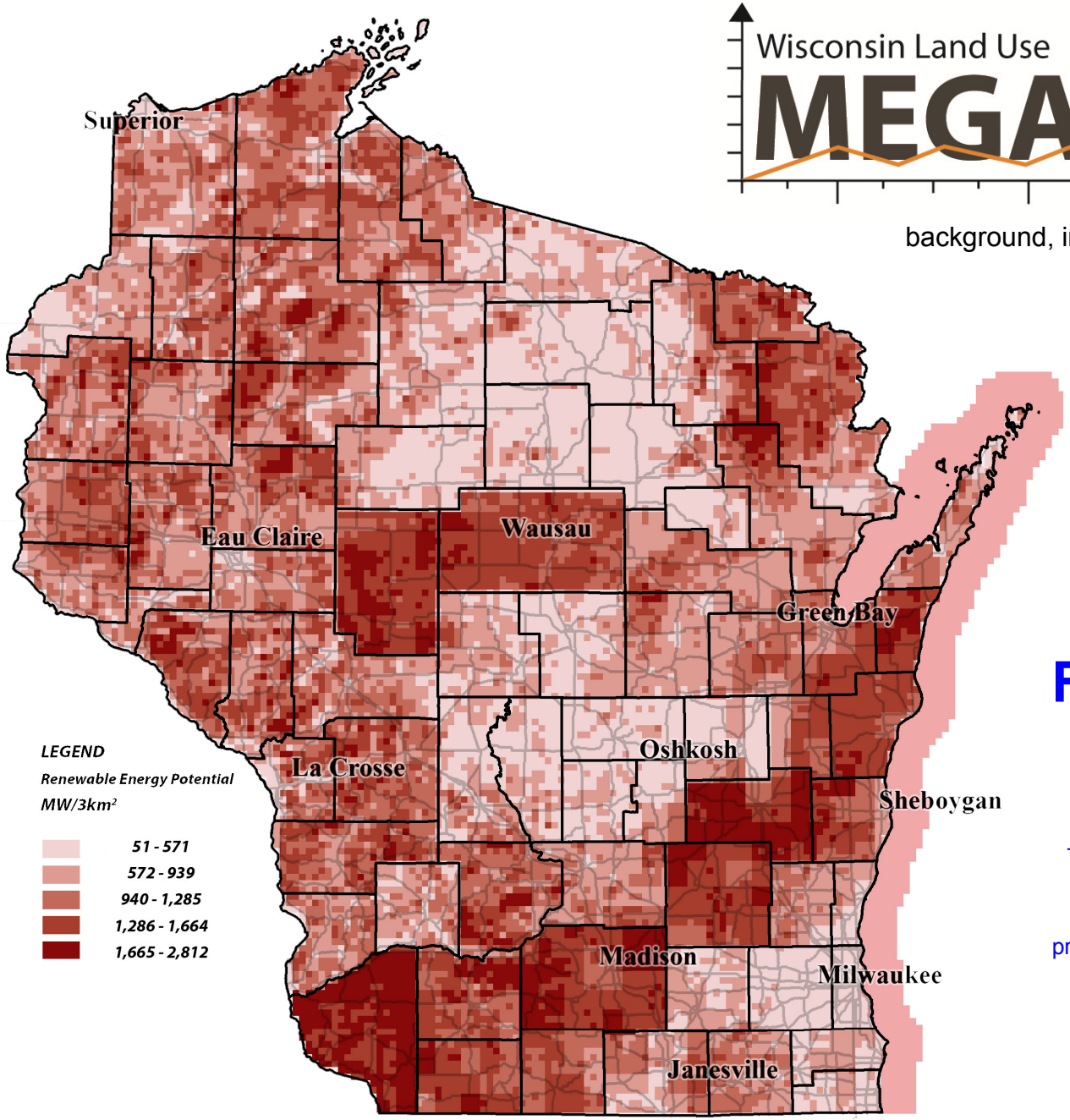
Summer 2013

Wisconsin Land Use

MEGATRENDS

background, impacts, policy … information you need to know



Find Your Community

What is the total renewable energy potential?

This map displays the total renewable energy potential in Wisconsin. Various data sources were converted to a common unit (megawatt) and combined using GIS to produce total energy potential. Renewable energy sources include: wind, biomass, solar, and biogas.[1,2]

Introduction

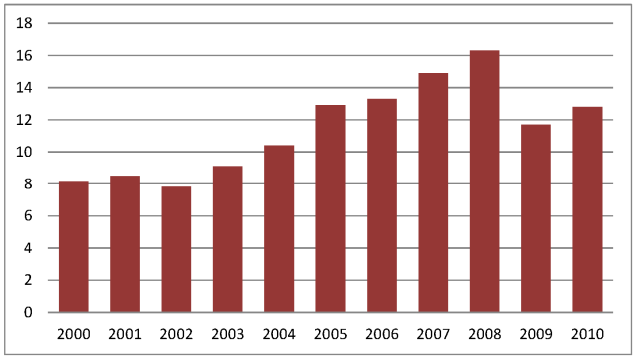
The production and distribution of energy in Wisconsin has distinct consequences for landscapes and land use. The Center for Land Use Education wrote *Wisconsin Land Use Megatrends: Energy* in 2008, which included a map scenario illustrating how Wisconsin might achieve its goal of producing 25 percent of its energy from renewable sources by 2025. Energy efficiency, building, transportation, and community design approaches to reduce energy use were also discussed.

This publication is intended for local government officials and others interested in investigating the connections between energy and land use. In it, we update information from our 2008 energy publication and discuss barriers, issues, and energy policies related to energy efficiency, wind, solar, biofuels, and nuclear energy. We wrap up by covering jobs related to energy efficiency and renewable energy. Energy policies in Wisconsin communities and in Midwestern states are discussed.

Trends in Wisconsin Energy Use and Sources

Coal, petroleum, and natural gas made up 81 percent of Wisconsin energy use in 2010. Yet because Wisconsin has no fossil fuels, these resources are imported from other states and countries. In 2010, $12.8 billion left Wisconsin to pay for fossil fuels, which averages $5,600 per household each year. Of that, $8.4 billion was for petroleum, $2.7 billion for natural gas, $1.1 billion for coal, and $0.7 billion for imported electricity. In the last decade, the money that has left Wisconsin for fossil fuels has generally trended upward from $8 billion per year to a high of $16 billion per year, as shown in Figure I1. Moving toward energy independence through energy efficiency and renewable energy reduces the billions of dollars that leave our state each year for fossil fuels and generates jobs in Wisconsin.

Figure I1: $ Leaving Wisconsin for Energy (Billions)



Energy use is often measured in British thermal units (BTUs). BTUs are the most common unit of energy to compare different types of fuel. Total energy use in Wisconsin has generally increased since energy tracking began in 1970. Energy use peaked in 2007 at 1,748 trillion BTUs, a 53 percent increase from 1970. From 2007 to 2010 energy use decreased 7 percent. Carbon dioxide emissions decreased by 6 percent from 2000 to 2010. These numbers do not account for the energy used to manufacture the many goods that are produced outside of the state and used here, from cars to computers. During this timeframe, Wisconsin population increased by 323,000 people (6 percent), and the number of households increased by 195,200 (9 percent), which likely contributed to a 3 percent increase in residential energy use. In contrast, there was a 10 percent decrease in the industrial sector energy use during this time, likely linked to the recession and 195,500 fewer people employed in the goods producing sector.[1,2] There was also a 9 percent decrease in transportation energy, likely due to more fuel efficient vehicles.

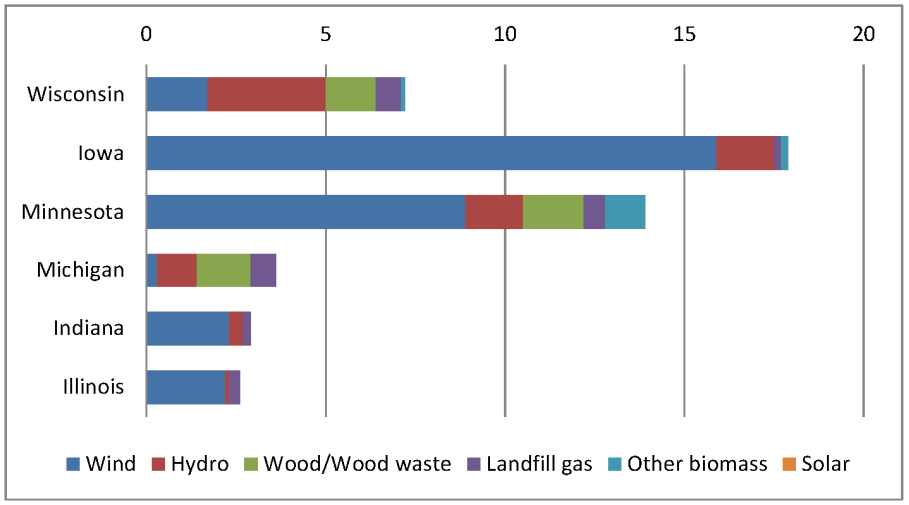
In 2010, $12.8 billion left Wisconsin to pay for fossil fuels. Moving toward energy independence reduces the dollars that leave our state and generates jobs in Wisconsin.

Renewable energy increased by 54 percent from 2000 to 2010 to reach 5.2 percent of total energy use in 2010. Factors contributing to this increase include Wisconsin's Renewable Portfolio Standard (RPS) which requires 10 percent of all electric energy consumed in the state to be renewable energy by 2015, ethanol tax credits, state funding for renewables through Focus on Energy, and federal tax incentives.

The largest absolute increases in renewable energy production from 2000 to 2010 were ethanol, biogas, biomass (e.g., wood and wood by-products), and wind.

In terms of the percentage of electricity generated from renewable, in-state resources, Wisconsin ranks in the middle of the pack of Midwest states (see Figure I2).

Figure I2: Percentage of Electricity from Renewable Energy in 2010



Energy Efficiency

The cheapest, cleanest, and most reliable source of energy is the energy we avoid using. Energy efficiency is often referred to as the "first fuel" in the effort to develop clean and secure energy resources. It saves money, does not infringe on other land uses, and reduces air and water pollution which affects human health.[1]

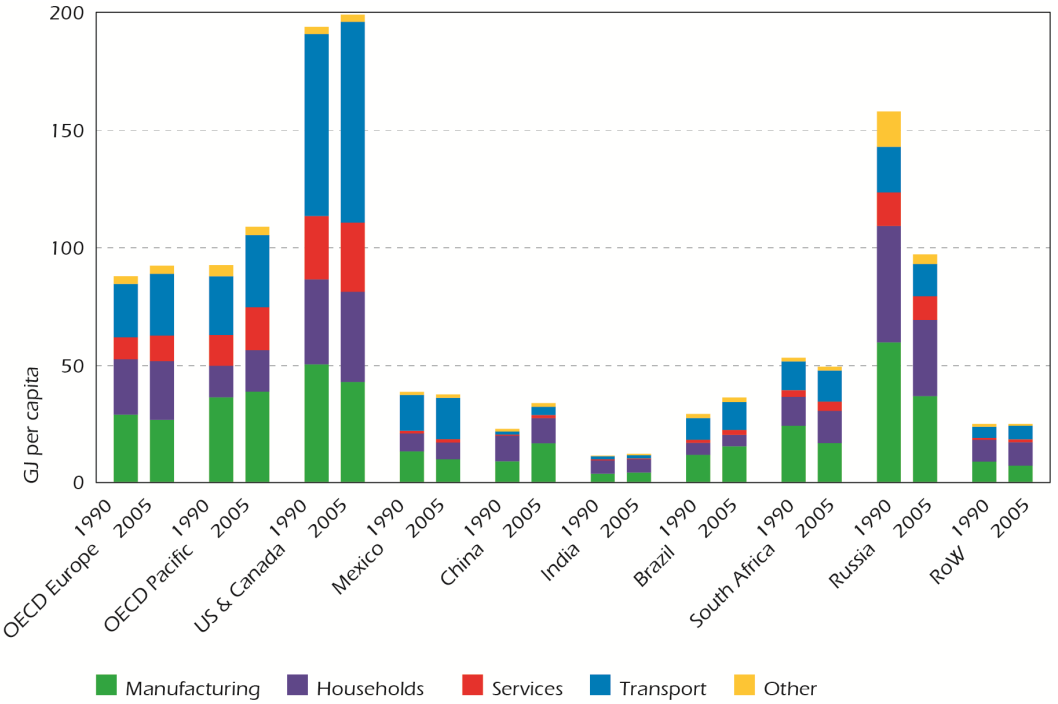
The following statistics highlight our key challenges to increasing energy efficiency:

- In 2010, 60 percent of the energy generated in Wisconsin was wasted before it ever got a chance to be used. The largest components of wasted energy came from electricity generation (power plants) and transportation, as shown in the energy flow diagram on page 14.[2]
- In Wisconsin the generation and distribution of electricity to its point of use is only about 30 percent efficient; the rest of the energy is lost as waste heat in the form of steam released at power plants and line losses.[3] Transportation was only 25 percent efficient in Wisconsin due to low fuel efficiency vehicles.[4]

Photo EE1: Coal-fired Weston Power Plant (© User:Royalbroil, Wikimedia Commons, CC-BY-SA 2.5)

From 1970 to 2010, energy use per person in Wisconsin has increased 11 percent.[5] Total energy consumption per capita in the U.S. and Canada is much higher than the rest of the world, as shown in Figure EE1.[6] This fact holds true for every sector of energy use including manufacturing, households, services, and transportation. Compared to Wisconsin, total energy consumption per capita is 50 percent lower in Europe and 80 percent lower in China. Fortunately there are many opportunities for energy savings. Some of the most significant opportunities are listed below:

Figure EE1: Total Final Energy Consumption per Capita. RoW = Rest of World. (© OECD/IEA 2008, fig. 2.6, p. 22)

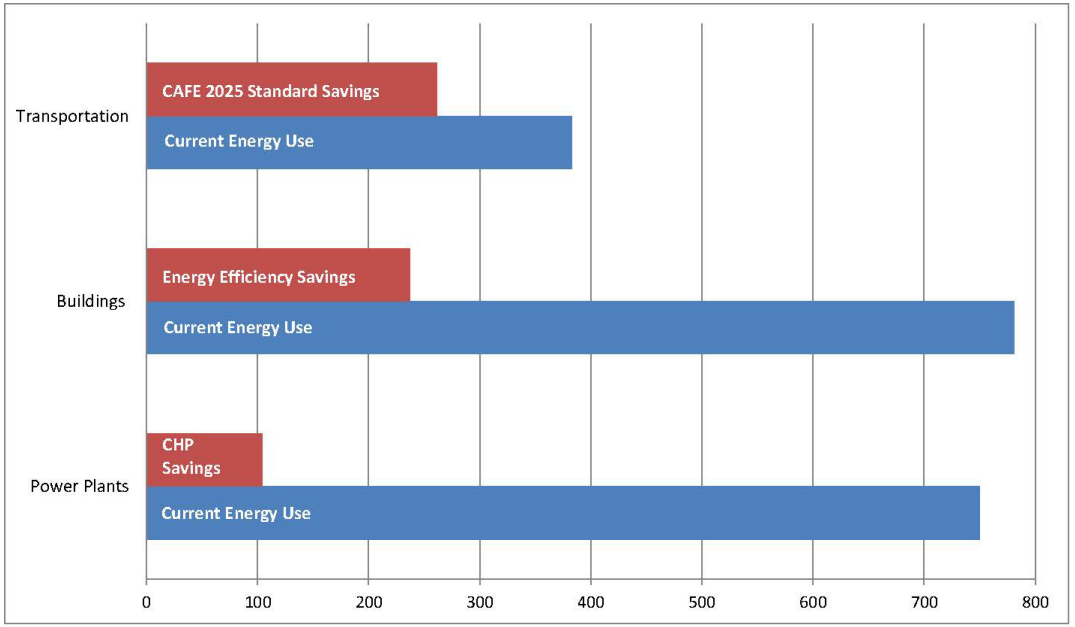


- Implementing the federal 2025 Corporate Average Fuel Economy (CAFE) standard of 54.5 mpg would reduce petroleum use in Wisconsin by 261 trillion BTUs per year, or 15.5 percent of total annual energy use.[7]
- Improving energy efficiency in buildings, including lighting, heating and cooling, refrigeration systems, and other appliances, would reduce natural gas and electricity use in buildings by 33 percent, which would save 237 trillion BTUs per year, or 14 percent of total annual energy use.[8]
- Converting 50 percent of power plants in Wisconsin to combined heat and power (CHP) and boosting the efficiency from 30 to 80 percent would save 104 trillion BTUs per year, or 6 percent of total annual energy use.[9]

Compared to Wisconsin, total energy consumption per capita is 50 percent lower in Europe and 80 percent lower in China.

Figure EE2 illustrates the potential energy savings from implementing 2025 CAFE standards, CHP at power plants, and building energy efficiency improvements. Savings total 602 trillion BTUs of energy savings per year, which is equivalent to 36 percent of Wisconsin's 2009 total energy use.

Figure EE2: Potential Energy Savings (in Trillions of BTUs Annually)



Barriers to Implementing Energy Efficiency

- Focus on Energy (FOE) energy efficiency programs have been cut in recent years.[10] Wisconsin's current FOE spending reduces electricity consumption by approximately 0.6 percent per year, far below some nearby states.[11]
- From 1970 to 2010, the vehicle miles traveled per capita in Wisconsin increased by 85 percent.[12] When compared to Germany, vehicle miles traveled per capita in Wisconsin are twice as high.[13]
- Implementation of CAFE standards depends on ongoing political support.
- Most Wisconsin power plants do not use or sell their excess steam that could be used for heating or manufacturing processes – this energy simply goes to waste.

Policies for 100 Percent Deployment of Energy Efficiency

- Increase FOE funding to reduce energy consumption. Indiana, Illinois, and Ohio have adopted energy efficiency standards that ramp up to a 2 percent reduction in electricity consumption each year. Minnesota and Iowa require 1.5 percent annual reductions in electricity consumption. A 2009 study by the Energy Center of Wisconsin found that achieving the 2 percent annual energy savings would require an energy efficiency investment of about $0.7 billion and return more than $1.9 billion in net savings to Wisconsin consumers. This investment in energy efficiency would also generate 11,000 to 13,000 net new jobs.[14]
- Adopt policies to encourage Wisconsin utilities to implement CHP, using or selling the excess steam from new and existing power plants. This could be done by including CHP when increasing the state's Renewable Portfolio Standard, providing favorable net metering regulations for CHP, or providing loans and loan guarantees for CHP projects. Leading state policies on CHP are available in the 2012 State Energy Efficiency Scorecard.[15]
- Implement the 2025 CAFE standards, which include an average fuel efficiency of 54.5 mpg.
- Reduce vehicle miles traveled through land use planning and zoning. Avoid urban sprawl by adopting mixed use and form-based code provisions aimed at creating more compact, walkable, bikeable, and transit-friendly areas. Avoid rural sprawl by discouraging new homes outside of cities and villages if they are not tied to land-based businesses like farming, forestry, or tourism.
- Locate homes in areas where households could replace some automobile use with public transit use. A 2011 study found this led to reductions of 39-50 percent of household energy use.[16]
- Build park and ride lots, public transit, and walking and bicycling infrastructure.[17]
- Encourage or require developers to build energy efficient buildings by offering density bonuses or expedited permitting. In addition, require energy benchmarking for existing buildings.

Wisconsin's Focus on Energy program started in 2001 and provides funding for energy efficiency and renewable energy projects. A 2011 audit of FOE found the program delivered a return of $2.30 for every dollar invested.[18]

Conclusion

Cost-effective policies for fuel efficient vehicles, buildings, and power plants can reduce Wisconsin energy use by a third and create over 11,000 jobs. Development patterns that reduce driving can also reduce the billions of dollars spent on petroleum that leave Wisconsin each year.

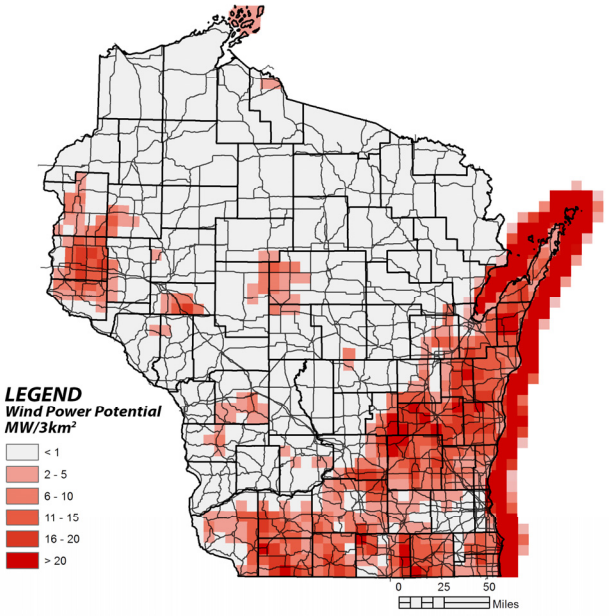
Wind

Wind power is an emissions-free renewable energy and does not produce waste byproducts in the energy production process.[1] Wind energy has increased from zero percent in 1995 to 4.1 percent of total renewable energy in 2009.[2] The U.S. Department of Energy concluded that wind could supply 20 percent of U.S. electricity supply by 2030 if further improvements in wind power transmission, manufacturing, and markets occurred.[3] Experts estimate that wind could be installed on 14.3 percent of Wisconsin land and has the potential to supply Wisconsin with 103,757 MW,[4] more than the state's current electricity needs.[5] See Figure W1.[6]

Policy

Wind energy is largely regulated at the state and local level, with the exception of tribal lands.[7] To create consistency in regulation, the Wisconsin legislature passed the Wind Siting Law (2009 Act 40). The Public Service Commission (PSC) adopted uniform guidelines (PSC 128) in 2010, which went into effect in 2012. The PSC has siting authority over wind energy systems 100 MW or larger and utility-owned systems of any size. These installations may include multiple turbines, often over 200 feet in height. Applicants must address restrictive criteria for siting, noise, shadow flicker, signal interference, stray voltage, construction, operation, and decommissioning.[8] Local jurisdictions were given siting authority for small, non-utility systems that are less than 100 MW.

Figure W1: Wind Potential in Wisconsin. This map displays the potential for wind energy in Wisconsin, including significant offshore potential in Lake Michigan.



Experts estimate that wind has the potential to supply Wisconsin with 103,757 MW, more than the state's current electricity needs.

In the past, Focus on Energy (FOE) incentives have supported wind projects for residential and business use.[9] However, the PSC cancelled FOE incentives for non-residential renewable energy projects in July 2011.[10, 11] FOE incentives for renewable energy systems were resumed in July 2012, with 75 percent of renewable energy incentives allocated to biogas, biomass, and geothermal, leaving 25 percent for wind and solar projects.[12, 13] Utilities have primarily installed wind to meet Wisconsin's renewable portfolio standards (RPS).[14] This may change in response to a 2011 state law (Act 34) favoring less expensive hydropower from Canada, purchased to meet the RPS.[15]

Barriers and Issues

The Wind Siting Law did not create uniform, statewide wind siting rules for systems smaller than 100 MW. Local jurisdictions can enact local wind ordinances to regulate wind energy systems up to 100 MW, though they cannot be more restrictive than the PSC's rules. Furthermore, some continue to express concerns about health effects and bird and bat deaths.[16, 17]

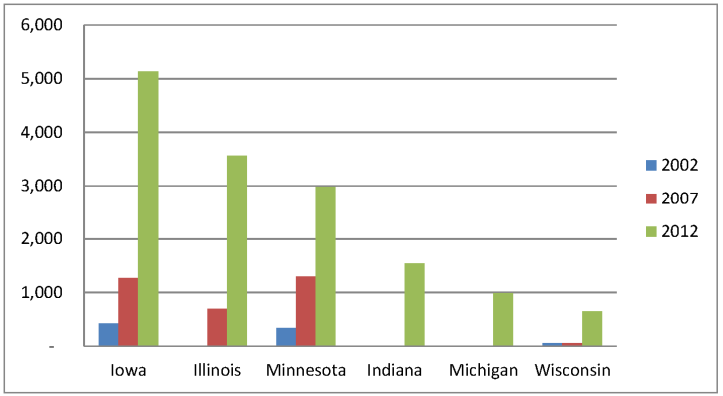
Overall Wisconsin is falling behind in installed wind capacity, with a total wind power capacity of 636 MW, compared to 4,536 in Iowa, 3,055 in Illinois, and 2,717 in Minnesota.[18] (See Figure W2.) Wisconsin's potential wind resource is ranked 18th for total installed wind capacity and 16th for total wind resource available.[19] Wind energy in the U.S. is almost exclusively on shore; however off-shore wind energy potential is also significant.[20]

The price of wind technology is comparable to gas-fired power plants.[21] While wind energy systems have capital and maintenance costs, there are no fuel costs.

Conclusion

Wisconsin's use of wind power is increasing, albeit at a slow pace compared to other Midwestern states. Maintaining stable statewide wind siting regulations will help developers and utilities plan for future wind development. New policies may also be needed, such as reversing Act 34's inclusion of hydropower, and adopting a more robust RPS since the 10 percent by 2015 goal has already been met.[22] See page 11 for more details.

Figure W2: Installed Wind Capacity by State (in MW)

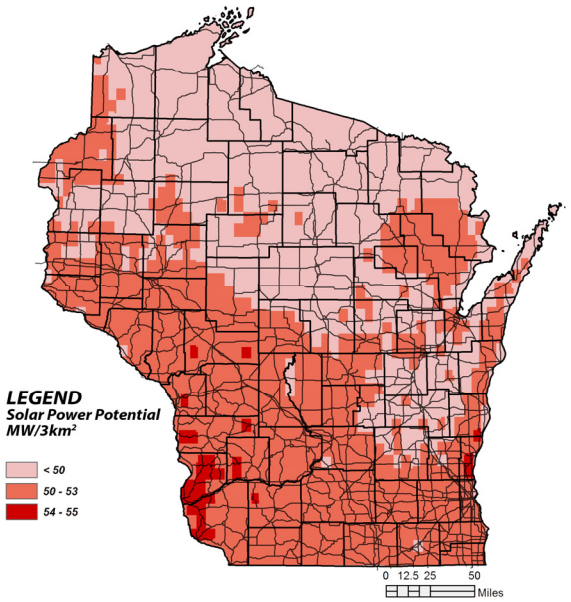


Solar

In Wisconsin, electricity produced from the sun using solar photovoltaics (PV) and solar thermal collection systems comprises about 0.2 percent of the total renewable energy generated.[1] Solar PV is what most people picture when they think of solar power: solar panels which generate electricity from the sun. Solar thermal collectors use solar energy to heat water for a variety of uses including domestic hot water, beer brewing, and pools.

Solar systems can be placed on sites unfavorable for other activities. For example, brownfields can be transformed into solar energy producing "brightfields", providing economic benefits through job creation and reducing reliance on nonrenewable sources of energy. Such systems are one type of community solar, and offer opportunities for development by municipalities and cooperatives.

Figure S1: Solar Potential in Wisconsin. This map displays the annual potential for solar energy in Wisconsin, assuming a flat PV collector.[8]



Policy

There are a variety of policies at the state and local level impacting the adoption of solar technologies.[2] Financial incentives include tax incentives, loans, property assessed clean energy (PACE) financing, rebates, and grants. The value added from solar and wind systems is exempt from property taxes in Wisconsin. The Wisconsin Focus on Energy (FOE) program provides financial incentives for solar installations.

The cities of Milwaukee and Madison have received funds through the U.S. Department of Energy (DOE) Solar America Cities program to promote solar technology adoption at the local level.[3]

The cities of Milwaukee, Madison, and Marshfield and other Wisconsin organizations received a DOE SunShot financial award in 2011 to streamline local permitting processes for solar energy projects, develop clear strategies to improve Wisconsin's net metering and interconnection standards, work to allow third parties to own solar electric systems, and support solar financing and group purchase options.[4,5]

Barriers and Issues

Solar installations in Wisconsin would likely increase if the state renewable portfolio standard (RPS) was amended to include a specified percentage of electricity from PV. Minnesota requires 1.5 percent of total electricity sales by utilities to come from PVs in 2020 while Illinois requires the same percentage by 2025.[6] Changing Wisconsin's law to clearly allow third parties to finance and own PV systems, known as a power purchase agreement (PPA), would also increase solar installations. With a PPA, a resident or business hosts a renewable system that is owned by a separate investor. The investor then sells electricity produced by a system to the host at lower rates than the host may otherwise get. In Illinois, Michigan, and Indiana PV PPAs are authorized by the state or currently in use within select jurisdictions within the state.[7] A third policy approach is to adopt an Advanced Renewable Tariff (ART), also known as a feed-in tariff, that requires utilities to purchase electricity from PVs at a price higher than the retail price for a set period of time. This type of policy provides a reliable payback period for the PV owner.

Photo S1: This Convergence Energy solar farm near Delavan harvests enough energy to power about 125 homes. (Photo courtesy of the Gazette, Janesville, Wisconsin)

Conclusion

Electricity generation from PVs in Wisconsin could be increased through financial incentives for installations, by adopting policies to require a portion of the RPS to come from PVs, clearly allowing PPAs which encourages third-party investing, streamlining local permitting processes, and ARTs.

Ethanol and Biogas

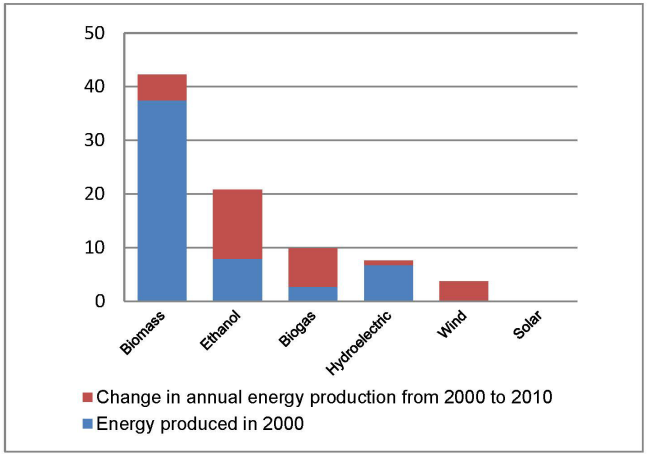
Ethanol is a transportation fuel made primarily by fermenting field corn. Biogas is produced by the decomposition of plant and animal matter in the absence of oxygen. Biogas is a mix of methane and other gases that can be burned to produce heat and electricity, or used for transportation fuel. From 2000-2010, ethanol and biogas production increased more than other renewable energies in Wisconsin as shown in Figure B1 (in red).

Ethanol

Ethanol is the most common biofuel and is often produced from corn. In 2010, 58 percent of gasoline in Wisconsin was blended with ethanol.[1]

Much has been made of the food versus fuel debate surrounding the growth in the ethanol market and resulting increase in corn production. Certainly the total acreage dedicated to corn production has grown with record high prices per bushel establishing a new production standard on farms across the Midwest that emphasizes planting corn year after year in the same field rather than rotating corn with other crops. In Wisconsin, total production rose to 3.75 million acres of corn in 2010 based on the Cropland Data Layer developed by the USDA.[2] Figure B2 shows the dominant corn production regions within the state of Wisconsin. Most corn production occurs in counties in south central Wisconsin.

Figure B1: Change in Wisconsin Annual Renewable Energy Production 2000-2010 in Trillions of BTUs (Note: 2010 solar production was 0.04.)

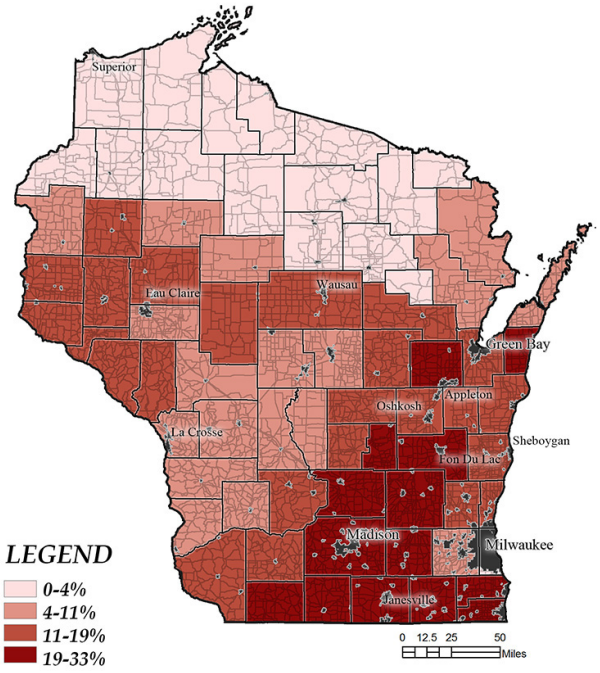


Examining the 2003 dataset from this series shows that corn production increased more than 930,000 acres in just seven years. These "recruited" acres represent a significant increase in the production capacity for corn for the state and suggest, when viewed independently of other demands on corn, progress toward achieving a goal of 10 percent of gasoline demand with ethanol. These recruited acres have the potential for adding approximately 420 million gallons of corn ethanol if an average production of 175 bushels per acre is assumed. In 2010, actual ethanol production in Wisconsin was 379 million gallons higher than in 2003, suggesting that a large portion of the corn from the converted acres was used for producing ethanol.[3] The lower energy content of corn ethanol compared to gasoline means that these acres can account for an equivalent of nearly 277 million gallons of gasoline, or just short of the 300 million gallons needed to meet 10 percent of 2011 gasoline demand in Wisconsin.

Barriers and Issues

This achievement is not without issues as the increase in acres dedicated to corn production comes at the expense of other land uses. This conversion is often overlooked in the discussion of achieving increased ethanol production and may be more important in Wisconsin where the agricultural sector has long been known for greater diversity when compared with other Midwestern states. The source for the recruited acreage was determined by comparing aggregate land use categories between the 2003 and 2010 USDA Cropland Data Layer. The most striking result from this analysis is that these recruited acres are not being converted evenly from a variety of land uses, but rather are concentrated in the conversion of grasslands and pasture. For a state that continues its prominence in the dairy sector, seeing the loss of nearly one million acres of pasture is a major shift that could negatively affect other sectors of the agricultural economy. This change may also represent a more permanent transformation of the landscape because unlike annual, rotational variations between row crops it is unlikely that these acres will revert back to pastureland in the short term due to longer periods required to reestablish quality pasture or grass — although hay and

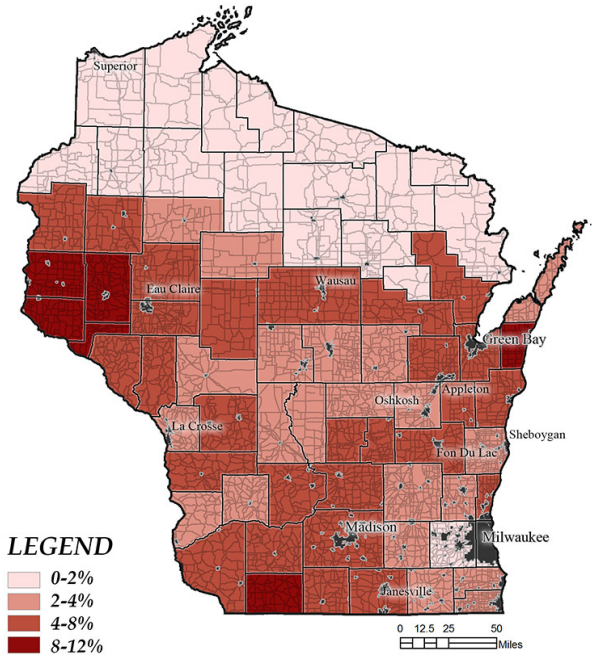
Figure B2: 2010 Percent of Total County Acreage in Corn Production



other forage crop prices will impact this trend as well. The data also suggest that this conversion is regionally concentrated, as shown in Figure B3, with the areas of highest conversion of pastureland to corn production located in Southwest Wisconsin, and regions near Eau Claire and Green Bay.

There is growing interest in producing cellulosic ethanol from switchgrass, woody biomass, or corn stover. The net energy value from cellulosic ethanol is higher than from corn grain: 3.9 times higher for corn stover and 10 times higher for switchgrass.[4] Other potential advantages cellulosic ethanol may have over corn grain ethanol include decreased environmental impacts from fertilizers and pesticides.[5] Cellulosic ethanol technology is still developing and may actually increase acreage demands to achieve biofuel goals due to lower energy returns per acre compared with corn ethanol.

Figure B3: 2003-2010 Percent of Total County Acreage Converted from Pasture to Corn Production



Policy

Ethanol production in Wisconsin has been largely driven by federal and state incentives in response to the energy crisis in the 1970s and oxygenate requirements in the Clean Air Act of 1990. Federal tax credits of 51 cents per gallon for corn ethanol began in 1978. In 2001 the state of Wisconsin began offering an additional subsidy of 20 cents per gallon up to 15 million gallons.[6,7] Wisconsin's first large-scale corn ethanol facility opened the same year.[8] Most state subsidies for ethanol sunseted in 2006, and federal subsidies for corn ethanol ended in 2011 so the industry will now compete with other fuels at market rate.[9,10] Current incentives are being directed at cellulosic ethanol and alternative fuel infrastructure.

Biogas

Total biogas production includes that from landfills, manure digesters, and wastewater treatment plants. Wisconsin leads the U.S. in biogas production from manure and food waste with approximately 40 anaerobic digesters. The total electrical production capacity of these digesters increased from 12 MW in 2009 to 30 MW in 2013, fueled mainly by dairy farms. Biogas generation could be further increased by installing generators at more large farms and at smaller farms, using community digesters to serve multiple smaller farms, and mixing wastes from different waste streams in the same digester to maximize biogas production.[11, 12]

According to the U.S. Environmental Protection Agency, Wisconsin has 28 operational landfill gas projects and another six candidate sites for biogas production.[13] Wisconsin also has 60 municipal wastewater treatment plants with a total capacity of 20 MW.[14]

Biogas can also be used for transportation fuel, sometimes called renewable or bio compressed natural gas (bio-CNG). Using a biogas-to-CNG vehicle fuel system, biogas is converted to bio-CNG for use in CNG or dual fuel vehicles.[15] These systems are now available on a smaller scale, making them more accessible for different municipal, business, or other uses.

Photo B1: City of Janesville Fast Fill Gas Pump. The Janesville wastewater treatment plant produces biogas (bio-CNG) for use in municipal vehicles. (Photo courtesy of city of Janesville)

Policy

Under most Renewable Portfolio Standards (RPS), including Wisconsin's, utilities typically opt for the lowest cost renewable energy sources, which are utility-scale wind turbines and utility-scale biomass. In contrast, the Advanced Renewable Tariffs (ARTs) used in Europe pay different rates by technology and size so that smaller systems receive higher rates than larger systems. Thus ARTs are more likely to favor biogas than the RPS.

In Wisconsin, two major factors have resulted in a comparatively large number of biogas projects: 1) the state-based Focus on Energy program that provides funding for renewable energy projects including biogas installations, and 2) the establishment of ARTs that include biogas by individual utilities.

Conclusion

As the energy market has had a positive impact on agricultural incomes it is clear that Wisconsin farmers are well positioned to participate in developing renewable energy through biofuels or advances in biogas technology that can be deployed at the farm scale. However, as the analysis here shows it is important that prior to implementing policies to create incentives for this production careful consideration should be paid to the possible trade-offs and how these new policies will further alter the agricultural landscape in Wisconsin.

Nuclear

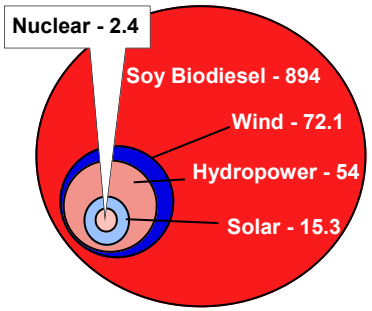
Nuclear generation represents about 10 percent of the state's total electric generating capacity. Wisconsin has two operating nuclear plants in Kewaunee and Manitowoc Counties. The Kewaunee nuclear plant is set to shut down in 2013 with a loss of 4.387 million MW hours in net generation. This energy loss is equivalent to the energy used to power approximately 300,000 homes. Point Beach (Manitowoc) has two reactors with a net generation of 7.767 million MW hours. It is owned by Florida Power & Light and has a license for each of its units. Unit 1's license expires in October 2030. Unit 2's license expires in March 2033.[1]

Nuclear energy plants have a low land use intensity as illustrated by Figure N1.[2] The values are square kilometers of affected area per terawatt-hour produced in that year. However, these values only consider the plant itself, not the entire life-cycle, which also includes mining, storage, disposal, and decommissioning.

Barriers and Issues

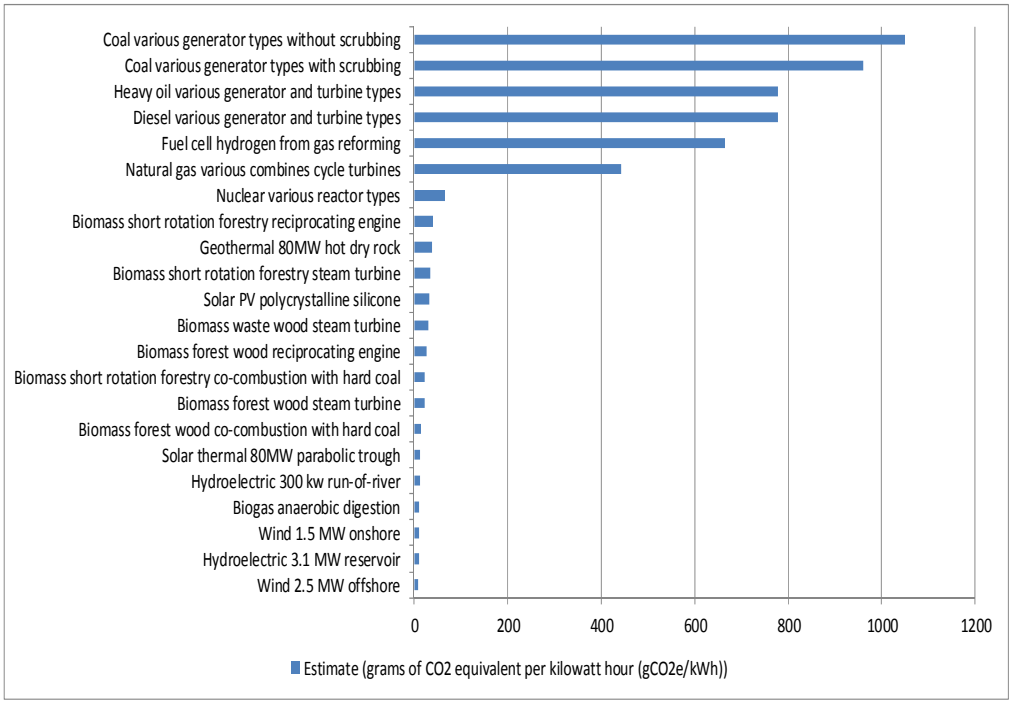
Wisconsin's reliance on fossil fuel-based energy production is projected to be as high as 87 percent by 2025.[3] The use of fossil fuels contributes to air pollution (sulfur dioxide, mercury, and carbon dioxide to name three). Nuclear power creates either none or very little of these air pollutants.[4] Figure N2 shows a comparison of carbon dioxide emissions for a range of electric power generation sources.[5] If Wisconsin wants to decrease carbon dioxide emissions from power plants, it will need to move away from fossil fuels-based electricity production to nuclear and renewables.

Figure N1: Land Use Intensity of Energy (km² per terawatt hour)



Barriers to new nuclear power include concerns over nuclear waste, uranium mining (none in Wisconsin), accidents, and costs. There is no consensus about nuclear waste storage at the national level. Uranium mining supplies the necessary fuel for nuclear power to operate. Air pollution and mine tailings are two sources of pollution from underground and open pit mines. Accidents are also a cause for concern. Wisconsin's two nuclear power plants have had their share of plant shutdowns and violations,[6] including lake weeds and silt obstructing heat exchangers in the core's cooling system, modifications due to flooding and seismic activity risks, a small explosion, and a failed circulating water pump forcing a manual shut down. Costs are another issue for nuclear power plant construction. Costs are estimated at around 1.8 cents per kilowatt hour (kWh) for existing nuclear plants. Construction costs for new nuclear plants are projected to be about $2,000 per kWh.[7]

Figure N2: Lifecycle Estimate for Electricity Generators



Policy

In 1983 Wisconsin Act 401 was signed into law and created a conditional moratorium prohibiting the Public Service Commission (PSC) from approving the construction of new nuclear power plants unless it is economically advantageous to ratepayers compared to other feasible alternatives, and not until a federally licensed repository for high level nuclear waste is operating with enough capacity to handle the waste from all nuclear power plants in Wisconsin.[8] Legislative attempts to repeal Wisconsin's moratorium on new nuclear plants have all failed.[9]

Conclusion

Nuclear energy has advantages within the context of greenhouse gas emissions, climate change, and land use intensity. However, the disadvantages due to construction costs, transport of waste and its storage, and associated risks offset its advantages. As of this writing, it does not appear that Wisconsin's energy future will include additional nuclear energy plants.

Jobs

The Bureau of Labor Statistics has defined green jobs as jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources. In 2010, 3.1 million jobs in the United States were associated with the production of green goods and services (GGS). GGS jobs accounted for 2.4 percent of total employment in 2010. The private sector accounted for 2.3 million GGS jobs and the public sector accounted for another 860,300. To look at GGS jobs a different way, manufacturing accounted for 461,800 GGS jobs, the most among any private sector industry.[1] The states with over 100,000 GGS jobs in 2010 were California (338,400), New York (248,500), Texas (229,700), Pennsylvania (182,200), Illinois (139,800), and Ohio (126,900). Table J1 shows Wisconsin in comparison to other states in the Upper Midwest, with little difference in terms of percentage.[2]

Renewable Energy

A narrower look at green jobs is to focus on renewable energy. Figures J1 and J2 illustrate the number of renewable energy businesses and jobs within the Upper Midwest.[3] Wisconsin is in the middle of the pack — it's not leading or lagging. However, Table J2 tells a different story. Wisconsin is lagging behind the other Upper Midwest states in terms of growth in clean energy jobs, with a negative growth rate along with

Figure J1: Renewable Energy Businesses 2007

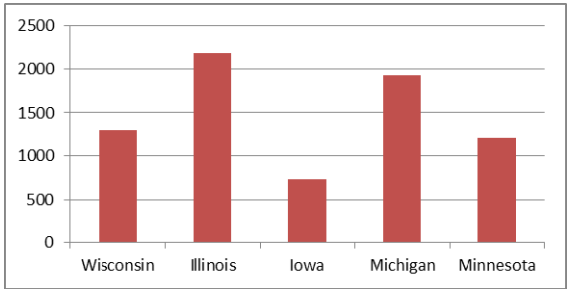
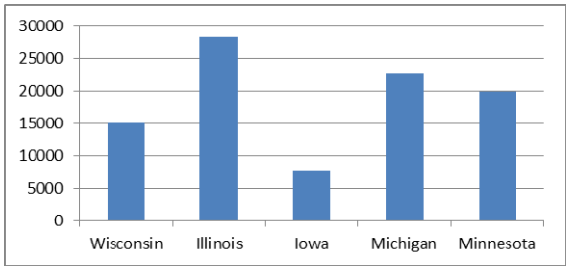


Figure J2: Renewable Energy Jobs 2007



Illinois. Iowa leads the pack with a positive growth rate. Looking at particular sectors of renewable energy, the National Solar Jobs Census found that Wisconsin ranked 13th with an estimated 1,676 solar jobs.[4] In terms of the supply chain, Wisconsin has about 135 solar power supply chain businesses and 171 wind power supply chain businesses, and over 12,000 Wisconsin jobs are tied to solar and wind power. In addition, old-line manufacturing companies are retooling to supply growing markets for renewable energy equipment.[5]

A different analysis from the Renewable Energy Policy Project (REPP) estimated that Wisconsin ranked eighth overall for renewable energy manufacturing job potential over a 15-year period to 2025. REPP estimated by 2025, Wisconsin could create a total of 35,133 jobs in 1,331 firms comprising wind (25,179), solar (4,943), geothermal (2,037), and biomass (2,974).[6]

Barriers

Numerous barriers exist to creating more jobs in the renewable energy field. Employers report several major obstacles to growth, including general economic conditions, lack of state incentives, and lack of consumer awareness.[7] Factors related to growth include expansion of federal tax incentives, creation of state or local incentive programs, consumer awareness of solar products and services, improvement in the overall economy, and development of renewable portfolio standards. Another factor is the abundance of natural gas due to hydrofracking that has made natural gas inexpensive as a prime fuel source. At the local level, barriers can include a regulatory environment, such as zoning, that does not permit for wind turbines and solar panels.

Conclusion

While total green jobs appear to be growing, they remain a small percentage of total employment. The outlook for renewable energy jobs is mixed. Certainly it appears that addressing the barriers at federal and state levels is critical for growth in the renewable energy field.

Table J1: GGS Employment 2011

	Total, All Ownerships			Private Ownership		
State	GGS Employment	GGS Percent	Total Employment	GGS Employment	GGS Percent	Total Employment
Illinois	136,447	2.5	5,502,322	105,751	2.2	4,686,483
Iowa	43,791	3.0	1,436,340	35,879	2.9	1,201,166
Michigan	82,644	2.1	3,770,225	69,116	2.1	3,179,778
Minnesota	75,302	2.9	2,558,310	60,509	2.7	2,184,391
Wisconsin	69,647	2.6	2,633,572	57,318	2.5	2,246,531

Table J2: Renewable Energy Jobs and Growth Rate

State	Total Clean Energy Jobs 2007	Avg. Annual Growth 1998-2007
Illinois	28,395	-0.25
Iowa	7,702	2.66
Michigan	22,674	1.20
Minnesota	19,994	1.38
Wisconsin	15,089	-0.55
U.S. Average	15,106	1.90

Common Policy Tools and Their Use in Midwestern States

Renewable energy and energy efficiency policies fall into categories based upon the type of assistance they provide. In general, policy tools are financial, capacity-building, regulatory, and symbolic.

Financial tools include tax credits and incentives, grants, cost-share programs, and loans. Capacity tools include education and outreach programs and technical assistance. Regulatory tools are policies set by governments requiring compliance. Finally, symbolic tools include policies that define or reflect social values to influence desired behaviors in the population. For example, if energy independence is the desired social value, marketing and advertising could be used to generate demand for energy efficiency or renewable energy. The following are common policy tools used for renewable energy projects.

Renewable Portfolio Standards (RPS)

RPS is a regulatory tool requiring utilities to meet renewable energy targets by a set date, and have been found to significantly influence adoption of new energy technologies. For maximum effectiveness, RPS should be mandatory, not voluntary.

All Midwest states have RPS, and Indiana is the only state with a voluntary RPS. Minnesota and Illinois have the highest RPS requiring 25 percent renewables by 2025.

The Wisconsin RPS was weakened by a 2011 law (Act 34) allowing utilities to meet their RPS with electricity purchased from large-scale, out-of-state hydropower. As a result, most utilities met 2015 obligations without construction of additional renewable energy in Wisconsin.[1]

Table P1: Renewable Portfolio Standards by State

State	RPS
Wisconsin	10% by 2015
Michigan	10% and 1100MW by 2015
Indiana	10% by 2025 (voluntary)
Iowa	105 MW
Minnesota	25% by 2025
Illinois	25% by 2025

Advanced Renewable Tariffs (ARTs)

Also known as buyback structures or feed-in tariffs, ARTs are financial tools that require utilities to purchase power at a price set higher than the retail rate.

Energy Efficiency Resource Standards (EERS)

EERS establish specific, long-term targets for reducing energy use that utilities must meet through customer energy efficiency programs. Wisconsin's EERS is lagging behind all of the other states in the Midwest.[2]

Table P2: EERS by State

State	EERS as Percentage of Retail Sales
Wisconsin	~0.65% annual savings of 2011-2014
Michigan	1% in 2012 and after
Indiana	1.1% in 2014 ramping up to 2% in 2019
Iowa	1-1.5% by 2013
Minnesota	1.5% annual savings in 2010 and after
Illinois	1% in 2012; 2% in 2015 and after

Public Benefits Fund

A public benefits fund adds a nominal cost to each utility bill, which provides funds for state energy needs. These funds can support renewable energy, promote energy efficiency, and provide support for low-income rate-payers. It can be used to provide incentives for renewable energy and conduct energy education programs. Sixteen states, including Wisconsin, have public benefits funds. In Wisconsin, Focus on Energy (FOE) is a public benefit fund.

Net Metering and Interconnection

Net metering is a financial incentive providing payments to landowners for the generation of renewable energy, usually at the retail electric rate. Lower net metering capacity usually results in lower payments to landowners. Wisconsin policy provides equivalent payment for energy generated for only 20 kW, whereas other Midwest states provide these payments for 40 to 1000 kW.[3,4]

Table P3: Net Metering Policies by State

State	Net Metering Policy
Wisconsin	20 kW for some utilities. Some utilities allow up to 100 kW
Michigan	150 kW for certain utility types
Indiana	1,000 kW for certain utility types
Iowa	500 kW for certain utility types
Minnesota	1,000 kW
Illinois	40 kW for certain utility types

Property Assessed Clean Energy (PACE)

PACE is a financial tool which allows municipalities the ability to finance renewable energy systems. According to the U.S. Department of Energy, the projects should not exceed 10 percent of the property's value, and the lien should not exceed the life of the renewable energy system. Most local PACE programs have been suspended due to a Federal Housing Financing Agency statement in 2010 concerning the senior lien status associated with most PACE programs.[5] River Falls and Milwaukee still have active PACE programs.

Conclusion

Wisconsin has the lowest standards in the Midwest for energy efficiency (EERS) and net metering. Stronger energy efficiency and renewable energy policies would help Wisconsin move toward energy independence.

Community Policies

Local communities use a variety of tools to plan for renewable energy and energy efficiency. More than 140 Wisconsin communities have become Energy Independent Communities by adopting the goal of generating 25 percent of their energy from renewable sources by 2025. The efforts of two Wisconsin communities considered leaders in this field are profiled below.

City of River Falls

POWERful Choices!: In April 2007, the city of River Falls partnered with River Falls Municipal Utilities (RFMU) to launch the POWERful Choices! initiative. This is a community-wide effort to demonstrate the effectiveness of energy efficiency, conservation, and renewable resource development. In 2008, the city began to benchmark and track local and municipal energy use and identified short- and long-term actions to achieve a 10 percent reduction in total energy use. As part of the initiative, city staff partnered with community leaders to select programs to help achieve these goals. Programs include financial incentives, product giveaways, home performance audits, weatherization, energy education, and training. In 2009, the city hired a full-time conservation and efficiency coordinator. After five years, the program has saved 23.5 million kWh of energy, $1.65 million in wholesale power purchase costs, and $1.75 million on customer electric bills.[1] The city is currently purchasing green power equal to 9 percent of its municipal operations and the community as a whole is purchasing green power equal to 15 percent of its purchased electricity use. The program goal of reducing community demand for electricity by 10 percent will be met between years seven and eight.

Photo CP1: In 2009, the city of River Falls constructed the first LEED certified city hall in Wisconsin, receiving "LEED-Silver" recognition. (Photo courtesy of River Falls Municipal Utilities)

Photo CP2: In 2008, the city of River Falls approved an ordinance allowing neighborhood electric vehicles (NEVs) on roads with a speed limit of 35 mph or less. (Photo courtesy of River Falls Municipal Utilities)

Feed-In Tariff: River Falls Municipal Utilities (RFMU) offers a feed-in tariff program through WPPI Energy, a regional power company serving 51 locally owned, not-for-profit electric utilities. Through this program, customers installing PV can receive a 10-year contract where RFMU will buy all the PV energy produced at 30 cents per kWh, and sell customers electricity back at 9.5 cents per kWh. Like all feed-in tariffs, this tariff provides certainty about the price the producer will be paid and when their initial investment will be paid back. RFMU gets renewable energy credits for 10 years, and currently has over 18 kW

The city of River Falls is located in northwestern Wisconsin just 35 minutes from the Twin Cities area. It has a population of approximately 15,000 residents. In 2008, the city signed on as a Wisconsin Energy Independent Community and an EPA Green Power Community.

Photo CP3: In 2007, a 3.7 kW photovoltaic dual-axis tracker system was installed at River Falls High School. A kiosk and website provide real-time energy production data. The system provides an estimated 5,236 kWh of energy per year. (Photo courtesy of River Falls Municipal Utilities)

installed and another 8 kW queued up for installation in 2013.[2]

City of Madison

Mpowering Madison: In 2007, the city of Madison together with a coalition of community partners launched the Mpowering Madison campaign. With a goal of reducing carbon dioxide emissions by 100,000 tons over four years, the campaign encouraged community residents and businesses to adopt six 'can-do' activities (see box at right).

The community exceeded their goal by reducing greenhouse gas emissions by 324,000 tons between 2007 and 2011.[3] The city contributed by making energy efficiency and lighting upgrades to city facilities, installing solar hot water systems on fire stations and other facilities, adding 24 hybrid buses to the Metro fleet, and purchasing green power equivalent to 22 percent of city operations.

Building on these successes, the city has a larger goal of reducing carbon dioxide emissions by 80 percent by 2050. Details are included in the Madison Sustainability Plan which was adopted by the City Council in early 2012.[4]

The Sustainability Plan's Carbon and Energy chapter

Photo CP4: Solar hot water heaters were installed at Fire Station 6. (Photo courtesy of the city of Madison)

Mpower Pledge

By taking the pledge, Madison residents and businesses agreed to perform one or more of the following steps:

1. Buy renewable energy
2. Improve energy efficiency
3. Install solar
4. Reduce car emissions
5. Plant trees
6. Conserve water

outlines specific goals and actions, highlighted here:

1. *Influence reductions in transportation related carbon impacts.* Actions include creating a city fleet transition plan to switch to low or no-carbon fuel options such as biogas, hybrids, and electric car charging.
2. *Systematically upgrade existing buildings, equipment, and infrastructure.* Actions include reallocating a portion of each city agency's operating budget to increase energy efficiency and reduce carbon emissions. The city will also develop policies, incentives, and energy performance targets that prioritize energy efficiency upgrades for the lowest performing buildings in the private sector.
3. *Improve new buildings and developments.* Actions include allowing on-site energy generation (e.g., on-site solar generation).
4. *Engage the public in energy efficiency and climate change programs.* Actions include creating a series of special action days.
5. *Obtain 25 percent of electricity, heating, and transportation energy from clean energy sources by 2025.* Actions include working to identify and rank various opportunities for greater biowaste-to-energy projects.
6. *Report carbon footprint to the public.* Actions include creating an internal carbon pricing system for the city.

Zoning and Subdivision Ordinance: To encourage the use of renewable energy, the city has also updated its zoning and subdivision ordinances.[5] The zoning ordinance now allows solar installations in historic districts and on landmark properties. The ordinance also allows for an easy staff-level permit as opposed to a more cumbersome committee approval process.

Madison's subdivision ordinance contains several provisions related to solar energy access. It requires streets to be oriented in an east-west direction or to within 20 degrees of such orientation so that the front or back of the house faces south to maximize solar gain. In addition, trees must be placed to minimize shading on the southern side of buildings.[6]

The city of Madison is the state capital and the second largest city in Wisconsin with a population of 237,000. In 2005, the city adopted the principles of The Natural Step. In 2010, it became an Energy Independent Community.

Photo CP5: A solar installation in the city of Madison. (Photo courtesy of the city of Madison)

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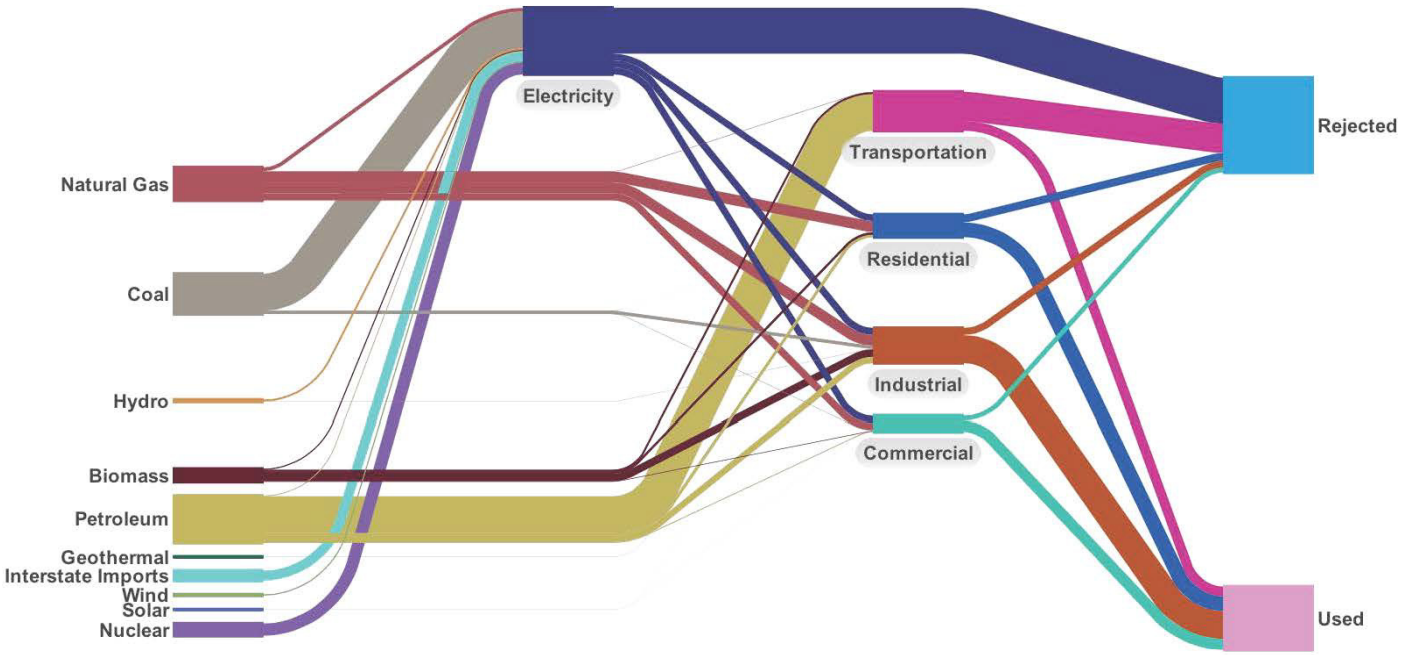

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Acknowledgments

Prepared by Lynn Markham, Anna Haines, Aaron Thompson, Dan McFarlane, Rebecca Roberts, Kristin Floress, and Kristy SeBlonka of the Center for Land Use Education and Kaitlin Johnson, Katie Lima, William Risse, and Benjamin Van Thiel of the UW-Stevens Point. Maps prepared by Dan McFarlane, unless otherwise credited.

The authors gratefully acknowledge the review and contributions of Jonathan Rivin, Diana Tscheschlok, Bret Shaw, Holly O'Higgins, Maria Redmond, and Sherrie Gruder.

Direct financial assistance for this project was provided by the University of Wisconsin Cooperative Extension.

On The Web

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