurgence of the wood products industry, a key source for low-cost fuel.

More detailed analyses are needed for several suggested policy changes. Four are related to wood fuel supply, and one is linked to existing cost recovery. The analyses should include

1. an examination of how MiDNR timber sales could be restructured to be more favorable for the wood-based electric power plants,
2. an assessment of strategies to reduce the number of no-bid sales and the costs of reoffering these sales,
3. an analysis of logging residue policy implementation with respect to existing guidance,
4. a review of stewardship contracting as a means to increase wood fuel supplies in Michigan, and
5. an evaluation of the \$1.0 million monthly cap on wood-based electric power production cost recovery enacted as part of Michigan Public Act 286 and other policies targeting renewable energy.

Michigan and other states are implementing renewable portfolio standards. Stand-alone wood-based electric power is an important component of the portfolio. Additional

studies, however, are needed to understand the competitiveness of this industry, economic and operational aspects of the woody biomass supply chain, and the policies that undergird it. The resolution of broader debates on climate change, carbon accounting, and energy policy will ultimately influence the future direction of this industry. In the meantime, states must address their unique policies related to renewable energy.

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