

The Wisconsin Jobs Project: A Guide to Creating Jobs in Sensors & Controls for Advanced Energy

A Letter from the American Jobs Project

It is no secret that America's middle class is in crisis; of the millions of jobs lost during the recession, most were good-paying, middle-class jobs.¹ Unfortunately, many of the jobs created during the recovery have been in low-skill, low-paying occupations.² It is true that the United States will not likely be able to attract the traditional manufacturing jobs of the past, but our research shows that with innovative policies and a smart focus on industrial sectors, states can become global hubs of innovation and create new jobs in advanced industries that capitalize on each state's strengths.

Our analysis starts with identifying the biggest market opportunity of our era. The world has embarked on a historic energy transformation, and the growing demand for advanced energy and its enabling technology draws on "the mother of all markets" for U.S. businesses to build and sell those solutions.³ Strategically minded businesspeople are taking advantage of this accelerating market and seeing outsized returns. In 2016, the private sector reported \$1.4 trillion in global advanced energy revenues, equal to that of the global apparel sector and nearly twice that of the global airline industry.⁴ And jobs? At least 9.8 million people were employed in the global advanced energy sector in 2016, and market growth could support 24 million jobs by 2030.⁵ The question for the United States is: Where will those new jobs be created?

We believe that our states are the answer to this question. If countries across the globe are seeking solutions for growing energy needs, how can U.S. businesses take advantage of this demand and build products locally that can be exported to the world? And how can we equip Americans with the skills those businesses need?

The American Jobs Project gives policymakers the tools to spur economic growth and create good-paying jobs in their states. Our analyses chart pathways designed to accelerate and expand a state's advanced energy economy. We propose innovative solutions built on extensive research and tailored to each state. These solutions are written with an eye towards streamlining bureaucracy and are seasoned with the principles of competition, local control, and fewer regulations.

The American Jobs Project will empower state and local leaders to build prosperous and equitable advanced energy economies that will transform our nation's energy future. If these recommendations are adopted, the beneficiaries will be those hard-working Americans looking for the dignity of a good-paying job.

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About Us

The American Jobs Project

The American Jobs Project is a nonprofit, nonpartisan, think-and-do tank focused on creating good-paying jobs in advanced energy and manufacturing through bottom-up, data-driven, 360° economic development. Our experts tailor best practice strategies for bolstering advanced energy and manufacturing, identify assets across the value chain, estimate an industry's job-supporting potential, and support stakeholder-led initiatives by communicating ideas and analyses. Through engagement with a broad cross-section of stakeholders, we develop a shared vision of effective strategies to leverage the unique competitive advantages offered by each state and generate positive economic impacts.

Wisconsin Energy Institute

The Wisconsin Energy Institute (WEI) is working on one of the most critical challenges of our time—the transition toward new, clean energy systems and solutions. WEI is led by scientists and engineers committed to crossing traditional research boundaries in order to make major breakthroughs in the way we source and use energy. The collaborative home of energy research and education at the University of Wisconsin–Madison, WEI fosters projects across disciplines, prepares the energy leaders of today and tomorrow, and enhances public understanding of energy issues.

Midwest Energy Research Consortium

The Midwest Energy Research Consortium (M-WERC) is the leading member-based Energy, Power, and Control (EPC) consortium in the Midwest. The organization leverages focused collaboration among over ninety recognized industry, academic, and non-governmental organization stakeholders through three signature platforms: Technology Innovation, Market Insights, and Engineering Entrepreneurship. Each area is targeted to accelerate growth and economic development of the Midwest EPC industrial sector.

Acknowledgments

This report would not be possible without the support of The JPB Foundation and Incite Labs.

Dozens of hands were involved in the process of researching, writing, designing, and reviewing the report. Mary Collins and Tiffany Wong were the lead authors. Henry Love and Santos Vazquez led economic analysis. Amariah Baker, Mat Squillante, and Madeleine Valdez led graphic design. Supporting researchers were Christopher Eldred, Andrew Herrmann, and Andrew Miller.

We extend our sincere gratitude to the hundreds of individuals from businesses, government, nonprofits, utilities, and universities for meeting with us, exploring ideas, participating in working groups, collaborating on the report, and sharing their vision for the future.

We thank the following individuals and organizations—in addition to those who respectfully choose to remain anonymous—for offering their insight and perspectives on this work.

Dean Amhaus, The Water Council

Jeffrey Anthony, M-WERC

Kelly Armstrong, Wisconsin Economic Development Corporation

Peter Bakken, Wisconsin Council of Churches

Bruce Beihoff, Wisconsin Energy Institute / M-WERC

Jamie Bernthal, Wisconsin Department of Workforce Development

Mary Blanchard, Wisconsin Energy Institute

Ian Blanding, Midwest Energy Efficiency Alliance

Doug Bremicker, WECC

Mitch Brey, RePower Madison

Buckley Brinkman, Wisconsin Center for Manufacturing Productivity

Chad Bulman, CB&I

Chelsea Chandler, Wisconsin Academy of Sciences, Arts & Letters

Matthew Christman, Wisconsin Biogas Council

Tom Content, Citizens Utility Board

Rob Cuzner, UW Milwaukee

Chris Deisinger, Syntropy Energy Solutions

Nick Dreher, Midwest Energy Efficiency Alliance

Marcus Dumke, Kinnektor

Dan Ebert, The Ebert Group

John Ernst, Kinnektor

Michael Falk, Wisconsin Alumni Research Foundation

Clint Fandrich

Mark Felsheim, Milwaukee Area Technical College

Don Ferber, Sierra Club

Jennifer Gottwald, Wisconsin Alumni Research Foundation

Frank Greb, Seventhwave

Aaron Hagar, Wisconsin Economic Development Corporation

Brett Halverson, Greater Madison Chamber of Commerce
Amy Heart, Sunrun
Tyler Huebner, RENEW Wisconsin
Kimberly Iversen, NEW IT Alliance
Erik Iverson, Wisconsin Alumni Research Foundation
Paul Jadin, Madison Region Economic Partnership
Andy Kellen, WPPI Energy
Michael Khbeis, Washington Nanofabrication Facility
Gregory Kleinheinz, UW Oshkosh
Molly Lahr, American Family Ventures
Robin Lisowski, WECC
Connie Loden, The New North
Kavita Maini, KM Energy Consulting
Michael Mallwitz, Milwaukee Area Technical College
Jack McGovern, UWSA Office of Economic Development
Chandra Miller Fienen, StartingBlock Madison
Jim Morgan, MRA - The Management Association
Adel Nasiri, UW Milwaukee
Greg Nemet, UW Madison
Seth Nowak, ACEEE
Andy Olsen, Environmental Law & Policy Center
Aaron Olver, University Research Park
Alan Perlstein, M-WERC
Don Peterson, Madison Gas & Electric
David Polk, Milwaukee Area Technical College
Gary Radloff, Wisconsin Energy Institute
Cate Rahmlow, Wisconsin Economic Development Corporation
Keith Reopelle, Dane County Office of Energy & Climate Change
Jeff Rich, Gundersen Envision
Brian Ross, Great Plains Institute
Chrystal Seeley-Schreck
Erick Shambarger, City of Milwaukee Environmental Collaboration Office
Howard Snyder, Northwest Side Community Development Corporation
Todd Stuart, Wisconsin Industrial Energy Group
Gregory Thomson
Troy Vosseller, gener8tor
Tate Walker, OPN Architects
Sammis White, UW Milwaukee
Ted Wilinski, Milwaukee Area Technical College
Sun Mountain Capital

Executive Summary

Wisconsin's sensors and controls industry is a significant economic opportunity for job growth, having the potential to support an annual average of 44,000 jobs through 2030. Wisconsin can capitalize on this opportunity by bolstering education and training, access to capital, the innovation ecosystem, value chain build-out, and local market growth.

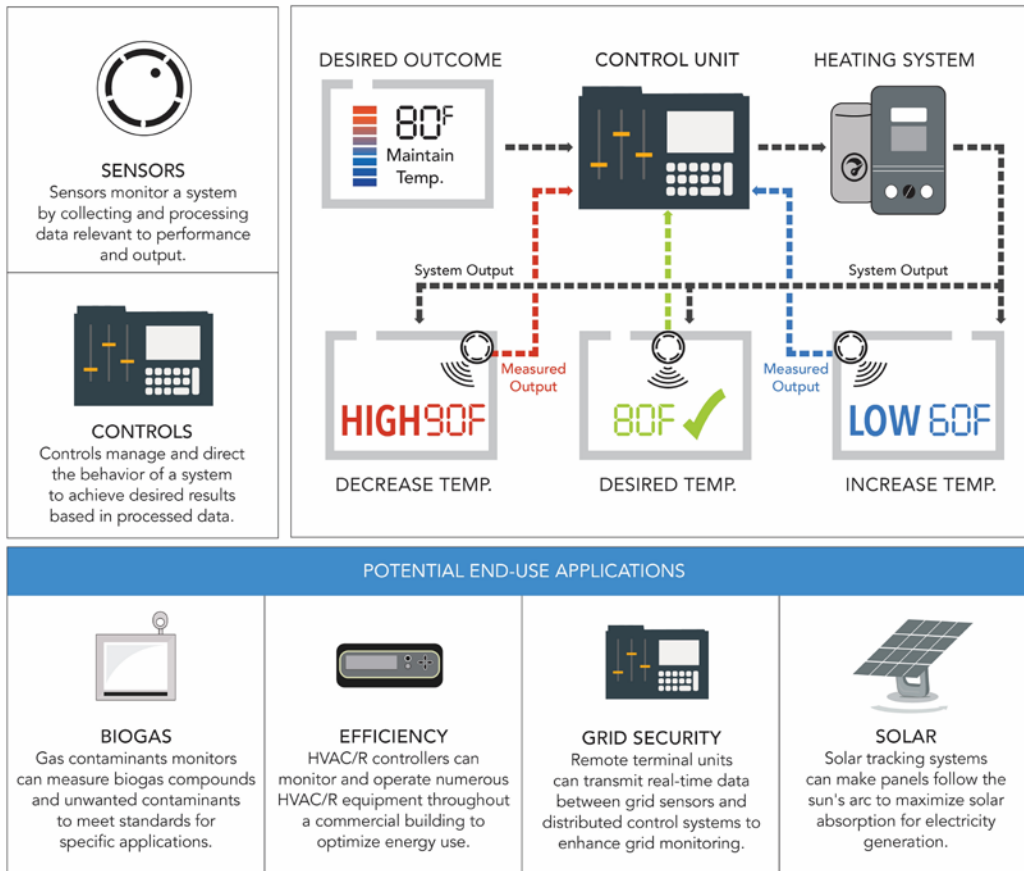
The American Jobs Project was born of two tough problems: the loss of middle-income jobs and congressional paralysis in the United States. It seeks to address these problems by taking advantage of one of the biggest market opportunities of our era—the advanced energy sector—and by doing so at the state, not the federal, level. State and local leaders who leverage the unique strategic advantages of their state to develop advanced energy economic clusters are poised to create quality jobs.

Wisconsin is faced with a growing need for skilled talent that is exacerbated by an aging workforce, out-migration, and a significant underemployed and long-term unemployed population.⁶ Efforts to foster good-paying manufacturing jobs and strengthen talent recruitment and retention could bolster the state's economy.

Extensive research and more than seventy interviews with stakeholders and experts in Wisconsin have identified sensors and controls as showing significant promise as a job creator and economic driver in the state. More than ever, advanced energy systems require extensive monitoring and operational controls to optimize production, minimize energy use, and leverage storage. Sensors and controls are hardware solutions that enable these technologies to be nimble and responsive to changing system-level conditions, such as weather patterns, available input resources, and energy demand. Wisconsin is well positioned to tap into market growth in this sector and rising demand for sensor- and control-embedded end-use technologies, such as biogas, efficiency, grid, and solar.

WHAT ARE SENSORS AND CONTROLS?

Sensors and controls are enabling hardware for efficient technologies in advanced energy production, conversion, conservation, and storage.



START CALL-OUT BOX

Local End-Use Market Opportunities Can Amplify Benefits

Sensors and controls are hardware solutions for active, agile, and efficient advanced energy systems. Wisconsin can also excel in supplying and building local end-use markets that integrate sensors and controls, particularly biogas, efficiency, grid, and solar.

- **Biogas.** Wisconsin has the potential to add over 1,300 new biogas projects, and gas contaminant monitors could be used to ensure viable output.⁷
- **Efficiency.** Wisconsin could save over 14 thousand GWh in electric energy, an opportunity for further deployment of smart building and energy management systems.⁸
- **Grid.** Wisconsin could benefit from planning for future grid needs and target Wisconsin-made, smart grid products for a secure, resilient, and efficient grid.⁹
- **Solar.** Wisconsin will add 249 MW of solar over the next five years, and solar tracking systems could be utilized to maximize electricity generation.¹⁰

END CALL-OUT BOX

Through the sensors and controls manufacturing industry, Wisconsin can leverage its numerous strengths to take advantage of expanding opportunities, such as:

- **Capitalizing on increasing technology demand.** The sensors and controls industry is projected to grow almost 7 percent annually through 2022.¹¹
- **Growing the manufacturing industry.** At least 209 companies manufacture sensors and controls for advanced energy systems.¹²
- **Bolstering the energy economy.** By deploying Wisconsin-made sensors and controls for safer and more efficient technologies in the state, increased local generation will divert some of the estimated \$14 billion spent on imported energy into Wisconsin communities.¹³
- **Leveraging university research expertise.** Wisconsin universities have unique research partnerships dedicated to sensing and control technologies and their end-use applications, ranging from bioenergy to grid technologies.¹⁴
- **Supporting quality, local jobs statewide.** With forward-thinking solutions, sensors and controls for advanced energy could support 44,000 Wisconsin jobs annually through 2030.¹⁵

To realize these opportunities, state and local leaders can pursue strategies that create a strong foundation for industry growth in sensors and controls and help Wisconsin businesses grow, innovate, and outcompete regional, national, and global competitors. In today's competitive, globalized economy, businesses are more likely to thrive in cities and states that offer a rich innovation ecosystem, provide fertile grounds for capital investment, boast a highly skilled workforce, and offer clear policy signals. By having a close network of suppliers and partners, Wisconsin companies can reap the benefits of increased productivity and operational efficiency, amplifying local job creation and economic growth.

Capitalizing on this opportunity offers real benefits for the state economy and Wisconsin residents. Annually through 2030, sensors and controls for advanced energy can support a total of 44,000 direct jobs from manufacturing and software development; indirect jobs from supplying equipment, materials, and services to manufacturers and developers; and induced jobs from spending in the local economy.¹⁶ This industry offers a diverse array of good-paying jobs that cater to different education and experience levels. Policymakers can support these jobs by seizing the opportunity presented by increasing global demand and overcoming barriers to industry growth.

Summary of Recommendations

The analysis presented in this report culminates in recommendations for Wisconsin's leaders based on best practices in the United States and abroad. Each recommendation identifies strategies to address barriers to industry growth or capitalize on untapped opportunities in the sensors and controls sector. Specifically, Wisconsin could target challenges in each foundational cluster element: workforce development, access to capital, the innovation ecosystem, and local market growth for sensor- and control-embedded biogas, efficiency, grid, and solar technologies. While the recommendations are intended to be complementary and would be more powerful if adopted as a package, each can also be viewed as a stand-alone option.

Workforce Development

Make Early College Programs More Accessible

Early college programs, also known as dual credit, enable students to earn a high school diploma while earning credits toward a degree. Wisconsin could continue to build on recent efforts to increase access to early college and facilitate entry to career pathways. Streamlining the funding process could reduce red tape, easing administrative burdens.

Provide a Tax Credit to Employers Hiring Apprentices

Apprenticeship programs provide valuable on-the-job skills, making them an important component of career development and workforce training in emerging industries. Employer involvement is a critical barrier to increasing the number of apprentices that can be supported by Wisconsin's exceptional apprenticeship programs. Wisconsin legislators could establish an employer tax credit for hiring youth and/or registered apprentices to increase apprenticeship participation.

Retain College Graduates and Recruit Out-of-State Talent

Up to 46,000 Wisconsin jobs will be left open by 2022 due to an aging population, net loss of residents, and lack of in-migration by college-educated people.¹⁷ In addition to training and prioritizing Wisconsinites for in-demand jobs, Wisconsin can retain college grads and target out-of-state expertise that will bolster in-state training and hiring to fill the impending worker shortage.

Access to Capital

Expand Corporate Venture Capital

Although Wisconsin excels at seed investing, companies face a critical funding gap in the early/growth and late stages, which has been only partially met by venture capital.¹⁸ Because corporate venture capital can better support follow-on capital for startups across their lifecycle, Wisconsin's industry associations could market the benefits of corporate venture capital, and the state could drive the development of a corporate fund of funds that builds relationships with national venture capital firms.

Innovation Ecosystem

Facilitate Mentorships for Entrepreneurs

A deficit of interactions between mentors and mentees exists in Wisconsin, and many entrepreneurs lack an understanding of how to properly engage mentors. Replicating successful programs that provide curated mentor-mentee matches and guide participants through the process can increase mentorship and encourage entrepreneurial activity.

Develop Testbeds for Large-Scale Energy Systems

While Wisconsin has exceptional university-based research labs, there are no testbeds at a similar scale dedicated to commercialization efforts and open to entrepreneurs. Wisconsin could establish an advanced energy testbed to accelerate technology development and stimulate innovation.

Establish a Wisconsin Biogas Innovation Voucher Program

Despite expertise at Wisconsin universities in anaerobic digesters, technical issues and the lack of shared knowledge reduce the overall profitability of the Wisconsin biogas industry. To address this issue, Wisconsin could establish a biogas innovation voucher program to connect new projects to in-state technical resources.

Local Market

Expand the Focus on Energy Program to Include the Energy-Water Nexus

The Wisconsin water technology cluster houses deep expertise in water management that can be leveraged to optimize energy-water efficiencies. To capture greater cost savings, Wisconsin should consider expanding the Focus on Energy program to also finance projects targeting the energy-water nexus.

Conduct a Forward-Looking Grid Study

With the rapid evolution of technologies and recent concerns for grid security, Wisconsin has the opportunity to prepare for future grid needs. The Public Service Commission of Wisconsin, with support from political and business leaders, could conduct an exploratory grid study to ensure strategic grid buildout and regulatory reform.

Explore Energy-as-a-Service Model for Grid Modernization Projects

The energy-as-a-service model can allow entities to more easily finance capital-intensive innovations for grid security and resiliency. Wisconsin counties, municipalities, or large facilities could supply local demand by exploring new models to upgrade infrastructure with less upfront capital.

Establish a Biogas Equipment Tax Credit

Potential biogas customers face high cost barriers to installation and operation, yet existing incentives inadequately address upfront costs, prioritize certain outputs, and fail to account for health and environmental benefits. By passing a biogas equipment tax credit, Wisconsin could incentivize statewide deployment and realize energy and cost savings.

Clarify Legality of Third-Party Ownership of Biogas and Solar Projects

Third-party ownership can offer a lower-cost option for accessing biogas and solar projects; however, Wisconsin lacks a clear policy on whether this financing mechanism is allowed. Wisconsin could clarify its legality through legislative or regulatory means in order to reduce its dependence on out-of-state energy imports.

Establish Consistent Net Metering Policies

An unclear and outdated net metering policy has made it challenging for Wisconsin residents and firms to invest in distributed generation such as biogas and solar. The Public Service Commission of Wisconsin and the Wisconsin Legislature could update the policy to spur the local market.

Introduction

Wisconsin can tap into the growing global advanced energy market to foster and support good-paying jobs for Wisconsinites. Through the strategic sector-based development of sensors and controls for advanced energy systems, Wisconsin could support 44,000 direct, indirect, and induced jobs annually through 2030.

The American Jobs Project aims to spur job creation in the advanced energy sector by identifying state-level economic opportunities and crafting right-fit solutions for in-state growth. This national initiative takes advantage of the accelerating demand for advanced energy and leverages a state's competitive advantages to build robust economic clusters. The American Jobs Project believes that manufacturing is a cornerstone of the U.S. economy—providing workers with good wages and causing a multiplier effect on local revenue and employment—and resolves to support industry jobs that are resistant to offshoring and automation.¹⁹ State and local leaders who seek to capitalize on state resources to create skilled, good-paying jobs can use this report as a foundation for action.

Extensive research and more than seventy interviews with stakeholders and experts in Wisconsin have identified sensors and controls as showing particular promise in the state. Given its robust industrial base, technical training programs, university research expertise, and cluster organizations, Wisconsin is well positioned to benefit from the rising demand for sensing and control technologies and their end-use applications. Opportunities to leverage these strengths to further serve growing regional, national, and global markets offer real benefits for both the state economy and Wisconsin residents. Strategic state-level coordination and collaboration could elevate in-state companies in the marketplace and facilitate middle-income job growth. By fostering growth in the sensors and controls industry, Wisconsin could reasonably support an average of over 44,000 direct, indirect, and induced manufacturing and supply chain jobs from 2018 through 2030 annually.²⁰

START QUOTE BOX

By developing the sensors and controls industry in the state, Wisconsin could reasonably support an annual average of 44,000 jobs from 2018 through 2030.

END QUOTE BOX

START CALL-OUT BOX

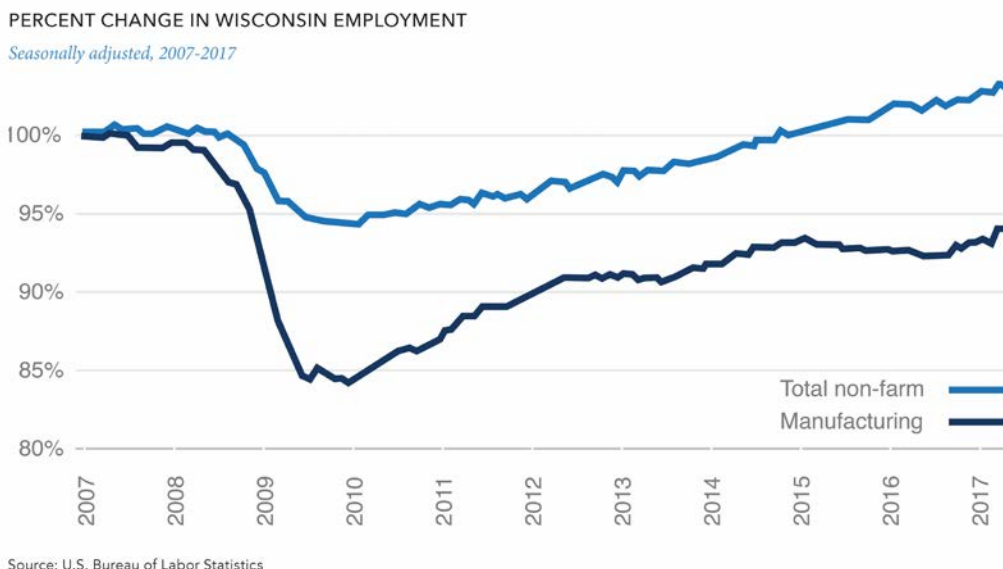
Advanced Energy Market Opportunity

Demand for advanced energy has soared in recent years and is poised for continued growth. In 2016, investment in the advanced energy sector was \$287.5 billion worldwide, nearly five times that of 2004.²¹ By 2040, investments are expected to total \$7.4 trillion.²² The advanced energy market is a clear opportunity for increased revenue and job growth.

END CALL-OUT BOX

Wisconsin's Need for Good-Paying Jobs

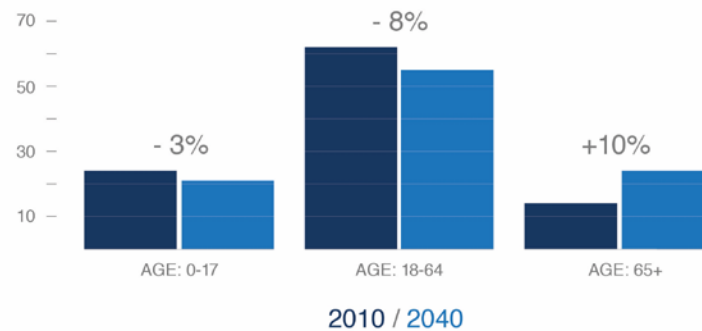
Like other Rust Belt states, Wisconsin suffered a blow to its legacy manufacturing industry during the recession and has yet to fully recover these jobs for hard-working Wisconsinites.²³ Manufacturing facilitates a strong labor market with good-paying job opportunities in the local economy, which can support groups facing severe employment barriers and low wages.



Despite having a low state unemployment rate, Wisconsin is still home to many communities facing employment barriers, such as Beloit, where plant closures have displaced workers, and Milwaukee, where 17.3 percent of African Americans are unemployed, compared to 11.6 percent statewide.²⁴ Targeted training, recruitment, and retention strategies are critical to improving conditions for these communities.

Wisconsin also faces an aging workforce and low population growth, spelling an impending “body gap” across industry.²⁵ Between 2010 and 2040, the population share of Wisconsinites ages 18 to 64 will shrink by 8 percentage points, while that of Wisconsinites ages 65 and up will increase by 10 percentage points.²⁶ Over the past two years, the Wisconsin Manufacturers & Commerce has recorded a jump from 53 percent to 77 percent of its membership having difficulty filling positions.²⁷ This data indicates a need for an economic development approach that continues to equip Wisconsinites with workforce-ready skills, but also prioritizes out-of-state talent attraction and improves the standard of living. State and local leaders are actively engaged in addressing Wisconsin’s workforce challenges, with recent hearings in the State Assembly and Senate on training, recruitment, and retention.²⁸

WISCONSIN'S AGING WORKFORCE



Source: Wisconsin Department of Administration

The Benefits of Sector-Based Development

Economic clusters are regionally situated groups of interconnected companies and institutions organized around a particular industry. In today's competitive, globalized economy, businesses are more likely to thrive in cities and states that offer a rich innovation ecosystem, provide fertile grounds for capital investment, boast a highly skilled workforce, and offer clear policy signals. Geographic proximity and repeated exchanges of information help foster an environment of coordination and cooperation among these companies and institutions, leveraging a trained workforce and each actor's unique expertise. By having a close network of suppliers and partners, companies can reap the benefits of increased productivity and operational efficiency, amplifying local job creation and economic growth.²⁹

Coordination and collaboration of multiple entities is essential to build a robust cluster. Cross-pollination of ideas and resources can bolster the innovation ecosystem, access to capital, workforce development, and value chain for an industry, and government and non-governmental organization can play a significant role in fostering connections across entities.



Banks & Investors Banks and investors provide capital for technology commercialization and business development in industry and innovation fields.



Labs, Incubators, Accelerators Innovation hubs partner with industry to tackle industry challenges and leverage entrepreneurship and commercialization expertise.



State & Local Government State and local government offers policy certainty and financing to support and encourage sector-based development via education and job training, business development and investment, R&D, and market incentives.



Schools, Community & Technical Colleges, Universities Schools and industry partner to ensure students learn STEM concepts and receive skills to meet in-state needs.



Industry Industry partners with innovation hubs to tackle industry challenges, promote entrepreneurship, and support technology commercialization.



Non-Governmental Organizations Non-governmental organizations, such as economic development and advocacy groups, advance strategies and connections to improve cluster assets.

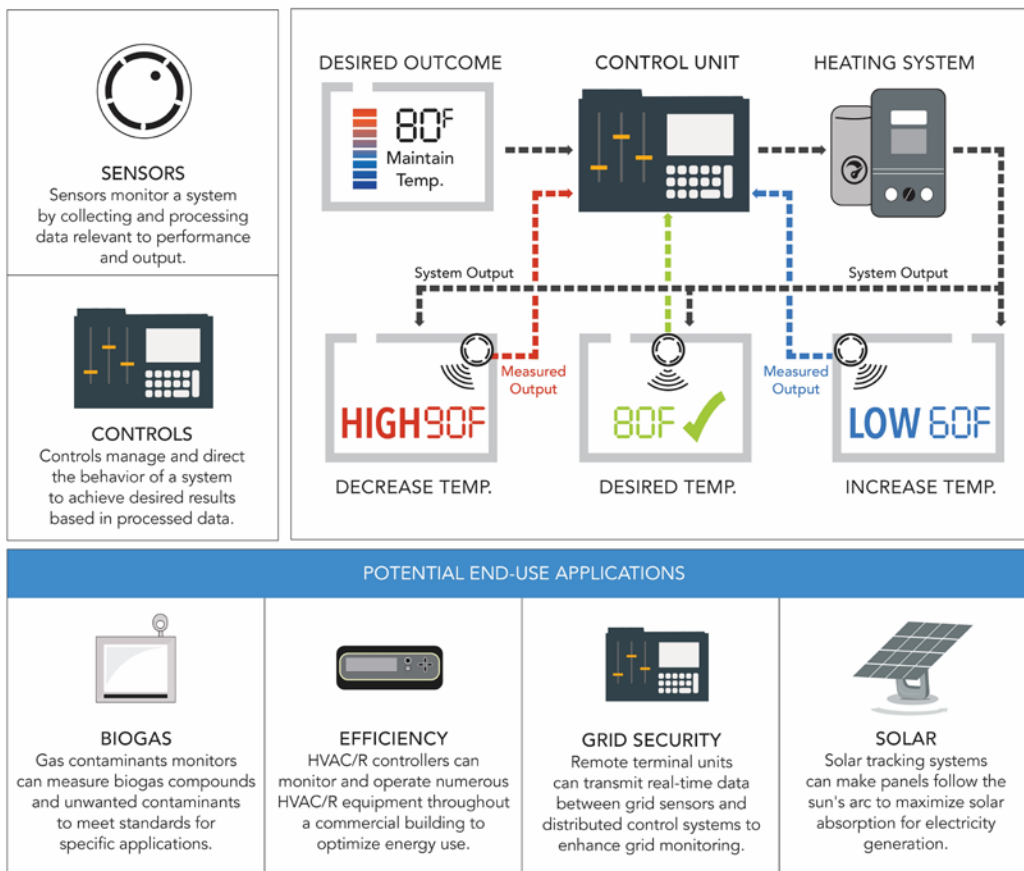
Wisconsin's Economic Opportunity in Sensors & Controls

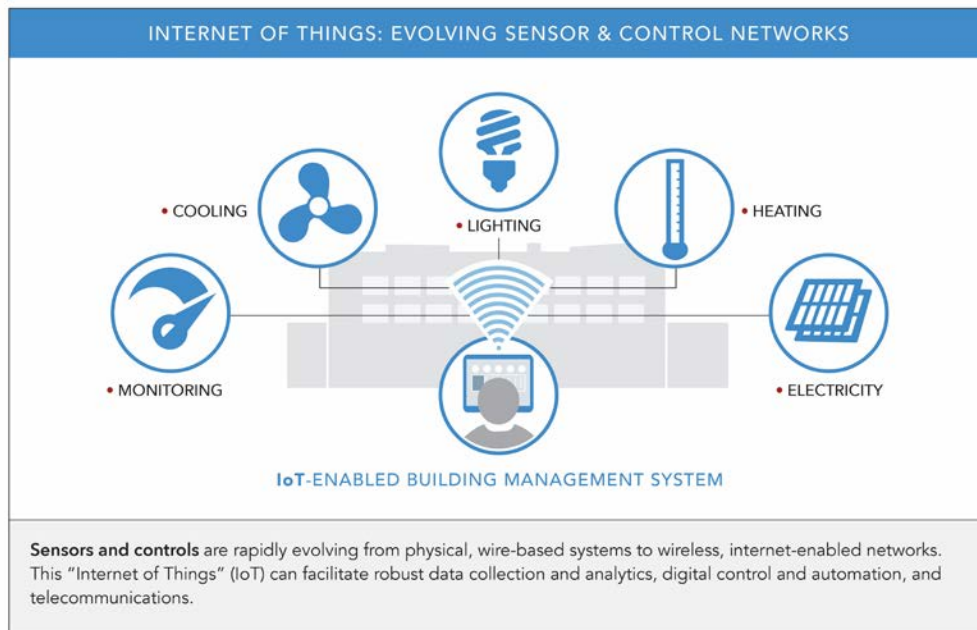
Sensors and controls are hardware solutions that enable nimble and responsive advanced energy systems. Wisconsin is well positioned to capitalize on rising market demand for sensors and controls—in addition to end-use applications in biogas, efficiency, grid, and solar—given the state's robust manufacturing industry, skilled technical workforce, university and industry expertise, and local market potential.

Sensors and controls are a unique opportunity for Wisconsin because of rising market demand for the technology and its end-use applications; the state's legacy manufacturing base in the energy, power, and control sector; its skilled technical workforce; its engaged university research community; and its potential to support a strong local market. Wisconsin is poised to become a leader in sensors and controls manufacturing, and state and local leaders could realize this potential through innovative strategies that leverage Wisconsin's competitive advantages and strategically target areas for growth.

WHAT ARE SENSORS AND CONTROLS?

Sensors and controls are enabling hardware for efficient technologies in advanced energy production, conversion, conservation, and storage.





Why Sensors & Controls in Wisconsin?

Wisconsin is poised to capitalize on multiple opportunities for economic growth and job creation by leveraging its strengths in the sensors and controls manufacturing industry.

Opportunity to Capitalize on Increasing Technology Demand

The market for sensors and controls is growing with increased interest in active, agile, and efficient advanced energy systems. It is projected to grow by 6.9 percent annually through 2022.³⁰ Wisconsin is well positioned to tap into this market growth and take advantage of rising demand for sensor- and control-embedded end-use technologies, such as biogas, efficiency, grid devices, and solar. For example, smart grid sensors will track an annual growth of 15.28 percent between 2017 and 2021, while sensors for energy management systems will see a 13.2 percent increase yearly from 2016 to 2024.³¹ Wisconsin manufacturing companies, which have strong out-of-state markets, are well prepared to serve this growing regional, national, and global demand.

Opportunity to Grow the Manufacturing Industry

Wisconsin's manufacturing industry supports the second-largest employment concentration in the nation, making up over 16.1 percent of the state workforce with an average annual compensation of \$68,878, and accounts for 18.95 percent of the state's total output.³² This legacy base has a significant intersection with the advanced energy sector: At least 209 companies manufacture sensors and controls for advanced energy systems.³³ Wisconsin's energy, power, and control cluster—which accounts for an additional 700 businesses engaged in energy generation, transmission, distribution, and storage—can support supplier networks and local market activities for these manufacturers.³⁴ Wisconsin's emerging information and communications technology sector for software development also complements the state's manufacturing expertise in sensing and control hardware.³⁵ Anchor companies include Johnson

Controls, Rockwell Automation, Regal Beloit, A. O. Smith, and Eaton’s Cooper Power Systems, all of which are engaged in state economic development activities.³⁶ Key cluster-focused organizations—the Midwest Energy Research Consortium, The Water Council, and the Wisconsin Economic Development Corporation—serve as important resources for strategically fostering industry growth.

START CALL-OUT BOX

Foxconn in Wisconsin

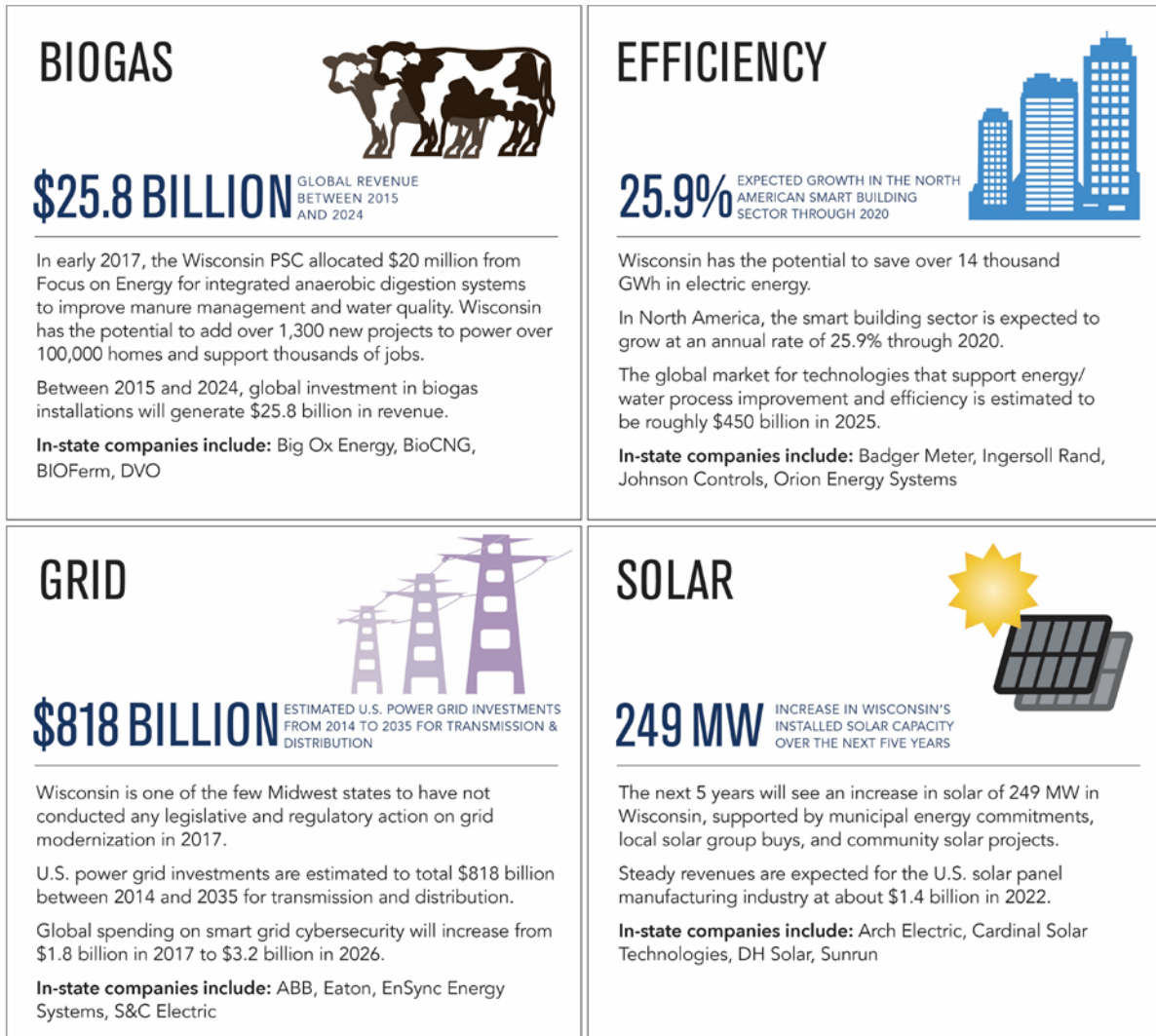
In July 2017, Foxconn Technology Group, a Taiwanese electronics manufacturer, chose Wisconsin as its North American hub for liquid crystal display (LCD) manufacturing.³⁷ Foxconn will invest \$10 billion to construct the facility, with 57 percent of labor and equipment sourced from Wisconsin businesses.³⁸ The facility is expected to create 13,000 direct jobs and have an annual economic impact of at least \$7 billion when it becomes operational in 2020.³⁹ Wisconsin is offering the company a fifteen-year, \$3 billion tax incentive package.⁴⁰ Foxconn cited Wisconsin’s tradition of manufacturing, skilled workforce, central access to transportation routes and energy/water resources, and government cooperation as key factors in the decision.⁴¹

END CALL-OUT BOX

Opportunity to Bolster the Energy Economy

Sensing and control technologies also dovetail with opportunities for cost savings and resource diversification in Wisconsin’s energy economy, particularly in biogas, energy/water efficiency, grid, and solar. Municipalities have led the way in expanding energy options for Wisconsinites via community solar programs, solar group buys, and property-assessed clean energy financing in addition to setting renewable portfolio goals and developing renewable energy projects.⁴² Local efforts to leverage biogas, such as the Janesville’s wastewater treatment digester and Dane County’s landfill, not only generate revenue from the state’s abundant biomass and waste resources but also reduce environmental impacts of agricultural and landfill operations.⁴³ Moreover, cultivating more local generation will help redirect some of the estimated \$14 billion spent on energy imports back into the state.⁴⁴ Technological enhancements alongside regulatory planning could also address high power rates for consumers.⁴⁵ Wisconsin-based companies are well equipped to support this growing local market.

SIGNIFICANT MARKET END-USE OPPORTUNITIES



Opportunity to Leverage University Research Expertise

Wisconsin's research universities play a key role in accelerating energy technologies. Both UW-Madison and UW-Milwaukee have a number of research partnerships dedicated to sensing and control technologies and their end-use applications, ranging from bioenergy, water efficiency, storage, microgrids, power conversion, and grid technologies.⁴⁶ Other universities offer specialized technological expertise, such as UW-Oshkosh's biogas capabilities.⁴⁷ These university-based research programs significantly engage industry players and help to spur industry innovation.

Opportunity to Support Quality, Local Jobs Statewide

The sensors and controls industry could help to address Wisconsin's need for good-paying jobs while offering a diverse array of jobs that cater to different education and experience levels. With forward-thinking solutions, sensors and controls for advanced energy could support an average

of 44,000 jobs annually through 2030.⁴⁸ This estimate includes direct jobs from manufacturing and software development; indirect jobs from supplying equipment, materials, and services to manufacturers and developers; and induced jobs from spending in the local economy. (See Appendix for jobs modeling methodology.) While economic growth may be concentrated near manufacturing facilities, Wisconsin could also foster a local market for sensors and controls and their end-use technologies to support job creation in installation, operation, and maintenance businesses distributed across the state.

JOB OPPORTUNITIES IN SENSORS AND CONTROLS



Mechanical Engineers

Design and develop mechanical tools, engines, and machines.

TYPICAL ENTRY-LEVEL REQUIREMENTS:
Bachelor's Degree

Wage: \$36.48



Electrical & Electronics Engineering Technicians

Assist engineers with design, production, and testing.

TYPICAL ENTRY-LEVEL REQUIREMENTS:
Associate Degree

Wage: \$26.79



Computer-Controlled Machine Tool Operators

Operate computer-controlled machinery to tool metal parts.

TYPICAL ENTRY-LEVEL REQUIREMENTS:
High School diploma or equivalent with on-the-job training

Wage: \$20.28



Industrial Production Managers

Oversee daily manufacturing operations.

TYPICAL ENTRY-LEVEL REQUIREMENTS:
Bachelor's Degree with 5+ years of work experience

Wage: \$51.91



System Software Developers

Develop underlying software systems or applications.

TYPICAL ENTRY-LEVEL REQUIREMENTS:
Bachelor's Degree

Wage: \$41.31

State Assets to Support Sensors & Controls Cluster Development

Foundational cluster elements are workforce development, access to capital, the innovation ecosystem, value chain build-out, and local market growth. Wisconsin has many assets that can be aligned with cluster-based development, including a base of over 200 sensors and controls manufacturers, technical training and career readiness programs, and public-private research partnerships.

Wisconsin can capitalize on its strengths in sensors and controls by strategically building an economic cluster. Clusters require several foundational elements coordinated for growth: education and training for a skilled workforce, access to capital for new and expanding businesses, an innovation ecosystem that cultivates new ideas, a comprehensive value chain, and a local market for Wisconsin-made goods. When fortified by clear market signals and policy certainty, these assets translate into major opportunities for business growth and job creation in the target sector, laying the groundwork to catalyze economic opportunity for thousands of Wisconsinites.

The following visual guides break down the key assets for a robust cluster. This section will use these guides to illustrate the state's strengths in each foundational element and showcase significant resources for Wisconsin's sensors and controls industry.

Workforce Development: Trained and skilled workers are fundamental to industry success, and strategic workforce development can support talent recruitment and retention. Workforce development requires collaboration across schools, businesses, and government offices to integrate STEM education, foster industry-ready skills via apprenticeships and career-integrated curriculum, enable stackable credentials that offer multiple entries and exits, and provide resources that match skills to available jobs.

Access to Capital: Access to investors or competitively priced non-dilutive capital can be the difference between success and failure for a new or expanding business. It is also important for consistent access to capital across development from the seed and early/growth stages to the late stage. An active investment environment can attract more entrepreneurs and investors to the state.

Innovation Ecosystem: Innovation is essential for business and industry competitiveness, and a strong knowledge hub can be a beacon for talent and investment. The innovation ecosystem supports fundamental research across universities and labs, fosters an entrepreneurial culture that seeks to advance and disrupt industries, and brings ideas to market.

Value Chain: An industry value chain is composed of an array of companies engaged in the manufacturing, sale, marketing, and distribution of technologies. It also includes organizations that represent business interests across platforms. This base provides a solid foundation from which to attract more companies and customers.

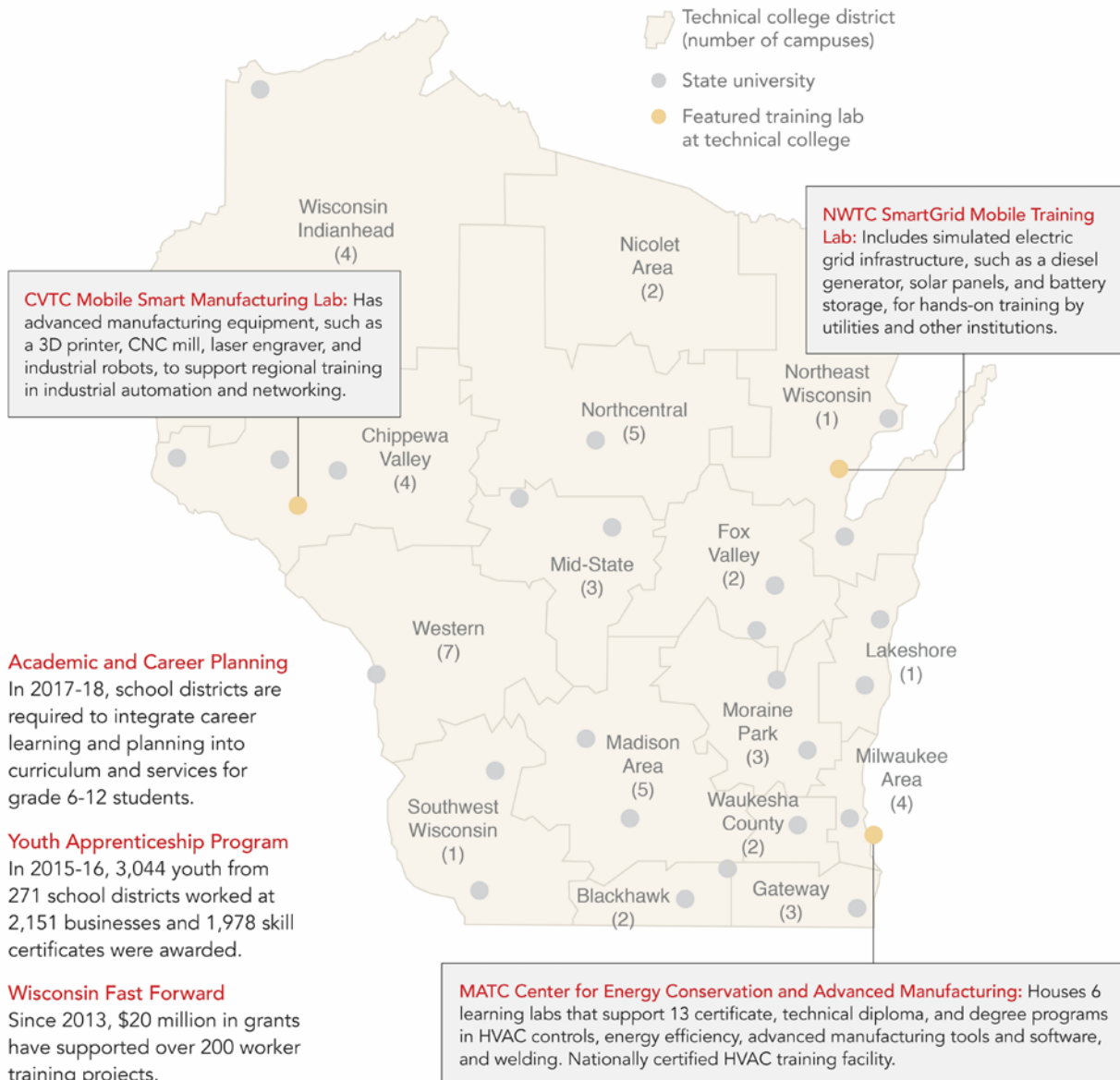
Local Market: Creating a local market for products sends a market signal to businesses that encourages investment in new facilities and employees. High local demand can build a local company base that could then expand to regional, national, and global markets. Clear utility and business regulatory environments coupled with resources for project development and end-user adoption can create a strong local market.



WISCONSIN'S WORKFORCE DEVELOPMENT ASSETS

Leveraging Educational Resources to Build an Industry-Ready Workforce

Key components of workforce development are STEM education, work-integrated learning, flexible career pathways, apprenticeships, skill-matching resources, and interagency cooperation. Wisconsin excels at hands-on, technical training and is committed to career readiness via its youth learning programs and robust higher education network.

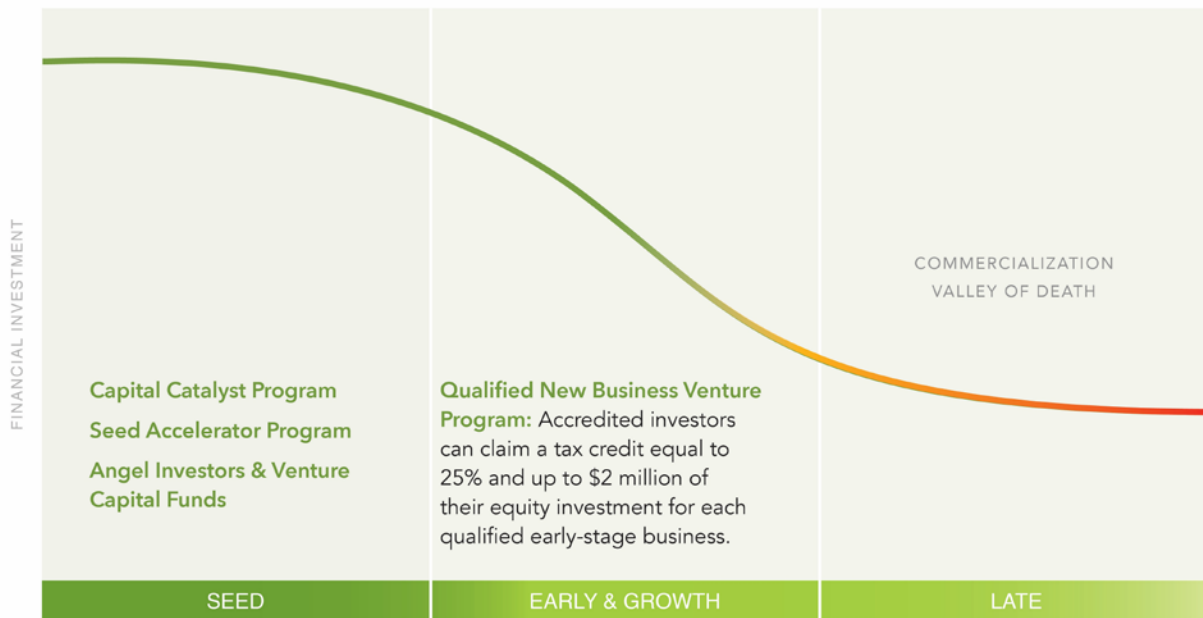




WISCONSIN'S ACCESS TO CAPITAL ASSETS

Investing in New and Growing Businesses

Key components of access to capital are diverse funding sources and robust funding available across the seed, early/growth, and late stages. Wisconsin offers a diversity of grants, loans, and investment programs to support businesses at the seed stage; however, in-state companies face a shortfall in funding during the early/growth and late stages, often called the commercialization valley of death.



Badger Fund of Funds: In 2013, Gov. Walker allocated \$25 million to a state fund of funds that will invest in venture capital firms supporting Wisconsin based businesses. To date, the fund of funds raised another \$10 million in private funds and invested in three venture capital firms in La Crosse, Neenah, and Madison.

Venture Capital Funds

SBIR Advance Matching Grants: Wisconsin-based SBIR/STTR awardees can receive up to \$75,000 or 50% of their Phase 1 award and up to \$75,000 per year for up to 2 years of their Phase 2 award.

Technology Development Loans

Entrepreneurial Micro-Grants



WISCONSIN'S INNOVATION ECOSYSTEM ASSETS

Working Together to Bring Ideas to Market

The innovation ecosystem encompasses entrepreneurship, research and development, and commercialization. Wisconsin's universities house many research hubs for fundamental and industry-related research. Although Wisconsin has a nascent entrepreneurial culture, the state has assets dedicated to cultivating an innovative spirit and supporting the growth of ideas.



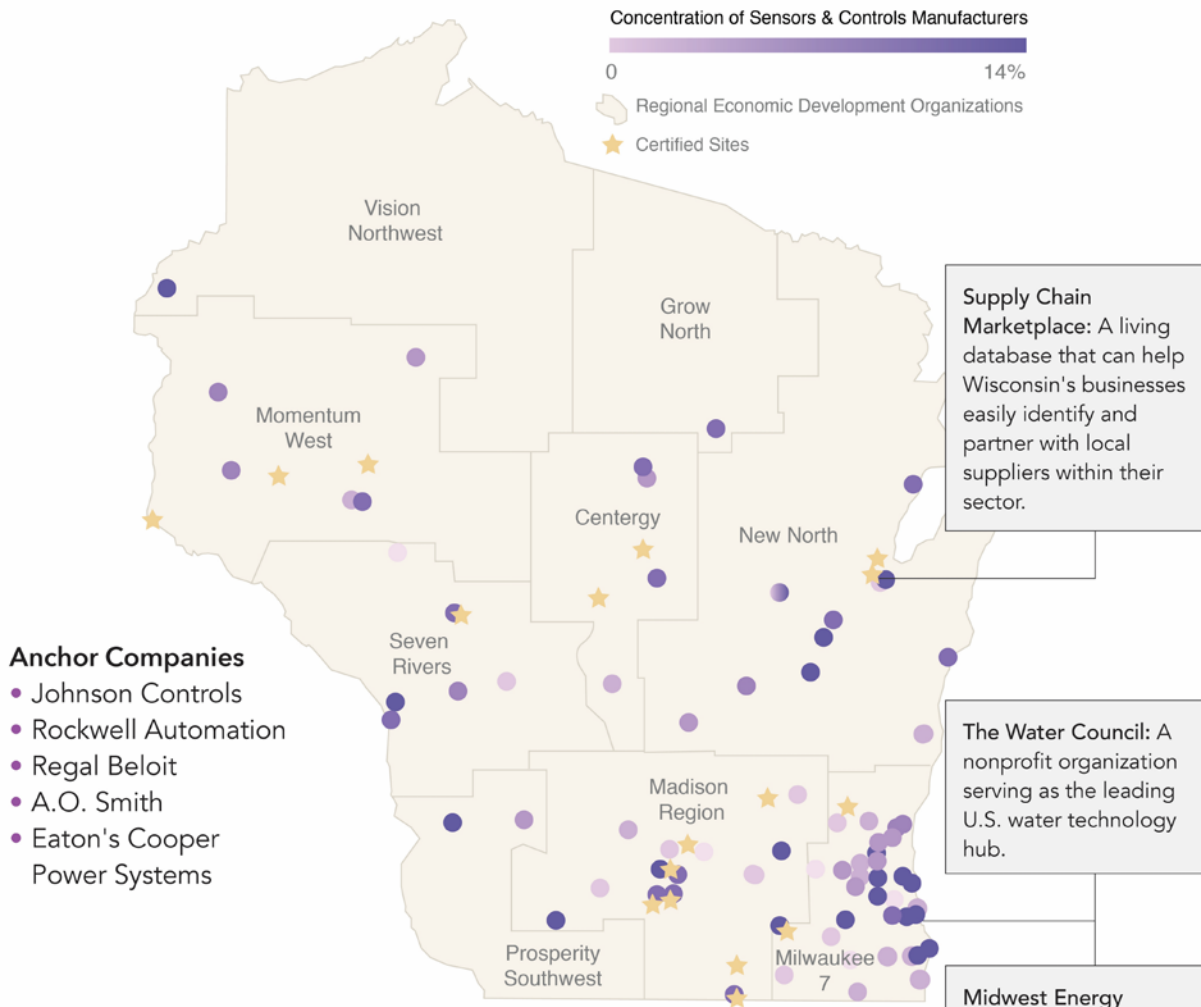
Entrepreneurship	Research & Development	Commercialization
<ul style="list-style-type: none"> • Kinnektor: An entrepreneur-led, community- and capacity-building organization supporting entrepreneurship and innovation in Wisconsin. • Gener8tor: A renowned accelerator for high-growth startups with additional programs for homegrown early-stage companies. • WERCBench Labs: An immersive technology and business development program for high-tech entrepreneurs in the energy, power, and control industry. • SBDC Entrepreneurial Training Program 	<ul style="list-style-type: none"> • Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) • Center for Grid-Connected Advanced Power Electronics Systems (GRAPES) • Great Lakes Bioenergy Research Center (GLBRC) • Power Systems Engineering Research Center (PSERC) • Johnson Controls Energy Advancement Research Lab • UW-Oshkosh Environmental Research and Innovation Center (ERIC) • UW-Milwaukee School of Freshwater Sciences 	<ul style="list-style-type: none"> • Wisconsin Alumni Research Foundation (WARF), UWM Research Foundation & WiSys Foundation: Technology transfer offices that collectively provide patenting, licensing, and commercialization support for inventions developed out of the UW system.



WISCONSIN'S VALUE CHAIN ASSETS

Expanding In-State Industry Capabilities

An industry value chain is anchored by businesses in manufacturing, supply, installation, operations and maintenance, project development, construction, and resource extraction. Strong value chains are also supported by industry associations and business attraction and retention resources. Wisconsin's sensors and controls value chain is concentrated in the Milwaukee region, but it is supported by companies throughout the state. Through value chain mapping and business attraction resources, Wisconsin could expand and fill gaps in its value chain, such as sensing and control software development.



Startup Snapshot

Scanalytics is an intelligent floor sensor technology startup using foot traffic analytics to help businesses boost customer engagement and productivity as well as optimize energy use. The startup has leveraged numerous Wisconsin assets for growth, including a technology development loan, the Gener8tor program, and the Rise of the Rest pitch competition in Green Bay.



WISCONSIN'S LOCAL MARKETS ASSETS

Encouraging Investment in Wisconsin-Made Goods

Key components of a good local market are end-user & project development resources, a favorable energy regulatory environment, and a business-friendly climate. Wisconsin can foster a local market by ensuring firms can easily do business in the state, customers can access financing for advanced energy projects, and state and local policies offer clear, transparent goals, rates, and requirements for advanced energy.

- End-User & Project Development Resources
- Energy Regulatory Environment

Focus on Energy: Since 2001, the statewide energy efficiency and renewable resource program has helped over 2.8 million Wisconsinites achieve over \$730 million in energy savings.

Commercial Property-Assessed Clean Energy (C-PACE): 22 counties and the City of Milwaukee allow commercial property owners to obtain low-cost, long-term loans for energy/water efficiency and renewable energy upgrades.

State Building Goals: All new state facilities must be at least 10% more efficient than the commercial code requirement, so long as such measures are cost-effective on a lifecycle basis.

Energy Service Companies: Wisconsin allows municipal buildings and schools to contract with energy service companies for energy-saving projects.

Renewable Portfolio Standard: Each Wisconsin utility was required to increase their renewables supply by 10% by 2015. Wisconsin met this goal 2 years early.

Clean Energy Manufacturing Revolving Loan Fund (CEMRLF): In its year of inception, 25 loans totaling \$39.2 million supported manufacturers' energy efficiency and waste reduction projects.

Policy Recommendations

To grow the sensors and controls industry, state and local leaders can address barriers and capitalize on opportunities across foundational cluster elements, such as expanding access to technical training opportunities, targeting talent retention and recruitment, leveraging corporate investment in the startup ecosystem, fostering a rich entrepreneurial culture, supporting technological innovation and knowledge sharing, and creating incentives for in-state technology deployment. These forward-thinking policies, programs, and ideas are intended to serve as stepping stones to discussion and collaboration.

Wisconsin's leaders can capitalize on the state's competitive strengths and demonstrate their commitment to the sensors and controls industry by enacting smart, forward-thinking policies and implementing non-legislative solutions. In particular, state and local leaders can apply innovative strategies that address barriers and missed opportunities across foundational elements, as noted by the icons. These broad strategies include improving workforce training, increasing business access to financial resources, fostering technology development and commercialization, and growing the in-state value chain. Wisconsin can also build a local market for sensor- and control-embedded end-use technologies such as solar, biogas, grid, and efficiency as an opportunity for industry growth. Robust demand near manufacturing facilities can help to create synergies that drive innovation, train and retain talent, and draw in out-of-state investors.

Whether taken as a whole or as piecemeal solutions, the following recommendations could attract private investment, stimulate the state's economy, and create good-paying jobs for Wisconsinites.

Workforce Development: Focuses on expanding access to technical training programs and establishing targeted incentives for talent retention and recruitment to bolster Wisconsin's technical workforce for the sensors and controls industry.

Access to Capital: Promotes in-state corporate engagement in Wisconsin's investment environment to increase available capital and funding sources for sensors and controls startups along their lifecycles.

Innovation Ecosystem: Facilitates applied technological innovation and knowledge sharing to build connective tissue in Wisconsin's research and entrepreneurial community for the sensors and controls industry.

Local Market: Creates incentives and clarifies energy regulations for biogas, efficiency, grid, and solar to stimulate in-state investment in Wisconsin-made, sensor- and control-embedded technologies.

Workforce Development

Policy 1: Make Early College Programs More Accessible

Opportunity

By 2020, over 60 percent of Wisconsin jobs will require education beyond the high school level.⁴⁹ Many good-paying jobs, such as advanced manufacturing, require hands-on training. However, Wisconsin's high school students lack the opportunity to experience the technical training that could enable them to succeed in career pathways such as advanced manufacturing.⁵⁰ Recent state efforts offer a platform for growth to improve access to educational advancement.

Solution

Early college, also known as dual credit, enables students to earn a high school diploma while earning credits toward an associate degree, often in technical fields. Moreover, early college can help increase high school graduation rates: In the United States, early college students are 12 percent more likely to graduate from high school than non-early college students.⁵¹ Wisconsin could continue to build on recent efforts to increase access to early college and encourage entry to career pathways. Early college could be made more accessible by streamlining the state's funding model and presenting courses needed for students to enter in-demand careers.

Streamline the Funding Process for Early College

In past years, the Wisconsin Department of Public Instruction allowed high school students to enroll at institutions of higher education, but local school boards were required to pay the full cost of a student's tuition.⁵² Given the tuition arrangement, districts with tight budgets—often those who serve low-income students—could support fewer students hoping to attend a local college. Recognizing this issue and the importance of dual credits, the 2017–2018 State Budget established a 50 percent subsidy of the cost of the student's postsecondary credit, paid for by the Department of Workforce Development and managed by the Department of Public Instruction.⁵³ Students are required to pay for 25 percent of the cost unless it is found to be an undue financial burden for the family.⁵⁴ In this case, the school board would be obligated to pay for the student's portion as well as the school board's unsubsidized portion.⁵⁵ The time-consuming funding process is cumbersome, creating the potential for administrative challenges that could reduce program uptake. Wisconsin leaders could consider future actions to streamline the complex funding process, looking to models that reduce red tape and decrease the burden on school districts, as realized in Georgia (see case study).

Facilitate Entry to Model Pathways for Students to Enter High-Demand Careers

It can be difficult for students to know what classes to take, and how classes will contribute toward a postsecondary degree or certificate in a relevant field. The Wisconsin Department of Public Instruction recently received a Regional Career Pathways Grant to create a program intended to increase student participation in career tracks in high-wage industries.⁵⁶ This effort will build upon previous career pathway work within the Technical College System.⁵⁷ Regional directors will collaborate with local corporate leaders to design pilot programs in four regions.⁵⁸ To expand early college opportunities, the Regional Career Pathways Program Directors should consider collaborating with other local leaders to facilitate entry into model pathways for early college, as the Pharr-San Juan Alamo Independent School District has done (see case study).

With thousands of new manufacturing jobs expected from Foxconn and almost two-thirds of jobs by 2020 requiring postsecondary education, Wisconsin should consider expanding early college to get young Wisconsinites interested in and prepared for the jobs of the future.⁵⁹ By clearly educating students on courses that count toward career-relevant certificates and streamlining the early college funding process, Wisconsin can prepare its residents for good-paying jobs like advanced manufacturing.

Key Players

Wisconsin Higher Educational Aids Board, Wisconsin Legislature, Wisconsin Department of Public Instruction, Regional Career Pathways Program Directors, Wisconsin Technical College System, University of Wisconsin System

Case Study: Georgia's Student Finance Commission

Georgia's Student Finance Commission (GSFC) receives annual appropriations to fund students in early college programs. Established in 1965, GSFC enables students to achieve professional goals by administering financial aid programs and providing financial aid advice, among other objectives.⁶⁰ Each school of higher learning enters into an agreement with GSFC that the school will accept funds from GSFC as payment for a high schooler's tuition, books, and fees.⁶¹ Transportation grants are also available for participating students through GSFC.⁶² Wisconsin could establish a funding structure similar to that of Georgia for dual credit programs through the Higher Educational Aids Board, which could likewise reduce pressure on public school boards.

Case Study: Pharr-San Juan-Alamo Independent School District

The Pharr-San Juan Alamo (PSJA) Independent School District early college program ensures students can easily sign up for classes that build toward degrees in high-demand careers. First, PSJA leadership audited its technical courses and assessed high-growth fields of employment in the area. Then, PSJA created six comprehensive career clusters that each contained several specific career pathways. Schools were able to choose best-fit pathways based on resources and local needs. Starting from the ninth grade, students took classes that investigated local careers, and counselors helped students decide on a cluster. Then, every tenth grader took a course exploring basics of the career cluster. Juniors and seniors could take at least twelve college credits by graduation.⁶³ After the creation of this early college program, the annual high school dropout rate fell by 75 percent.⁶⁴ In the first two years of the program, the number of students attending college after high school doubled, and in three years, high school graduation rates increased by 25 percent.⁶⁵

Policy 2: Provide a Tax Credit to Employers Hiring Apprentices

Barrier

Apprenticeships offer significant benefits to local workers and businesses. They empower students to develop valuable on-the-job skills while still bringing home a paycheck, and they help employers and industry clusters meet the demand for trained workers. These benefits reverberate up to the state level: Apprenticeship programs can produce more than \$27 in tax returns for every \$1 invested by the state over the career of an apprentice.⁶⁶ Wisconsin has exceptional youth apprenticeship (YA) and registered apprenticeship (RA) programs; however,

employer involvement is a critical barrier to increasing the number of apprentices they can support.⁶⁷ While Wisconsin does offer support to regional consortia in establishing apprenticeships, the state does not currently offer direct incentives to businesses hiring apprentices.

Solution

To encourage business participation, state legislators could establish an employer tax credit for hiring youth and/or registered apprentices. Employers could receive a higher tax credit for hiring youth apprentices. Currently, twelve states offer a tax credit for apprenticeships, but Wisconsin could look to South Carolina's as a model (see case study).⁶⁸ Other states provide larger incentives for veterans hired as apprentices or target certain manufacturing occupations, as in Montana and Rhode Island, respectively.⁶⁹ There has also been bipartisan support for this incentive at the federal level; however, bills are stalled in both chambers.⁷⁰

The tax credit could also help build a stronger bridge between the state's two apprenticeship programs by requiring employers to value YA graduates in RA programs properly. For example, employers could allow YA graduates to test out of the first year of instruction, receive credit for YA hours, or gain higher priority in placement.⁷¹

Improved engagement of the private sector in hands-on training can help build a skilled workforce and retain talent in homegrown businesses. Economic development groups and cluster organizations could specifically target companies in advanced energy and manufacturing to capitalize on the state industry's high-growth potential.

Key Players

Wisconsin Legislature, Wisconsin Department of Workforce Development, Employers, Workforce Development Boards

Case Study: South Carolina's Apprenticeship Tax Credit

South Carolina has demonstrated how a small investment in apprenticeships can have significant payoffs for workers and the state. The state's apprenticeship system offers a modest \$1,000 tax credit per apprentice per year to help offset planning and administration costs.⁷² In order to count towards the credit, an apprentice must be employed for at least seven months each year of their program, for up to four years.⁷³ In addition to the tax credit, administrative assistance from the state's Apprenticeship Consultants helps to increase program uptake by providing dedicated experts who work with businesses interested in establishing apprenticeships in the state.⁷⁴ The system has served over 26,000 apprentices.⁷⁵

Policy 3: Retain College Graduates and Recruit Out-of-State Talent

Barrier

Maintaining a robust workforce primes a state for growth by maintaining a stable tax base and ensuring employers can fill jobs. However, the viability of the Wisconsin workforce is at risk due to an aging population, net loss of residents, and lack of in-migration by college-educated people.⁷⁶ The U.S. Census Bureau estimates that Wisconsin experienced a net loss of 61,000

residents from 2005 to 2015, and by 2022, up to 46,000 Wisconsin jobs will be left open as a result of changing worker demographics.⁷⁷

Solution

To strengthen the Wisconsin workforce, the state could retain more college graduates and recruit college-educated workers to live and work in Wisconsin. Programs that assist with student loan debt, a financial burden carried by 58 percent of U.S. college graduates, could serve as a tool to entice more people to live and work in Wisconsin.⁷⁸ Wisconsin could look to programs such as Opportunity Maine to retain college graduates and recruit newcomers to the state (see case study).

By creating a similar program to retain college graduates and recruit qualified out-of-staters to live and work in Wisconsin, the Badger State can mitigate the impacts of an aging workforce and negative net migration. To emphasize retention of college graduates over recruitment of out-of-state residents, a larger tax credit could be offered to those graduating from Wisconsin universities. Retaining and recruiting top talent to fill available jobs will be an asset to Wisconsin employers while ensuring a reliable tax base and resilient economy.

Key Players

Wisconsin Economic Development Corporation, Wisconsin Legislature, University of Wisconsin System

Case Study: Opportunity Maine

Due to an aging workforce, Opportunity Maine was established in 2008 to retain Maine graduates and recruit newcomers to the state. Administered by the Maine Revenue Service, the program provides individuals or employers with a tax credit for student loan payments.⁷⁹ The candidate must be a Maine resident working in the state, paying taxes at least nine months out of the year, and graduated with an associate or bachelor's degree from an accredited U.S. college or a graduate degree from a Maine university after 2015 to qualify.⁸⁰ Individuals receive refundable tax credits for associate degrees and bachelor's degrees in STEM fields, while non-STEM degree recipients and graduate degrees earned in Maine are nonrefundable, carrying forward for up to ten years.⁸¹ If an employer pays the employee's monthly student loan balance, the value is deducted from the state tax return. There is a cap of \$377 per month with an individual credit, but there is no credit cap if the employer pays.⁸² A core pillar of the state's recruitment strategy, the program was expanded in 2016.⁸³ While not attributable to the Opportunity Maine program alone, Maine was ranked second in the nation for domestic net migration of people with a bachelor's degree or higher from 2010 to 2014.⁸⁴

Access to Capital

Policy 4: Expand Corporate Venture Capital

Barrier

Access to capital is essential for local entrepreneurs to grow their businesses, bring products to market, and create new jobs. Wisconsin excels at seed investing due to a strong angel network

and an outgrowth of resources; however, Wisconsin companies face a critical funding gap between the early/growth and late stages, which has been only partially met by venture capital.⁸⁵ Wisconsin received less than 0.2 percent of national venture capital investments in 2015 and had roughly the same share in previous years.⁸⁶

Solution

As the Badger Fund of Funds continues to cultivate regional venture capital firms, Wisconsin could leverage its sizeable corporate base to increase the amount of venture capital funding in the state and attract investments from national venture capital firms.⁸⁷ Greater corporate engagement could inject both capital and expertise into the startup ecosystem and support ventures across the startup lifecycle.

Corporate venture capital (CVC) is when a large firm purchases an equity stake in a small venture.⁸⁸ In 2016, CVCs participated in 19.5 percent of all global deals and invested \$24.9 billion across 1,352 deals.⁸⁹ On the investor side, large firms see CVCs as an opportunity to form an ecosystem, secure market intelligence, and make financial returns.⁹⁰ On the investee side, CVCs offer in-house industry expertise and networks, attract additional investors, and come with a readiness to invest across the startup lifecycle—a significant asset for greater access to capital in Wisconsin.⁹¹

Encourage Large Corporations to Develop Direct Investment Arms

The state could encourage corporate leaders to establish direct investment arms to create new platforms for financial gains while spurring industry innovation and entrepreneurship in the state. American Family Ventures, a Wisconsin-based CVC, demonstrates the positive local impacts of this investment strategy (see case study). Smaller companies hoping to get involved in direct investment could first become a limited partner in a local qualified venture fund, which offers knowledge on local startup activity and access to tax credits through the Qualified New Business Venture program.⁹²

Business organizations, such as the Wisconsin Manufacturers & Commerce and the Wisconsin Technology Council, could market the benefits of corporate engagement in the startup ecosystem and collaborate on building a manual for establishing CVC arms. For example, the CVC model was featured in the 2017 OnRamp Manufacturing Conference hosted by Gener8tor and the Wisconsin Manufacturers & Commerce.⁹³ Among 135 CVCs actively investing in the U.S. market, CVCs like GE Ventures, next47 (Siemens), and ABB Technology Ventures target innovations in advanced energy, next-generation manufacturing, and the Internet of Things and could also serve as CVC models for interested Wisconsin companies.⁹⁴

Establish a Corporate Fund of Funds to Attract National Venture Capital Investment

Wisconsin could also pool corporate funds to invest in national venture capital firms and foster relationships that encourage investors to engage with the in-state entrepreneurial community. The Wisconsin Economic Development Corporation and Kinnektor could facilitate the development of this corporate fund of funds, drawing from the model of Greater Cincinnati region's Cintrifuse Syndicate Fund (see case study). This investment mechanism could attract venture capital into the state and boost Wisconsin's status as a robust innovation ecosystem.

Through either mechanism, greater corporate engagement in the investment environment could diversify and increase access to capital for Wisconsin startups across their lifecycles.

Key Players

Wisconsin Economic Development Corporation, Corporate Leaders, Wisconsin Manufacturers & Commerce, Wisconsin Technology Council, Kinnektor

Case Study: American Family Ventures

American Family Ventures is one of the few homegrown CVCs and one of the few investing in in-state startups within its focus on connectivity, data analytics, and insurance innovation.⁹⁵ American Family Insurance established a CVC arm to stay ahead of the industry and explore options for strategic returns; direct investments have enabled access to new technologies and partnerships to better serve its customers.⁹⁶ At the local level, American Family Ventures helps to diversify available capital and stimulate the local entrepreneurial culture.⁹⁷ Since 2010, it has invested in over forty early- and later-stage companies and has sponsored state assets, such as Gener8tor and the Wisconsin Technology Council.⁹⁸ The CVC is also cited as supporting the growth of 125 local startup jobs from 2012 to 2014.⁹⁹

Case Study: Cintrifuse Syndicate Fund

Cintrifuse is a business-led initiative to build a thriving startup hub in the Greater Cincinnati region. Cintrifuse's Syndicate Fund pools capital from local businesses, foundations, and universities and invests in early-stage venture capital funds across the nation, providing a national innovation pipeline.¹⁰⁰ While selected venture capital funds are not required to invest in the region, Cintrifuse aims to build relationships that encourage investors to look towards Cincinnati's entrepreneurial community for potential investments, thereby increasing available capital for local startups.¹⁰¹ Supported by nearly thirty investors, the \$57 million Syndicate Fund has produced a 7:1 return on investments for the region, with at least five of the fourteen funds investing in Cincinnati.¹⁰²

Innovation Ecosystem

Policy 5: Facilitate Mentorships for Entrepreneurs Statewide

Barrier

Mentorships leverage seasoned individuals' past experience and current expertise, guiding entrepreneurs to bring their ideas to fruition and building strong networks within the state. They are an especially valuable and economic strategy for growing startup ecosystems: As entrepreneurs gain experience, they can help to pay it forward for others in the field. Wisconsin has consistently ranked last in business startup activity as measured by the Kauffman Index of Entrepreneurship.¹⁰³ Wisconsin's nascent entrepreneurial culture results in a deficit of interactions between potential mentors and mentees as well as a lack of understanding of how to maximize the intangible benefits of these connections.

Solution

Wisconsin's startup ecosystem continues to foster more opportunities for organic collisions and knowledge sharing, strengthening the connective tissue between individuals and resources. Resources such as Kinnektor and the Wisconsin Technology Council serve a key role in gathering the entrepreneurial community and facilitating these interactions.¹⁰⁴

This activity could be supported by a programmatic network of mentors to provide more opportunities for entrepreneurs to be connected to the right person with the right network and industry expertise. Curated mentor matches can go a long way in building lasting relationships and serve as a platform to better recruit, engage, and retain talent for mentorships. To improve curation, mentorship programs could, among other strategies, tap into alumni networks or focus on specific industries. MERLIN Mentors offers an effective model for fostering entrepreneurial mentorships that could be replicated across the state (see case study).

Universities, incubators, accelerators, and/or economic development organizations could adopt this program model to manage a volunteer mentor network and organize curated mentor-mentee matches. These regional programs could target local industries where there is an established corporate base and startup activity to ensure better matching potential. Through a distributed mentorship network, entrepreneurs throughout the state could have a front door to people with relevant expertise and connections. By leveraging local startup experience, Wisconsin could further develop entrepreneurs and foster an innovative spirit.

Key Players

Universities, Incubators/Accelerators, Economic Development Organizations, Entrepreneurial Community

Case Study: MERLIN Mentors

MERLIN (Madison Entrepreneur Resource, Learning and Innovation Network) is a south-central Wisconsin-based resource dedicated to cultivating the entrepreneurial community by facilitating mentorships and knowledge sharing. MERLIN was established in November 2008 with support from the Wisconsin Alumni Research Foundation, University Research Park, the Wisconsin School of Business, and the Office of Corporate Relations at UW–Madison.¹⁰⁵ Mentor-mentee relationships are curated through group screenings and are dynamically matched based on a mentee's needs and a mentor's business and technical experience.¹⁰⁶ Mentors cannot have any financial ties to the startup, preventing potential conflicts of interest. The MERLIN Mentors program focuses on developing entrepreneurs rather than businesses to instill lasting skills; therefore, entrepreneurs gain free tailored advice on funding, business formation and management, strategic planning, and technical issues. Over its first seven years, MERLIN mentored 270 entrepreneurs and supported the creation or growth of 100 companies with a network of over 100 volunteer mentors.¹⁰⁷

Policy 6: Develop Testbeds for Large-Scale Energy Systems

Barrier

Entrepreneurs and businesses attempting to develop and commercialize new advanced energy technologies must overcome significant barriers to enter the global market. In addition to the lack of testing and scaling resources, they may be hindered by limited time and funding, mainly

due to lengthy, onerous application processes.¹⁰⁸ Testbeds are user facilities for testing new products that centralize needed equipment and streamline access, helping to decrease costs, expedite time to market, and encourage knowledge sharing.¹⁰⁹ While Wisconsin has exceptional university-based research labs, there are no testbeds at a similar scale dedicated to commercialization efforts and open to the public.

Solution

Wisconsin could sponsor and create an advanced energy testbed to accelerate technology development and stimulate innovation. The testbed could support large-scale testing of sensor- and control-integrated energy systems for entrepreneurs and businesses. The state could look to the Washington Nanofabrication Facility as a model for ensuring flexible and efficient user access (see case study). The testbed could also anchor and serve as a front door to a network of testing resources across the state, such as the Wisconsin Energy Institute's high bay lab, the Global Water Center, and the M-WERC Energy Innovation Center.¹¹⁰ Streamlined access to research and commercialization resources helps promote the entrepreneurial culture in Wisconsin.

Municipalities and regional economic development groups—with support from local universities, industry, incubators, and accelerators—could collaborate to facilitate funding for the testbed from the state and/or via match programs. They could leverage the testbed as a public education and business attraction tool for Wisconsin's robust energy, power, and control sector. By centralizing and streamlining access to testing resources for advanced energy innovators, Wisconsin could accelerate technology development and further spur the entrepreneurial culture.

Key Players

Wisconsin Legislature, Municipalities, Regional Economic Development Groups, University of Wisconsin System, Corporate Leaders, Entrepreneurial Community, Midwest Energy Research Consortium, Incubators/Accelerators

Case Study: Washington Nanofabrication Facility

Based out of the University of Washington, the Washington Nanofabrication Facility is a public access resource that houses micro- and nanotechnology testing capabilities and fabrication services. Entrepreneurs and businesses that wish to use the testbed must simply participate in an initial consultation to discuss project feasibility, design, and safety. The Washington Nanofabrication Facility offers à la carte pricing and services to accommodate all user types. All interested users can access the lab if it meets their needs and they accept the user agreements.¹¹¹ The facility supports 200-250 unique users and over 220 projects each year, with a 3:2 ratio of industrial users from small and large companies to academic users.¹¹² Through in-house training and expertise, users can utilize equipment after a few hours, develop processes within days depending on the complexity of the problem, and develop a prototype in 3-6 months.¹¹³ If the lab lacks a certain capability, lab staff help to facilitate connections to other resources that can fill the identified gap. From 2012 to 2016, this customer service-oriented approach supported a 283 percent increase in the lab's revenue.¹¹⁴

Policy 7: Establish a Wisconsin Biogas Innovation Voucher Program

Barrier

Numerous in-state anaerobic digester (AD) firms could capitalize on Wisconsin's potential market opportunity: In the dairy sector alone, Wisconsin could add up to 1,168 new AD systems in the state, increasing the state's supply of homegrown energy resources.¹¹⁵ However, technical issues ranging from design/engineering to proper operations hinder industry growth at both a state and national level, preventing farmers from investing in biogas and making existing AD systems less reliable and profitable.¹¹⁶ In a survey of the Wisconsin biogas industry, the lack of shared knowledge to improve the overall profitability of biogas projects and the lack of inter-sector collaboration were noted as barriers to industry growth.¹¹⁷ While groups such as the Wisconsin Biogas Council continue to disseminate knowledge on AD systems, the wide variety of AD types, operational needs, feedstocks, and herd dynamics make it a challenge for projects to efficiently and safely operate.

Solution

Wisconsin could leverage its position as a first-in-class biogas research hub and transfer knowledge to local farmers and firms to address each project's unique barriers through the creation of a Wisconsin Biogas Innovation Voucher Program. This program could effectively drive down the cost structure and reduce the amount of time required to optimize a system. Wisconsin could issue innovation vouchers that provide AD manufacturers, developers, or operators with funds to consult at state universities on current or planned projects. These funds could be used at Wisconsin universities with relevant subject-matter expertise such as the UW-Oshkosh Environmental Research and Innovation Center (ERIC). As the first and only lab certified by the American Biogas Council, ERIC is uniquely positioned to leverage its exceptional research and training capabilities.¹¹⁸ Similar programs in New Mexico and Tennessee have been used to connect local businesses to state-based research institutes, thus creating knowledge hubs and ensuring project success in emerging technologies (see case studies).

A similar voucher program could benefit the Wisconsin biogas industry through the creation of a knowledge hub that would help Wisconsin-based AD developers, operators, and manufacturers to stay on the cutting edge while ensuring that farmers install a technically and economically viable AD system. ERIC and other Wisconsin institutes could consult on design, operations, and maintenance, among other technical capabilities and know-how, to get new Wisconsin biogas projects up and running. A particular focus on input and output testing and design safety could help allay concerns regarding biogas implementation and propel Wisconsin's leadership on this national issue. By providing the opportunity for new AD projects to benefit from local experts and state-funded research, Wisconsin firms and farmers can efficiently optimize their AD systems and maximize their investments, ultimately stimulating biogas deployment in Wisconsin and increasing opportunities for locally-made, sensor- and control-embedded technologies.

Key Players

UW-Oshkosh Environmental Research and Innovation Center, Wisconsin Legislature, Public Service Commission of Wisconsin's Office of Energy Innovation, American Biogas Council, Farmers, Project Developers

Case Studies: New Mexico and Tennessee Innovation Vouchers

The New Mexico Small Business Assistance Program is a successful model that has helped 2,341 businesses gain access to technology at the Sandia or Los Alamos National Labs through a competitive application process that matches qualified businesses to lab scientists.¹¹⁹ The state government provides funding for the program, incentivizing the labs to engage with local small and medium-sized businesses.¹²⁰ In Tennessee, the state created a \$2.5 million innovation voucher program whereby local manufacturers of varying sizes can “purchase” services from Oak Ridge National Lab to develop new products and processes.¹²¹

Local Market

Policy 8: Expand the Focus on Energy Program to Include the Energy-Water Nexus

Opportunity

Wisconsin is a freshwater hub that supports millions of Wisconsinites and water-reliant manufacturing and agriculture industries.¹²² With an abundant water supply, the state’s water technology cluster houses deep technological expertise in water management. Because energy and water resources are intrinsically tied, Wisconsin has a significant opportunity to leverage its expertise and target this energy-water nexus to not only generate cost savings and optimize efficiencies, but facilitate market growth. With a statewide fund dedicated to energy-water nexus projects, investment in sensors, controls, and cross-cutting efficiency technologies could grow significantly.

Solution

Wisconsin should consider allowing water efficiency projects to be eligible under the Focus on Energy program, funded through contributions from water utilities. Since 2001, Focus on Energy has helped over 2.8 million Wisconsinites achieve over \$730 million in savings through energy efficiency and renewable resource upgrades.¹²³ Funding at the scale of Focus on Energy for water conservation and efficiency can capture a greater range of energy and cost savings. States such as Colorado (see case study), Massachusetts, and California offer examples of how to implement such a program.

Projects eligible for financial assistance could include developing water conservation plans, implementing efficiency upgrades, enhancing metering infrastructure, and conducting education and outreach campaigns. Funding for water efficiency projects could come from contributions from water utilities, ensuring that funds for energy efficiency projects are used for their intended purpose. Water and wastewater facilities, manufacturing and agriculture industries, and municipal governments can particularly benefit from the program. Wisconsin could generate significant savings through this program expansion while supporting local jobs producing sensors and controls for water management, as well as installation, operation, and maintenance jobs around the state.

Key Players

Wisconsin Legislature, Public Service Commission of Wisconsin, Wisconsin Department of Natural Resources, Water Utilities, Focus on Energy

Case Study: Colorado's Water Efficiency Grant Program

The Water Efficiency Grant Program was established in 2005 and expanded in 2007.¹²⁴ Through the Colorado Water Conservation Board, water providers and governmental institutions can apply for grants to support water conservation-related outreach, planning, and implementation. The program has awarded over \$4.2 million since its inception.¹²⁵ Awarded projects include the City of Cortez's automated metering system, expected to produce 138 acre-feet in water savings over its first two years, and the Center for Resource Conservation's thirty water assessments across the St. Vrain Valley School District, which included hands-on learning for students.¹²⁶

Policy 9: Conduct a Forward-Looking Grid Study

Opportunity

The legacy power grid is the centerpiece of the U.S. energy economy, delivering critical electricity from generators to consumers. However, new challenges and priorities are driving major changes to the current electricity system. There is a focus on flexible capacity due to increased renewable energy deployment and distributed generation, increased customer participation in electricity markets, the need for resilience to weather events and natural disasters, aging infrastructure, and mounting concerns around vulnerability to cyber and physical attacks.¹²⁷ These trends signal changing economic, security, and consumer priorities, and, consequently, an urgent need for grid modernization.

Wisconsin has previously been on the leading edge of grid reinvestment. In 1997, state leaders came together to address Wisconsin's severe reliability issues and prevent a major blackout.¹²⁸ Today, Wisconsin has one of the most reliable power grids in the Midwest, which provides a secure vantage point for the time being.¹²⁹ However, the pace of technological and economic change with respect to the grid evolves more rapidly than ever. Wholesale markets continue to create new market structures, the variety of technologies connected to the grid increases on a daily basis, and concerns for grid security are on the rise. Wisconsin could take the initiative now to prepare for future needs.

Solution

Wisconsin could draw from initiatives in Ohio and Minnesota (see case studies). The state could replicate Ohio's exploratory approach to first account for considerations of future grid technologies, regulations, and customer needs and to reduce potential impact on electric rates. Minnesota also demonstrates a potential piecemeal model for grid modernization in a regulated electricity market, which mirrors Wisconsin's market structure.¹³⁰ Proper planning can ensure strategic transmission and distribution grid buildout and regulatory reforms that minimize rate increases and customer impacts while preparing for future changes in load.

The Public Service Commission of Wisconsin, with support from political and business leaders, could conduct an exploratory technological, regulatory, and market review of needs and opportunities on the horizon, informing future utility plans and state-level action. The study could include consideration of flexible resources, such as demand response, fast-ramping supply,

and battery storage, in addition to information and communication technologies, such as advanced metering infrastructure, voltage regulation equipment, power flow controllers, and equipment health sensors—all of which could support an agile and active grid.¹³¹

Key Players

Public Service Commission of Wisconsin, Utilities, Electricity Customers

Case Study: Ohio’s PowerForward Initiative

In 2017, the Public Utilities Commission of Ohio jumpstarted the PowerForward initiative to analyze the grid of the future. Presented as an exploratory exercise rather than a strategic roadmap, PowerForward focuses on the technological and regulatory implications of Ohio’s future grid and how to improve the customer experience.¹³² The three-phase initiative includes future-looking conferences in which stakeholders will clarify a vision of the grid followed by a review of key enabling technologies and regulatory reforms to achieve this vision, likely ranging from battery storage and advanced metering to utility revenue models and rate designs.¹³³ The findings will guide individual utility grid modernization proposals and may recommend changes at the legislative level.¹³⁴

Case Study: Minnesota’s Grid Modernization Proceeding

Minnesota is the first state with a vertically-integrated electricity market to tackle grid modernization.¹³⁵ In response to e21, a stakeholder-driven grid planning initiative, the Minnesota Public Utility Commission opened a grid modernization proceeding that will clarify definitions and principles, assess potential issues, and evaluate regulatory reforms needed for Minnesota’s future power grid.¹³⁶ The proceeding will likely touch on assets such as smart inverters, advanced metering, battery storage, and dynamic voltage control.¹³⁷ Minnesota’s grid reliability has allowed the state to take a methodical approach to grid planning and prioritize customer value at every step.¹³⁸

Policy 10: Explore Energy-as-a-Service Model for Grid Modernization Projects

Opportunity

The manner in which energy is generated, distributed, and consumed continues to evolve at a rapid pace, making sensor- and control-embedded technology more ubiquitous than ever. Electricity consumers, large and small, now demand greater control over electricity in their homes, manufacturing facilities, and data centers. For instance, 63 percent of Fortune 100 companies have energy goals requiring renewable energy supply.¹³⁹ Moreover, over 140 municipalities in Wisconsin have established renewable energy goals.¹⁴⁰ With ever-changing requirements for energy generation and use, innovations in financing options, such as energy-as-a-service, can assist utilities, municipalities, or other entities to incorporate capital-intensive technologies for the grid that use Wisconsin-made sensors and controls.¹⁴¹

Solution

As defined by Navigant, energy-as-a-service is “the management of a customer’s energy portfolio needs—such as portfolio strategy, program management, energy supply, energy use, and asset management—by applying new products, services, technology solutions, and both project- and enterprise-wide financing instruments that avoid customer capital expenditures

while reducing energy use, spend, and risk.”¹⁴² In the global commercial and industrial sector, the energy-as-a-service market will grow from about \$60 billion in 2017 to \$221.1 billion in 2026.¹⁴³

Municipal utilities may want to incorporate innovative technologies, but they may not have available capital. Energy-as-a-service models are now expanding beyond solar, as seen with Schneider Electric’s “microgrid-as-a-service” project in partnership with Duke Energy (see case study). Wisconsin-based companies could also offer this type of service to tap into the growing market.

Exploring innovations in finance such as energy-as-a-service can help Wisconsin entities and communities meet local sustainability goals or supply energy to Fortune 500 companies, without large upfront capital investments. Developing energy-as-a-service models can help Wisconsin-based companies and municipalities install transformative grid technologies that embed locally-produced sensors and controls while encouraging grid resiliency and supporting the local economy.

Key Players

Utilities, Municipalities, Businesses

Case Study: Montgomery County’s Microgrid Projects

In Montgomery County, Maryland, officials were interested in increasing grid resiliency and meeting internal renewable energy goals. However, upfront capital procurement of a system to meet these needs proved a challenge for the county. Therefore, Montgomery County partnered with Schneider Electric and Duke Energy on the construction of two microgrid systems that included solar and cogeneration facilities at critical infrastructure sites. Instead of paying for the system upfront, Montgomery County will buy the power produced, while Schneider Electric will maintain the microgrid and Duke will own the facility.¹⁴⁴ This model allows smaller utilities or municipalities to invest in next-generation technologies without the upfront capital.¹⁴⁵

Policy 11: Establish a Biogas Equipment Tax Credit

Barrier

Biogas is a significant opportunity in Wisconsin due to a wealth of input resources and numerous benefits, ranging from on-site energy/heat supply and access to new markets to waste reduction and nutrient management.¹⁴⁶ The state has about 170 biogas systems with the potential to add over 1,300 new projects, and Wisconsin-made biogas contaminant monitors can increase the productivity of new projects.¹⁴⁷ However, potential customers face significant cost barriers to installation and operation, especially high project costs and low returns on investment due to low buyback rates for electricity production.¹⁴⁸ Furthermore, state and federal incentives do not adequately address upfront costs, prioritize certain outputs, and do not account for health and environmental benefits.¹⁴⁹ Wisconsin’s property tax exemption for biogas equipment applies to operational projects; the federal production tax credit, which expired in 2016 for non-wind technologies, applied to electricity generated from biogas projects, excluding cogeneration (electricity and useful heat) for on-site use and renewable natural gas.¹⁵⁰

Solution

To signal that Wisconsin is committed to biogas development, the state could pass a biogas equipment tax credit to reduce the payback period and improve the return on investment of biogas projects. Wisconsin could model the incentive after the U.S. solar investment tax credit or North Carolina's expired 35 percent renewable energy investment tax credit (see case studies).¹⁵¹ The credit could incentivize statewide deployment and enable customers to take advantage of market opportunities across biogas outputs, such as the federal renewable fuel market.¹⁵²

A biogas equipment tax credit could significantly stoke investment in biogas facilities, taking advantage of the state's abundant biogas input resources and creating alternative revenue streams from agricultural, landfill, wastewater, and food scrap operations. This increase in investment could also attract manufacturers that produce advanced digester systems embedded with advanced sensors and controls, such as biogas contaminant monitors.

Key Players

Wisconsin Legislature, Public Service Commission of Wisconsin's Office of Energy Innovation, Farmers, Project Developers

Case Study: North Carolina Biogas Investment Tax Credit

North Carolina is second only to Iowa in swine production, prompting legislators to incentivize the production of biogas from abundant animal waste.¹⁵³ To stimulate the local biogas industry, North Carolina offered an investment credit equal to 35 percent of the cost (up to \$2.5 million per installation or up to 50 percent tax liability) of eligible renewable energy property.¹⁵⁴ In 2013 alone, the program resulted in \$7.98 of private investment in renewable energy property for every \$1 of credit, leading to approximately \$42.6 million in private investment for biomass energy over the course of that year.¹⁵⁵ Furthermore, a 2014 analysis of swine biogas operations conducted at the University of North Carolina concluded that the investment tax credit accounted for 48 percent of biogas system revenues in the first five years of operation.¹⁵⁶

Case Study: U.S. Solar Investment Tax Credit

The federal solar investment tax credit is a 30 percent tax credit on equipment cost for residential and commercial solar energy installations.¹⁵⁷ Since its creation in 2005, the credit has been extended multiple times and now applies to projects completed by the end of 2023, with a gradual decrease beginning in 2020.¹⁵⁸ Previously, only operational projects were eligible for the credit, but taxpayers can now take advantage of the credit when construction begins.¹⁵⁹ The credit has supported a 1,600 percent growth in annual solar installations from 2006—an annual increase of 76 percent.¹⁶⁰ From 2016 to 2020, the credit is expected to nearly quadruple installed capacity, more than double solar employment, and inject \$132 billion into the U.S. economy.¹⁶¹

Policy 12: Clarify Legality of Third-Party Ownership of Biogas and Solar Projects

Barrier

Third-party ownership is when a company owns and operates an energy system on a customer's property, and the customer either leases the technology or buys the electricity generated under a power purchase agreement.¹⁶² This alternative financing model does not require upfront payments and offers electricity customers lower system costs through increased competition and

better access to tax incentives for customers with limited credit and tax-exempt and governmental institutions. In fact, third-party ownership accounts for about 50 percent of new residential solar, and in 2015, 67 percent of non-residential solar in the United States.¹⁶³ In Wisconsin, interested customers face a lack of clarity on whether third-party-owned biogas and solar projects are allowed, limiting consumer choice, market demand, and local job creation.

Solution

Wisconsin could clarify the legality of third-party ownership through state legislation or a statement by the Public Service Commission of Wisconsin. State law prohibits public utilities from serving customers of another utility. It is still unclear whether third-party providers are considered public utilities.¹⁶⁴ Wisconsin could draw from Nevada, which faced a similar issue with regulatory and legislative action (see case study). Increasing local access to electricity can reroute out-of-state energy expenditures back into Wisconsin.

If Wisconsin chooses to allow third-party ownership, Wisconsinites will have more options to capitalize on-site resources, such as rooftop space and digester inputs for biogas. Greater access to these financing models could boost in-state demand and attract manufacturers of sensor- and control-embedded solar and biogas technologies, project developers, and installers to the state. By increasing local solar installation and maintenance jobs, third-party ownership can support more of Wisconsin's skilled technical workforce.

Key Players

Wisconsin Legislature, Public Service Commission of Wisconsin

Case Study: Nevada

In Nevada, third-party installations similarly came into question because they fit the state's definition of a utility.¹⁶⁵ The Public Utilities Commission addressed this issue in a 2008 net metering docket and ruled in favor of third-party ownership, stating that third-party-owned, net-metered systems are not public utilities and are outside regulatory review.¹⁶⁶ Furthermore, the Commission noted that the decision was consistent with the state's policy goals to support renewable energy deployment, stoke economic development, and diversify the energy supply.¹⁶⁷ The Nevada Legislature, with support from the Governor, codified this exemption in 2009.¹⁶⁸ The reduced cost barrier of third-party ownership has been cited as supporting the surge in residential solar demand in Nevada: Between 2014 and 2015, Nevada's residential solar market jumped in rank from fourteenth- to second-largest in the United States.¹⁶⁹

Policy 13: Establish Consistent Net Metering Policies

Barrier

Businesses require consistent and clear policies that send a signal a state is open for business. Used in forty states, net energy metering sends a clear market signal to local businesses and residents about the value of the electricity they generate and deliver back to the grid.¹⁷⁰ In fact, Wisconsin was one of the first states with a net metering policy, first established in 1982.¹⁷¹ Despite Wisconsin's initial leadership to create market certainty for residents, the Badger State is overdue for an update to its net metering policy. Wisconsin's rules regarding compensation for electricity generated by customer-sited resources do not incent investment in biogas and solar

systems. Rules vary from utility to utility, making it challenging for Wisconsin residents and firms to determine how they will be compensated for the electricity they generate and distribute.¹⁷²

Solution

The Public Service Commission of Wisconsin and the Wisconsin Legislature could revise net energy metering policies to send a clear market signal to Wisconsin businesses and residents. Wisconsin policymakers should consider establishing a statewide policy that fairly compensates excess generation from customer-sited facilities more uniformly. Either increasing and standardizing the statewide system size cap or not specifying a limit, as states like Ohio have done, will provide further clarity to consumers.¹⁷³ Additional design considerations could include virtual net metering for community solar projects, annual accounting periods, and reduced fixed charges. These policy elements can significantly impact local market growth and job creation based on perceived investor risk, as seen in Nevada (see case study).

By establishing transparent, uniform policies on how Wisconsinites are compensated for electricity generated, by raising or eliminating size caps and increasing compensation for excess generation, more firms and residents will be likely to invest in systems like biogas and solar. Electricity generation systems on farms and in neighborhoods can play a greater role in fueling economic development, creating installation jobs for Wisconsinites and growing demand for Wisconsin-made products.

Key Players

Wisconsin Legislature, Public Service Commission of Wisconsin

Case Study: Nevada

In Nevada, unfavorable policy changes influenced the exodus of major solar installers and in-state employers. Vivint Solar exited in 2015 when deployment tapered after the net metering cap was reached.¹⁷⁴ SolarCity and Sunrun shut down operations in the state following the 2016 decision to reduce net metering rates and add fixed charges for existing net metering customers, with the former cutting 550 local jobs.¹⁷⁵ Nevada experienced a 32 percent decrease in solar installation jobs over that year.¹⁷⁶

Call to Action

Wisconsin's emerging sensors and controls cluster is a solid foundation upon which the state can grow its economy, support 44,000 jobs, and become a leader in the production and deployment of advanced energy technology. The policies recommended in this report are complementary and intended to help Wisconsin manufacture products within the state, foster entrepreneurship for technological advances, fund innovation with accessible capital, equip workers with needed skills, and grow demand for sensors and controls technology.

START QUOTE BOX

Wisconsin has the opportunity to support over 44,000 direct, indirect, and induced jobs in the sensors and controls industry from 2018 through 2030. This cluster is well positioned to serve a significant portion of national demand, especially considering its robust industrial base, technical training programs, university research expertise, and cluster organizations.

END QUOTE BOX

To fully realize Wisconsin's potential in the sensors and controls sector and position the state for continued growth, policymakers will need to make a concerted effort to seize the opportunity presented by increasing global demand. Strong leadership plays an important role in promoting Wisconsin's competitive advantage in the industry and creating quality jobs. State and local economic development depend on the collective work of many partners across government, universities, industry, and other stakeholders. This report recommends actions that each group can take to support the sensors and controls sector. Continued collaboration is necessary to address barriers to cluster growth and demonstrate that the state is ripe for investment.

Wisconsin's leaders can draw from among dozens of innovative strategies that city, county, and state governments across the country and abroad have implemented to create job opportunities in the advanced energy sector. Examples of these best practices and a fully cited version of this report can be found on the American Jobs Project website at <http://americanjobsproject.us/>. Furthermore, the American Jobs Project can continue to serve as a partner to Wisconsin by organizing working groups and conducting deeper analyses, such as identifying value chain gaps, exploring policy strategies, and evaluating the state's comparative advantage in other advanced industries.

When a state succeeds in building an economic cluster, the benefits are felt throughout the state: A more resilient state economy, a skilled twenty-first century workforce that is trained for the jobs of tomorrow, a firm base of young people optimistic about job opportunities close to home, and a rich hub for innovation and collaboration.

START CALL-OUT BOX

Growing the Sensors and Controls Cluster, Growing Jobs

- Make early college programs more accessible
- Provide a tax credit to employers hiring apprentices
- Retain college graduates and recruit out-of-state talent
- Expand corporate venture capital

- Facilitate mentorships for entrepreneurs statewide
- Develop testbeds for large-scale energy systems
- Establish a Wisconsin biogas innovation voucher program
- Expand the Focus on Energy program to include the energy-water nexus
- Conduct a forward-looking grid study
- Explore energy-as-a-service model for grid modernization projects
- Establish a biogas equipment tax credit
- Clarify legality of third-party ownership of biogas and solar projects
- Establish consistent net metering policies

END CALL-OUT BOX

Appendix 1: Economic Impacts, Jobs Estimates, and Modeling Methodology

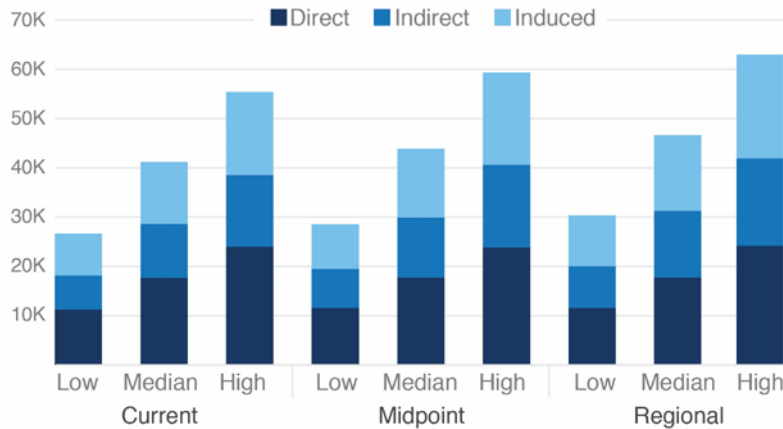
From 2018 through 2030, Wisconsin's sensors and controls industry could support an annual average of 44,000 direct jobs from manufacturing and software development; indirect jobs from supplying equipment, materials, and services to manufacturers and developers; and induced jobs from spending in the local economy.

The American Jobs Project believes the key to job creation lies in local action. Our jobs estimates are intended to start a conversation about how state and local leaders can work together to set their goals and utilize the same tools and data that we have used to estimate potential impacts.

To estimate jobs potential for the advanced energy sensors and controls industry in Wisconsin, we utilize several reputable tools, analyses, and projections to determine global and national estimates of future demand, the current estimated state market penetration for advanced energy sensors and controls businesses, and industry benchmarks for wages and profits. We use these inputs to generate multiple industry growth scenarios based on varying levels of market penetration and supply chain concentration. Each scenario shows the average number of jobs that the in-state manufacturing industry could support annually from 2018 through 2030. The actual number of jobs in any given year could vary significantly from the average, and the annual average is intended to be a target over the analysis timeline.

We suggest that the Median market penetration and the Midpoint supply chain concentration are realistic goals for Wisconsin. If Wisconsin can grow its market share and build a supply chain to these levels, the industry could support an annual average of over 44,000 direct, indirect, and induced jobs from 2018 through 2030. Thus, the advanced energy sensors and controls industry could serve as a major vehicle for future state economic growth while creating quality jobs for Wisconsinites.

**AVERAGE ANNUAL JOBS IN WISCONSIN'S
ADVANCED ENERGY SENSORS AND CONTROLS INDUSTRY**
By Market Penetration and Supply Chain Concentration, 2018-2030



START CALL-OUT BOX

Definitions

Market Penetration

Amount of sales of a product as a percentage of the total sales volume for that product in a defined market.

Supply Chain Concentration

Level at which target industries could meet supply chain needs from in-state companies.

Direct Jobs

Jobs created or sustained due to direct increases in sales to companies in the target state industry.

Indirect Jobs

Jobs created or sustained due to higher demand for equipment, materials, and services from supplying industries that support the target state industry.

Induced Jobs

Jobs created or sustained due to increased local spending by employees of the target state industry and its supplying industries.

Multiplier Effect

Refers to when the economic impact generated is larger than the initial investment due to cascading spending from target state industry to its supplying industries and workforce to products and services in the local economy.

END CALL-OUT BOX

Modeling Approach

We utilize IMPLAN, a proprietary model maintained by the Minnesota IMPLAN Group, and its 2013 data package to conduct our regional economic analysis. IMPLAN uses average expenditure data to estimate how industry spending cascades throughout the economy to suppliers and consumer-facing industries. IMPLAN tracks multiple rounds of indirect and induced spending impacts, until that spending “leaks” out of the selected regional economy, as determined by local purchasing coefficients built into the model.

Drawing from reputable sources, we develop multiple scenarios in which Wisconsin could grow its advanced energy sensors and controls industry. Each scenario represents varying levels of market penetration and supply chain concentration, which generate different inputs for the IMPLAN model.

Market penetration is shown at three levels (Low, Median, High), with the lower bound being Wisconsin’s current estimated market share and the upper bound being the estimated market share of the current market leader for advanced energy sensors and controls. Another level represents the median between both bounds. We use Bureau of Labor Statistics’ (BLS) Quarterly Census of Employment and Wages (QCEW) and IBISWorld data to estimate market share as a function of establishments, wages, and revenue.¹⁷⁷

Three supply chain concentration levels (Current, Midpoint, Regional) are presented to identify the impacts of growing Wisconsin’s supply chain. The lower bound uses the current state economy, demonstrating the effect of merely maintaining the present level of supply chain concentration. The upper bound uses the Great Lakes Region (WI, IL, IN, MI, OH, and PA) as the model to represent the impacts of Wisconsin having as complete of an advanced energy sensors and controls supply chain as is available in the selected states. Another level gives the midpoint between both bounds.

It is important to note that we do not include any financial impacts associated with the construction of new facilities that may result from an increased number of advanced energy sensors and controls firms locating in the Wisconsin economy during the analysis timeline, nor do we include consulting, services, construction, or installation jobs associated with advanced energy sensors and controls.

Model Inputs

Advanced energy sensors and controls are an industry of industries and a subset of the Energy, Power, and Control (EPC) sector as defined by M-WERC.¹⁷⁸ Utilizing M-WERC’s definition of the EPC sector aligns our analysis with their ongoing work. Our analysis utilizes North American Industry Classification System (NAICS) codes, the basis for most macroeconomic analysis and reporting. To estimate the economic impacts of advanced energy sensors and controls, we look at several associated technologies:

- Advanced Motor Controls¹⁷⁹
- Electric Switches¹⁸⁰
- Building Automation Controls¹⁸¹

- HVAC Controls
- Energy Management Systems
- Lighting Control Systems
- Sensors¹⁸²
 - Process Industries¹⁸³
 - Machinery Manufacturing¹⁸⁴
 - HVAC and Lighting¹⁸⁵
 - Power Plants
- Smart Grid Transmission and Distribution Sensors and Controls¹⁸⁶
 - Remote Terminal Units
 - Synchrophasors
 - Reclosers, Fault Measurement Units, and Automated Feeder Switches

Estimates of market demand for advanced energy sensors and controls technologies are taken from BCC Research, Technavio, and IBISWorld reports. Annual demand for our analysis timeline is derived from the current estimates and compound annual growth rates through 2030. We assume that the rates stay constant through 2030 since they do not project that far into the future.

Estimates of average wages are taken from IBISWorld, IMPLAN, and BLS QCEW. Owner income is also derived from IBISWorld and IMPLAN, wherever possible.

The current market penetration of Wisconsin's advanced energy sensors and controls industry is estimated as a function of current estimated employment and firms. IBISWorld's ratio for employment per unit of revenue and the current concentration of firms in Wisconsin, as well as QCEW employment and firms data, are applied to Technavio's and BCC's market demand totals to estimate current employment and revenues.

Model Outputs

Once the data is prepared for input into IMPLAN, we run the model for each scenario and generate the following direct, indirect, and induced estimates for Wisconsin's advanced energy sensors and controls industry: employment, labor income, GDP, total economic output, state/local tax revenue, and federal tax revenue. Only employment outcomes are given in this report. Additional output estimates are available by request.

We present employment as an average of annual jobs sustained. These outcomes are based on the total job-years, or one full-time equivalent job sustained for one year, that exist within the timeframe of our analysis. Jobs in any given year can vary greatly within the timeframe. Additionally, job losses in industries that compete with those in our analysis are not evaluated. Models do not perfectly predict behavior, so job estimates could vary based on the reality of what is purchased locally and the impact of foreign and domestic competition. The estimates presented in this report are highly dependent on sustained local action towards developing and maintaining the target state industry.

Appendix 2: References for Infographics

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