RENEWABLE **ENERGY** INNOVATION **PROJECT**

Proof of Concept Center Plan for Minnesota

Statewide • Energy • Innovation • Collaboration

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FORWARD

Region Five Development Commission (R5DC) and Minnesota High Tech Association submitted an application in 2011 to the federal i6 Green Challenge Grant program. Although that proposal was not successful, the U.S. Economic Development Administration (EDA) encouraged R5DC and the Minnesota Department of Employment and Economic Development (DEED) to apply for a planning grant to continue its work on a more coordinated state strategy for supporting economic development tied to the state's emerging renewable energy and energy efficiency businesses. This Minnesota Renewable Energy Proof of Concept Center (REPoCC) planning grant process has been underway since October 2012.

The overall mission of this 18-month planning process has been to identify the state's strengths and opportunities in green energy and develop a plan for a statewide energy business cluster that will provide a framework for investments of private and public capital resources, accelerate innovation and commercialization of research, and build an energy sector that has a global market reach.

The Core Team, responsible for carrying out the activities funded by the federal planning grant consisted of:

- Region Five Development Commission – Cheryal Lee Hills
- Minnesota DEED – Kari Howe, Connie Ireland, Robin Sternberg,
- University of Minnesota – Natural Resources Research Institute – Brian Brashaw, Pamela Sarvela
- Independent consultants - Michael Krause of Kandiyo Consulting, and James Robins of Robins Consulting

Substantial efforts were also made by designated planning grant partners that included:

- *Minnesota Solar Energy Industries Association (MnSEIA)* – Lynn Hinkle
- *BioBusiness Alliance of Minnesota* – Dale Wahlstrom, Rebekah Kent, Gregg Mast

I. Executive Summary

The Minnesota Renewable Energy Proof of Concept Center planning grant team spent 18 months listening and learning from multiple stakeholders in the emerging industry cluster of renewable energy and energy-related businesses in Minnesota. The result of this outreach around the state was to identify opportunities and outline an implementation strategy for a Proof of Concept Center (PoCC) model that will accelerate the pace of private sector innovation, business growth and job creation. This future renewable energy-energy efficiency PoCC, has adopted the working title of the Minnesota Renewable Energy Innovation Project (REIP).

The planning grant team found that there is a considerable amount of existing capacity and activity in the state around the development and commercialization of energy technologies. However, these activities lack focus and coordination and Minnesota has lost some of its competitive position among state and regional ecosystems that are intentionally designed to support innovation and entrepreneurship. In addition, the capacity for innovation that does exist in the state needs to be more closely aligned with the dynamics of the private sector and energy businesses in the state that are at various stages of development.

REIP offers a model for addressing the lack of an overall energy strategy by coalescing a number of important statewide networks, including a network of higher education and private research institutions, and a network of economic development agencies providing business services. REIP will focus on improving the links between these statewide networks and public and private sources of capital investment. It will also establish stronger communication links between private sector businesses and policy makers who share an interest in leveraging private investment in jobs and business growth with supportive public policies and programs.

REIP also represents a renewed effort to bring Minnesota's emerging energy businesses together by developing a central clearinghouse of information on the state's clean energy sector. REIP will continue processes that have been underway by others for convening stakeholders and developing clear goals as part of an ongoing statewide dialogue about future energy policy initiatives. Metrics and systems of data collection and analysis will be developed by REIP and its partners to track the growth of Minnesota's clean energy sector and its progress on broadly shared goals and priorities. Finally, the sector's business needs and opportunities for growth will be surveyed and integrated with state and private sector investments in trade and the development of global markets for Minnesota-made energy technologies, goods and services.

As a recent editorial column writer in the state said, Minnesota needs more focused efforts to prioritize its foundation competitiveness using a value proposition perspective. Similarly, one of the goals of the Itasca Group, a consortium of major Minnesota business CEOs, is to foster an ecosystem for research and innovation and encourage higher education collaboration that optimizes workforce investments and commercialization activities. The REIP planning team strongly agrees with these comments and has focused on how Minnesota can accelerate innovation and commercialization among a particular industry sector: renewable energy, energy efficiency and energy-related technologies. The planning team's specific recommendations and an outline for future action are laid out in this report.

Why Minnesota as a center for clean energy?

Minnesota is among the few U.S. states that have no carbon fuels - oil, natural gas or coal, however the state has abundant wind, solar and biomass renewable energy resources. Our energy-intensive climate and large industrial, mining and agricultural base give us a large energy footprint. The U.N. International Panel on Climate Change has estimated that the geographic location and varied biomes of the Upper Midwest will experience some of the most pronounced effects of global climate change resulting from greenhouse gas emissions. Minnesota has more reasons – but also more resources - than most other states to chart a path to a clean and renewable energy future.

Minnesota has been known in the past for its innovation, entrepreneurial culture and legacy of global businesses that currently export $20 billion a year to world markets. Recently, however, the Kauffman Center ranked Minnesota's climate for business innovation and entrepreneurship near the bottom of the 50 states. The state has an opportunity to rebuild its entrepreneurial environment for all of its technology and knowledge-based sectors by focusing on the current surge in business innovation in renewable energy, energy efficiency and smart grid technologies.

As it has in building powerful sectors in agriculture, food science, computers and medical technology and devices, Minnesota can focus strategically on its emerging clean energy sector to create a more flourishing climate for other areas of business innovation, commercialization and deployment. In short, Minnesota can create jobs and businesses in the state but also be a model for the nation and the world of how to make the transition from fossil fuels to a strong economy and resilient communities that are entirely powered by renewable, carbon-free or very-low-carbon sources of energy.

Why focus on renewable energy and energy efficiency?

A study by the International Economic Development Council (IEDC) has predicted above-average global growth for renewable energy industries over the next several decades. IEDC also found that the single most important factor for the success of state-focused energy programs was strong political leadership that is tied to a formal and comprehensive strategic plan.

Meanwhile, the greatest barrier to success identified by IEDC was insufficient investment and financing for research and for entrepreneurs and startup ventures seeking to capitalize on research findings.

As Minnesota's efforts to advance its renewable energy sector proceed, it will be important to ensure that rural communities and Minnesota small businesses are not excluded from renewable energy development in favor of opportunities for large, out-of-state companies. In Minnesota, rural communities and small towns are particularly well-positioned to reduce their use of imported fossil fuels and generate new sources of income from payments for the use of land for wind and solar, energy crops for power and heat, and revenues from production of renewable electricity, bio-based transport fuels and thermal energy. New products and service providers will emerge and be manufactured in these communities, as well as in the metro region. The capital that is retained in regional economies and spent locally rather than exported to buy energy from other states or countries will become a powerful driver of economic well-being.

The urgent challenge for Minnesota today is how to accelerate the innovation and growth of its energy-related businesses in a highly-competitive and dynamic global market. The REIP planning team certainly supports all of the efforts in Minnesota to create a statewide energy vision and a comprehensive plan for growth of a clean energy sector. We believe that such a plan should be grounded in the economic reality of limited public funding and maximize the benefits from investments by the private sector as well as targeted public investments. Any state energy plan also needs to be broadly supported by state residents as well as the marketplace. To accomplish this challenging task, Minnesota should move quickly to develop a formal and detailed strategic plan of action for its energy sector that will:

- Expand the state's manufacturing capacity and supplier networks for renewable energy, energy efficiency and smart-grid technologies and equipment;
- Recognize that dollars sent elsewhere to buy energy– $14 billion a year – extracts those dollars from local economies and set specific policy goals to retain that capital as a cornerstone of state job creation and economic development policy;
- Work with industry to support state trade initiatives and foreign direct investment that expand the "traded-wealth" value of renewable energy businesses in the state;
- Increase investment and in the state's ecosystem for innovation, commercialization and business expansion to support entrepreneurship in all areas, including energy fields;
- Brand and market Minnesota as a national and global leader in renewable energy, energy efficiency and smart grid technologies;
- Create a shared message and set of goals that can be articulated by Minnesota's political and business leaders at the local, state, federal and international level;
- Align workforce development efforts with industry needs to assure that we have the best and most highly-skilled employees that are in demand by energy-related businesses;
- Engage a broad group of private sector energy business leaders for continuous advice and comment on state policies, marketing and business needs for services and capital.

Challenges and Opportunities

As Minnesota proceeds, there are a number of regional and national factors that present both opportunities and challenges for the state to establish itself as a global leader in clean and renewable energy. These factors represent the national and global context in which statewide stakeholders will need to develop the next phases of REIP and a state energy plan.

Trade: Minnesota already has strong trade relationships with some European and Asian countries that are leaders in developing renewable energy businesses and may be looking to establish U.S. operations. The opening of a U.S. Import-Export Bank office in Minneapolis, new state trade offices, and the initiation of an EB-5 foreign direct investment program are examples of tools in place for building global trading relationships and acquiring technology and Foreign Direct Investment for growth of the state energy business cluster.

Forest Industries: Minnesota has 28,800 direct jobs and 31,700 indirect jobs in primary and secondary wood industries, including paper, lumber and wood composites manufacturing and secondary industries such as windows, doors, cabinetry, flooring, and furniture. The wood products sector has $15.8 billion of total economic effect, $8.8 billion in exports, and is the fifth largest manufacturing sector in Minnesota by employment. Mill shutdowns and curtailments are having a large impact on timber markets in Minnesota and total wood

harvested and utilized in Minnesota has been significantly below optimal harvest levels. Under-utilized forest and timber infrastructure represents opportunities for better utilization and management of Minnesota's forest resources for bio-based industries, fuels and energy generation.

Federal Policy: The current set of federal tax incentives for renewable energy is scheduled to be scaled back in the next few years. At the same time, federal regulation of carbon dioxide and coal-fired power plants will most likely make renewable energy comparatively more cost-competitive. In the absence of comprehensive federal energy policy, states like Minnesota need to be ready to innovate and step in to fill gaps in national policy..

2013 Energy Legislation: In the 2013 energy legislation, Minnesota electric cooperatives and municipalities are exempt from most of the provisions. That bill also exempted the energy-intensive mining and wood products industries from energy legislation. Long-term success for the state in meeting its renewable energy goals will require that the transition to renewable energy must be seen as economically beneficial for all of these groups.

Structural: The state's energy programs, incentives and policy development are spread across several agencies and departments. Research support, workforce development, support for entrepreneurs, economic development planning and most other elements that benefit the state's renewable energy sector are generally done well but by multiple agencies that sometimes lack overall coordination. The state needs greater integration, communication and focus in its energy-related programs and also needs to coordinate state-mandated programs managed by utilities.

Rural Minnesota, Agriculture, and Other Legacy Industries: The state's agriculture sector and rural communities have seen some economic benefits from wind and bio-fuels and could continue to be some of the biggest beneficiaries of renewable energy innovation. Pilot programs are looking at ways to substitute renewables for carbon fuel use in farm operations and in the mining sector. Agriculture and forestry have great opportunities to expand their roles in bio-based energy and materials. Some of the state's legacy companies already have renewable energy products and services that represent their fastest growing business divisions.

Utility Regulation: Minnesota's regulated utility model and dual-track energy policies for investor-owned utilities and other utilities are barriers to widespread deployment of renewable energy. There needs to be a new utility model that encourages utilities to invest directly and own more of the renewable energy that is developed and to shift to more "downstream" activities such as energy trading, project financing, energy services and project management and financing of investments to upgrade the utility grid for widespread deployment of renewable energy.

Capital: Minnesota-based investment capital, that keeps most of the economic benefits in the state over time, is starting to flow to the state's renewable energy sector. However, early stage funding for advanced development and commercialization of promising research and business startups is still particularly difficult to obtain. The state needs to ensure that most of the benefits from venture capital investments and third-party financing stay in local economies. The risks of early stage investment in energy technologies need to be shared between the public and private sectors.

Manufacturing: The state's current renewable energy manufacturing base can be expanded as U.S. and foreign firms consider locations in Minnesota based on state energy incentives and other policy initiatives. To capitalize on this interest in business relocations and to expand manufacturing of Minnesota energy technologies and products, Minnesota should have a specific focus on manufacturing and supplier networks as part of its state energy plan.

All of these challenges can be met and turned into opportunities by a comprehensive and strategic plan that is coordinated among public policy advocates, private sector entrepreneurs and investors, community development practitioners, and researchers in our colleges and universities. As one planning grant participant put it, Minnesota is well-positioned to protect its environment, create good-paying jobs, and become the "Silicon Valley" of sustainability and renewable energy. A number of European countries---Germany, Sweden, Denmark---have achieved this with certain energy technologies, but Minnesota could follow this pattern with more of an all-of-the-above approach to renewable energy technologies.

II. Planning Tasks

In 2011, Region Five Development Commission (R5DC) and the Minnesota High Tech Association jointly submitted an i6 Green Challenge Grant application. The application was a regional finalist, but was not among only six projects that were funded nationally. Subsequently, the U.S. Economic Development Administration (EDA) urged Minnesota to request planning funds to continue working on the strengths and weaknesses of its i6 Green proposal; federal funds for that purpose were awarded in October 2012.

This planning grant from EDA has been jointly administered by the Minnesota Department of Employment and Economic Development (DEED) and R5DC. Other core planning team members included the Minnesota Solar Energy Industries Association (MnSEIA), BioBusiness Alliance of Minnesota (BBAM), Natural Resources Research Institute (NRRI) at the University of Minnesota-Duluth, Olson Energy, and Blue-Green Alliance; Kandiyo Consulting, a Minneapolis-based energy consulting firm, was contracted to provide additional grant project management. A federal planning grant of $150,000 from EDA was matched with public and private cash and in-kind resources for a total of $300,000 allocated to this planning project.

The planning team has focused specifically on a Proof of Concept Center (PoCC) model which is a well-defined economic development approach that is in operation in many locations and has been supported by EDA. PoCCs take many forms but are generally framed around coordinated activities that accelerate research and development to commercialization pathways. The planning team adopted the name of the Renewable Energy Innovation Project (REIP) for its Minnesota-based PoCC planning process.

For purposes of this federal planning grant, the project team has assumed a broad definition of renewable energy, energy efficiency and energy-related

Chip Laingen (Defense Alliance), Tom Nelson (Advanced Power & Energy Cluster), Jeff Hensley (Wall Companies / Minnesota Innovation Park), Rebekah Kent (BBAM), Jim Marti (U of M - CSE / Minnesota Nano Center)

businesses while recognizing that a future REIP may need to be more focused and opportunistic. Over time, there will likely be more specific emerging technologies that offer the greatest promise for both rapid and long-term economic stimulus and job creation. These specific sectors may include solar electric, solar thermal, small wind, bio-based fuels and products, thermal energy and integrated technologies for energy storage, smart grid management, energy management and energy conservation.

The outcome of the planning project was not necessarily to recommend the creation of another entity, but to recommend strategies for better coordination and rationalization of existing economic development efforts that are energy-related. One of the immediate goals of the REIP has been to define an energy-related business cluster and outline a state economic development strategy for expanding that cluster that can be more competitive for state and federal funding. This strategy includes laying the foundation for impending federal grants, but includes a framework for state funding while also maximizing the leverage of private sector investments in energy businesses.

The establishment of the Minnesota Renewable Energy Innovation Project (REIP), will benefit entrepreneurial businesses focusing on renewable energy innovation, including energy efficiency and smart grid management; firms that design, engineer, commission, manufacture or construct energy systems; investors who provide early-stage funding and later-stage financial assistance for projects and businesses; higher education research, development and testing centers linked to commercialization; and existing or spin-off firms with a role in supply chains and marketing. It will also benefit state residents as renewable energy and energy efficiency systems are more fully implemented across the state. While the economic development benefits of this project will be felt statewide, there are likely to be particular benefits for rural communities from reduced energy costs, job creation and business growth.

Minnesota's grant-funded planning process has not answered every question and has certainly not identified every network or organizational relationship that will be needed for a successful PoCC. However, it does contribute to better defining a proposal for a statewide clean energy initiative and it recommends soecific steps and joint actions that the planning team believes will lead to a more vibrant entrepreneurial environment for renewable energy. This report establishes the framework for a comprehensive state plan to accelerate innovation and commercialization of energy-related products and services. The specific goals for a Minnesota PoCC that were identified by the planning team and were the focus of the planning team's efforts include:

1. Expand state support for basic and applied research, development and technology transfers in the state's higher education institutions, with appropriate methods for protecting and commercializing Intellectual Property.
2. Build a statewide network of Business Support Services to help companies find comprehensive resources at various stages of business or product development and in all regions of the state.

3. Formalize a process of private sector engagement for advice and comment on policy initiatives and for recommendations on continual improvements in programs and incentives that meet business needs for accelerating growth.
4. Craft state policies that integrate with federal initiatives, and leverage federal and state resources with investments of private capital in Minnesota's cluster of energy firms.
5. Increase capital formation and risk-sharing partnerships for more investment in research, promising new technologies, business expansion and market development.
6. Establish shared goals and metrics for measuring success in jobs, economic activity, marketing and branding that communicates Minnesota's energy expertise to the world.
7. Identify priority markets for export and increased public-private investments in market development, both foreign and domestic.

A. Research, Development and Technology Transfer

One of the goals of the planning grant was to survey programs and define a collaborative network of higher education and privately-financed programs for research, testing and commercialization of new energy technologies.

Lessons Learned

As part of the planning grant, representatives of research programs, primarily within the University of Minnesota, met several times to discuss ways to improve collaboration and create stronger connections with businesses, entrepreneurs and investors. A total of 27 participants attended an initial meeting in November 2012 and 21 people from 18 organizations within the University and also representing external stakeholders came together to discuss greater collaboration in research in October 2013.

As part of its planning grant work, the core team identified energy-related research activities in the state, including the following organizations at the University of Minnesota:

UMTwin Cities: Departments of Mechanical Engineering; Electrical and Computer Engineering; Chemical Engineering and Materials Science; Chemistry; Aerospace Engineering; Earth Sciences; Bioproducts and Biosystems Engineering; Agronomy and Plant Genetics; Forest Resources; Plant Biology; Ecology, Evolution and Behavior; Biochemistry, Molecular Biology and Biophysics; and the St. Anthony Falls Laboratory and the Institute on the Environment.

UMCrookston: Center for Biofuels and Renewable Energy Technology.

UMDuluth: Department of Industrial and Mechanical Engineering; Natural Resources Research Institute (NRRI).

UMMorris: Office of Renewable Energy Initiatives; West Central Research and Outreach Center.

UMRochester: Hybrid Energy Systems Study (HESS).

The challenges raised at the meetings of research organizations were familiar to nearly all of the participants although there was also general optimism that the current environment has become more conducive to greater collaboration among research institutions. There was also a general consensus that these organizations and others need to continue coming together for further conversation about collaboration. Key findings from the discussions among researchers include:

- The state's abundance of all-of-the-above renewable energy opportunities is reflected in the diffused structure of research at the University and in policy-making and regulation within state government.
- There is no central entity within the University of Minnesota or within the state that provides comprehensive information, resources, metrics, policy models and expert contacts on energy issues.
- The lack of overall focus and connection between programs was a dominant theme throughout the discussions and a frustration shared equally by UM officials and external stakeholders.
- Minnesota is making progress on its ecosystem for entrepreneurship and business innovation but remains at a competitive disadvantage with other states for developing a dynamic sector and industrial cluster of energy-related firms.
- Minnesota underperforms in receiving research funding from many federal agencies, particularly the National Science Foundation (NSF) and the Department of Defense. Some researchers believe this may be due, in part, to an anti-military political environment in the 1980s and 1990s that caused some defense contractors to move their operations out of the state.
- Various UM research teams from the Twin Cities, Crookston, Morris and Duluth campuses are

pursuing energy-related initiatives, but these activities are not coordinated. As examples of this diverse range of energy research attendees at the planning group's research and commercialization meetings noted the following current activities in UM organizations:

- Institute on the Environment (IonE): engaging more Capstone projects, including more involvement of social sciences, and convening other UM entities to develop an energy focus;
- Office of Business Relations: draft plan on how to better focus UM efforts to meet the needs of state energy businesses;
- Office of Technology Commercialization (OTC): working on a specific patent strategy for energy-related technologies;
- Natural Resources Research Institute (NRRI): cooperating with former IREE program staff to review previous research activities and develop a draft list of energy-related researchers within the University.

- The College of Science and Engineering (CSE) recently increased its faculty complement from 409 to 420 and currently serves 5,400 under-graduates and 2,600 graduate students. CSE has an active, dedicated program for reaching out to businesses and hosts a Solar Lab program.

A key finding of the REIP planning project is that faculty and research scientists lack the formal or informal social networks needed to facilitate technology transfers from their own research. Literature on the subject also suggests that faculty and research scientists who receive more industry funding for "sponsored research" tend to do more applied research and the physical proximity of business incubation to the University increases the level of tech transfers.

Brian Brashaw (NRRI - REIP representative, NRRI Wood Materials and Manufacturing program director)

The State of Minnesota and the UM have made previous efforts to better coordinate energy-related programs and commercialization efforts such as an IREE inventory within the University that was conducted several years ago. Recommendations for better research-to-commercialization coordination were also included in the report from the state Science and Technology Authority that has since been disbanded.

There are other current models and activities that could be brought together with research communities in higher education to focus and advance the state's energy strategy. Models reviewed by the planning team included: BioBusiness Alliance of Minnesota (BBAM) Innovation Engine, Wall Companies' proposed Innovation Park near the UM-Twin Cities campus, West Central Research Outreach Center farm-based energy audits and research at UM-Morris, Blue-Green Alliance's Clean Energy Manufacturing Center, and the proposals being advanced by the Southern Minnesota Competitiveness Project.

Institute on the Environment (IonE)

IonE, and its Northstar Initiative for Sustainable Enterprise (NISE), is emerging as the central focal point and convener for energy-related activities and programs within the University. It is promoting research teams across University departments in five key areas: energy, food and land use, freshwater, population and development, and whole systems analysis. It is also developing programs that include specialized training for students in entrepreneurship and systems thinking. A new center is forming at IonE around energy, law and policy and other "softer barriers" to renewable energy deployment.

Central to the work of the NISE is a consortium of leading thinkers who meet every six months to discuss research barriers and opportunities and develop a parallel research agenda. The consortium has a goal of undertaking at least five projects at a time that will result in reports, analytical tools and demonstration projects. NISE projects are designed to be outcomes oriented and based on fundamental research within the University and other research institutions.

The energy focus of IonE is on biofuels, solar energy, wind energy, energy storage, energy economics and energy efficiency---all important elements of the proposed Minnesota REIP. Its research activities are intended to be collaborative and stakeholder-driven with an exchange of new ideas and solutions that leverage the power of the private market to innovate, disseminate new knowledge and remove market and policy barriers.

In particular, the Northstar Initiative is designed around collaborative asset valuation and exchanges within the complex systems that shape supply chains, asset ownership, information infrastructure and emerging public policies. By linking energy, water and environmental systems, University researchers hope to establish more robust and comprehensive environmental metrics for evaluating intervention and investment strategies.

The stated goal of IonE's current leadership is to see Minnesota become a global leader in modern energy systems, including energy storage and a smarter power grid.

Next Steps for the Research Community at the University of Minnesota

An outcome from the discussions among research organizations was general agreement on some next steps that should be undertaken as a precursor to the formation of the REIP. These next steps are to:

1. Agree on a convener within the University and a process and timeline for continued dialogue on coordination of current University activities related to renewable energy research and commercialization.
2. Develop strategies for the University to increase its interaction with the renewable energy sector in the state and other research and concept-to-commercialization programs.
3. Define a role for the University in a REIP and a role in a central clearinghouse of information on renewable energy and commercialization resources.
4. Reach out to other organizations that should be part of the ongoing dialogue between the University and external stakeholders on renewable energy issues.
5. Continue clarifying the intellectual property considerations for the UM to minimize potential conflict between private inventors, businesses and the University.
6. Identify funding strategies that will assist energy entrepreneurs and businesses to access University research staff and facilities for more sponsored research.
7. Collaborate with workforce and education stakeholders to expand formal and informal education programs in basic science and technology fields at all educational levels.

Additional Survey Findings

IREE: The University of Minnesota's Initiative for Renewable Energy and the Environment (IREE) was founded in 2003 and operated as an institution-wide entity that was not tied to a particular college or center. IREE initially focused on strategic investments in programmatic capacities and seed-grant opportunities before turning its attention to large, multi-year research projects with high potential in emerging energy fields based on strategic exploitation of the state's competitive advantages.

IREE received state-mandated utility funding of $44 million over 10 years and leveraged that with nearly $100 million in additional research funding. IREE supported 250 research projects, supported a University community of 600 researchers that included 70 graduate student theses, and entered into 200 partnerships with businesses, industry groups, and state and federal agencies. State-mandated funding for IREE was suspended by the Legislature in 2012 and subsequently the IREE program was terminated. As referenced earlier, the University's Institute on the Environment (IonE) maintains some of IREE's activities related to energy systems.

IREE conducted an exercise to map and coordinate energy-related work within the University several years ago, and a database of University research activities and researchers can be found at http://iree.environment.umn.edu but the

database has not been updated with the most recent research work.

NRRI: The Natural Resources Research Institute (NRRI) at UM-Duluth has a program of applied research that is commercialization oriented and often works with external public and private stakeholders. Woody energy crop development and energy storage are major parts of its commercialization focus including a SunGrant project on woody biomass hybrid poplars. Current efforts at NRRI are focused on woody biomass treatment and processing into solid wood fuels and include studies of torrefaction, densificiation and hydrothermal carbonization. Through its affiliation with the trade association Heating the Midwest, NRRI also works on utilizing the existing infrastructure for harvesting wood fiber to appropriately-scaled end uses such as offsetting the $2.2 billion spent in the Midwest on propane and heating oil for space heating.

Front Door for Business: The University of Minnesota's Front Door for Business has set goals to be more thorough, transparent and dynamic in order to achieve its stated purpose of simplifying access to University resources for businesses. There is a new database portal called Experts@Minnesota (http://researchumn.com/tapping-into-expertsminnesota) for businesses, news media and other audiences to access University expertise. However, to date, the portal has been used mostly by researchers within the University to make connections between themselves and other researchers.

The University recently announced a new Office for Economic Development (OED) to address some of the concerns about links to private businesses and state economic development policy.

Pat Donahue (NRRI Secondary Woods program director)

OED will provide strategic direction and leadership for University-wide economic development activities in recognition of an increasing need for public-private partnerships to meet the economic development goals of the state and region. OED will bolster University research and technology commercialization efforts through increased outreach to business and industry partners. The new office will also leverage existing university expertise and resources in new programs and activities designed to enhance cross-university connectivity and promote the university's unique strengths in research, entrepreneurship and innovation.

UMMorris: The University of Minnesota-Morris campus has been implementing a hands-on development program for renewables. The emphasis has been on wind and biomass energy and more recently on solar technology. Morris recently expanded its agenda to include time-of-day pricing mechanisms for solar energy. Located on the Morris campus, West Central Research and Outreach Center (WCROC) is a separate program with links to the UM-Saint Paul campus. It has a well-defined 10-year vision to reduce the energy footprint of the agricultural sector and recently received state funds for energy audits of farming operations that are then re-engineered with renewable energy sources.

OVPR/OBR: The Office of the Vice President of Research and the Office of Business Relations (OVPR/OBR) has defined its role as being a "concierge" within the University. OVPR has new leadership and is hosting campus-wide discussions and focus groups on research programs. It is producing a draft plan and strategy to be released in 2014 that will focus on better coordination of the 160 UM research "centers" and on improving connections to state business needs.

CERTs: The Clean Energy Resource Teams (CERTs), are a part of University Extension, and view their program of grassroots outreach as part of the traditional land grant institutional model. CERTs is governed by seven regional steering committees that allow it to address regional priorities while also ensuring a broad statewide presence. CERTs represents an established network for outreach and mobilization around energy issues in communities throughout the state.

Extension: UM Extension also has oversight and management responsibility for the federally-funded EDA Center at UM-Crookston and the University of Minnesota Sustainable Development

Partnership centers that assist with community planning and efforts to increase economic and social resiliency.

CSE: The College of Science and Engineering (CSE) conducts mostly basic research that tends to have a longer timeline to commercialization. There is also increased activity in federally funded solar research at CSE's Solar Lab Project. CSE has some of the strongest existing outreach networks to private companies. More research funding would provide an impetus for greater collaboration between researchers and businesses, a theme that was repeated throughout the discussions of research needs.

OTC: The Office for Technology Commercialization (OTC) has made many of its connections for commercialization of University of Minnesota research with companies outside of Minnesota, and also works with businesses outside of the U.S. OTC covers a large number of technology categories and receives over 300 invention disclosures a year, which yielded over 100 patent filings in 2012. Renewable energy is currently the focus of several research disclosures yearly. Working with smaller companies on commercialization remains a challenge as the intellectual property issue is an expensive hurdle from many small companies to overcome. OTC has continually improved its processes in making assessments at earlier phases of research and has had success in converting research into patents and business licenses.

Through OTC, the University also recently announced a second program, MN IP Try and Buy, to address issues related to IP licensing. (See http://www.research.umn.edu/techcomm/industry-sponsor.html). The MN-IP Try and Buy program provides a simple, straight-forward approach to licensing of existing IP from the University. Companies can see the license terms upfront including a nominal fee for a short option period (the "Try" period) along with the terms to convert to a full, regular license (the "Buy" option). Some eligible technologies for MN IP Try and Buy are already listed on the OTC website while others will be added in the near future. This program will complement the another new program, MN-IP Create, that provides a simple, straight-forward process for companies to obtain exclusive, royalty free rights to all IP that results from their sponsored research. If sales from the sponsored IP research exceed $20 million, a small, one percent royalty payment is due from the IP recipient to the University.

A more detailed analysis of IP issues within the University of Minnesota is included below.

Blue-Green Alliance: Blue-Green Alliance is a non-profit coalition of groups that has been a core planning team partner in the REIP planning grant. Among its initiatives, Blue-Green has had a results-oriented program called the Clean Energy Manufacturing Initiative that works with private industries to reduce their environmental footprint and also to expand their production of clean tech products. The Alliance received federal ARRA funding for green job training initiatives that have built additional statewide capacity for training in green careers, including renewable energy.

BBAM: BBAM is a non-profit subsidiary of Life Sciences Alley, a trade association, and it has also been a core planning team partner on the REIP planning grant. BBAM focuses on bio-sciences and bio-industrial technologies including renewable energy. It has a specific goal of enhancing the value-chain for Minnesota businesses through its Innovation Engine program that it is building through statewide networking efforts. It also sponsors the Minnesota Angel Network (MNAN) that has contacts with over 1,000 certified seed capital and venture capital investors.

Defense Alliance and APEC: The Defense Alliance of Minnesota is a small business support organization that was started as a private research-to-commercialization initiative but has also received federal funding from SBA since 2010. It focuses on business development and technology procurement between small businesses and the Department of Defense. Defense Alliance reports that there has been little effort by Minnesota businesses to access the Defense Department's Rapid Innovation Funds. Similarly to OTC, the Defense Alliance finds nearly all of its commercialization partners for promising research are with businesses outside of Minnesota.

Defense Alliance recently initiated the Advanced Power & Energy Cluster (APEC) with contacts in 27 states but with a focus on the Upper Midwest. APEC's networks could become more active in identifying promising markets for Minnesota technology in energy fields, including renewables and smart grid applications. Global markets are especially important to APEC which is supporting congressional efforts to re-direct some foreign military assistance into energy development based on U.S. technology in other countries.

Minnesota Innovation Park: Wall Companies is a private real estate company that is developing the Minnesota Innovation Park on 15 acres just east of the UM-Minneapolis campus. Its proximity to the University will allow it to

leverage research by University researchers and act as the catalyst for advanced commercialization of new products and technologies. Energy is one of four areas of focus for the new business park along with food science, robotics and bio-sciences. Wall Companies has also noted that the University has received $875 million in recent years from the National Institute of Health (NIH) yet there has been less applied private research coordination from that NIH funding than at other major higher education institutions.

UMore: Another site-based opportunity for building capacity for testing and demonstrations is a large site in Dakota County that has been owned by the University of Minnesota since the 1950s. UMore currently has some wind testing capacity and agricultural testing but has much more potential for applied academic research with private sector partners and technology validation of energy related clean technologies (http://eolos.umn.edu/news/eolos-wind-research-station-commissioning-ceremony).

Energy Research within the MnSCU System

The Minnesota State Colleges and Universities (MnSCU) system has an equally complex challenge with a diffusion of its energy-related programs across its 37 campuses. The state attempts to assist business owners or students in getting access to MnSCU training programs in energy fields through its MnGreenCareers.org website, however a review of programs finds at least some aspect of energy-related training or research at 17 different campuses with no overall coordination of these training programs.

Some leadership on energy issues within MnSCU has come from the International Renewable Energy Technology Institute (IRETI) at Minnesota State University-Mankato in the past, and energy program coordination is part of the mission for the emerging Minnesota Energy Center based at Minnesota West Community and Technical College in Granite Falls. IRETI was created as a non-profit institute to serve private businesses as an independent testing center, primarily for solid combustible biomass, manure and other biomass materials for bio-methane or liquid fuels. It has potential capacity for other research, development, training and education services related to energy.

Another MnSCU focal point with connections to energy businesses is the Minnesota Center for Engineering and Manufacturing Excellence (CEME). It is based at South Central Community College in Mankato and includes partnerships with 10 other MnSCU institutions. There is also the 360-Degree Manufacturing and Applied Engineering Center of Excellence that is based at Bemidji State University that includes partnerships with nine other MnSCU institutions. Other MnSCU centers with some aspects of energy-related research are located at:

Winona State: College of Science and Engineering.

Bemidji State: Department of Art, Design and Engineering.

St. Cloud State: Department of Biology; Integrated Science and Engineering Laboratory.

Minnesota State-Moorhead: College of Science, Health and the Environment.

Anoka-Ramsey Community College: Department of Biology.

The MnSCU Chancellor's Office recently presented a "Charting the Future" document to the MnSCU Board that is expected to lead to greater focus and coordination within MnSCU for energy-related research and workforce development programs in energy fields. The goal of the document is to improve collaboration between MnSCU institutions in order to use system resources and human capital to its highest potential. This effort could lead to the establishment of a limited number of Centers of Excellence, at least one in each region of the state, that are focused on one or more energy-related technologies.

Intellectual Property Protections

The REIP project team recognized that Intellectual Property (IP) protections can be a barrier for early stage businesses, especially when those businesses are working in partnership with the University of Minnesota and MnSCU institutions. As a result, the planning grant team conducted some detailed research on the structure and guidelines for IP that is generated from within the University and also when higher education researchers are working on a contracted basis with private firms.

IP Within the University As a leading research institution, the University of Minnesota produces a great deal of IP, either through faculty, staff or student research work or company-sponsored research agreements. IP-related negotiations between the University and private enterprises include commercialization of IP produced by students and faculty (IP transfers from the University) and the negotiation of IP rights to sponsored research funded by private businesses.

Intellectual Property Process – University of Minnesota

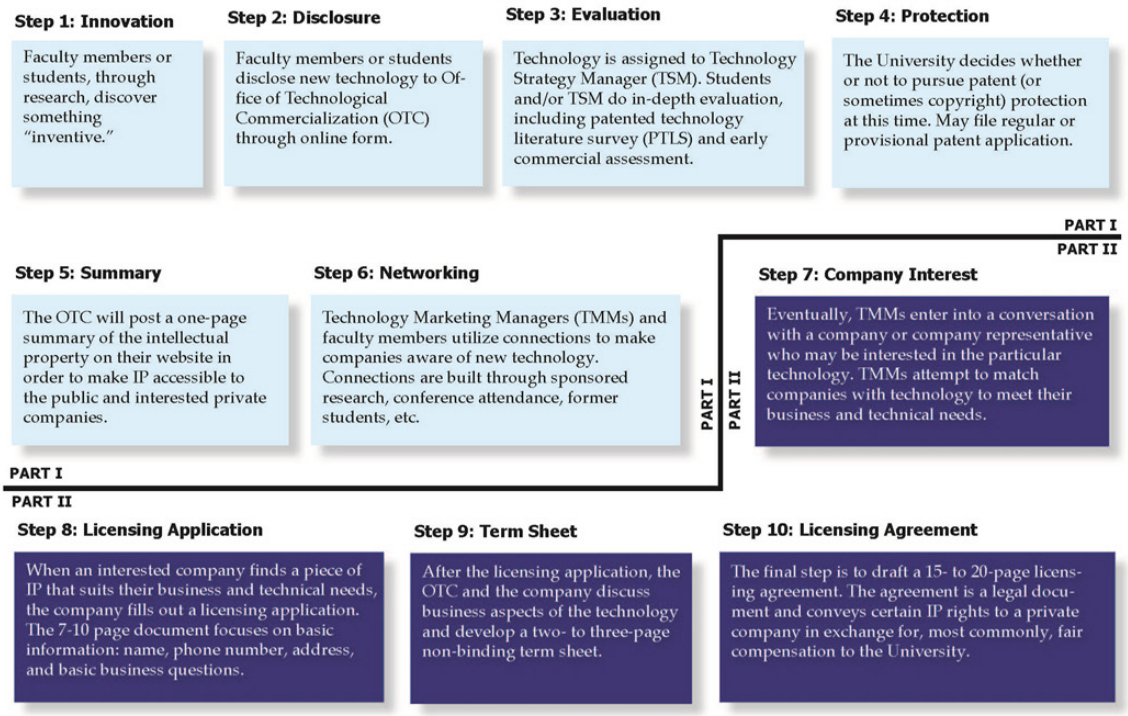

Figure 1

When University research results in something researchers believe is inventive, they file an invention disclosure with the University's Office of Technology Commercialization (OTC). It is the "tech transfer" office that is common in most universities, especially large public research institutions like the University of Minnesota. The OTC builds connections between interested businesses and technology emerging from university research, then negotiates IP licensing agreements between the two entities. OTC also assists businesses make connections between their market, and technical needs and expertise at the University.

The process of transferring IP rights from university research to an interested company is outlined in Figure 1. Once "inventive" discoveries are disclosed to the OTC, Technology Strategy Managers evaluate the technology, conduct a patent and technology literature survey (PTLS) and an early commercial assessment (ECA). The University determines whether or not to pursue a patent or copyright protection. Once the technology has been protected, Technology Marketing Managers post a summary of the technology on the OTC website and work to attract companies or individuals who may be interested in utilizing the technology.

The second step of the technology transfer process takes place after a company has expressed interest in IP at the University. A company fills out a licensing application that includes mostly basic information and the company and OTC enter into discussions for a non-binding term sheet on the business aspects of the technology. The final step is a licensing agreement formally conveying certain IP rights to a company in exchange for fair compensation.

IP That Results from Contracted Research: The University of Minnesota's research reputation and location in a major metropolitan area with many additional locations throughout Minnesota make it a prime target for businesses interested in accessing academic and research resources.

The Office of Sponsored Projects Administration (SPA) conducts project agreement negotiations with the sponsoring companies. The University retains patent and other IP rights that result from University work, but will grant the research sponsor an exclusive royalty-free license as part of the MN-IP Create program. The business terms for a license are determined upfront at the start of the research program rather than later when IP has been created This approach increases the business certainty for the sponsoring company with fewer unknowns regarding the license terms.

The University conducts about $700-800 million in sponsored research annually and entered into over 70 licensing agreements from this sponsored research in 2012.

Sponsored research agreements typically include IP clauses and confidentiality agreements that can play a major role in the protection of IP.

The IP process at the University of Minnesota is comparable or better than at other research schools The University of Minnesota's process for addressing IP-related issues has been very similar to other large public universities but it is now more of a national model through its MN-IP Create and MN-IP Try and Buy programs. Most schools have a technology transfer office and a sponsored projects office. Many schools, including Minnesota, also have a "one stop" office for businesses to access university resources.

The University of Minnesota's Office of Business Relations, like the University of Michigan's Business Engagement Center (BEC), or Ohio State's Industry Liaison Office (ILO) serves as a "front door" to finding licensable technology or university experts. These centers may not necessarily focus on one particular area of need for businesses, but help a business find a wide range of resources that support the regional business community.

Other comparable programs include the Business Engagement Center at the University of Michigan, Industry Liaison Office at Ohio State University, Find a Researcher at the University of Utah, and a searchable research database at Kent State University.

University of Minnesota and business differences regarding IP: Conflicts and concerns regarding IP rights may stem from a fundamental difference in how businesses and universities view IP. In the private sector, a company views IP as proprietary—a potentially lucrative asset for the business. Universities are more likely to view research as an opportunity to enhance the public's knowledge. Businesses may see university faculty, staff and students as "workers for hire," while universities see their role as contributing to the larger sphere of knowledge or publishing their research to advance their academic careers.

One of the most important purposes of the IP legal system is to institutionalize protections that create incentives for further innovations. In this sense, IP is not intended to be a commodity that is permanently owned but reflects a short-term compromise and shared benefit that provides incentives for authors, scientists and artists to continue innovative research activities.

While this view of IP may not always help businesses settle IP conflicts, it is important to understand how both parties view the IP system before approaching an IP negotiation. Having realistic expectations and experience working with the university will help facilitate a better relationship and better understanding regarding IP concerns.

Minnesota Innovation Partnerships (MN-IP): To alleviate some of the concerns surrounding IP, the University of Minnesota introduced the Minnesota Innovation Partnerships (MN-IP Create) program in 2011. It allows research sponsors to receive exclusive, worldwide rights to all inventions resulting from a sponsored project by paying at least $15,000 or 10 percent of the sponsored project's budget upfront, whichever is greater. The research sponsors also must agree to one percent royalties on net sales resulted from University research that exceed $20 million.

MN-IP includes other benefits to the sponsor, including no annual minimums or technology commercialization fees, freedom to sublicense or cross license, and rights to use any data arising from the sponsored project free of charge.

The objective of the MN-IP program is to provide a clear, upfront approach to IP negotiations in sponsored research, while protecting the University's financial interest when sponsored research results in a highly profitable IP product, service or technology.

Small Business Challenges: The University often focuses on large projects sponsored by major corporations but small businesses and entrepreneurs often have a need to sponsor research as well. Small businesses may have a harder time getting into the University research network since they typically lack the financial capital that can capture the interest of University research experts.

Other than the costs associated with sponsored research, the process for IP negotiations at the University is relatively standardized and uniform, with no unique advantages or disadvantages for small businesses. For some small firms costs of sponsored research may be also be for access to legal counsel, which the University strongly encourages during negotiations. Small businesses are sometimes less accepting of the need to make IP systems a continuing incentive for innovation and small businesses are often more protective of their potential IP because at early stages of their business development IP is seen as the most valuable thing that they have.

Conclusions and Recommendations about IP:
As a major research institution, the University of Minnesota produces a large amount of IP through individual faculty, staff and student research as well as sponsored research projects. Understanding how the IP negotiations system works at the University can help minimize conflicts between private enterprises and a public institution.

- IP takes many forms including trademarks, trade secrets, and trade dress as well as patents. Copyrights also protect original work, but must be registered with the Library of Congress in order to be enforced in court.
- When faculty, staff or students make an "inventive" discovery through their research, it is reported to the Office of Technology Commercialization (OTC) where Technology Marketing Managers identify businesses interested in purchasing a licensing agreement.
- When businesses sponsor research, IP negotiations usually take place through the Sponsored Projects Administration (SPA). The MN-IP program offers sponsors a chance to acquire exclusive, worldwide rights to the IP in exchange for at least $15,000 or 10 percent of the project's budget (whichever is greater) upfront and one percent royalties on annual net sales over $20 million. If this option is not used, businesses and OTC negotiate licensing terms after the IP is developed and reported.
- Though not required, the University suggests and expects businesses to seek legal advice when entering into a legally-binding IP licensing agreement.

Greater Collaboration Among Research Entities

The REIP planning grant team drafted a Memorandum of Understanding or Partnership Collaboration Agreement that it recommends be the basis for initial discussions among research and technical assistance entities around the state. Additional discussions will be needed to build the necessary comprehensive and coordinated research-to-commercialization network in Minnesota on energy issues. The outlines of a collaboration agreement as proposed by the REIP, include, at a minimum, the following elements:

- Standardized process and screening criteria for initial intake of research requests among all entities participating in the research network;
- A comprehensive list of referrals and specialized expertise for research for use by REIP, economic development practitioners and the University;
- Greater focus and coordination of research at the University of Minnesota and MnSCU and better alignment with state policy goals and the needs of the private market;
- Joint development strategies to increase the overall level of funding for research and development programs.

As a result of its research, REIP is also recommending that a portion of research funding be given directly to the startup firms or the entrepreneur. These "research vouchers" could be used to access any of the research programs or institutions that are part of the statewide network, based on the entrepreneurs' interests and needs. The selection of a research partner by an entrepreneur could be driven by geographic proximity, an existing relationship, or the specialized knowledge of a particular researcher. This approach will shift some of the focus of research to applied areas and assure that a significant portion of research dollars are spent based on market-driven priorities.

B. Business Support Services

The goal of this planning task was to begin developing a network of economic development agencies that can serve all areas of the state with comprehensive commercialization pathways for energy-related entrepreneurs and businesses.

Lessons Learned

The backbone for a statewide network of business services is a multitude of existing organizations that are generally members of the Minnesota Association of Development Organizations (MADO). MADO is an association of the ten federally designated Economic Development Districts (EDDs) in Minnesota, which are also referred to as RDOs, or Regional Development Organizations. Nine of the organizations are Regional Development Commissions (RDOs) and one is a foundation, West Central Initiative Foundation. MADO serves 65 of the state's 80 non-metro counties. RDOs were established by Minnesota statute in 1969 to provide technical assistance to the local units of government in their region.

A survey of these Business Service Providers was conducted by the REIP planning team in December of 2012 and identified gaps in the resources and skills needed among the front-line business assistance providers across the state. Of the 41 service providers who filled out

the survey, over half of respondents indicated that there was a need for some of the services that REIP may offer, including access to early-stage funding, technical assessment of new energy technologies, referrals to research and development centers, and assistance with defining markets. When asked specifically about whether there are unmet needs for energy entrepreneurs, 38 percent said there are some unmet needs and 49 percent were unsure if there are unmet needs.

Although these survey respondents are already part of a statewide network that provides many of the services needed by energy entrepreneurs, there is still a need for increased connectivity and collaboration among regions. Services already provided include loans (78%), technical assistance (70%), referrals to capital funding (73%), and referrals to higher ed partners (68%). However, only 23 percent of respondents conducted feasibility or assessment studies of new technology or inventions. Survey respondents work with a range of state and federal partner, including Initiative Foundations (78%), DEED (72%), SBDCs (72%), USDA Rural Development (67%), and the Small Business Administration (56%), but only one respondent had worked with the Department of Defense or DARPA.

The greatest needs found by the survey were for technical assessment and market viability of new energy technologies, and greater access to early-stage or bridge financing that would help entrepreneurs get through the initial stages of business development. Business service providers also want these connections and referrals to be intentional, action-oriented and formalized, and not just based on informal networking.

Michael Lalich (NRRI founding executive director - recently retired)

While it is not necessary to have a comprehensive range of resources and expertise available in all areas of renewable energy in every region, practitioners need to know where that expertise can be found within the network as the network and emerging regional Centers of Excellence develop around specific energy technologies. When making referrals within the network, front-line staff in the state's business service providers network want to be able to find the right individuals for particular tasks, and not just the right organizations.

The survey also found strong support for a clear statewide plan and set of goals, with leadership and support from the Legislature and Administration, that includes consistent economic development policies and incentives for the renewable energy sector. At the state level, Minnesota has recognized the need for a similar type of coordinated business services with its Minnesota Business First Stop program. This program brings a range of state agencies together to assist businesses, including in the coalescing industry cluster around energy. In fact, 37 percent of the businesses that have used the Minnesota Business First Stop program so far have been in renewable energy and bio-based businesses. Regional opportunities and interests in energy fields can also be linked to statewide planning through Comprehensive Economic Development Strategy (CEDS) planning and other regional planning processes.

The planning grant also included a review of business service models from other states including the Kansas KOIN network that is based on a hub-and-node model for interconnection. The planning team looked at other tools such as a social network analysis that evaluates the network's capacity for virtual delivery of services as a way to overcome geographic barriers, and business-to-business network-weaving models focused on strengthening supply chain relationships among firms.

To be more successful, the Business Services network in the state should have access to a more comprehensive clearinghouse of information on energy-related issues, a clearinghouse that can be access virtually regardless of where startups may be in their commercialization progression. The various providers of these front-line services need to continue their collaboration to identify the pathways for businesses and entrepreneurs at all stages

to advance their business ideas and reach commercialization. The basis of these pathways will be access to technical assistance for assessing market viability and for the businesses themselves, and broad and diverse referral networks for the entire range of business services that may be needed. For many businesses physical access to business support services will be important and the virtual clearinghouse should be closely aligned with regional centers of expertise on energy issues throughout the state that continuously respond to business needs with updated information and interventions that will add value to businesses and accelerate their commercialization progress.

There is also a strongly perceived needs to raise the overall renewable energy technical literacy of the state's business service providers and broaden their understanding of business and project financing issues that are unique to the energy sector. This training needs to include fundamental principles of renewable energy, energy storage and smart grid technologies as well as the types of supply chain relationships these technologies need. The planning team discussed options for this ongoing energy sector training such as developing partnerships with the Economic Development Association of Minnesota (EDAM) for technical assistance, perhaps in partnership with the retired executive volunteers from the Renewable Energy Technical Assistance Program (ReTAP), the Bio-Business Alliance of Minnesota (BBAM), or some of the MnSCU training programs.

In addition, there is an emerging "carbon college" initiative under development at the University of Minnesota-Morris. Clean Energy Resource Teams (CERTs), which is governed by seven regional councils across the state and has a strong statewide network and outreach mission could be the delivery mechanism for some of this training work. Even though it has a well-established network, CERTs also generally lacks the technical information or knowledge of financing tools in energy fields to provide the kind of substantive content needed for effective training.

An estimated 75 percent of front-line business services staff across the state are women, however women are still under-represented in most energy-related technical and business fields. Likewise, there is a general lack of minority business participation in renewable energy and energy efficiency fields, with a particular dearth of Minority Business Enterprises (MBEs) available for contracting and sub-contractinig on energy projects. These deficiencies should be part of the focus of any efforts to establish training programs and business development initiatives.

C. Private Sector Engagement

The specific goal of this planning grant task was to define the categories of private sector representation from priority energy business and technology sectors that could serve as advisors to the planning team on its plan for a Proof of Concept Center and the state as a whole as it develops its energy plan.

Lessons Learned

The REIP planning team recognized that greater dialogue and engagement with a broad base of private sector stakeholders will be critical to the success of a future Proof of Concept Center and state energy initiatives. The specific goal of the planning grant was to define the cross-section of energy-related products and services that make up the energy industrial cluster in Minnesota and begin to identify representatives of these businesses and sectors that can provide ongoing advice and counsel to the statewide REIP.

The REIP plan includes a matrix for a 12-member Private Sector Advisory Group (PSAG) and a job description that defines participation in the group. The matrix was developed to include representation from multiple renewable energy technologies (solar, wind, bio-based, energy efficiency/grid), and representation of different industry types (manufacturing, design and construction, and project finance). In order to reflect the statewide nature of the REIP, the ideal PSAG membership would include six members from the Minneapolis-St. Paul metro area and six members from non-metro regions of the state.

Members of the PSAG will be expected to review information and participate in 4-5 meetings a year. It could be staffed by the REIP and would be designed to provide advice and recommendations on key aspects of the state energy program including policy development, business services, research, capital funding and market development and branding.

It will be important in structuring the PSAG to do so in a way that mutes competitive impulses, i.e. address issues in the aggregate rather than with specific models that could be proprietary to one or more businesses. Members will also need to abandon their firm-specific agendas for a more collective approach that recognizes the goals of the state's clean energy sector to improve as a group. One process for selecting the membership of an ongoing advisory group could be to allow specific industry associations,

such as MnSEIA, BBAM or the state chapter of the American Wind Energy Association, to nominate candidates for the group.

The REIP plan is also recommending that the state consider making this group a permanent part of the policy-making process, similar to other industry groups, as a way to provide continuous review and advice on state energy policies for the Administration and the Legislature. The REIP planning team found that policy makers are generally interested in a state energy vision that leverages the resources of the private sector, reflects economic realities and is generally supported in the private marketplace but that there is a lack of a formalized dialogue for bringing these perspectives together. At the same time, based on research on other successful PoCC models, private sector stakeholders in energy see significant benefits in increased interaction with state and local policymakers, utility regulators and venture capital representatives.

To achieve these mutually beneficial goals, private sector stakeholders must have more direct lines of two-way communication with policy makers. Although there are active industry groups in specific renewable technologies, such as wind, solar and biomass, these groups do not interact among themselves on a regular basis and there is no formalized structure for these private sector stakeholders in renewable energy to communicate with policy makers, researchers or other actors in the state's renewable energy sector.

Specific to the planning grant, the first task of an initial PSAG will be to review and comment on the findings and recommendations in this report. On an ongoing basis, one of the principle roles of the PSAG could also be to conduct periodic "opportunity scoping" that identifies the most promising areas within the renewable energy and energy efficiency sector for investment and policy focus. As a whole, these private sector representatives have access to a great deal of market intelligence that, in the aggregate, can be very useful in informing state policy and the priority-setting needed for an effective state energy plan.

Don Fasnacht (NRRI) and Cheryal Lee Hills (Region Five Development Commission executive director)

The importance of a robust dialogue with the private sector will result in benefits that can cut across all elements of a future REIP. The University of Minnesota, for example, agrees that it needs to increase its commercialization "batting average" through more robust interaction with the private sector in Minnesota. For example, IonE's interest for stronger private sector networks remains an important goal, but one that is not yet a reality.

Since 2006, the Agriculture Utilization Research Institute at UM-Crookston has conducted energy roundtables with mostly private sector participants. These roundtables, however, have mostly been confined to opportunities in bio-based energy research and commercialization areas and have not generally included other renewable technologies.

A summary of the benefits of greater private sector engagement includes:

- The research community needs to have better access to the network of businesses, entrepreneurs and investors that are critical to turning research and ideas into viable products.
- Policy makers need to know that the policy initiatives they are considering to drive growth in the energy sector will have the intended effects and not be an unintended hindrance to the emerging state energy industries.
- Private sector members should have a regular forum to articulate their needs for capital investment or other business services such as workforce training or marketing support at various stages of business development and growth.
- The state's investments in market development and trade opportunities should include more of the on-the-ground market intelligence that energy businesses as a whole can bring.
- The state's energy businesses and the investment community will

benefit from metrics that measure the performance of the state's energy cluster and the data that can be provided by private businesses.

- Private businesses need to provide advice and be in agreement with overall branding and marketing of the statewide energy sector and be able to incorporate it into their individual marketing efforts.
- Private sector engagement and the participation of business leaders will help maintain political support for the state's energy efforts.

D. Policy Reform and Development

The goal of this planning grant task was to streamline and coordinate the process of developing state energy policies and regulation by establishing an appropriate working group on policy and building links to other stakeholders in energy policy.

Lessons Learned

Policy stakeholders met several times during the REIP planning process to discuss policy development at the state level. As a result of those discussion, the REIP plan identified areas of potential agreement on five key elements:

- Policy makers need to emphasize the success of past state energy policies.
- There needs to be greater integration and coordination of current policy reforms and studies.
- The process of identifying weaknesses, policy gaps and inconsistencies in state energy policies will never be done.
- There needs to be agreed upon goals and measurement on the efficiency and effectiveness of energy policy initiatives.
- Policy makers need to coordinate with other REIP working groups such as private sector advisory, capital access, metrics and marketing.

Much of what was discussed and recommended at these early meetings of the REIP Policy Working Group was carried out by far-reaching energy legislation in 2013. Given the fact of substantive legislative action on energy policy, most of the working group discussions shifted toward longer term renewable energy policy goals, a better-integrated state energy policy structure, and a strategy to raise awareness of Minnesota's concept-to-commercialization renewable energy capabilities.

In the absence of a more robust and comprehensive national energy policy, the states have become the primary arena for development of policies that support innovation and growth in renewable energy and energy efficiency. Through at least 2016, federal policy will continue to provide some significant tax incentives for renewable energy development, in the form of the 30% Investment Tax Credit and an accelerated schedule for the depreciation of energy assets. However, the on-again, off-again nature of federal Production Tax Credits for wind energy and increasing critiques of federal bio-fuel standards are examples of the policy uncertainty at the federal level that can hinder longterm business planning.

At the same time, the 2013 Legislative Session in Minnesota was very active on renewable energy issues, particularly focused on solar energy, rate reforms, and long-term energy planning as key segments of the Legislature's omnibus economic development bill. One solar industry representative responsible for monitoring action at the State Capitol described the session as "trying to drink from a fire hose" because of the flow of ideas and policy initiatives. Overall, the general trajectory of these state energy programs has been to shift from direct grants and rebates to enhanced financing tools and more performance-based incentives.

The 2013 legislation clarified aspects of the state's Property Assessed Clean Energy (PACE) financing tool and extends from 15 to 25 years the required payback period for efficiency or renewable investments by public agencies that utilize Guaranteed Energy Savings Contract rules. Thus far, PACE programs have been moving forward with private capital or only minimal amounts of publicly-issued bond debt, which has had the effect of increasing interest costs and shortening the terms for the PACE loans to less than the legislatively authorized terms. However, the St. Paul Port Authority (SPPA) has established a PACE program capitalized with pulic bonds that is being offered to local units of government throughout the state through a joint powers agreement. This SPPA program and others that may emerge are likely to increase the level of PACE financing that is available for energy projects in the state.

Since the legislation was signed into law in May 2013, a number of rule-making and planning activities have been underway through the state energy office (Division of Energy Resources) within the Commerce Department and through the deliberations of the Minnesota Public Utilities Commission (PUC). In addition, there are six major

studies related to renewable energy in the 2013 law that are likely to have significant impacts on future policy formulation at the state levels. Some of these legislative changes, rule-making and planning activities include:

- Implementation of a 1.5 percent solar energy generation target by 2020 that is in addition to the Renewable Portfolio Standard (cooperatives and municipals, and mining and wood products industries are exempted).
- Xcel was required to file a plan by September 30 for administering "community solar gardens" that allow for virtual net metering, set rates and provide for no limits or discriminatory pricing can be used for solar gardens; PUC approval of Xcel's community solar plan is expected in March 2014.
- Development of a Value of Solar Tariff algorithm by the state energy office that bases rates on the distributed generation and environmental benefits of solar energy and may be used by utilities as an alternative to new net metering limits up to 1.0 megawatt.
- Further study and analysis of transmission enhancements to facilitate renewables, grid-connected storage systems, and solar thermal potential.

MnSEIA estimates that the 1.5 percent solar generation mandate and community solar provisions will add 1,800 to 2,000 Minnesota jobs, and increase solar capacity by at least 400 to 500 megawatts over the next seven years. Moving forward, the question may be to what extent Minnesota is willing and capable of filling the gap left by policy uncertainties at the federal level. One option would be to fashion a set of "blink on" state incentives that would take effect only if federal incentives for renewable energy are curtailed.

Connie Ireland (DEED representative to REIP) and Brian Brashaw (NRRI)

The focal point for policy initiatives at the state level is emerging as the Next Generation Energy Board, a joint legislative and state agency body that will be responsible for developing a Minnesota Energy Futures Study by January 2014. The Next Gen Board has previously been most active on bio-based energy issues, but appears poised to expand its agenda to other energy technologies and to work more closely with the Environmental Quality Board (EQB), the joint body of state agencies that coordinates state environmental policy. The state energy office, the Division of Energy Resources within the state Commerce Department, will also play a central role in developing a well-defined renewable energy policy roadmap for the state.

The statutory charge for the NextGen Energy Board is to decrease the state's reliance on fossil fuels, increase the use of local energy sources, expand agricultural and natural resource sustainability, and promote rural economic vitality. The Board is also statutorily charged with examining the future of fuels, such as synthetic gases, biobutanol, hydrogen, methanol, biodiesel and ethanol within Minnesota, examining the opportunity for biobased content and biobased formulated product production at integrated biorefineries or standalone facilities using agricultural and forestry feedstocks and, developing equity grant programs to assist with the development of locally owned facilities.

Community solar garden (CSG) legislation, in particular, is most likely to have transformational impacts on Minnesota's energy markets and the growth of its solar energy businesses. The virtual net metering aspect of CSGs allows ratepayers of all types---renters, non-profits, homeowners, public agencies, big and small businesses---to invest and be beneficiaries of cost-effective solar energy projects. Large-scale CSGs are able to reduce the per-kilowatt cost for implementation of solar energy for most customers by 50 percent or more and will bring additional portfolio financing to solar systems as a form of distributed generation.

Minnesota's Division of Energy Resources (DER) also completed a major study of microgrid energy systems in December 2013. The report outlines the impacts microgrids could have on energy supplies, the development of storage and demand-management systems and emergency preparedness for disasters. Among the study's recommendations are to implement a state microgrid demonstration program similar to efforts in New York, Connecticut and New Jersey, and to clarify access to the general distribution system for micro-grid systems. Across the country, microgrids are currently most likely to be developed at military installations, university campuses, schools and hospitals, but that pattern could be expanded in Minnesota.

Microgrids also tend to lead to formation of specialized areas with higher levels of renewable energy deployment. The goal of such systems is to maintain critical community services during energy emergencies, bring communities back on-line more quickly after disasters, and assure that power is available for critical sites such as hospitals, water systems, fire stations, etc. Another step in this direction by Minnesota is a recent grant from the state's Renewable Development Fund (RDF) for a microgrid demonstration project that will be developed by the University of St. Thomas in St. Paul at a site in Chisago County.

Minnesota's energy policy initiatives this year are on top of a number of progressive state energy policies that have been in place, in some cases, for nearly a decade:

- Renewable Portfolio Standard of 25 percent by 2020 (30 percent for Xcel)

Biofuel production

- Energy conservation target of 1.5 percent reduction in baseload demand each year
- Greenhouse gas emissions reduction target and a state Climate Action Plan
- Bio-fuels market share target and a state ethanol subsidy
- Property Assessed Clean Energy (PACE) bonds as a local option

The state's largest utility, Xcel Energy, has some robust rebate programs for energy conservation and solar photovoltaics, although the incentives are mostly targeted for smaller investments in solar installations. Most other state utilities have much more modest incentives, or no incentives at all, and the state's cooperative and municipal utilities generally opposed 2013 policy changes and have been exempted from compliance with those new requirements. The Made in Minnesota (MIM) solar rebate program, now administered by DER, will invest $15 million a year for 10 years in performance based incentives for small solar energy installations that use solar equipment made in the state.

Minnesota currently has a utility model based on cost recovery plus fixed rates of return on assets. For the last two decades, the state has also had a dual policy track for utilities and renewable energy-one for Xcel Energy and another track for all other state utilities, particularly for electric cooperatives and municipal utilities. REIP core team partners Blue-Green Alliance and MnSEIA in particular expressed some concern over exemptions from new energy mandates for some utilities and specific major energy-users.

The current utility model has at times been perceived as a barrier to implementation of renewable energy. However, that has also lead to an increasing amount of discussion of unbundling energy services provided by utilities and decoupling of energy rates from the return on a utility's asset base. Ideally, the two tracks for energy policy applied to utilities will become more unified, even though that will add complexity to the policy fabric with utilities that have significantly different economic and political factors that guide their resource planning.

Minnesota funds energy conservation through a variety of loan and rebate programs, most of them administered directly by the state's utilities. In addition to the mandatory Conservation Improvement Program (CIP) program that requires all utilities to make annual expenditures on conservation measures, Xcel Energy funds a Solar Rewards rebate program that is targeted for mostly smaller solar energy installations below 40

kilowatts. Current state law allows up to 10 percent of CIP funds to be spent on renewable energy, but most utilities other than Xcel do not spend much of their CIP funds on renewable energy incentives and some of that CIP funding has now been re-directed into statewide programs such as the Made in Minnesota rebates.

Xcel Energy is required to fund the Renewable Development Fund (RDF) based on the amount of nuclear waste storage at its Prairie Island nuclear facility. Some of these funds have been appropriated by legislative action to projects such as energy-related research and the Made in Minnesota bonus for solar energy equipment. However grants totaling more than $30 million were made by Xcel in 2014, following a competitive grant process for renewable energy projects that recently received final PUC review and approval.

Minnesota also has some general programs to support entrepreneurship and startup businesses, including the Investment Fund, Job Creation Fund and an Angel Investment Tax Credit that was approved in 2010. These programs have been funded as part of the biannual budget process and are generally over-subscribed soon after the start of new funding rounds. Additional funding was allocated for infrastructure investments and workforce housing tied to economic development, but neither of these programs is specific to the energy sector. The Legislature also appropriated funds to open three additional state trade offices, and those offices were selected in December 2013 by the Minnesota Trade Office to be in Cologne-Dusseldorf, Germany, Sao Paolo, Brazil and Seoul, South Korea, in addition to an existing trade office in Shanghai.

Many individual cities, counties and economic development agencies have their own programs for promoting business development and job creation, some supported with dedicated local tax levies that are combined with pass-through grants from the Department of Employment and Economic Development (DEED) or through the use of tax increment financing. The Iron Range Resources and Rehabilitation Board (IRRRB) is an economic development agency supported by iron ore depletion taxes and has supported some renewable energy projects, including incentives for the solar equipment manufacturer, Silicon Energy, to locate in the City of Mountain Iron industrial park.

Governor Mark Dayton made a clear policy statement at the start of the 2013 Legislative Session in his State of the State address by declaring his support for the "next leap forward toward a sustainable energy future." As part of its efforts, the planning grant team periodically briefed key members of the Administration on the proposal for a REIP, including Ellen Anderson who has been designated as the Governor's point person on renewable energy, Will Seuffert who was on the Governor's staff and now heads the EQB, and Kathy Tunheim, a long-time public relations and communications professional, who serves as a special adviser to the Governor.

In late 2013, Minnesota was selected to receive a grant from the National Governors Association to review and recommend state energy-related policy initiatives with the assistance of the National Conference of State Legislatures (NCSL). With the help of the NCSL, Minnesota will look at policy models and best practices in other states with aggressive energy programs. The recommendations will be forwarded to the EQB which

may develop another comprehensive energy policy agenda for the 2015 legislative session.

Green Jobs Task Force: The Minnesota Green Jobs Task Force was established in 2008 by the Legislature and was co-chaired by one member of the State Senate and one member of the State House of Representatives. The Task Force was charged with developing an action plan for state policies that would allow Minnesota to:

- Make green job activities in the state more visible and directed;
- Increase funding to encourage green technology;
- Provide support for innovation, research and patents in green technology;
- Create a platform for coordination and the leverage of existing efforts in order to access more federal funding.

As part of its work, the Green Jobs Task Force also completed a Market Analysis in 2009 and concluded that Minnesota has the potential to increase the number of green jobs in the state at the high end of the range by about 20,000 by 2020, and increase economic activity in this area by $4 billion to a total of $15 billion. Some other key findings of the Market Analysis:

- Minnesota receives just 72 cents back from federal sources for every $1 it pays in federal taxes and fees, ranking 46th among the 50 states.
- Minnesota already has a strong concentration of renewable energy firms, many of which are experiencing high rates of growth.
- The state's tribal governments receive lower levels of federal energy funding than their counterparts in nearby states such as Wisconsin, Michigan and South Dakota.
- The University of Minnesota receives 32 percent of federal research funding in Minnesota, compared to 70 percent for the University of Michigan in Michigan, although some of this disparity is due to a large amount of federal funds from the National Institute of Health (NIH) going to the Mayo Clinic.
- In the period 2002-2007, Minnesota had 1,800 patents per 250,000 population in all categories, which lagged behind Michigan, Illinois and Ohio.
- Minnesota's patents in renewable energy were comparable to Illinois, Ohio, Pennsylvania and Washington, lagged behind Colorado and Michigan, but were better than Wisconsin and Iowa.
- Colorado has three times as many solar energy-related patents as Minnesota, in part because of the presence of the National Renewable Energy Laboratories (NREL) in Golden.
- 53 percent of Minnesota's ethanol production is exported to other states.
- Minnesota also has a high concentration of architects, engineers and technicians that are considered essential to development of a green technology cluster.
- Renewable energy employment has a very high jobs multiplier, with 5.1 indirect jobs for each direct job attributed to the sector.

Presaging the later findings of the REIP planning process, the Green Jobs Task Force concluded that Minnesota needs to improve the coordination of its energy and green technology programs and better target its research activities. The Task Force also reached the conclusion that Minnesota "has positive assets to pursue additional solar-related manufacturing opportunities." The Task Force report made a number of other recommendations related to job creation and financing in the renewable energy and green technology sectors, including to:

- Create a grant and loan program that targets the green technology sector
- Develop a package of state tax credits for the green technology sector
- Expand specialized training programs tied to job skills that green technology firms seek
- Provide greater incentives to bio-gas and biomass-to-energy businesses
- Increase funding for a pre-seed investment and grant program.

Germany as an energy policy model for Minnesota

The office of Lt. Governor Yvonne Prettner Solon, the University's Humphrey Institute, the Center for German and European Studies, and the Institute on the Environment (IonE) have been leading a policy dialogue with business and policy leaders in Minnesota and Germany. Based on some similarities between that country and Minnesota on energy issues, there have been a number of policy tours of Germany, most recently for top state energy and economic development administrators in December 2013.

Mosel River, Germany

The German energy policy model is characterized by a strong national energy program, supportive cooperatives and agricultural lobbies, rural community engagement, and financial institutions that have become knowledgeable in renewable energy financing. Biomass energy and biogas installations using animal waste, crop residues, energy crops and woody waste streams are particular strong in rural regions. Biogas generators that supply electricity and some thermal energy reached an installed capacity of nearly 1,600 megawatts in capacity in Germany by 2009. Bio-based electricity, heat and methane production are all the focus of carefully targeted government policies while bio-fuels for transport are experiencing decreased levels of policy support.

German energy policy is not generally technology neutral like Minnesota's Renewable Portfolio Standard. It has tailored incentives for particular technologies and sizes of installations. Smaller biogas projects, for example, receive a higher incentive payment to encourage more farm-scale and community-scale development.

Germany has also set sector-specific renewable energy targets in electricity, heat and biofuels using specific energy technology sources.

Rural regions and towns in Germany have been especially successful at implementing renewable energy strategies with some rural regions creating regional business clusters that are approaching 100 percent renewable energy generation. Rural communities in Germany, similar to rural areas in Minnesota, benefit from a greater abundance of land for the installation of wind, solar and biomass facilities, close proximity to waste stream biomass from farming for biogas and biofuels, and access to wood and waste wood for high-efficiency biomass boiler systems.

The downside to the German and other European energy systems, at least from the perspective of European utilities, has been its impact on the financial performance of investor-owned utilities. Since their peak in 2008 at $1.3 trillion in market value, the 20 largest utilities in Europe have lost more than half of that market capitalization. The market loss has been greatest in those European countries, such as Germany, that have seen the most rapid growth in the deployment of renewable energy. (http://ec.europa.eu/energy/gas_electricity/studies/doc/electricity/20130610_eu_balancing_master.pdf)

NGA Policy Academy

Minnesota was one of four states selected in 2013 to participate in the National Governors Association (NGA) Policy Academy, focusing on better integration of clean energy industries with the state's economic development tools. The NGA initiative will be specifically tied to Minnesota job priorities to increase exports, Foreign Direct Investment (FDI), access to capital, and to streamline regulation, and better align workforce development investments with industry needs.

The Policy Academy process is designed to help Minnesota identify its particular strengths and weaknesses for building a more competitive business base and stimulating markets for energy-related technology, products and services. Specific tools employed during the process include site visits, asset mapping and cluster analysis to identify the best market opportunities and to conduct an evaluation of innovation metrics. Recommendations from other Policy Academy projects typically include the creation of centers of excellence, Proof of Concept Centers, incubators, and forums for engaging the private sector.

An action plan will be sent to the Governor by July 2014, with proposed funding mechanisms to sustain the effort. These funding sources may include some limited new funding and a reallocation of current utility incentives, bond programs and revolving loan funds. Overall, Minnesota's plan will build upon the best practices in other states for enhancing performance in innovation, commercialization, manufacturing and exports, such as Colorado's Advanced Industries Accelerator Act.

The NGA effort in Minnesota includes participation by high-level representatives from state agencies, major stakeholder groups, and the Legislature. The timeline may include some modest refinements in the 2014 legislative session to landmark energy legislation passed in 2013 with the likely development of a stronger legislative agenda for consideration by the 2015 Legislature.

Minnesota Business First Stop

Minnesota Business First Stop is an initiative of the Governor's office and the Minnesota Legislature. The goal of Minnesota Business First Stop is to deliver a high-level of customer service to help streamline the development process for complex business expansions and relocations that involve financing, licensing, permitting, and technical assistance from multiple state agencies. Commissioners of nine state agencies provide coordinated leadership and appoint experienced lead staff to work across agencies to focus problem solving as needed to address the economic, environmental and community concerns common to innovative and complex projects in today's markets.

Lead staff from state agencies meet with agency commissioners to coordinate assistance for projects ranging from multi-million dollar expansions to innovative clean energy, water quality or green chemistry projects. Team agency partners include: the Department of Employment and Economic Development (DEED) as the lead agency, Department of Commerce-Division of Energy Resources (DER), Department of Natural Resources (DNR), Department of Transportation (MnDOT), Department of Labor and Industry, Department of Revenue, Minnesota Pollution Control Agency (MPCA), Department of Agriculture, and Iron Range Resources and Rehabilitation Board IRRRB). By legislative statute, Minnesota Business First Stop also has current responsibilities for coordinating marketing and promotion of Minnesota as a national and global leader in clean energy innovation.

Another effort at achieving sustained cooperation between state policy leaders representing the broad span of emerging renewable technologies has developed as the Minnesota Clean Energy & Jobs Campaign with facilitation by the Fresh Energy policy organization (http://fresh-energy.org/tag/minnesota-clean-energy-jobs-campaign/). It has shown promise with a high level of successful sector coordination that the project participants believe has strong potential for an enduring, unified effort.

Robert Olson (Olson Energy), Jaime Simonsen (MnSCU / interim director of Minnesota Energy Center), Lissa Pawlisch (MnCERTs / Minnesota Institute for Sustainable Agriculture / NextGen Energy Board), Brian Brashaw (NRRI)

E.Capital Formation and Access

The goals of this planning grant task were to survey existing programs in Minnesota and other states for capital investment in emerging energy businesses and research and commercialization activities and make recommendations to expand access to capital and financing.

Lessons Learned

As part of the planning grant, Robert Olson, Olson Energy, convened a group of private and public sector experts on energy financing. The meetings included representatives from state and federal agencies such as USDA Rural Development and the state Commerce Department. There was early recognition that the work of this group would be closely related to policy recommendations to the extent that state funding or loan guarantees are part of the plan. The Capital Access Working Group also discussed a number of other key issues such as:

- Current barriers to financing of renewable energy projects and businesses in Minnesota
- Financing models and incentive programs in other states
- Anticipated levels of need and types of financing needed by energy businesses.

The focus of REIP's Capital Access Working Group (CAWG) was to make recommendations as part of a future statewide program for business and job acceleration such as REIP. The overall goals of such a program will be to increase access to capital for energy-related firms and entrepreneurs at all stages of development. The group identified priorities for increased funding in several areas:

- Market-driven research funding that supports applied or sponsored research for an individual business or entrepreneur;
- Early-stage venture or seed capital for commercialization of promising new technologies or services;
- Working capital for a business that is seeking to expand its capacity, re-engineer its processes to serve a supply chain need, or enter into new markets with an established technology or service;
- Project financing for renewable energy development in Minnesota that helps to meet demand in regional markets and also develop business models for other markets.

The barriers that were identified by the working group included a lack of sufficient resources in all categories at the same time as there was little coordination among an estimated 75 utility-administered financing programs and eight state loan programs for energy businesses. There was also a general concern that current federal incentives and third-party financing structures tended to favor large, out-of-state firms that have extracted millions of dollars from the regional economy. An example of this capital extraction that was cited was the large-scale wind energy development in Southwest Minnesota at Buffalo Ridge. The hodgepodge of state financing programs and the bias of federal programs towards large national developers has forced many Minnesota energy businesses to rely more on conventional equity partnerships and bank debt financing.

The principal resource for investment in energy efficiency and renewable energy in Minnesota

is the Conservation Improvement Program (CIP) which requires state utilities to invest 1.5 percent of their gross retail revenues from the sale of electricity or natural gas in conservation projects (Xcel has a 2.0 percent requirement as a nuclear utility). Of this amount, five percent can be allocated to renewable energy development, or up to 10 percent with approval by the Department of Commerce. Total CIP spending by electric and gas utilities is about $120 million a year and the American Council on an Energy Efficient Economy (ACEEE) estimates that Minnesota spent $191 million in 2011 on electric conservation, or 3.24 percent of electric utility budgets, while also spending $41 million on gas conservation or $28.61 for each gas utility customer. As noted earlier, some of the CIP funding that can be used for renewable energy development has now been pulled into statewide programs of energy incentives.

In the private sector, the Minnesota Angel Network program that is affiliated with BBAM and the Life Science Alley trade association has built an extensive network of 1,000 investment firms. Although its focus is not strictly on energy-related entrepreneurship and business development, it has a strong interest in public-private partnerships for risk-sharing and needs to be aligned with other state efforts to build increased capital pools.

Barriers to Clean Energy Funding: To date, energy developers feel utility companies, which tightly control the terms of Power Purchase Agreements (PPA) for larger projects, have not been willing to pay their actual avoided costs for renewable energy production. The retail price of energy, particularly in these PPAs with utilities for larger renewable projects, does not reflect the true avoided cost for utilities or the cost recovery pricing that is needed by developers.

In contrast to established renewable energy technologies, to the extent that there is an increasing state focus on new energy technologies, investors will be interested in process guarantees for their venture capital. This sharing of the capital risk to bring these new technologies to scale, perhaps with loan guarantees from public agencies, will be essential to a more robust venture capital market for energy entrepreneurs in the state.

As it has in other areas, Minnesota has generally been under-weighted in its share of funding from federal agencies for renewable energy projects and businesses. Overall, the state receives an estimated 72 cents of each $1 it sends to the federal government in support of federal programs. Specific programs that are under-weighted include USDA Rural Development's Renewable Energy for America Program (REIP) grants, Business and Industry (B & I) loan guarantees and Rural Economic Development Loan and Grant (REDLG) programs. The Small Business Administration's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (SBTT) are also under-weighted in the state. Minnesota tribal governments receive much less per capita in federal funding than their counterparts in other states, including adjacent states such as Wisconsin. Very little ARPA-E funding for research on storage, smart-grid applications, advanced inverters or green building systems has been awarded in Minnesota.

One of the principal tools of federal tax policy that would support renewable energy development would be extension of Master Limited Partnership (MLP) status to renewable energy businesses and projects. This federal tax provision, currently available only to the oil and gas industry, would encourage more passive-income investment in projects and businesses while allowing for greater tax efficiency in the use of tax credits and business expenses. Extension of federal MLP tax treatment for the renewable energy industry is currently pending in Congress where it has bi-partisan support, including several members of Minnesota's congressional delegation.

As the level of private and public capital resources increases in Minnesota there should be a focus on new energy technologies. However, current financing tools are not available that address the capital risk to get these technologies through the commercialization process and to utility or market scale. Current financing tools do not provide initial process guarantees for private venture capital investments and there is no clear formula for sharing the risk to bring new energy technologies to scale.

The state Investment Tax Credit for early-stage venture capital funding is a useful tool but it was quickly over-subscribed in its initial round and did not receive additional funding in 2013. There is also a need for more "bridge financing" that covers business development costs and project financing until tax credits, rebates, grants and other funding sources can be accessed near the end of project completion.

The recent round of RDF grants totaling about $30 million includes funding of solar, wind and biomass projects, mostly in the service area of Xcel Energy, as well as about $9 million for energy research projects. The goals of the RDF

program, as defined in its enabling legislation, include to increase the market penetration of renewable energy in Minnesota, promote the startup, expansion and attraction of renewable energy firms, support energy-related research and development efforts, and develop near-commercial and demonstration scale renewable energy generation and grid infrastructure projects.

These RDF projects will advance the understanding of effective development models and energy technologies. Reporting requirements on lessons learned from the inivestment of RDF funding will begin to be available to the general public, utilities and the energy industry in 2014 and 2015. However, RDF funding, which is largely managed and controlled by the utility that funds it within broad parameters set by the Legislature, is not necessarily well-connected to other state investments or priorities in renewable energy.

There are many market indications that Minnesota is moving into more utility-scale models for renewable energy beyond its current development of wind and biofuel capacity. For example, a 2.0 megawatt solar project near Slayton, Minnesota developed by Ecos Energy and constructed by DH Blattner & Sons, indicates that Minnesota is poised for larger, utility-scale solar energy projects in partnership with utilities. Xcel Energy has indicated to the PUC that it will seek up to 150 megawatts in large-scale solar projects of five to 15 megawatts beginning this year as part of its planning to meet the 1.5 percent solar resource mandate by 2020.

Other State Funding Models: Oklahoma has a useful PoCC model for accelerating commercialization that includes optimizing market alignment, creating a commercialization roadmap and providing funding for product development and market entry. Oklahoma has three funding programs at early-stage development and mentoring, venture capital seed funds and angels, and funds for entrepreneurial development. The Oklahoma model includes a six-point set of goals:

- Identify pre-commercialization opportunities
- Evaluate relevant markets
- Develop pre-market prototypes based on industry/customer input
- Place prototypes in front of first customers to validate viability
- Work closely with innovation coaches and business support providers
- Provide focused seed capital to high-priority opportunities.

Other states that have some type of an "emerging energy fund" include Alaska, California, Nebraska, North Carolina, Colorado, and Oregon. New York recently enacted a Green Bank fund of $165 million that is expected to grow to $1 billion and will be used for credit enhancement, loan loss reserves, loan bundling and securitization, and will stimulate secondary markets as a means to leveraging an increase in private capital investment in renewable energy projects and companies in that state.

Recommendations for Increasing Capital Access

The most critical area for capital access is to provide pre-seed funding, often in modest amounts of $50,000 to $500,000, to cover the earliest stages of commercialization related to proof of concept, assessment of market and pricing competitiveness, and prototyping of technologies combined with IP protections as needed. Subsequently, additional funding and technical assistance resources will be needed by businesses to assist with developing business plans, sales and marketing plans, and preparation of presentations to financing sources.

After its discussions and review of other state models, the Capital Access Working Group formulated an inventory of funding and financing tools for consideration by state policy leaders.

State Wind and Solar Renewable Energy Certificates (RECs): RECs in Minnesota could be modeled after REC markets in Massachusetts, which requires purchases by the state's utilities. Prices are set by the market, generally at 80-90 percent of the penalty payment for failure to secure sufficient RECs to meet the state-mandated timetable. The state should consider allowing RECs to be banked for future years and increase the shelf life of current-year RECs beyond one year. A REC market mechanism could build on the existing Minnesota REC-X program that includes the local economic development value of renewable energy

Investment Tax Credits: North Carolina has a specific state tax credit tied to investment in renewable energy-related businesses that can be offset against state tax liabilities. These state tax credits are for investments in businesses rather than projects, such as the state's "angel investment credit". A state investment tax credit is an example of a "blink on" tax policy that could be implemented if federal incentives for renewable energy are curtailed after 2016.

Production Tax Credits and Feed-In-Tariffs: These credits pay an additional amount for renewable energy generation or mandate a minimum level of payment from utilities for renewable energy generation. The value of the credits or the tariff is typically based on equalizing the amount of subsidies to fossil-fuel based energy to "level the playing field" for renewable energy. These production-based incentives support renewable energy projects by removing the variability between different renewable energy technologies and put the incentive on a kilowatt-hour of electrical power with an additional rate tariff for each kilowatt-hour. This approach was essentially adopted by the 2013 Legislature in the form of the Value of Solar alternative tariff that utilities may voluntarily adopt as an alternative to expanded net metering.

Loan Guarantee Fund: Designed to support lending by Minnesota banks to more early-stage and startup renewable energy businesses. The loan guarantees from the State of Minnesota would reduce the risk of lending and provide lenders with more of a process guarantee for emerging technologies. Small banks may be willing to capitalize an investment pool with smaller "participation loans" and joint ventures that spread the investment risk. To be most effective, state loan guarantees need to be coordinated with a range of loan guarantees that are provided by several federal agencies including USDA and SBA, and non-profit lenders such as the statewide network of Initiative Foundations.

PACE Bonds: Publicly issued bonds used to capitalize a loan pool for energy efficiency and renewable energy improvements to commercial-industrial buildings is already authorized under state law. However, the program has been slow to take shape and the largest program to-date is a capital pool created by the St. Paul Port Authority to which individual cities or other local jurisdictions can participate through a joint powers agreement. There needs to be an expanded pool of PACE bond capital and efforts to stimulate greater interest among private property owners in the use of PACE bonds as a financing tool

Funding meeting.

Interconnection Financing: Some states, notably California and New Mexico, subsidize the costs for renewables to interconnect to transmission or distribution systems. These costs, when paid by the utility, could be a condition for the utilities to receive the financial benefits of any renewable energy certificate (REC) values. Some updating of net metering and interconnection rules was done by the 2013 Legislature, but only for the state's investor owned utilities

Require PPAs to Reflect True Avoided Cost Rates: The Value of Solar rate algorithm that will be established in 2014 or the capacity credit tariff under consideration by the PUC for solar projects is evidence of a policy move in this direction. However, these rate reforms are voluntary for investor owned utilities and do not apply to cooperative or municipal utilities.

Minnesota Clean Energy Fund

A new Minnesota Clean Energy Fund (MCEF) could be capitalized by combinations of several different sources:

- Pooling of an additional five percent of CIP funds currently authorized for spending on renewables;
- Phase-out of the RDF program over 5-10 years and replacement with an equivalent "system impact fee" paid by all state utilities based on sources of power generation;
- Create preferential access for clean energy in some of the current state programs for economic development and job creation;
- Create a Minnesota Clean Energy Bond that would be offered to citizens, businesses and the Minnesota Investment Board as an investment option tied to the clean energy sector.

The goal of a new MCEF would be to capitalize an initial loan and grant fund of $50-100 million that would be governed by a Clean Energy Investment Board with some portion set aside for administration, loan due diligence and business support services for clean energy entrepreneurs. Some of the MCEF grant and loan priorities for investment could be:

1. Loans to start-up companies of up to $500,000, forgivable based on actual job creation and/or the establishment of a manufacturing facility in Minnesota.
2. Pre-seed, angel investments of up to $250,000 for early stage commercialization and market-entry assessments for the most promising research.
3. Research vouchers of up to $50,000 that could be used by entrepreneurs and start-ups at any Minnesota research facility that is affiliated with the statewide network of researchers.
4. Staffing for 2-3 venture loan specialists within state government to work with promising energy firms.

F. Metrics and Measurement

The goals of this planning grant task were to define a shared set of metrics and identify the means of measurement for achieving the goals of REIP and a statewide energy program by recommending strategies for data collection, analysis and dissemination of findings.

Lessons Learned

An outline for metrics and measurement of REIP goals was drafted and discussed with a number of REIP planning process stakeholders, including UM Extension and the University's Applied Economic Department. The REIP planning team recommends that the function of developing metrics and the means measurement should become a central function of any future REIP initiative. The draft outline for the program's metrics, as it was discussed with various stakeholders, included the following points:

- Define the distinct categories of energy and economic development information to be tracked and measured;
- Create metrics for each category of information and a baseline for comparative and longitudinal analysis;
- Develop sources of existing data and outline uniform systems of reporting;
- Identify gaps in necessary data and develop strategies for addressing data gaps;
- Define various types of analysis such as policy-focused or business-focused (investment-finance centric) or both;
- Build the team for professional analysis of data and reporting on predictive and longitudinal trends in the metrics;
- Create a reporting architecture defined by format and audiences that will best be able to convey and utilize findings and conclusions to appropriate audiences.

There is a critical need for "big data" in the state's renewable energy sector that reflects the market reality that there is often a bundling of appropriate clean energy and energy efficiency technologies. Data systems also need to incorporate advanced strategies for measurement and interpretation, and a consensus philosophy for how data and measurement will be used for decision-making. The goal of this approach will be to allow three primary audiences---policy makers, industry leaders and capital investors---to overcome their "anchor biases" regarding the renewable energy sector in Minnesota. Ultimately, the state's renewable energy sector will be most successful if it can agree upon on a single set of goals, and the means to measure progress on those goals in a uniform way.

Research by the International Economic Development Commission (IEDC) and others on metrics used by successful economic development strategies has created an inventory of scoring and measurement of key components such as the levels of research and development, and the overall environment for entrepreneurial activity (www.iedconline.org). Other examples of data and metrics that might be collected as part of tracking and measurement of energy-related businesses include:

- Numbers of patents per capita, by clustered NAICS codes or industry category
- Total public and private research and development spending, including federal funding
- Numbers of science and technology graduates from state institutions
- Numbers of internships with science and technology companies
- Overall job growth in science and technology fields, broken down by more specific categories
- Aggregate investment in Minnesota renewable energy deployment
- Levels of venture capital and seed capital funding of Minnesota energy firms
- Levels of trade and exports by energy businesses

G. Market Development

The goal of this planning grant task was to identify partners and outline a collaborative agreement with a core group of state agencies

and private sector stakeholders to identify priority export markets for Minnesota-based energy products and services.

Lessons Learned

Based on the *Cluster Initiative Guidebook*, nearly all of the most successful industrial clusters around the world have included objectives related to trade. The focus on trade in these other efforts comes from the recognition that building more traded wealth and developing a global market reach enhances the efficiency and economies of scale for local businesses. It also recognizes that the global attractiveness of Minnesota's energy businesses will increase the state's ability to attract foreign firms and foreign direct investment (FDI) to its energy sector. Some of the specific goals for trade and market development in a Minnesota-based clean energy cluster include:

- Promoting exports by firms in the cluster, particularly firms that are under-performing in terms of exports;
- Assembling market intelligence about foreign market opportunities from private sector stakeholders and industry associations;
- Attracting new energy firms and expertise to the state clean energy cluster;
- Improving the climate for attracting Foreign Direct Investment (FDI);
- Creating a clear brand for global marketing of the state clean energy cluster.

The planning grant team worked with the Minnesota Trade Office (MTO) to review the existing programs and initiatives that are being done within the MTO, the state's International Trade Representative, MTO-sponsored Solar Roundtables, and targeted countries, particularly in Europe. Key staff within MTO, which is a division of the state Department of Commerce, were also briefed on the REIP planning grant as MTO workplans were being developed for 2014 and 2015.

Export training programs in Minnesota are currently offered in several locations and it has been reported by MTO that small-to-medium energy businesses are often represented in those meetings. The state also maintains an existing website for these potential export businesses (http://energy.sourceguides.com/businesses).

As the state's export promotion agency, the MTO assists companies grow their export business through daily counseling, export education programs and through trade missions, usually lead by the state's Governor. The MTO has eight international trade representatives, one of whom is assigned full time to assist environmental and energy sector firms.

The MTO conducts regular scanning activities, collects market intelligence to identify potential trade opportunities and shares these with clients on an individual basis or as part of presentations at export education and networking events.

The MTO routinely refers clients to partner federal agencies, principal among them the U.S. Commercial Service with has over 120 overseas offices. There are a number of other agencies, such as the U.S. Trade and Development Agency, which offer programs of interest to renewable energy sector firms, and the MTO regularly refers companies to them. In 2013, Minnesota was also selected for the opening of a new U.S. Import-Export Bank office in Minneapolis.

Minnesota actively seeks to attract foreign firms to relocate to Minnesota through a variety of outreach initiatives. In early 2014, the MTO expects to have a full time Director for Foreign Direct Investment on staff to expand active investment attraction efforts. In addition to existing offices in China and Europe, the MTO is actively seeking partners to establish new trade programs in Korea and Brazil during 2014. The primary mission of these offices will be to promote the attraction of investment, with export promotion an important secondary mission.

State trade activities include a number of initiatives for specific clusters such as clean energy and energy efficiency. These include a roundtable event series for solar energy and its supply chain industries, smart grid business sector and other energy and environmental business sectors and clusters. The Minnesota Department of Employment and Economic Development (DEED) also maintains a website with presentations, resource directories, databases, a calendar of activities and export reports.

It is clear from other state economic development program models that there needs to be close market alignment with research and policy initiatives in order to accelerate

commercialization. Although Minnesota has tremendous growth potential in its own energy markets, and spends $14 billion on energy that is imported from outside of the state, the greatest long-term growth for Minnesota energy businesses will be from expanded domestic and foreign markets. Currently, the planning grant team concluded that there needs to be continuing attention on building links between resources and emerging energy businesses that have trade potential and that there are still some gaps in the suite of necessary programs to promote traded wealth and foreign investment.

Investments in commercialization activities need to include an evaluation of the most relevant markets and support product prototypes that are based on industry input and feedback from first customers as a way to test market viability. Minnesota is making expanding investments in foreign markets with 2013 funding for the opening of three new foreign trade offices and these functional capacities for market assessment need to be part of building the range of services for those investments in new state capacity for trade promotion.

Because the state's Fortune 500 companies have internal trade promotion capacity, most of the MTO programs and services are utilized by small and medium-sized businesses. These programs include technical assistance, training, export promotion, and a library of economic data and company directories on foreign markets..

Nationally, federal agencies project that 95 percent of future business opportunities and growth for U.S. companies will come from foreign markets. The federal Renewable Energy and Energy Efficiency Initiative includes 23 inter-agency strategies among eight federal agencies: Commerce, Energy, State, USDA, and the U.S. Trade Representative, U.S. Trade and Development Agency, Export-Import Bank, and Overseas Private Investment Corporation (see www.export.gov).

As noted, Minnesota was the site for one of four new federal Import-Export offices that were opened in 2013. The office can provide trade assistance to firms producing products with at least 50 percent U.S. content. The office will also reinforce metro region initiatives that seek to double exports by Minnesota companies that may have supply chain benefits in non-metro communities. Minnesota has also adopted an EB-5 target employment designation that encourages foreign direct investment of $500,000 and gives limited residency status to foreign nationals and their families when the investment creates or preserves at least five direct jobs and five in-direct jobs.

While most of the recent focus of foreign entrepreneurs has been on California, New York and Florida, Minnesota is gaining visibility from sources of foreign direct investment in European countries and in the emerging economies of Asia, South America and Africa.

III. REIP Implementation Strategy

The goals for this planning grant task included to create an implementation-ready plan, initial budget and funding recommendations for the REIP and identify the necessary partnerships and coordinated funding sources that will be the first steps for implementation of a statewide Proof of Concept Center focused on renewable energy.

Models and Principles

The literature review and findings of the various REIP working groups suggest that the greatest collective impact from a Proof of Concept Center in Minnesota will come from formation of a central entity that has dedicated staffing and funding. This central entity need not be a large organization if it has the right mix of stakeholder partners and access to networks among existing organizations and programs that allow it to create a structured process towards a common set of goals. This process for achieving greater collaboration among energy-related programs needs to begin with a neutral convener that builds a culture of shared goal-setting and measurement that is then continuously communicated among an ever-increasing circle of participants.

There are numerous models of this type of commercialization acceleration that can be evaluated for successful practices and adapted for use by the Minnesota REIP. These include local models such as the Clean Energy Project Builder developed by CERTs and the Southwest Minnesota Initiative Foundation, and Treehouse, which is a collaborative health care IT project based in downtown Minneapolis.

Lake Superior

Minnesota is not starting from scratch. The state Science and Technology Authority (STA) report in 2010 included findings and recommendations that parallel the primary finding of the REIP planning process that the state needs a more focused effort to accelerate the growth of its energy entrepreneurs and new businesses. STA also recommended that the state identify sources for more seed funding of start-up businesses, create a more supportive environment for entrepreneurs, focus on supportive policies and the establishment of collaborative networks, and work together to increase the level of federal funds coming to the state for research, business development and workforce training. Although STA was phased out after the 2012 legislative session, many of its recommendations were incorporated into the Destination 2025 plan that was a project of BBAM and which is still being implemented.

The Natural Resources Research Institute (NRRI) at UM-Duluth is another model of a research and commercialization program that has focused on wood products and mining but includes most of the elements of a successful research-to-commercialization strategy. Although NRRI has worked mostly with businesses in Northeastern Minnesota, it has an interest and some of the capacity needed for expansion into other technology areas and other parts of the state. As noted earlier, NRRI has also played a leading role in Heating the Midwest, an industry and research consortium focusing on bio-based energy that has set a policy goal of having 15 percent of all thermal energy used in the Midwest come from renewables such as biomass by 2025. That gives it a strong foundation and some of the necessary connections for further work on bio-based energy technologies.

Commercialization models from other regions of the country include the virtual network models used by Energy Match in the Pittsburgh area and the Clean Zone in New England that is part of the New England Clean Energy Council. Most of the models evaluated were closed tied or physically located at major research universities and were available to entrepreneurs in any and all technology areas. While these models were instructive on certain basic principles, this report recommends that REIP be established as an independent entity outside of the University of Minnesota and also that it be focused on a particular sector, renewable energy and energy-related technologies.

In Minnesota, the closest model to an established PoCC is the Bio Business Alliance of Minnesota (BBAM), a non-profit subsidiary of Life Sciences Alley (LSA), which is itself an industry trade association. BBAM has been developing its Innovation Engine as a business resource network around the state that includes training for entrepreneurs, coaching for entrepreneurs seeking capital investment, and referrals to other resources needed for businesses through BBAM's network of strategic partnerships. BBAM also has an exclusive license to use the Kauffman Center FastTrac system for preparing business plans and investor presentations. A key component of the Innovation Engine is the Minnesota Angel Network (MNAN) that provides an internal review of investment potential and makes connections with more than 1,000 accredited investors.

A key strength of BBAM and LSA is an ability to transfer many of the lessons learned from Minnesota's well-recognized medical technology cluster. BBAM's Innovation Engine brings to the collaboration current commitments of private sector and foundation funding that represent a 4-to-1 match of state funds and it has some of the most developed relationships with sources of investment capital. BBAM and LSA staff and volunteers also have expertise that can provide the content for a range of training needs, including education and training that is specific to commercialization.

Yet another well-established Minnesota organization, the Agricultural Utilization Research Institute (AURI), provides research and development services to businesses that create new products and add value to agricultural production. Since 2006, AURI has convened more than 525 individuals from 217 organizations as part of the Minnesota Renewable Energy

Roundtable to identify bio-energy and bio-product opportunities. The Roundtable steering committee includes the Minnesota Departments of Agriculture and Commerce, the University of Minnesota and MnSCU. To date, the Roundtable has promoted goals and demonstration projects mostly in biomass gasification, bio-fuels and utilization of agricultural byproducts but it also may have some potential to expand into other areas and other energy technologies.

Finally, the Southern Minnesota Competitiveness Project (SMCP) has brought together 18 economic development agencies in 38 counties to develop a more focused economic development strategy. This region of the state is home to one million people and has three times the national average manufacturing base of rural communities, including major research and manufacturing institutions such as the Mayo Clinic and Hormel Foods. While this region has considerable resources for economic development, it lacks focus and strategy and has only 50 percent of the average availability of business and professional services as other rural regions.

Overall Vision for the REIP

Despite its impressive history of innovation and commercialization, Minnesota currently lags other states in providing a robust ecosystem for business innovation in energy-related and most other technology areas. A recent study by the Blandin Foundation found that Minnesota ranks 40th in its policy environment for entrepreneurs and the Small Business and Entrepreneurship Council ranked Minnesota's tax system 50th for its support of entrepreneurs. The Kauffman Center's Entrepreneurship Index ranked Minnesota 48th for its entrepreneurial environment.

Minnesota needs to focus on its strengths in higher education research, workforce training, industrial infrastructure, and community, political and business leadership to rebuild its culture of entrepreneurship. Building a strong culture of collaboration and innovation around renewable energy and energy efficiency technologies can draw on these strengths and a growing array of energy entrepreneurs and business innovators. Bringing the state's public assets together with the diverse talents of the private sector around a common vision will accelerate the growth of a dynamic Minnesota renewable energy cluster that can have a global reach. The first step will be for REIP to initiate a highly inclusive process among wind, bio-based, solar and other energy-related industries and policy stakeholders to develop a more detailed set of goals that will lead to substantial job creation and business activity throughout the state.

The summary recommendations and framework for development of the REIP include:

A. Research, Development & Technology Transfer Services:

- Establish a coordinated research/ commercialization network based initially on a signed Partnership Collaboration Agreement (PCA);
- Identify anchor institutions and candidates for specialized Centers of Excellence in specific research sectors;
- Create standardized protocols for managing requests for research assistance and a uniform system for technology assessment;
- Increase funding for research/ commercialization activities overall and fund "research vouchers" that can be used by entrepreneurs at the participating research institution of their choice;
- Work with the private sector to track industry trends and new renewable energy and energy efficiency technology through ongoing "opportunity scanning" activities.

B. Business Support Services:

- Establish a statewide coordinated network of comprehensive business service providers based on a signed PCA;
- Define clear pathways for front-line business service providers to direct entrepreneurs to general or specialized renewable energy expertise according to their needs;
- Provide continuing professional development for business service providers in clean technology commercialization, renewable energy fundamentals and updates on energy market trends;
- Standardize intake forms and create a uniform system of technology assessment, stage gate reviews, and seed capital investment potential.

C. Private Sector Advisory Engagement:

- Recruit participation commitments from private sector members that meet the criteria of REIP's private sector matrix;
- Establish a permanent advisory function from private sector representatives at the state level for review and comment on state energy policy and the network of

research and commercialization services;

- Establish participation commitments by the private sector in REIP governance that is sector and regionally balanced;
- Create regular sessions for feedback from energy businesses on "opportunity scoping" and priority "deal sectors" within renewable energy.

D. Policy Reform and Development:

- Continue rationalizing the current state energy policies and programs around a shared agenda and goals;
- Create an ongoing process for private sector feedback on policy revisions and reform;
- Restructure state agencies for more coordinated energy policy and program implementation;
- Strengthen relationships with federal agencies and congressional partners and communicate a clear and consistent Minnesota agenda for building its energy sector;
- Implement best practices in energy policy from other states that can be adapted to help meet Minnesota's energy goals.

E.Capital Formation and Access:

- Increase the total amount of funding for research, testing and commercialization activities in the state;
- Increase access to capital and financing for start-up, emerging and growing companies;
- Develop shared, public-private risk management strategies and process guarantees for investors;

Don Fasnacht (NRRI director of Center for Applied Research and Technology Development)

- Create a more robust and coordinated state "clean energy fund" with clear criteria and ongoing funding sources;
- Increase the leverage of funding from federal agency, private sector and institutional sources;
- Focus state incentives to maintain most of the economic benefits from energy sector development in state and regional economies;
- Increase the levels of business relocation and Foreign Direct Investment in Minnesota energy businesses.

F. Metrics/Measurement and Branding:

- Agree upon goals and metrics for measuring economic development and job creation in the renewable energy sector;
- Build the capacity of REIP for the collection and analysis of data and metrics;
- Develop a baseline of existing economic activity in energy-related fields and identify leading data indicators;
- Create a system of dissemination of metrics and analysis to support private sector, non-profit and public policy decision makers;
- Adopt "Renewable Energy Innovation Project" (REIP) or a similar name as the program brand for the Minnesota PoCC;
- Create a comprehensive communications strategy for the general public and all stakeholders of the REIP and its energy sector goals and activities.
- Create a comprehensive information clearinghouse including a go-to website for renewable energy resources and information.

G. Market Development:

- Support the ongoing leadership from the Minnesota Trade Office for evaluating priority markets for export development in energy products and services;
- Develop a plan of action and sources of funding for joint marketing of Minnesota energy firms in priority markets;
- Develop targeted strategies and incentives for increasing business relocation and foreign direct investment in Minnesota's renewable energy cluster;

- Work with the private sector on continuous "opportunity scoping" to identify new energy products and services and the best new markets for increasing traded wealth.

REIP Concept and Development

The Stanford Social Innovation Review (SSIR) found that the establishment of a successful industry cluster most often involves a core group of stakeholders who abandon their individual agendas for a collective approach---based on acceptance of the belief that we will all do better when we all do better. This initial group of core stakeholders must have the analytical acumen to assess the environment that currently exists for growth of the cluster, and the ability to identify gaps and needs for targeted improvement. The core group must also offer mutual benefit to project partners in order to find agreement on a single set of goals and a system of measurement that all stakeholders agree will be the indicators of success. To date, the core team that has managed the REIP planning grant has only begun to build this type of core group and the momentum for establishing the Minnesota REIP.

SSIR also found that the most successful industrial clusters tend to have a centralized infrastructure or entity and dedicated funding and staffing to manage what it develops as a more structured process. Such a process needs to be based primarily on mutual benefit as well as the system of shared measurement and goals and its continuous communication of results.

Although this approach has worked well elsewhere, the REIP planning team is mindful of the fact that Minnesota already has many current participants in energy-related research, commercialization, business development, training and policy development that are heavily invested in their own programs and resources. As noted earlier, one of the state's strengths is its abundance of renewable energy opportunities in all categories. That is also one of Minnesota's weaknesses because it leads to diffused communities of interest that may recognize the need and the benefits of greater collaboration but find it difficult to set aside their individual interests.

In this kind of environment collaboration, the REIP planning team suggests that the priority starting point should be to create a central clearinghouse of information and initiate frequent communication and convening exercises to begin building the necessary networks and trust levels among key participants. It is also clear from the research on successful industrial strategies that where there are many stakeholders in a largely unorganized environment, strong political leadership and a strong vision will be the most important factors for building a clearly defined industrial cluster and a comprehensive plan of action.

This starting point for Minnesota must include recognition that better cross-sector, multiple-technology coordination will produce greater results than simply devoting more resources to single organizations or isolated instances of intervention. The state has tremendous opportunities to recapture most of the dollars leaving the state to buy fossil-fuel energy and put those dollars to work creating jobs and building businesses in the state. Instead of exporting dollars to buy energy, Minnesota can export energy technology and products to the world. In short, Minnesota can shift its energy "balance of payments" from a deficit to a surplus with an aggressive shift from fossil fuels to renewable energy sources.

Developing an increased level of necessary interplay between government, private sector and economic development stakeholders will require focused efforts to build relationships and a shared agenda among the state's many organizations and programs. The planning grant team's recommendation for a Proof of Concept Center (PoCC) in Minnesota is to brand it as the Renewable Energy Innovation Project (REIP) and begin that work. REIP will focus on a set of limited but core functions that begin to build connections and keep project partners focused on shared goals. The great majority of program activity, investment and policy development will continue to be lead by several anchor institutions and their networks. The only condition for participation at this point is that these partners must agree to a clarification of roles and responsibilities and agree to truly collaborative participation in the REIP. A third set of core functions that will be critical to the long-term success of advancing the renewable energy sector in Minnesota will be the joint responsibility of all of the participants in the REIP. This proposed structure for REIP is represented in the diagram below.

REIP Structure and Form

The Minnesota Renewable Energy Innovation Project (REIP), is our recommendation for how the process of accelerating innovation and commercialization in energy-related fields can begin in Minnesota. REIP will be a new but limited initiative that will operate as a project with certain focused responsibilities. A successful REIP initiative in Minnesota will primarily be an entity that is the sum of its organizational parts and

Minnesota Renewable Energy Innovation Project (REIP) model

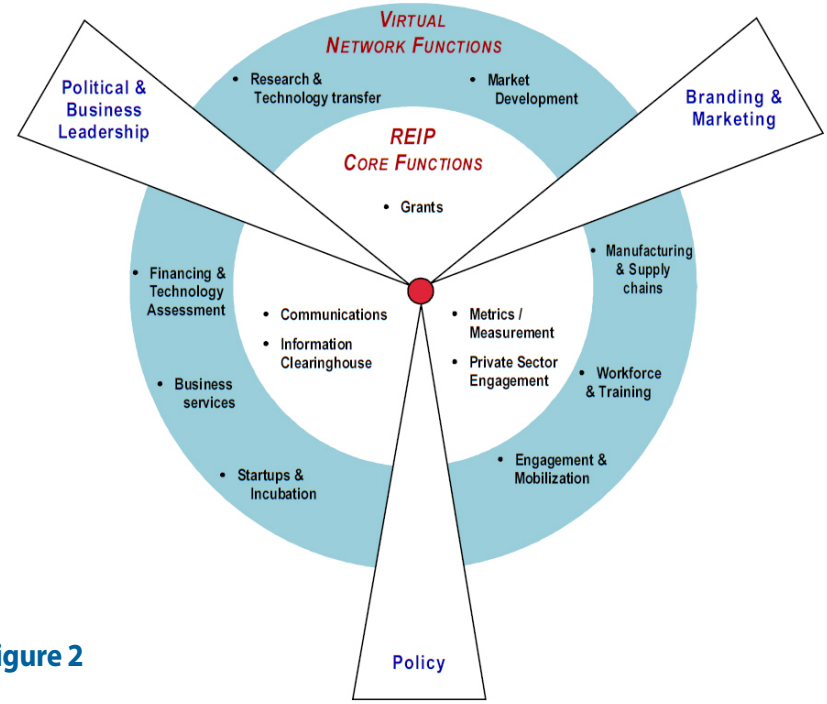

Figure 2

networks. The overall goal for REIP will be to develop and foster action based on a shared understanding of the opportunities and challenges the state faces in developing a renewable energy cluster in a highly competitive global marketplace.

Summary of REIP Core Functions

Based on this proposed organizational model there will be five primary functions for REIP:

- Information Clearinghouse
- Communications
- Metrics and Measurement
- Private Sector Engagement
- Assistance with Grants and Resource Development

An important core function of the REIP will be as a clearinghouse of information with responsibility for ongoing communication, agenda-setting and facilitation that encourages dialogue and develops increasing levels of trust among the state's energy stakeholders.

As the information clearinghouse and communications hub, REIP will be primarily responsible for developing metrics around project goals and creating the infrastructure for collection, measurement and analysis of data to track progress on project goals.

REIP will also work with key stakeholders to build and nurture a network of private sector engagement across all kinds of energy technology and multiple sectors. This private sector engagement will be available for advice and comment on the work of other networks and activities, and be the basis for ongoing "opportunity scoping" within the renewable energy industry.

Finally, REIP will develop its own capacity and assist others to expand their capacity to write grants, undertake fundraising and generally seek funding for investment in development of the statewide renewable energy sector.

Summary of Core Functions of REIP Networks and Partners

Other core functions that will be critical to building a successful renewable energy cluster in Minnesota will be undertaken by existing anchor organizations and networks that agree to participate in a statewide energy plan of action. The REIP planning grant found that the organizational capacity to undertake these tasks mostly exists in the state, although it was sometimes painfully obvious that the networks for coordinated action need to become much better coordinated before programs and activities should be strengthened with additional resources.

These network and anchor institution functions will be physically accessible to as many parts of the state as possible and also virtually available among the necessary organizational partners in order to provide comprehensive services that are truly accessible on a statewide basis. These network functions include:

- Research and Technology Transfer
- Market Development
- Manufacturing and Supply Chains
- Workforce and Training
- Engagement and Mobilization
- Financing and Technology Assessment
- Business Services
- Start-ups and Incubation

Summary of Shared Functions for All REIP Partners

Finally, this REIP implementation plan is recommending that three areas of focus for development of the renewable energy cluster in Minnesota be cross-cutting among all stakeholders. Although there may be lead organizations and designated conveners in these areas, participation should include all of the REIP partners. These functions include:

- Policy Development and Review
- Branding and Marketing
- Political and Business Leadership
- Detailed REIP Functions and Roles

Information Clearinghouse: There is currently no central clearinghouse of information on all aspects of renewable energy and energy efficiency in Minnesota and such a clearinghouse will be essential for building a successful industrial cluster. REIP will be responsible for inventorying current sources that serve some of the need and linking to those existing sources of information. REIP will also identify gaps that exist in offering comprehensive information on energy in Minnesota and develop the means to fill those gaps. A web portal for access to comprehensive information with expanded information and links to other organizatios and partners, will be available to the public, energy businesses, and all other stakeholders. The clearinghouse will include measurements of performance based on an established baseline and agreed upon metrics for performance over time.

Communications: The importance of regular and ongoing communication has been identified from research as a key factor in other successful industry clusters. As the central clearinghouse for information, it will also be the responsibility of REIP to regularly communicate high-quality information to stakeholders and the public at-large. Communications planning will identify key audiences and messages and include reporting on metrics and measurement such as economic impact analyses and case studies. The information regularly communicated by REIP should be of a quality that allows private sector, public sector and non-profit sector participants to take action and make decisions. Communication strategies will include proactive outreach to traditional and social media outlets and will include providing these outlets with an appropriate toolkit and contacts for their own reporting on the state's renewable energy cluster.

Metrics and Measurement: There is a critical need for comprehensive, high-quality data tied to the goals agreed upon by REIP participants for accelerated development of the renewable energy cluster in Minnesota. REIP will lead the collaborative effort to develop a shared system for measuring progress on established goals and will build the capacity for longitudinal and comparative analysis of Minnesota's relative position on key energy industry indicators. Metrics will focus on the measurement of inputs, outputs and process-related outcomes as well as identified qualitative measures of success.

Private Sector Engagement: REIP will provide the primary staff support for a statewide advisory network that represents the renewable energy and energy efficiency sector in Minnesota. As noted, it is recommended that this group not just serve as advisory to the REIP and REIP partners, but be established as an official advisory group to the Legislature and Administration on state energy policies and programs.

Grants and Resources: REIP will be responsible for some of the grant-writing and fundraising with a priority on securing the necessary resources for full implementation of Minnesota's REIP plan. REIP will also support other REIP partners that are seeking grant funds for activities that are central or complementary to state energy goals and objectives. A specific goal will be to improve the state's competitiveness for federal grant dollars by clarifying the state's plan and strategy for development of its energy-related industry cluster. As part of this effort, REIP will also reach out to the state's charitable foundations to foster collaboration and coordination of foundation grant-making in Minnesota related to renewable energy and economic development.

Detailed Network Functions and Roles

Research and Technology Transfer:

Minnesota has major research institutions as key assets for its REIP commercialization model, including the University of Minnesota and the statewide network of MnSCU institutions. While UM researchers conduct both theoretical and applied research in a wide range of energy-related fields, MnSCU is more likely to be focused on applied research and sponsored research on behalf of specific businesses.. There are also major private research activities in the state, including within the state's well-established medical devices industry and at institutions with global footprints such as the Mayo Clinic, Hormel and 3M, as well as smaller research entities such as Open Access Technology Inc. (OATI) and Aspen Research that are available to businesses on a fee-for-

service basis. This rich network of research institutions will be brought together to collaborate on strategies to increase the overall level of funding available for research. REIP is also proposing that a portion of research dollars be awarded directly to entrepreneurs and second-stage businesses that can carry the funding to the research partner of their choosing.

The success of the proposed model for a Minnesota Proof of Concept Center will depend on more focused and collaborative research activities within the state's land grant institution, the University of Minnesota. The University's research focus also needs to be better coordinated with other research activities at regional Centers of Excellence based at MnSCU campuses and the work of private research firms. The Institute on the Environment (IonE) through its relationship with the Office of the Vice President for Research, is emerging as the most likely convening entity for his coordination within the University.

All of these higher education research activities need to build stronger links to the private sector through formal and informal networks that bring faculty, staff and students together with business expertise that can lead to greater commercialization of promising research findings. The research network should also participate in opportunity scoping, identification of key research priorities and the formation of multi-disciplinary research teams to work on major research issues across institutional lines.

It should be a particular goal of the REIP program, in conjunction with the research network, to dramatically increase the degree of commercialization by Minnesota-based companies working with the University's Office of Technology Commercialization (OTC) and the Defense Alliance's federally-funded SBIR program.

Outside of the established systems for commercialization in place at the OTC and the Defense Alliance, BBAM's Innovation Engine and its relationship with the Kauffman Center for Entrepreneurial Leadership will be another established pathway for use by the state network of business service providers and others to access initial screening of inventions, a stage-gate process for business startups, access to seed funding and other commercialization services. BBAM also offers specialized training on how to identify and commercialize new technologies through its Applied Business Training (ABT) program.

Market Development: The Minnesota Trade Office (MTO) will be the lead agency for identifying new market opportunities for Minnesota energy products and services. Energy-related technologies are already a major part of the Metro Export Initiative (MEI) goal to double exports from the Minneapolis-St. Paul metro area, a goal that should be expanded to include the entire state. The state's Biomass Partnership with Sweden, its policy tours in Germany, and new and existing trade offices in China, Germany, Brazil and Korea represent the backbone of an aggressive state trade effort. These investments in trade offices and trade programs should be closely coordinated with federal resources devoted to trade expansion and should rely, in part, on advice and feedback from REIP's private sector advisory group to identify specific opportunities for Minnesota energy companies.

The MTO has the capacity to help promote the benefits of the REIP to its client base through existing marketing and outreach channels. We expect a regular pipeline of mutual referrals between the MTO and REIP, and promotion of the REIP in regular MTO events and trade missions. Because the MTO has been legislatively charged with understanding and seizing global opportunities for trade and investment, it will play an important advisory role in matching up global demand for energy technologies and solutions with the supply of commercially viable ideas that are generated by the state's private energy sector. The MTO will be key to an ongoing process of developing strategies that play to existing strengths and forecasted demand for emerging technologies around the world.

Manufacturing and Supply Chains: Minnesota is likely to seek an IMCP grant to provide additional resources for building the state's manufacturing base and supply chain relationships. Although this IMCP proposal will be focused on medical technology and medical devices, it will have significant overlap with the goals of the REIP by restoring the state's overall ecosystem for innovation and commercialization. Blue-Green Alliance's Manufacturing Initiative and other MnSCU programs such as the Southern Minnesota Center for Agriculture and South Central Community College's Center for Engineering and Manufacturing Excellence provide the basis for further collaborative efforts to expand manufacturing jobs in this sector.

Workforce and Training: There are currently several workforce groups that are focused specifically on the energy sector in Minnesota. The Energy Jobs Association of

Workforce training and coordination.

Minnesota (EJAM) is made up mostly of building trade unions, energy service companies, and advocates for renewable energy development in the state. The Minnesota Energy Consortium is a Pew Foundation-funded planning process that seeks to address the critical workforce needs of the state's utilities and is made up mostly of these utilities and workforce training providers within MnSCU. These initiatives should be brought together and integrated with MnSCU efforts to better coordinate and expand its statewide training programs in renewable energy and energy-related fields.

In addition, the Minnesota State Energy Sector Partnership (MSESP) created in 2009 by the Governor's Workforce Development Council, is designed to forge an integrated and demand-driven system of education, training, and support services in energy efficiency and renewable energy industries. MSESP has a goal to anticipate skill needs and career pathways and was funded by a three-year, $6 million U.S. Department of Labor grant (http://www.gwdc.org/initiatives/msesp/index/html).

Other recent workforce initiatives include a joint effort proposed by The Itasca Group, a consortium of major business executives, Life Science Alley and the University of Minnesota for a collaboration effort to expand experiential learning in science and technology fields for students at Minnesota institutions of higher education.

Engagement and Mobilization: The University of Minnesota Extension Service has a well-established statewide network on energy issues with its Clean Energy Resource Teams (CERTs) and through its Regional Community Partnerships. Extension has the infrastructure and the programmatic focus to engage and mobilize stakeholders, particularly in rural communities around the state, for action on renewable energy. Extension should be given the task of communicating the opportunities clean energy offers for economic development to the general public and small businesses. It also has the capacity to identify and nurture political and business leaders in these communities around the state's common energy agenda and goals that are established by the REIP process in Minnesota.

Financing and Technology: Assessment New financing and funding tools recommended by the REIP's capital access working group should be implemented by the network, led by key stakeholders in finance and the Minnesota Angel Network (MNAN). MNAN already has a focus on expanding capital available to businesses at various stages of development, developing strategies for risk-sharing and promoting more direct investment in the state's energy sector. A particular focus of MNAN and this stakeholder group should also be to create mechanisms that keep as much of the financial benefits of renewable energy projects and new energy businesses and jobs as possible in local and regional economies.

Business Services: A clear distinction exists between the needs of startup businesses and second-stage businesses that have fewer than 100 employees and revenues of $1-50 million but are poised for growth. Startups and entrepreneurs will realistically have success with less than half of all commercialization efforts but access to comprehensive business services can increase the chances for success.

Identifying the factors that are most characteristic of clean energy business success and scoring entrepreneurs and startups with these objective criteria in a consistent and transparent fashion will be critical to REIP program. Second-stage companies are those companies that are often poised for significant business and job growth, will require different interventions and support services, primarily access to adequate sources of capital investment and working capital finance.

The backbone for providing business services will be the network of regional development commissions that will enter into a Partnership Collaboration Agreement. This network of practitioners will be continually trained in energy-related issues and will have ready access to subject matter experts and established pathways for commercialization based on the

needs of individual businesses. Region Five Development Commission will continue its leadership role in convening this statewide network and building its capacities for work with renewable energy entrepreneurs and businesses.

Startups and Incubation: Startups that pass through the initial phases of a stage-gate review should have access to grants and forgivable loans tied to numbers of jobs retained or created. Site-based incubation is occurring at a handful of sites in the state and will be enhanced by the Innovation Center that is planned by Wall Companies at a site near the U of M's Minneapolis campus. Additional space available for business incubation should be identified by regional business providers and qualified startup businesses should be given vouchers similar to a Section 8 housing voucher that they can take anywhere and that subsidizes their costs for space based on their assets and revenues. This will not only serve their space needs but will provide a stimulus for industrial parks and infrastructure investments that have been made by communities throughout Minnesota.

Details of System-Wide Functions and Roles

Policy Development and Review: The Next Generation Energy Board has been given the short-term task of charting an aggressive state energy course and it will continue to be the focus for energy policy development at the Capitol along with the state Environmental Quality Board and Minnesota DEED. The work of the Next Gen Board and EQB needs to be expanded to include all clean energy technologies, a process that is underway with the National Governors Association grant that is reviewing best practices in energy policy in other states and will recommend adaptations of these policies for Minnesota.

This REIP implementation plan recommends that all of the stakeholders that make up the Minnesota REIP program should be included in the review and comment on these proposed energy policies as they develop. In particular, it should be a priority role for the private sector advisory group to review and comment on proposed energy policies and programs. Minnesota should also consider policies that will fill gaps in federal policy or are the most complementary with federal energy policies and programs.

Branding and Marketing: All participants in the state REIP initiative need to be responsible for building and reinforcing the state's branding as a global leader in renewable energy and energy efficiency. Individual marketing and branding efforts should be encouraged to reference links to this overall brand and build Minnesota's reputation as a global center for "Made in Minnesota Clean Energy". REIP will work with marketing and branding experts to create metrics and the means of measurement for progress on developing this brand and to help track investments made in marketing of the state's energy sector as a whole.

Political and Business: Leadership Political and business leaders need a common message when talking about the future of energy use and opportunities for energy businesses in Minnesota. All stakeholders in the REIP will be responsible for promoting an understanding of Minnesota's renewable energy industries and the state's vision of a new energy future to national and international audiences.

IV.

Renewable Energy Innovation Project (REIP) Preliminary Budget

The following budget draft represents establishment of a modest REIP program with a staff complement of 2.5 FTEs. It also makes a very preliminary estimate of funding that may be available to other lead entities that will be responsible for the various networks that will make up Minnesota's REIP initiative. It is generally recommended that the funding for full implementation of the REIP come equally from federal funds, state funds and private funds and be committed for at least a three-year period.

REIP Direct Expenses

Staffing 2.5 FTEs	$160,000	
Consultant Services	100,000	
Space and Equipment	50,000	
Meeting/Travel Expenses	40,000	
Communications	100,000	
Metrics and Measurement	50,000	$500,000

The overwhelming majority of program activities and investments in renewable energy will come from existing and expanded funding programs that are currently in place. These funding targets by functional category should be part of the focus for creating a shared agenda and goals for the REIP process that is based on mutual benefits. It is anticipated that these programs and fuinds will be administered on an ongoing basis by the anchor institutions and networks that form around REIP core activities and participate in REIP activities.

Funding for Anchor Organizations and Networks

Technology/Finance Assessment	$250,000	
Business Services	500,000	
Capital Access	250,000	
Workforce and Training	500,000	
Research/Tech Transfer	1,500,000	
Engagement/Mobilization	250,000	
Centers of Excellence	1,500,000	
Market Development	250,000	
Incubation/Startup Grants	500,000	
Manufacturing/Supply Chain Grants	1,500,000	$7,000,000
TOTAL:		$7,500,000

RESOURCES

The following listing includes reports referenced in this Final Report, as well as supplemental sources that relate directly to the narrative findings. Numerous current and recent research activities reported from inside and outside government have contributed to the considerations and conclusions reached in this report.

RESOURCES

Affordable Energy: Forest Products Companies Need, Use and Produce It / Minnesota Forest Industries
www.minnesotaforests.com

Agroscience as a development driver: Minnesota's Agbioscience Strategy
http://www.auri.org/assets/2013/12/Minnesotas+Agbioscience+Strategy+-+Final+Report-1.pdf

Beyond Biofuels: Renewable Energy Opportunities for U.S. Farmers / Heinrich Boll Stiftung - The Green Political Foundation
http://www.boell.org/downloads/Beyond_Biofuels_report.pdf

Business Plan for Building Energy Efficiency Testing and Integration Center and Demonstration Network (BETI)
http://www.psrc.org/assets/5590/BETIBusinessPlan.pdf

Clean, Green Economy Jobs in Minnesota's Renewable Energy Sector
Timothy Nolan - Minnesota Pollution Control Agency, September 2012

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RENEWABLE ENERGY INNOVATION PROJECT (REIP)
MAJOR MEETING LOG

Ongoing Core Team teleconference meetings
1-1.5 hours (3-5 attendees) – 38 meetings

Monthly: April-Oct. 2012; twice monthly: Nov. 2012-Dec. 2013; monthly: January-March 2014.

5/9/12 – Pre-approval full-day meeting of Core Team, NRRI, ED regions, EDA – 14 attendees

Emphasis on NRRI activities and participation, key partner roles, EDA coordination – with regional administrator Dennis Foldenauer attending.

8/21/12 - Pre-approval full-day project planning meeting – 11 attendees representing all partners

DEED headquarters meeting with address from DEED commissioner Phillips, strategy discussions.

11/7/12 - R&D group / Business Services group – full day meeting

Bringing higher education and private sector leaders together, as well as separate break-out sessions for both working groups; 15 attendees from R&D, 7 from Business Services (96 invited – 29 total attendees including additional core team members). New DEED commissioner Clark provided introductory remarks.

12/7/13 – Capital Formation initial meeting – half day meeting

Hosted by Bob Olson (Olson Energy), several major financing and renewable energy financiers participated. Of 51 invitees, 17 attended the IDS – Minneapolis meeting.

1/8/13 – Core Team update & planning – full day meeting at DEED

Assessment of work in all project areas including Business Services Survey results, transition from Memo of Understanding to Partnership Collaboration Agreement concept, coordination of work groups.

2/22/13 – Policy Working Group – half day meeting at State Office Building

Defined initial role of the policy group, focusing most closely on identifying law changes and incentives for legislative attention (many of which were addressed in major 2013 legislation). Of 67 invitees, 14 attended (five others had RSVP'd but severe winter weather limited participation).

3/1/14 – Capital Formation concluding meeting – two hours

Working group recommendations were finished at the IDS meeting attended 8 participants.

5/28/13 – Core Team update & planning – full day meeting at DEED

Revised work plan projections following sequestration based on EDA six-month extension. Initial planning for August retreat with Core Team and partners.

7/22/13 – Teleconference & in-person consult with Governor's senior advisor Kathy Tunheim

Updating Administration on project status, Tunheim provided clear vision of Administration's renewable energy / economic development priorities. Sharing her communications expertise, Tunheim helped sharpen a concise REPoCC (later REIP) vision. Two-page strategy was later provided to the Administration.

8/13/13 – Core Team & Partners full-day retreat in Brainerd – 10 attending

Focus on remaining goals in work group categories, outline of final report draft, detailed plans for Minnesota Innovation Park as outlined by Dale Wahlstrom (BBAM).

10/15/13 – Higher Education & Renewable Energy Stakeholders half-day meeting

Bringing higher education leaders and stakeholders interested in facilitating concept to commercialization, the meeting attracted 22 participants (of which 8 are active external stakeholders) from a list of 57 invitees. Several participants indicated that this type of meeting was a helpful missing communication link, and further efforts (and opportunities for greater in-depth conversation) would be advisable.

12/9/13 - Core Team & Institute on the Environment (IonE) teleconference & in-person meeting

Follow up to the October Higher Education meeting, making an effort to more closely associate REIP with IonE efforts. Lewis Gilbert, managing director of IonE, indicated strong desire to get involved, and integrate IonE into the next phase of project coordination.

This final report was prepared with feedback requested from 56 core team members, partners and active REIP participants who were provided initial and final report draft documents for full review.

This report was prepared in collaboration with:

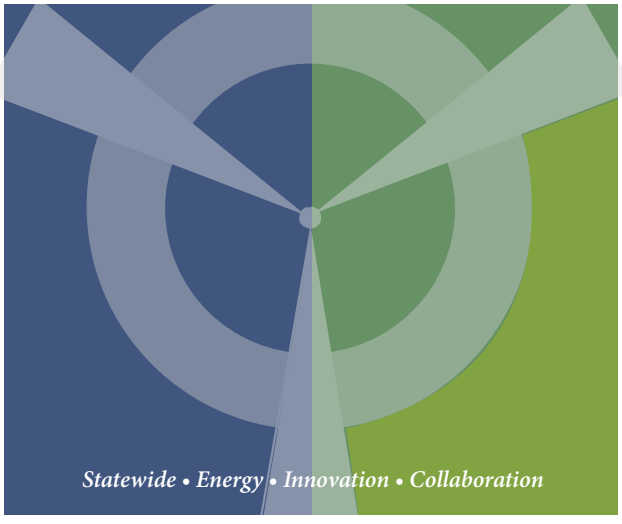
Region Five Development Commission

Minnesota Department of Employment and Economic Development

University of Minnesota – Natural Resources Research Institute

Independent consultants – Kandiyo Consulting and Robins Consulting

PROOF OF CONCEPT CENTER PLAN FOR MINNESOTA



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