

This Wisconsin State Summary educates policymakers and the public about EERE investments and their positive impacts in Wisconsin.

# Wisconsin

The U.S. Department of Energy (DOE) is pursuing an all-of-the-above approach to developing every source of American energy. The Office of Energy Efficiency and Renewable Energy (EERE) leads DOE efforts to build a strong clean energy economy, a strategy that is aimed at reducing our reliance on foreign oil, saving families and businesses money, creating middle-class jobs, and reducing pollution.

This strategy will position the United States as the global leader in clean energy, increasing our nation's competitiveness. In 2012, \$268 billion was invested globally in clean energy, a 500% increase since 2004.<sup>6</sup> Trillions of dollars will be invested in the coming decades. Clean energy represents one of the most important economic development races of the 21st century. We face a stark choice—the clean energy technologies of tomorrow can be invented and manufactured in Wisconsin and the rest of the United States for domestic use and export around the world, or we can cede global leadership and import those technologies from China, India, Germany, and elsewhere.



## Wisconsin's Clean Energy Resources and Economy

- Clean Economy Jobs (2010): 76,800+
- Average Annual Growth Rate of Clean Economy Jobs (2003–2010): 0.7%
- Average Annual Wage of Clean Economy Jobs (\$2009): \$37,931<sup>1</sup>

With its abundant supply of conventional hydroelectric power, biomass, and wind, Wisconsin is well on its way to meeting its goal of producing 10% of its electricity from renewable sources by 2015. Eligible resources for Wisconsin's Renewable Portfolio Standard include solar, wind, hydroelectric power, biomass, geothermal technology, tidal or wave action, and fuel cell technologies that use qualified renewable fuels. Already, 7.4% of Wisconsin's net electricity generation comes from renewable energy resources.<sup>3</sup> Additionally, Wisconsin's high corn production allows it to produce substantial amounts of ethanol. In 2010, the state produced 438 million gallons, ranking it ninth in ethanol production across the United States.

Wisconsin's support of energy efficiency has historically been strong. In 2006, Wisconsin enacted legislation that required energy utilities to spend 1.2% of revenues on efficiency programs, and gave the Public Service Commission (PSC) discretion to revise energy efficiency goals and funding levels every 4 years.<sup>4</sup> In late 2010, the PSC increased program funding, and set new, higher, goals for the period of 2011–2014. A few months later, however, the legislature capped program expenditures at the level set in 2006, and the PSC lowered its annual energy savings goal to 10% above 2009 levels.<sup>5</sup>

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



## EERE and Wisconsin

EERE helps create Wisconsin’s clean energy economy today, developing and delivering innovative, market-driven solutions for the following:

- **Sustainable transportation** – making transportation cleaner and more efficient through solutions that put electric drive vehicles on the road and replace oil with clean domestic fuels
- **Renewable electricity generation** – reducing the cost of renewable energy through solutions that squeeze more usable power from sustainable resources and improve the economics of manufacturing and installation
- **Energy-saving homes, buildings, and manufacturing** – developing cost-effective energy-saving solutions that help make our country run better through increased efficiency—promoting better plants, manufacturing processes, and products; more efficient new homes and improved older homes; and other solutions to enhance the buildings in which we work, shop, and lead our everyday lives.

## EERE Investments in Wisconsin

EERE invests in Wisconsin through a broad range of clean energy projects, from energy efficiency to wind, solar, vehicles, biofuels, and other technologies. EERE supports cities, communities, and families to develop innovative, cost-effective energy solutions through the research, demonstration, and deployment activities we conduct with Wisconsin and its businesses, universities, nonprofits, and local governments.

### Sustainable Transportation



#### Alternative Fuel Vehicles and Infrastructure Expansion Improve Energy Security



Statewide (Headquartered in Milwaukee)  
EERE investment: \$16M

EERE supported the **Wisconsin Clean Transportation Program**, which Wisconsin’s State Energy Office administers, with \$15 million in American Recovery and Reinvestment Act (ARRA) funding to deploy 18 alternative fueling and charging stations. The Program also works with nearly 200 public and private fleets throughout Wisconsin to put more

than 300 alternative fuel vehicles on the road, including heavy and light-duty electric drive, propane, and natural gas vehicles. Through the vehicles and infrastructure built as part of this project, the Wisconsin State Energy Office estimated it will displace more the equivalent of more than 1.5 million U.S. gallons of gasoline per year, and will create jobs by supporting domestic manufacturing and converting vehicles to use alternative fuels. Through a separate competitive award, Wisconsin is also building 27 new E85 (a fuel blend containing up to 85% ethanol) fueling stations, and is installing biodiesel blending equipment at three fuel terminals.



Wisconsin, home to the Wisconsin Southeast Area Clean Cities coalition, retains 263 alternative fueling and charging stations. *Photo from the City of Milwaukee.*

#### Johnson Controls Develops an Improved Vehicle Battery, Works to Cut Battery Costs in Half



Milwaukee, Wisconsin  
EERE investment: \$3.68M

**Johnson Controls’** Holland Technology Center in Milwaukee matched EERE’s investment to develop and build a new lithium-ion battery cell and accompanying system that substantially increases the energy density of plug-in electric vehicle battery cells. Johnson Controls is using this technology to develop a standard, commercialized lithium-ion cell for plug-in electric vehicles. Johnson Controls also has a project underway to improve manufacturing processes that will reduce manufacturing costs for lithium-ion vehicle battery cells by 50%.



### Exploring Hydrogen Generation from Biomass-Derived Sugar and Sugar Alcohols to Reduce Costs



Madison, Wisconsin  
EERE investment: \$1.9M

With support from EERE, researchers at **Virent, Inc.** in Madison, developed new cost-effective methods to produce hydrogen from renewable resources like biomass-derived sugar and sugar alcohols. Hydrogen can be used with fuel cells to produce clean, efficient power with water as the only by-product. Conventional hydrogen-generating processes require three or more reaction steps, and use non-renewable fossil fuels. The new aqueous phase reforming process (APR) can generate hydrogen from sugar and sugar alcohols in a single-step catalytic reactor process. Because APR employs liquid feedstocks, rather than high temperature compressed gas feedstocks, it has the potential to be less costly than conventional generating processes.

### University of Wisconsin-Madison Improves Fuel Efficiency in Advanced Diesel Engines



Madison, Wisconsin  
EERE investment: \$3M

In 2012, a team of researchers at the **University of Wisconsin-Madison** completed a project with funds from EERE to develop high-efficiency combustion engines for light- and heavy-duty vehicles using a variety of approaches—including the use of multiple fuels, and refining the interactions within and between the engine and other components. By combining a number of different strategies to improve engine efficiency, the university team showed a potential for a 50% increase in fuel economy for cars and a 20% increase for trucks without the need for emissions after-treatment—a process that is often required to meet emissions standards but decreases fuel efficiency. Because of its potential, several vehicle and engine manufacturers are further pursuing this technology. In addition, the team created and utilized design and computer simulation tools that will allow other researchers to design low-emission and fuel-efficient engines. The University provided \$600,000 for this project.

### Clean Cities Coalition Helps Stakeholders Choose Smart Transportation Solutions



Milwaukee, Wisconsin  
EERE investment: \$30K annually to each coalition

Wisconsin is home to the **Wisconsin Southeast Area Clean Cities** coalition, one of nearly 100 EERE-coordinated Clean Cities coalitions nationwide. Clean Cities coalitions are self-organized groups of local community, government, and business stakeholders that provide resources and technical assistance for the deployment of alternative and renewable

fuels, idle-reduction measures, fuel economy improvements, and new transportation technologies. Clean Cities' efforts to adopt smart transportation solutions have displaced more than 4.5 billion gallons of gasoline and diesel since 1993. EERE provides these groups with information, professional development opportunities, non-financial project support, and other forms of technical assistance. In 2011, the Wisconsin Southeast Area coalition reduced fuel consumption by the equivalent of more than 2 million U.S. gallons of gasoline and prevented 12,000 tons of greenhouse gas emissions. The coalition includes more than 2,000 public and private stakeholders, and promotes the use of Wisconsin's 263 alternative fueling and charging stations. In 2011, the coalition leveraged EERE's support to raise almost \$72,000 from stakeholders and non-EERE grants.

### Renewable Electricity Generation



### Helping Ensure High-Quality Installation of Solar Power Technologies



Custer, Wisconsin  
EERE investment: \$1M

The **Midwest Renewable Energy Association (MREA)** is working with EERE to accelerate market adoption of solar technologies by ensuring all installations of solar power technologies are of high quality. In this effort, MREA is organizing a network of instructors, installers, engineers, administrators, and other industry stakeholders to create useful and informative instructional resources for installing solar technologies. The Solar Instructor Training Network addresses a critical need for high-quality, local, and accessible training in solar system design, installation, sales, and inspection—which helps streamline the process of installing residential and small commercial rooftop solar systems, making solar energy both more accessible and affordable. With EERE support, MREA will provide instructor development opportunities and also create sustainable jobs within the solar installation industry.

### Building a Ladder to Careers in the Wind Industry



Milwaukee, Wisconsin  
EERE investment: \$300K

EERE funds have helped two schools establish a career ladder for Southeast Wisconsin graduates to enter or advance in the wind industry. The two schools—the **University of Wisconsin (UW)** and the **Milwaukee Area Technical College (MATC)**—worked jointly to develop a total of seven new wind energy courses and to establish three new certificate programs: a Green



Certificate in Wind Energy at MATC, as well as undergraduate and interdisciplinary graduate certificates in Wind Energy at UW-Milwaukee. In addition, the university has installed a laboratory-scale wind turbine for student instruction, established a collaborative industry advisory board, and is working with industry to identify student internship opportunities.



The Milwaukee wind turbine not only provides clean energy for the city, it helps support Wisconsin's growing wind industry, as the majority of components were made in Wisconsin. *Photo from Nick Korth, Midwest Renewable Energy Association.*

### Potawatomi Tribe Deploys Clean Energy Technology



Milwaukee and Stone Lake, Wisconsin  
EERE investment: \$2.6M

The **Forest County Potawatomi Tribe**, supported by an investment from EERE, is implementing an integrated renewable energy deployment plan that will provide heating, cooling, and electricity for the tribe's buildings. The plan includes three elements. The first, a biogas cogeneration plant at the tribe's Milwaukee administration building, will employ digesters to produce fuel from the byproducts of nearby dairy, meat, and beverage processing operations. This system is expected to generate two megawatts of electricity. The second element, a solar panel installation at the Milwaukee building, is expected to generate an additional

35,000 kilowatt hours of electricity per year. Finally, a biomass-powered heating system will be installed at the tribe's Stone Lake campus. In total, these projects are expected to reduce annual greenhouse gas emissions by 87,000 metric tons, which is equivalent to taking more than 18,000 passenger vehicles off the road for a year.

### Creating a Stronger Community of Wind Educators



Cleveland, Wisconsin  
EERE investment: \$200K

EERE joined with **Lakeshore Technical College (LTC)** in Cleveland to create a landmark educational partnership that coordinates wind education resources among institutions across the state. Partners include seven Wisconsin technical colleges; a regional economic development collaborative; the National Coalition of Certification Centers; the Wisconsin Energy Research Consortium; and the Wisconsin Wind Works Alliance, a group of 300 wind power supply-chain vendors and manufacturers. LTC's accomplishments include participation in industry roundtables; shared programming and articulation agreements; high school outreach activities including monthly visits, videos, and a mobile trailer for school presentations; development of a Wisconsin Careers website and DVD; and a self-guided walking tour of four wind turbines on the LTC campus. This effort has produced long-lasting industry and educational partnerships, allowed for coordination of job and internship opportunities for students, and gathered resources from industry partners that will allow further enhancement of the wind curriculum.

### Expanding Educational Opportunities for the Wind Energy Workforce



Madison, Wisconsin  
EERE investment: \$600K

The **University of Wisconsin-Madison (UW-Madison)** is supporting wind energy workforce development and training for the civil design and construction sector. Funding from EERE has enabled curriculum development for the University's Energy and Policy Graduate Certificate and online Master's degree in Sustainable Engineering, with wind energy specializations under consideration. These programs allow students to design small wind turbine blades, towers, battery chargers, and alternators. Student designs are presented via a website and open house. UW-Madison has also established an internship program for students in cooperation with the wind power industry, and is developing a series of continuing education courses in wind energy balance-of-plant design, including curricula on civil, geotechnical, electrical, structural, and construction management for wind site development, design, and construction. In parallel with the continuing engineering education short courses, UW-Madison also developed an upper-level, for-credit university design class in the balance-of-plant area.



## Energy-Saving Homes, Buildings, and Manufacturing



### New Sensor Network Technology Increases Manufacturing Efficiency



Milwaukee, Wisconsin  
EERE investment: \$3M

EERE supported **Eaton Corporation** in the development and successful deployment of an electric motor overload and monitoring solid-state relay. Eaton's relay, called Motor Insight™, can reduce installation and infrastructure costs for manufacturers by up to 84% compared with conventionally wired systems. Motor Insight™ can predict potential equipment failure and allows for predictive and scheduled maintenance—helping prevent unscheduled downtime or inefficient operation of equipment in the manufacturing process that can waste energy and increase maintenance costs. In addition to monitoring electric motor health, the technology provides line conditioning for improved motor reliability and reduced maintenance downtime. It also reduces abnormal and inefficient operation using real time communication and control of motor operation.<sup>7</sup> The technology is so effective that it can eliminate unnecessary fault-finding inspections at manufacturing facilities.

### Briggs & Stratton: Putting All Energy Efficiency Options on the Table



Milwaukee, Wisconsin  
EERE investment: \$1.29M

Through support from EERE and Wisconsin's Focus on Energy program, among other sources, industrial manufacturer **Briggs & Stratton** has implemented hundreds of energy efficiency projects, including an overhaul of the steam and heating system at the company's Wauwatosa, Wisconsin, facility. Results include increasing the facility's energy efficiency by 42%—saving more than 962 billion British thermal units of natural gas energy and more than 1.4 million kilowatt hours of electricity annually, which is enough to power about 120 homes.<sup>8</sup> The project involved replacing the facility's old steam boiler and large HVAC units with appropriately sized and more efficient boilers and HVAC units.

### Adopting Combined Heat and Power Technologies Reduces Energy Loss



La Crosse, Wisconsin

Over the last few years, **Gunderson Lutheran Health System (GL)** has implemented several energy projects to meet its goal of achieving energy independence by 2014. EERE provided preliminary design and technical assistance to GL and its partner, the La Crosse County Solid Waste Department, to find a beneficial use for landfill gas that is generated at the La Crosse County Landfill. GL installed a compressor and pipeline system to transfer the gas from the landfill to the GL-Onalaska Campus for combustion in an engine-generator system. Locating the generator system on GL's campus instead of at the landfill enables the system to capture waste heat for use in the medical campus buildings, in addition to generating electricity. This partnership allowed GL to become the first known energy independent medical campus in the country.

### University of Wisconsin-Milwaukee Industrial Assessment Center Provides No-Cost Energy Assessments



Milwaukee, Wisconsin  
EERE investment: \$1.5M

The **University of Wisconsin-Milwaukee's** Industrial Assessment Center (IAC) provides many small and medium-sized manufacturing companies with no-cost energy assessments, while also serving as an important training ground for the next generation of energy-savvy engineers. Although the IAC just opened in March 2012, it has already helped manufacturers reduce energy costs by performing eight industrial assessments. Nationally, these assessments have helped participating manufacturers save more than \$5.6 billion in energy costs.<sup>9</sup>

### Appliance Rebate Program Benefits Wisconsinites



EERE investment: \$5.4M

In 2010, EERE provided the State of Wisconsin with American Recovery and Reinvestment Act (ARRA) funds to implement a residential appliance rebate program. Wisconsin's **Focus on Energy Program** offered rebates ranging from \$25 to \$2,000 for the purchase and replacement of existing appliances, such as boilers, clothes washers, dishwashers, refrigerators, freezers, furnaces, heat pumps, and water heaters. Focus on Energy has issued more than 18,000 rebates for clothes washers, refrigerators, and furnaces alone. Residents replaced more than 45,000 products under this program and have reduced their energy consumption by an estimated 166 billion British thermal units annually—saving an estimated \$3.2 million.



Wisconsin residents were able to replace more than 45,000 products through the state’s Focus on Energy Program, reducing their energy consumption by an estimated 166 billion British thermal units. *Photo from D&R International, Ltd., NREL 07720*

### Better Buildings Neighborhood Program in Wisconsin



Milwaukee, Madison, and Racine, Wisconsin  
EERE investment: \$20M (total BBNP investment in Wisconsin)

With funding from DOE’s Better Buildings Neighborhood Program, the **Wisconsin Energy Conservation Corporation (WECC)** and its partner cities of Milwaukee, Madison, and Racine created Wisconsin Energy Efficiency, a program to upgrade residential and commercial buildings and support job creation in Wisconsin. This program will educate residents about the value of energy efficiency and financing options for home energy upgrades. Wisconsin Energy Efficiency will also offer special pricing on ENERGY STAR® qualified appliances; rebates for home energy assessments; incentives for achieving more than 15% energy savings by acting on the recommendations of those assessments; and special financing, incentives, and assistance to local businesses to perform energy upgrades.

All participating contractors in the broader WECC program are required to pass a WECC-qualification process. This process has created jobs by promoting local hiring and sustainable wages for home energy professionals. Since the program launched in March 2011, WECC has completed 933 residential evaluations and 349 residential energy upgrades, and has provided 89 residential loans ranging from \$1,000 to \$15,000 for home energy efficiency upgrades.<sup>10</sup>

## Deploying Clean Energy Solutions in Wisconsin Communities

EERE invests in the deployment of energy efficiency and renewable energy projects in communities across Wisconsin. These investments catalyze economic development, create jobs, generate clean energy, and reduce utility bills. Many of these investments are a result of the American Recovery and Reinvestment Act (ARRA). As of January, 2013, of the more than \$235 million in EERE ARRA funds allocated to the State of Wisconsin for deployment projects, more than 99% has been spent through the Energy Efficiency and Conservation Block Grant Program, State Energy Program, and Weatherization Assistance Program.

### Building Clean Energy Infrastructure

With financial and technical support from EERE, energy officials at the state level and in 43 communities have selected and overseen the completion of hundreds of projects that are delivering the benefits of clean energy to citizens throughout Wisconsin. EERE allocated approximately \$94 million in ARRA funds to support activities that

- Contributed to increased energy efficiency and cost savings for about 1,040 buildings (nearly 21 million square feet) through building retrofits
- Installed 63 renewable energy systems, including solar energy systems with a total capacity of nearly 820 kilowatts
- Funded more than 300 workshops, teaching approximately 53,000 people to perform energy audits and install renewable energy systems
- Installed approximately 2,300 energy-efficient streetlights and more than 2,200 energy-efficient traffic signals.

### Weatherizing Homes for Lower Income Families

Wisconsin has spent 100% of approximately \$141 million in ARRA funds it received to weatherize homes. The state surpassed its ARRA goal of weatherizing approximately 21,000 homes. Statewide, this has resulted in annual energy savings of more than one trillion British thermal units and has averted nearly 93,000 metric tons of carbon pollution to date, which is the equivalent of taking more than 19,300 passenger vehicles off the road for a year. These projects have enabled income-eligible families to save hundreds of dollars per year on heating and cooling bills by improving their homes’ energy efficiency, as well as the health and safety of home environments.<sup>11</sup>



## Deployment Project Examples

### WIP Invests in Increased Sustainability of Small Businesses



Madison, Wisconsin  
EERE investment: \$1.2M

**Idle Free Systems, Inc.**—a Wisconsin small business that produces battery-powered, idle-elimination systems—expects to create several jobs through expanded production of idle elimination solutions. Discretionary idling for a typical fleet sleeper truck can consume as much as 3,000 gallons of diesel fuel per year. Depending on diesel prices, this means the Idle Free technology can deliver annual savings of up to \$10,000 for drivers by reducing fuel consumption, fuel-related costs, and maintenance costs, as well as by reducing the frequency of oil changes.<sup>12</sup>



Betin Incorporated's anaerobic digester transforms industrial waste into electricity. *Photo from Betin Inc./Montchevre*

Front page photo from iStock 6855177; page 2: iStock 17393871; page 3: Dennis Schroeder, NREL 19156; page 5: Jim Tetra, U.S. Department of Energy Solar Decathlon

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# A Proven Track Record

Snapshot of National Outcomes from EERE Investments

## EERE's Return on Investment for Clean Energy Technologies

- EERE's \$931 million investment in vehicles combustion engine R&D from 1986 to 2007 achieved a net benefit of \$69 billion (2008 dollars) in fuel savings for users of heavy-duty diesel trucks.<sup>15</sup>
- EERE's \$3.7 billion investment in solar photovoltaic R&D from 1975 to 2008 resulted in a net economic benefit of \$15 billion (2008 dollars) due to module efficiency and reliability improvements.<sup>16</sup>
- EERE's \$1.7 billion investment in wind energy R&D from 1976 to 2008 resulted in a net economic benefit of \$8.7 billion (2008 dollars) due to wind turbine efficiency, energy capture, and reliability improvements.<sup>17</sup>
- A 2001 National Academy of Sciences analysis found that investments of \$1.6 billion in energy efficiency R&D in the first two decades of DOE's existence from 1978 to 2000 realized a net economic benefit of approximately \$30 billion (1999 dollars).<sup>18</sup>

## Sustainable Transportation

- EERE research has helped reduce production costs of automotive lithium-ion batteries by more than 50% since 2008 and is on track to reach its goal of enabling cost-competitive market entry of plug-in hybrid electric vehicles within the next 10 years.
- EERE's activities to achieve cost-competitiveness for biofuels have resulted in the recent achievement of reaching a modeled cellulosic ethanol production cost of \$2.15 per gallon of ethanol (or \$3.27 per gallon of gasoline equivalent).
- EERE's efforts have reduced the projected costs of automotive fuel cells (assuming high-volume manufacturing) by more than 35% since 2008 and 80% since 2002—doubling the durability of fuel cells from 950 hours of demonstrated operation in 2006 to more than 2,500 hours of operation on the road.<sup>19</sup>

## Renewable Electricity Generation

- Without EERE involvement, the average solar photovoltaic (PV) module production cost per watt would have been \$5.27 in 2008, rather than \$1.92. EERE has accelerated solar industry progress by an estimated 12 years.<sup>20</sup>
- Without EERE involvement, cumulative wind power deployment through 2008 would have been less than a third of actual 2008 levels. EERE has accelerated the overall progress of the wind industry by an estimated 6 years.<sup>21</sup>

## Energy-Saving Homes, Buildings, and Manufacturing

- More than 6,200,000 homes have been weatherized with EERE funding provided to states or leveraged from other sources with EERE support since 1976—creating an average energy savings of \$350 or more per year and avoiding \$1.6 billion in energy costs during winter 2005 alone for all households weatherized.<sup>22</sup>
- Due to EERE appliance standards implemented through 2012, a typical household today already saves about \$180 per year off its utility bills. Households can expect to save more than \$300 per year by 2030, as they replace their existing appliances with newer models that use less energy—a cumulative savings to consumers of more than \$900 billion by 2020, and more than \$1.6 trillion through 2030. The cumulative energy savings of these standards phased in through 2012 will be about 70 quadrillion British thermal units (quads) of energy through 2020, and will amount to 120 quads through 2030. (The United States consumes a total of about 100 quads of energy per year.)<sup>23</sup>
- EERE and its partners in the manufacturing sector have successfully launched 220 new, energy-efficient technologies, received 78 R&D 100 Awards, and delivered technical assistance to more than 33,000 industrial plants.<sup>24</sup>
- Since 2005, EERE has facilitated \$3.1 billion of efficiency investments in federal government facilities from performance-based contracts, which will result in energy cost savings of approximately \$8.5 billion over the life of the energy-saving measures. The savings on utility bills and operation and maintenance created through the facility upgrades will be used to pay for the project over the term of the contract, and the agencies will continue to save money and energy after the contract term has ended.<sup>25</sup>

The Office of Energy Efficiency and Renewable Energy is at the center of creating the clean energy economy today. We lead U.S. Department of Energy efforts to develop and deliver market-driven solutions for renewable electricity generation; sustainable transportation; and energy-saving homes, buildings, and manufacturing. To learn more about the activities of the Office of Energy Efficiency and Renewable Energy, visit [eere.energy.gov](http://eere.energy.gov). If you have questions or comments about the information in this document, please contact us at [EE.Communications@ee.doe.gov](mailto:EE.Communications@ee.doe.gov).