XCEL ENERGY
RENEWABLE DEVELOPMENT FUND (RDF)

Biennium Report to the
Minnesota State Legislature
and the Minnesota Public Utilities Commission

JANUARY 1, 2009 – DECEMBER 31, 2010

Xcel Energy®

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Xcel Energy is a U. S. investor-owned electricity and natural gas company with regulated operations in eight Midwestern and Western states. Based in Minneapolis, we are one of the largest utility companies in the nation, serving approximately 3.4 million electricity customers and 1.9 million natural gas customers through our four wholly-owned operating companies. Northern States Power Company – Minnesota (NSP-Minnesota), an Xcel Energy company, provides electricity to 1.4 million customers in Minnesota, North Dakota and South Dakota, and natural gas to 0.5 million customers in Minnesota and North Dakota.

The Renewable Development Fund (RDF) is an NSP-Minnesota administered program mandated by the Minnesota State Legislature with oversight by the Minnesota Public Utilities Commission. The RDF's mission is to increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology.

I. Executive Summary

We are pleased to submit this 2009 – 2010 Biennium Report regarding Xcel Energy's Renewable Development Fund ("RDF") Program.[1] This report documents our efforts to support the development of emerging renewable electric energy technology and reduce customer costs in the process.

Two of the most significant RDF projects completed during the biennium were the 600 kW solar photovoltaic (PV) project at the Minneapolis Convention Center and the 400 kilowatt (kW) solar PV project at St. John's University. In addition, a new solar PV leasing program was initiated to support small-scale (less than 40 kW) projects at residential and business properties. Also, a solar/wind hybrid power kit was developed by the West Central Telephone Association for use in remote locations. The hybrid kit may soon be available on a commercial basis.

We also saw considerable progress regarding two RDF projects of major significance: a two megawatt (MW) wind-to-battery storage project near Luverne, MN and a 10 MW run-of-the river hydroelectric project on the Mississippi River at Lower St. Anthony Falls. The wind-to-battery project became fully operational in early 2011, and the Lower St. Anthony Falls hydro project achieved commercial operations at the end of 2011. A complete list of RDF projects that were active during the biennium is included in this report. (See Appendix A.)

At the request of the Minnesota Legislature, the RDF Program was the subject of an extensive review during 2009-2010 by the Office of the Legislative Auditor. The legislative auditor's report, completed in the fall of 2010, generally found that the RDF project selections and grant awards approved by the Minnesota Public Utilities Commission, and administered by NSP-Minnesota, have followed reasonable processes. The legislative auditor, however, raised questions about the future administration of the RDF Program and the possible need for the Minnesota Legislature to clarify the mission of the RDF Program. An executive summary of the legislative auditor's evaluation is attached to this report.

In 2010, the Minnesota Legislature enacted two changes regarding the RDF Program. The first change specifies that $21 million from the RDF Program shall be made available for solar PV system rebates over the next five years that use solar modules either manufactured or assembled in Minnesota. The RDF solar rebate program is administered in conjunction with our Solar*Rewards program, which provides an incentive payment of $2.25 per watt for solar PV systems under 40 kW. The amount of the RDF solar rebate shall be up to $5 per watt of installed generating capacity, not to exceed 60 percent of total installation cost.

[1] This biennium report is submitted in compliance with an Order issued by the Minnesota Public Utilities Commission on April 20, 2001 in Docket No. E-002/M-00-1583 *(Adopting Proposal for Oversight and Operation of Renewable Development Fund).*

In 2010, the Minnesota Legislature amended Minn. Stat. 116C.779 to modify NSP's annual assessment for the RDF Program. Previously, we were mandated to set-aside $16 million annually due to dry cask storage at the Prairie Island nuclear power plant. Under the new law, NSP-Minnesota must set-aside $500,000 annually to the RDF Program for each cask at Prairie Island once the total number of stored casks reaches 33. At the end of 2010, 26 casks were stored at Prairie Island and it is anticipated that 33 casks will be stored at the facility beginning in 2013.

In May 2011, the Minnesota Legislature approved a temporary prohibition on Minnesota Public Utilities Commission approval of new RDF grant projects. This hold is in effect until July 1, 2012. During this period, the Minnesota Legislature intends to consider possible revisions to the RDF program mission.

II. RDF Program Background

The RDF Program was mandated by the Minnesota Legislature in 1994 in conjunction with legislation regarding the Prairie Island Nuclear Generating Plant in Red Wing, Minnesota. As a condition of storing spent nuclear fuel in dry casks at Prairie Island, Minn. Stat. § 116C.779 initially required NSP-Minnesota, as the public utility owner of the plant, to transfer to a renewable energy fund $500,000 for each dry cask containing spent fuel after January 1, 1999, amounting to $9 million annually. In 2003, this statute was amended to extend nuclear-waste storage at our Prairie Island plant and increased the amount we must pay to $16 million annually, of which $10.9 million annually shall be used to fund renewable small-wind, hydro and biogas incentives via the renewable energy production incentive (REPI) program administrated by the Department of Commerce. (See Section IV. for further discussion of REPI.)

In 2007, the statute was amended to add an additional assessment of $350,000 for each dry cask stored at our Monticello Nuclear Generating Plant. Ten casks were filled in 2008 and continue to be stored at our Monticello plant. Since 2008, the annual set-aside for the RDF Program has been $19.5 million. In 2010, the set-aside for the RDF Program was changed to $500,000 annually for each cask at Prairie Island once the total number reaches 33 stored casks. At the end of 2010, 26 casks were stored at Prairie Island and it is anticipated that 33 casks will be stored there beginning in 2013.

The cost of Commission-approved program expenses allocated to Minnesota is recovered through an adjustable surcharge on customer bill statements as part of their monthly charges for electricity. This surcharge mechanism is known as a "rate rider." In 2009, the RDF charge was $0.000723 per kWh. Since then, we have been able to reduce the RDF charge in 2011 to $0.000609 per kWh. For a typical residential customer using 750 kWh per month, the RDF cost per month is 46 cents. On October 1 each year, we submit to the Commission our proposed RDF rate rider charge for the forthcoming year along with a publicly available RDF Program annual financial report which summarizes past expenses and provides a two-year expense forecast.

The RDF Advisory Board was established by the Company, and serves as a voluntary and independent entity to assist the Company in evaluating and selecting grant project proposals for recommendation to us and the Commission. The board uses technical and professional consulting resources, as needed, to carry out its duties. The board has seven members (See Appendix B) consisting of representative from the following:

- Environmental interests (2)
- Prairie Island Indian community (1)
- Residential customers (1)
- Commercial and Industrial customers (1)
- NSP-Minnesota (2)

Recommendations for RDF project grant awards are submitted to the Commission and the Minnesota Department of Commerce, Division of Energy Resources (DER), for review and approval. NSP-Minnesota then negotiates and enters into a grant contract with the project sponsor which includes a specific work plan, schedule, and required deliverables. NSP-Minnesota RDF program staff has responsibility for the practical day-to-day administration of the RDF grant contracts and resources. RDF grant funds are disbursed to the grant recipient on a reimbursement basis only.

III. RDF Program Mission and Performance Metric Evaluation

The RDF's mission is to:

- Increase the market penetration of renewable energy resources at reasonable costs in the NSP-Minnesota service territory
- Promote the start-up, expansion and attraction of renewable energy projects and companies in the NSP-Minnesota service territory
- Support emerging renewable energy technology through research and development

The RDF Program has established the following performance metrics for evaluating program effectiveness:

- Expansion of knowledge base
- Environmental benefits
- Economic benefits

These performance metrics, detailed below, are revisited after the completion of each project to determine whether the project: 1) remained on course with its stated goals, 2) furthered RDF program objectives, and 3) was a prudent and beneficial grant award on behalf of our customers.

Expansion of Knowledge Base: Project milestone reports and final reports submitted by grant recipients provide a public venue for the disclosure of new research breakthroughs that can stimulate the further development of new renewable technologies. These reports are available on our RDF Program web page at

www.xcelenergy.com/rdf. In addition, the publication of project results in scientific journals and the presentation of research activities at conferences and other forums provide another avenue to expand the academic and practical knowledge base of renewable energy technologies. During this biennium, 18 articles were published in scientific journals. Sixty-five papers were presented at a variety of regional, national, and international conferences and workshops. (See Appendix C) These publications and venues provide a critical scientific peer review of project research findings and are a basis for additional research activities or commercial efforts. In addition, RDF research projects have resulted in a number of patent filings. One project, Perennial Grass Biomass, received a provisional patent for a rhizome processor to plant miscanthus at a commercial scale. Another project, Inertial Wind Storage, received final approval of a patent for a pulse-width modulation controller that can be used for matrix converters used in the wind industry.

A number of RDF projects have received special awards during the biennium including:

- The City of Minneapolis (EP3-11) received the 'Best Project Design' Award in 2010 from the Minnesota Renewable Energy Society
- West Central Telephone Association's (RD3-58) received a 'State Leadership in Clean Energy' Award in 2010 from the Clean Energy States Alliance for a uniquely effective and innovative approach to deploying clean energy
- freEner-g's (EP3-12)solar leasing concept was recognized as the 'Best Eco-Lease' in 2009 by the magazine *Midwest Homes* during their feature "Best of the Twin Cities"

The RDF's environmental contribution is the avoidance of both air pollutant and greenhouse gas emissions when compared with alternative methods of generating electricity. Installed RDF energy production projects generated 43,966 megawatt hours (MWh) of electricity during the 2009-2010 biennium. Overall, RDF projects have generated a total of 103,839 MWh of electricity produced from a renewable energy resource. (See Table IIIa). Since solar electricity is only generated during daytime periods, it can also help meet demand energy requirements.

Solar and wind resources, which create no air emissions, have provided all RDF project power generation to date. When compared to electrical energy produced by coal, the RDF generation has provided environmental benefits through the reduction in several primary air emission categories (See Table IIIb). Solar and wind-sourced electrical generation offsets the release of particulate matter resulting from conventional electrical power generation.

Table IIIb - Air Emission Reductions (Compared to Coal)			
Emission	Prior to 2009 (pounds)	Biennium (2009 - 2010) (pounds)	Total (pounds)
CO_2	127,531	93,646	221,177
SO_2	802	589	1,391
NO_X	455	334	789
VOCs	3.05	2.24	5.29
Hg	0.65	0.48	1.13
Pb	0.79	0.58	1.37
Emissions data are based on statistics provided in the U.S. Energy Information Administration *Annual Energy Review 1998*			

RDF projects have also generated Renewable Energy Credits (RECs) which are tradable, non-tangible energy commodities. One REC represents one MWh of electricity. These credits represent the environmental attributes of the power produced from renewable energy projects. RDF projects have generated 66,227 RECs which can be used to meet our renewable energy goals and requirements.

Economic Benefits: RDF grants for renewable energy research and energy production initiatives generate significant economic benefits. During the biennium RDF expenditures have included more then $15.8 million in RDF project grant reimbursements, about $19.4 million in REPI payments, and $11.1 million in funding for special legislative projects. RDF expenditures promote and expand economic activity on both a local and regional scale through the purchase of goods and services, expansion of employment opportunities to provide those goods and services, and in some case the fostering of new or expanded business opportunities. In the case where permanent energy production facilities are constructed, the RDF investment can also expand the property tax base for a community through land improvements. RDF grant funds support supply-side economic growth by providing an incentive for people to produce goods and services which allow consumers to benefit from a greater supply of those goods and services at lower prices.

1. Leveraged Funds: RDF grant awards have leveraged other funds to expand and/or enhance project activity. Since RDF program inception in 2002, RDF grant awards have stimulated the investment of over $136 million in renewable energy. This includes nearly $94 million in construction activity, goods and services as a result of the start-up, expansion and attraction of renewable energy projects and companies in the NSP-Minnesota service territory and more then $42 million in research. Energy production projects that have been active during the past biennium, have leveraged over $52 million, which is equivalent to $1.94 for every RDF dollar spent. (See Table IIIc).

Table IIIc – Energy Production Funds Leveraged (Active Projects in 2009 - 2010 Biennium)				
Technology	Grant	Cost Share	Total Costs	Leverage
Biomass	$2,936,530	$16,806,444	$19,742,974	572%
Hydro	$7,100,000	$29,300,000	$36,400,000	413%
Innovative	$10,000,000	$365,621	$10,365,621	4%
Solar	$6,337,402	$3,146,827	$9,524,229	49%
Wind	$1,200,000	$2,670,126	$3,870,126	223%
Total	$27,573,932	$52,289,018	$79,902,950	189%

An additional $5.7 million has been leveraged for research and development in Minnesota. Research and development projects typically do not have the extensive leverage capacity as compared to energy production because the funding is predominately applied to personnel rather than construction and material costs (See Table IIId). RDF grant dollars leverage $0.69 for every grant dollar invested.

Table IIId - Research and Development Funds Leveraged (Active Projects in 2009 - 2010 Biennium)							
Technology	Minnesota			Outstate			Total Leverage
	RDF Grant	Cost Share	Leverage	RDF Grant	Cost Share	Leverage	
Biomass	$5,342,630	$1,402,711	26%	$5,194,961	$644,317	12%	19%
Solar	$732,032	$0	0%	$1,493,608	$941,600	63%	42%
Wind	$2,136,999	$4,281,036	200%	$370,000	$28,236	8%	172%
Total	$8,211,661	$5,683,747	69%	$7,058,569	$1,614,153	23%	48%

2. Job Creation: Money being invested into an area's economy for the material delivery of goods and services results in the need to hire additional or retain existing employees to meet the business needs. Therefore, money spent on energy production projects, as well as research and development projects, provide real economic benefits through the promotion of commerce and additional work hours. Organizations such as the National Renewable Energy Laboratory, the U.S. Department of Energy, and the American Council for an Energy Efficient Economy have developed job calculator models to evaluate the impact of dollars spent on renewable energy and energy efficiency projects. On average, these tools indicate that 10 to 11 jobs are created and/or retained (permanent and temporary) for each $1 million invested. Of the nearly $15.8 million in RDF project grant funds disbursed in 2009 and 2010, RDF project activity leveraged an additional $11.0 million for an investment of more than $26 million in renewable energy projects. This resulted in $13.5 million for construction projects to produce more renewable energy generation capacity and $13.3 million to fund renewable energy research. The employment resulting in this investment was 150 to 190 construction related jobs, and about 144 research jobs that were either created or retained during the biennium**.**

   It should be noted that several out-of-state projects utilized Minnesota contractors or project hosts located in the NSP-Minnesota service area and are not included in the previous numbers. This project association keeps the research relevant to

Minnesota and directs additional RDF funds to businesses and organizations in the state. These projects include:

- American Crystal Sugar Corp., Moorhead, Minn. hosted the project demonstration site for the University of Florida (RD-34)
- Grid and delivery system data from NSP-Minnesota is being analyzed for anti-islanding and loss-of-mains by Northern Plains Power Technologies (RD3-21)
- Haubenschild Farms, Princeton, Minn. provides feedstock and a testing site for University of North Dakota (RD3-68)
- P & J Farms, Northfield, Minn. is host to the gasification demonstration for Coaltec USA (RD3-77)

IV. RDF Funding Activity

Since 2001, the RDF program has provided $158.2 million for renewable energy initiatives including $52.0 million for REPI payments, $36.4 million for legislatively mandated projects and programs, and $15 million ($5 million each year for Fiscal Years 2010 – 2012) to the University of Minnesota for the Initiative for Renewable Energy and Environment (IREE). The balance of $67.5 million has been awarded over three grant cycles to 62 projects as follows:

RDF Grant Awards

2001 (Cycle 1 – 17 Projects)

- $15.5 million in grant awards
- 11 research projects
- 6 energy production projects

2005 (Cycle 2 – 23 Projects)

- $29.5 million in grant awards
- 17 research projects
- 6 energy production projects

2007 (Cycle 3 – 22 Projects)

- $22.5 million in grant awards
- 16 research projects
- 6 energy production

Renewable Energy Production Incentives (REPI)

As specified by Minn. Stat. §116C.779, Subd. 2., the RDF Program provides Renewable Energy Production Incentive (REPI) payments up to $10.9 million for qualifying including up to $9.4 million annually for electricity generated by wind energy conversion systems

and up to $1.5 million annually for on-farm biogas recovery facilities and hydroelectric facilities. Minn. Stat. §216C.41 authorizes an incentive payment of 1.0 cents per kWh for wind projects through 2018, biogas projects through 2015, and hydro projects through 2021. REPI payments since program inception have totaled about $61 million.

In 2009, the Minnesota Legislature approved legislation to expand the eligibility of hydroelectric facilities that qualify for REPI payments. The Lower St. Anthony Falls hydroelectric project was completed in December 2011 and will begin to receive REPI payments.

Initiative for Renewable Energy and the Environment (IREE)

In 2009, the Minnesota Legislature amended Minn. Stat. §116C.779, Subd. 3, to provide $5,000,000 per year for four years (fiscal years 2010 – 2013) from the RDF account to the University of Minnesota for IREE. In 2011, the appropriation for FY2013 was eliminated which reduced the total appropriation to $15,000,000. (Session Laws 2011, Chapter 97, Section 3). These grant funds may be used by IREE for the environmentally sound production of energy from renewable energy sources, the environmentally sound production of hydrogen from biomass and other renewable resources, the development of energy conservation measures, energy storage technologies, and policy analysis to facilitate adoption of low-carbon renewable energy technologies. IREE is required by statute to provide an annual report directly to the Minnesota Legislature on their activities supported by the RDF Program.

Division of Energy Resources (DER) Program Support

In 2009, the Minnesota Legislature approved an appropriation of $1,975,000 over a two year period (fiscal years 2010-2011) from the RDF account to the Division of Energy Resources for grants to promote renewable energy projects and community energy outreach and assistance (2009 Session Laws, Chapter 37, Article 2, Section 3).

RDF Solar Rebates

In 2010, the Minnesota Legislature approved a measure to utilize $21 million from the RDF Program for solar rebates over the next five years ($2 million in state fiscal year 2011, $4 million in state fiscal year 2012, and $5 million per year in state fiscal years 2013 – 2015). The legislation specifies that NSP-Minnesota shall administer the RDF rebates for solar PV systems less than 40 kW installed by customers in the NSP-Minnesota service territory. The RDF solar rebates are only available for systems that use solar modules either manufactured or assembled in Minnesota. The amount of the RDF solar rebate shall be the difference between the sum of all rebates awarded to the applicant and $5 per watt of installed generating capacity. Further, the amount of all rebates or other forms of financial assistance awarded to an applicant by a utility and the state, including the RDF solar rebate must not exceed 60 percent of the total installed cost of the solar PV installation net of federal income taxes at the highest applicable income tax rates.

V. Overall RDF Project Status

In order to maintain program transparency, the RDF administration files quarterly progress reports with the Commission (available at www.puc.state.mn.us) summarizing project activity. In addition, RDF grant recipients submit project milestone reports to NSP-Minnesota providing a description of activities and findings. We post milestone reports on the RDF web page at www.xcelenergy.com/rdf.

A. Current Contracts

RDF projects have contract periods of varying lengths and start dates based upon the specific variables and time requirements inherent to the project. Project duration has ranged from two months to 72 months. Some projects are dependent upon seasonal factors (i.e. wind patterns, weather, crop growth, winter construction restrictions, etc.), and project tasks need to be synchronized with calendar dates.

Of the 60 projects that have entered into RDF grant contracts since the Program's inception, eight projects were initiated during the biennial period (See Table Va).

Table Va - Summary of Projects Initiated (1/1/2009 – 12/31/2010)		
	Prior to 12/31/2008	1/1/2009 - 12/31/2010
Cycle 1	17	0
Cycle 2	23	0
Cycle 3	12	8

Thirty projects were completed prior to the biennial period, eight projects were completed during the biennial period and 22 remain active (See Table Vb).

Table Vb - Summary of Completed Projects (1/1/2009 – 12/31/2010)			
	Prior to 12/31/2008	1/1/2009 - 12/31/2010	Active as of 1/1/2011
Cycle 1	16	0	1
Cycle 2	13	6	4
Cycle 3	1	2	17

B. Energy Production Project Status

Ten energy production projects were active during the biennial period of which three completed their proposal activity with an installed capacity of 3.0 MW (See Table Vc). Annual electrical production from this additional installed capacity is projected to be 5,591 MWh. More than $27 million of RDF funding has been awarded and obligated to these ten RDF energy production projects. This investment has leveraged an additional $53.4 million for project design, planning, and materials for construction projects in Minnesota.

Table Vc - Summary Energy Production Projects (1/1/2009 – 12/31/2010)				
Technology	Total Projects	Completed Projects	Installed Capacity (MW)	Funds Leveraged
Biomass	2	0	0	$16,806,444
Hydro	2	0	0	$29,300,000
Innovative	1	1	0	$365,621
Solar	4	2	1.0	$2,150,320
Wind	1	1	2.0	$2,670,126
Totals	10	4	3.0	$51,292,511

C Research and Development Project Status

Twenty research and development production projects were active during the biennial period with five completing their proposal activity during that period. (See Table Vd). More than $15 million of RDF funding has also been awarded and obligated to these R&D projects. This investment has leveraged an additional $7.3 million from other sources for renewable energy research.

Table Vd - Summary Research Development Projects (1/1/2009 – 12/31/2010)					
Technology	Total Projects	Completed Projects	Published Articles	Scientific Papers	Funds Leveraged
Biomass	13	3	11	37	$2,047,028
Solar	3	0	1	5	$941,600
Wind	4	2	5	23	$4,309,272
Totals	20	5	17	65	$7,297,900

D. Reimbursement of Project Costs

Grant funds are disbursed on a reimbursement basis according to project progress and milestones stipulated in each RDF grant contract. More than $15.5 million was disbursed in the biennium to reimburse project costs (See Table Ve). Some projects were completed under budget, and a $724,546 savings was credited to the Program for future RDF grant awards.

Table Ve - Use of Funds Under RDF Contract (1/1/2009 – 12/31/2010)					
Cycle	Contracted RDF Funds	RDF Funds Dispersed			Funds not utilized
		Prior to 12/31/2008	1/1/2009 - 12/31/2010	Balance after 1/1/2011	
Cycle 1	$15,550,401	$11,633,734	$46,620	$3,561,409	$308,637
Cycle 2	$27,840,996	$19,266,523	$5,437,146	$2,721,438	$415,889
Cycle 3	$22,510,293	$957,534	$10,364,253	$11,188,506	$0
Total	$65,901,690	$31,857,791	$15,848,019	$17,471,353	$724,546

E. Project Benefits to NSP-Minnesota Customers

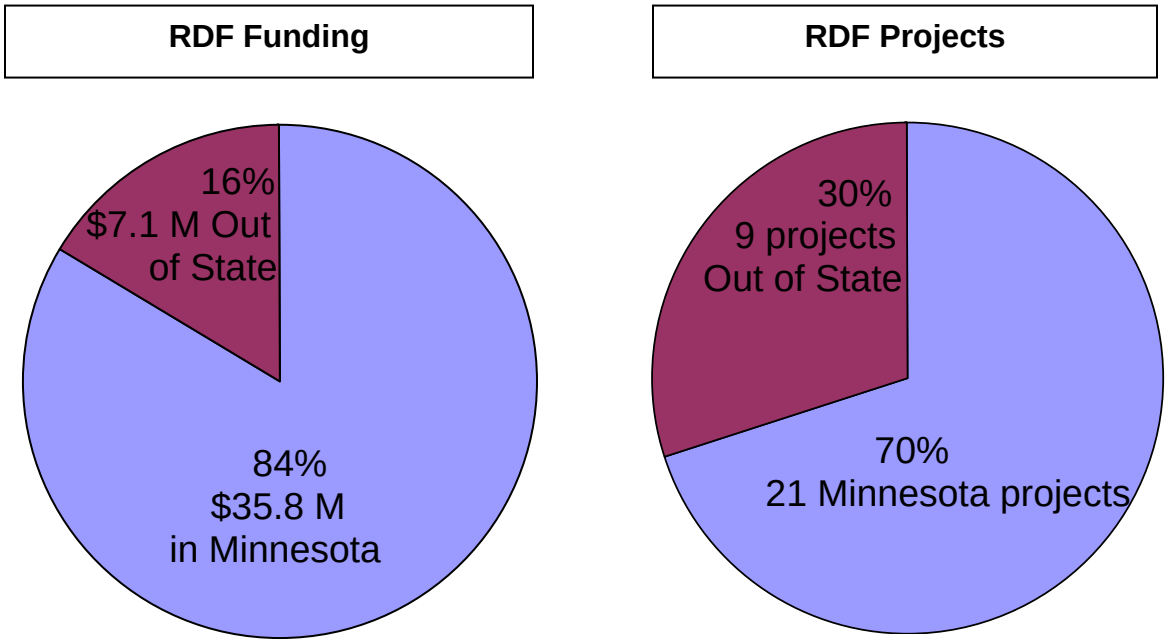
A majority of RDF projects are based in Minnesota. As a result, a majority of RDF dollars are also spent in the NSP-Minnesota service area. One of the selection criteria for RDF grant projects is the benefits a project will bring to NSP-Minnesota customers. Therefore, research activity conducted by an entity that is not located in Minnesota needs to be applicable and transferable to the state. This is often accomplished through the use of a Minnesota site serving as a host for the development and demonstration of an RDF project. (See Table Vf)

Table Vf – Minnesota Hosts Activities (1/1/2009 – 12/31/2010)

Project	Grantee	Minnesota Host	Host Location	Host Activity
RD-34	University of Florida	American Crystal Sugar	Moorhead, Minn.	Pilot demonstration of digester
RD-87	Global Energy Concepts	Wind Developer	Southwest Minn.	Wind data collection
RD3-68	University of North Dakota	Haubenschild Farms Dairy	Princeton, Minn.	Pilot demonstration of digester
RD3-77	Coaltec Energy USA	P & K Farms	Northfield, Minn.	Pilot demonstration of gasifier

Appendix D details the Minnesota congressional districts that have either hosted project activity or have had a project sponsor(s) located within their boundaries.

The following chart depicts the number of RDF projects that have been located, and the funding for such projects, within and outside of Minnesota:



VI. Office of the Legislative Auditor Evaluation

A. Background

The RDF has been recognized by many as an important source of funding for renewable electric energy research and renewable electric energy production projects. However, questions have also been raised about the scope, benefits and structure of the fund. Therefore, in 2009 the Minnesota Legislature directed the Office of the Legislative Auditor (OLA) to conduct an RDF Program evaluation. The review was to focus mainly on: 1) the process for determining which projects receive RDF support, 2) whether RDF projects have met statutory goals and provided Minnesota-specific benefits, and 3) whether project outcomes have been effectively communicated to the public and policy makers. The legislative auditor's evaluation and report was issued in the fall of 2010.

B. RDF Evaluation Findings

The legislative auditor's findings included the following:

- Over time, the Legislature has broadened the allowable use of RDF dollars including some projects that were not related to renewable electric energy
- Administrative responsibility for RDF projects has grown more diffuse between three separate entities: NSP-Minnesota, the University of Minnesota Initiative for Energy and the Environment (IREE), and the Minnesota Department of Commerce
- Generally, RDF project selections and grant award administered by NSP-Minnesota and subject to the regulatory oversight of the Minnesota Public Utilities Commission have followed reasonable processes
- Inconsistencies exist in grant selection criteria and project oversight among the three entities that have authority over their respective allocation of RDF dollars
- Additional efforts are warranted to improve ratepayer involvement in the RDF project selection process
- Additional efforts are warranted to make RDF project results more available to the public

The legislative auditor also offered a number of key recommendations including:

- The Minnesota Legislature should consider adopting a single process for approving RDF grant awards and should assign such authority to either the Legislature or the Commission
- The Legislature should clarify the purpose and the structure of the RDF Advisory Board
- The Legislature should require that all RDF project reports as well as the overall financial status of the RDF Program should be posted on one public website

Appendix E summaries the report findings and recommendations to the State Legislature.

C. Status of Fund

The legislative auditor's report points out that the RDF Program is supported entirely by funds from NSP-Minnesota customers, and as such, it is not a public fund. The legislative auditor further questioned whether the Legislature, given its role in determining how RDF dollars are allocated, should designate the RDF as public money and make it part of the state's budget. We believe it is important to recognize the Minnesota Legislature mandated establishment of the fund as part of compromise legislation authorizing the dry cask storage of spent nuclear fuel at the Prairie Island Nuclear Generating Plant. In essence, the Minnesota Legislature provided policy direction to dedicate a certain portion of our resources for a specific purpose – the advancement of renewable electric energy generation. In many respects, the RDF statutory mandate is like other policy directives from the Legislature such as energy conservation requirements that specify how we should deploy our resources. We remain committed to fulfilling the RDF mandate established by the Legislature, and believe the most appropriate way to administer the RDF Program is by us with the oversight of the Commission.

VII. Conclusion

The RDF Program continues to be a source of funding for renewable electric energy research, development, and demonstration projects in Minnesota. Throughout the past ten years and three grant award cycles, the RDF Program has supported projects of state, regional and national significance. Yet, not all projects unfold as planned, and it often takes years for the results from research projects to bear fruit. We are cognizant of lessons learned in conjunction with past RDF projects, and are applying such lessons to future efforts.

We look forward to working with the Minnesota Legislature and the Minnesota Public Utilities Commission on possible revisions to the RDF Program. Further, we remain committed to making certain the RDF Program provides maximum benefits for those individuals who most directly make it possible – our customers.

Appendix

Appendix A – RDF Projects During Biennium (1/1/2009 – 12/31/2010)

	Contract	Project Name	Grant	Type	Cycle	Category	Status	Project End Date
1	AH-01	Crown Hydro	$5,100,000	EP	1	Hydro	Active	9/4/2007*
2	EP-26	Hilltop	$1,200,000	EP	2	Wind	Completed	3/2/2009
3	EP-34	Lower St. Anthony Falls	$2,000,000	EP	2	Hydro	Active	6/30/2011
4	EP-43	Mesaba/Excelsior Energy	$10,000,000	EP	2	Innovative	Completed	6/24/2010
5	EP-44	CMEC	$2,000,000	EP	2	Biomass	Active	12/12/2010
6	EP-51	RCM Digesters/Diamond K Dairy	$936,530	EP	2	Biomass	Active	7/11/2011
7	RD-27	Rural Advantage	$318,800	RD	2	Biomass	Completed	4/12/2009
8	RD-34	University of Florida	$999,995	RD	2	Biomass	Completed	5/16/2009
9	RD-50	Energy Performance Systems	$957,929	RD	2	Biomass	Active	1/16/2012
10	RD-72	Production Specialties	$228,735	RD	2	Biomass	Completed	11/16/2009
11	RD-87	Global Energy Concepts	$370,000	RD	2	Wind	Completed	5/7/2009
12	EP3 - 3	Best Power Intl	$1,994,480	EP	3	Solar	Completed	5/28/2010
13	EP3 - 11	City of Minneapolis	$2,000,000	EP	3	Solar	Active	1/15/2013
14	EP3 - 12	Freenerg	$1,488,922	EP	3	Solar	Active	12/10/2010
15	EP3 - 13	Minnesota Dept. of Natural Resources	$894,000	EP	3	Solar	Active	3/12/2013
16	RD3 - 1	University of Minnesota	$992,989	RD	3	Biomass	Active	10/22/2013
17	RD3 – 2	Sartec	$350,000	RD	3	Biomass	Active	6/11/2011
18	RD3 - 4	Bepex International	$924,671	RD	3	Biomass	Active	12/28/2010
19	RD3 - 12	NSP-Minnesota	$1,000,000	RD	3	Wind	Active	8/8/2011
20	RD3 - 21	Northern Plains Power Technologies	$493,608	RD	3	Solar	Active	6/11/2012
21	RD3 - 23	University of Minnesota	$819,159	RD	3	Biomass	Active	5/22/2011
22	RD3 - 25	University of Minnesota	$732,032	RD	3	Solar	Active	10/22/2011
23	RD3 - 28	University of Minnesota	$979,082	RD	3	Biomass	Active	1/22/2013
24	RD3 – 42	University of Minnesota	$999,999	RD	3	Wind	Active	8/7/2013
25	RD3 - 53	Interphases Solar	$1,000,000	RD	3	Solar	Active	10/22/2011
26	RD3 - 58	West Central Telephone Association	$137,000	RD	3	Wind/Solar	Completed	5/12/2010
27	RD3 - 66	University of North Dakota	$999,065	RD	3	Biomass	Active	12/31/2011
28	RD3 - 68	University of North Dakota	$970,558	RD	3	Biomass	Active	4/1/2011
29	RD3 - 71	University of North Dakota	$999,728	RD	3	Biomass	Active	1/1/2012
30	RD3 - 77	Coaltec Energy USA	$1,000,000	RD	3	Biomass	Active	10/22/2010
		Total RDF Projects	**$42,887,282**					

** An amendment approved by the Commission extends the end date of the project to 400 days from the property acquisition date.*

Appendix B - RDF Advisory Board

- Nancy Lange, energy program director
  Izaak Walton League
  Representing the environmental community

- Linda Taylor, clean energy director
  Fresh Energy
  Representing the environmental community

- Lise Trudeau, engineer
  Minnesota Division of Energy Resources
  Representing residential customers

- Bride Siefert, energy policy director
  Minnesota Chamber of Commerce
  Representing commercial and industrial customers

- Heather Westra
  Representing Prairie Island Indian community

- Betsy Engelking, director of resource planning
  NSP-Minnesota
  Representing NSP-Minnesota

- Brian Zelenak, manager regulatory administration
  NSP-Minnesota
  Representing NSP-Minnesota

RDF Administration

- Tim Edman, program manager

- Mark Ritter, grant administrator

Appendix C - Scientific Articles and Presentations

Scientific Articles

Date	Grant #	Grantee	Article Title	Journal
January, 2009	RD-107	NREL	Structure-Dependent Photophysics of First Generation Phenyl-Cored Thiophene Dendrimers	*Journal of Physical Chemistry*
January, 2009	RD-56	U of M	Fuel Properties of Biomass Feed Streams at Ethanol Plants	*Applied Engineering in Agriculture*
April, 2009	RD3-23	U of M	Economic and Environmental Impacts of U.S. Corn Ethanol Production and Use	*Economic Research of Federal Reserve Bank of St. Louis*
May, 2009	RD-56	U of M	Integrating Biomass to Produce Heat and Power at Fuel Ethanol Plants	*Applied Engineering in Agriculture*
June, 2009	RD-56	U of M	Economics of Biomass Gasification/Combustion at Fuel Ethanol Plants	*Applied Engineering in Agriculture*
June, 2009	RD-56	U of M	Biomass Integrated Gasification Combined Cycle for Heat and Power at Ethanol Plants	*Energy Conversion and Management*
June, 2009	RD3-23	U of M	A Biomass Supply Logistics System	*American Society of Agricultural and Biological Engineers (ASABE)*
July, 2009	RD3-23	U of M	Current and Future Ethanol Production Technologies: Production Costs and Return Rates	*International Journal of Biotechnology*
August, 2009	RD3-23	U of M	Will New Technologies Preserve Minnesota's Ethanol Industry?	*Rural Minnesota Journal*
December, 2009	RD3-42	U of M	A Wind Tunnel Investigation of Wind Turbines Wakes: Boundary-Layer Turbulence and Surface Roughness Effects	*Boundary-Layer Meteorology*
January, 2010	RD3-42	U of M	A Modulated Gradient Model for Large-eddy Simulation: Application to a Neutral Atmospheric Boundary Layer	*Physics of Fluids*
April, 2010	RD3-25	U of M	Structural and Electronic Properties of Dual Plasma Co-deposited Mixed-phase Amorphous/ Nanocrystalline Thin Films	*Journal of Applied Physics*
May, 2010	RD3-23	U of M	A Corn Stover Supply Logistics System	*Applied Engineering in Agriculture*
July, 2010	RD3-71	UND	Biomass in Microturbines	*Renewable World Magazine*
July, 2010	RD3-42	U of M	Thermal Stability and Boundary-Layer Effects on Wind Turbine Wakes. A Wind Tunnel Study	*Boundary-Layer Meteorology*
September, 2010	RD3-12	NSP-Minnesota	Wind to Battery	*Energize*
November, 2010	RD3-25	U of M	Enhanced Crystalization of Amorphous Silicon Thin Films by Nanocrystallite Seeding	*Applied Physices*
December, 2010	RD3-23	U of M	Reducing Life Cycle Greenhouse Gas Emissions of Corn Ethanol	*Biomass and Bioenergy*

Papers/Presentations

Date	Grant #	Grantee	Paper Title	Conference	Location
January, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	Power Storage Conference	Las Vegas, NV
February, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration and SmartGrid*	Net Zero Energy Workshop	Colorado Springs, CO
February, 2009	RD3-12	NSP-Minnesota	*Wind-to-Battery*	MISO	Denver, CO
April, 2009	RD3-42	U of M	*A Wind Tunnel Investigation of Wind Turbine Wakes: Boundary-layer Turbulence and Surface Roughness Effects*	European Geophysical	Vienna, Austria
April, 2009	RD3-42	U of M	*Parameterization of turbulent fluxes and wind turbine*	European Geophysical	Vienna, Austria
April, 2009	RD3-12	NSP-Minnesota	*Wind-to-Battery*	MISO	Denver, CO

May, 2009	RD3-23	U of M	*Ethanol Economics Update: More Excitement Ahead*	MN Extension Ag Lender Conf.	Montevideo, MN
May, 2009	RD3-53	Interphases	*New Concepts for Manufacturing High Efficiency Flexible Solar Cells*	2009 Nanotech Expo	Houston, TX
June, 2009	RD3-23	U of M	*Economics of Expanding Biofuel Production in the Upper Midwest*	National Science Academy	Madison, WI
June, 2009	RD3-23	U of M	*Ethanol Update: Getting Paid to Reduce our Footprint*	MN Extension Ag Lender Conf.	Stewartville, MN
June, 2009	RD3-23	U of M	*Comparing Financial Performance of Current and Future Ethanol Production Technologies*	International Starch Conf.	Champaign, IL
June, 2009	RD3-23	U of M	*Biomass for Combined Heat and Power at Ethanol Plants*	Fuel Ethanol Workshop	Denver, CO
June, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	North Central Electric League	Minneapolis, MN
June, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	Minnesota Utility Investors	Mankato, MN
July, 2009	RD3-25	U of M	*Bubbly Silicon: A New Mechanism for Solid Phase Crystallization of Amorphous Silicon*	ASME International	San Francisco, CA
July, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	IWWG Wind Power Conf.	Chicago, IL
July, 2009	RD3-68	UND	*Sulfide Mitigation Project Update*	Great Plans Water Consortium	Grand Forks, ND
August, 2009	RD3-23	U of M	*Biomass for Combined Heat and Power at Ethanol Plants*	NCGA Land Use Conference	St. Louis, MO
August, 2009	RD3-23	U of M	*Ethanol Production: Technologies and Rates of Return*	MN Extension Ag Lender Conf.	Lamberton, MN
August, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	Wholesale Customer	Denver, CO
September, 2009	RD3-23	U of M	*Biomass for Combined Heat and Power at Ethanol Plants*	Malavecchia Experiment	Venato, Italy
September, 2009	RD3-23	U of M	*Financial Performance of Current and Future Ethanol Production Technologies*	Universita Degli Studi Di Padova	Padova, Italy
September, 2009	RD3-23	U of M	*Economic Viability of Biofuels: the Interplay of Policies and Advancing Technologies*	Int.Congress of Biocombustibles	Guayquil, Ecuador
October, 2009	RD3-23	U of M	*Generating Electricity from Biomass – Making Ethanol from Corn More Renewable*	University of Minnesota	St. Paul, MN
October, 2009	RD3-23	U of M	*Advanced Technologies and Biofuels Production*	University of Minnesota	St. Paul, MN
October, 2009	RD3-23	U of M	*Production Costs, Prices, and Profitability of Biofuels*	University of Minnesota	St. Paul, MN
October, 2009	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	Innovative Clean Technologies	Denver, CO
November, 2009	RD3-42	U of M	*Development of a High-Resolution Virtual Wind Simulator for Optimal Design of Wind Energy Projects*	E3 Conference	Minneapolis, MN
November, 2009	RD3-42	U of M	*A Wind Tunnel Investigation of Wind Turbine Wakes*	American Physical Society Meeting	Minneapolis, MN
November, 2009	RD3-42	U of M	*Large-Eddy Simulation of Wind Turbine Wakes*	American Physical Society Meeting	Minneapolis, MN
December, 2009	RD3-23	U of M	*Biomass Densification*	Solutions for Sustainability	St. Paul, MN
February, 2010	RD3-23	U of M	*Coproducts and other Biomass for CHP at Fuel Ethanol Plants*	EUEC 2010 Conference	Phoenix, AZ
March, 2010	RD3-23	U of M	*Biomass Densification*	Biomass Wrkshp	Normal, IL
March, 2010	RD3-23	U of M	*Densification, BIGCC and Torrefaction*	Redwood Area Development	Redwood Falls, MN
March, 2010	RD3-23	U of M	*Densification, BIGCC and Torrefaction*	Southwest MN Energy Board	Slayton, MN

March, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind Energy Integration*	CERA Week	Houston, TX
April, 2010	RD3-25	U of M	*Controlled Crystallization of Hydrogenated Amorphous Silicon Thin Films by Nanocrystallite Seeding*	Material Research Society	San Francisco, CA
April, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration*	SPS Wholesale Conference	Amarillo, TX
May, 2010	RD3-25	U of M	*Seed-induced Crystallization of Amorphous Silicon for the Formation of Large-grain Poly-crystalline Silicon*	International Energy Conf.	Phoenix, AZ
May, 2010	RD3-23	U of M	*A Corn Stover Supply Logistics Systems*	International Biomass Expo	Minneapolis, MN
May, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration*	NCEA Delivery Workshop	Minneapolis, MN
June, 2010	RD3-23	U of M	*Reducing Life Cycle Greenhouse Gas Emissions of Corn Ethanol (ASABE Paper #1008902)*	ASABE Annual International Mtg	Pittsburgh, PA
June, 2010	RD3-23	U of M	*Commercial Scale Grinding of Corn Stover and Perennial Grasses (ASABE Paper #1009062)*	ASABE Annual International Mtg	Pittsburgh, PA
June, 2010	RD3-23	U of M	*Superheated Steam Drying Technology in an Ethanol Production Process (ASABE Paper #1009069)*	ASABE Annual International Mtg	Pittsburgh, PA
June, 2010	RD3-23	U of M	*Biomass Integrated Gasification Combined Cycle Systems at Corn Ethanol Plants (ASABE Paper #1009171)*	ASABE Annual International Mtg	Pittsburgh, PA
June, 2010	RD3-23	U of M	*Using Biomass to Make Electricity*	Biomass Field Day	Maplewood, MN
June, 2010	RD3-23	U of M	*Biomass Densification, Logistics and Use to Produce CHP*	Biomass Field Day	Alexandria, MN
June, 2010	RD3-23	U of M	*Economics of Using Biomass to Produce Heat and Electricity at Ethanol Plants*	Fuel Ethanol Workshop	St. Louis, MO
July, 2010	RD3-66	UND	*Wood Biomass Potential in the United States*	Biomass 10' Workshop	Grand Forks, ND
July, 2010	RD3-4	Bepex	*Torrefaction: Economic Conditions to Make It Profitable*	Biomass 10' Workshop	Grand Forks, ND
July, 2010	RD3-71	UND	*Integrated Gas Turbine - Gasifier Pilot-Scale Power Plant*	Biomass 10' Workshop	Grand Forks, ND
July, 2010	RD3-25	U of M	*Crystallization Enhancement of Amorphous Silicon Films with Embedded Silicon Nanoparticles*	Gordon Research Conference	New London, NH
August, 2010	RD3-23	U of M	*BIGCC and Densification Technologies*	Farmfest	Redwood Falls, MN
August, 2010	RD3-28	U of M	*Biomass Residue Removal*	USDA Field Days	Morris, MN
September, 2010	RD3-12	NSP-Minnesota	*Wind-to-Battery Project Update*	EPRI Energy Storage Meeting	Orlando, FL
September, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration - Wind-to-Battery Project Preliminary Results*	IDC Energy Conference	Boulder, CO
September, 2010	RD3-28	U of M	*Crop Residues of the Contiguous United States: Balancing Feedstock and Soil Needs*	Sustainable Feedstocks Wksp	Atlanta, GA
October, 2010	BB-06/ RD-50	EPS	*Whole Tree Energy™ & Protecting Our Natural Resources*	ASME	Plymouth, MN
October, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration - Wind-to-Battery Project Preliminary Results*	SD Regional Power Conf.	Sioux Falls, SD
October, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration - Wind-to-Battery Project Preliminary Results*	Midwestern Wind Energy	Ames, IA
October, 2010	RD3-28	U of M	*Sustainable Residue Removal for Energy Production*	ND SWC Society	Sidney, MT
October, 2010	RD3-28	U of M	*Sustainable Residue Removal: Review and Research*	USDA Research Laboratory	Long Beach, CA
November, 2010	RD3-42	U of M	*Turbulence Characteristics Around a Staggered Wind Farm Configuration. A Wind Tunnel Study*	American Physical Society	Long Beach, CA
November, 2010	RD3-28	U of M	*Bioenergy Systems: Soil quality and Sustainability*	American Crop Science Society	Sidney, MT
December, 2010	RD3-12	NSP-Minnesota	*Energy Storage for Wind and Solar Integration - Wind-to-Battery Project Preliminary Results*	IREE E3 Conference	St. Paul, MN

Appendix D – Location of RDF Projects by Congressional District

RDF Projects (1/1/2009 - 12/31/2010)								
RDF Contract	Grant	Type	Cycle	Renewable Category	Host Site		Project Sponsor	
					District	Location	District	Organization
District 1								
RD-27	$318,800	RD	2	Biomass	1	Forrest Farms, Luverne	1	Rural Advantage, Fairmont
EP-51	$936,530	EP	2	Biomass	1	Diamond K Dairy, Altura	CA	RCM Digesters, Berkley
EP3-13	$894,000	EP	3	Solar	1	Lake Shetek State Park	4	MN DNR, St. Paul
RD3-12	$1,000,000	RD	3	Wind	1	Beaver Creek, Rock County	5	NSP-Minnesota, Minneapolis
District 2								
RD3-1	$992,989	RD	3	Biomass	2	Rahr Malting, Shakopee	3	U of M, St. Paul
EP3-13	$894,000	EP	3	Solar	2	Afton State Park	4	MN DNR, St. Paul
RD3-77	$1,000,000	RD	3	Biomass	2	P & J Farms, Northfield	IL	Coaltec Energy USA, Carterville
District 3								
EP3-13	$894,000	EP	3	Solar	3	Ft. Snelling State Park	4	MN DNR, St. Paul
EP3-3	$1,994,480	EP	3	Solar	6	St. John's University	3	Best Power, Minnetonka
EP-26	$1,200,000	EP	2	Wind	7	Edgerton area	3	Hilltop Farms, St. Louis Park
District 4								
RD3-23	$819,159	RD	3	Biomass	4	U of M, St. Paul	4	U of M, St. Paul
EP3-12	$1,488,922	EP	3	Solar	4	Metro area	5	Freenerg, Minneapolis
RD3-1	$992,989	RD	3	Biomass	2	Rahr Malting	4	U of M, St. Paul
EP3-13	$894,000	EP	3	Solar	Various	Statewide	4	MN DNR, St. Paul
District 5								
AH-01	$5,100,000	EP	1	Hydro	5	Crown Hydro, Minneapolis	5	Crown Hydro, Minneapolis
EP-34	$2,000,000	EP	2	Hydro	5	St. Anthony Falls, Minneapolis	5	U of M, Minneapolis
RD3-4	$924,671	RD	3	Biomass	5	Bepex, Minneapolis	5	Bepex, Minneapolis
RD3-25	$732,032	RD	3	Solar	5	U of M, Minneapolis	5	U of M, Minneapolis
EP3-11	$2,000,000	EP	3	Solar	5	Convention Center, Minneapolis	5	City of Minneapolis
EP3-12	$1,488,922	EP	3	Solar	5	Metro area	5	freEner-g, Minneapolis
RD3-42	$999,999	RD	3	Wind	5	St. Anthony Falls Laboratory	5	U of M, Minneapolis
RD3-12	$1,000,000	RD	3	Wind	1	Beaver Creek, Rock County	5	NSP-Minnesota, Minneapolis
District 6								
RD3-2	$350,000	RD	3	Biomass	6	Sartec, Anoka	6	Sartec, Anoka
EP3-3	$1,994,480	EP	3	Solar	6	St. John's University	3	Best Power, Minnetonka
EP3-13	$894,000	EP	3	Solar	6	Wm O'Brien State Park	4	MN DNR, St. Paul
RD-50	$957,929	RD	2	Biomass	7	Traverse County area	6	EPS, Rogers
District 7								
RD3-28	$979,082	RD	3	Biomass	7	U of M, Morris	7	U of M, Morris
EP-26	$1,200,000	EP	2	Wind	7	Edgerton Area	3	Hilltop Farms, St. Louis Park
RD-34	$999,995	RD	2	Biomass	7	ACSC, Moorhead	FL	University of Florida, Gainesville
RD-50	$957,929	RD	2	Biomass	7	Traverse County area	6	EPS, Rogers
RD-57	$997,000	RD	2	Wind	7	Lake Benton area	4	Windlogics, St. Paul
EP3-13	$894,000	EP	3	Solar	7	Lac qui Parle Wildlife Area	4	MN DNR, St. Paul
District 8								
EP-44	$2,000,00	EP	2	Biomass	8	CMEC, Little Falls	8	CMEC, Little Falls
EP-43	$10,000,00	EP	2	Innovative	8	Excelsior Energy, Coleraine	8	Excelsior Energy, Coleraine
RD3-58	$137,000	RD	3	Wind/Solar	8	West Central Telephone Assoc.	8	WCTA, Menahga
RD3-66	$999,065	RD	3	Biomass	8	Marcel, MN	ND	UND, Grand Forks
RD3-68	$970,558	RD	3	Biomass	8	Haubenschild Farms, Princeton	ND	UND, Grand Forks

Appendix E – Office of Legislative Auditor Evaluation Executive Summary

OLA

OFFICE OF THE LEGISLATIVE AUDITOR

STATE OF MINNESOTA

Evaluation Report Summary / October 2010

Renewable Energy Development Fund

The Renewable Development Fund was created to help develop renewable sources of electricity, but its impact so far has been limited.

Major Findings:

- Since 1999, Xcel Energy has transferred about $165 million into a Renewable Development Fund (RDF), as directed by state law. The fund was established "for development of renewable energy sources," and grants from the fund were initially awarded entirely by the Public Utilities Commission (PUC).
- During the past decade, the Legislature has broadened the RDF's allowable uses, and administrative responsibility for RDF-funded projects has grown more diffuse. Increasingly, the Legislature has played a role in the allocation of RDF funds.
- RDF project costs are borne mainly by Xcel Energy's Minnesota ratepayers. However, representatives of these ratepayers have not been adequately involved in RDF project selection processes.
- Many RDF projects have helped advance knowledge about renewable energy technologies, but a much more limited number have directly contributed to the deployment of these technologies in Minnesota.
- There has been inadequate public communication of RDF-funded project findings and information on the status of the fund.
- Most RDF grants have been awarded using reasonable administrative processes, but there are some inconsistencies among RDF administrators in grant selection criteria and oversight.
- The RDF is maintained by a private corporation outside the state treasury—an unusual arrangement for a state-mandated account.
- State law does not address the use of RDF funds for administrative purposes.

Key Recommendations:

- The Legislature should consider adopting a single process—with clearer criteria—for approving projects to receive RDF grants, assigning authority for final decisions to either the PUC or the Legislature.
- If the Legislature opts to have the PUC approve all projects, it should clarify the purpose and structure of the board that now advises the PUC on project selection.
- If the Legislature prefers to assume final authority for all RDF grant awards, it should (1) create an advisory board to help select projects and (2) designate the RDF as a state fund.
- The Legislature should require that reports on individual projects and the RDF's overall financial status be posted online, preferably at one public Web site.
- The Legislature should amend state law to address the use of the RDF for administrative costs.

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The RDF is maintained by a private company and subject to minimal state oversight, but it has been accessed by the Legislature as if it were a state fund.

Xcel Energy's Minnesota ratepayers pay for most RDF costs, but they are not always represented in RDF project selection processes.

Report Summary

The 1994 Legislature mandated the creation of the Renewable Development Fund (RDF) for the purpose of developing renewable sources of electricity, such as wind, solar, and biomass. Xcel Energy—as operator of the state's nuclear power plants—was required to annually transfer funds to the RDF as part of legislation that allowed Xcel to store spent nuclear fuel at its Prairie Island nuclear plant (and later its Monticello plant). Since 1999, Xcel has transferred about $165 million into the RDF, and Xcel recovers RDF expenditures from its ratepayers.

Through mid-2010, about 200 grants had been made with RDF funds. Nearly half focused on biomass as an energy source. About 86 percent of RDF grants were awarded to Minnesota-based grantees.

The RDF is not part of the state treasury, but the Legislature has increasingly designated how its revenues are used.

The RDF is maintained by Xcel Energy, not a state agency. The Legislature apparently established the RDF as an account outside the state's budget process to discourage its use by future legislatures for purposes other than those originally envisioned.

As a non-state fund, the RDF is subject to limited review by executive branch finance staff, and it has not been subject to financial audits by the Office of the Legislative Auditor. Rarely have funds been established in a similar way in Minnesota state government.

State law says expenditures from the RDF may only be made with the approval of the Public Utilities Commission (PUC). Increasingly, however, the Legislature has played a role in the allocation of RDF funds, transferring them to various agencies to administer legislatively specified initiatives. Also, the Legislature has broadened the RDF's allowable uses, authorizing projects that go beyond the original purpose of developing renewable sources of electricity.

Because the Legislature has accessed the RDF as if it were a state fund, the Legislature should consider making the RDF part of the state treasury and subject to the state's budgeting and oversight processes. This would subject the fund to greater accountability. The Legislature should also consider whether a fund intended to foster renewable energy development throughout Minnesota should continue to be funded by a single utility. However, we do not recommend extending RDF financial obligations to other utilities unless the Legislature establishes a clear rationale in law for collecting such revenues.

Fragmentation of RDF administration has contributed to inconsistencies in project selection and grants management.

Originally, the PUC approved all RDF projects and grantees. The PUC still plays a role in approval and oversight of certain projects, but the Legislature, Department of Commerce, and University of Minnesota now also select projects (without direct PUC participation).

Most RDF grants have been awarded on the basis of reasonable administrative processes for project selection—for example with proper solicitations of proposals and involvement of outside experts. However, fragmentation of administrative responsibilities has contributed to some important inconsistencies.

For example, Xcel Energy ratepayer representatives are involved in the selection of projects approved by the PUC, but they are not formally represented in the selection of other projects. Also, while RDF reports overseen by Xcel Energy acknowledge the role of the RDF and Xcel ratepayers, the reports overseen by the University of Minnesota and Department of Commerce usually do not. In addition, some types of

projects that the PUC has deemed ineligible for RDF funding—such as projects not related to electricity production—have been authorized by the Legislature. Furthermore, Xcel Energy and the Department of Commerce enter into formal contracts with grantees, but the University of Minnesota does not.

State law references a PUC-created advisory body (the RDF Board) in the project selection process, but the law does not adequately specify the composition and purpose of the board. The Legislature should clarify the role of this board.

The Legislature should also consider consolidating the RDF project approval process, rather than continuing with multiple avenues for allocating RDF revenues and authorizing projects. Options for consolidation include (1) relying on a regulatory body (the PUC) to select all projects (as originally prescribed by the RDF law) or (2) establishing a process in which the Legislature would authorize all RDF projects based on input from an advisory body (perhaps a modified version of the RDF Board). The latter option should only be considered if the Legislature brings the RDF into the state treasury and therefore under its budgetary authority. Under either approach, the Legislature should consider adopting clearer statutory criteria to guide the selection of RDF projects.

The RDF's impact on electricity generation has been limited, partly reflecting the types of projects funded.

Many RDF projects have improved knowledge about renewable energy, but the RDF's direct impact on the deployment of these technologies has been limited.

Some RDF-funded grants have aimed to create or refurbish facilities that produce renewable energy. Overall, these grants have had a small impact on Minnesota's electricity generation. In 2007, the electricity produced as a result of these grants equaled less than 0.1 percent of the electricity generated statewide.

Also, some large RDF grants have not led to the creation of energy production facilities that were intended. For instance, a firm spent $10 million in RDF funds to design and plan a "clean coal" plant for which the PUC has not authorized a purchase of power agreement. Another RDF grantee's plans for a hydroelectric facility have been stopped by its inability to obtain a lease of city park land.

RDF-funded "incentive payments" to existing renewable energy facilities have had a somewhat larger impact.[1] In 2007, the electricity produced by these facilities equaled about 1.5 percent of the electricity generated by Minnesota utilities.

Most RDF grants have been for "research and development" projects that address underlying questions about new technologies. While some RDF research projects have contributed to tangible outcomes—such as licenses for commercial uses of technology, or patent applications—most have not had impacts this direct. This partly reflects the fact that many projects approved by the University of Minnesota or PUC have involved preliminary stages of research for unproven technologies (such as new types of photovoltaic cells to capture solar energy). Often this research has involved exploration of basic scientific concepts and assumptions, not applications in the later stages of technology development or ones related to specific Minnesota users.

Early-stage research can be an important part of technology development, but it is unusual for this type of research to be funded by individual states' renewable energy initiatives or the ratepayers of an individual utility. There is probably a role for RDF-funded research of this sort, but our report suggests that the

[1] Under Minnesota's Renewable Energy Production Incentives program, payments are made to facilities based on the actual amount of electricity produced.

The findings of RDF projects have not been adequately conveyed to policy makers and persons who might put this research to use.

Legislature sharpen the focus of the RDF by stating in law a preference for projects with direct Minnesota benefits "where reasonable."

Communication of RDF information has been inconsistent and sometimes inadequate.

Clear communication of RDF project results provides accountability to policy makers, the general public, and ratepayers, and it can also help ensure greater use of the reports.

No single report has presented the Legislature or others with a clear, consolidated overview of all RDF activities, such as a list of all RDF-funded projects. Also, there is no single Web site that provides links to all RDF-funded reports. This partly reflects the fact that RDF projects have been administered by multiple entities. For example, Xcel Energy has provided online links to all final reports issued by the grantees it oversees on behalf of the PUC. However, there are no Web sites with links to all of the RDF reports overseen by the University of Minnesota and Department of Commerce.

Furthermore, the adequacy of individual RDF reports has varied. Many of the reports are challenging to understand—especially for nonexperts, but also for some readers with more technical knowledge. Some of the reports lack the details that might be useful to other researchers, to persons interested in putting the technology to use, or to people who want to better understand what was accomplished with large grants through a publicly authorized program.

State law should address possible uses of RDF funds for administrative costs.

State law does not explicitly address whether—and which—administrative costs can be paid for from the RDF. Xcel Energy and the University of Minnesota have paid for certain RDF administrative costs with RDF funds; the Department of Commerce generally has not.

The PUC has adopted a policy capping the RDF-funded administrative costs borne by Xcel Energy, but this cap does not apply to other entities administering RDF funds. In addition, there have been differing interpretations of the PUC's administrative cost cap.

Summary of Agency Responses

In a letter dated October 12, 2010, Public Utilities Commission Chair David Boyd said the OLA report provides the Legislature and stakeholders with "a solid foundation" to explore the purpose, structure, and oversight of the RDF. He said a centralized approval process—by either the PUC or Legislature—"could be an important strategy" to improve the RDF's coordination and accountability. Boyd said that if the Legislature assigns this role to the PUC, it should consider authorizing the PUC in law to approve projects administered by entities it does not otherwise oversee, such as the Department of Commerce and University of Minnesota. He said if the Legislature decides instead to approve RDF projects itself, it should consider adopting a statewide funding mechanism for the RDF.

In a letter dated October 12, 2010, Xcel Energy Director of Regulatory Administration James Alders said the OLA report is "thorough" and "fair." He said Xcel would prefer to administer RDF resources "with the oversight of the [PUC]."

In a letter dated October 11, 2010, Jonathan Foley and Richard Hemmingsen of the University of Minnesota said they would act "in the very near future" to implement some of the OLA report's recommendations, such as posting final reports online. They advocated having a governing board of legislators and ratepayer representatives provide guidance, oversight, and coordination on RDF projects, while preserving the strengths of the University's "rigorous and effective" project selection process. They also favor having the RDF support a broad range of renewable energy projects, not just projects related to renewable forms of electricity.

The full evaluation report, *Renewable Energy Development Fund*, is available at 651-296-4708 or:
www.auditor.leg.state.mn.us/ped/2010/rdf.htm

Appendix F – RDF Information Sheets (Examples)

INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Investing in Renewable Energy

HIGH PERFORMANCE BIOGAS TREATING

Project Description

Anaerobic digestion is a well known process for converting organic matter into biogas. While biogas is a very useful renewable energy source, combustion of untreated biogas for the removal of hydrogen sulfide (H_2S) contributes to acid rain and is corrosive to combustion engines. This project investigated a technology that will selectively remove H_2S without generating a waste stream or creating new atmospheric emissions of sulfur dioxide (SO_2) or related compounds.

Methodology

Phase 1 - A laboratory study was conducted using 'simulated' biogas consisting of a three gas blend of methane (CH_4), carbon dioxide (CO_2) and H_2S. A chemisorbent was sprayed into a chamber, which came into contact with the simulated biogas that was flowing in an opposite direction from the chemisorbent. Results supported the position that the proposed technology would remove H_2S at an adequate rate.

Phase 2 - A field demonstration using a slip stream of biogas generated from a commercial scale source was conducted at a municipal wastewater treatment facility. The treatment unit was scaled up to handle a larger volume of biogas and operated for six months.

Executive summary

This research project investigated a technology that can selectively remove H_2S from biogas without generating a waste stream or emitting SO_2 to the atmosphere. Anaerobic digestion of organic materials generates biogas that is primarily comprised of methane, CO_2, H_2S, and water vapor. Other contaminants may also be present such as siloxanes. Unless these contaminants are removed, such as H_2S which is the most deleterious, biogas has fairly limited utility.

Grantee: Production Specialties
Project Dates: 10/16/2005 – 11/16/2009
RDF Funding Cycle: 2nd
Project Funding: $228,735 RDF Grant (Total project cost $492,502)
Project ID: RD-72
RDF Mission: To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

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HIGH PERFORMANCE BIOGAS TREATING

There are several treatment methods which remove H_2S from biogas, but virtually all result in the generation of a waste stream, require a sulfur recovery unit or release SO_2 emissions. These treatments also require very large volumes of gas (typically, more that 30 million cubic feet per day) to economically justify the cost to build a facility. As a result, treating biogas from a smaller anaerobic digester operating on agricultural waste (manure and litter) and waste from municipal wastewater treatment plants would be a good market for this technology.

Benefits

The project showed that a selective chemisorbent can be used to reduce the concentration of H_2S to very low levels (concentrations less than 250 ppmv) and therefore increase the utility of biogas as a renewable energy resource. When this technology is applied:

- Reduced operating costs for treating biogas
- No solid waste created as a result of treating the biogas
- Greenhouse gas emissions will be reduced
- Biogas can be used to produce usable energy, as opposed to flaring the biogas, which could displace fossil fuel use

Lessons learned

- The chemisorbent solution must be stored in a sealed container to limit degradation from the reaction with air and oxygen
- The cost to remove H_2S can be done for less then $0.50/mmbtu

Outcomes

The key outcome was confirmation of the chemisorbent system's usefulness to improve the quality of biogas improving the quality of biogas. This included:

- Support for municipal waste water treatment facilities as an 'under served' market
- Regulating low pressure gas flow may require compressing the gas to a level greater than 15 psig and then using a flow control valve to feed the treater system
- Successfully demonstrated that the treating system could remove more than 97 percent of the H_2S from a stream containing as much as 3,500 ppm H_2S

RDF Mission:

To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Development of Remote Telecom Power Kit

Project Description

West Central Telephone Association (WCTA) received an RDF grant to create a power "kit" that combined solar and wind generation technologies with battery storage. The kit is able to provide reliable renewable electricity to power remote telephone switching nodes or other remote applications. WCTA developed a monitoring system, installed five test systems, and optimized equipment settings and configurations to find the ideal system configuration for power production.

Methodology

Five wind/solar hybrid systems were custom-configured to match a variety of wind resources and assorted grid configurations (net metered, grid interactive and off-grid). The systems were installed and data was gathered over the course of approximately six months. During that time experiments were performed to determine how to optimize the system configurations. At the end of the test period, the data was analyzed to determine the technical, economic and market feasibility of the systems. All five systems were shown to be feasible in all categories, with some recommendations that could improve payback on the systems.

Executive Summary

The project goal was to create a simple and cost-effective remote power kit. Although WCTA's interest is to use these kits to supply power to remote telephone switching nodes, the units can also be utilized anywhere that is removed from the electrical grid. The system configuration meets the niche market for distributed electrical generation in telecommunications, agriculture and wilderness endeavors. The project brings renewable energy technology into a mainstream application. In addition, utilization of the kits improves the integrity of rural power systems without requiring additional transmission lines.

Grantee: West Central Telephone Association
Project Dates: 3/12/2009 – 11/11/2009
RDF Funding Cycle: 3
Project Funding: $137,000 RDF Grant (Total project cost $233,926)
Project ID: RD3-58
RDF Mission: To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

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DEVELOPMENT OF REMOTE TELECOM POWER KIT

Benefits

- The power kits help provide rural telephone customers with reliable, uninterruptible service.
- The monitoring solution developed for this research is now being used by other small wind and solar researchers, and has potential to be used in Smart Grid applications.
- The five systems tested during this project will continue to be used for research as other innovative equipment, such as a hybrid wind/solar controller, is brought to market.
- Wind power curves have been independently verified for the five small wind turbines.
- All five wind/solar hybrid remote power kits have been developed to the point where they are technically and economically viable products ready to be brought to a wide variety of potential markets.
- Each hybrid kit on average will reduce electricity consumption by approximately 2,245 kWh per year, thereby preventing emissions in Minnesota of nearly 4,500 pounds of carbon dioxide, 13 pounds of nitrous oxide, seven pounds of sulfur dioxide, and more than one-half gram of mercury each year.

Lessons Learned

- Within the range of the tested equipment, the make and model of the components is less critical than the way the equipment is sited and configured together.
- No matter how sophisticated the monitoring equipment, proper calibrations and data "scrubbing" are vital to the accuracy of data collected.
- The positive response from the rural population indicates that in addition to the excellent public relations gained from installing the renewable energy kits, there is a real market potential for the rural residential, agricultural and small business segments.
- Anything that can help decrease the overall cost of the systems, such as wholesale pricing on components, efficiencies in the installation process, and grants and rebates, as well as anything that can speed up the payback period, such as greater energy efficiencies, or additional funding for energy produced (renewable energy credits, carbon credits, etc.) will increase the market potential for this product.

Special Recognition

- Recognized by U.S. Senator Amy Klobuchar during a "Green Jobs Tour" and received a Carbon Buster Award.
- Received a State Leadership in Clean Energy (SLICE) Award from the Clean Energy States Alliance (CESA).
- A Minnesota State Community and Technical College in the nearby community of Wadena partnered with WCTA to create renewable energy training modules for its electrician programs, including tours of the research sites.
- A mobile solar unit developed through this program was used to recharge emergency battery operated equipment when the City of Wadena (pop. 4,265) was devastated by a F5 tornado.

RDF Mission:
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INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Installation and Operation of a Large-Scale Solar Photovoltaic System

Project Description

Best Power Int'l, LLC received an RDF grant to design, build, own and operate a 400 kW solar photovoltaic (PV) energy generation facility to be located at St. John's University near Collegeville, Minn. Energy generation from the project facility is sold to Xcel Energy. During the summer, the solar facility produces about 20 percent of the Abbey and university's electrical needs, and overall, it will provide four percent annually.

Methodology

The 400 kW direct current facility utilizes a single axis tracking PV system. The major components of the system include photovoltaic modules, azimuth array trackers and inverters. PV solar modules consist of thin wafers made of silicon or other conductive material. When sunlight hits the wafers, a chemical reaction occurs, resulting in the release of electricity. The single axis tracker is designed to withstand 90 mph winds. The tracking system increases the power output of the panels by about 15 percent and produces enough energy for about 65 homes. The trackers require annual maintenance consisting of replenishing lubricant and a visual inspection of moving parts components.

Executive Summary

The project demonstrates the investor-equity concept as an energetically productive and environmentally responsible option for large-scale PV facilities in Minnesota. Knowledge gained has been used to understand issues faced when installing large, commercial solar PV projects. The St. John's site serves as a research and education tool for students and visitors who want to learn more about solar power. The public can view the operation of the facility at **http://live.deckmonitoring.com/?id=saint_johns_solar_farm**.

Grantee: Best Power Int'l, LLC
Project Dates: 8/7/2009 – 5/27/2010
RDF Funding Cycle: 3
Project Funding: $1,994,480 RDF Grant (Total project cost $3,183,303)
Project ID: EP3-3
RDF Mission: To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

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INSTALLATION AND OPERATION OF A LARGE-SCALE SOLAR PHOTOVOLTAIC SYSTEM

Benefits

- Familiarize Minnesotans with solar PV and educated the public on Minnesota's excellent solar resource
- Provide a full-scale demonstration of utility solar power in Minnesota
- Create a foundation of project management experience and knowledge regarding installations of this size
- Generate renewable energy during peak periods and serve as a test case to analyze the effects of solar energy generation on load management

Lessons Learned

- Site Control: For solar installations that are on a leased site, obtaining a 20 year commitment for a large tract of land can be problematic.
- Contractor Selection: Identifying strong project partners with an interest in the industry were critical in maintaining project schedule and managing capital costs.
- Design and Engineering: Involve key regulatory officials early to allow the design team to react to recommendations before final design and product procurement.
- Procurement of PV Modules: Selecting a product is the beginning of a 25+ year relationship and demands critical review of the product specification, warranty and overall company stability.
- Permits and Licenses: Commercial solar projects are new to the region and do not necessarily fit within the current regulatory framework. Indentify key stakeholders early in the process to address potential regulatory obstacles.
- Insurance Verification: General liability coverage options for solar systems are extremely limited.
- Site Preparation: An integrated design that takes into account all aspects of a particular site can reduce costs and shorten the construction schedule.
- Module Delivery: Utilizing American made products avoided complications with U.S. Customs and overseas shipping.

Outcomes

- It provides a full-scale demonstration of utility solar power in Minnesota.
- It has created a foundation of project management experience and knowledge regarding installations of this size.
- It will generate renewable energy during peak periods and will serve as a test case to analyze the effects of solar energy generation on load management.
- In Celebration of Earth Day, St. John's provided tours to the public. More than 300 people attended.
- The project was awarded the Commercial Renewable Energy Project of the Year by the Minnesota Renewable Energy Society in 2010.
- Renewable Energy Production: The facility will produce approximately 575 MWh annually of renewable energy and will contribute toward Xcel Energy's Renewable Portfolio Standard.

RDF Mission:

To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

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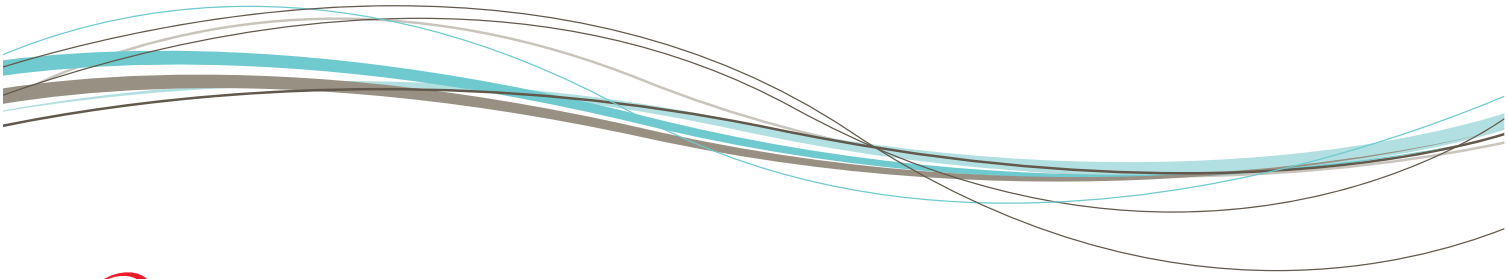

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