



Wind Energy & Economic Development

Forum Brief

April 24, 2007 • East Lansing, MI

Overview

Development of wind energy in the U.S. influences local economies and can also have impacts at the state and national levels. On April 24, 2007, the U.S. Department of Energy's Wind Powering America (WPA) program and the National Wind Coordinating Collaborative (NWCC) convened a forum on the economic development impacts and manufacturing opportunities presented by wind power development in the Great Lakes region and around the country. Forum speakers represented a wide range of perspectives, including turbine manufacturers, economists, federal agencies, the wind industry, regulators, and others. Summaries of their remarks are provided in this brief.

National Economic Development Impacts of Wind Energy

Introduction

Larry Flowers, Wind Powering America

Wind Powering America Technical Director Larry Flowers kicked off the forum with an overview of economic development impacts that wind power development can spur:

- Construction jobs
- Operations and maintenance jobs
- Property tax revenues
- Landowner revenues
- Manufacturing & assembly opportunities

Building a wind energy facility can induce a multiplier effect where increased income to people working at the facility or receiving payments for turbines on their property causes induced increases in spending that benefit business owners and others within a community not directly connected to the wind facility. Also, comparative economic development impacts of wind power are greater than fossil fuel generation in many cases; later in the program, speaker Suzanne Tegen addressed this point further in her presentation.

Wind Turbine Manufacturing: Challenges & Opportunities

Lawrence Willey, General Electric

Larry Willey, Manager of Wind Conceptual Design for the General Electric (GE) wind division, focused on what getting to 20% wind electric power generation in the U.S. by 2030 would require from the manufacturing sector. Maintaining a manufacturing growth rate of 20-25% for the next decade, and then holding production rates through 2030 would make the 20% target achievable. Such a growth rate is ambitious, yet very doable given the commodity nature of the wind turbine equipment—the average annual growth rate for nuclear energy was 17% between 1960 and 1997, 10% for gas turbines over a 17-year period, and 6.2% for hydropower between 1950 and 1996.

Crucial to achieving high wind growth rates are availability of raw materials and investment. Meeting such raw material demands may be challenging, particularly for core materials like balsa wood and foam, carbon fiber, and permanent magnets. The cost of supplies like resins and adhesives could also impact turbine markets. Nevertheless, material availability is not considered a constraint to reaching 20% U.S. wind energy. Turbine manufacturers are striving to reduce the amount of steel used and replace it with lighter materials, as well as streamline machinery and production, to make turbine manufacturing less resource intensive.

Only limited wind turbine manufacturing is happening in the U.S. at present. Greater and more consistent wind power investment in the U.S. could induce increased domestic turbine manufacturing capacity. Increasing capacity also requires having sufficient supply of turbine components like gearboxes, steel castings, carbon fiber, and permanent magnets.

Economic analysis done using the U.S. Department of Energy's Jobs and Economic Development Impact (JEDI) model suggests that achieving a 20% wind energy target could translate into over 40,000 "direct" jobs annually, i.e. jobs that are onsite or closely related to the wind facility.

There are drivers for greater domestic turbine manufacturing. First, 10-15% of project cost is getting the large components to a site. The closer manufacturers are to sites, the lower these costs and the greater the economic case for wind. Promoting energy portfolio diversification and increased training of qualified labor also encourage wind development. Finally, state and federal policies that reduce financial risks are another wind incentive. These elements working in concert would help bring greater wind manufacturing opportunities to the U.S.

Rural Economic Development Impacts: Modeling and State Analyses

Marshall Goldberg, MRG & Associates

Marshall Goldberg developed the Jobs and Economic Development Impact (JEDI) model for the National Renewable Energy Laboratory. The JEDI model is designed to calculate local economic impacts associated with the construction and operation of wind farms. The model is publicly available online at

http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=707 for anyone to use. The minimum amount of information needed to run an analysis is the wind facility location (state or county), year of construction, and plant size. The more details are entered, the more accurate and refined the results; other factors which may be added include:

- Construction costs (materials and labor)
- Equipment costs (turbines, rotors, towers, etc.)
- Other costs (utility interconnection, engineering, land easements, permits, etc.)
- Annual O&M costs (personnel, materials, and services)
- Other parameters (financial: debt and equity, taxes, and land lease)

From this input, the model provides data on direct, indirect, and induced impacts.

- Direct impacts: happen onsite (e.g. construction workers) and offsite (e.g. cement truck drivers)
- Indirect impacts: jobs in and payments made to business supporting those doing direct impacts, e.g. bankers financing the construction and equipment suppliers
- Induced impacts: jobs and earnings resulting from the spending by people directly and indirectly supported by the project, e.g. grocery store clerks, retail salespeople and child care providers.

Mr. Goldberg emphasized that the economic benefits of wind power development depends on the extent to which expenditures are spent locally. Changes in expenditures are matched with region

specific and personal expenditure pattern multipliers. Where expenditures are being made is factored into the multipliers. The multipliers for employment, income, output (economic activity), and personal expenditure patterns are derived from the IMPLAN (Impact Analysis for PLANning) model, a social accounting and impact analysis tool.

The assumptions used play an important role in determining the model results. Default values used by JEDI are updated regularly online. The availability of local resources can also significantly influence the costs and economic benefits seen within the state or region. The results provided by JEDI look something like the following:

Wind Plant - Project Data Summary			
Year of Construction		2007	
Project Location		MICHIGAN	
Project Size - Nameplate Capacity (MW)		100	
Turbine Size (KW)		1500	
Number of Turbines		67	
Construction Cost (\$/KW)		\$1,600	
Annual Direct O&M Cost (\$/KW)		\$15.50	
Money Value (Dollar Year)		2006	
Project Construction Cost		\$160,000,000	
Local Spending		\$18,708,252	
Total Annual Operational Expenses		\$26,522,000	
Direct Operating and Maintenance Costs		\$1,550,000	
Local Spending		\$1,179,153	
Other Annual Costs		\$24,972,000	
Local Spending		\$908,000	
Debt and Equity Payments		\$0	
Property Taxes		\$640,000	
Land Lease		\$268,000	

Local Economic Impacts - Summary Results			
	Jobs	Earnings	Output
During construction period			
Direct Impacts	141	\$7.1	\$18.3
Construction Sector Only	138	\$6.8	
Indirect Impacts	55	\$2.0	\$5.2
Induced Impacts	84	\$2.7	\$8.1
Total Impacts (Direct, Indirect, Induced)	280	\$11.9	\$31.6
During operating years (annual)			
Direct Impacts	9	\$0.9	\$1.6
Plant Workers Only	9	\$0.5	
Indirect Impacts	4	\$0.2	\$0.5
Induced Impacts	11	\$0.4	\$1.1
Total Impacts (Direct, Indirect, Induced)	33	\$1.4	\$3.1

Notes: Earnings and Output values are millions of dollars in year 2006 dollars. Construction period related jobs are full-time equivalent for the construction period. Plant workers includes field technicians, administration and management. Economic impacts "During operating years" represent impacts that occur from plant operations/expenditures. The analysis does not include impacts associated with spending of plant "profits" and assumes no tax abatement unless noted. Totals may not add up due to independent rounding.

This analysis of a 100 MW wind project in Michigan shows about 280 jobs resulting from the construction phase (approximately one year) and 9 ongoing operation and maintenance jobs. JEDI is capable of generating state and county level reports. After adapting the model to run a national analysis, the preliminary results showed about 317 GW of wind power across the country by 2030 and 5 million jobs created. The results of this projection depend on what percentage of wind turbines used is manufactured in the U.S.; the model assumes 50% in the short term, growing to 80% by 2030. Mr. Goldberg suggested that the key to achieving such a target is to get out the word to policy makers about the economic benefits of wind energy.

Wind Power: A Texas Economic Development Story *Susan Williams Sloan, American Wind Energy Association*

The Texas legislature passed its first renewable portfolio standard (RPS) in 1999, but the tremendous growth of wind power there has led the state to expand its target. The Texas RPS requires utilities to have a certain percentage of renewable energy, either generated themselves or acquired through buying credits. Texas has over 2,500 MW of wind power installed and in 2006 became the leading wind power state and number 6 in the world. Much of the wind development is happening where oil and gas resources were harnessed and opportunities for economic development were quite attractive. Landowners with turbines on their property can receive payments of \$2,000 - \$4,000 per MW per year. About \$8 million is going out to Texas landowners annually, additional income to their farming and ranching profits.

Communities are also seeing benefits from wind development, with tax revenues available for building schools, hospitals, and other public goods. New jobs are another attractive feature and have led to increased demand for trained technicians. Local business such as motels, restaurants, suppliers, and accountants can also see increased demand for their services. Many wind component manufacturers now base some or all of their operations in Texas, providing benefits statewide.

Wind development drivers include:

- Good wind resources
- Transmission access
- Willing power buyers
- The U.S. Production Tax Credit (PTC)
- Renewable Portfolio Standards (RPS)
- Local initiatives
- Interested landowners and local officials

In the same vein, barriers to development include limited transmission access, intermittent PTC availability, limited RPSs, and local opposition. Texas faced transmission limitations in 2001 when wind power boomed in the McCamey area, which led to curtailment of facilities until sufficient transmission was put in place. Texas could reach up to 5,000 MW of wind power by the end of 2008, showing what can be attained when the right features are in place.

Manufacturing Panel

Renewable Energy – Manufactured Energy *George Sterzinger, Renewable Energy Policy Project*

The Renewable Energy Policy Project (REPP) investigated whether large-scale wind power development would only benefit regions with good wind resources. Part of that analysis involved looking at where wind turbine component manufacturing might occur in the U.S. 60% of wind energy's cost comes from component manufacturing, so this represents a significant piece of the economic picture.

REPP began by identified the major manufactured components and the parts that go into each piece. Then they looked for a benchmark, the Socolow and Pacala stabilization wedges, and calculated how much renewable energy is needed to equal one climate stabilization wedge, e.g. 50,000 MW of wind nationwide. REPP then looked at individual components like towers and the investment amount and jobs related to achieving 50,000 MW of wind power. Using U.S. Economic Census data, REPP could identify the number of U.S. firms that manufacture towers and estimated that each state would receive

a percentage of revenue based on their manufacturing capacity. For example, if 121 Michigan firms can manufacture towers and 121 represents 4% of the U.S. market, then Michigan gets 4% of the money invested to achieve 50,000 MW of wind.

REPP's analysis estimates that Michigan could receive \$1,468,000 in investments and 10,369 manufacturing jobs. This analysis was done not only for wind but also solar photovoltaic, geothermal, and biomass. For wind, supply bottlenecks were identified for 50% of the components studied. Identifying companies that produce the undersupplied components and encouraging them to increase their capacity is a potential next step. REPP is also urging states to consider multi-state agreements between states with high renewable resource potential and those with high manufacturing potential.

Clipper Windpower: An Overview of Manufacturing *Kevin Rackstraw, Clipper Windpower*

Clipper Windpower formed in 2000 and manufactures four wind turbine models. The wind industry is concerned about turbine availability; at the same time, suppliers are looking for assurance that there will be a buyer, i.e. a market for the product, so they can get bank loans and build a solid business. Clipper's turbines are sold out through 2008 and are close to selling out for 2009. The company is limited from selling more because it cannot get enough of the quality components they need. Gaining greater control of the supply chain is how Clipper aims to overcome this challenge.

Mr. Rackstraw reviewed some of the ways Clipper has differentiated its product, such as simplifying designs, increasing reliability, reducing weight, and using sensors to anticipate fatigue. Clipper sources globally and since manufacturing flows towards stable markets, Europe has a considerable amount of the wind turbine manufacturing. The industry is seeing 50% growth in costs due to rising steel and other commodity price increases, ramping up of wind industry demand, and competition for commodities and supplier capacity from other industries. Mr. Rackstraw said supply chain management, manufacturing excellence, and innovation are the keys to driving costs down and maintaining competitive edge.

Unstable U.S. policy, represented primarily by the PTC, has made it hard for manufacturers to plan expansions. Mr. Rackstraw suggested that long term PTC extension, as is proposed, would lead to greater stability and the ability to expand capacity. Where Clipper chooses to locate its manufacturing facilities depends on several factors, but proximity to markets is a huge driver. Political commitment to wind also helped Clipper decide to locate its first plant in Iowa. Utility leadership and good processes for transmission expansion also help build markets for wind power. State policies like renewable portfolio standards are providing some foundation for stable U.S. markets. State tax incentives and transparent and efficient siting regulations are other factors that foster wind power development by increasing market certainty.

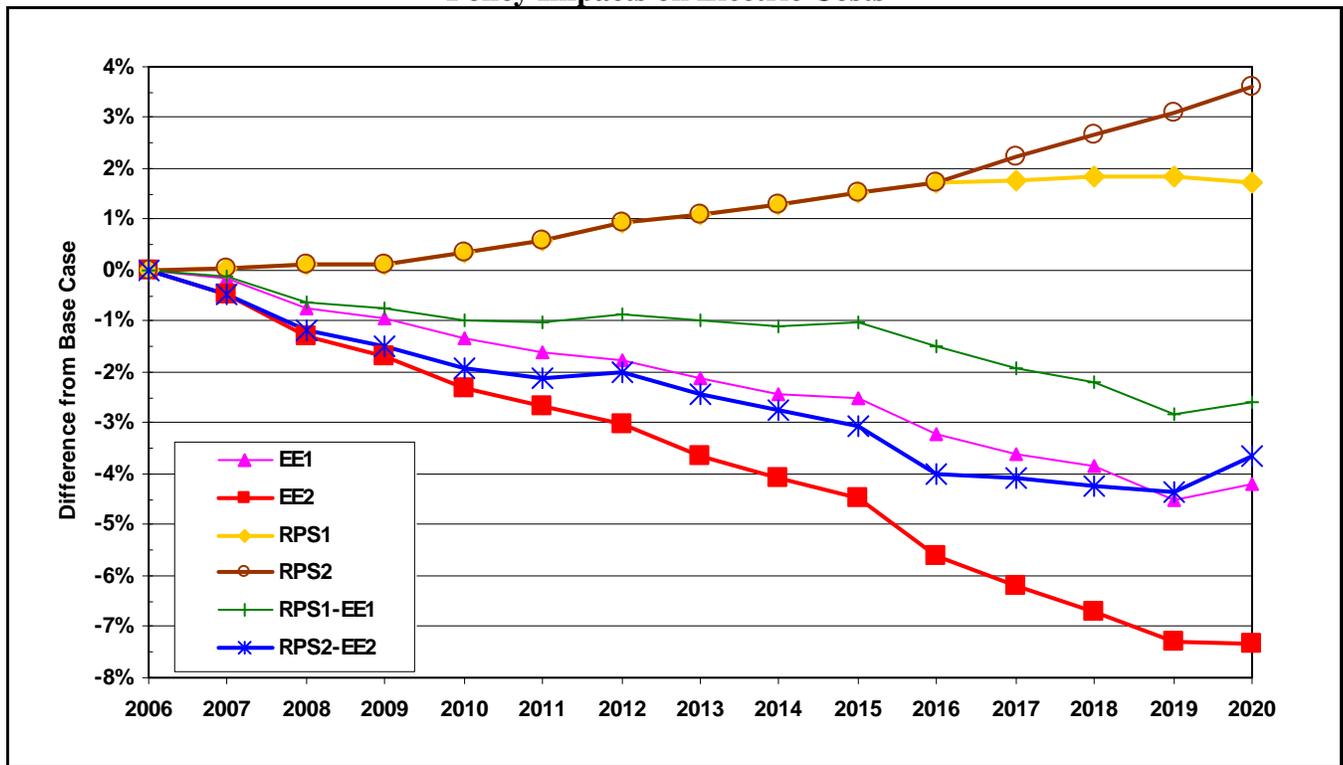
A Study of Economic Impacts from the Implementation of a Renewable Portfolio Standard and an Energy Efficiency Program in Michigan

Jim Croce, NextEnergy

NextEnergy is a non-profit founded by the state of Michigan to accelerate alternative energy industry development in the state and thereby diversify its economy. The organization managed a study sequencing the state energy plan and taking a comprehensive look at a RPS. Researchers used the Energy 2020 tool combined with the Regional Economic Models, Inc. (REMI) and tried to be conservative with their assumptions. Nine different cases were modeled, with varying RPS targets and levels to which energy efficiency was factored in. Cost assumptions and other data were drawn from Michigan's 21st Century Energy Plan, requested by the governor and published in January 2007.

Modeling the nine cases, the results showed a moderate increase in electricity costs, with 2 – 4% cost increases for RPS-alone cases and reduced electricity costs when renewables and energy efficiency were used together.

Policy Impacts on Electric Costs



Carbon dioxide (CO₂) emissions were highest for the base case, with the moderate energy efficiency case reducing CO₂ emissions by 10,900 metric tons/year by 2020 and the moderate RPS case reducing CO₂ emission by 6,500 million metric tons/year by 2020. Combined moderate energy efficiency and RPS was projected to reduce 2020 CO₂ emissions by over 17,800 million metric tons/year

The economic analysis showed that the larger the RPS, the higher the associated gross regional product. Generally the models saw increased employment and again the greater the RPS, the more jobs resulted. Disposable personal income reduced slightly for RPS-alone cases but increased for energy efficiency alone or in concert with a RPS.

Through this study, NextEnergy concluded that implementation of energy efficiency programs outlined in the 21st Century Energy Plan will result in significant economic benefit to Michigan over the status quo. Further, a RPS's economic impacts are projected to be positive over the life cycle of renewable power generation plants. Energy efficiency and RPS used in tandem appeared to help avoid negative impacts to disposable personal income and could help defer the need for new fossil fuel generation. The case studies demonstrated emissions reductions with values reflected in the economic factors evaluated. NextEnergy believes that these results reinforce the positive outcomes a state or federal RPS could have for Michigan.

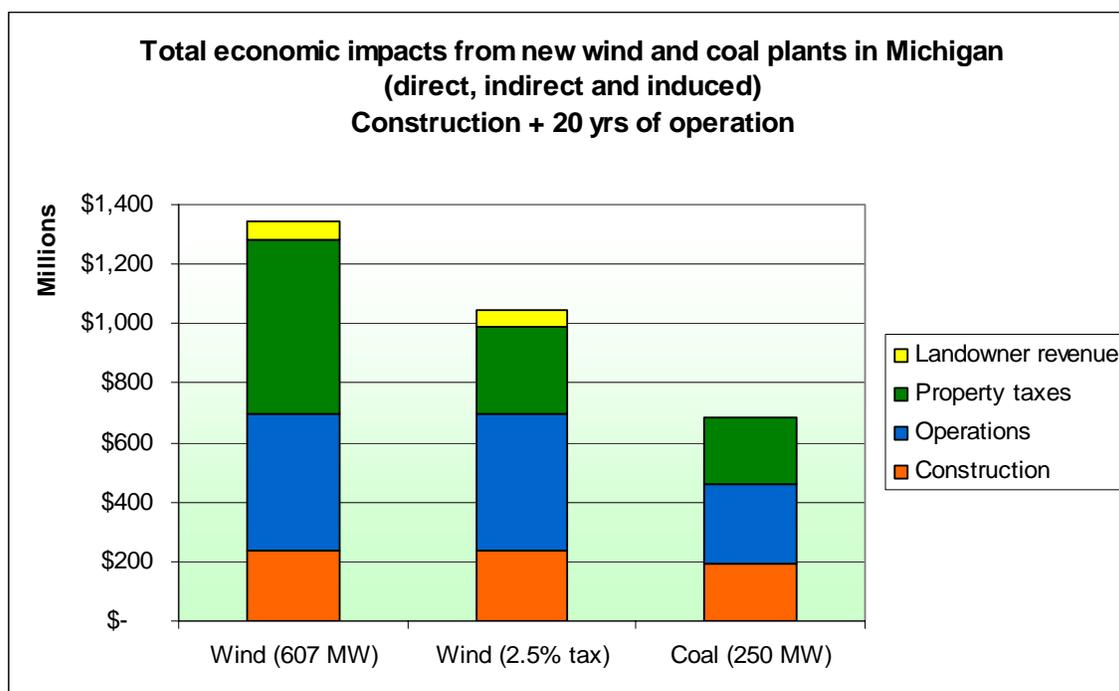
Rural Economic Development Panel

Economic Development: Wind vs. Coal

Suzanne Tegen, National Renewable Energy Laboratory

NREL's JEDI model can be used to assess economic impacts of both wind and coal. The wind JEDI model is already publicly available and the coal model is being reviewed for public release. Ms. Tegen used JEDI to compare wind and coal on an energy equivalent basis. Assuming coal has an 80% capacity factor and wind has a 35% capacity factor, 250 MW of coal has the same energy output as 607 MW of wind in Colorado. Inputs to the analysis included construction costs, operation and maintenance costs, the year and location of the project, the cost and location of fuel (applies to coal only), and land lease payments (applies to wind only).

Analyses run for Colorado and Michigan both indicated a greater number of jobs from wind generation than coal on an energy equivalent basis. If turbines are manufactured in-state, the wind jobs increase even further over coal. The total economic impacts were also found to be greater for wind than coal. Michigan's tax structure is under review, so Ms. Tegen took half of the average tax benefit for modeling purposes.



A Bridge Between Theoretical and Actual Economic Impacts: Montana's Wind Power Experience

Mike Costanti, Matney-Frantz Engineering

NREL used JEDI in 2004 to estimate the economic development impacts of wind power in six Montana counties. The findings suggested that local impacts would be maximized through education, planning, and action and supported local ownership. Mr. Costanti set out to evaluate whether the JEDI predictions were actualized. Investigating the Judith Gap Wind Project, he found that *direct* construction phase jobs averaged out to 160, compared to JEDI's prediction of 109 jobs. JEDI estimated 26 annual O&M phase jobs but only 10 jobs were planned by the developer, Invenergy. Judith Gap did significantly benefit the county where it is located; the local impact fee brought in \$775,000/year for the first three years.

Clean Renewable Energy Bonds (CREB) allow government entities to obtain interest-free financing for renewable energy projects by providing investors with a federal tax credit in lieu of interest payments. CREBs are a way for public entities and cooperatives to achieve parity with PTC/depreciation benefits available to taxable entities.

The CREB applications received are stacked like a pyramid, with the smallest on top and largest at the bottom, and the accepted starting at the top. Matney-Franz Engineering helped 35 Montana cities and counties submit CREB applications in 2006; 33 of them were accepted, translating into \$30.7 million and 34 MW of wind. All the proposed projects are 100% CREB financed and will be built with re-manufactured turbines. Re-manufactured turbines are being utilized because they have lower installed costs, benefit from improvements and warranties related to the re-manufacturing, and are well matched to rural electric loads. Of the nearly 750 CREB applications received, over 600 projects were approved ranging in value from \$23,000 to \$31 million. Congress authorized a second CREB round with applications due July 2007.

To determine if a CREB application is worth pursuing, Mr. Costanti described wind projects as a “three-legged stool” where the following components are needed:

- 1) Wind resource
- 2) Transmission access and capacity
- 3) Project buyer

Wind studies are used to evaluate the wind resource. Smaller projects are easier to interconnect to the transmission grid. Project buyer avenues might include direct utility sale, qualifying facilities, net metering, or bi-lateral sales. Feasibility assessments typically take 3 – 12 months and require qualified legal, financial, and technical teams; potential applicants must consider how they will cover assessment costs. Mr. Costanti emphasized that CREB projects must make legal, financial and technical sense to move forward. He closed by encouraging action, even if projects are small, because small projects can help get larger projects started.

Windpower Economic Development: Economic Development from the View of a (Former) County Commissioner

Jack Keers, Pipestone County (MN) Commissioner

Mr. Keers formerly served as a Minnesota county commissioner and shared his perspective on how elected officials can facilitate wind power development and use the development to yield economic benefits. Major economic benefits that he outlined included construction labor and materials, land lease payments, local government taxes, and employment for ongoing maintenance. Projects can also be community owned, which helps retain more of the benefits locally. One study by Arne Kildegaard found that community wind projects had approximately 5 times the financial impact of other ownership models and another study by the Southwest Regional Development Commission indicated local ownership had 10 times the financial impact. A September 2004 [US General Accounting Office study](#) found that local ownership of wind systems generates an average of 2.3 times more jobs and 3.1 times more local dollar impact compared to "out of area" interests.

Echoing what Ms. Tegen’s presentation indicated, Mr. Keers provided examples of how wind power can produce higher economic development benefits than other energy development. He cited a May 2005 [US Dept of Energy study](#) showed that wind power brings higher direct economic benefits to local economies than any other form of new electricity, including from coal and natural gas.

Mr. Keers highlighted that economic development benefits can play a key role in garnering public acceptance of wind power projects.

The Rural Minnesota Energy Board (RMEB), a collection of over 15 rural counties, works on legislation that encourages wind and other renewable energy development. The RMEB supported a wind energy production tax that varies with wind farm size. The RMEB works to ensure adequate transmission grid access for wind and promote increased communication between energy companies and local communities. Finally, the RMEB supported Minnesota's Community Based Economic Development (C-BED) legislation. Creating greater opportunities for wind energy in Minnesota is bringing related manufacturing opportunities to the state, including a Suzlon blade plant in Pipestone, MN.

Focus on Michigan Panel

The speakers in this session

- Andy Such, Michigan Sustainable Energy Coalition
- Fred Keller, Cascade Engineering
- Bernie Lieberg, K&M Machine-Fabricating
- Allan O'Shea, Manistee County (MI) Commissioner
- Brion Dickens, Lakers School

discussed the current landscape for wind energy in Michigan and possible future directions. Michigan does not currently have a renewable portfolio standard (RPS), but Senate Bill 213 introduced by Senator Birkholz calls for a 8% RPS by 2013. Getting legislators to focus on RPS passage is challenging, according to speaker Andy Such.

Speaker Fred Keller noted that wind energy in the state could help stabilize energy prices and contribute to energy reliability. He also suggested net metering as a way to let more small energy producers see benefits.

Local manufacturer Bernie Lieberg talked about the nationwide markets for the turbine hubs and gearboxes made by his company. He called for assistance with tax abatement and workforce training and encouraged incentives like a RPS and PTC to make Michigan the state of choice for turbine manufacturing.

Allan O'Shea, a county commissioner, described how some commissioners shy away from development and can benefit from tools like model wind ordinances. Mr. O'Shea received a grant to write a model wind ordinance for Michigan and it is in production. Another challenge for wind development noted by Mr. O'Shea is frequent commissioner turnover and the associated need for educating regulators about wind.

Brion Dickens discussed his experience developing a school wind project, financed by a Michigan Public Service Commission grant. The township planning commission passing wind-friendly zoning allowed for construction of three turbines that produce 300 MW of power annually, bring energy savings equal to approximately one teacher's annual salary.

Michigan Next Steps Brainstorming Session

Great Lakes Renewable Energy Association (GLREA) executive director Jennifer Alvarado led participants through a brainstorming session about steps needed to move wind energy forward in Michigan. Participants made the following suggestions:

- Support a national RPS; write Congressional representatives and encourage them to vote for a national RPS.
- Seek public support for a Michigan RPS and consider a higher target like 20% renewable energy
- Get business leaders and manufacturers mobilized to connect with legislators to pass RPSs.
- Pursue a state-level workforce development plan for wind and/or renewables. Focus on what the needs are and how to meet those needs.
- Do more transmission studies and encourage greater transmission development based on study results.
- Consider state-level guidance to help overcome local zoning uncertainties.
- Encourage more small businesses to use wind power.
- Work at getting Michigan utilities more engaged and demonstrate to them that wind can be integrated without causing financial hardships.
- Survey manufacturers about their capabilities and match them up with industry needs.
- Step up efforts to educate future workers in the wind energy field.

Ms. Alvarado and her colleagues planned to use this list to help guide their future activities.

Presentations summarized in this brief are available for free download at <http://www.nationalwind.org/events/forums/070424/presentations/default.htm>.

About this Issue Forum

The National Wind Coordinating Collaborative (NWCC) is a group formed in 1994 and comprised of representatives from the utility, wind industry, environmental, consumer, legislatures, and state, federal and tribal government sectors to support the development of an environmentally, economically, and politically sustainable commercial market for wind power.

The issue forum concept was developed to provide members with information about wind interaction topics outside of regularly discussed areas like wildlife, transmission, and siting.

This brief is intended to make available some of the information from the Issue Forum to NWCC members, interested parties, and others. Presentations from this session are available online at <http://www.nationalwind.org>.

For more information, or to receive copies of NWCC publications, contact:

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