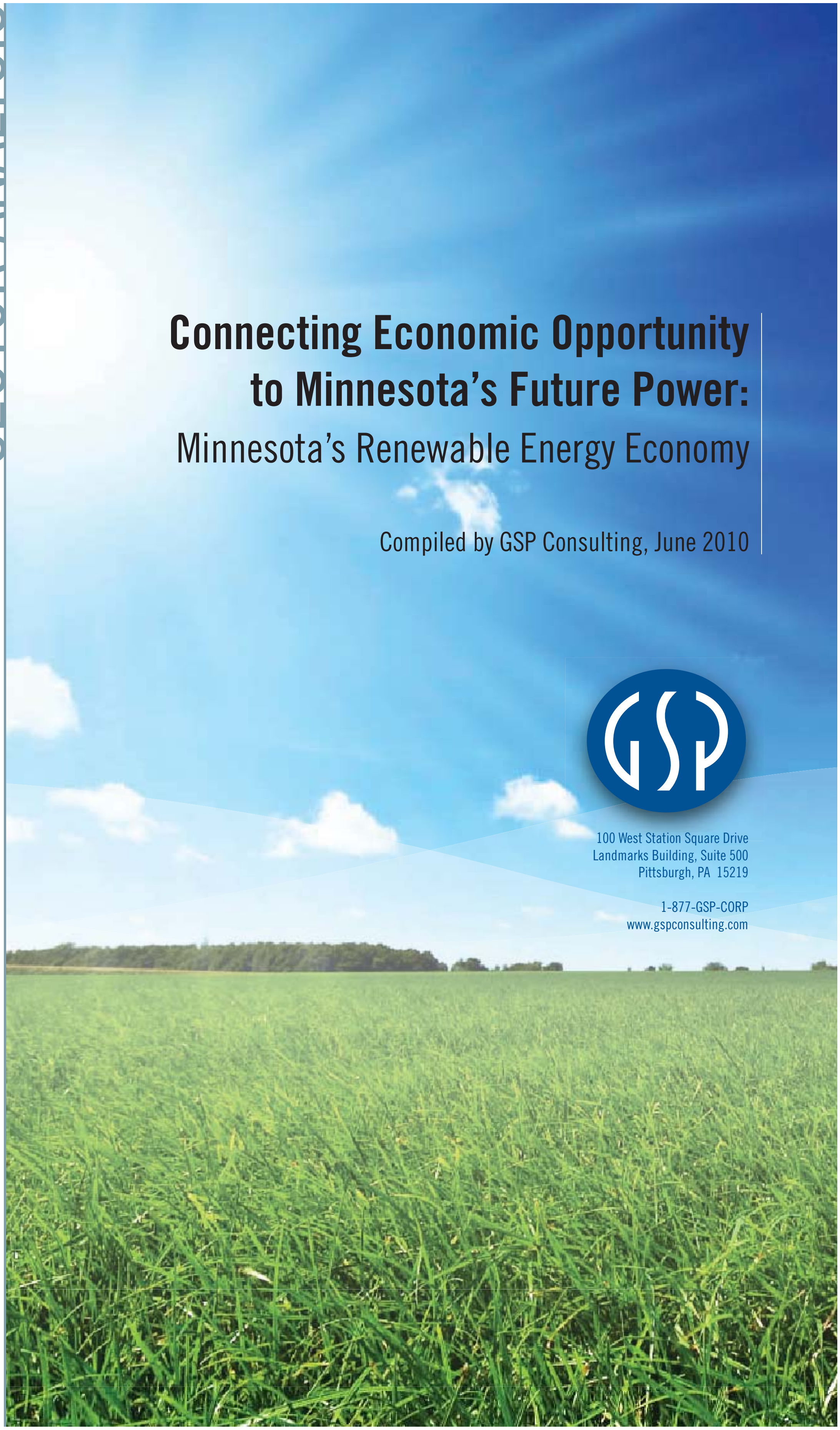
SECTOR ANALYSIS



Connecting Economic Opportunity to Minnesota's Future Power:

Minnesota's Renewable Energy Economy

Compiled by GSP Consulting, June 2010

GSP

100 West Station Square Drive
Landmarks Building, Suite 500
Pittsburgh, PA 15219

1-877-GSP-CORP
www.gspconsulting.com

Minnesota REM™
MN Renewable Energy Marketplace
www.mnrem.org

Created and Prepared by GSP Consulting Corp., Pittsburgh, PA
on behalf of
Minnesota Renewable Energy Marketplace

This workforce solution was funded by a grant awarded under Workforce Innovation in Regional Economic Development (WIRED) as implemented by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

Table of Contents

Executive Summary

While the age-old adage that you can't get something from nothing certainly rings true, perhaps the greatest untapped resources are those that are most difficult to hold in ones hands: the sun, the wind, and geothermal energy. These three combined with other renewable sources of energy like biomass and biofuel constitute an opportunity for Minnesota to grow its economy and become a regional and national leader in the technological development and production of renewable energy.

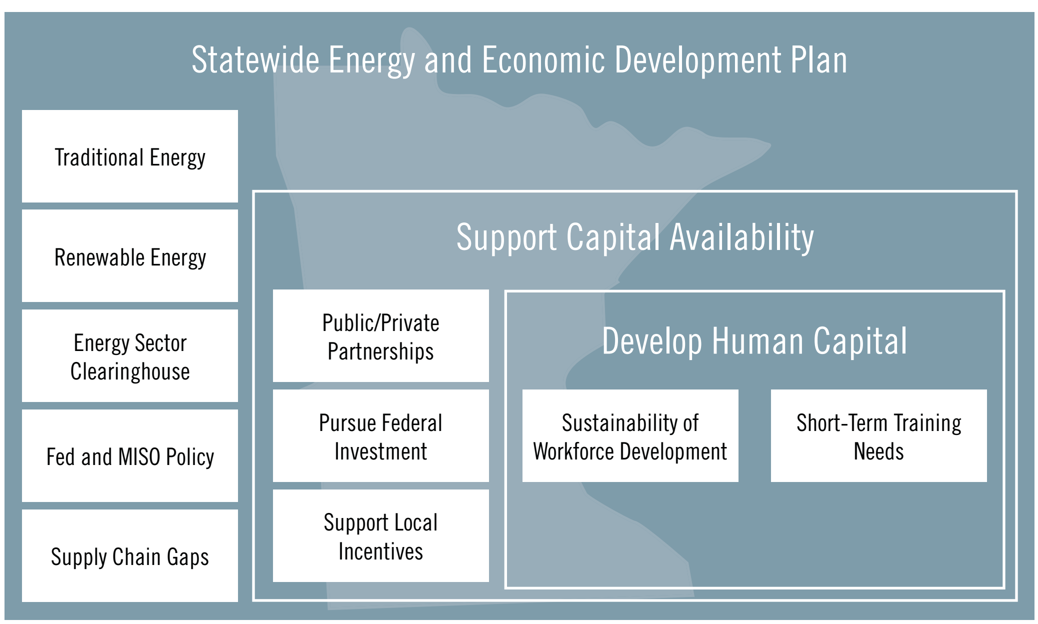
The Minnesota Renewable Energy Marketplace (MNREM) has been actively supporting the growth of the renewable energy sector in Minnesota for the past two years. In this time they have worked with more than 100 industry partners and impacted over 8,100 Minnesota residents and have worked to provide new opportunities for the industry sector to evolve. This report provides a snapshot of where the renewable industry sector stands today in the state. The recent oil spill in the Gulf of Mexico highlights the need for the United States to better diversify its energy portfolio toward cleaner, less dangerous, more local sources. MNREM is seeking to understand what this process looks like, where the opportunities exist, and what barriers must first be overcome. The renewable energy sector is a rapidly evolving area and ongoing efforts are required to take the pulse of the industry and seek answers to some key questions.

MNREM engaged the independent consulting firm, GSP Consulting, to conduct a renewable energy sector assessment to begin to answer these questions. MNREM recognizes that the renewable energy sector continues to evolve but as it prepares for its next phase of supporting the industry it is a good time to take a current snapshot of the sector. This report builds on other publically available reports that profile Minnesota including:

- "Minnesota's Energy Future: A Study of the State's Power Generation and Transmission Industry Cluster and Recommendations for its Regional Competitiveness", May 2010[1]
- "Destination 2025: Focus on the Future of Renewable Materials Industry", January 2009[2]
- "Minnesota Environmental Initiative: Green Economy Partnership Process", March 2010[3]

Other reports discussing national and international renewable energy opportunities were also reviewed to understand Minnesota's context in the global marketplace. Ultimately, the discussions and findings settled on the following areas that require attention if Minnesota is going to take full advantage of its opportunities.

Figure 1: A Holistic Strategy



Through a variety of sources including industry data, previous reports, and first hand research by communicating with more than 100 individuals through interviews, focus groups, and surveys, the following has been learned:

- Minnesota should **create a Statewide Energy Plan combined with a supporting Economic Development Plan**. This effort would allow support of the recommendations contained in this report and most likely identify additional opportunities as the energy and economic and workforce development communities work together.

- Most consumers and small companies are citing an overload of information on the energy sector and often confusing opportunities to support the adoption of renewable technology or energy efficiency. **There is a need for a real-time information source, a *Renewable Energy Clearinghouse*, to provide tools to interested consumers who are seeking to adopt renewable and/or energy efficiency technology.** This is the type of role that MNREM can support as it moves forward with its next phase.

- An Energy Plan and Renewable Energy Clearinghouse would allow communities and private companies throughout the state to better align their interests. **This report details a sample of low cost policy options that if implemented thoroughly can have significant positive benefits for the industry.** Technical Assistance and informational services are needed to assist stakeholders in the state implement these type of initiatives.

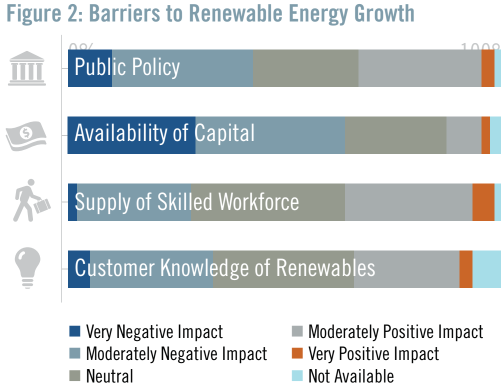
- The University of Minnesota was seen as a significant research resource for the renewable energy industry that is underutilized. Participants in this analysis noted that apart from the Morris campus (which should be lauded as a model for renewables utilization) the University is not engaged enough with industry to help lead technology development and push the market forward. **The University should more thoroughly engage with a broad range of industry players. This will be critical to achieving economic success from the renewable energy economy. The recent DOE turbine grant offers an excellent opportunity to turn public private-partnership into market opportunities.**

- **Renewable energy manufacturing can play a key role in enhancing economic growth – while wind turbine implementation has been a focal point, MN must look beyond this resource and look at the renewable energy supply chain.** When asked, "What sectors are the best opportunities for growth in the renewable energy industry within MN?"42% of participants said Energy Efficiency, while 38% of participants said Wind. Additionally, one expert commented that "The best opportunities for employment in the state for renewable energy seems to lie in the manufacturing of components for systems used to produce renewable energy."

- Capital markets continue to cause difficulties in the renewable energy marketplace. **Over 64% of the survey respondents identified availability of capital as being a moderate to severe barrier.** This report highlights the need for ongoing outreach and integration of public and private partners to form Public-Private Partnerships. Such models are being adopted throughout the country especially in areas of renewable adoption and energy efficiency retrofits. Minnesota's policy of selecting the lowest cost provider may save the state initial money, but may actually lead to lower revenues long term by disincentivizing development of the Minnesota's domestic industry.

The diagram below depicts areas that need development for Minnesota's renewable energy sector to continue to prosper.

Figure 2: Barriers to Renewable Energy Growth



- Additional federal opportunities will continue to present themselves as the Department of Energy, Department of Defense, and Economic Development Administration launch new programs or recapitalize existing efforts. According to this analysis, efforts to access federal dollars can be time consuming and a barrier for smaller projects. **A resource should exist in the state that can support applicant's efforts to identify and pull down federal funding opportunities.**

- The future of Minnesota's renewable energy workforce can be strong - the Great Recession did hurt the industry slightly. The state, however, due to a developing workforce, strong government support, and an abundance of natural resources will continue to expand their workforce *if* continued commitments to maximizing Minnesota's renewable resources are made. If this happens, renewable energy sectors should see moderate growth until 2025. **The research for this report indicated that 87% of respondents believed that given the opportunity to expand within the next year, they would be able to find the proper workforce to fill new positions with the exception of engineering degrees.**

- Minnesota has benefited significantly, in the short term, from the receipt of workforce development funding from the American Recovery and Reinvestment Act (ARRA). Concern is raised though over the sustainability of the efforts that are being supported and the availability of similar levels of training dollars as the economy begins to rebound and significant hiring occurs. **This fact calls for a strong integration between the various workforce investments in green initiatives in the state and plan now to leverage other resources once the ARRA federal funds are expended.**

- **All Minnesota education systems need to better align their resources, utilize articulation agreements and truly engage industry leaders to identify curriculum to best prepare and train our students for future careers in the Renewable Energy Sector.** Minnesota also as a state needs to get beyond its borders and partner and leverage expertise for neighboring states education institutions. MNREM has supported many cross institution and business led coalitions through the 28 projects that they have funded. Their experience has formed the opinion that Minnesota needs the K-12, MNSCU, University of Minnesota and private colleges and universities to collaborate and listen to industry needs to develop the workforce the state needs to move into the future.

- **MNSCU, Labor and the Workforce Investment Boards (WIBs) should work together to assure training resources provided utilize existing trades expertise and do not duplicate existing programs.** This will involve agreements on accreditation both in the trades and in the education system and allocation of resources from the WIBs. As mentioned the ARRA funding for workforce development is a great opportunity in the short-term but is will not be long lived and these groups need to insure that the resource is invested in a way that supports long-term training infrastructure.

Minnesota is blessed with natural resources that can be utilized for energy production. Growth opportunities have been identified in wind, solar, and biomass production. These opportunities require attention due to possible competing issues:

- Other states are committing funding to these same industries and actively compete with Minnesota for investment.

- The renewables industry as a whole is facing increased competition from China and others, as states attempt to implement their RPS's while not adding to state budgetary deficits

- Connectivity and transmission of renewables remain a serious threat to the growth of renewables and their workforce.

- Finally, public policy must be a driving force behind helping Minnesota continue its leadership, spur investment, develop its workforce, and connect synergistic opportunities.

MNREM can be a leading and unifying force behind these goals, utilizing its expertise as an industry-led organization. The key to its success will be its continued ability to engage policy leaders with market-driven solutions, connecting industry to workforce, and building Minnesota's competitive advantages in the renewable energy economy.

The Renewable Energy Policy Landscape

Potential United States Public Policy Drivers

In the US there has been significant demonstrated emphasis on the renewable energy sector by both Congress and the President. The passage of the American Recovery and Reinvestment Act provide numerous opportunities for renewable energy companies to participate in a variety of programs from tax credits, to loan guarantees and direct subsides of projects. As we write this report several additional initiatives are being considered by congress that are important to note.

The US Congress has several bills under consideration that may ultimately shape the future of the renewable energies market in Minnesota. The "Senate Climate Change Bill" (i.e., The American Power Act) would have the most significant impact on the growth of Minnesota's renewable energies market. This bill is more likely to be passed by the Senate than the much more stringent "House Climate Change Bill" (i.e., The American Clean Energy and Security Act) that was already passed in the house. Other proposed bills could also help Minnesota's renewable energy sector grow. They include:

- The Security in Energy and Manufacturing (SEAM) Act 10 Million Solar Roofs and 10 Million Gallons of Solar
- Water Heating Act of 2010 Act
- The Clean Energy Technology Manufacturing and Export Assistance Act

The three bills, however, are only at the first step of the legislative process. Introduced bills and resolutions first go to committees that deliberate, investigate, and revise them before they go to general debate. The majority of bills and resolutions never make it out of committee. If passed these bills could increase demand for renewable energies, the amount of federal funding for renewable energies R&D, and increase tax credits to renewable energy companies. The bills should be closely monitored through the legislative process.

On the other hand, Title V under the Clean Air Act may negatively affect the growth of Minnesota's biomass sector. Under the already passed Clean Air Act, the growth of biomass could be negatively affected. Currently, the EPA does not provide any exemptions for biomass power. This means that greenhouse gas (GHS) emissions from biomass would be treated similar to other GHS emissions (e.g., Coal plants).

American Power Act

Clean Energy Jobs and American Power Act (S. 1733) would establish a cap and trade system for greenhouse gas (GHG) emission allowances and sets goals of reducing U.S. emissions by 20% by 2020 and by 83% by 2050. The bill was introduced on September 30th 2009. On February 2nd 2010, it was placed on Senate Legislative Calendar under General Orders. This bill was considered in committee which has recommended it be considered by the Senate as a whole. Although it has been placed on a calendar of business, the order in which legislation is considered and voted on is determined by the majority party leadership. As of the writing of this report it is predicted that a vote may be taken by August 2010.

The bill includes several provisions that would have an impact on the renewable energies market. The provisions include:

- The development of a Universal Trust Fund
- Advancing or encouraging clean, renewable, alternative, innovative and/or efficient energy technology, projects, research and/or practices
- Supporting the development of programs to aid workers in the fields of clean energy, renewable energy, energy efficiency, climate change mitigation, and adaptation

The domestic clean energy development strategy is section one of the 1,000-page bill. This section facilitates the expansion of a range of energy sources including renewable energy and energy efficiency. It also has provisions that will include clean energy technology research and development and provides for significant clean energy job training opportunities and demonstration projects.

These provision would provide allowances from the universal trust fund to be distributed on a competitive basis to institutions of higher education, companies, research foundations, trade and industry research collaborations, or other appropriate R&D entities to promote the development and deployment of clean energy technology, which includes technology that produces solar, wind, geothermal, biomass, tidal, wave, ocean, other renewable, and nuclear energy; improves the efficiency of energy transmission, distribution, or storage; enhances building, industry, or manufacturing energy efficiency; enables smart grid development; produces an advanced or sustainable material with energy applications; enhances water security; or improves energy efficiency for transportation.

A study conducted by the Peterson Institute of International Economics concluded that the American Power Act would increase the renewable energy capacity by 24 gigawatts by 2030. The majority of this capacity would be from wind (roughly 58% of the increased capacity). Biomass would account for 23% of the increased capacity. Solar also would account for 13% of the increased capacity.[4] This growth in renewable energy capacity would lead to roughly 19,000 renewable energy jobs created yearly nationwide.

<u>What this could mean for Minnesota</u>
Minnesota is well positioned to see sustained growth in the renewable energies sector due to American Power Act. Minnesota's skilled workforce and potential renewable energy generation capacity could attract a significant amount of funding from the American Power Act. Currently, Minnesota is only capitalizing on a small percentage of its potential wind, solar, and biomass generation capabilities. If funding from the American Power Act is secured, the growth of this sector would have a significant impact on the number of jobs directly related to the renewable energies sector and the number of indirect jobs (e.g., construction, manufacturing) created by sector's growth.

The Security in Energy and Manufacturing (SEAM) Act
The Security in Energy and Manufacturing (SEAM) Act of 2010(S.3324) was introduced on May 6th, 2010. This bill is in the first step in the legislative process being referred to the Senate Finance Committee

Security in Energy and Manufacturing Act of 2010 or the SEAM Act of 2010 amends the Internal Revenue Code to expand the qualifying advanced energy project credit. This act would allocate $5 billion of grants or tax credit amounts to manufacturers of goods and components (other than for assembly of components) in the United States that are used in alternative energy projects.

This act is a continuation of the Advanced Energy Manufacturing Tax Credit (48C). The Advanced Energy Manufacturing Tax Credit was authorized in the ARRA and requires the Secretary of Treasury to work in consultation with the Secretary of Energy. It provides a 30 percent credit for domestic companies for investments in new, expanded, or reequipped clean energy manufacturing projects.

Since being first authorized the Advanced Energy Manufacturing Tax Credit program has seen significant growth in investment and job creation in the renewable energies sector. The provision has seen $2.3 billion in federal funds leveraged by roughly $5.4 billion in private investment to support new, expanded, or re-equipped clean energy manufacturing projects.[5] As many as 17,000 jobs have been directly created by the tax credits, while roughly 41,000 can be attributed to the accompanying private investment in renewable energy technologies.

<u>What this could mean for Minnesota</u>
Minnesota's renewable energy manufactures could benefit greatly from the passage of the SEAM Act. The bill would prioritize companies that manufacture goods and components in the US. This would ensure that the US manufacturing base produces all parts in the renewable energy sector supply chain. Minnesota's strong manufacturing base could allow the state to capitalize on this opportunity to increase the number of high-paying manufacturing jobs. Minnesota could become one of the nation's renewable energy sector leaders in the production of goods and components for the renewable energy sector. The state could provide an integral link in the Nation's renewable energy sector supply chain. Its skilled workforce and manufacturing capabilities could be utilized to produce good and components used in renewable energy.

10 million solar roofs and 10 million gallons of solar water heating act of 2010 Act
The 10 Million Solar Roofs and 10 Million Gallons of Solar Water Heating Act of 2010 (H.R.4597) was introduced on February 4th, 2010. This bill is in the first step in the legislative process. The bill was referred to the House Energy and Commerce Committee.

The bill aims to increase the quantity of solar photovoltaic electricity by providing rebates for purchase and installation of an additional 10 million solar roofs and additional solar water heating systems with a cumulative capacity of 10 million gallons by 2019. The US Secretary of Energy would establish a program to provide rebates to solar PV and heating systems. The requirements of the program are:

- Rebates to fund 10 million additional solar systems with a cumulative capacity of at least 30,000MW.
- 200,000 solar heating systems also to be funded by rebates, with 10 million gallon cumulative capacity.
- Rebates would be available for a homeowner, business, nonprofit entity, or State or local government.
- Solar PV systems up to 2MW in scale would be eligible.
- Department of Energy would be required to provide information to all rebate recipients on other federal, state and local rebates available for energy efficiency improvements.

What this could mean for Minnesota
The 10 Million Solar Roofs and 10 Million Gallons of Solar Water Heating Act of 2010 could have a positive impact on the states renewable energy sector. Due to Minnesota's long hours of sunlight during the summer months, the state has the same solar potential as Tallahassee, Florida and Houston, Texas. However, Minnesota's homeowners have been slow to adopt solar photovoltaic panels citing the high-cost of purchase and installation. Minnesota's solar thermal industry could see significant benefits as the cost structures are already favorable and the industry has a long history of success in the state, especially in water heating solutions. Minnesota should advocate for an equal treatment between solar pv and solar thermal to insure a level playing field. If the bill is passed, the state could potentially see an increase its percentage of renewable energy generation and create thousands of employment opportunities in manufacturing and installation occupations.

The Clean Energy Technology Manufacturing and Export Assistance Act

The Clean Energy Technology Manufacturing and Export Assistance Act (H.R. 5156) was proposed on April 27th, 2010. This bill is in the first step in the legislative process being referred to the House Energy and Commerce Committee.

The proposed program would require a new national strategy for clean energy exports. The department of Commerce would administer the $15 million program to help clean energy manufactures boost exports. The established fund would help manufactures to reduce production costs and encourage a national clean energy technology exports. These would be achieved by 5 activities:

1. Developing critical analysis of policies to reduce production costs and promote innovation, investment, and productivity in the clean energy technology sector
2. Help educate companies about how to tailor their activities to specific markets with respect their product slate, financing marketing, assembly, and logisitics
3. Help US companies learn about export process and export opportunities
4. Help US companies to navigate foreign markets
5. Help US companies provide input regarding clean technology manufacturing and trade policy developments and trade promotion.

What this could mean for Minnesota
This bill, if enacted, would help Minnesota's renewable energy manufacturing industry by allowing them to reduce production costs and encourage innovation, investment, and productivity in the renewable energy technology sector. The US Department of Energy has found that the increase in exports of green technology could reach $40 billion per year and could create more than 750,000 jobs by 2020. Many of these jobs could be created in

Title V operating permits under the Clean Air Act

The U.S. EPA released an updated version of its final "tailoring" rule this week outlining which polluters will be required to account for their greenhouse gas (GHG) emissions when obtaining New Source Review and Title V operating permits under the Clean Air Act.

The agency is set to begin formally regulating GHGs for large industrial plants in January 2011, while exempting smaller sources like farms, restaurants, schools and other facilities. Under the proposal, EPA estimated that 14,000 large industrial sources would need to obtain greenhouse gas permits, and about 3,000 of those sources would be newly subject to Clean Air Act operating permit requirements.

The schedule for phasing in sources looks like this:

- January 2011: facilities that must already obtain New Source Review permits for other pollutants will be required to include GHGs in their permits if they increase their emissions of the gases by at least 75,000 tons of carbon dioxide equivalent per year

- July 1, 2011: EPA will extend the requirements to new construction projects that emit at least 100,000 tons of GHGs and existing facilities that increase their emissions by at least 75,000 tons per year, even if they do not exceed thresholds for other pollutants. Sources that emit at least 100,000 tons of greenhouse gases per year will also be required to account for GHG emissions in their Title V operating permits.

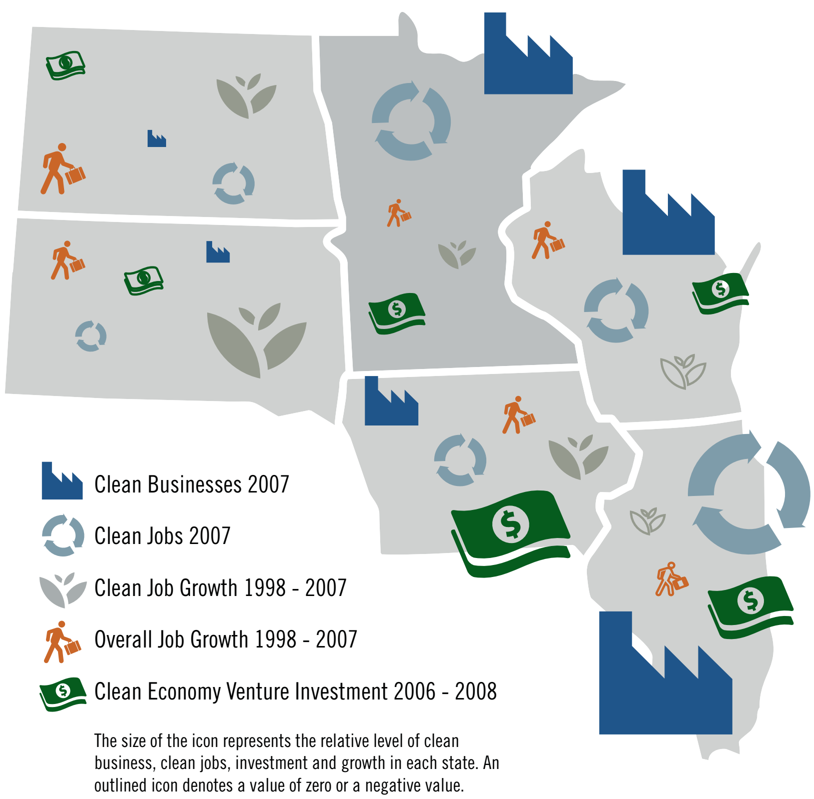
- July 1, 2011 through June 30, 2013: EPA estimates about 550 sources will need to obtain operating permits for the first time due to their GHG emissions. Most of those sources will likely be solid waste landfills and industrial manufacturers, according to EPA. About 900 new facilities and modifications per year will trigger New Source Review permitting requirements based on greenhouse gas emissions.

In these new regulations, emissions from biomass or biogenic sources are treated the same as other sources of greenhouse gases. The EPA has not finalized any exemptions from applicability or different applicability thresholds for biomass or biogenic sources.

What this could mean for Minnesota

Without an exemption for biomass or biogenic generation, Minnesota's renewable energy market could take a significant hit. Biomass is an abundant source of renewable energy for the state due to its unique structure of wooded areas to the North and rich farmlands to the South. The sector is expected to see significant growth over the coming years due to the state's commitment to adopt renewable energy. This regulation could be a major impediment to the expected growth of the sector due to a 'one size fits all' approach and the costs of getting an environmental consultant to help meet the annual permitting process is going to be an onerous cost for a lot of the single-plant operators in the biomass generation business.

Figure 3: Benchmark States



State Policy Framework

Minnesota
Minnesota has a fairly comprehensive state incentive structure to support the renewable energy industry including one of the leading renewable fuels portfolio standards (RPS), programs like net metering and community-based energy development (C-BED), and the legislature recently approved a five-year, $50 million angel investor tax credit designed to spur early-stage investment in high tech start-ups. This credit should help Minnesota begin to regain a competitive edge against regional competitors such as Wisconsin which have been ramping up incentive programs over the past few years.

Iowa
The Iowa Power Fund is a program to improve the economic competitiveness and increase the demand for renewable energy technologies and approaches by providing funding for business and research programs. Iowa also offers a renewable energy production tax credit of 1.5¢ per kilowatt-hour energy sold by wind energy facilities and other renewable energy facilities. The Iowa Energy Center provides grants for renewable energy research to universities, non-profits, and Iowa-based foundations. For 2010 Iowa is looking to develop community based energy development, similar to Minnesota, and have their utilities board establish feed in tariffs for new Renewable Energy Systems.

North Dakota
In March 2007, North Dakota established a renewable fuels portfolio standard (RPS) goal that 10% of all electricity sales be obtained from renewable and recycled energy by 2015. North Dakota's Renewable Energy Program (REP) provides financial assistance for the development of renewable energy and related technologies through the Renewable Energy Fund. In 2009 state Legislature established the fund as a continuing appropriation of $3,000,000. The program also provides for technical assistance to the Renewable energy Council by the Department of Commerce. North Dakota also provides an income tax credit for the cost of acquiring and installing a geothermal energy system and a exemption from local property taxes for renewable energy devices serving a building.

South Dakota
In February 2008, South Dakota established a renewable fuels portfolio standard (RPS) goal that 10% of all electricity sales be obtained from renewable and recycled energy by 2015. In March 2010, South Dakota established a new property tax incentive for facilities that generate renewable energy. The first $50,000 or 70% of the assessed value of eligible property is exempt from the property tax. Also in March 2010, South Dakota established a tax refund for new and expanded wind-energy facilities the amount of the tax refund is a percentage of the taxes paid (up to 55% for projects that cost $40 million or more).

Wisconsin
The Wisconsin Department of Commerce's Clean Energy Business Loan Program provides low-interest loans to for-profit manufacturing companies for projects that support renewable energy and energy efficiency jobs within the state. Loans will be issued for up to 25% of project cost at a fixed interest rate of 2% over terms of 5-7 years (working capital) or 5-10 years (equipment). The Rural Energy for America Program (REAP) provides agricultural producers and small businesses located in a rural area grants up to $500,000 and loans up to $25,000,000 for renewable energy projects. Wisconsin also has two sales tax exemptions that apply to renewable energy.

Illinois
A business establishing a new wind power facility in Illinois that will not be located in an Enterprise Zone* may be eligible for designation as a "High Impact Business." The facility with this designation is exempt from the state's 6.25% sales tax. Illinois has developed fuels portfolio standards (RPS) targets for the future of their state. By 2020 17.5% of Illinois' energy must come from renewable resources and by 2025 25%. The Renewable Energy Resources Trust Fund (RERTF) supports renewables through grants, loans and other incentives administered by the Illinois Department of Commerce and Economic Opportunity (DCEO).

Comparing States

The following chart is a helpful summary from Database of State Incentives for Renewable Energy which compares the number of incentives by type for benchmark states.

Table 1: Financial Incentives for Renewable Energy by State

State	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Rebates	Grants	Loans	Industry Support	Bonds	Production Incentives
Illinois			1	2	1 2	1 1 1	2		1	1
Iowa	1	2	1	3	12	1	2 1			1
Minnesota			2	1	5 21	2 2	6 2			1 1
North Dakota	1	1		2	1		2			
South Dakota			1	4	2		2			
Wisconsin	1	1	1	1	6 4	1 2	2 1 1	2		5
Federal	3	4	0	0	0	3	5	1	0	1

■ State ■ Utility ■ Local ■ Nonprofit

The Renewable Energy Industry Market

Projections indicate the health of the renewable energy job market will remain strong in the coming years. Minnesota has a strong commitment to transition from fossil fuels to renewable energies. This continued commitment to renewable energy development coupled with an abundance of natural resources should lead to job growth in jobs directly related to renewable energy generation and use.

However, the impact of the recent recession has dampened growth, especially in terms of accessing capital markets and incentivizing growth. Challenges to national output, such as the insurgency of Chinese renewable energy products may limit competition.

Prior to the economic recession, Minnesota has positioned itself well as a national leader in renewable energy sector. It has capitalized on the state's availability of natural resources and an adequately skilled workforce. In 2007, Minnesota was the 4th highest producer of non-hydroelectric renewable electric generation as a percentage of total state electricity generation (7.2% MW) according to the National Renewable Energy Laboratory.[6] Minnesota also provides residents with several solar and renewable energy programs to increase interest in renewable energies.

Minnesota only capitalizes on small percentages of the state's solar and wind power capacity. The state also can increase energy generation from biomass due to the potential growth of biomass and current structures suitable for biomass.

Wind

Wind provides the greatest opportunity for job creation among the renewable energy sector due the state's virtually untapped wind energy generation capacity. As of the end of 2009, the state was producing just over 1,800 megawatts (MW) of installed wind power capacity.[7] The state, however, could achieve as much as an estimated 75,000 MW from wind energy generation. Conservative estimates indicate that Minnesota will reach 10% (7,500 MW) of installed utility-scale wind power capacity by 2021.[8]

The growth of the industry will lead to an increased demand of skilled workers in the wind energy industry. Even the modest 7.5% (an increase of 5,748 MW of energy generation) increase would create between 344 and 1149 permanent operation and maintenance jobs. The National Renewable Energy Laboratory (NREL) estimates that per every 100 MW of wind energy generation there are 6 to 20 permanent operation and maintenance jobs.

While the federal production tax credit (PTC) helps to drive the development of wind production owned/financed by large corporations, the PTC does not incent community scale wind since it only offsets against investment income, which most owners/operators at this scale simply do not have. To fully explore wind resources, Congress needs to include some aspect of ordinary income into the PTC. Congress will also need to consider how to assist communities with ongoing issues around costs of building out or upgrading transmission capacity as discussed later in this report.

Solar

Minnesota's solar energy capacity also has not been aggressively utilized. NREL estimates indicate that Minneapolis has the 4th highest potential of annual rooftop solar power generation (5375 kWH) of any city in the United States. This is a result of Minnesota's numerous sunny days and the longer hours of daylight during the summer months. This natural resource also could be utilized in many other areas of the state to supplement other utility-scale generation. Solar rooftop panels could account for 10% of the states energy generation if 25% of Minnesota's single family houses adopted the technology.[9]

The state and federal government (under the American Recovery and Reinvestment Act (ARRA)) have significantly increased the financial incentives and funding to aid the adoption of rooftop solar panels. Currently, the state offers several tax credit programs to households that adopt the technology. Under the U.S. Department of Energy's Solar Cities program, Minneapolis will receive $3 million in federal funding to increase the number of solar rooftop panels.[10] However, it should be noted that of the $3 million, solar thermal projects received at most $500,000.

This $3 million dollar investment will create an estimated 17 permanent high-paying solar energy operations and maintenance jobs in Minneapolis this year. According to a study conducted by UC Berkeley's Renewable and Appropriate Energy Laboratory, 5.65 permanent jobs are created per $1 million of investment.[11] In Minnesota, these workers will have a higher annual wage than the national average. The overall US solar energy growth also should lead to another 587 jobs being created in Minnesota over the coming years.[12]

Minnesota's solar energy incentive programs (e.g., SolarSense rebate program) should have a positive impact on the growth of the solar energy related jobs. These incentives coupled with the long-term savings for homeowners should make rooftop solar panels more attractive in the coming years. However, the poor economic climate has hurt some potential growth due to the short-term insulation costs. It is important to note that recent trends and legislation have heavily favored solar PV over solar thermal. The State needs to be careful not to overly incent the PV industry at the expense of the established and growing, thermal market. Doing so will limit interest and hurt Minnesota's overall solar potential.

Biofuels

The role of biofuels in achieving energy independence is currently in the national spotlight. Specific to Minnesota, the future of the biofuels industry lies between the confluence of available funding, public opinion, and policy. Minnesota has been a leader in the manufacture of several different biofuels, including corn-based ethanol, cellulosic ethanol and soy-based biodiesels. According to the Renewable Fuels Association in 2010 Minnesota has the 4th largest ethanol production capacity in the US and as of 2009 was one of only 4 states where E10 makes up 100% of their market.[13] Additionally, in 2009 the production of an estimated 10.6 billion gallons of ethanol helped support nearly 400,000 jobs in all sectors of the economy nationwide.[14]

After the recent economic downturn, financial institutions have been hesitant to make loans for the development and expansion of biofuel production plants, especially those producing cellulosic ethanol. Banks consider cellulosic plants to be of higher risk and question if the technology will work efficiently on a larger scale. Congress initially looked for cellulosic ethanol production to top 100 million gallons in 2010, but in the face of setbacks within the industry they have decided to reduce their target for 2010 to 6.5 million gallons.[15] Cellulosic companies can still look to the federal government for funding by way of a loan guarantee through the Department of Energy, but currently no loan guarantees have been made.

Additionally, the ethanol industry in general is coming up against market saturation. Much of the automobile fuel sold already contains 10% ethanol, and the industry estimates that it already sells 13 billion gallons/yr. The federal goal/cap is 15 billion by 2015 and this amount will be easily reached. Without state or federal action to up the allowable percentage of ethanol blends, the domestic market will not be able to grow. Biofuels also face a public anti-ethanol campaign.

The Grocery Manufacturers Association (GMA) along with food companies, livestock producers, environmental groups, and oil companies have spent millions of dollars on an anti-ethanol campaign and lobbying efforts in Washington. The basis of their campaign, "Food vs. Fuel" is that increases in demand for corn due to higher ethanol production is increasing the price of livestock feed, which in turn is driving up the prices of food at the grocery store. According to the GMA, this process has led to ever increasing amounts of land being plowed under in order to expand harvesting. Another rival to US biofuels is the Brazilian ethanol industry. Their goal is to pressure Congress to remove or reduce tariffs that prevent their sugarcane based ethanol from gaining market share in the US. The basis of their campaign is that sugarcane ethanol is more environmentally friendly than corn-base ethanol.

In response to these anti-ethanol campaigns, Growth Energy an ethanol industry group formed in 2008, is scaling up their lobbying and public relation efforts. Combined with the Renewable Fuels Association, they spent more than $1.5 million on lobbying in 2009, and recently Growth Energy launched a $2.5 million television ad campaign in an attempt to reduce skepticism about ethanol.[16]

Growth Energy is working with the EPA to increase the legal level of ethanol concentration in gasoline.[17] According to a Minnesota statute, by 2013, 20% of the total gasoline sold must contain ethanol. It is unlikely that Minnesota will achieve this solely through the sale of E85 and E20.[18] They will also need to rely on efforts directed at the EPA to make E20 a legal fuel across the nation.

Raising the gasoline standard to E20 will have a large impact on the Minnesota ethanol industry by doubling the size of the market for ethanol within the state and fostering development in the biofuel industry.[19] Ethanol is not the only prominent biofuel in Minnesota. As of 2009, all diesel fuel sold in the state must contain 5 percent biodiesel (B5), and by 2015 this level will rise to 20 percent biodiesel (B20).[20] This increase will boost Minnesota's farm economy and the additional demand will assist in the growth of Minnesota's biodiesel industry. With technology increasing grain yields, and decreasing energy and water usage in biofuel creation, ethanol is and can continue to be a powerful economic driver in Minnesota's agriculture sector and the state's economy as a whole.

On a national level, as the public and Congress question the sustainability of the biofuels industry, billions in tax credits are set to expire at the end of the year.[21] The Volumetric Ethanol Excise Tax Credit (VEETC), also known as "the blender's credit" is a federal tax credit designed to induce gasoline refiners to include ethanol in their supply of gasoline to the marketplace. The VEETC was originally part of the American Jobs Creation Act of 2004 and it provides a $0.45 tax credit per gallon of ethanol blended. While the VEETC initially provided different level of tax credits for E10 and E85 ethanol blends, the 2008 Farm Bill normalized the credit to $0.45 for both blends. Additionally, the VEETC applies a tariff on imported ethanol - such as sugarcane based ethanol from Brazil - to induce blenders to source their ethanol from domestic producers. The VEETC is due to expire at the end of 2010 and a bill to renew it was introduced by Rep Earl Pomeroy (D-ND) in March 2010. As of June 2010 the bill, H.R. 4940 – Renewable Fuels Reinvestment Act is currently in committee and has yet to be voted on in the House or Senate.

One ethanol industry expert noted that the US has a mandate for 90% petroleum. Regardless of which side one falls on, it is clear the state and federal regulations and incentives will be imperative in the direction that the biofuels market takes, and the impacts will be felt throughout Minnesota's economy.

Biomass

Biomass also has long-term potential as a utility-scale renewable energy source. The state has two strong sources of biomass. The northeastern forest product industry and loggers provide wood waste that can fuel power plants. The southern and western farmers provide agricultural waste commonly used in biomass energy generation. Overall, the state could produce up to 25 million tons of biomass per year.[22]

These excellent sources of biomass can be processed at co-generation plants to significantly increase the state's renewable energy power supply. In the short-term, this would capitalize on the current energy generation structures. These plants would develop con-generation plans that would include biomass into their current generation efforts. The long-term goal, once technology develops, is to develop several stand-alone biomass energy generation plants.

Currently, Minnesota still has not maximized the potential energy generation. The state utilizes less than 33% of potential energy generation from biomass. In 2007, Minnesota produced 1,293 megawatts per hour (MWh) from biomass energy generation. This is significantly less than the potential 4,200 MWh Minnesota could produce yearly.[23]

The short-term co-generation plans and long-term stand-alone plants would increase the number of Minnesota's renewable jobs. The National Renewable Energy Laboratory reports that for every megawatt of biomass power produced, 4.9 jobs are created.[24] Current proposed plants, like the Central MN ethanol CMEC plan, will be a strong source of job creation over the next several years.

The future of Minnesota's renewable energy workforce looks strong despite some impact from the Great Recession. Due to a developing workforce, strong government support, and an abundance of natural resources, the state will continue to expand their workforce. The sectors that will produce the most jobs will be wind, solar, and biomass energy generation. These sectors should see moderate growth until 2025.

Global, US, and Macroeconomic Trends in Renewable Energy

The renewable energy landscape across the United States and Minnesota is projected to experience continued growth in the next few decades and will be an important and vital aspect of domestic energy production. Renewable energy is projected to account for approximately 45% of the total increase in energy production between 2008-2035 under the Production Tax Credit for Renewable Energy (PTC) that is due to sunset by 2012 and 2013.[25] If the tax incentives remain in place through 2035 then renewable energy is projected to account for 61-65% of the total increase in electricity generation.[26] Wind and biomass are projected to be the largest sources of growth among renewable energy from 2008-2035, where wind generation is projected to increase from 1.3 percent of total generation in 2008 to 4.1% in 2035.[27] Biomass is projected to grow from 0.9% of total generation in 2008 to 5.5% in 2035.[28] In addition, according to a recent report in *The Financial Times*, renewable energy is close to surpassing nuclear power as a total share of US electricity generation, with nuclear power presently accounting for 9% of US energy production and renewables at 7%.[29]

According to an article in *The New York Times* the recent recession in the US dampened the outlook on renewable energy in the short-term – primarily due to falling natural gas prices as well as the high upfront capital requirements for renewable projects – yet the medium to long-term prospects are much brighter.[30] The desire of the Obama administration to enact climate change legislation in the near future further reinforces the prospects for renewable energy. Policy inducements and legislative incentives will continue to be the primary driver of the growth in renewable energy in the US, but there is no reason to assume that these trends will reverse themselves, especially given the recent Deepwater Horizon oil leak in the Gulf of Mexico. Additionally, trends in other developed countries like the UK, which are on pace to exceed their emissions reduction targets, are likely to add further pressure on the US to do

One ethanol industry expert noted that the US has a mandate for 90% petroleum.

the same. This will only continue to increase demand for renewable energy sources in the US according to another analysis done by *The Financial Times*.[31]

In terms of global investment in renewable energy wind, solar, and biomass are leading the way. Bloomberg New Energy Finance estimates that China WindPower Group Ltd, Iberdrola SA, and Duke Energy Corp will develop approximately $65 billion in wind generation plants in 2010.[32] This investment is estimated to add close to 41 gigawatts of generation capacity, which is equivalent to the construction of 34 new nuclear power stations.[33]

Bloomberg New Energy Finance also predicts that global investment in renewable energy may exceed $200 billion in 2010, after witnessing a 6% decline in investment in 2009.[34] In addition, the International Energy Agency estimates that electricity generation from renewable energy resources will account for 9% of total generation by 2030, up from a current share of 2.5% of the global total. An important driver of this increase in renewable energy investment is an overall decline in the price of wind turbines, which have decreased by approximately 15%. This decline in turbine prices, coupled with stimulus funds allocated specifically to renewable energy investments, provides more power generation for the same amount of money.[35] Governments around the world (primarily the US, China, and the EU) are poised to spend $184 billion on renewable energy projects in the next few years, with approximately two-thirds estimated to be spent by the end of 2011.[36]

Renewable Energy in Minnesota

Minnesota currently houses several important possibilities for renewable energy expansion. The state has a robust manufacturing infrastructure and job growth related to renewable energy production will be concentrated primarily in manufacturing sectors that are part of the supply-chain of materials utilized in the production of renewable energy.

In terms of specific renewable production, wind energy is perhaps the most important renewable energy source in Minnesota. Minnesota currently ranks seventh in the US in electricity generation from wind production with approximately 1,800 wind sites currently in operation and 262 additional sites currently under construction.[37]

Biofuels remain an important component with Minnesota being the 4th largest producer of ethanol and having over 150 E85 fueling stations. It also leads the country in the number of blending stations. While solar energy and biomass are also important targets for renewable energy production in Minnesota, wind power has emerged as the most likely target for growth. The reasons for this are two-fold. First, the geographic location of Minnesota provides it with an abundance of wind (particularly because it lies between the high-wind states of North and South Dakota). Second, Minnesota's Renewable Energy Standards (RES) mandates that utility companies in Minnesota must generate 25% of their sales from renewable sources by 2025.[38] In addition, the mandate required that Xcel Energy (the largest electricity producer in Minnesota) generate 25% of their electricity from wind sources.[39]

The link provided by the renewable energy industry to the manufacturing sector bears important implications for job growth in Minnesota. If the US continues on a path to enact carbon emissions legislation then the increase in demand for renewable energy will be an important driver for job creation in the state. The increase in demand for renewable energy in Minnesota as a result of national carbon emissions legislation is projected to create an additional 18,405 jobs through engaging with approximately 1,070 firms throughout the state. These job projections however are only reflective of those jobs created through renewable energy production and do not include the additional jobs positively affected through an overall increase in demand. In Minnesota, over 250,000 occupations have the potential to be integral to the renewable energy infrastructure in the state.[40]

Renewable Energy Sector Stakeholder Opinions

In order to gauge what the real-time opinions are of Minnesota's Renewable Energy Sector Stakeholders, the consulting team developed and executed a web-based survey. The goal of the survey was to engage stakeholders in a conversation about the opportunities and threats to Minnesota's current renewables industry, as well as future growth options Ninety-four participants completed the survey which provides a solid base of data and information for analysis.

Survey respondents participated in a wide variety of areas in the renewable energy sector marketplace. While there was no clear majority, the top categories were for Solar (47%), Energy Efficiency (46%), Biofuel (41%), and Wind (40%). Respondents could select more than one option. While the industry sector participants served were varied, fully 50% were from the Education and Training organizations followed by Service providers at 23% and Suppliers and Component Manufactures at 15%. Most organizations employed under 50 people (53%), and operated within Minnesota only (45%). Themes in participants' responses can thus be given more credibility and reliability due to the broad range of respondent backgrounds.

Overview Perspective of Survey Respondents

The survey revealed that respondents were overall very positive toward the potential of renewable energy to continue to grow and build market share. **Energy Efficiency was viewed as having the best opportunity for growth by 41% of the respondents.** This ranking was followed by Wind at 39%. In fact, between options of "Good" or "Best" all types of renewable energy scored at or above 50% with the lowest being Biofuel at 50% even. Conversely, biofuel had the highest "Poor" rating of 14% followed by Solar and Geothermal at 11% each. These opinions most likely reflect general uncertainty about the future of biofuels which was discussed earlier.

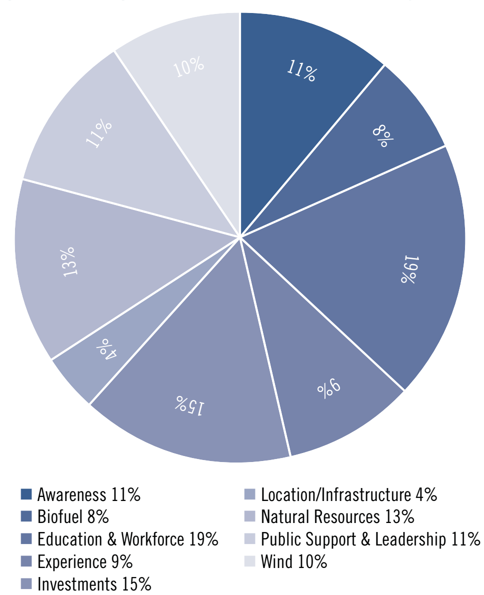
When asked to choose from several options and rate the positive or negative effect on the respondent's business, the availability of capital came across as having by far the most negatively perceived impact on the renewables industry. **Over 64% of the survey respondents identified availability of capital as being a moderate to severe barrier to their growth.** The negative perceptions of public policy were a distant second with 42% believing policy to be moderately or very negatively impacting the industry. However, 28% thought that policy was having a moderately positive impact so this category was split. The other categories of workforce and customer knowledge came across as mostly neutral and positive. While several noted political and state support for renewables, another made a distinction and cited "strong past political support." It is important to note that the Minnesota State Legislature recently passed an Angel Investor Tax Credit which will hopefully spur growth. However, Minnesota needs to guard against resting on the laurels of past success and leadership while competitors catch up and pass Minnesota in terms of engagement, capacity, and incentives.

The following section summarizes the identified strengths, weaknesses, opportunities and threats of the survey respondents:

Strengths

- Education and Training
- Natural resources
- Manufacturing infrastructure
- Wind and biomass availability
- Public is engaged and aware which creates the political will for paving the path forward for renewables

Figure 4: Strengths of MN's Renewables Economy



Respondents overwhelmingly viewed the natural resources of Minnesota, especially in wind and biomass as strengths on which to continue to build the renewable fuels industry. Many commented positively about the inherent workforce in these areas as well, though this may be due to a bias as workforce

Minnesota has an "overreliance on 1st generation renewables, where we lead, but (we) do not lead in next generation" renewables.

training providers made up a large portion of the survey. The current manufacturing infrastructure was also seen in a positive light, and one that could be utilized further.

However, it is important to note is what is not mentioned. Chief among these was the lack of response toward research and development (R&D) or innovation. Besides the presence of natural resources, there is a dearth of items listed that will help boost Minnesota's competitive advantage. **While states like Wisconsin and Iowa innovate and actively incent and spur investment, Minnesota must be careful not to depend on past success to drive future growth.**

> Minnesota is a case where there are "multiple groups with similar goals that overlap but do not leverage common initiatives and goals."

One participant opined that Minnesota has an "overreliance on 1st generation renewables, where we lead, but (we) do not lead in next generation" renewables. 2nd and 3rd generation renewables include cellulosic ethanol, biobutanol, algae, and others. It is important to note that under the Renewable Fuel Standard (RFS) program within the Energy Independence and Security Act of 2007 (EISA), Congress created requirements for how much renewable fuel (corn ethanol, biomass-based diesel, cellulosic ethanol, and other "advanced" fuels) must be blended in the nation's petroleum supply. Of the 36 billion gallons of biofuel in set to be blended in 2022 corn ethanol is not to exceed 15 billion gallons. Such a ruling should give rise to advancing next generation fuels such as cellulosic ethanol/ biomass where Minnesota has great natural resources.

Respondents do appear to be cognizant of these weaknesses, which plays to the high levels of general awareness that the Minnesota public appears to have when it comes to renewables.

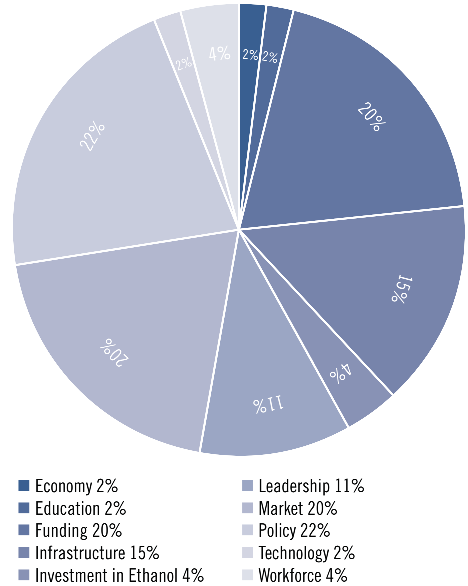
Weaknesses

- Public policy is not aggressive
- Market instability
- Funding availability
- Infrastructure
- Leadership – no unified approach or voice

Respondents were quick to highlight several areas where they perceive Minnesota to be weak. Of the responses, weaknesses in Public Policy, the overall Market for renewables, and Funding Availability were most cited with 20 – 22%. Infrastructure came fourth with 16% and 11% thought that Leadership was the most significant weakness. However, the interconnectivity between these items should not be lost.

Public policy leadership is needed help mitigate market

Figure 5: Weaknesses of MN's Renewables Economy



instability, and funding availability, and assist in infrastructure development. While the federal government must take a stronger role in developing a comprehensive energy policy and driving demand, the State of Minnesota can increase its interaction with the federal authorities in helping to better plan grid connectivity so that it benefits local communities, as well as engaging in better zoning policies seeking to promote renewable energy development. However, numerous participants in the survey felt that the State's different resources were operating in silos, thus making it difficult for private business to navigate the processes in place that are meant to promote the renewable fuels industry. According to one respondent, this was leading to private enterprise "locat(ing) processing facilities in MN, but corporate offices elsewhere."

While market instability is somewhat more difficult to inoculate the state against, a leadership structure that assists and leads renewables deployment and utilization through the promotion of R&D, innovation, and connectivity with workforce development could create a more fertile ground for long term success. One respondent noted that Minnesota was a case where there were "multiple groups with similar goals that overlap but do not leverage common initiatives and goals."

They went on to state that "our focus is on the public sector (when) in reality other states are more open minded to public/private partnerships." Perhaps most pointed was a participant that claimed "Many groups work on renewables in MN which good, but it feels like the jobs are going to the Dakotas. SD and ND seem to have "Now Hiring" signs out and MN has lots of happy green messages."

A clearinghouse model of information collection and sharing could go a long way toward assisting these efforts into a single stream. Such a model would better connect companies in Minnesota throughout the renewable energy sector supply chain. An interesting example of this currently occurring is the Minnesota Biomass Exchange. However, there is no mechanism that can systematically unite suppliers, manufacturers, and end users while at the same time determine and fill workforce needs at each level. The final piece to such a model would be the integration of a public policy arm that could act as an industry voice in working with state and federal regulatory bodies to draft and augment incentive structures, and unify efforts around infrastructure development.

While infrastructure was not singled out as prevalently as some choices for respondents, it still remains a significant weakness to Minnesota's renewable energy market and barrier to increased investment and development. This is perhaps most prevalent in the wind industry with grid connectivity being of central import. However, several survey respondents also noted a lack of ethanol blender pumps in the state, so the infrastructure issues are not only found in one industry.

Central to grid connectivity are issues surrounding the consistency of projected levels of energy production. An expert in transmission who works with the Midwest Independent Transmission System Operator (MISO), the Federal Energy Regulatory Commission (FERC), and others noted that the up-front cost of building out or upgrading transmission infrastructure to many renewable energy facilities did not merit the investment. This was due to a lack of consistent production. While a wind farm could operate at X level, it would not do so consistently so transmission capacity would only be built to level Y because it was more likely to consistently receive that level of power. Without the ability to successfully store renewable energy, the market is faced with a serious puzzle. However, it is important to note that an Xcel Energy battery storage project in SW MN is seeing success.
One strategy to overcome this obstacle may be in a potentially forthcoming grant announcement around batteries and storage. The US Department of Energy (DOE) originally intended to fund eight energy regional innovation clusters (E-RICs). In 2010 three of the original eight have turned into federal funding opportunity announcements (FOA); Energy Efficient Building Systems, Fuels from Sunlight (hydrogen power), and Modeling & Simulation for Nuclear Reactors. Each of these grants was a joint announcement from the DOE, Small Business Administration (SBA), Economic Development Administration (EDA), and the Manufacturing Extension Partnership (MEP) program and totals a $130 million investment over the next 5 years with the aim of fostering transformative technology and transferring it quickly from the research phase into a deployed capability. The grant program also seeks to avoid or at least change the university and national lab research models that are costly and slow.

According to DOE "The proposed Energy Innovation Hubs will be major multidisciplinary, multi-investigator, multi-institutional integrated research centers. The Hubs are modeled after the forceful centralized scientific management characteristics of the Manhattan Project (e.g., Los Alamos and the Metallurgical Laboratory at the University of Chicago), Lincoln Lab at MIT that developed radar, and AT&T Bell Laboratories that developed the transistor, and on the three $25 million-per-year DOE Bioenergy Research Centers (BRCs) established by the U.S. Department of Energy's Office of Science in 2007.

The Hubs will bring together top researchers from academia, industry and the government laboratories with expertise that spans multiple scientific and engineering disciplines under the leadership of a dynamic scientist-manager. These teams will orchestrate an integrated, multidisciplinary systems approach to overcoming critical technological barriers to transformative advances in energy technology. The Hubs will advance U.S. global leadership in the emerging green economy and are focused in areas that have exceptional potential to reduce our dependence on imported oil and greenhouse gas emissions."

The DOE also supported the inclusion of a grant centered around batteries and energy storage that would receive the same level of funding and commitment. **While this FOA is unlikely for at least another year, it would be a necessary step to begin aligning partners at the university, government, nonprofit, and industry levels around coming up with strategies for partnership, and ways to utilize research around energy storage for the economic development of the state and region.**

Opportunities

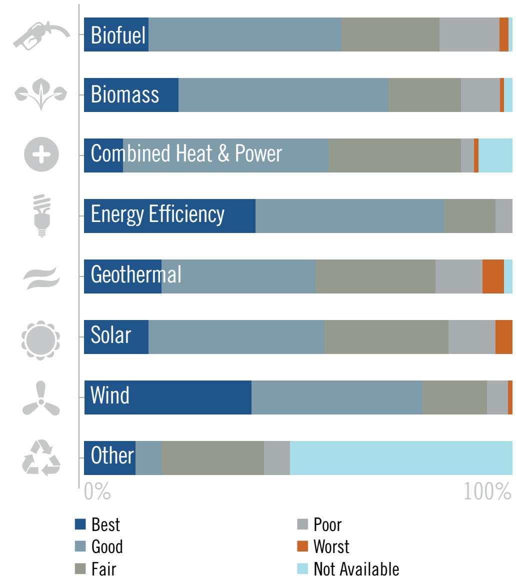
- Wind and biomass availability
- Energy efficient technologies
- Pipeline construction to export renewables
- Component manufacturing
- Distributed power generation

Clear opportunities were varied with the exception of ubiquitous references to the availability of natural resources, especially in terms of building upon Minnesota's already strong market in wind and biomass. **However, when asked to rank where the best opportunities for growth within the renewable energy industry existed, energy efficiency slightly edged wind (41% to 39%).** What this shows may be a broadening understanding of where national trends are headed.

> "The best opportunity for employment in the state, for renewables, seems to lie in the manufacturing of components for systems used to produce renewable energy."

The American Recovery and Reinvestment Act of 2009, awarded the Office of Energy Efficiency (EERE) $16.8 billion for its programs and initiatives. Of that amount, over $11.6 billion went toward projects related to non-vehicle efficiency strategies.[41] Inherent in this conversation is the role that the supply chain for renewable energy and energy efficient projects needs to play. Minnesota has a manufacturing base that can be utilized for such a strategy. According to the U.S. Census Bureau's Annual Survey of Manufacturers, Minnesota ranks 13th in the number of workers employed in the manufacturing sector. However, it ranks 5th in terms of Computer and Electronic Product manufacturing and 10th and 11th in Fabricated Metal and Machinery respectively. As one survey respondent put it "The best opportunity for employment in the state for renewables seems to lie in the manufacturing of components for systems used to produce renewable energy." These strengths could be utilized to build the renewable energy supply chain. However it will also take an understanding of complex systems and a level of quality control that may not be as readily available in Minnesota. Renewables energy and especially wind components, cannot afford to fail. They must last 15 – 20 years with minimal maintenance. An example of an industry that currently must meet such standards is aeronautics. Leaders from Minnesota should engage with these types of firms as well as other precision industries to see what cross-over opportunities exist.
Pipeline construction for biofuels was also discussed but may not be feasible. While respondents did recognized that neighboring states such as the Dakotas, Nebraska, and even Colorado might be the most likely purchasers of Minnesota's renewable energy production (along with Canada), an undertone existed of the need to ensure that local needs were also met.

Figure 6: Opportunities for MN's Renewables Economy



Minnesota must support investment in the development and introduction of 2nd and 3rd generation renewables such as cellulosic ethanol, biobutanol, algae, and others. These sources will become critical as federal standards are revised to support newer blends. The University of Minnesota is conducting research in some of these areas and industry should be engaged to bring technologies to market scale.

Finally, distributed power generation (DG) was one opportunity that participants saw had growth potential. An energy strategy that incorporates DG might better address local job needs and economic development potential, as well as meet local energy needs. Distributed generation is a strategy that can help promote community wind and other community-based energy development (C-BED) projects to assist rural energy needs and create local jobs. Minnesota's C-BED tariff program through its utilities helps to provide better cash flow for the first 10 years of a C-BED project's life. This appears to be a program that can be built up to further promote renewable energy at the local level.

Threats

- Lack of funding, especially start-up capital
- Lack of tax incentives and uncertainty regarding continuation
- The general economic downturn
  - Makes purchasing more expensive items more difficult.
  - Long term investments are more difficult
- Public policy
  - Governments continue to fund old energy economy
  - initiatives or old approaches
  - Lack of tax incentives
- Uncertainty of tax incentives or energy policies (such as cap and trade)
- China

Respondents saw numerous threats to Minnesota's renewable industries chief among these being access to capital and financial incentives. Experts in the field believe that capital exists but that investors are being extremely conservative and cagey given current market conditions. This risk-averseness, while understandable, not only leads to a slowdown in new projects, but also inhibits expansion of the existing renewables infrastructure already in Minnesota.

The American Wind Energy Association[42] found that Minnesota added only 56 MW of wind in 2009 and that level was added during the first quarter. By contrast, numerous states including Iowa, Illinois, and North Dakota saw new projects come online throughout the year. While the first quarter of 2010 has been very slow in terms of new capacity, it should be noted that Minnesota ranked 23rd out of 27 states that had new wind energy come online. Competitor states such as Iowa, Illinois, and North Dakota had 879 MW, 632 MW, and 488 MW developed respectively. It is important to note that Minnesota still has the 7th highest level of wind production. However, as an example of a historically strong renewable industry, wind in Minnesota is facing barriers in getting to market that other states are overcoming. There are a host of potential reasons including financing and public policy.

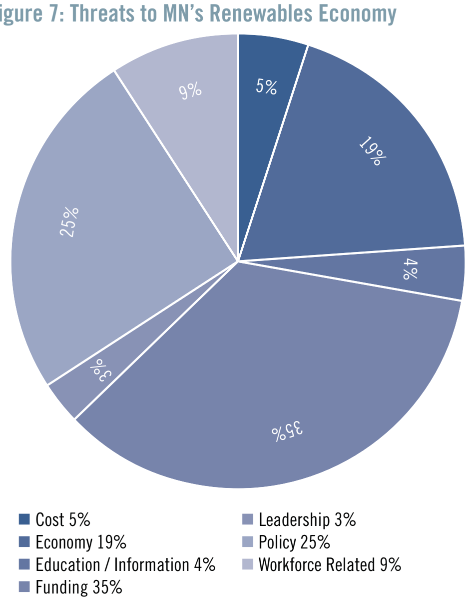
Perhaps an unintended consequence is the onslaught of Chinese products into the US given their cheaper production costs. Unfortunately, the selection of these firms and products sends additional jobs overseas. **Minnesota and other states need to find a way to repatriate some of this work.**

The global leaders in wind turbine manufacturing have historically been European companies such as Gamesa and Vestas and the US based General Electric, but in recent years the Chinese government has made a commitment to renewable energy. In 2009, China invested more money than the US in renewable energy for the first time in at least five years.[43] They are targeting 100 GW of wind power by 2020, a lofty increase from the 1 GW of power they produced from wind in 2005.[44] To meet their target will require an increased demand for wind turbines and wind turbine components now and in the future.

The Chinese government wants their wind projects fitted with components from the local Chinese wind industry, rather than relying on imported parts. They adopted a policy requiring that turbines sold to government-controlled wind farms be comprised of 70% components manufactured in China. Since government-controlled wind farms make up more than 80% of the total wind farms in China,[45] firms such as GE, Vestas, and Gamesa set up manufacturing plants in China.

Minnesota should not fault China in seeking to expand its renewables across the globe to the United States. The opportunity exists. It is up to Minnesota and other states to become more competitive, technologically savvy, an efficient in production, and in turn export back to the huge and growing Chinese market.

Figure 7: Threats to MN's Renewables Economy



"It is up to Minnesota and other states to become more competitive, technologically savvy, an efficient in production, and in turn export back to the huge and growing Chinese market."

"According to a study conducted at American University, 80% of the nearly $2 Billion ARRA dollars allocated for new wind facilities in the US are being sent to foreign manufacturers of wind turbines."

Another result from China's wind policy is the growth of Chinese turbine manufacturers. With local companies cornering the market in China (Chinese turbine manufacturers now account for over 60% market share in China[46]), Chinese companies are now looking to expand into the global market. Xinjiang Goldwind wants to be one of the world's top three wind turbine makers in five years and expand internationally into markets such as the US. They are taking steps to make this possible by offering shares in the Hong Kong market with the goal of raising $1 billion. 40% of this capital will be used to build manufacturing plants and 24% will be used to expand overseas.[47] They already have one wind project in the US and are looking to develop more. Also, China's Wang Song, Vice-President of Mingyang Wind Power, believes that his company can provide the most affordable wind energy services in the US. Mingyang is currently planning for offices in the US and they are currently working on a wind project located in Texas.[48]

While China seeks to become a world leader in wind power, there are some concerns about their recent global expansion. Chinese firms are winning bids for projects both in China and across the rest of the world by having a lower cost of production, but claims are being made that Chinese firms do not consider quality, life cycle costs, and rate of return when they are bidding for work. Competitors believe Chinese-made turbines and components are below quality standards and wind farm operators that use Chinese-made turbines are already complaining about their quality.[49]

Another concern involves the loss of potential jobs on wind projects in the US. According to a study conducted at American University, 80% of the nearly $2 Billion ARRA dollars allocated for new wind facilities in the US are being sent to foreign manufacturers of wind turbines; Creating an estimated 6,000 jobs overseas and only a few hundred jobs in the US.[50] The most controversial project is a $1.5 Billion wind farm in Texas. A Chinese company, A-Power, is building the farm and was expected to receive $450 million from ARRA. The project will create 300 US construction jobs, but more importantly will create 2,000 manufacturing jobs in China.[51]

In Pipestone Minnesota the newest wind turbines at Buffalo Ridge wind farm were manufactured in China. While China's entrance into the US market has lowered the price of wind components and ultimately lowered the amount of capital needed to enter into the wind industry,[52] Minnesota and Buffalo Ridge are not immune from potential risks and negative impacts. Nationwide, the wind industry is closely monitoring the quality of the turbines at Buffalo Ridge; questioning who is responsible in China for the warranty and repair of a broken turbine and how long repairs would take.

Finally, importing turbines from China can potentially have a negative impact on the local turbine manufacturing industry. In 2009, Suzlon Energy was forced to lay-off 160 workers from their Minnesota plant also located in Pipestone. In 2009, plans for a new wind energy gearbox factory in southeast Minnesota were put on hold.[53]

It will take time to see what the result of the layoffs in terms of future Chinese expansion and the growth of the local market. It must still be determined the impact that concerns about Chinese quality will have. While the economic downturn played an important role in these events, importing components from China still has a drastic role in limiting the growth of the Minnesota wind turbine industry.

Policy was the second most cited threat after financing. Specific threats included the uncertainty as to tax incentives, particularly federal incentives. The Recovery Act extended the Production Tax Credit (PTC) and incentive tax credit (ITC). The bill also created a third program. In lieu of tax credits, wind, biomass, geothermal, and solar projects can receive a grant of up to 30% of the basis of the property's value. What is important to note is that these credits, which help to drive investment and development of renewables, have often been allowed to lapse. The Recovery Act marks only the fourth time since 1999 that Congress has extended the credits before they lapsed. Such volatility hurts investment and leads to lack of capital. According to the Union of Concerned Scientists, "In 2003, the wind power industry added 1,687 megawatts (MW) of capacity—a 36 percent annual increase. With no Production Tax Credit in place for most of 2004, U.S. wind development decreased dramatically to less than 400 MW—a five-year low. With the Production Tax Credit re-instated, 2005 marked the best year ever for U.S. wind energy development with 2,431 MW of capacity installed—a 43 percent increase over the previous record year established in 2001."[54]

Consistent public policy allows financial institutions to plan, mitigate risk, and therefore open up investment. Wisconsin was repeatedly cited as an example to look toward, with specific mentions of the Focus on Energy program as well as their aggressive solar and geothermal tax incentive structure. Focus on Energy works with eligible Wisconsin residents and businesses to install cost effective energy efficiency and renewable energy projects. This not only assists promotes efficiency, but can lead to increased demand for manufactured energy efficiency components and products that state businesses can seek to produce.

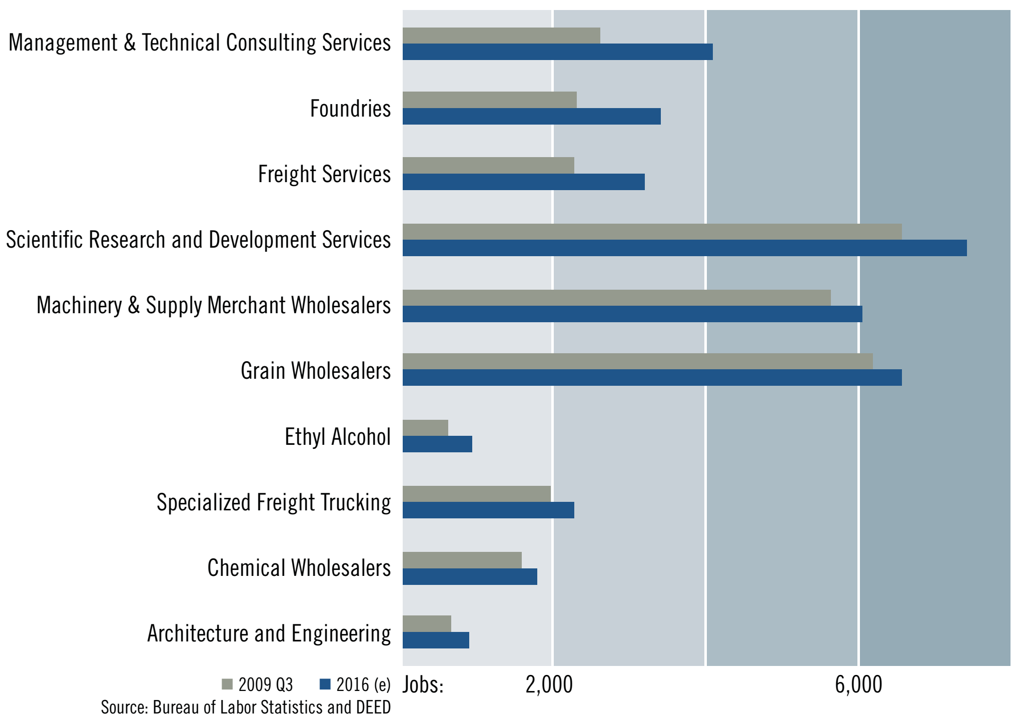
Minnesota must find ways to manage risk and incent investment to grow its renewables portfolio and market share.

The Renewable Energy Sector Workforce

Industry Projections[55]

The renewable energy sector in Minnesota is expected to experience growth in a number of sectors by 2016. Industries in the Renewable Energy sector should grow from an estimated 59,600 jobs in 2009 more than 64,100 by 2016.

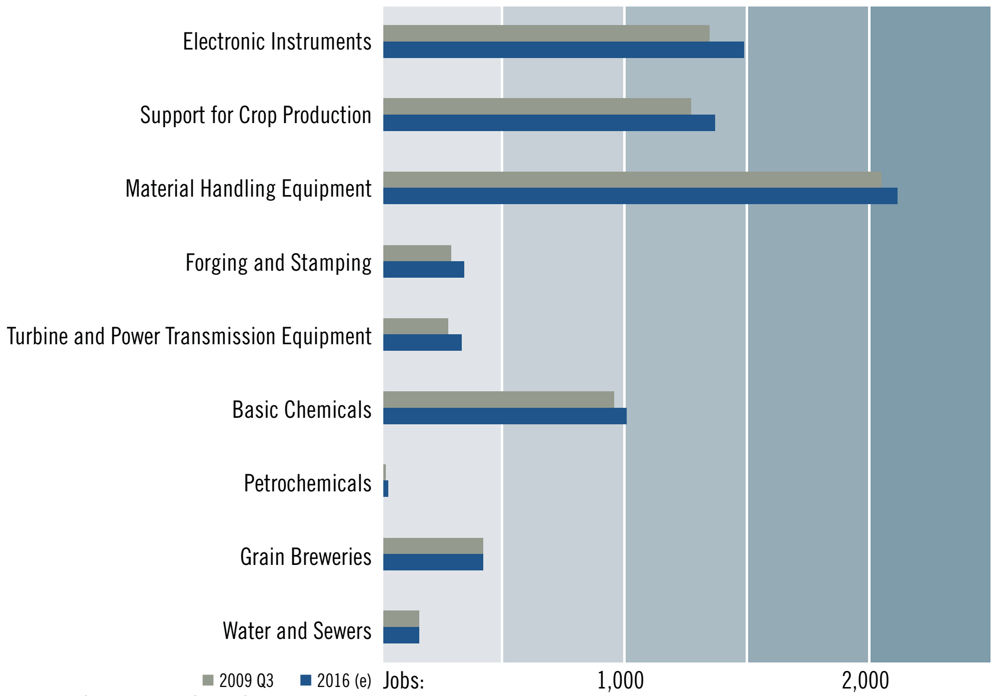
Figure 8: Projected Significant Employment Growth by Industry



"In 2003, the wind power industry added 1,687 megawatts (MW) of capacity—a 36 percent annual increase. With no PTC in place for most of 2004, U.S. wind development decreased dramatically to less than 400 MW—a five-year low.

These estimates reflect the turbulence in the economy and assume that any recovery will be slow and difficult. The job growth reflects the increasing service intensity of renewable energy, as well at the demand for biofuels and supply chain components in electronics, machinery and turbines (see Figure 5 and Figure 6).

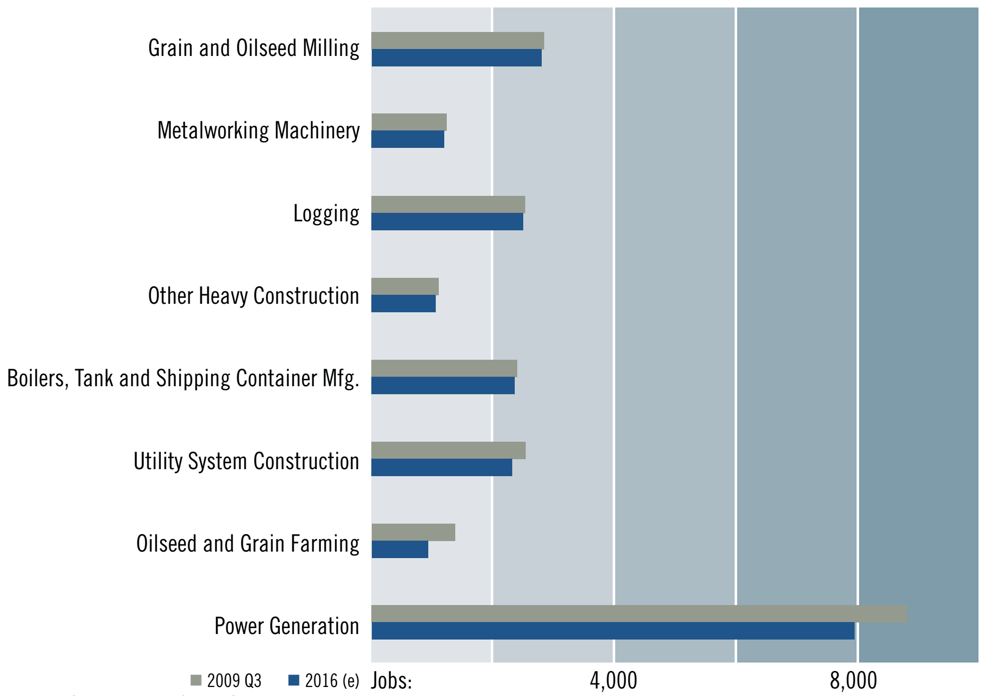
Figure 9: Projected Stable or Moderate Employment Growth by Industry



Source: Bureau of Labor Statistics and DEED

The projections also reflect the shift away from more traditional centralized energy sectors with declines in utility system construction and power generation and supply (Figure 7). The decline in power generation and supply reflects the shift towards distributed generation that should be accelerated by Minnesota's authorization of a Property Assessed Clean Energy (PACE) program in March 2010 as well as continued implementation of Net Metering. With reduced demand for large, centralized power generation, the construction of these facilities is also projected to fall.

Figure 10: Projected Employment Decline by Industry



Source: Bureau of Labor Statistics and DEED

The small declines in Grain and Oilseed Farming and Milling, Logging and Metalworking Machinery reflect conflicting forces on these sectors. The growth of renewable energy will have a positive influence on these sectors but competition from low cost producers, reduced demand from other industries, as well as efficiency gains will dampen growth for these industries.

Achieving Growth

In order for Minnesota to achieve growth in renewable energy, it will take an initial injection of management and technical talent. The growth cycle of a firm begins with a core of leaders (managers and technical) that develop the products, services and business. As the firm grows, support staff are added. For example, an early stage firm might begin with a core team of ten manager/engineers and no support staff. Later they may add one or two support staff. Finally, when the firm reaches maturity the ratio is flipped and you have five to ten support staff for each manager or engineer. The survey conducted for this project, described in the following section, notes that occupations and skills most needed to grow the sector are those most lacking in Minnesota today.

Table 1: Industries in Renewable Energy and Biofuels

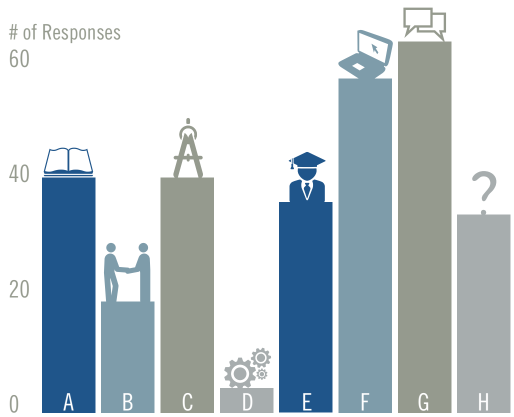
		Employment		
NAICS Code	**Title**	**2009 Q3**	**2016 (e)**	**Change**
1111*	Oilseed and Grain Farming	1,396	923	(472)
1133	Logging	2,562	2,500	(62)
1151*	Support Activities for Crop Production	1,274	1,374	101
2211	Power Generation and Supply	8,879	7,951	(928)
2213	Water, Sewage and Other Systems	170	171	1
2371	Utility System Construction	2,529	2,301	(228)
2379	Other Heavy Construction	1,116	1,050	(66)
3112*	Grain and Oilseed Milling	2,844	2,827	(17)
31212*	Grain Breweries	426	430	3
3251	Basic Chemical Manufacturing	959	1,013	54
32511*	Petrochemical Manufacturing	34	45	11
325193*	Ethyl Alcohol Manufacturing	632	954	322
3315	Foundries	2,329	3,430	1,101
3321	Forging and Stamping	295	355	60
3324*	Boiler, Tank and Shipping Container Manufacturing	2,431	2,362	(68)
3335	Metalworking Machinery Manufacturing	1,229	1,210	(18)
3336	Turbine and Power Transmission Equipment	290	346	56
33392*	Material Handling Equipment Manufacturing	2,039	2,107	68
3345	Electronic Instrument Manufacturing	1,352	1,490	138
4238	Machinery & Supply Merchant Wholesalers	5,640	6,067	428
42451*	Grain Wholesalers	6,200	6,588	387
42469*	Chemical & Allied Products Merchant Wholesalers	1,581	1,798	218
4842	Specialized Freight Trucking	1,973	2,280	307
4885	Freight Transportation Arrangement	2,290	3,200	910
5413	Architectural and Engineering Services	680	898	217
5416	Management & Technical Consulting Services	2,622	4,085	1,463
5417	Scientific Research and Development Services	6,564	7,423	859

*Biofuel industries that are not part of the current Bureau of Labor Statistics Renewable Energy Definition.

Workforce

While many industries often struggle with creating or accessing a qualified workforce, the survey respondents had great confidence in their ability to access workers. Results of the survey revealed that 87% believed they would be able to find the necessary workforce if expansion occurred in the following year. However, in comments left by respondents a dichotomy was revealed between those in workforce training and education and their supreme optimism in their abilities and programs, and others who lamented access to a labor force with the prerequisite skills. While one commented that all they needed was funding, and another complained that "industry needs to involve us in the process," others cited a need to train from scratch and one more stated that "hiring puts a great deal of stress on training and boarding costs." What is clear is that while the majority feel the workforce is present, there remains a strong contingent that finds significant challenges in accessing the right skilled labor.

Figure 11: Employee Recruitment Strategies



A Community Colleges (2 yr or <)
B Private Recruiters
C Career and Technical Schools
D Union Apprentice Programs
E Colleges and Universities (4 yr)
F Posting on Job Boards
G Word of Mouth
H Other

"Hiring puts a great deal of stress on training and boarding costs."

The coordination issues identified in the survey are not unique to Minnesota but our analysis indicated that due to the level of interest across sectors in the renewable energy economy that Minnesota can be unique in finding a solution to these issues. Currently MNSCU, Labor and the Workforce investment Boards are all focused on building out curriculum, training and certifications for renewable energy and green jobs. In addition community groups and organizations like the BlueGreen Alliance are investing funds to support training and industry outreach. Minnesota has a short-term opportunity to align these efforts to develop long-term results. It will take coordination and at times debate regarding approaches, but in the end Minnesota can be a national model for effective training and skills development in the renewable energy sector.

Key Skill Gaps

- Leadership/Management skills and experience
- Engineers
- Tradespeople
- General technical skills

Lacking skills are far ranging, from boiler operators to building code experts. However several themes emerged. First, there appears to be a need for engineers, and electrical, mechanical, bio, and chemical were all referenced. There were several notes about those with general technical skills being difficult to find. Second, there is a dearth of individuals with leadership and managerial capabilities. Finally, a lack of skilled tradespeople was cited. Overarching all of these was the repeated difficulty of getting employees to relocate to rural areas. A surprising result, was the lack of comments related to math, communication, and soft skills. In numerous other studies that GSP Consulting has conducted across a number of different sectors, the need for these skills was always prevalent. While there was some mention, other needs (such as for engineers) dominated. What this says is that either the workforce is generally, highly trained, or more likely, that the positions required within the current levels that the renewable industry is operating are more high level, technical, and require additional training beyond typical "on-ramp" requirements.

To overcome these obstacles, employers used a number of means to recruit workers. 60% of respondents used word of mouth while 54% incorporated job boards into their search strategy. 38% looked to community colleges or Career and Technical Schools. Only 4% had utilized union apprenticeship programs. While this low number may be due to unfamiliarity with such programs, the lack of tradespeople when looking at skill needs likely signals a low level of interaction overall between union training programs and business, despite the need for such laborers.

As MNREM expands there exists a clear role for the organization to act as an intermediary between the resources of urban areas like the Twin Cities and more rural locations. There is a focused need to attract talent, and work with trade unions or other trade training programs to ensure that there is a pipeline of skilled employees participating in Minnesota's regenerative economy throughout the all of the state.

Recommendations

Low Cost Policy Options

Recognizing the current state budgetary situation GSP has identified a few low cost policy/ implementation options that can be pursued in order to continue to support the growth of the industry.

Implementation of PACE

On March 29, 2010 Governor Pawlenty signed into law Minnesota's authorizing legislation (H.F. 2695 / S.F. 2568) for Property Assessed Clean Energy programs. This legislation opens a new financing tool for promoting the adoption of renewable energy that does not require public subsidy. Property owners finance the improvements based on a special tax assessment on their property. This assessment is used to secure bonds issues by local authorities that pay the upfront costs of energy improvements.

This legislation will not only help the adoption of renewable energy in Minnesota, but it secures the state's leadership in renewable energy policy. In order to take full advantage of the opportunity, Minnesota needs to ensure that local governments are able to implement the program effectively. This could be a potential role for MNREM or other statewide group to play in assisting with implementation. The state authorizing legislation is only the first step.

The City of Berkeley website provides a case study on the local adoption of a PACE Program adoption that can be disseminated to municipalities in Minnesota. Information for interested champions is also available from Renewable Funding.[56]

Enhancing PACE Authority

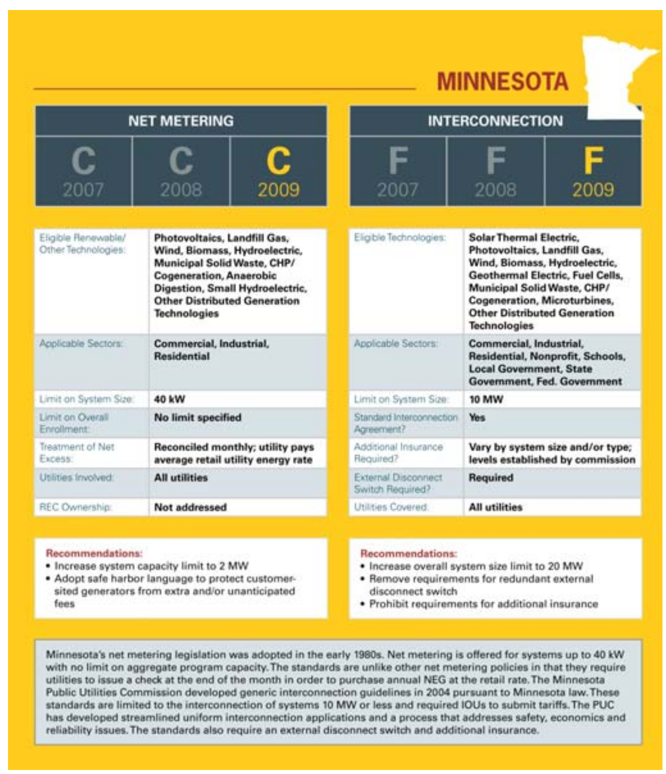
Minnesota's PACE legislation as it was presented to the Governor in legislation H.F. 2695 / S.F. 2568 addresses eight of the ten best practice guidelines for PACE law. If possible, these issues could be addressed in the official 2010 session law or could be handled in state guidelines or future revisions.

The first is that Minnesota's PACE authority includes a restrictive list of qualifying improvements which appear to exclude water conservation improvements from the definitions of improvements.

Net Metering

Minnesota does not address the ownership of Renewable energy credits (RECs). "RECS provide another potential stream of revenue for owners of systems that generate electricity with renewable resources. In many areas of the United States, RECs are bought and sold as a commodity in voluntary "greenpower" markets or are directly used to fulfill a utility's RPS requirements. Utilities should not be permitted to seize RECs from system owners without paying the market price for them. Minnesota's Net Metering and Interconnection policies and regulations are ranked poorly by the Interstate Renewable Energy Council".[57]

Furthermore, Minnesota could seek to increase its Net Metering facility size limits. Currently Minnesota's limit is 40 KW whereas neighboring states such as Michigan, North Dakota, and Iowa allow 150 KW, 100 KW, and 500 KW respectively.



MINNESOTA

NET METERING		
C 2007	C 2008	C 2009

Eligible Renewable/ Other Technologies:	Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Municipal Solid Waste, CHP/ Cogeneration, Anaerobic Digestion, Small Hydroelectric, Other Distributed Generation Technologies
Applicable Sectors:	Commercial, Industrial, Residential
Limit on System Size:	40 kW
Limit on Overall Enrollment:	No limit specified
Treatment of Net Excess:	Reconciled monthly; utility pays average retail utility energy rate
Utilities Involved:	All utilities
REC Ownership:	Not addressed

Recommendations:
- Increase system capacity limit to 2 MW
- Adopt safe harbor language to protect customer-sited generators from extra and/or unanticipated fees

INTERCONNECTION		
F 2007	F 2008	F 2009

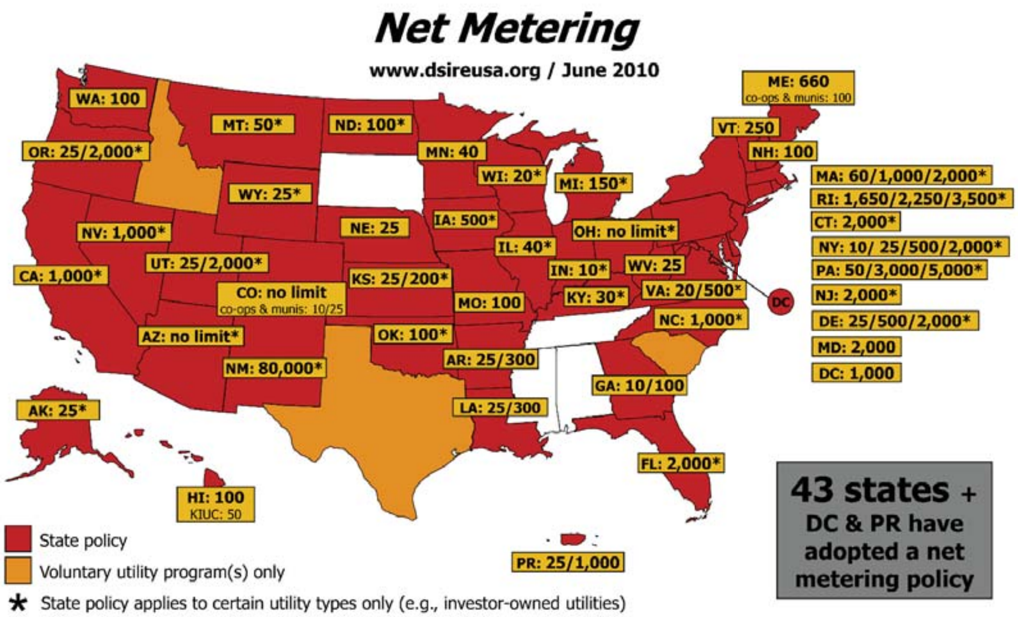
Eligible Technologies:	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Fuel Cells, Municipal Solid Waste, CHP/ Cogeneration, Microturbines, Other Distributed Generation Technologies
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Fed. Government
Limit on System Size:	10 MW
Standard Interconnection Agreement?	Yes
Additional Insurance Required?	Vary by system size and/or type; levels established by commission
External Disconnect Switch Required?	Required
Utilities Covered:	All utilities

Recommendations:
- Increase overall system size limit to 20 MW
- Remove requirements for redundant external disconnect switch
- Prohibit requirements for additional insurance

Minnesota's net metering legislation was adopted in the early 1980s. Net metering is offered for systems up to 40 kW with no limit on aggregate program capacity. The standards are unlike other net metering policies in that they require utilities to issue a check at the end of the month in order to purchase annual NEG at the retail rate. The Minnesota Public Utilities Commission developed generic interconnection guidelines in 2004 pursuant to Minnesota law. These standards are limited to the interconnection of systems 10 MW or less and required IOUs to submit tariffs. The PUC has developed streamlined uniform interconnection applications and a process that addresses safety, economics and reliability issues. The standards also require an external disconnect switch and additional insurance.

Figure 12: Interstate Renewable Energy Council Connectivity Scorecard (2009)

Figure 13: Net Metering Limits by State (KW)



Policy and Growth Recommendations

- **Minnesota should create a Statewide Energy Plan combined with a supporting Economic Development Plan.** This effort would allow support of the recommendations contained in this report and most likely identify additional opportunities as the energy and economic and workforce development communities work together.

  - MN is a leader in renewables but is facing increasing competition – MN has one of the nation's most aggressive renewable portfolio standards. The RPS for Xcel Energy is 30% renewables by 2020; other utilities: 25% by 2025. Many Minnesotans feel that the back-up support to meet or exceed these goals is often not there. Some survey respondents specifically cited Wisconsin as a competitor state that had much more aggressive incentive programs to build and operate renewable energy projects. Between Minnesota, Iowa, South Dakota, North Dakota, Wisconsin, and Illinois about 50 new policies/programs began since the beginning of 2009. While Minnesota does not need to copy other state's actions, especially in light of the current state fiscal situation, it is important to keep an eye on what the other communities are doing. A statewide energy and economic development plan would be a tool to manage both attainment of the RPS goals as well as supporting economic growth.

- Most consumers and small companies are citing an overload of information on the energy sector and often confusing opportunities to support the adoption of renewable technology or energy efficiency. There is a need for a real-time information source, a renewable energy clearinghouse, to provide tools to interested consumers who are seeking to adopt renewable and/or energy efficiency technology. Develop a clearinghouse model that links up the renewable energy supply chain, addresses workforce needs and opportunities, and can act as an independent body that can develop and recommend public policy, leverage resources to pursue and win federal funding to develop the renewables market.

- Renewables manufacturing can play a key role in enhancing economic growth – while wind turbine implementation has been a focal point, **MN must look beyond this resource and look at the renewable energy supply chain.** When asked "What sectors are the best opportunities for growth in the renewable energy industry within MN?"42% of participants said Energy Efficiency, while 38% of participants said Wind. Additionally, one expert commented that "The best opportunities for employment in the state for renewables seems to lie in the manufacturing of components for systems used to produce renewable energy."

- Capital markets continue to cause difficulties in the renewable energy marketplace. Over 64% of the survey respondents identified availability of capital as being a moderate to severe barrier. **This report highlights the need for ongoing outreach and integration of public and private partners to form Public-Private Partnerships. Such models are being adopted throughout the country especially in areas of renewable adoption and energy efficiency retrofits.**

- Additional federal opportunities will continue to present themselves as the Department of Energy, Department of Defense, and Economic Development Administration launch new programs or recapitalize existing efforts. According to this analysis, efforts to access federal dollars can be time consuming and a barrier for smaller projects. **A resource should exist in the state that can support applicants efforts to identify and pull down federal funding opportunities.**

- The future of Minnesota's renewable energy workforce can be strong - the Great Recession did hurt the industry slightly. The state, however, due to a developing workforce, strong government support, and an abundance of natural resources will continue to expand their workforce if continued commitments to maximizing Minnesota's renewable resources are made. If this happens, renewable energy sectors should see moderate growth until 2025. The research for this report indicated that 87% of respondents believed that given the opportunity to expand within the next year, they would be able to find the proper workforce to fill new positions with the exception of engineering degrees. Renewable energy jobs in Minnesota also should continue to receive higher wages than the national averages.

- Minnesota has benefited significantly, in the short term, from the receipt of funding from the American Recovery and Reinvestment Act. Concern is raised though over the sustainability of the efforts that are being supported and the availability of similar levels of training dollars as the economy begins to rebound and significant hiring occurs. **This fact calls for a strong integration between the various workforce investments in green initiatives in the state and plan now to leverage other resources once the ARRA federal funds are expended.**

- **MN needs to build 2nd and 3rd Generation renewable energy capacity and better build out then renewables supply chain with regard to manufactured goods, as well as services those products.** The development of high quality, rigorously engineered components will give greater comfort to developers in utilizing American made products. This will also build out internal servicing capabilities.

- **A distributed energy generation strategy needs to be incorporated into MN's energy and economic development future.** Doing so will build upon local interest and acceptance of renewables as well as build out intellectual capacity around renewable technologies. This component could be a key to success in employing highly skilled workers in more rural communities

- **MN should align strategies and interest to pursue federal funding around energy storage, specifically a DOE energy regional innovation cluster (E-RIC).** Connectivity and transmission are key barriers to renewables success. The ability to become a hub for energy storage development will not only allow Minnesota to become a test-bed of ways to better integrate renewables into the grid, but it will also help build the internal infrastructure around the design, development, and production of these products which will become ubiquitous as renewables deployment increases across the globe.

References

[1] Available at: http://www.mnrem.org/wiki

[2] Available at: http://www.biobusinessalliance.org/Files/531111_d2025_whitepaper_renewable_materials_smaller_secured.pdf

[3] Available at: http://www.mn-ei.org/projects/images/Green/GreenEconFinalReport.pdf

[4] Trevor Houser, Shashank Mohan, and Ian Hoffman, “Assessing the American Power Act: The Economic, Employment, Energy Security, and Environmental Impact of Senator Kerry and Senator Lieberman’s Discussion Draft,” Peterson Institute for International Economics, May 2010: http://www.piie.com

[5] Senator Sherrod Brown, “Advanced Energy Manufacturing Tax Credit Would Help Manufacturers Retool for Clean Energy Economy,” Senator Brown’s Office, Press Release, 6 May 2010: http://brown.senate.gov/

[6] Elizabeth Doris, Joyce McLaren, Victoria Healey, and Stephen Hockett, “State of the States 2009: Renewable Energy Development and the Role of Policy,” National Renewable Energy Laboratory, Technical Report, October 2009: http://www.nrel.gov/

[7] Based upon data from the American Wind Energy Association: http://www.awea.org/projects/

[8] Salman Mitha, PhD, “Jump Starting Minnesota’s Green Economy,” Minnesota 2020, 12 May 2010: http://www.mn2020.org/

[9] Ibid

[10] Nate Lew, “Minnesota Pushes Solar Energy Industry,” Cooler Planet, 13 January 2010: http://solar.coolerplanet.com/News/1131001-minnesota-pushes-solar-energy-industry.aspx

[11] Daniel M Kammen, Kamal Kapadia, and Matthias Fripp, “Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?,” Renewable and Appropriate Energy Laboratory, Energy and Resources Group, Goldman School of Public Policy, University of California Berkeley, 2004 April 13: http://rael.berkeley.edu/

[12] National Wildlife Federation, “Charting a New Path for Minnesota’s Electricity Generation and Use:” http://www.nwf.org/globalwarming/energypdfs/MINNESOTA_10-22-4.pdf

[13] Renewable Fuels Association, “Climate of Opportunity,” February 2010: http://www.ethanolrfa.org/page/-/objects/pdf/outlook/RFAoutlook2010_fin.pdf?nocdn=1

[14] LECG, LLC, “Contribution of the Ethanol Industry to the Economy of the United States,” February 2010

[15] Mark Steil, “Future of Cellulosic Ethanol Remains Uncertain,” MPR News, 26 April 2010: http://minnesota.publicradio.org/display/web/2010/04/23/cellulosic-ethanol/

[16] Mary Clare Jalonik, “Ethanol Industry Stepping Up Its Influence in Washington,” MPR New, 13 April 2010: http://minnesota.publicradio.org/display/web/2010/04/13/ethanol-influence/

[17] Ibid

[18] Ralph Groschen, “Legislative Report on Ethanol: Review of E20,” Minnesota Department of Agriculture, 15 January 2009: http://www.mda.state.mn.us/news/publications/renewable/ethanol/legrpt-ethanol-e20.pdf

[19] Ibid

[20] Minnesota Department of Agriculture, Biodiesel Program: http://www.mda.state.mn.us/en/renewable/biodiesel.aspx

[21] Mary Clare Jalonik, “Ethanol Industry Stepping Up Its Influence in Washington,” MPR New, 13 April 2010: http://minnesota.publicradio.org/display/web/2010/04/13/ethanol-influence/

[22] Bill Berguson, “Biomass Energy Potential in Minnesota,” University of Minnesota – Extension, 29 April 2009: http://www.extension.umn.edu/agroforestry/components/Biomass-Energy-Potential-Minnesota.pdf

[23] National Wildlife Federation, “Charting a New Path for Minnesota’s Electricity Generation and Use:” http://www.nwf.org/globalwarming/energypdfs/MINNESOTA_10-22-4.pdf

[24] G. Morris, “The Value of the Benefits of U.S. Biomass Power,” National Renewable Energy Laboratory (NREL), November 1999: http://www.nrel.gov/docs/fy00osti/27541.pdf

[25] US Energy Information Administration, Annual Energy Outlook 2010: 68

[26] Ibid: 68

[27] Ibid: 68

[28] Ibid: 68

[29] Hal Weitzman, "Wind of Change Sparks US Renewables Revival," The Financial Times: 22 September 2009

[30] Matthew L Wald, "Cost Works Against Alternative and Renewable Energy Sources in Time of Recession," The New York Times: 28 March 2009

[31] Fiona Harvey, "Target for Emissions Cut to be Exceeded," The Financial Times: 8 June 2010

[32] Jeremy Van Loon and Alex Morales, "Wind Energy Investment of $65 Billion May Curb Carbon," Bloomberg Businessweek: 22 March 2010

[33] Ibid

[34] Ibid

[35] Ibid

[36] Jeremy Van Loon, "Renewable Energy Investment May Reach $200 Billion in 2010," Bloomberg BusinessWeek: 17 March 2010

[37] American Wind Energy Association, U.S. Wind Energy Projects: http://www.awea.org/projects/

[38] Minnesota Department of Employment and Economic Development, Minnesota's Renewable Energy Standards: Creating a Strategy to Maximize Economic Benefits: 15 November 2007: www.leg.state.mn.us/docs/2007/mandated/070696.pdf

[39] Ibid

[40] Robert Pollin and Jeannette Wicks-Lim, "Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investments," Political Economy Research Institute: University of Massachusetts, Amherst: June 2008

[41] US Department of Energy - Energy Efficiency and Renewable Energy "American Recovery and Reinvestment Act:" http://www1.eere.energy.gov/recovery/

[42] American Wind Energy Association, "AWEA Year End 2009 Market Report," January 2010: http://www.awea.org/publications/reports/4Q09.pdf

[43] Jeremy Van Loon, "Renewable Energy Investment May Reach $200 Billion in 2010," Bloomberg BusinessWeek: 17 March 2010

[44] Rajesh Chhabara, "Foreign Turbine Manufacturers Struggle to Cash In On Chinese Wind Market," Wind Energy Update, 21 September 2009: http://social.windenergyupdate.com/industry-insight/foreign-turbine-manufacturers-struggle-cash-chinese-wind-market-0

[45] Ibid

[46] Ibid

[47] John Duce, "Goldwind Looks at US, Europe," Business Day, 7 June 2010: http://www.businessday.co.za/articles/Content.aspx?id=111071

[48] O.K. Carter, "China's Wind Energy Industry Blown Away By Texas Weather," Fort Worth Business Press, 31 May 2010: http://www.fwbusinesspress.com/display.php?id=12652

[49] Rajesh Chhabara, "Foreign Turbine Manufacturers Struggle to Cash In On Chinese Wind Market," Wind Energy Update, 21 September 2009: http://social.windenergyupdate.com/industry-insight/foreign-turbine-manufacturers-struggle-cash-chinese-wind-market-0

[50] Jonathan Karl, "New Wind Farms in the U.S. Do Not Bring Jobs," ABC World News,9 February 2010: http://abcnews.go.com/WN/wind-power-equal-job-power/story?id=9759949

[51] Ibid

[52] Don Shelby, "US Wind Power, Made in China," WCCO, 26 January 2010: http://wcco.com/energy/chinese.manufactured.turbines.2.1449547.html

[53] Mark Steil, "Wind Turbine Company's Woes Mirror That of the Industry," MPR News, 8 June 2009: http://minnesota.publicradio.org/display/web/2009/06/08/pipestone_turbines/

[54] Union of Concerned Scientists, "Production Tax Credit for Renewable Energy," 22 April 2009: http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html

[55] Methodology Notes
These projections were based on long-term forecasts from DEED adjusted for current growth trends and market forecasts. The definition of renewable energy industries was developed by the Bureau of Labor Statistics. This definition has not been finalized or formally adopted, but it represents the closest thing to a standardized definition of renewable energy. Biofuels are not included in the current BLS definition so we noted those codes that have been added to the BLS definition. DEED's industry projections for 2006 to 2016 are provided for three and four digit NAICS industries. The growth estimates for these industries were allocated to the more detailed six digit industries and adjusted for growth trends from 2006 to 2009Q3.

[56] Berkeley Program Documents: http://www.renewfund.com/pace/case-studies

NAICS	Industry Description
113310	Logging
221111	Hydroelectric power generation
221119	Other electric power generation
221121	Electric bulk power transmission and control
221122	Electric power distribution
221330	Steam and air-conditioning supply
237130	Power and communication system construction
237990	Other heavy construction
325193	Ethyl alcohol manufacturing
325199	All other basic organic chemical mfg.
331511	Iron foundries
331512	Steel investment foundries
331513	Steel foundries, except investment
331521	Aluminum die-casting foundries
331522	Nonferrous, except Al, die-casting foundries
331524	Aluminum foundries, except die-casting
331525	Copper foundries, except die-casting
331528	Other nonferrous foundries, exc. Die-casting
332111	Iron and steel forging
332112	Nonferrous forging
333511	Industrial mold manufacturing
333611	Turbine and turbine generator set units mfg.
333612	Speed changer, drive, and gear manufacturing
333613	Mechanical power transmission equipment mfg.
334519	Other measuring and controlling device mfg.
423830	Industrial machinery merchant wholesalers
482111	Line-haul railroads
484230	Other specialized trucking, long-distance
488510	Freight transportation arrangement
541360	Geophysical surveying and mapping services
541370	Other surveying and mapping services
541620	Environmental consulting services
541690	Other technical consulting services
541711	Research and development in biotechnology
541712	Other physical and biological research

[57] James Rose and Shaun Chapman, "Freeing the Grid: Best and Worst Practices in State Net Metering Policies and Interconnection Procedures: 2009 Edition," Network For New Energy Choices, November 2009: http://www.newenergychoices.org/uploads/FreeingTheGrid2009.pdf

About GSP Consulting Corp.

GSP Consulting Corporation includes several service areas that combine to make the firm's expertise unique. GSP Government Affairs enables the short-term and long-term growth of our clients through innovative government strategies. GSP Development Services assists clients with complex development and remediation projects to reduce risk, cut costs, save time and leverage capital investment. The collective experience of the GSP Team has included work with private companies ranging from the one-person, garage-based entrepreneur to Fortune 100 corporations and everything in between. In addition, the GSP team has worked with state and local governments assisting them in developing broad-based economic development strategies.

About the Economic Architecture Practice

The GSP Economic Architecture (EA) team provides world class services combined with practical experience that allows us to understand that someone has to 'do' what we recommend. Our team has worked with state, county, and municipal governments, universities, regional technology trade associations, and other economic development stakeholders to assess their economic conditions and develop sophisticated growth strategies.

These strategies have formed the basis for new programs and organizations related to specific industry clusters, business accelerators/incubators, entrepreneurial development, early stage investment capital, workforce training, and more. To learn more about the Economic Architecture Practice, please contact Rich Overmoyer, Principal, Economic Architecture at 1-877-GSP-CORP or rich@gspconsulting.com. For more information on GSP Consulting visit www.gspconsulting.com

An Economic Architecture Analysis

100 West Station Square Drive | Landmarks Building, Suite 500 | Pittsburgh, PA 15219
877-GSP-CORP | www.gspconsulting.com

Grow Your Enterprise