The Minnesota Jobs Project: A Guide to Creating Jobs in Energy Efficiency

A Letter from the American Jobs Project

It is no secret that America's middle class is in crisis; indeed, "the hollowing out of the middle class" has become a well-worn phrase, causing politicians to rail, bloggers to rage, and citizens to reel. Polls consistently reveal that jobs and the economy are at or near the top of citizen concerns.[1] Of the millions of jobs lost during the recession, most were good-paying, middle-class jobs.[2] Unfortunately, many of the jobs created during the recovery have been in low-skill, low-paying occupations.[3] These trends are not going to reverse themselves unless there is a targeted focus on high-growth, advanced industries. Leadership is needed, but the gridlocked U.S. Congress has failed in recent years to adopt robust policies to stoke middle-class jobs in America.

In President George W. Bush's autobiography, *Decision Points,* the former president recounts a conversation he had with then-President of China, Hu Jintao. "What keeps you up at night?" President Bush asked President Hu as an icebreaker. As we can easily guess, what kept President Bush up at night was concern over terrorism. Hu Jintao's response was telling: what kept him up at night was "creating 25 million new jobs a year" for his people.[4]

Is it possible to create good-paying American jobs in today's global economy? And what if the solutions did not involve Congress at all? What if there were creative middle-class job creation strategies being developed and tested in the laboratories of democracy—the states and cities? The American Jobs Project seeks to answer these questions and provide a research-based guide to action for state and local leaders who are kept up at night trying to figure out how to create jobs for the people they serve.

Our quest starts with identifying the biggest market opportunity of our era: the global demand for advanced energy and its enabling solutions. The world has embarked on a historic energy transformation, and the United States plays a crucial role in accelerating the energy transition. Whether borne out of a need for diverse,

reliable, and clean power or to achieve energy independence from unstable regimes, the growing demand for advanced energy and its enabling technology creates "the mother of all markets" for local U.S. businesses to build and sell those solutions. [5] Strategically minded businesspeople looking at global growth projections in advanced energy demand are making major investments and reaping large revenues. In 2015, the private sector reported nearly $1.4 trillion in global advanced energy revenues.[6] Advanced energy investments are now bigger than the global apparel sector and nearly twice the size of the global airline industry.[7] And jobs? At least 9.4 million people were employed in the global advanced energy sector in 2015, and doubling the share of renewables could nearly triple employment.[8] The question for the United States is: Where will those new jobs be created?

The American Jobs Project is focused on finding ways for our states to be the answer to this question. If countries across the globe, including the United States, are seeking technical products and 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 to build their advanced energy products?

It is true that the United States will not likely be able to attract the traditional industrial manufacturing jobs of the past; those jobs are gone—either to low-wage countries or to automation—and we must accept the fact that they are not coming back.[9] 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 specific advanced industries that capitalize on each state's strengths.

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. Many are best practices, some are new, and all are centered on a state's business ecosystem. 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 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 nationally focused, research-based project managed by the American Jobs Initiative, a nonprofit organization dedicated to U.S. economic growth through advanced industries. The organization is driven by six core team members and has received support from nearly one hundred student researchers with a broad range of expertise, including law, business, engineering, and public policy. The American Jobs Project brings best practice strategies and innovative ideas from around the globe to local and state governments and stakeholders, creating bottom-up strategies that create good-paying jobs in advanced industries.

Ellen Anderson, University of Minnesota

Ellen Anderson is the Executive Director of the University of Minnesota's Energy Transition Lab, where she leads University efforts to develop and implement innovative solutions to our biggest energy challenges through collaborative teams of university researchers and industry, government, and community leaders. Previously, Anderson was the senior advisor on energy and environment to Governor Mark Dayton, and assisted the Minnesota Environmental Quality Board on similar issues. Anderson helped coordinate state clean energy economy planning, and served as chair of the Minnesota Public Utilities Commission. Anderson served in the Minnesota Senate from 1993 to 2011 and was re-elected five times. Anderson holds a B.A. from Carleton College and J.D. cum laude from the University of Minnesota Law School. She has served in numerous leadership and community volunteer positions and received dozens of awards for her leadership in energy, environment, and economic and social justice.

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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.

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Dozens of hands were involved in the process of researching, writing, designing, and reviewing the report. Robin Sternberg and Tiffany Wong were the lead authors and researchers. Mary Collins served as the lead editor, Henry Love was the lead analyst, and Amariah Baker was the graphic designer.

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Executive Summary

The American Jobs Project was borne of two tough problems: loss of middle-class jobs in America and congressional paralysis. It seeks to address these problems by taking advantage of one of the biggest market opportunities of our era—the advanced energy and energy efficiency sectors—and to do so at the state, not the federal, level. State and local leaders who leverage the unique strategic advantages of their state and region to grow localized clusters of interconnected companies and institutions are poised to create quality jobs. This report serves as a strategic guide to support those efforts.

Extensive research, interviews, and roundtables with stakeholders and experts in Minnesota have identified energy efficiency as a high potential area in the state. The energy efficiency sector can move technological innovation forward, create middle-class jobs for Minnesota, and elevate Minnesota companies in the global marketplace.

Minnesota is well positioned to benefit from rising global demand for energy efficiency products given its base of 450 companies, leading research universities with expertise in energy efficiency technology, strong innovative workforce, and attractive business climate. Opportunities to leverage these strengths and momentum to further serve growing regional, national, and global markets offer vast potential benefits for the state economy and Minnesota residents.

However, there are several barriers hindering Minnesota's energy efficiency progress and preventing the industry from reaching its full potential. These barriers to growth range from policies that discourage capital investments to lack of access to capital for growing businesses, a shortage of skilled workers, and changing workforce demographics.

To take full advantage of the existing opportunities, state leaders can pursue strategies to solidify the foundation for industry growth and to help Minnesota businesses grow, innovate, and outcompete regional, national, and global competitors. With forward-thinking policies, Minnesota's energy efficiency industry

can support over 26,000 direct, indirect, and induced jobs annually through 2030. This estimate includes both new and sustained jobs. An increase in direct jobs will spark local job growth and economic development as employees spend their earnings in the local economy.

Summary of Recommendations

The analysis presented in this report culminates in recommendations for Minnesota's leaders based on best practices in the United States and abroad. Each recommendation identifies opportunities for barrier removal and future growth in the energy efficiency sector. 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.

Incentivizing Energy Efficiency Investments

Policy 1: Institute Energy Benchmarking and Disclosure for Public and Commercial Buildings to Encourage Efficiency Upgrades. A statewide requirement will help monitor building energy performance, illuminate potential energy savings opportunities, and achieve environmental benefits. Minnesota legislators could strengthen the B3 Benchmarking Program by requiring participation and covering both public and commercial buildings. *Key players: Governor's Office, Minnesota Legislature, Minnesota Department of Commerce, Minnesota Department of Administration, building administrators.*

Policy 2: Update Utility Combined Heat and Power (CHP) Policies to Incentivize CHP Implementation. Minnesota has a large, untapped energy savings potential in CHP, but barriers include confusing standby rates, inconsistently applied interconnection standards, and a lack of financial incentives. Minnesota regulators could update utility policies to incentivize and streamline projects. *Key players: Minnesota Public Utilities Commission, Minnesota Department of Commerce, gas/electric utilities, consumers.*

Increasing Access to Capital for Business Development

Policy 3: Establish a Fund of Funds to Stimulate the Investment Environment. A state-initiated fund of funds could bolster Minnesota's investment environment and provide critical capital for early-stage ventures and small businesses in the state's clean energy economy. Minnesota could sell insurance premium tax credits to leverage insurance companies for investment capital. *Key players: Governor's Office, Minnesota Legislature, Minnesota Department of Employment of Economic Development, private investors, venture capital firms, insurance companies, businesses, entrepreneurs.*

Policy 4: Offer Working Capital Loans to Support Small Clean Energy Business Operations. Current state grants and subsidies are primarily dedicated to financing deployment of clean energy technology, but do not directly support the companies that innovate and manufacture these products. To ensure longer-term financial security, Minnesota could either provide direct loans or increase access to private loans through credit enhancements. *Key players: Governor's Office, Minnesota Legislature, Minnesota Department of Commerce, lending companies, small businesses.*

Strengthening Workforce Development for Energy Efficiency Jobs

Policy 5: Develop Degree and Certificate Programs on High Performance Buildings. Technological innovation in the building efficiency sector requires an adaptive, skilled workforce. Minnesota's colleges and universities could ensure Minnesotans are prepared for the jobs of the future by developing cutting-edge programs. *Key players: Minnesota Department of Employment and Economic Development, Minnesota State Colleges and Universities, regional economic development organizations, educational institutions, nonprofits, businesses, local communities.*

Policy 6: Establish an Industrial Assessment Center in Minnesota to Increase Access to Efficiency Training and Technical Assistance. As part of an effort under the U.S. Department of Energy, industrial assessment centers (IACs) provide free energy audits and efficiency recommendations for small and medium-sized

manufacturers. Because faculty and students conduct services, IACs offer a unique skills training resource for students. Minnesota could explore options to establish this technical and educational resource on a university campus. *Key players: University of Minnesota, Minnesota Department of Employment and Economic Development.*

Policy 7: Develop Employee Engagement and Retention Strategies to Support Minnesota's Changing Workforce. Minnesota faces a severe workforce shortage due to an aging population and underutilization of minority groups. To best capture the value and expertise of these groups, Minnesota could convene stakeholders to develop a diversity and inclusion toolkit that offers engagement and retention strategies for businesses and employment centers. *Key players: Minnesota Department of Employment and Economic Development, One Stop Shop for Seniors, WorkForce Centers, regional economic development organizations, employers, employees.*

Recruiting and Expanding Energy Efficiency Companies

Policy 8: Organize an Energy Efficiency Business Association to Drive Cluster Development. Minnesota has an expansive value chain dedicated to energy efficiency, yet the state lacks an organized business association. Through greater collaboration and cooperation, business leaders could share knowledge and resources, maintain a supply chain database, and advocate for business interests, among other activities. *Key players: Businesses.*

Policy 9: Target Foreign Direct Investment to Expand the State Energy Efficiency Value Chain. Foreign direct investment is when an international business locates operations in the state or buys a stake in an in-state company. State and local leaders could conduct targeted investment missions to address supply chain gaps and expand employment opportunities for Minnesotans. *Key players: Minnesota Department of Employment and Economic Development, Minnesota Trade Office, regional economic development organizations, University of Minnesota, businesses.*

Introduction

The American Jobs Project aims to spur job creation in the advanced energy sector by identifying innovative, state-specific policies and non-legislative solutions. This national initiative takes advantage of the emerging global demand for advanced energy and related products. The American Jobs Project team analyzed the advanced energy economy in Minnesota and designed recommendations specifically tailored to the state. Extensive research, interviews, and roundtables with local stakeholders and experts helped to develop these recommendations.

This report identifies opportunities to stimulate growth in an advanced energy economic cluster that leverages the state's legacy industries, current investments, and entrepreneurial business development activities. State and local leaders who seek to capitalize on the state's resources to create skilled, good-paying jobs can use this report as a foundation for action.

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What is Advanced Energy?

Advanced energy diversifies energy sources, uses energy more productively, and reduces health and environmental costs. All sources, technologies, products, and services that help meet the need for affordable, secure, and clean energy are advanced energy. For example, advanced energy encompasses renewable energy sources, such as solar, wind, hydro, geothermal, and biofuels. Advanced energy also incorporates technologies and services that improve energy efficiency or make energy available when needed, such as photonics, smart buildings, energy storage, demand response, and smart grids. Other technologies and products that reduce energy consumption include electric vehicles, efficient industrial processes, and airplane bodies made of lightweight composites.

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Why Advanced Energy?

Demand for advanced energy has soared in recent years and is poised for continued growth. In 2015, investment in the advanced energy sector totaled $329 billion worldwide, more than five times the total in 2004.[10] In the United States alone, over $323 billion was invested in advanced energy between 2010 and 2015.[11] In nationwide polls, Americans increasingly support renewables over other forms of energy.[12] Projections show that by 2030 renewables could account for 27 percent of the U.S. energy mix and roughly 50 percent in the power sector alone.[13] These trends point to a clear market signal: demand for advanced energy will continue to grow substantially and create opportunities for investment and job growth.

Furthermore, the advanced energy sector fosters many good-paying, middle-class jobs. In 2016, nearly 3.3 million employees were engaged in the national advanced energy industry, including low-carbon emission generation (800,000), energy-efficient products and services (2.2 million), and alternative fuel vehicles (259,000).[14] In particular, in 2016, solar and wind employment grew by 25 percent to 374,000 employees and 32 percent to 102,000 employees, respectively.[15]

Many advanced energy jobs are in the manufacturing sector,[16] which offers higher wages for the U.S. workforce and stimulates local job growth. Manufacturing jobs average an hourly wage of $26—over three times the federal minimum wage.[17] Thus, the average manufacturing worker is in the middle class.[18] For each U.S. job created in manufacturing, 1.6 new jobs in local goods and services are also supported.[19]

Why Economic Clusters?

"Clusters are geographically close groups of interconnected companies and associated institutions in a particular field, linked by common technologies and skills."

Michael E. Porter, Clusters of Innovation[20]

Economic clusters encompass a variety of linked industries and institutions—including suppliers of specialized services, machinery, and infrastructure—which form a supply chain.[21] Clusters also extend to manufacturers of complementary products and to industries related in skills and technologies. By placing themselves near industry allies, companies can benefit from each other's unique expertise and a trained workforce.[22] Companies in a cluster enjoy access to specialized assets, which helps increase productivity and efficiency.[23]

Geographic proximity and repeated exchanges of information help foster an environment of coordination and cooperation among these companies and institutions. Business clusters are shown to increase the productivity of companies, drive innovation in the field, and facilitate the commercialization of this innovation by increasing communication, logistical support, and overall interaction between cluster entities.[24] By having a close network of suppliers and partners, companies can reap the benefits of greater operational efficiency and reduce costs.[25] Clusters also help build a strong foundation for creating employment opportunities and retaining jobs.

Key Cluster Elements

Economic clusters require strong foundations for growth. 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, and boast a highly skilled workforce. A successful innovation ecosystem bridges the gap between the knowledge economy and the commercial economy, while access-to-capital programs provide the necessary funds to facilitate commercialization and expansion of businesses. Seamless connections between researchers, entrepreneurs, and investors are vital to the success of advanced energy technology companies—bringing innovative ideas to the marketplace quickly and efficiently. Trained and skilled workers are also fundamental to the success of an economic cluster. A thoughtful, sector-based workforce development approach that engages industry and related nonprofits can ensure businesses are equipped to identify employment needs and schools prepare workers with the skills needed to fill available jobs.

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Local demand is not essential for cluster development, but it can help establish a geographic base. In the energy efficiency industry, a state may benefit from having high local demand to build a local company base that could then expand to regional, national, and global markets. Local abundance of raw materials and natural resources can also help grow a local manufacturing cluster. For example, a state with a high solar energy potential or an abundance of silicon can be a natural home for a thriving solar manufacturing cluster. However, if local adoption of solar technology is slow, the state can tap into larger regional, national, and global markets to drive cluster development.

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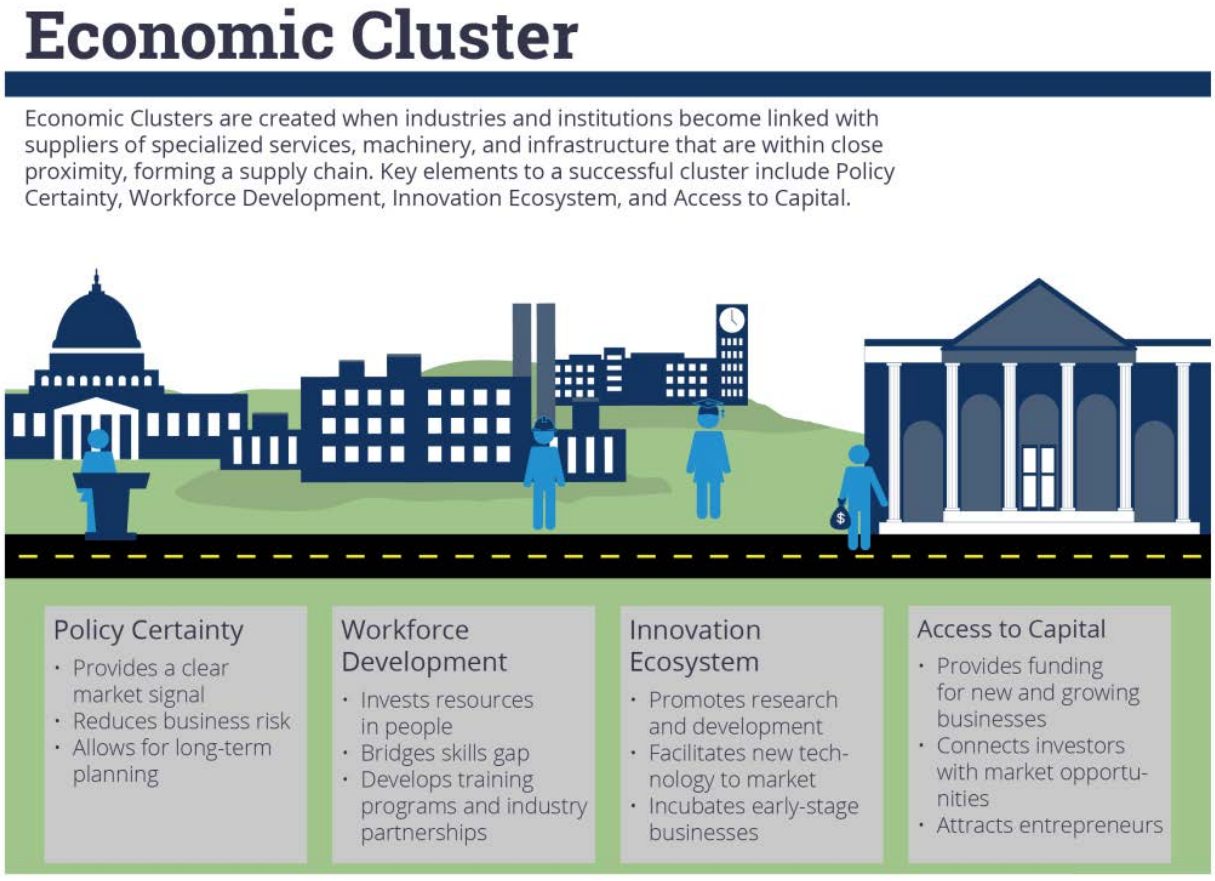


Jobs Potential of Cluster Growth

Clusters can foster a large number of direct, indirect, and induced jobs by stimulating economic activity in a region. Maximizing job creation is highly

dependent on local activity. Workers in manufacturing clusters earn income from sales made throughout the region or nation, bringing out-of-state dollars into the local community. Increased local demand supports additional local jobs and income at other value chain companies in areas such as installation and maintenance. These dollars are spent and re-spent in the local economy, creating and maintaining additional jobs in grocery stores, restaurants, medical providers, and other sectors. Because advanced energy and energy efficiency technologies typically generate cost savings, more money is available to spend in the local economy. The result is a multiplier effect where a dollar of earning in a cluster circulates throughout local businesses and their employees, and creates an impact greater than the initial injection.[26] Therefore, promoting an economic cluster by fostering the growth of existing cluster members as well as building out the value chain could result in an economic impact many times greater than the direct earnings impact.

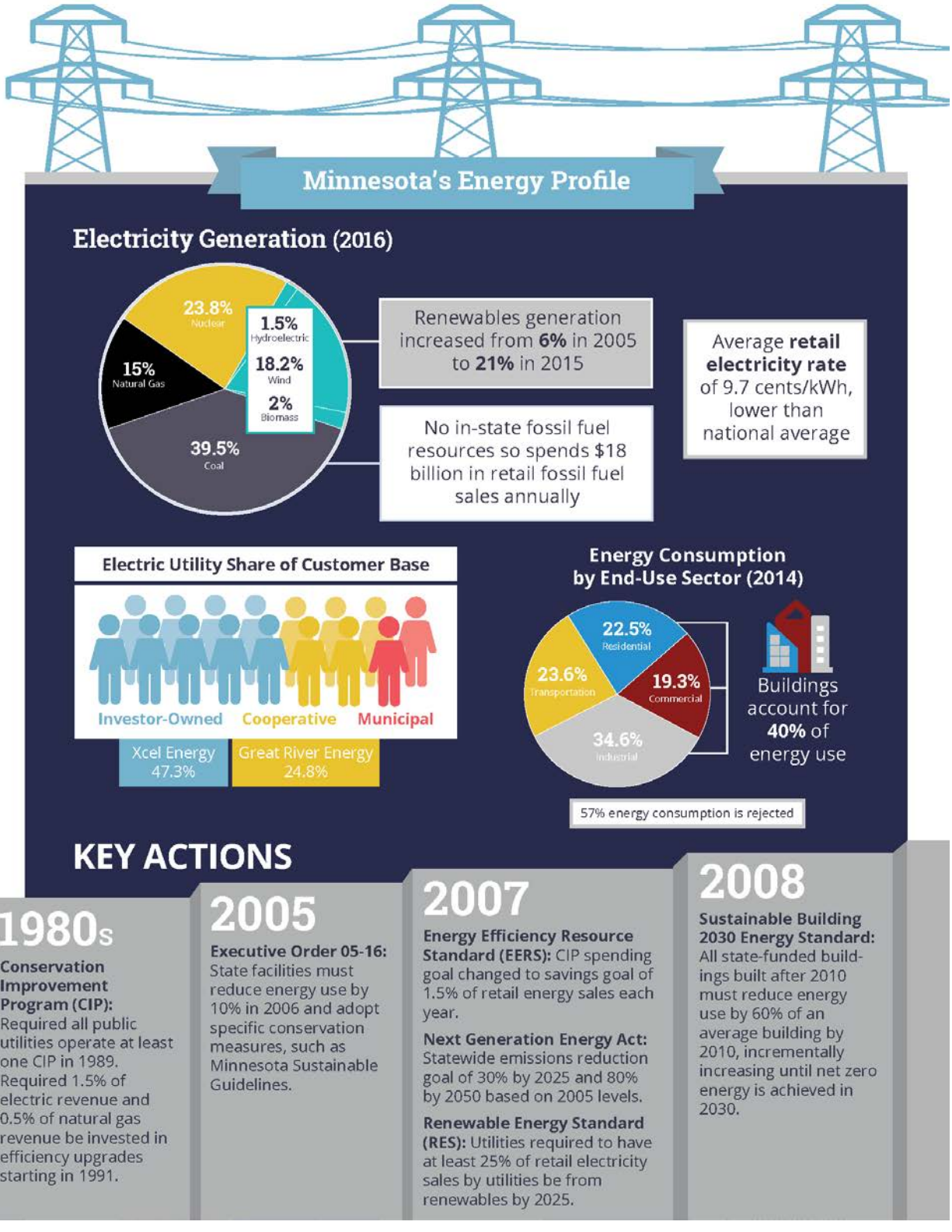
Report Structure

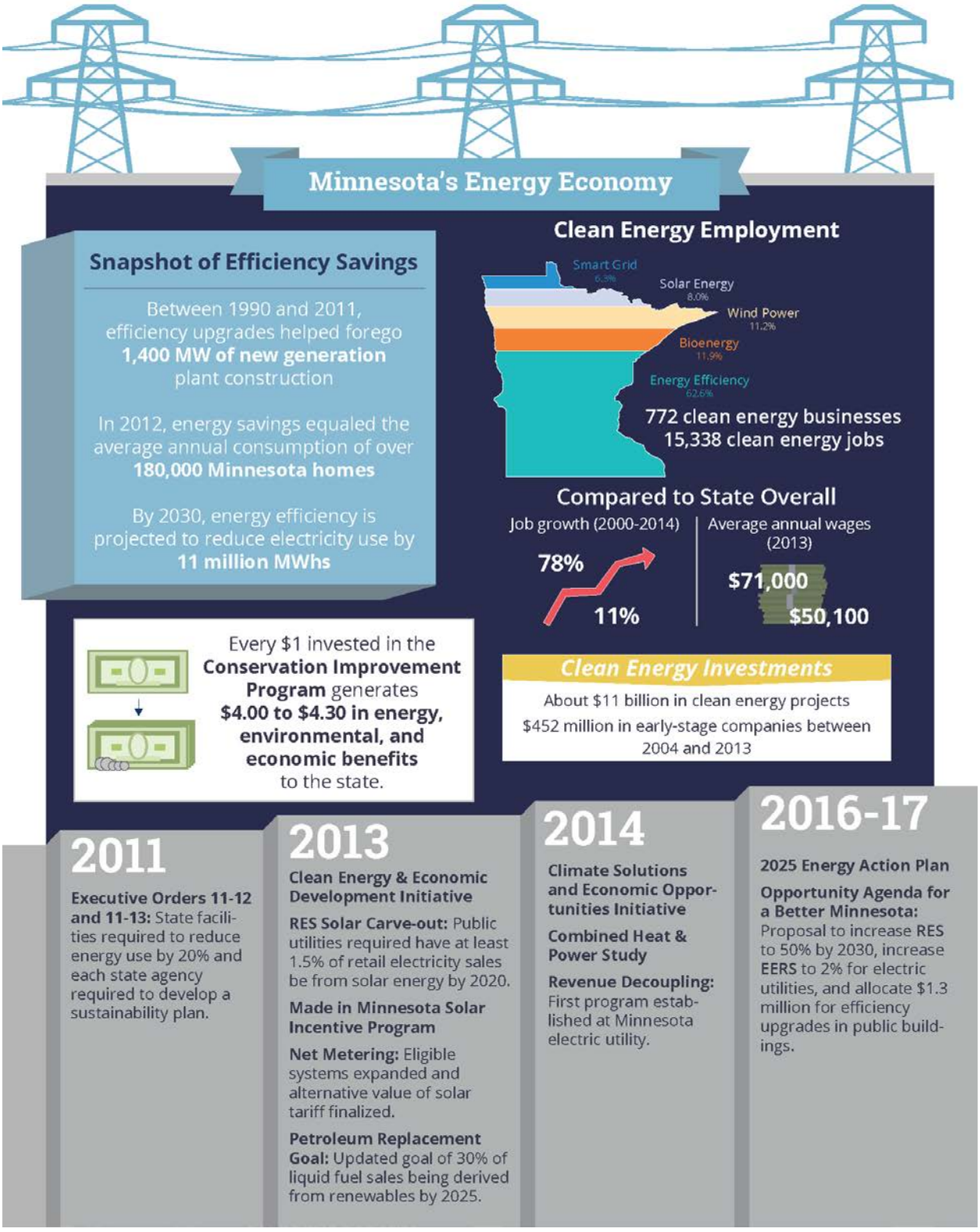
The Minnesota Jobs Project: A Guide to Creating Jobs in Energy Efficiency begins by highlighting Minnesota's economic opportunity to build a globally competitive energy efficiency cluster. The next section gives an overview of the energy efficiency industry and specific technologies that Minnesota could leverage. Then, the report outlines Minnesota's cluster development assets to support the innovation ecosystem, access to capital, and workforce development. The analysis culminates in an assessment of the job growth potential of the state's energy efficiency industry and policy recommendations tailored to Minnesota. A fully cited version of the report is available on the American Jobs Project website at http://americanjobsproject.us/.

Minnesota's Economic Opportunity in Energy Efficiency

Minnesota's Current Energy Economy

Minnesota does not possess its own coal, petroleum, or natural gas resources, and spends $18 billion annually in retail fossil fuel sales to meet its energy consumption needs.[27] Yet, Minnesota is rich in natural energy sources, and renewable energy production represented one-fifth of the state's energy supply in 2015.[28] The state possesses the seventh-largest installed wind capacity in the United States,[29] plentiful sunshine for solar power generation,[30] and large agricultural resources for bioenergy production.[31] Installed solar capacity reached 14 MW in 2013 and is projected to grow to 400 MW by 2020.[32] Electricity from biomass accounted for 1,828 GWh in 2012, a 42 percent increase since 2007.[33] In terms of transportation fuels, Minnesota is ranked fourth in the country for ethanol production capacity.[34] Although the state has abundant waterways, including the Mississippi River, local hydropower only represents about 1 percent of current supply,[35] with additional hydropower imported from Canada.[36] Minnesota also operates two nuclear power plants, which were responsible for about 21 percent of the state's electricity generation in 2015.[37]


Minnesota's Energy Profile
Electricity Generation (2016)
23.8% Nuclear
1.5% Hydroelectric
18.2% Wind
2% Biomass
15% Natural Gas
39.5% Coal
Renewables generation increased from 6% in 2005 to 21% in 2015
No in-state fossil fuel resources so spends $18 billion in retail fossil fuel sales annually
Average retail electricity rate of 9.7 cents/kWh, lower than national average
Electric Utility Share of Customer Base
Investor-Owned
Cooperative
Municipal
Xcel Energy 47.3%
Great River Energy 24.8%
Energy Consumption by End-Use Sector (2014)
22.5% Residential
19.3% Commercial
34.6% Industrial
23.6% Transportation
Buildings account for 40% of energy use
57% energy consumption is rejected
KEY ACTIONS
1980s
Conservation Improvement Program (CIP): Required all public utilities operate at least one CIP in 1989. Required 1.5% of electric revenue and 0.5% of natural gas revenue be invested in efficiency upgrades starting in 1991.
2005
Executive Order 05-16: State facilities must reduce energy use by 10% in 2006 and adopt specific conservation measures, such as Minnesota Sustainable Guidelines.
2007
Energy Efficiency Resource Standard (EERS): CIP spending goal changed to savings goal of 1.5% of retail energy sales each year.
Next Generation Energy Act: Statewide emissions reduction goal of 30% by 2025 and 80% by 2050 based on 2005 levels.
Renewable Energy Standard (RES): Utilities required to have at least 25% of retail electricity sales by utilities be from renewables by 2025.
2008
Sustainable Building 2030 Energy Standard: All state-funded buildings built after 2010 must reduce energy use by 60% of an average building by 2010, incrementally increasing until net zero energy is achieved in 2030.


Minnesota's Energy Economy
Snapshot of Efficiency Savings
Between 1990 and 2011, efficiency upgrades helped forego 1,400 MW of new generation plant construction
In 2012, energy savings equaled the average annual consumption of over 180,000 Minnesota homes
By 2030, energy efficiency is projected to reduce electricity use by 11 million MWhs
Clean Energy Employment
Smart Grid 6.3%
Solar Energy 8.0%
Wind Power 11.2%
Bioenergy 11.9%
Energy Efficiency 62.6%
772 clean energy businesses
15,338 clean energy jobs
Compared to State Overall
Job growth (2000-2014)
78%
11%
Average annual wages (2013)
$71,000
$50,100
Every $1 invested in the Conservation Improvement Program generates $4.00 to $4.30 in energy, environmental, and economic benefits to the state.
Clean Energy Investments
About $11 billion in clean energy projects
$452 million in early-stage companies between 2004 and 2013
2011
Executive Orders 11-12 and 11-13: State facilities required to reduce energy use by 20% and each state agency required to develop a sustainability plan.
2013
Clean Energy & Economic Development Initiative
RES Solar Carve-out: Public utilities required have at least 1.5% of retail electricity sales be from solar energy by 2020.
Made in Minnesota Solar Incentive Program
Net Metering: Eligible systems expanded and alternative value of solar tariff finalized.
Petroleum Replacement Goal: Updated goal of 30% of liquid fuel sales being derived from renewables by 2025.
2014
Climate Solutions and Economic Opportunities Initiative
Combined Heat & Power Study
Revenue Decoupling: First program established at Minnesota electric utility.
2016-17
2025 Energy Action Plan
Opportunity Agenda for a Better Minnesota: Proposal to increase RES to 50% by 2030, increase EERS to 2% for electric utilities, and allocate $1.3 million for efficiency upgrades in public buildings.

Since the 1980s, Minnesota has demonstrated its leadership in advancing policies that stimulate development and demand in the clean energy economy.[38] For example, Minnesota was the first state to mandate a diesel fuel blend with 2 percent biodiesel in 2002, which grew to 5 percent and then 10 percent in subsequent years.[39] The state also passed a voluntary renewable energy objective for electric utilities in 2001 and then fortified its commitment in 2007, requiring that 25 percent of electricity come from renewable sources by 2025.[40] In fact, the state proposed legislation in 2017 that would increase the standard to 50 percent by 2030.[41]

In 2014, Minnesota's clean energy economy supported over 15,300 jobs, 772 business establishments, higher than average wages, ninety-eight patents (ranked eighth nationally), and $11 billion in renewable energy projects.[42] Clean energy jobs grew by an impressive 78 percent from 2000–2014, seven times faster than total employment.[43] The sector is largely supported by installation jobs (75 percent of the clean energy workforce) and small businesses (80 percent of the clean energy corporate base).[44] Continued efforts to increase in-state renewable energy and energy efficiency could eliminate dependence on fossil fuel imports, allowing Minnesota to recapture $18 billion that could be reinvested in the state while creating thousands of local jobs for Minnesotans.[45]

Landscape for Job Growth

Minnesota is home to many economic assets such as diverse industry strengths in agriculture, mining, medical technology, manufacturing, and financial services; a highly skilled and engaged workforce; a large number of multinational companies; and a strong civic culture.[46] In fact, Minnesota has added 280,000 jobs since the recession and, in February 2017, unemployment fell to 4.0 percent.[47]

However, this recovery has failed to reach all Minnesotans, with significantly higher unemployment rates in certain geographic regions and among minority groups,[48] as shown in Figures 1 and 2. While unemployment figures for the majority white population are very low, at 3 percent, Minnesota's black population faces an 8.5 percent unemployment rate, as of February 2017.[49] This is a significant improvement from the previous year's black unemployment rate of 13.6 percent.[50]

The ratio of black to white unemployment in the Minneapolis–St. Paul metro area is one of the highest relative disparities in the nation.[51] Minnesota has thousands of unemployed citizens who desire the dignity and security of a good-paying job, but who may lack the educational and job resources to realize this.

Figure 1. Minority unemployment is significantly high. (Source: U.S. Census Bureau, 2015)

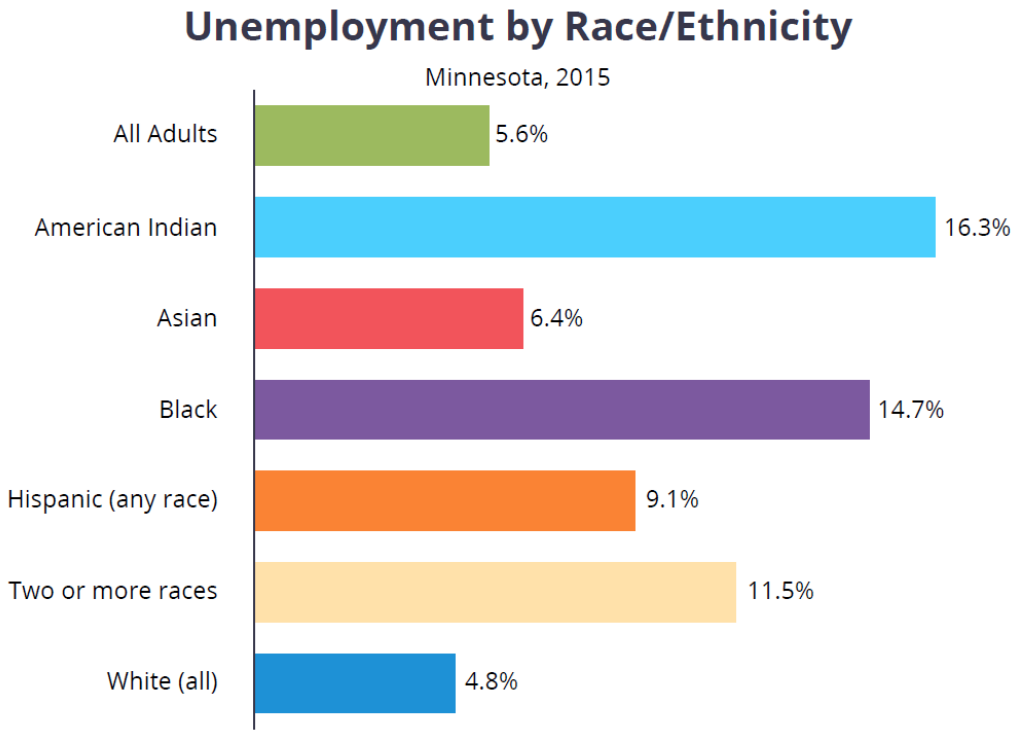
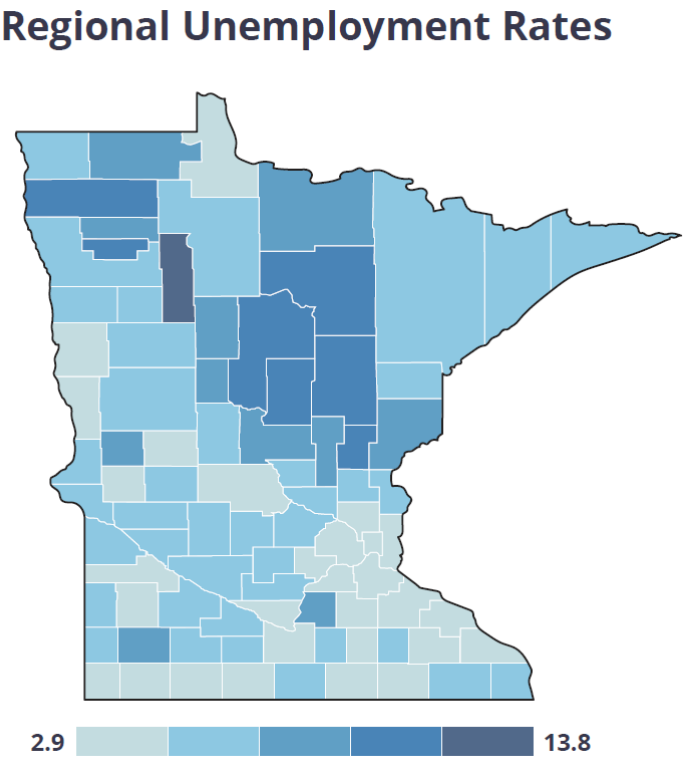


Figure 2. County unemployment rates are higher across Greater Minnesota. (Source: Minnesota Department of Employment and Economic Development, December 2016)



Additionally, the state faces a severe shortage of skilled workers and knowledge capital, in part due to an aging workforce and underutilization of the minority population. A 2011 Minnesota Skills Gap Survey found that nearly half of business respondents experience moderate to severe workforce shortages, particularly in skilled production (58 percent) and science and engineering (44 percent), as well as low-skilled production (16 percent).[52] Between 2010 and 2015, jobs held by Minnesotans over the age of fifty-five jumped by 27.3 percent, while total job opportunities increased by only 9 percent.[53] The young working population is also not expanding enough to meet employment demands,[54] and the underutilized minority population will become a more sizable portion of the workforce. Between 2016 and 2030, minority groups will grow by 37.3 percent compared to 4.1 percent in the white population.[55] Yet recent focus groups in the Twin Cities region show that 60 percent of professionals of color have long-term plans to move out of the state, particularly due to an isolating workplace and neighborhood culture.[56] These trends signal an urgent need to strengthen training, retraining, retention, and

diversity programs to expand skill development and retain current workers, especially for high-growth industries.

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Wage Trends in Minnesota

Wage growth has not tracked closely to increases in productivity, and has mainly benefited high-income earners. Minnesota reports a high income per capita, at an average of $52,117 compared to the U.S. average of $49,571,[57] and a relatively low cost of living.[58] However, income growth in recent years has been slight, despite a 1.4 percent growth in output per job between 2009 and 2013.[59] The bottom tenth percentile of wage earners, in particular, experienced a startling 12.1 percent wage decline between 1999 and 2013.[60] In turn, the state passed a bill in 2014 to gradually ramp up the minimum wage from $6.15 to $9.50 per hour.[61]

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Minnesota's Strengths, Weaknesses Opportunities, and Threats in the Energy Efficiency Industry

Minnesota's energy efficiency sector has the potential to bolster job opportunities within the changing workforce landscape while amplifying the environmental and economic impacts of energy efficiency in the state. As the state's largest clean energy sector, energy efficiency accounts for 62 percent of clean energy jobs, nearly $700 million in total annual wages, and about 450 business establishments.[62] Minnesota's industry base includes large corporations such as 3M, Ecolab, Honeywell, Pentair, Andersen Windows, and Marvin Windows and Doors. Over 9,900 Minnesotans are employed full time in energy efficiency work.[63] This number jumps to 47,000 employees when including those who have part-time engagement in energy efficiency work.[64]

Minnesota has prioritized energy efficiency since the 1980s, and has continued to remain steadfast in its support through innovative policies and programs. In the building efficiency sector, the state government leads by example by benchmarking energy use in state buildings (B3 Benchmarking) and setting construction standards

for state-bonded commercial, institutional, and industrial buildings (SB 2030).[65] Minnesotans also have access to numerous financial and technical assistance resources for efficiency upgrades, many of which are offered by the state. The state requires utilities to establish a Conservation Improvement Program with an annual energy savings goal of 1.5 percent.[66] This goal may increase to 2 percent for electric utilities under a recent proposal by Governor Dayton.[67] The 2007 Next Generation Energy Act encourages energy conservation through an economy-wide greenhouse gas emission reduction goal of 80 percent by 2050.[68] Despite progress made toward this goal, the state missed its 15 percent by 2015 benchmark and projects that it will miss the 30 percent by 2025 benchmark if further actions are not taken.[69]

In 2015, Minnesota vaulted to tenth place on ACEEE's State Energy Efficiency Scorecard[70] and, more importantly, cut electricity emissions by 13 percent between 2006 and 2011.[71]

Despite an excellent track record of policies and accomplishments and an abundance of assets in the industry, there is still room for growth as outlined in the following table.[72] New initiatives could tackle the many opportunities for improved energy efficiency given that 57 percent of energy consumed in Minnesota is wasted.[73] In particular, Minnesota could target inefficiencies in its building stock, which are estimated to be 35 percent for the residential and commercial sectors and 20 percent for the industrial sector.[74] Capitalizing on energy efficiency through strategic policies and programs would produce huge energy, cost, and emissions savings while fostering economic growth and building Minnesota's robust energy efficiency industry.

Strengths	**Weaknesses**
• Early policy leadership on energy efficiency • Robust value chain of 450 business establishments, which includes Fortune 500 companies (Honeywell, 3M, Pentair, Ecolab) • Highly educated workforce	• Potentially high capital costs, large time investment, and long payback periods of efficiency upgrades • Lack of venture capital funding and working capital loans for early-stage and small clean energy businesses • Lack of coordinated and sustained

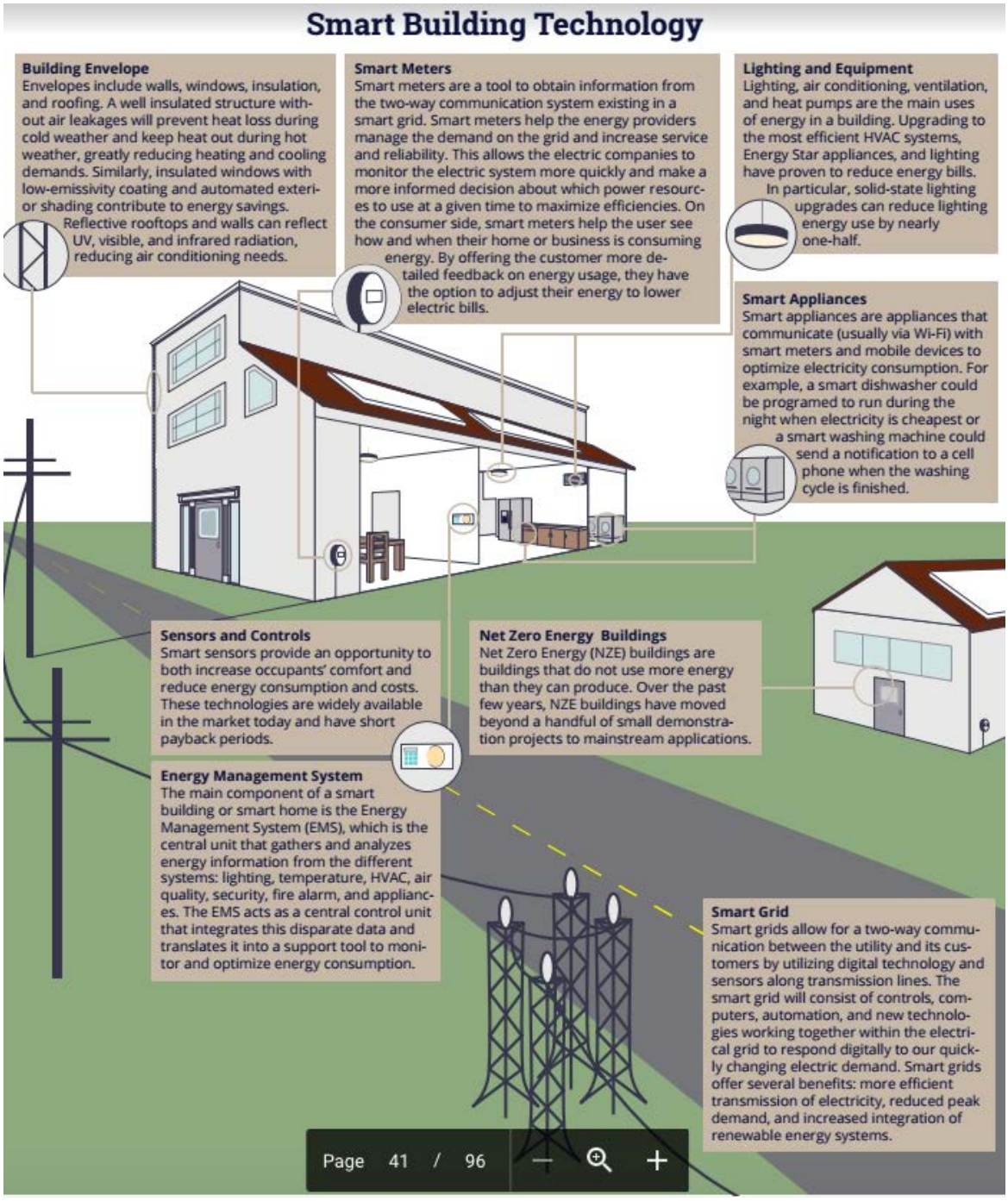
• Strong collaboration across universities and colleges on industry-focused education and training • Numerous low-cost resources for energy assessments and efficiency upgrades • Strong slate of state tax credits	state leadership • Unclear policy signals for utility customer CHP implementation
Opportunities	**Threats**
• 57 percent of Minnesota's energy consumption is wasted, a sizable portion from the building stock • Growing national demand for smart building technology, estimated at 25.9 percent each year until 2020, and for other efficiency technologies • Potential to engage large corporations and real estate owners on efficiency upgrades • Employment potential of unemployed and underemployed communities • Outreach programs through the utilities and nonprofits, including the Center for Energy and Environment	• Potential policy uncertainty at the state and federal levels • Supply and innovation from out-of-state businesses • Fluctuating electricity and natural gas prices • Aging workforce and loss of institutional leadership

Highlighted Energy Efficiency Technologies

Smart Building Technology

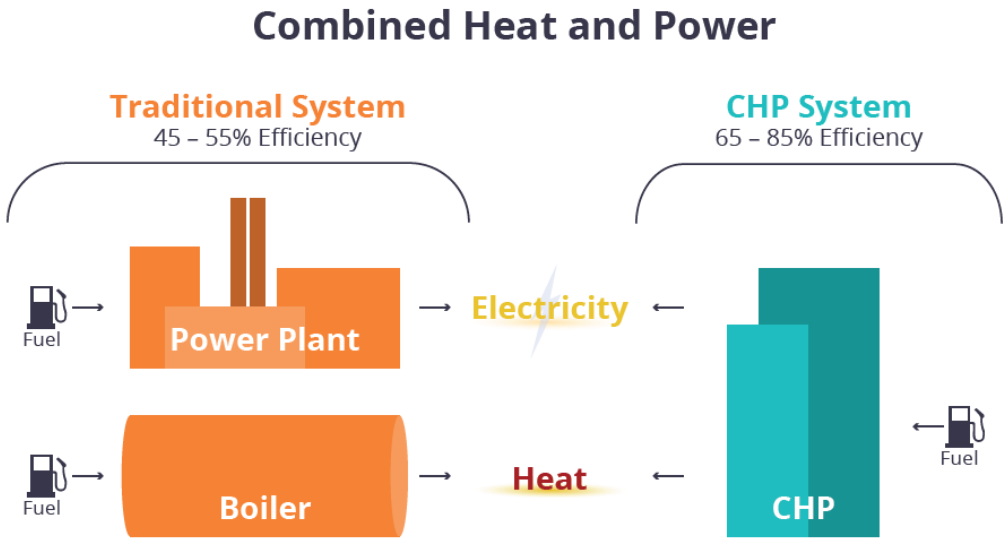
Smart buildings utilize information technology to automate operations with the goal of comfort and productivity as well as energy efficiency and low environmental impact. [75] Smart building technologies are integrated through two-way communication and responsive controls. This means lighting, appliances, plug loads, energy generation and storage, and heating and cooling systems are ideally connected through a home energy management system (HEM) for residential buildings or a building energy management system (BEM) for commercial and

industrial buildings. Components within the energy management system might include sensors, controllers, actuators, and management software. Through machine-to-machine communication, this highly sophisticated and efficient system is able to respond and adjust to changing conditions in order to optimize building performance. Technological innovation is expected to enable a 35 percent reduction in building energy use by 2030.[76]



Combined Heat and Power

Combined heat and power (CHP) is the production of both electricity and thermal or mechanical energy through a single system to meet a local demand. CHP recovers and utilizes waste heat from electricity production to enable cogeneration, which can significantly reduce fossil fuel use and greenhouse gas emissions.[77] In fact, CHP systems have the capacity to improve energy efficiency by up to 40 percent.[78] A form of distributed generation, CHP can have outsized benefits, especially when implemented in industrial, commercial, and institutional buildings that require a large concentration of energy. CHP is also compatible with numerous fuels, such as natural gas and biomass.[79]



Market Trends and Opportunities

Minnesota could capture significant energy and cost savings opportunities across its building stock and gain revenue by serving out-of-state markets. The economic benefits include increasing local and regional demand for Minnesota products, supporting jobs and businesses across the value chain, and garnering cost savings for building owners—money that could then be spent in the local economy.

Buildings make up 40 percent of energy use in Minnesota and end-use inefficiencies are estimated at a substantial 35 percent of that amount.[80] Minnesota has made policy strides to improve efficiencies in new or retrofitted public

buildings.[81] Minnesota has over sixty-eight million square feet of public buildings that could still be retrofitted at a cost of approximately $343 million.[82] The state's private commercial buildings and industrial facilities are also a large source of potential savings. Commercial building retrofits alone have a 2.8 million MWh energy savings opportunity,[83] and industrial energy conservation across seven manufacturing sectors could generate 7 percent in overall electricity savings.[84]

START CALL OUT BOX

Achieving Net Zero Energy in the City of Duluth[85]

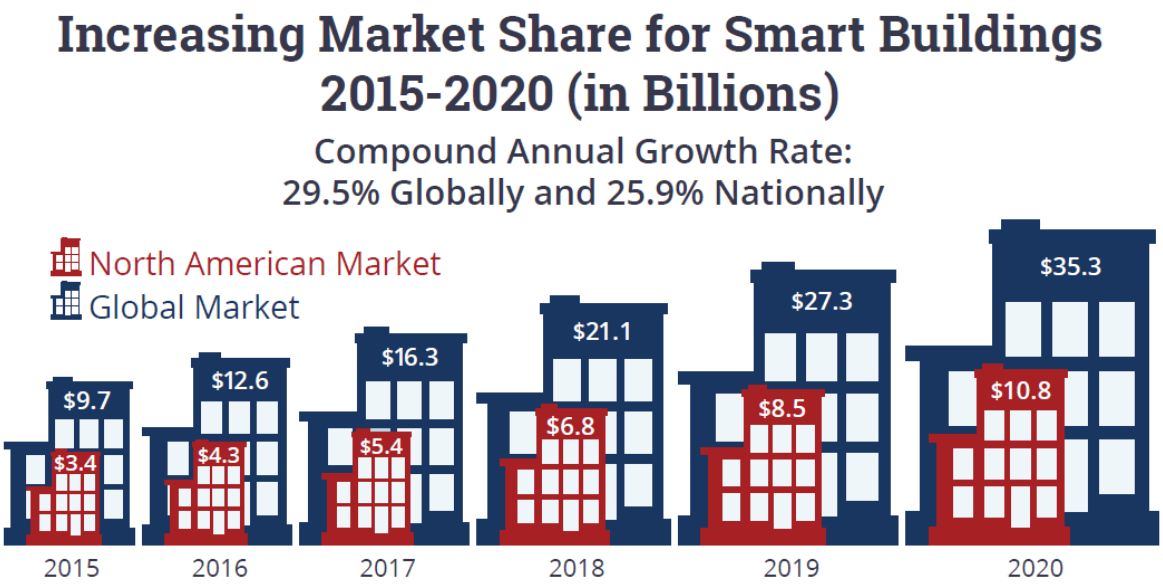
The University of Minnesota's Energy Transition Lab and the Center for Sustainable Building Research partnered to determine actionable steps to transition Duluth's building stock to net zero energy. Using an ideal target building, the research team developed a computer model to assess the potential energy savings of various conservation measures. These measures included minimizing exhaust flow, better insulating the roof and walls, reducing air infiltration, updating refrigeration, and curtailing the internal equipment plug load. The model found that each measure could cut energy use by 44 to 62 percent and result in annual savings of $4,700 to $7,600.

END CALL OUT BOX

There is also a greater potential for CHP implementation in the state. Minnesota currently has fifty-two CHP sites with an installed capacity of 960 MW,[86] and over 3,000 MW of untapped technical potential across industrial, commercial, and institutional sites.[87] In particular, Minnesota could look at facilities with large energy loads, such as manufacturing plants, utility cooperatives, university buildings, and hospital complexes.[88]

Additionally, Minnesota's energy efficiency companies are well positioned to supply the growing demand for smart building technology. The market is driven by government regulations, concerns of climate change, and the rising and uncertain energy costs.[89] In North America, the sector is expected to grow at an annual rate of 25.9 percent through 2020.[90] The U.S. residential and commercial building stock accounts for 40 percent of national energy use[91] and could continue to be a major target for energy efficiency initiatives.

Figure 3. The U.S. and global market share for smart buildings will grow substantially through 2020. (Source: Allied Market Research, January 2014)



Charting the growth of specific components within the value chain could also help Minnesota determine the best industries to leverage its strengths. For example, energy-efficient windows and HVAC systems will see accelerated market growth on a global level. The market for energy-efficient windows is expected to grow from $10.1 billion in 2016 to $25.3 billion in 2026, with significant growth in the residential sector.[92] The market for energy-efficient HVAC systems for commercial buildings will jump from $22.8 billion in 2015 to $47.5 billion in 2024.[93] Minnesota could strengthen its energy efficiency industry to capitalize on future market growth.

State Assets to Support Energy Efficiency Cluster Development

Having a strong economic foundation is essential to sustaining and growing clusters. Minnesota has a solid foundation upon which it could expand the energy efficiency industry. Reinforcing its assets in the innovation ecosystem, access to capital, workforce development, and project development and finance for energy efficiency upgrades could support the expansion of existing energy efficiency companies and attract new businesses to the state.

Innovation Ecosystem

START CALL OUT BOX

Innovation Ecosystem

- Promotes research and development
- Facilitates movement of new technology to market
- Incubates early-stage businesses

END CALL OUT BOX

In today's competitive, globalized economy, businesses are more likely to thrive in cities and states that offer a rich innovative environment. A successful ecosystem interconnects universities, entrepreneurs, investors, businesses, government, and nonprofits to facilitate open exchange of resources, information, and support. Innovation leads to high-skilled, local jobs, and the streamlined transfer of ideas from the lab to the marketplace accelerates further entrepreneurship and job creation. In particular, robust innovation ecosystems offer efficient intellectual property protection mechanisms, mentoring for entrepreneurs, and active engagement of businesses and venture capital.

Minnesota has consistently ranked high in innovation, especially in the cleantech sector. In the 2016 America's Top States for Business scorecard, Minnesota captured the ninth spot for Technology and Innovation, which factored in infrastructural support for research and development (R&D), research grants, and patents.[94] In 2013, Minnesota had the eighth most clean energy patents and the twelfth most patents for energy efficiency technology in the United States.[95] State leaders can continue to support this robust innovation ecosystem at both the university and business levels.

Research Universities

Located in the Twin Cities metro area, the University of Minnesota (UMN) is a top-tier, public research university and a major innovation hub in the state.[96] UMN ranks fourteenth in R&D expenditures ($800 million) compared to other U.S. academic institutions.[97] UMN emphasizes collaboration between university researchers and state industries through programs such as Minnesota's Discovery, Research, and InnoVation Economy (MnDRIVE) initiative and the Minnesota Innovation Partnerships (MN-IP) program. Launched in 2013, MnDRIVE is a state-funded initiative that dedicates $18 million annually to academic-business partnerships in four emerging industries: robotics, sensors, and advanced manufacturing; global food ventures; environmental solutions; and brain conditions.[98] MN-IP provides opportunities for industry to license university technologies and sponsor research.[99]

UMN leads clean energy and energy efficiency research in the state. Within the Department of Mechanical Engineering, researchers are pursuing more efficient energy conversion in solar, lighting, and vehicles.[100] The Center for Sustainable Building Research focuses on the built environment and community development, which includes innovations in green building policies and practices.[101]

Resources for Business Innovation and Expansion

At the business level, Minnesota offers numerous resources to support R&D. Minnesota provides a Credit for Increasing Research Activities that reduces income or franchise tax by 10 percent on qualifying expenses up to $2 million and 2.5 percent for additional expenses.[102] Minnesota sets aside $2.6 million in grants

annually for the Conservation Applied R&D Program, which funds energy efficiency technology R&D that can help utilities reach their annual energy savings goals.[103] Through the Innovative Voucher Program, small businesses are also eligible for up to $25,000 to receive technical assistance from higher-education and nonprofit service providers, such as MN-SBIR.[104] MN-SBIR helps Minnesota companies access the federal Small Business Innovation Research and Small Business Technology Transfer Programs by offering trainings, business and technical assessments, and award assistance.[105]

Additionally, the Greater Minnesota Job Expansion Program encourages job growth outside the metro region and in traded sectors. Businesses that add at least two full-time equivalent workers or increase employment by 10 percent—whichever is greater—within three years are eligible for a sales tax refund.[106]

Access to Capital

START CALL OUT BOX

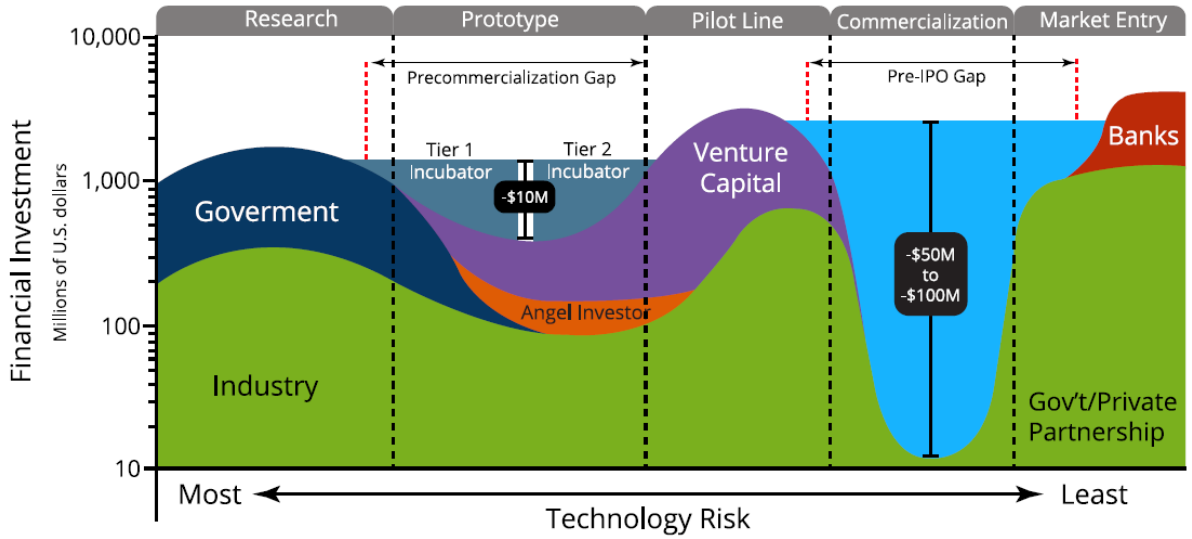
Access to Capital

- Provides funding for new and growing businesses
- Connects investors with market opportunities
- Attracts entrepreneurs

END CALL OUT BOX

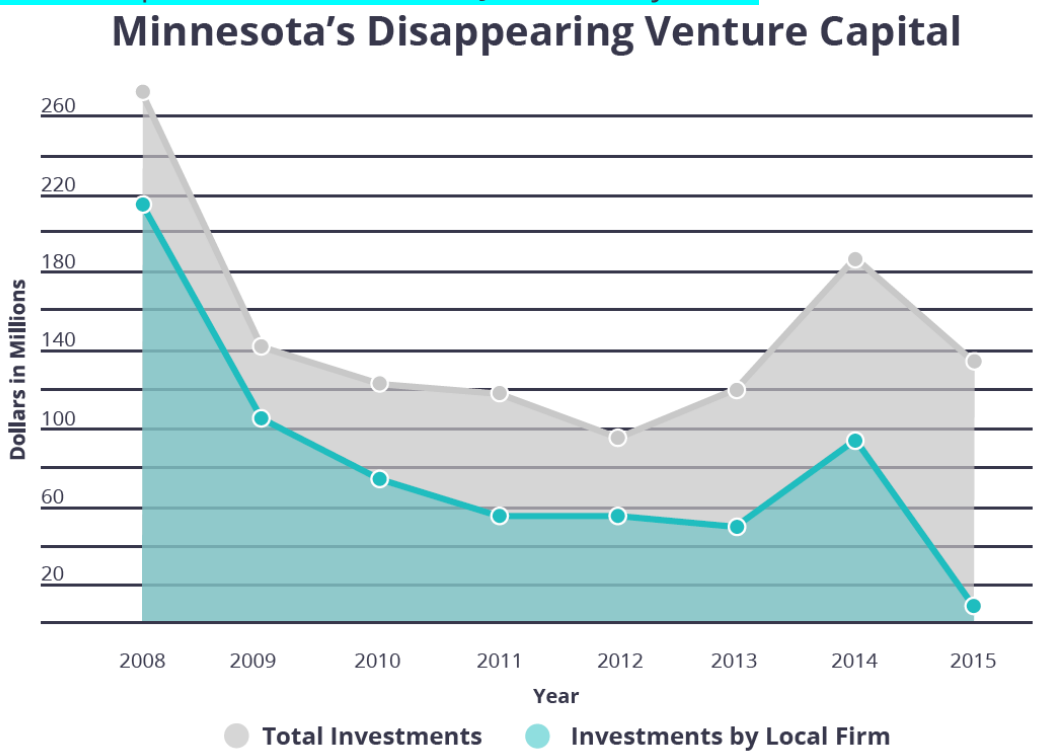
Access to capital is essential for small businesses and entrepreneurs to develop new products, grow their businesses, bring products to market, and create new jobs. Having access to investors and non-dilutive capital, such as grants and loans, can be the difference between success and failure, especially to bridge the two "valleys of death" in technology transfer (Figure 4). In 2015, 77 percent of venture capital funding went to companies in California, New York, and Massachusetts; businesses in the other forty-seven states had to compete over the remaining 23 percent, stifling innovation across the country and highlighting the importance of state policies for new venture capital investments.[107] Moreover, venture capital investments in the cleantech sector have tapered in recent years,[108] signaling a need for creative and diverse funding sources.

Figure 4. New technologies need help crossing the "valleys of death" during technology development and commercialization. (Source: U.S. Department of Energy)



Minnesota has suffered from declining competitiveness for venture capital and decreasing local private investments.[109] Many local firms, including those that were instrumental in funding the now-strong medical technology industry, have either left the state or are aging out (Figure 5).[110] To ensure the success of as many new and growing businesses as possible, Minnesota's leaders should consider creating policies to attract more diverse capital to the state and establish navigation services for business funding.

Figure 5. Venture capital in Minnesota has decreased dramatically since 2008. (Source: Minneapolis/St. Paul Business Journal, May 2016)



Programs and Resources for Entrepreneurs

START CALL OUT BOX

Dilutive and Non-Dilutive Capital

Dilutive capital, such as venture capital, reduces shares of ownership in a company. Non-dilutive capital, such as grants and loans, do not dilute firm ownership.

END CALL OUT BOX

Minnesota caters to different business development needs by offering a diverse slate of dilutive and non-dilutive financing programs. The Minnesota Investment Fund supports expanding businesses by awarding funds to local government units that offer loans.[111] The Angel Tax Credit Program encourages private investment in high-tech sectors by giving investors a 25 percent tax credit.[112] In fact, Minnesota leveraged $14.7 million in tax credits to attract $58.9 million of investment in 105 businesses in 2016.[113] Businesses eligible under the Angel Tax Credit Program also

have special access to $20,000 to $250,000 in loans through the Angel Loan Program.[114]

UMN cultivates an entrepreneurial culture within the university and across the state. The Venture Center, which connects researchers, entrepreneurs, industry executives, and investors in order to transition university research from the lab to the market, has launched one hundred startups with $219 million in investment capital since 2006.[115] The Carlson School of Management hosts an annual startup competition called the Minnesota Cup, which has grown into the largest of its kind in the country.[116] Entrepreneurs also have access to financial and technical assistance through Cleantech Open Midwest, a regional business accelerator within the larger Cleantech Open network. Since 2010, the program has assisted ninety startups that raised $20 million in investments.[117]

Workforce Development

START CALL OUT BOX

Workforce Development

- Invests resources in people
- Bridges skills gaps
- Develops training programs and industry partnerships

END CALL OUT BOX

Trained and skilled workers are fundamental to cluster development. If firms in the same cluster are able to coordinate with the government, schools, and related nonprofits on policies and programs to train workers, they will be better equipped to identify employment needs and find qualified workers with the necessary skills to fill available jobs. A thoughtful workforce development approach includes industry best practices for recruiting, hiring, training, promotion, and compensation; education and training infrastructure (including community colleges, project-based learning experiences, and apprenticeship programs); and public policy—specifically rules, regulations, and funding streams related to workforce and education.[118]

Minnesota has a large, well-educated labor pool of over three million people, ranking third in the percentage of the population with a high school degree or higher and eleventh in the percentage with a bachelor's degree or higher.[119] However, Minnesota is facing a new workforce paradigm, with an increasingly older and more diverse workforce that will require targeted retention and training strategies to maintain its competitive advantage and to meet industry demand for skilled labor. Minnesota can leverage its large network of educational institutions, programs, and resources to continue to build a skilled workforce.

START CALL OUT BOX

State Plan to Strengthen Education and Employment

As required by the Workforce Innovation and Opportunity Act, Minnesota introduced a bold plan to strengthen education and employment in the state between 2016 and 2020. Minnesota centered its plan on two primary goals: (1) amplify educational and employment opportunities for people of color and people with disabilities and (2) build career pathways led and informed by industry leaders.[120] Stemming from these goals, Governor Dayton created the Office of Career and Business Opportunity to help disadvantaged workers navigate career pathways and pursue business opportunities.[121]

END CALL OUT BOX

Technical Education Programs

The Minnesota State Colleges and Universities system is the fourth-largest system of two-year colleges and four-year universities in the United States, consisting of thirty colleges and seven universities with fifty-four campuses throughout the state.[122] This broad network provides numerous opportunities for Minnesotans across the state to receive a quality education and gain workforce-ready skills.

To respond to current and future workforce needs in high-demand industries, including energy, Minnesota established State Centers of Excellence across its network of schools.[123] The 360 Manufacturing and Applied Engineering Center of Excellence is a collaborative effort between fourteen state colleges, educators, and business leaders to recruit, educate, and train workers for careers in advanced manufacturing.[124] The 360 Center also leads Dream It. Do It. Minnesota, a collaboration with industry to promote careers in manufacturing.[125] Similarly, the

Minnesota Center for Engineering and Manufacturing Excellence focuses on developing talent in engineering and advanced manufacturing through STEM-based outreach, targeted degree programs, and professional development.[126] The Minnesota Energy Center gathers ten colleges and business leaders in the energy industry to develop and manage energy education programs, with roughly forty across the colleges.[127] Specific to the building efficiency sector, UMN Extension's Housing Technology Team conducts trainings for building professionals and conservation improvement workshops for building owners.[128]

Minnesotans can also access regional training programs, such as Twin Cities R!SE and HIRED in the Twin Cities region. Both programs offer skills development and employment training for disadvantaged, unemployed, and underemployed groups.[129]

Programs and Resources for Employment and Training

The Minnesota Job Skills Partnership Program supports the strategic development of training and retraining programs by businesses and educational institutions. The program includes a Pathways Program that helps transition people with severely low incomes to better-paying jobs and a Job Training Incentive Program that targets in-house training opportunities for Greater Minnesota businesses.[130] Since 2011, the Jobs Skills Partnership Program has awarded $41 million to train over 48,000 workers.[131] Minnesota businesses can also tap into up to $1 million for capital investments through the Job Creation Fund.[132]

The state offers special program support to disadvantaged groups, including at-risk youth, refugees, displaced workers, senior citizens, and veterans. Minnesota can leverage the federal Work Opportunity Tax Credit to incentivize employment from groups with consistently high unemployment rates.[133]

Additionally, Minnesota encourages out-of-classroom learning through apprenticeships and internships. In 2015, the state received $5 million in federal funds to expand its apprenticeship program in five demand industries, including advanced manufacturing and information technology.[134] Through SciTechsperience, college students studying science, technology, engineering, and

math (STEM) can tap into internship opportunities at small and medium-sized companies.[135]

Project Assessment, Development, and Finance

The state offers many loans for energy audits and efficiency upgrades, including for residential properties;[136] commercial, industrial, and nonprofit facilities through the statewide Commercial Property Assessed Clean Energy (PACE) Program;[137] and public entities.[138] For examples, municipal, university, school, and hospital buildings can leverage the Guaranteed Energy Savings Program for technical and financial assistance on reaping energy and cost savings.[139] Under the Commercial PACE Program, Minnesotans are better able to pursue building upgrades that may be capital intensive. Upfront costs are covered by private loans and customers can repay the loan on their property taxes, while receiving the incremental cost savings of the upgrade.[140] Utility customers can also tap into programs offered by utilities via the Conservation Improvement Program, such as energy audits and project rebates.[141] Moreover, the UMN-based Minnesota Technical Assistance Program (MnTAP) provides free scientific and engineering advice to businesses and municipalities on industrial solutions to improve operational efficiency. With over thirty years of experience, MnTAP has helped companies realize 65 million kWh and 5 million therms of energy savings, in addition to significant water and waste reductions, saving businesses over $1.5 million per year.[142] Because of the diversity of resources, organizations such as the Center for Energy and Environment and Clean Energy Resource Teams help connect Minnesotans to appropriate funding.[143]

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Significant Energy and Economic Impacts of State Weatherization Assistance Program[144]

Minnesota's Weatherization Assistance Program offers free energy assessments for low-income homeowners, with support from federal funds. When the Department of Commerce received $138 million in federal funding through the American Recovery and Reinvestment Act, the funds enabled 20,000 homes to receive energy efficiency upgrades. As a result, nearly 500 jobs were supported each quarter and households averaged a decrease in primary heating fuel by 23 percent, which equates to initial permanent savings of about $350 for homeowners.

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Jobs Impact of Minnesota's Energy Efficiency Cluster

Minnesota's Energy Efficiency Companies

Minnesota's energy efficiency cluster benefits from a diverse group of businesses, ranging from growing startups to large, established businesses. Two companies are featured here to demonstrate the vast power of this cluster's structure and the enormous potential to foster more home-grown energy efficiency companies.

START IN TEXT BOX

Honeywell Home and Building Technologies, Golden Valley: *~1565 Employees*[145]

- Founded in 1927 with earlier roots of innovation and development in Indiana and Minnesota
- Now an international Fortune 100 company with business divisions in aerospace, home and building technologies, safety and productivity solutions, and performance materials and technologies
- Building technologies division develops products for home comfort, security, and sustainability, including building automation systems, commercial combustion controls, and installation and maintenance services
- Three Minnesota facilities dedicated to building technologies in Golden Valley, Vadnais Heights, and Bloomington
- Along with three aerospace facilities, Honeywell in Minnesota has over $272 million in purchases and contracts with in-state suppliers

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75 Fahrenheit (75F), Burnsville: *~16 Employees*[146]

- Established in Minnesota in 2012 and launched second office in India in 2016
- Leverages the Internet of Things and cloud computing for a self-optimizing building automation system that addresses HVAC, lighting, and energy management needs for light commercial buildings

- Awarded the grand prize at the 2014 Minnesota Cup and the 2014 Rise of the Rest pitch competition, among other state and national recognitions
- Partnered with the United Nations Environment Program's Sustainable Buildings and Climate Initiative

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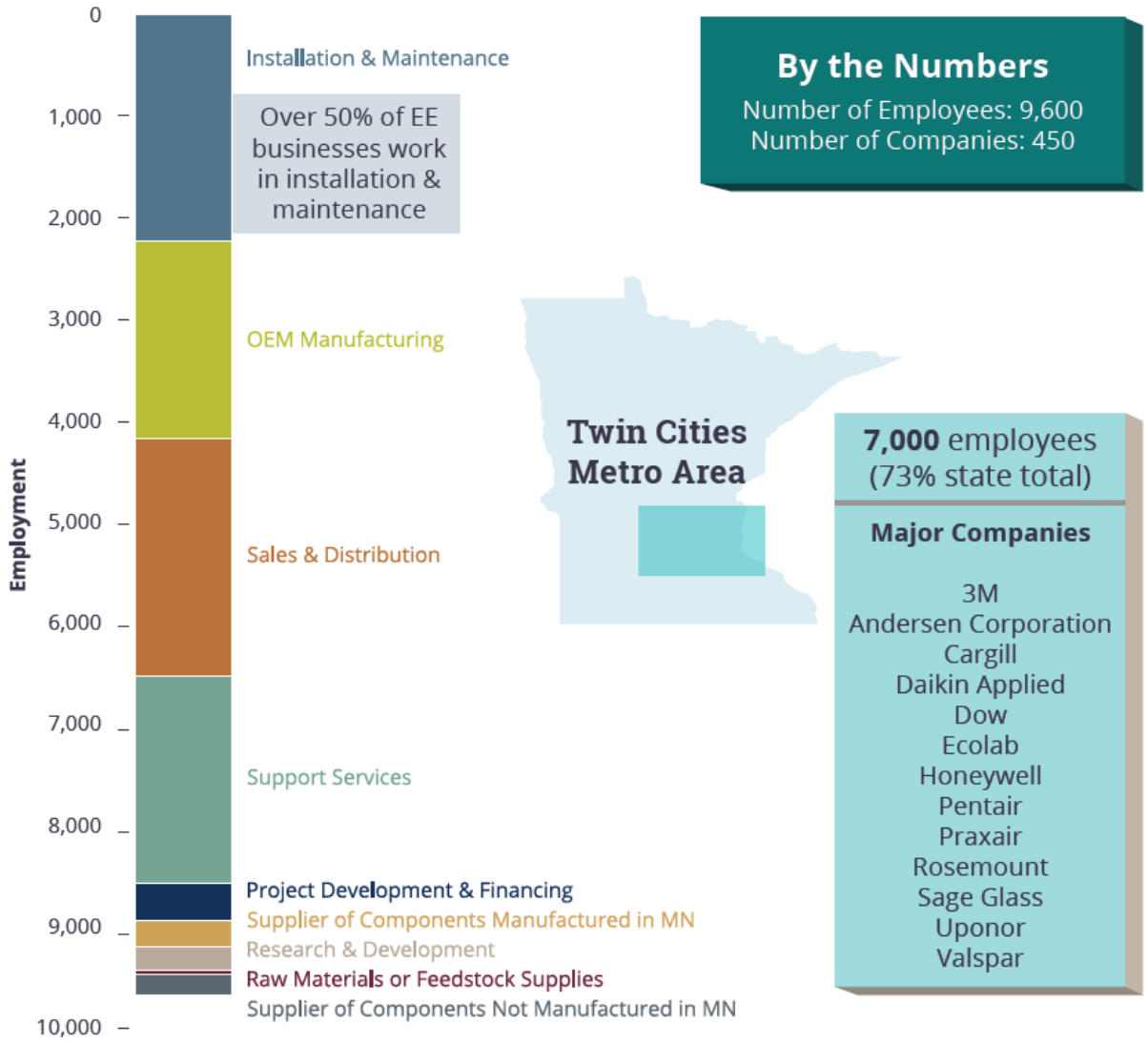
Snapshot of Minnesota's Energy Efficiency Cluster



Types of Job Opportunities in Energy Efficiency

	Job Description	Typical Entry-Level Training*	Average Hourly Wage in MN*
HVAC / Refrigeration Mechanics and Installers	Install and repair temperature and air quality control systems for buildings	Postsecondary education, apprenticeship	$25.93
Floor, Ceiling, and Wall Insulation Workers	Apply insulating materials to building structures	On-the-job training	$22.98
Mechanical Insulation Workers	Apply insulating materials to pipes, ductwork, and other mechanical systems	HS diploma or equivalent, apprenticeship	$30.80
Construction and Building Inspectors	Evaluate compliance with building codes and regulations	HS diploma or equivalent, on-the-job training	$31.11
Construction Laborers	Work on construction sites	On-the-job training	$21.34
Electricians	Install, maintain, and repair electrical systems	HS diploma or equivalent, apprenticeship	$28.27
Utility Meter Readers	Record and verify meter data	HS diploma or equivalent	$23.44
Electrical Engineers	Design and develop electrical equipment	Bachelor's degree	$44.45
Mechanical Engineers	Design and develop mechanical tools, engines, and machines	Bachelor's degree	$39.27
Engineering Technicians	Assist head engineers with design, production, and testing	Associate degree	$27.64
Systems Software Developers	Develop underlying software systems or applications	Bachelor's degree	$51.04
Stationary Engineers and Boiler Operators	Manage facility equipment such as HVAC and power systems	HS diploma or equivalent, on-the-job training	$27.03
Urban and Regional Planners	Develop plans for land use and infrastructure	Master's degree	$33.37
Sales Representatives	Sell technical and scientific products for wholesalers or manufacturers	Bachelor's degree	$56.03

* Data from U.S. Bureau of Labor Statistics, 2015 Occupational Outlook Handbook and May 2015 State Occupational Employment and Wage Estimates

Potential Job Growth from Energy Efficiency Cluster Development

To estimate jobs potential for the Minnesota energy efficiency industry, we combine existing tools, analyses, and projections from several reputable sources. Rather than provide a specific estimate, we examine multiple outcomes that show the average number of jobs that could be supported annually through in-state energy efficiency projects in the residential, commercial, and industrial sectors from 2017 through 2030, a fourteen-year timeframe.

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As national demand for energy efficiency increases, Minnesota's energy efficiency cluster could grow to serve a larger portion of national demand than it does currently. Creating local demand for products sends a market signal to businesses, encouraging investment in new facilities and employees. By creating a robust market for energy efficiency products and services within the state, Minnesota could reasonably support over 26,000 direct, indirect, and induced jobs from 2017 through 2030 (Figure 6). This projection includes both new and sustained jobs.

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Direct, Indirect, and Induced Jobs

To estimate the potential economic impact of Minnesota's energy efficiency supply chain, we distinguish direct, indirect, and induced jobs.

- Direct jobs: reflect jobs resulting from increases in demand for energy efficiency projects in Minnesota.
- Indirect jobs: reflect jobs resulting from changes in transactions between industries as supplying industries respond to increased demand from Minnesota's energy efficiency industry.
- Induced jobs: reflect jobs resulting from changes in local spending as a result of increased demand in Minnesota's energy efficiency and indirect industries.

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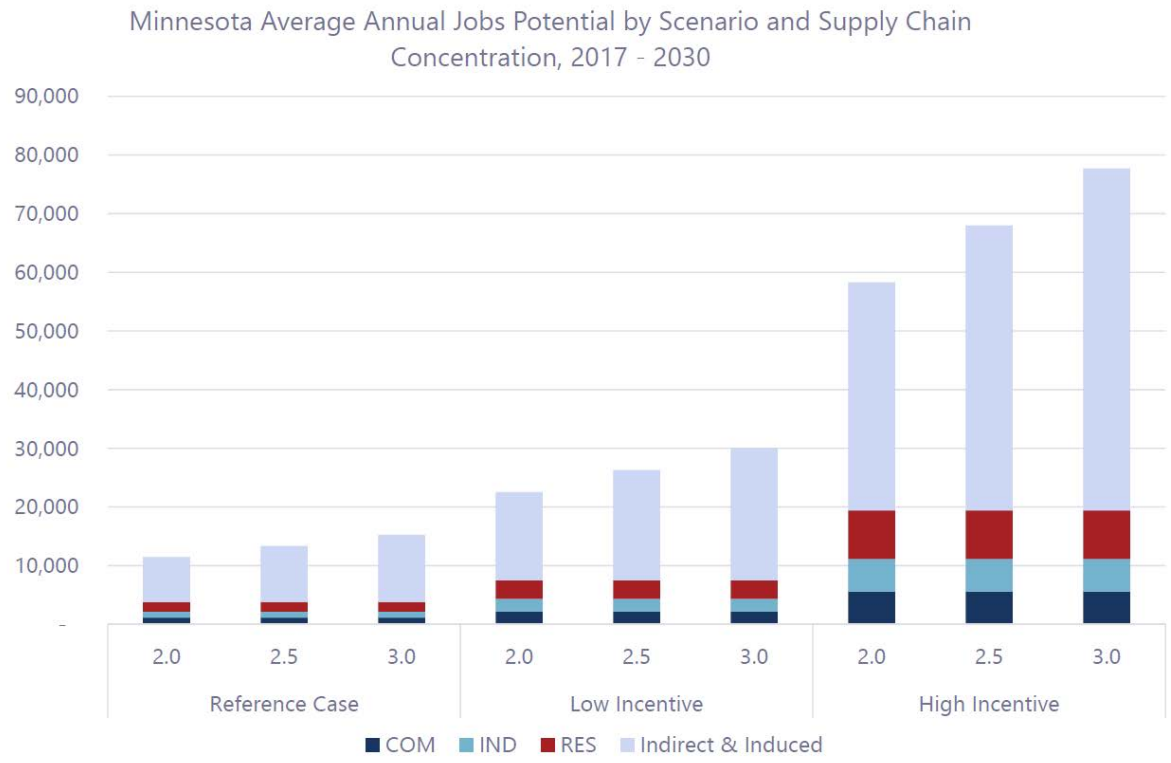
To generate these estimates, the energy efficiency analysis utilized Jobs from Energy Efficiency (JEE-1), a proprietary energy efficiency economic analysis model created by the Don Vial Center on Employment in the Green Economy. The multiple outcomes for direct, indirect, and induced jobs were calculated for three projected energy reduction scenarios and three levels of supply chain concentration. The appendix provides a more detailed description of our modeling approach and resources used.

Projected Energy Reduction: The projected energy reduction scenarios represent the range of expected changes in energy consumption due to energy efficiency. We used three scenarios based on projections developed by the U.S. Energy Information Administration (EIA): Reference Case, which assumes achievement of efficiency goals similar to Clean Power Plan compliance; Low Incentive, which assumes policies similar to a low price on carbon emissions; and High Incentive, which assumes policies similar to a higher price on carbon emissions. Efficiency gains were measured as the difference in consumption in Minnesota from EIA's No Clean Power Plan scenario for the residential, commercial, and industrial sectors. This metric was used to calculate direct jobs.

Supply Chain Concentration: Supply chain concentration refers to the level at which Minnesota is able to fill its supply chain needs from in-state companies. We applied three generally accepted multipliers for energy efficiency projects to estimate indirect and induced jobs: 2.0, 2.5, and 3.0. These multipliers are used to model varying levels of supply chain concentration in the local economy (i.e. one direct job supports three indirect and induced jobs).

Figure 6. Minnesota could support an average of 26,000 jobs from 2017 through 2030.



The JEE-1 model calculates annual jobs supported by in-state energy efficiency projects across sectors. Thus, direct jobs are those in construction, installation, and maintenance and indirect jobs are those in energy-efficient product manufacturing. While the jobs analysis does not account for the possibility of Minnesota supplying a significant portion of growing out-of-state demand, it demonstrates a reasonable target for initial cluster development. Creating a robust energy efficiency market within Minnesota can further grow and attract in-state companies and serve as a stronger foundation to tap into regional, national, and global markets.

START IN TEXT BOX

Minnesota's energy efficiency industry could generate outsized economic impacts across all market sectors. A recent report by BlueGreen Alliance and the Don Vial Center estimated that Minnesota could create 15,000 direct jobs (in job-years) from 2016 to 2030 by achieving a 20 percent reduction in energy consumption in the MUSH sector, which includes municipal buildings, universities, schools, and hospitals.[147]

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If Minnesota achieves the energy efficiency reductions of the low incentive scenario and attracts enough suppliers to reach the intermediate supply chain concentration level, the state's energy efficiency industry could support 26,000 jobs across the residential, commercial, and industrial sectors. Thus, Minnesota's energy efficiency industry could serve as a major vehicle for economic growth, while creating quality jobs for Minnesotans.

Policy Recommendations

Minnesota's policymakers will play a decisive role in the future of energy efficiency in the state. Strategic policies can drive demand for Minnesota's energy efficiency products and services. In particular, state and local leaders could take bold action to encourage energy conservation in the commercial and industrial sectors, while fostering business resources, stimulating the investment climate, and developing targeted workforce programs. These efforts could not only generate vast energy, cost, and emissions savings in the state, but also grow Minnesota businesses and create thousands of jobs across the value chain.

Incentivizing Energy Efficiency Investments

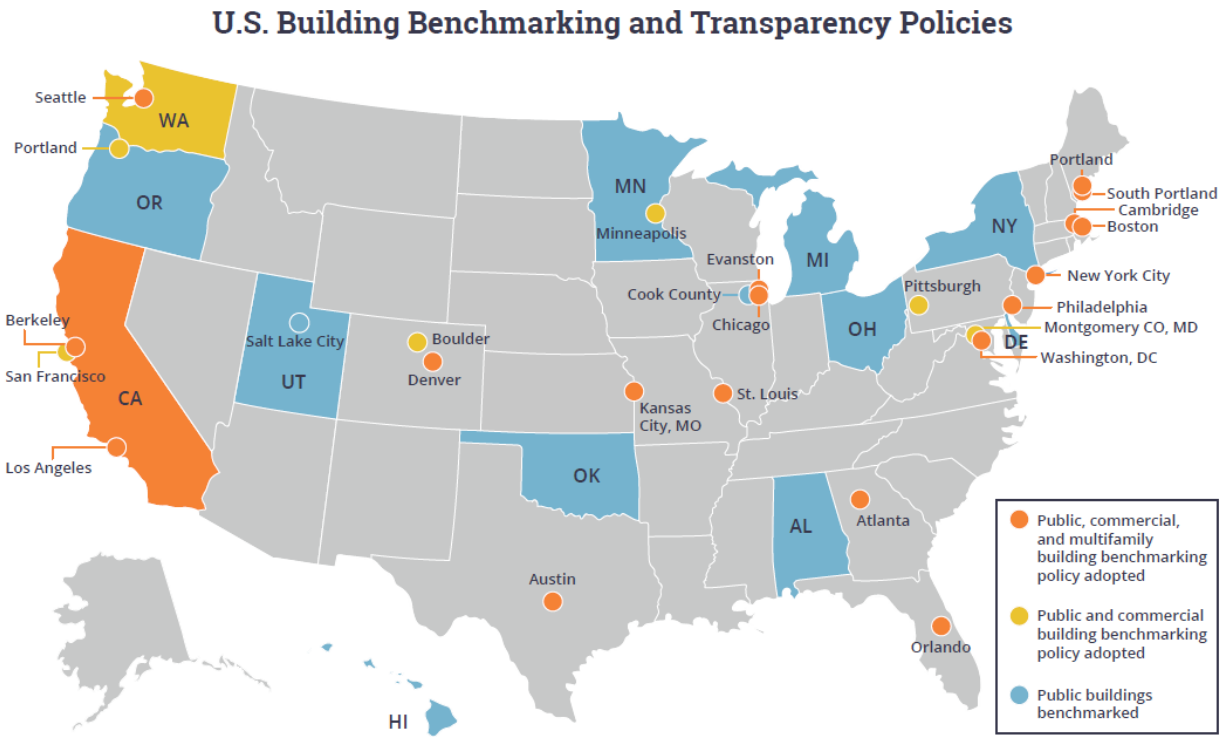
Policy 1: Institute Energy Benchmarking and Disclosure for Public and Commercial Buildings to Encourage Efficiency Upgrades

The B3 Benchmarking program allows administrators of public buildings to track their energy use and assess potential conservation strategies, while the SB 2030 Energy Standard requires progressive energy savings for state-bonded commercial, institutional, and industrial buildings. Through these innovative policies and programs, Minnesota targets energy use across the building stock and encourages emissions reductions by tracking data and setting goals. Minnesota could amplify both programs by mandating energy benchmarking and disclosure for public and commercial facilities to encourage energy conservation at low to no cost to the state government.

Building disclosure programs have shown that transparency in energy use successfully motivates building owners to adopt efficiency upgrades at minimum cost to the state or municipality. They can also lay the groundwork for friendly "race to the top" rivalries among building owners and communities. A statewide building disclosure requirement could follow the example set by Minneapolis and other U.S. cities and states, as shown in Figure 7. Demonstrating success abroad, Australia's

commercial building disclosure program stimulated cumulative benefits from reduced energy use amounting to $44 million in value between 2010 and 2014 and potentially up to $168 million when adding in workforce productivity gains.[148]

Figure 7. States have begun to adopt benchmarking policies for public, commercial, and multifamily buildings. (Source: Institute for Market Transformation, February 2017)



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Minneapolis Leads the State with First Commercial Building Benchmarking and Disclosure Program in the Midwest

In 2013, Minneapolis became the first city in the Midwest to pass an ordinance requiring public and private commercial buildings to benchmark and disclose their energy usage.[149] The city publishes the buildings' energy ratings on its website, using transparency to encourage building owners to cut energy consumption. At the 2016 deadline, 96 percent of commercial buildings participated in the program, with 91 percent deemed compliant or exempt.[150] To further incentivize efficiency projects, Minneapolis launched the Building Energy Challenge in 2015, which challenges individual buildings to cut their greenhouse gas emissions by 15 percent

by 2020.[151] Buildings enrolled in the challenge receive recognition and are eligible to compete for annual awards.
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To reap the benefits of this cost-effective practice, Minnesota legislators could require the B3 Benchmarking Program for public buildings and extend obligations to commercial buildings. The state could also encourage leadership and competition by expanding the Clean Energy Community Awards to organize annual challenges and recognize individual efficiency leaders, in addition to innovative communities. A statewide building disclosure ordinance could increase demand for energy efficiency services and products, and create thousands of high-quality jobs across the value chain.

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Outcome-Based Energy Codes
Traditional codes target specific structural components of a building, such as the windows, building envelope, lighting, and HVAC equipment;[152] however, they are limited in their ability to address the ways in which energy is actually wasted in buildings from design, construction, and occupancy use, among other areas. As a result, many buildings are not achieving optimal levels of energy savings.[153] As an alternative, states can implement outcome-based energy codes (also known as compliance-based codes) that focus on annual energy use of a building rather than specific physical upgrades. This allows building owners to implement a wider variety of measures to improve the energy performance of a building.[154] With better energy performance data and tracking capabilities, Minnesota could evaluate compliance and energy savings with its most recent energy codes and explore whether outcome-based energy codes would be appropriate in the state.
END CALL OUT BOX

Policy 2: Update Utility CHP Policies to Incentivize CHP Implementation

Combined heat and power is the cogeneration of electricity and thermal or mechanical energy in a single localized system, and it remains a major energy savings opportunity in Minnesota, with over 3,000 MW of untapped potential.[155]

However, Minnesota has had only four new installations since 2010.[156] Despite its economic and efficiency benefits, CHP implementation is inhibited by high upfront costs, long payback periods, and lack of experience with the technology.[157] Minnesota's utilities further discourage investment in the technology due to confusing standby rates and inconsistently applied interconnection standards for connecting CHP systems to the grid. Minnesota could reduce these barriers by creating tiered interconnection standards to fast-track smaller CHP systems and integrate CHP into existing energy efficiency goals to incentivize utility investment in CHP systems.

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Recommendations to Improve Standby Rates in Minnesota

Because utilities have already invested in infrastructure to supply electricity to potential CHP adopters, they often implement standby charges on customers that install CHP to help offset lost revenue, emphasizing that those customers may need backup power from the utility.[158] Potential CHP adopters in Minnesota currently face complicated and unclear standby rates, which may discourage investment. A 2014 study by the University of Illinois at Chicago's Energy Resources Center outlined key improvements Minnesota could make to address this barrier.[159]

- Ensure standby rates are transparent and understandable for potential customers to accurately assess needed investments for CHP.
- Make standby rates align with time-of-use energy rates to encourage energy use during off-peak hours.
- Include a forced outage rate to incentivize efficient CHP operation and limited use of backup power.
- Charge standby rates only during on-peak hours and on a daily basis to further encourage energy use during off-peak hours and increased CHP system reliability.
- Eliminate grace periods for exempting standby rates to not interfere with market signals of previous recommendations.

In the 2015 CHP Action Plan, the Minnesota Department of Commerce called for continued discussion of this issue with the Minnesota Public Utilities Commission via a regulatory proceeding on standby rates.[160] There is currently an open docket on the issue (Docket No. 15-115).[161]

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Create Tiered CHP Interconnection Standards

The Minnesota Public Utilities Commission (PUC) currently has uniform interconnection standards for all CHP systems under 10 MW, but the PUC could streamline implementation by raising the size cap and creating a tiered system that at least fast-tracks smaller units.[162] This process would reduce time and cost burdens for CHP interconnection for both utilities and customers. The PUC could look to model procedures established by the Federal Energy Regulatory Commission's Small Generator Interconnection Procedures (SGIP).

While designated for interstate transmission-level interconnections, SGIP aggregates national best practices and is often used to guide state-specific regulatory policies, as seen in neighboring Illinois, Iowa, and South Dakota.[163] SGIP outlines three tiers of review: one for inverter-based generators up to 10 kW; a fast-track process for systems up to 5 MW and based on voltage and location characteristics, of most relevance to CHP systems; and a default study process for remaining small generators.[164] Early this year, the PUC convened a working group to discuss updating state standards to reflect SGIP best practices, as part of an open docket (Docket No. 16-521).[165] The PUC should consider prioritizing CHP systems in this discussion to enable major efficiency benefits.

Establish Gas/Electric Utility Incentives for CHP Installation

Minnesota currently offers no financial incentives for CHP installation or production.[166] The ability to leverage the Conservation Improvement Program to invest in CHP installations is not clearly outlined in the legislation and hinders utility deployment, as identified by Minnesota stakeholders.[167] As part of the 2015 CHP Action Plan, the Minnesota Department of Commerce committed to analyzing whether CHP could be properly integrated into the program or whether an Alternative Portfolio Standard for CHP would be more appropriate.[168] While these analyses are underway, Minnesota utilities could take the lead on incentivizing CHP adoption by offering direct financial incentives and/or technical assistance.

Minnesota utilities could offer grants or rebates to commercial and industrial customers for CHP installation. For example, Southwest Gas in Arizona offers a rebate of $400 to $500 per kW up to 50 percent of project costs for CHP systems that achieve a fuel efficiency of at least 60 percent.[169] The program is supported by

ratepayers and cost savings from the utility's larger efficiency portfolio.[170] Similarly, Minnesota Power, which supplies electricity to northeastern Minnesota, offers grants to commercial, industrial, and agricultural customers for renewable energy and efficiency upgrades, including CHP systems. At $200 per kW saved, the incentive is capped at $50,000 and is tiered based on the customer's annual average demand.[171]

Minnesota utilities could also offer technical assistance to potential CHP customers to conduct feasibility analyses and project development—a common type of CHP incentive among utilities.[172] Philadelphia Gas Works, for example, dedicates internal staff and funds to identifying optimal CHP sites and conducting in-depth assessments for customers.[173] If both the utility and customer choose to advance the project, the customer designates a contractor to develop the project and the utility pays the upfront costs. The customer then pays the cost back incrementally on their monthly utility bill. As of 2013, Philadelphia Gas Works has supported fifteen CHP projects.[174] Because it is a public utility and does not seek a profit, the utility leverages the program as an economic development tool to maintain relationships with large businesses and encourage community energy and cost savings. To reduce the administrative burden, Minnesota utilities could engage with the U.S. Department of Energy's CHP Technical Assistance Program and the U.S. Environmental Protection Agency's CHP Partnership to tap into project support services.[175]

These efforts could enable efficiency upgrades through CHP by establishing clear policies and incentives for utilities and potential CHP customers. The Minnesota PUC, Department of Commerce, utilities, and consumers could work toward positive outcomes on the topics of standby rates, interconnection standards, and incentives. Utilities, in particular, could take the lead by offering financial and technical support for local CHP installations.

Increasing Access to Capital for Business Development

Policy 3: Establish a Fund of Funds to Stimulate the Investment Environment

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What is a Fund of Funds?

A fund of funds is a fund that invests in other investment funds as opposed to investing directly in stocks, bonds, or other securities.[176] Because a fund of funds has a diverse portfolio, investors are better protected from high-risk investments and exposed to more ventures.[177] Thus, a fund of funds not only fosters the state's investment community but also increases access to capital for in-state businesses.

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Early-stage companies and small businesses typically have limited financial capital for growth and development. These companies tend to lack physical assets that can be leveraged for bank loans. Minnesota's venture capital activity has failed to provide substantial funding for in-state businesses. The state captured only 0.63 percent of national venture capital funding in 2015,[178] and legacy venture capital firms have left the state or are aging out.[179] The state government could create a fund of funds to not only foster Minnesota's investment community, but also increase access to capital for early-stage and small businesses in the state.

A state fund of funds could focus on providing patient capital to clean energy businesses, offering long-term financial security and bridges over the valley of death during technology development and commercialization. In order to ensure that Minnesota clean energy companies have access to patient capital, the state can set management criteria for the fund of funds. The state could require investment managers that receive funds to (1) invest in Minnesota companies, (2) hold investments in excess of 5 years, (3) provide industry returns, and (4) invest in clean energy companies. By attracting investments from the nation's premier venture

capitalists and private equity investors, Minnesota will also gain their knowledge, discipline, and expertise.

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The Need for Patient Capital

Patient capital refers to funds invested in a company for the long term.[180] Patient capital is important for advanced energy startups because advanced energy technologies can take decades to fully develop. Venture capital firms typically have a fund horizon of three to five years, a model unsuitable for advanced energy firms.

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Significant Returns from State Fund of Funds

Similar funds of funds in Illinois and Utah have demonstrated success. Since 2005, Illinois has channeled $66 million of state funds into eighteen private investment funds.[181] The state has had rates of return around 6 percent.[182] Moreover, these investments have supported about 6,300 new Illinois-based jobs.[183] In 2016, Illinois refinanced its fund of funds with $222 million, which is expected to create over 18,000 jobs.[184] In Utah, a nonprofit, quasi-governmental organization manages the state's $300 million economic development program. Utah invests in a diverse portfolio, including out-of-state funds.[185] This encourages outside investments in Utah companies and in-person mentoring of the in-state businesses. As of February 2016, Utah's twenty-eight partner funds have invested $723 million in sixty-seven Utah companies, supporting over 2,700 new jobs and $35 million in new tax revenue.[186]

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Minnesota could budget public funds for this fund of funds. Alternatively, the Minnesota Department of Employment and Economic Development could engage insurance companies to raise money for the state fund of funds by selling insurance premium tax credits. Insurers could contribute to the state fund of funds in exchange for a credit against the premium tax liability that can be used in a later year. As the fund of funds earns returns on investments, Minnesota could require that the majority of the returns be deposited into the general fund to recover the initial investment by the state.

While this type of mechanism has been used in many states,[187] it has seen recent success in Maryland and Pennsylvania, where tax credits were auctioned off to insurers and then distributed to designated investment partners.[188] Established in 2011, the InvestMaryland program is jointly managed by the Department of Business and Economic Development and the Maryland Venture Fund Authority, a nine-member group of business and investment experts.[189] Maryland employs a hybrid model in which two-thirds of the funds go to selected private venture firms, about one-third filters into the state-run Maryland Venture Fund, and a small portion is directed to the Maryland Small Business Development Financing Authority.[190] InvestMaryland raised $84 million in the auction, exceeding its goal of $70 million.[191] These funds were distributed to about seven venture capital firms[192] and have since supported three iterations of the InvestMaryland Challenge, an international business competition.[193] Although attributable to multiple factors, the state experienced a 33 percent growth in venture capital from $470 million (fifty-seven deals) in 2012 to $623 million (sixty-two deals) in 2013, over the time of InvestMaryland's initial funding.[194]

Similar to Maryland, Pennsylvania created the Innovate in PA program in 2013 and auctioned $100 million in deferred insurance premium tax credits.[195] Innovate in PA is projected to create at least 1,850 technology jobs, about 3,500 indirect jobs, and a return of $2.37 for every dollar invested.[196]

Minnesota could bring outsized economic impacts to in-state businesses and foster its entrepreneurial culture by attracting state and national venture capital firms. Greater access to venture capital could give Minnesota's innovators the opportunity to bring their best ideas to the market and build thriving businesses in the state.

Policy 4: Offer Working Capital Loans to Support Small Clean Energy Business Operations

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Working Capital

Working capital is the difference between a company's current assets and current liabilities; essentially, it is the cash that the company has on hand to operate on a

day-to-day basis.[197] Working capital is generally not used to purchase long-term assets or expansion. For startups, having working capital is important to ensure the company can pay its operating expenses as it establishes a customer base.
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Small clean energy companies report limited access to working capital as a key barrier to growth and survival.[198] Current government grants and subsidies are primarily dedicated to financing deployment of clean energy technology, but do not directly support the companies that innovate and manufacture these products. Minnesota could expand access to working capital loans to efficiently fill financing gaps and leverage private funds, while protecting taxpayer dollars.

Minnesota could either offer direct loans to clean energy businesses or increase their access to private loans by providing credit enhancements to lenders in the form of loan loss reserves or loan guarantees. Loans to businesses could be provided at low interest rates and over long terms, and repayments could be recycled and reused to support additional capital investments. The state government could provide initial capital and the Department of Commerce could administer the program.

Programs in Pennsylvania and Ohio demonstrate both options to increase working capital. PIDC Philadelphia, a public-private economic development corporation, offers working capital, machinery, and equipment loans to small and midsize businesses with $150,000 to $10 million in revenue.[199] These loans range in size from $50,000 to $750,000 and are drawn directly from PIDC funds, with PIDC also responsible for credit analysis and underwriting.[200] The Ohio Capital Access Program creates loan loss reserve funds for accredited lenders, with eligible borrowers gaining access to up to $250,000 in working capital financing.[201] Lenders are responsible for all phases of the transaction, but are insured against default by access to a reserve fund. This fund is created by matching contributions from the borrower and lender of between 1.5 and 3.0 percent and a contribution from the Ohio Development Services Agency of 10 percent of the loan amount.[202]

State leaders could offer working capital loans to address Minnesota's small clean energy business finance needs and drive faster deployment of capital to grow

businesses. This financial security will allow Minnesota's small businesses to thrive and create innovative clean energy solutions for the state.

Strengthening Workforce Development for Energy Efficiency Jobs

Policy 5: Develop Degree and Certificate Programs on High Performance Buildings

Because of innovations in the building efficiency industry, education and training must also innovate to meet changing employment needs. For example, traditional HVAC, facility management, and energy assessment skills have to be updated for increasing deployment of smart technologies in high performance buildings. To address this barrier, Minnesota could engage both businesses and colleges on expanding or creating specialized degree and certificate programs tailored to industry needs, enabling training pathways to good-paying jobs for Minnesotans.

Minnesota could first conduct a survey of businesses along the energy efficiency value chain to uncover skills gaps and projected workforce shortages in the in-state industry. The Minnesota State Colleges and Universities could then create programs and curriculums targeting these skills gaps and high-demand skills in data analysis, digital controls, and systems programming. Minnesota could also leverage its statewide network of WorkForce Centers to help promote the educational programs to populations with high unemployment, develop networking and apprenticeship opportunities, and match graduates with potential employers. Minnesota could consider an organizational model similar to the Maryland WorkSmart program that would encourage active industry engagement and provide a singular access point for industry.

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Maryland WorkSmart

In November 2016, the Maryland Association of Community Colleges partnered with the Department of Commerce to create the Maryland WorkSmart program, a one-stop shop for businesses and workforce stakeholders. The program enables

community colleges to strategically partner with industry to assess instruction needs and tailor training programs. If an employer needs training that does not exist, Maryland WorkSmart will work with them to reach out to national leaders to create new training modules. Each community college will have a WorkSmart Center, making it easier for industry to approach colleges about training.[203]
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Developing these programs in the community college system would be especially valuable because, as other states have shown, many of these skills can be acquired within two years. Allowing students to graduate in the shortest time possible could reduce program costs, making these programs affordable and accessible to more Minnesotans. With these industry-aligned programs and employment resources in place, state leaders could ensure that Minnesota's workforce has good-paying job opportunities and that energy efficiency companies have qualified workers, boosting economic growth in the state.

START CALL OUT BOX
Innovative Building Education at the Community College Level[204]
Laney College, a community college in Oakland, California, offers five certificate and degree programs for building technology education. Under the Environmental Control Technology Department, students can earn certificates in building automation as well as building performance and energy efficiency, both of which provide a broader and more integrative approach to smart building management. Through these programs, students have access to traditional HVAC, refrigeration, and performance monitoring skills in addition to cutting-edge skills in digital controls, building automation systems, and sustainable design.
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Policy 6: Establish an Industrial Assessment Center in Minnesota to Increase Access to Efficiency Training and Technical Assistance

Funded by the U.S. Department of Energy (DOE), Industrial Assessment Centers (IACs) are university-based centers that provide free energy and cost savings assessments for small and medium-sized industrial facilities.[205] IACs help

manufacturers identify and recommend solutions to address inefficiencies in energy use, manufacturing processes, and waste production. Within a year, IAC assessments often identify over $130,000 in potential savings and almost 40 percent of those recommendations are immediately implemented,[206] with each assessment averaging a 5 to 7 percent improvement in energy savings and energy productivity.[207] In addition to efficiency upgrades for local businesses, IACs offer significant training for university students. Working closely with faculty, undergraduate and graduate students gain real-life experience and applicable skills in industrial engineering, energy audits, data analysis, and optimization.[208] In fact, IAC graduates possess a more valuable skill mix than peers and tend to be hired twice as fast.[209] To leverage this technical and educational resource in Minnesota, UMN could pursue federal funding to house a regional IAC.

For the 2017–2021 period, DOE allocated $35 million for IACs at twenty-eight universities across twenty-five states.[210] The closest centers to Minnesota are located at the University of Illinois, Chicago and the University of Wisconsin-Milwaukee, but Minnesota businesses are outside the eligible range to access these IACs.[211] To address gaps such as this, DOE extended funding to set up IACs in underserved areas, with selections to be announced in May 2017.[212] UMN-Duluth submitted an application to the extension opportunity. If the state is unable to secure access to an IAC, Minnesota universities could make a strong case for federal selection in 2021 if federal funding continues.

To create a sustainable state program that is not dependent on federal funding, Minnesota should consider providing block grants to support the development and operation of regional IACs, such as the Minnesota Technical Assistance Program in the Twin Cities region. State funding could be allocated through the Conservation Applied R&D program to help a center build its industrial client base and increase student training opportunities. A federal IAC or similar state program could effectively strengthen industrial energy efficiency while also developing a stronger workforce to meet local employment needs.

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Minnesota Technical Assistance Program

The Minnesota Technical Assistance Program (MnTAP) provides free scientific and engineering advice to businesses and municipalities on industrial solutions to

improve operational efficiency. Over thirty years, MnTAP has helped companies realize 65 million kWh and 5 million therms of energy savings, in addition to significant water and waste reductions, saving businesses over $1.5 million per year.[213] MnTAP also engages junior and senior college students from any school through its summer internship program, with over 220 intern projects completed.[214] Students are given the opportunity to work on-site with local companies on waste and energy reduction projects,[215] providing quality on-the-job training in technical energy assessment and project management. Located at UMN's School of Public Health, MnTAP has been unable to get a joint appointment with the College of Science and Engineering and apply for IAC funding, which requires an IAC be housed in an accredited engineering school.
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Policy 7: Develop Employee Engagement and Retention Strategies to Support Minnesota's Changing Workforce

Minnesota is faced with a severe shortage of skilled workers and knowledge capital due to an aging workforce and an underutilization of the minority population. As previously mentioned, recent focus groups show that 60 percent of Twin Cities professionals of color have long-term plans to move out of the state, especially due to an isolating workplace and neighborhood culture.[216] Employee engagement and retention efforts could both bolster Minnesota's industry and enrich Minnesotans' quality of life as the state transitions to a new generation of employees. To complement the state's efforts under the Workforce Innovation and Opportunity Act, state and business leaders could work together to develop a Minnesota workforce inclusion toolkit, share best practices and success stories with employers across the state, and implement a plan to create a more inclusive culture.

Previous state surveys identified the most successful retention strategies: healthcare benefits, increased wages, retirement plans, flexible work arrangements, and improved organizational culture.[217] Other strategies could include customized compensation packages to meet seniors' individual needs, deferred retirement incentives, and specialized, in-house skills trainings to build job satisfaction. Businesses could also offer and reward volunteer opportunities at work that help pass on intellectual capital and increase engagement, such as mentorships and advisory roles. Additionally, retention of professional employees from different

backgrounds will require ongoing diligence and a campaign of acceptance and inclusion. Similar retention efforts in Tennessee, Ohio, Colorado, and Virginia could provide examples of how to strengthen Minnesota's workforce.[218]

Minnesota could conduct dialogues among stakeholders to devise and advance state- and business-level strategies for engagement and retention of these target groups. Participants could include the Office of Career and Business Opportunity, the Governor's Diversity and Inclusion Council, the One Stop Shop for Minnesota Seniors, WorkForce Centers, employers, and employees. In particular, Minnesota could look to the Association of University Centers on Disabilities' Diversity and Inclusion Toolkit as a model for a state-specific toolkit that can be used by businesses and employment centers.[219] This engagement and retention discussion could also outline potential resources for inclusion training and professional networking opportunities. By specifically targeting the changing workforce, Minnesota will be well positioned to support Minnesota businesses and maintain jobs in the state.

Recruiting and Expanding Energy Efficiency Companies

Policy 8: Organize an Energy Efficiency Business Association to Drive Cluster Development

Minnesota's robust and mature energy efficiency industry is comprised of nearly 450 establishments,[220] yet it does not have an organized business association. Business associations have proven to be beneficial to company and job growth, and, without a unified industry, energy efficiency businesses in Minnesota may be operating at a disadvantage. In fact, previous roundtables identified peer-to-peer exchange and collaboration as a significant business priority in the state's energy efficiency industry.[221] Industry leaders could take the lead on forming a state energy efficiency business association that enables cooperation and collaboration across the value chain in areas such as knowledge sharing, asset growth, policy advocacy, and cluster development. Minnesota could look to Michigan's Energy Efficiency Contractors Association as a model.

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Michigan Energy Efficiency Contractors Association[222]

Formed in 2013, the Michigan Energy Efficiency Contractors Association (MEECA) is a nonprofit trade association that aims to promote and advance Michigan as a national industry leader. MEECA gathers companies along the value chain in design, installation, and assessment for the entire building stock. To achieve its goal, MEECA's main strategies are to (1) conduct outreach to legislators and policymakers about the industry and its positive economic and social impacts, (2) promote effective technologies and best practices for increasing building efficiency in the state, and (3) support workforce development programs.

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An energy efficiency business association could conduct a variety of inward and outward activities to support its members and grow the industry. Member fees could help fund administration and operation expenses. Activities could include:

- Maintaining a public supply chain database;
- Conducting outreach campaigns to promote investment in energy efficiency;
- Organizing knowledge-sharing and networking events;
- Hosting research projects and hackathons to solve broad industry challenges;
- Identifying regional and federal contract opportunities;
- Supporting the development of a STEM curriculum and industry-specific training programs; and
- Advocating for policies that increase demand for efficiency technologies and services and support business development.

The business association could also expand its role to drive cluster development and facilitate strategic growth in the state. Whether through working group, a formal partnership, or a nonprofit entity, organizing a group could be one way to ensure businesses have a seat at the table and serve as the driving force behind cluster development efforts. Minnesota could look to states such as North Carolina and Colorado, which have both successfully established public-private partnership schemes to grow their cleantech clusters.

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Broad Approach to Cluster Development

Minnesota's energy efficiency business association could be a key driver of cluster development, convening stakeholders and resources to engage in strategic initiatives. Industry leaders and economic developers could determine the best approach for cluster development in the state, with one potential approach outlined below.[223]

- **Initial Engagement:** Identify and engage with key stakeholders in industry, government, academia, and other relevant fields.

- **Cluster Analysis:** Map company base and evaluate intercompany linkages, externalities, and synergies. Define and evaluate industry assets in workforce development, access to capital, and innovation ecosystem as well as supply- and demand-side policies and programs. Conduct market trend and competitive position analyses.

- **Strategy Formation:** Develop vision and goals for the cluster based on analyses. Create strategic policy and institutional initiatives to improve cluster competitiveness and identify drivers for each initiative.

- **Strategy Implementation:** Get initiatives in motion, mobilize investment and public-private partnerships, and improve the business environment.

- **Cluster Sustainability:** Establish formal or informal organizational structure to continue cluster initiatives and investments.

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North Carolina's Research Triangle Regional Partnership—an association of economic development agencies in the state's Research Triangle region—founded the Research Triangle Cleantech Cluster (RTCC) as a way to strategically engage industry leaders in the regional development of the cleantech sector.[224] Notably, while RTCC's Advisory Council bridges the public-private divide by drawing from industry, academia, and government, the Board of Directors that steers the cluster

is composed exclusively of business leaders.[225] This organizational structure positions industry players to contribute valuable insight and to substantially influence the industry's regional growth strategy.

By contrast, the Colorado Clean Energy Cluster (CCEC) puts industry, universities, and government on relatively equal footing within its Board of Directors.[226] CCEC relies on a "triple helix" model—referring to the cluster's reliance on all three stakeholder groups—to develop public-private partnerships that address clean energy problems.[227] The model in turn generates programs such as FortZED, which brings together local businesses, the City of Fort Collins, and Colorado State University to catalyze and promote advanced energy solutions.[228]

An active partnership could draw on the resources, expertise, and networks of each entity to maximize its reach and impact. Through its members and partners, the business association would have a unique understanding of cluster assets and areas for improvement in regulatory and legislative policy, access to capital, research and development, project finance, and workforce development. Once formed, a partnership could serve multiple purposes, including stakeholder and regulator education, legislative advocacy, business development, and business outreach. Regardless of whether a partnership follows the North Carolina or Colorado models, it could give Minnesota businesses increased authority and control over the direction of the cluster.

The state government could support the efforts of the cluster by facilitating activities and providing funding for joint initiatives. An energy efficiency network could provide enormous value for Minnesota businesses and the state by facilitating exchange, strengthening cluster assets, and presenting a unified voice on policies that impact their businesses. Organizing a business association would signal Minnesota's commitment to cultivating the energy efficiency cluster and supporting good-paying jobs in the state.

Policy 9: Target Foreign Direct Investment to Expand the State Energy Efficiency Value Chain

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What is Foreign Direct Investment?

Foreign direct investment (FDI) occurs when a company based in another country makes an investment in the United States by establishing operations or acquiring business assets.[229] FDI increases capital in the economy, encourages transfer of technology and expertise, creates job opportunities for the local workforce, and fills gaps in the local supply chain. Strategies for state leaders include conducting FDI missions to foreign countries, inviting industry leaders to in-state conferences and tours, and providing business incentives.

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Foreign direct investment (FDI) is a common strategy to fill business gaps and inject jobs and capital into the state economy. Minnesota could leverage its strong business climate to attract international investment and operations in the state, especially to support high-growth industries. In fact, Minnesota-based subsidiaries of global companies support over 97,900 workers, with 36 percent in the manufacturing sector.[230] In order to expand employment opportunities for Minnesotans while strengthening the energy efficiency cluster, Minnesota could evaluate key value chain gaps that could guide FDI missions. Through more strategic stakeholder engagement, state and local leaders could further identify supply chain barriers and conduct targeted missions to attract investment from foreign companies. Minnesota could look to national best practices and resources to enhance its FDI initiative.

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Best Practices for FDI and Exporting Programs[231]

The U.S. Department of Commerce commissioned an extensive study of the most successful FDI and exporting programs around the country and found that state leaders of these programs share several key practices. The report found that they:

- Engage universities in making international connections and economic development;

- Foster good relationships with economic development resources engaged in FDI;
- Collect good data about companies in the cluster;
- Develop contact points at companies overseas;
- Embrace and adapt to cultural differences, e.g., language-specific business cards and marketing materials; and
- Commit to long-term involvement in FDI efforts.

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The Massachusetts–Israel Innovation Partnership (MIIP) offers an innovative model on how to facilitate global connections. Launched in 2011 following Governor Patrick's trade mission to Israel, MIIP grew from an industry research collaborative to a joint FDI partnership. Major Israeli companies have expanded operations to the state and Massachusetts companies have invested in Israeli intellectual property and R&D operations.[232] As of 2015, more than 200 Israeli-founded companies have made a home in Massachusetts.[233] These businesses accounted for $9 billion in direct revenue, $18 billion in total economic impact, and 4 percent of the state GDP, as well as 9,000 direct jobs and 27,000 indirect and induced jobs.[234]

To enhance its FDI strategy, Minnesota could first engage with SelectUSA, a federal program that provides marketing assistance, strategic counsel, and business linkages for economic developers and companies. Many foreign companies looking to invest in the United States approach SelectUSA as a first step.[235] The state could utilize its foreign trade offices in Brazil, China, Germany, and South Korea to better promote Minnesota globally and encourage more businesses to expand in Minnesota.[236] Additionally, Minnesota could actively seek assistance from lead generation consultants like WAVTEQ and OCO Global,[237] regional energy efficiency consortiums, and local universities to identify and engage with companies that may be interested in locating operations in the state. This strong network of partners could help bolster FDI in Minnesota. The following table gives a snapshot of companies that could be targeted by the state.

Company	Country	Description
2G Energy[238]	Germany	Manufactures CHP systems fueled by natural gas and biogas
Legrand[239]	Canada	Produces building control system, network infrastructure, and lighting products for smart buildings
Spilling Technologies[240]	Germany	Manufactures steam engines and turbines that can be integrated into CHP systems
TEDOM[241]	Czech Republic	Manufactures CHP systems fueled by natural gas, biogas, and mine gas
Theben[242]	Germany	Produces sensors, controls, and smart meter gateways for building systems
Vaillant Group[243]	Germany	Produces high-efficiency HVAC products

FDI can be pursued across Minnesota at the state and local levels, with support from regional economic development organizations, local businesses, and universities. Having a larger presence of global corporations in Minnesota could grow the state's energy efficiency value chain, enhance the knowledge economy, and create good-paying jobs for Minnesotans.

Call to Action

Minnesota's existing energy efficiency cluster is a solid foundation upon which the state can grow its economy, create 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 Minnesota manufacture products within the state, foster entrepreneurship for technological advances, fund innovation with accessible capital, equip workers with needed skills, and stoke demand.

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Growing the Energy Efficiency Cluster, Growing Jobs

- Institute Energy Benchmarking and Disclosure for Public and Commercial Buildings to Encourage Efficiency Upgrades
- Update Utility CHP Policies to Incentivize CHP Implementation
- Establish a Fund of Funds to Stimulate the Investment Environment
- Offer Working Capital Loans to Support Small Clean Energy Business Operations
- Develop Degree and Certificate Programs on High Performance Buildings
- Establish an Industrial Assessment Center in Minnesota to Increase Access to Efficiency Training and Technical Assistance
- Develop Employee Engagement and Retention Strategies to Support Minnesota's Changing Workforce
- Organize an Energy Efficiency Business Association to Drive Cluster Development
- Target Foreign Direct Investment to Expand the State Energy Efficiency Value Chain

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Minnesota has the opportunity to support over 26,000 direct, indirect, and induced jobs in the energy efficiency industry from 2017 through 2030. Minnesota could serve a significant portion of national and local demand, given its robust supply chain, innovation ecosystem, and strong business climate.

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To fully realize Minnesota's potential in the energy efficiency industry 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 Minnesota's competitive advantage in the industry and creating quality jobs for Minnesotans. State and local economic development depends on the collective work of many partners across government, universities, businesses, and other stakeholders. This report recommends actions that each group can take to support the energy efficiency industry. Continued collaboration is necessary to address barriers to cluster growth and demonstrate that the state is ripe for investment.

Minnesota'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 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 Minnesota by organizing working groups and conducting deeper analyses, such as identifying supply 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.

Appendix: Jobs Modeling Methodology

Modeling Approach

The American Jobs Project combines existing tools, analyses, and projections from several reputable sources to estimate job potential. Rather than providing a specific estimate, we show jobs potential across a range of possible outcomes. All jobs are shown as the average annual jobs that could exist during the analysis timeline (2017–2030). 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 believe the key to job creation lies in local action. Our estimates are intended to start a conversation about how local stakeholders can work together to set their goals and utilize the same tools and data that we have used to estimate potential impacts.

Jobs from Energy Efficiency Tool

The U.C. Berkeley Don Vial Center on Employment in the Green Economy developed the Jobs from Energy Efficiency (JEE-1) model to quickly estimate direct job outcomes of different policy scenarios related to smart building and energy efficiency efforts. While the Jobs and Economic Development Impact (JEDI) model and other tools are commonly used to estimate the jobs impact of renewable energy projects and policies, the absence of a similar tool for employment related to energy efficiency makes it difficult for policymakers and advocates to quantify the economic development benefits of energy efficiency policies and investments without sophisticated and time-intensive analysis. The JEE-1 model is a simple, quick, and relatively easy-to-use tool that can estimate gross direct job creation of alternative scenarios.

The model is based on job-years per GWh multipliers calculated for different energy efficiency program types across four primary sectors: residential, commercial, MUSH, and industrial/agricultural.

The JEE-1 model is based on the best available literature on (1) total cost of saved energy, (2) effective useful life estimates of energy-efficient products, and (3) jobs per million-dollar investment in energy efficiency. All efficiency gains are measured as the difference in consumption from the U.S. Energy Information Administration's (EIA) base No Clean Power Plan case.

Indirect and induced jobs are estimated using a simple range of multipliers common to energy efficiency job estimates: 2.0, 2.5, and 3.0.

U.S. Energy Information Administration: Annual Energy Outlook 2016

Our jobs analysis uses EIA's National Energy Modeling System (NEMS).[244] As described by EIA:

> NEMS is a modular economic modeling system used by EIA to develop long-term projections of the U.S. energy sector, currently through the year 2040.
>
> The level of regional disaggregation in NEMS varies across sectors. For example, Lower 48 states electricity markets are represented using 22 regions, coal production is represented by 14 regions, and oil and natural gas production is represented in 9 regions. In many but not all cases, regional boundaries follow state borders. To the extent possible, this analysis includes the Clean Power Plan using regional targets derived from the final EPA ruling.
>
> The Reference case projections developed in NEMS and published in the *Annual Energy Outlook 2016* generally reflect federal laws and regulations and state renewable portfolio standards (RPS) in effect at the time of the projection. The Reference case does not assume the extension of laws with sunset provisions. In keeping with the requirement that EIA remain policy-neutral, the Reference case does include proposed regulations such as the Clean Power Plan.

> By explicitly modeling the intensity targets, NEMS does not require or assume specific levels for individual compliance strategies. The discussion of EIA's analysis presents results in terms of the compliance options used to meet the regionalized Clean Power Plan targets.

The scenarios used for the energy efficiency analysis were: Reference Case, Low Incentive, High Incentive, and No Clean Power Plan.[245] These projections represent the range of expected changes in energy consumption due to energy efficiency. This was measured as the net annual difference between the base No Clean Power Plan case scenario's total energy consumption (business as usual) and the three efficiency incentive scenarios for residential, commercial, and industrial sectors.

Reference Case – Effects of the Clean Power Plan

EIA describes the Reference Case scenario in the Annual Energy Outlook:

> The Clean Power Plan (CPP) rule, issued under Section 111(d) of the Clean Air Act, is the U.S. Environmental Protection Agency (EPA) program to regulate carbon dioxide (CO2) emissions at existing fossil-fired electric power plants. EPA estimates that the CPP will reduce CO2 emissions from the power sector by 32% from 2005 levels by 2030. As described in the Annual Energy Outlook 2016 (AEO2016) Legislation and Regulations section, the CPP rule allows states to choose either mass-based or rate-based emissions targets. A mass-based target simply specifies an annual limit on the amount of CO2 that can be emitted by states from the affected sources. A rate-based target requires states to meet an annual adjusted emission rate (lbs CO2/MWh) based on emissions from affected sources divided by generation from affected sources, which for this calculation includes new non-emitting sources, such as nuclear and renewable capacity, and incremental energy efficiency. The rule also provides flexibility in other areas, such as regional cooperation through trading.
>
> . . .
>
> In comparison with the EIA's analysis of the preliminary CPP rule, which was based on the Annual Energy Outlook 2015 (AEO2015) Reference case, the analysis described here includes other differences in underlying trends that are unrelated to the CPP but influence compliance decisions. These differences include lower natural gas prices, lower capital costs for

renewable electricity generation plants, and extension of renewable tax credits.

In February 2016, the U.S. Supreme Court issued a stay of enforcement of the existing plant rule, pending resolution of legal challenges from the states and the affected industries. The AEO2016 Reference case assumes that the CPP will proceed as currently promulgated, and that all states will implement it by using a mass-based standard that caps emissions from both existing and new power plants, with allowance revenues rebated to ratepayers. Alternative cases consider how outcomes could change with different implementation approaches, without the rule in place, and in a scenario with tighter standards beyond 2030.

Reductions in CO2 emissions can be achieved by switching from carbon-intensive fuels (such as coal) to less carbon-intensive natural gas-fired power plants or to zero-carbon technologies (such as renewables and nuclear power). Other options to reduce CO2 emissions include improving plant efficiency to reduce fuel use and increasing energy efficiency to reduce energy demand. Compliance decisions made by the states, as well as any future court decision regarding the rule, would have implications for plant retirements, capacity additions, generation by fuel type, demand, and prices.

Low Incentive Case

EIA also describes the Low Incentive scenario in the Annual Energy Outlook:

In the Low Incentive case, a CO2 fee is used as a proxy for demand-side energy efficiency incentives. The fee increases gradually from zero in 2017 to $12.50 (2015 dollars) per metric ton (mt) of CO2 in 2023. After 2023 the CO2 fee increases by 5%/year, to approximately $29/mt CO2 in 2040.

High Incentive Case

EIA describes the High Incentive scenario in the Annual Energy Outlook:

The High Incentive case also uses a CO2 fee as a proxy for demand-side energy efficiency incentives. In this case, the fee increases gradually from zero in 2017 to $35/mt CO2 (2015 dollars) in 2023. Thereafter, the CO2 fee increases by 5%/year, to approximately $80/mt CO2 in 2040.

Base Case – No Clean Power Plan

Finally, EIA describes the base No CPP case in the Annual Energy Outlook:

> The No CPP case assumes that the final CPP rule is permanently voided and is not replaced by other controls on power sector CO2 emissions. States have no federal requirement to reduce CO2 emissions from existing power plants, but other programs remain in place, including the Regional Greenhouse Gas Initiative (RGGI), the California Assembly Bill 32 (AB 32), and the Global Warming Solutions Act of 2006. Also, state and regional renewable portfolio standard programs remain in place, as described in the Legislation and regulations section, and may have an indirect impact on CO2 emissions.

Limitations of Jobs Modeling

It is important to note the limitations of these modeling methods. As mentioned, the estimates shown are only average annual jobs created or sustained and we base this off of the total job-years, or one full-time equivalent job sustained for one year, that exist within the timeframe of our analysis. This does not mean that every year will have the same number of jobs over the timeline. Any given year could be above or below the average we present. Job losses in industries that compete with those in our analysis are also not evaluated. Models do not perfectly predict behavior, so indirect and induced job estimates could vary greatly based on the reality of what is actually purchased locally. Also, foreign and domestic competition can play a significant role in limiting the potential for job creation. The estimates presented in this report are highly dependent on sustained local action towards developing and maintaining these industries.

Model Inputs

First, we identified energy efficiency scenarios for the economic impact modeling. We utilized EIA data on energy consumption by sector to identify several energy efficiency pathways that would diverge from the base No CPP case. This data is only available at the regional scale, so past state-level consumption data was used to identify the share of energy consumption for each state in the region. The average consumption for the previous five years was carried into the future as the weighted average of energy consumption for each state.

Second, we calculated the difference in net energy consumption between the three policy scenarios selected and the No CPP case for each sector, from 2017 through 2030.

Third, the Don Vial Center entered this data into JEE-1 and estimated the associated economic impacts for each sector. We then applied multipliers that are commonly used for energy efficiency to estimate direct, indirect, and induced jobs.

Model Outputs

Outputs were reported for each scenario in terms of employment, labor income, construction hours, and investment. Only employment is presented in the report, and we represent this output as the average annual employment during the analysis period. The additional output data is available by request.

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