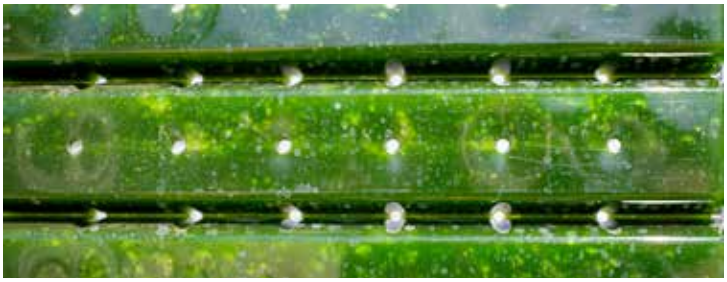
Xcel Energy's
Renewable Development Fund (RDF)

Biennium Report to the Minnesota Public Utilities Commission

January 1, 2013 – December 31, 2014



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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. In Minnesota, Northern States Power Company, a Minnesota corporation (NSP-Minnesota), an Xcel Energy Company, provides electricity to 1.2 million customers and natural gas to about 37,000 customers.

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.

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Funding for the Renewable Development Fund provided by the customers of Xcel Energy.

I. Executive Summary

This 2013 – 2014 Renewable Development Fund (RDF) Biennium Report documents Xcel Energy's efforts to support the development of emerging renewable electric energy technology and reduce customer costs in the process.

Some of the most significant energy production projects commissioned during this biennium were the installation of the first RDF-funded biomass project, a 300 kilowatt (kW) anaerobic digester at Diamond K Farms near Altura, Minnesota, and the installation of the largest photovoltaic (PV) facility in Minnesota, a 2.0 megawatt (MW) solar farm near Slayton, Minnesota. In total, the RDF has funded more than 23.9 MW of generation capacity at renewable energy facilities which has generated more than 135 megawatt hours (MWh) of electricity during this biennium. Research activities ranged from demonstrating and developing sustainable cropping techniques of energy crops to modeling the impact of wind blade turbulence upon power generation at wind farms. RDF funded research has continued to expand the knowledge base for renewable energy technologies by having five articles published in scientific journals and the delivery of two presentations before peers and industry officials during the past two years. A complete list of RDF projects that were active during the biennium is included in Appendix A of this report.

Renewable power sources play an important role in Xcel Energy's electric system in Minnesota. The RDF has funded new electric power supply from biomass, wind, solar, and hydro resources. These resources work to meet customers' energy needs by:

- Diversifying our energy portfolio so we are not overly dependent on any one power source;
- Providing energy at a fixed cost without being subject to changes in fuel prices, which can be the case with power from coal and natural gas; and
- Producing clean power that helps us meet new, tougher environmental requirements, as well as renewable energy standards.

In this biennium, nearly 70 renewable energy proposals were received for the fourth cycle of RDF grant awards. In March 2014, the Minnesota Public Utilities Commission (Commission) approved Cycle 4 awards for 20 renewable energy production projects, predominately featuring solar technologies, 6 renewable energy research and development projects, and 3 higher education block grants to Minnesota colleges and universities. A total of $42 million in grants from the RDF were approved. Nearly 70 renewable energy proposals were considered for funding.

The complete list of awards is summarized in Tables 1 through 3.

TABLE 1 - Cycle 4 Energy Production Awards

ID	Grant Recipient	Project Location	Technology	Grant Award	Project Cost	Capacity (kW)
EP4-3	Minneapolis Public School	Minneapolis	Solar	$ 917,250	$ 1,949,002	485
EP4-4	SGE Partners LLC	South St. Paul	Biomass	$ 5,000,000	$ 14,847,764	1,100
EP4-5	Best Power, Int'l (SSND)	Mankato	Solar	$ 900,000	$ 1,811,857	907
EP4-6	Best Power, Int'l (St. John's Expansion)	Collegeville	Solar	$ 172,213	$ 414,033	198
EP4-7	Anoka Ramsey Community College	Coon Rapids	Solar	$ 828,900	$ 1,825,976	458
EP4-9	Mondovi Energy Systems	Mondovi, WI	Biomass	$ 2,000,000	$ 13,220,683	2,000
EP4-11	Innovative Power Systems, Inc.	St. Paul	Solar	$ 1,850,000	$ 2,698,200	967
EP4-13	Metropolitan Airports Commission	Bloomington	Solar	$ 2,022,507	$ 4,189,000	1,180
EP4-15	MN Renewable Energy Society	TBD	Solar	$ 2,661,320	$ 4,036,420	1,000
EP4-20	Target Corporation	St. Paul	Solar	$ 583,513	$ 1,060,933	350
EP4-21	Farmamerica	Waseca	Solar/Wind	$ 600,000	$ 600,000	120
EP4-22	Minneapolis Park & Recreation Board	Minneapolis	Solar	$ 969,741	$ 1,119,133	200
EP4-24	Bergey Windpower Co.	Central Minnesota	Wind	$ 1,106,600	$ 3,191,745	500
EP4-29	Dragonfly Solar, LLC	Dodge Center	Solar	$ 1,650,000	$ 2,650,000	998
EP4-34	City of St. Paul	St. Paul	Solar	$ 555,750	$ 741,000	105
EP4-39	Goodwill Solar, LLC	St. Paul	Solar	$ 1,075,250	$ 1,525,250	700
EP4-41	City of Hutchinson	Hutchinson	Solar	$ 958,369	$ 1,742,489	402
EP4-42	Aurora St. Anthony Limited, LLC	St. Paul	Solar	$ 398,000	$ 911,798	252
EP4-43	Cornerstone Group	Bloomington	Solar	$ 310,310	$ 705,250	152
EP4-48	Oak Leaf Energy Partners Ohio, LLC	Shakopee	Solar	$ 2,000,000	$ 2,864,810	1,000
			Total	**$ 26,559,723**	**$ 62,105,343**	**13,074**

TABLE 2 - Cycle 4 Research and Development Awards

ID	Grant Recipient	Project Location	Technology	Grant Award	Project Cost
RD4-2	U of M (Dairy)	Morris	Solar/Wind	$ 982,408	$ 982,408
RD4-4	Xcel Energy Business Systems	Minneapolis	Solar	$ 390,000	$ 505,000
RD4-11	U of M - NRRI (Torrefaction)	Minneapolis	Biomass	$ 1,899,499	$ 2,345,502
RD4-12	U of M (Noise)	Minneapolis	Wind	$ 625,102	$ 625,102
RD4-13	U of M (VWS)	Minneapolis	Wind	$ 1,391,684	$ 1,391,684
RD4-14	Barr Engineering	Minneapolis	Wind	$ 161,081	$ 161,081
			Total	**$ 5,449,774**	**$ 6,010,777**

TABLE 3 - Higher Education Block Grants

ID	Grant Recipient	Location	Grant Award
HE4-1	Minnesota West Community and Technical College	State Wide	$5,500,000
HE4-2	University of St. Thomas	Chisago City	$2,157,215
HE4-3	University of Minnesota	Minneapolis	$3,000,000
		Total	**$10,657,215**

Four Cycle 4 energy production projects commenced in 2014. One project (EP4-6) installed an additional 182 kW capacity to the St. John's University Solar farm in Collegeville. Construction of the new arrays was completed and those arrays began to produce power in December 2014. The project incorporated a side-by-side comparison of linear axis tracker technology and fixed tilt technology. A static, ground-mounted PV array was installed adjacent to the existing single-axis tracking array currently in place at the St. John's Solar Farm. Data obtained from the two arrays are available to help researchers and developers determine which technology may be best suited for energy needs and constraints for a particular site in Minnesota.

With each funding cycle of the RDF, we learn more about the process and the selection of projects. As with previous cycles, unique challenges presented themselves during the Cycle 4 process. Transparency is important to ensure that the selection of projects is fair and RDF monies are directed to projects that are in the best interest of our electric customers who provide the sole support for the RDF. An extensive evaluation led to the identification of four main areas of the selection process that will be areas of focus in future RDF cycles. The four areas identified are:

- The decision making process,
- The purpose and amount of grants,
- The role of the RDF advisory group, and
- Communications.

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 (the RDF Statute) initially required NSP-Minnesota, as the public utility owner of the plant, to transfer $500,000 for each dry cask containing spent fuel to a renewable energy fund after January 1, 1999, amounting to $9 million annually. In 2003, this statute was amended to extend the life of the nuclear-waste storage at Xcel Energy's Prairie Island plant and increased the amount Xcel Energy 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 V for further discussion of REPI.)

In 2007, the statute was further amended for an additional assessment of $350,000 for each dry cask stored at Xcel Energy's Monticello nuclear generating plant. Ten casks were filled in 2008 and continue to be stored at our Monticello plant. Since 2008, a combined total of $19.5 million has been set-aside annually for the RDF program. In 2013 the annual set-aside increased to $22.75 million and in 2014 increased to $24.6 million.

St. John's Solar Farm—comparison of tracking and non-tracking solar arrays

In 2012, the Minnesota Legislature amended the RDF Statute. These changes recognize that the Commission is the appropriate entity to exercise oversight of the RDF program, given that it is funded entirely by Xcel Energy ratepayers. The new legislation provides more flexibility for the Commission to modify, if agreed to by Xcel Energy, or disapprove proposed RDF expenditures that it finds to be non-compliant with the RDF statute or otherwise not in the public interest. In 2012, the amendments added language to focus funding on the mission previously developed by the RDF advisory group: to increase market penetration of renewable energy, to promote the start-up, expansion, and attraction of renewable energy projects, to stimulate research and development, and to develop near-commercial and demonstration scale renewable energy projects or renewable

energy infrastructure delivery projects within the state. The RDF Statute was also amended to add the already-used practice of having all energy production and research and development proposals evaluated by an independent evaluator. Definition was given to the consulting role that the RDF advisory group provides and the amendments clarified that Xcel Energy has full and sole authority to determine which expenditures shall be submitted to the Commission for approval. Several RDF administrative requirements that were already in place due to Commission orders were incorporated into the RDF Statute. These incorporations included that reports must contain sufficient detail for technical readers as well as a clearly written summary for non-technical readers, reports must be posted online on a public web site and reports must acknowledge that the project was made possible in whole or part by Xcel Energy's Minnesota electric ratepayers.

The cost of Commission-approved program expenses allocated to Minnesota is recovered through an adjustable surcharge on Xcel Energy's customer bill statements as part of their monthly charges for electricity. This surcharge mechanism is known as a "rate rider." On October 1st each year, Xcel Energy submits an RDF summary report to the Commission. This summary report contains a proposed RDF rate rider charge for the upcoming year and an annual financial report which summarizes the RDF programs past expenses and a two-year expense forecast. In 2014, the RDF charge was $0.000750 per kWh. For 2015, Xcel Energy reduced the RDF charge to $0.000563 per kWh. For a typical residential customer using 750 kWh per month, the RDF cost per month is 42 cents.

Diamond J Dairy—Anaerobic digester produces biogas from a 1,100 cow dairy.

The RDF advisory group was developed in 2000 by Xcel Energy and established by 2001 order of the Commission, and assists Xcel Energy in the review of applications and makes funding recommendations to Xcel Energy that, in turn, makes recommendations to the Commission. For the last three cycles, Xcel Energy has used technical and professional consulting resources, as needed, to evaluate proposals. The advisory group makes recommendations regarding the selection of projects and currently has seven members consisting of representatives from the following organizations:

- Environmental interests (two)
- Prairie Island Indian Community (one)
- Residential customers (one)
- Commercial and Industrial customers (one)
- Xcel Energy (two)

The RDF advisory group is further detailed in Appendix B.

Xcel Energy program staff has responsibility for the practical day-to-day administration of the RDF grant contracts and resources.

III. RDF Program Mission and Performance Metric Evaluation

The RDF's mission was established on October 5, 2006 through a Commission Order as an operational guideline for the fund.

"The overall purpose (mission) of the fund is to increase the market penetration within the state of renewable electric energy resources at reasonable costs, promote the start-up, expansion, and attraction of renewable electric energy projects and companies within the state, stimulate research and development within the state into renewable electric energy technologies, and develop near-commercial and demonstration scale renewable electric projects or near-commercial and demonstration scale electric infrastructure delivery projects if those delivery projects enhance the delivery of renewable electric energy."

Energy Performance Systems tree harvester demonstration

The University of Minnesota researched planting, cultivation, and harvesting strategies of wild grasses and woody plants that can be used as an energy crop on highly erodible land that has minimal cropping options.

The 2012 amendments to the RDF Statute further supported this mission by placing it in the RDF Statute. The RDF program has established the following performance metrics for evaluating program effectiveness:

A. Expansion of knowledge base

B. Environmental benefits

C. Economic benefits

These performance metrics, detailed below, are revisited after the completion of each project to determine whether the project:

- Remained on course with its stated goals,
- Furthered RDF program objectives, and
- Was a prudent and beneficial grant award on behalf of our customers.

A. 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 the RDF 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, five articles were published in scientific journals. Two papers were presented at a variety of regional and national 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, during the previous biennium there were two RDF research projects that were actively seeking patents and one RDF research project that received its patent. In 2012, Northern Plains Power Technologies submitted a patent application for their Cycle 3 project (RD3-21) which is still pending approval. The project developed methods to detect islanding created when distributed generation facilities are connected to the power grid. The University of Florida filed a patent, which is pending, for findings developed during their Cycle 2 project, (RD-34) which demonstrated a system for anaerobic digestion of solid and soluble organic wastes from sugar beet processing. A Cycle 1 project (CW-06) received a patent for a pulse-width modulation controller that can be used for matrix converters used in the wind industry.

Minnesota Valley Alfalfa Producers—Research to improve pelleting process for biomass to be use as a fuel for an energy facility

B. Environmental Benefits. 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 135,219 MWh of electricity during the 2013-2014 biennium. Overall, RDF projects have generated a total of 323,970 MWh of electricity from renewable energy resources. **(See Table 4**).

TABLE 4 - Electrical Generation (MW)

Type	Prior Biennium's	Current Biennium	Total Generation
Biomass	0	589	589
Hydro	27,060	74,646	101,701
Solar	12,573	10,013	22,586
Wind	149,118	49,970	199,088
Total	**188,751**	**135,219**	**323,970**

Hydro, solar and wind resources create no air emissions. When compared to electrical energy produced by coal, the RDF generation has provided environmental benefits through the reduction of several primary air emissions **(See Table 5)**. Hydro, solar and wind-sourced electrical generation offsets the release of particulate matter resulting from conventional electrical power generation. RDF electrical generation projects are helping Xcel Energy meet a goal to reduce CO_2 emissions 20 percent from 2005 levels by 2020.

TABLE 5 - Air Emission Reductions (Compared to Coal)

Emission	Prior to 2013 Pounds	Biennium (2013 – 2014) Pounds	Total Pounds
CO_2	265,599	180,103	445,702
SO_2	499	270	769
NO_X	375	203	578
VOC_S	9.54	6.80	16.34
Hg	4.27	2.70	6.97
Pb	2.48	1.76	4.24

Emissions data is based on Xcel Energy's 2013 Corporate Responsibility Report

RDF projects have also generated Renewable Energy Credits (RECs) which are tradable, non-tangible energy commodities. These credits represent the environmental attributes of the power produced from renewable energy projects. RDF projects have generated 302,206 RECs which are used to meet Xcel Energy's renewable energy goals and requirements **(See Table 6)**.

TABLE 6 - Renewable Energy Credits (RECs)

REC Measurement	Prior to 2013	Biennium (2013 - 2014)	Total
kWh	195,013	222,773	417,786
Credits	145,821	156,385	302,206

C. Economic Benefits. RDF grants for renewable energy research and development and energy production initiatives generate significant economic benefits. During the biennium, RDF expenditures included more than $3.8 million in RDF project grant reimbursements, $13.1 million in REPI payments, more than $5.8 million for solar rebates, and $12.1 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, and in some cases, the fostering of new or expanded business opportunities. In cases where permanent energy production facilities are constructed, RDF investments 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 the RDF program inception in 2002, RDF grant awards have stimulated the investment of more than $157 million in renewable energy. This includes more than $112 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 than $45 million in research. Energy production projects that have been active during the past biennium, have leveraged over $11.6 million, which is equivalent to $1.58 for every RDF dollar spent. **(See Table 7)**

TABLE 7 - Energy Production Funds Leveraged (Active Projects in 2013 – 2014 Biennium)

Technology	Grant	Cost Share	Total Costs	Leverage
Biomass	$936,530	$2,688,974	$3,625,504	287%
Hydro	$1,538,591	$2,612,647	$4,151,238	170%
Solar	$4,878.966	$6,350,494	$11,229,460	130%
Total	**$7,354,087**	**$11,652,115**	**$19,006,202**	**158%**

An additional $4.2 million has been leveraged during the past biennium for research and development which includes $4.0 million 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 8)**. RDF grant dollars leverage $0.86 for every grant dollar invested.

TABLE 8 - Research and Development Funds Leveraged (Active Projects in 2013 – 2014 Biennium)

Technology	Minnesota			Outstate			Total Leverage
	RDF Grant	Cost Share	Leverage	RDF Grant	Cost Share	Leverage	
Biomass	$3,076,287	$3,669,914	119%	$850,000	$274,511	32%	100%
Wind	$999,598	$286,199	29%	$0	$0	0%	29%
Total	**$4,075,885**	**$3,956,113**	**97%**	**$850,000**	**$274,511**	**32%**	**86%**

2. **Job Creation:** Money 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, provides 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 $3.8 million in RDF project grant funds disbursed in 2013 and 2014, RDF project activity leveraged an additional $4.4 million for an investment of $6.8 million in renewable energy projects. This resulted in $3.5 million for construction projects to produce more renewable energy generation capacity and $3.3 million to fund renewable energy research. This investment resulted in 320 to 350 construction related jobs and about 300 research jobs that were either created or retained during 2013 – 2014.

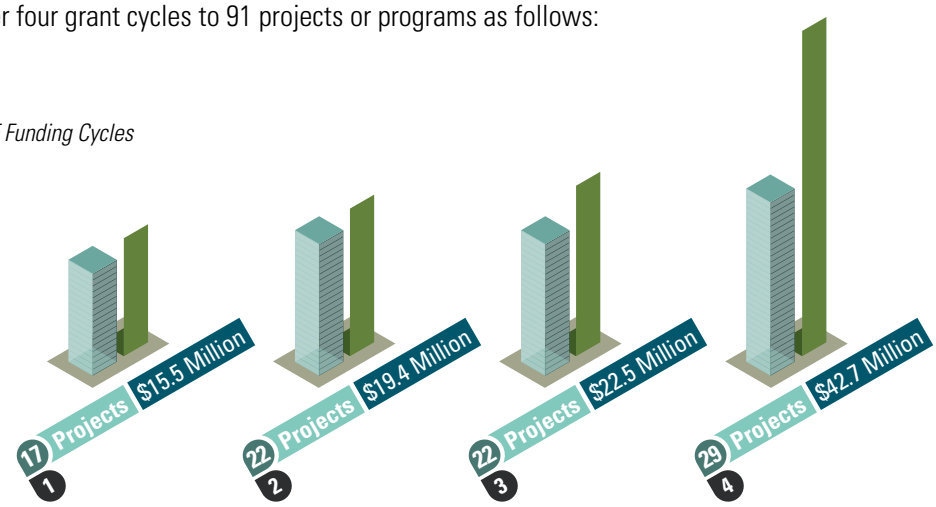
   It should be noted that one out-of-state project used a project host located in the NSP-Minnesota service area is not included in the previous numbers. This project association keeps the research relevant to Minnesota and directs additional RDF funds to businesses and organizations in the state. This project was:

   - P & J Farms, Northfield, Minnesota, is host to the gasification demonstration for Coaltec USA (RD3-77).

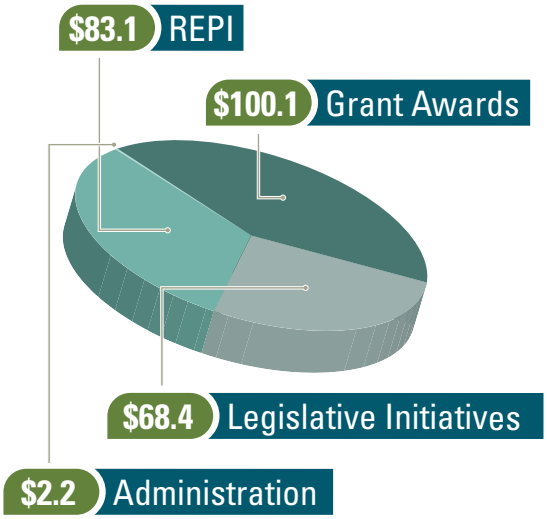
IV. RDF Funding Activity

Since 2001, the RDF program has provided $253.8 million for renewable energy initiatives including $83.1 million for REPI payments, $68.4 million for legislatively mandated projects and programs, and $2.2 million for general program support. These mandated programs included the appropriation of $15 million ($5 million each year for 2010–2012) to the University of Minnesota for the Initiative for Renewable Energy and Environment (IREE). The balance of $100.1 million has been awarded over four grant cycles to 91 projects or programs as follows:

RDF Funding Cycles

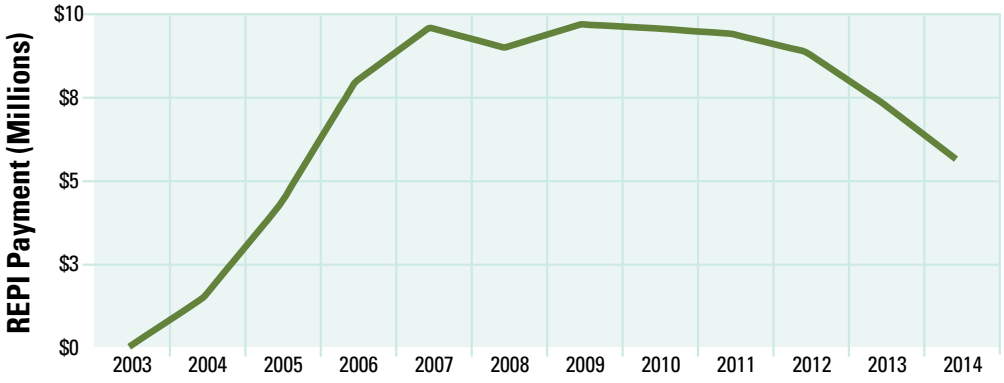


RDF Spending



As specified by Minn. Stat. §116C.779, subd. 2., the RDF program provides Renewable REPI payments up to $10.9 million for qualifying projects 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 1.5 cents per kWh for qualified wind projects through 2018, biogas projects through 2015, and hydro projects through 2021. Approximately 225 MW of small wind facilities are subscribed in the program. REPI payments since program inception have totaled about $83.1 million.

REPI Annual Payments

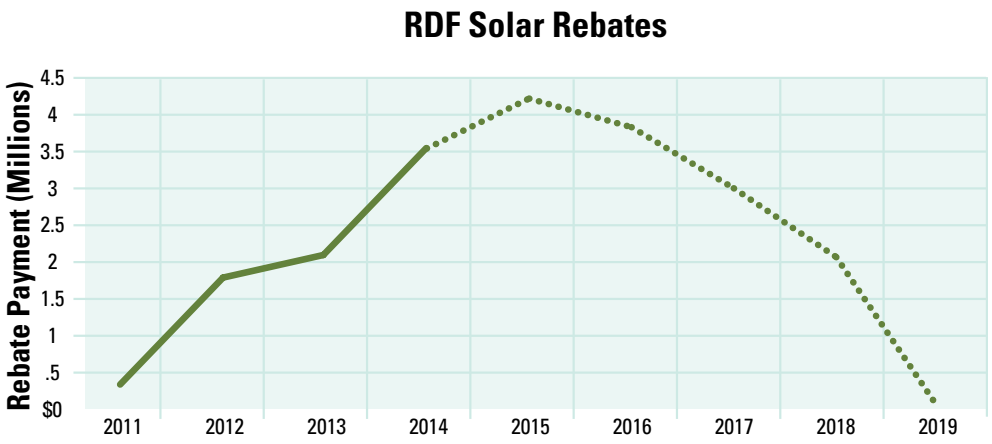


Initiative for Renewable Energy and the Environment (IREE)

In 2009 the State Legislature appropriated $2.2875 million from the RDF to support renewable energy projects and programs administered by the Office of Energy Security and $15 million from the RDF to support the University of Minnesota's Initiative for Renewable Energy and the Environment (IREE).

RDF Solar Rebates

In 2010, the Minnesota Legislature approved a measure to dedicate $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 Xcel Energy 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 manufactured or assembled in Minnesota. There are two businesses producing solar panels in Minnesota that qualify for the Minnesota Bonus solar rebates: tenKsolar in Bloomington, Minnesota and Silicon Energy in Mountain Iron, 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.



Solar rebates were first disbursed in 2011 for the installation of 383 kW photovoltaic capacity. Since the inception of the program, $8.0 million has been disbursed to install 3,229 kW of PV capacity in Minnesota and have all used Minnesota-made modules. In the biennium $5.8 million has been paid in rebates and 1,665 kW of additional PV capacity has been installed.

Solar*Rewards

In 2013, Minnesota legislation was approved to establish a solar energy incentive program to be operated for five consecutive calendar years commencing in 2014 with $5,000,000 allocated for each of the five years from the RDF. Commencing with the commissioning of a PV system, a qualifying system would be paid a production incentive over the course of 10 years. On October 31, 2013, Xcel Energy filed a program proposal with the Department of Commerce seeking approval of the Company's new Solar*Rewards program which was approved on March 28, 2014. Solar*Rewards incentives cannot be combined with incentives from other state and utility programs, including Made in Minnesota (MIM) Solar Energy Production Incentive Account. In 2014 the Solar Energy Incentive Program incurred $55,503 of expenses.

MIM Solar Incentive Account

In 2013, Minnesota legislation established a "Made in Minnesota" solar energy production incentive account as a separate account in the special revenue fund in the state treasury. Beginning January 1, 2014, and each January 1 thereafter, through 2023, for a total of ten years each electric public utility subject to Conservation Improvement Program (CIP) requirements must annually pay to the Commissioner of Commerce five percent of the minimum amount it is required to spend on CIP. Affected utilities are Xcel Energy, Minnesota Power, Otter Tail Power and Alliant. Funds from the RDF, when added to the total amount paid to by the four affected utilities, makes a combined annual payment of $15 million. In 2014 the RFD payment to the MIM Solar Incentive Account was $12,021,295.

V. Overall RDF Project Status

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. Milestone reports are posted on the RDF web page at **www.xcelenergy.com/rdf**.

A. Current Contracts

RDF projects have contract periods of varying lengths based upon the specific variables and time requirements inherent to the project. Project duration has ranged from two months to 153 months but the typical project length is just over three years, at 40 months. Some projects are dependent upon seasonal factors (i.e. wind patterns, weather, crop growth, winter construction restrictions, etc.), which require project tasks to be synchronized with calendar dates. The ability for the RDF to allow multi-year projects has been advantageous to biomass research projects that track impact parameters over the course of several growing seasons.

Of the 66 projects that have entered into RDF grant contracts since the RDF's inception, four projects signed contracts during the biennium **(See Table 9)**.

TABLE 9 - Summary of Projects Initiated (1/1/2013 – 12/31/2014)

	Prior to 12/31/2012	1/1/2013 – 12/31/2014
Cycle 1	17	0
Cycle 2	23	0
Cycle 3	22	0
Cycle 4	0	4
Total	**62**	**4**

Fifty-one projects were completed prior to the biennium, seven projects were completed during the biennium and eight projects with signed contracts remain active **(See Table 10)**.

TABLE 10 - Summary of Completed Projects (1/1/2013–12/31/2014)

	Prior to 12/31/2012	1/1/2013 – 12/31/2014	Active as of 1/1/2015
Cycle 1	16	0	1
Cycle 2	21	2	0
Cycle 3	14	5	3
Cycle 4	0	0	4
Total	**51**	**7**	**8**

B. Energy Production Project Status

Nine energy production projects were active during the biennium. Three of these have installed an additional capacity of 3.082 MW **(See Table 11)**. Annual electrical production from this added generation capacity is projected to be 6,033 MWh. More than $10.5 million of RDF funding has been awarded and obligated to these nine RDF energy production projects. This investment has leveraged an additional $11.7 million for project design, planning, and materials for construction projects in Minnesota during this 2013 – 2014 biennium period.

TABLE 11 - Summary Energy Production Projects (1/1/2013–12/31/2014)

Technology	Total Projects	Completed Projects	Installed Capacity (MW)	Funds Leveraged
Biomass	1	1	.300	$2,688,974
Hydro	1	0	0	$2,612,647
Solar	6	3	2.782	$6,350,494
Wind	1	0	0	$0
Totals	**9**	**4**	**3.082**	**$11,652,115**

C. Research and Development Project Status

Six research and development (R&D) projects were active during the biennium with three completing their research activity during that period. **(See Table 12)**. More than $4.9 million of RDF funding has also been awarded for these R&D projects of which $0.8 million was disbursed during the biennium. This investment has leveraged an additional $4.2 million from other sources for renewable energy research for a total of $5.0 million during this biennium period. All of these research funds were utilized for research and development projects within Minnesota.

TABLE 12 - Summary Research Development Projects (1/1/2013 – 12/31/2014)

Technology	Total Projects	Completed Projects	Published Articles	Scientific Papers	Funds Leveraged
Biomass	5	2	4	2	$3,944,425
Wind	1	1	1	0	$286,199
Totals	**6**	**3**	**5**	**2**	**$4,230,624**

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 $7.3 million was dispersed in the biennium to reimburse project costs **(See Table 13**). Some projects were completed under budget, and $2,494,201 in savings was credited to the RDF program for future RDF grant awards.

TABLE 13 - Use of Funds Under RDF Contract (1/1/2013 – 12/31/2014)

Cycle	Contracted RDF Funds	RDF Funds Dispersed			Funds not utilized
		Prior to 12/31/2012	1/1/2013 – 12/31/2014	Balance after 1/1/2015	
Cycle 1	$15,550,401	$11,671,876	$0	$3,561,409	$317,116
Cycle 2	$29,440,996	$26,401,410	$968,149	$0	$2,071,437
Cycle 3	$22,510,293	$18,470,652	$2,767,198	$1,166,795	$105,648
Cycle 4	$3,148,554	$0	$0	$3,148,554	$0
Total	**$70,650,244**	**$56,543,938**	**$3,735,347**	**$7,876,758**	**$2,494,201**

E. Project Benefits to NSP-Minnesota Customers

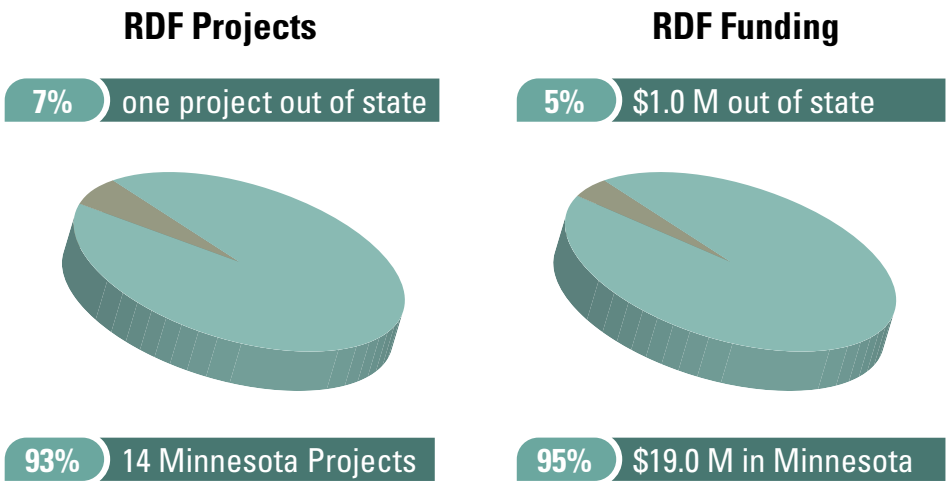
A majority of RDF projects are based in Minnesota. As a result, a majority of RDF dollars are also spent in the NSP-Minnesota service area. One of the selection criteria for RDF grant projects relates to the benefits a project will bring to NSP-Minnesota customers. Therefore, research activity conducted by an entity that is not located in Minnesota needs to be applicable and transferable to Minnesota. 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 14). Only one research project in the biennium was not based in Minnesota.

TABLE 14 - Minnesota Hosts Activities (1/1/2013–12/31/2014)

Project	Grantee	Minnesota Host	Host Location	Host Activity
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 located within their boundaries.

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



Sartec researched how algae can feed on the CO_2 emissions from a coal-fired power plant to then be harvested and have the lipids converted into bio-diesel. The biofuel can then be sold to offset emission reduction costs.

VI. Conclusion

The RDF program continues to be a source of funding for renewable electric energy research, development, and demonstration projects in Minnesota. Over the past ten years and four 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. There have been many lessons learned in conjunction with past RDF projects and these lessons will be applied 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 A - Active RDF Projects During Biennium (1/1/2013–12/31/2014)

	Contract	Project Name	Grant	Type	Cycle	Category	Status	Project End Date
1	AH-01	Crown Hydro	$5,100,000	EP	1	Hydro	Active	1/20/2017*
2	EP-51	Diamond K Dairy	$936,530	EP	2	Biomass	Complete	5/18/2014
3	RD-50	Energy Performance Systems	$957,929	RD	2	Biomass	Complete	2/19/2013
4	EP3-10	Outland Renewable	$2,000,000	EP	3	Solar	Complete	4/1/2013
5	EP3-11	City of Minneapolis	$2,000,000	EP	3	Solar	Complete	1/15/2013
6	EP3-13	Minnesota Dept. of Natural Resources	$894,000	EP	3	Solar	Complete	3/12/2013
7	RD3-1	University of Minnesota	$992,989	RD	3	Biomass	Active	1/22/2014
8	RD3-28	University of Minnesota	$979,082	RD	3	Biomass	Complete	9/22/2013
9	RD3–42	University of Minnesota	$999,999	RD	3	Wind	Complete	8/7/2013
10	RD3-69	Minnesota Valley Alfalfa Producers	$1,000,000	RD	3	Biomass	Active	1/23/2015
11	RD3-77	Coaltec Energy USA	$1,000,000	RD	3	Biomass	Active	4/22/2016*
12	EP4-5	Best Power – SSND	$900,000	EP	4	Solar	Active	10/3/2016
13	EP4-6	Best Power – St. Johns Expansion	$172,213	EP	4	Solar	Active	4/2/2016
14	EP4-22	Bergey Windpower	$969,741	EP	4	Wind	Active	4/28/2016
15	EP4-24	Minnesota Park & Recreation Board	$1,106,600	EP	4	Solar	Active	11/24/2017
		Total RDF Projects	**$20,009,083**					

** Project end date dependent upon anticipated completion of project activity.*

Appendix B - RDF advisory group as of January 2015

- Ben Gerber, manager energy policy
  Minnesota Chamber of Commerce
  Representing commercial and industrial customers

- Tami Gunderzik, senior manager product portfolio
  NSP-Minnesota
  Representing NSP-Minnesota

- Eric Jensen, energy coordinator
  Izaak Walton League
  Representing the environmental community

- Michelle Rosier, senior campaign and organizing manager
  Sierra Club North Star Chapter
  Representing the environmental community[1]

- Kevin Schwain, manager emerging customer program
  NSP-Minnesota
  Representing NSP-Minnesota

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

- Heather Westra
  Representing Prairie Island Indian community

RDF Administration

- Paul Lehman, program manager

- Mark Ritter, grant administrator

[1] *Prior to Ms. Rosier joining the RDF advisory group, Linda Taylor was an environmental representative on the RDF advisory group from 2012 – 2014.*

Outland Renewable Energy —When finished, this 2 MW photovoltaic installation near Slayton, Minn. will be the largest solar facility in Minnesota.

Appendix C - Scientific Articles and Presentations

Scientific Articles

Date	Grant #	Grantee	Article Title	Journal
January, 2013	RD3-42	U of M	Drag Reduction in Large Wind Turbines Through Riblets: Evaluation of Riblet Geometry and Application Strategies	*Renewable Energy*
February , 2013	RD3-28	U of M	Crop and Soil Responses to Using Corn Stover as a Bioenergy Feedstock	*Agriculture In-Press*
January, 2014	RD3-28	U of M	Aspen Plus Simulation of Biomass Integrated Gasification Combined Cycle Systems at Corn Ethanol Plants	*ScienceDirect*
February, 2014	RD3-28	U of M	Modelling of Superheated Steam Drying for Combined Heat and Power at a Corn Ethanol Plant Using Aspen Plus software	*ScienceDirect*
February, 2014	RD3-28	U of M	An Unsteady-State Two-Phase Kinetic Model for Corn Stover Fluidized Bed Steam Gasification Process	*ScienceDirect*

Papers/Presentations

Date	Grant #	Grantee	Paper Title	Conference	Location
January, 2013	RD3-1	U of M	*Short-term Effects of Native Grassland Biofuel Harvests on Birds and Small Mammals in Western Minnesota*	73rd Annual Midwest Fish and Wildlife Conference	Wichita, KS
February, 2013	RD3-1	U of M	*Short-term Effects of Native Grassland Biofuel Harvests on Birds and Small Mammals in Western Minnesota*	Minnesota Chapter of the Wildlife Society	Walker, MN

Lower St. Anthony Falls Hydroelectric Facility—Minneapolis, Minn.

Appendix D - Location of RDF Projects by Congressional District

RDF Projects (1/1/2013-12/31/2014)								
RDF Contract	Grant	Type	Cycle	Renewable Category	Host Site		Project Sponsor	
					District	Location	District	Organization
District 1								
EP-51	$936,530	EP	2	Biomass	MN01	Diamond K Dairy, Altura	CA	RCM Digesters, Berkley
EP4-5	$900,000	EP	4	Solar	MN01	School Sisters, Mankato	MN05	Best Power, Hopkins
District 2								
EP3-13	$894,000	EP	3	Solar	MN02	Afton & Nerstrand State Parks	MN04	MN DNR, St. Paul
RD3-1	$992,989	RD	3	Biomass	MN02	Rahr Malting, Shakopee	MN04	U of M, St. Paul
RD3-77	$1,000,000	RD	3	Biomass	MN02	P & J Farms, Northfield	IL	Coaltec Energy USA, Carterville
District 3								
RD-50	$957,929	RD	2	Biomass	MN07	Traverse County area	MN03	EPS, Rogers
District 4								
EP3-13	$894,000	EP	3	Solar	MN04	Minnesota state parks	MN04	MN DNR, St. Paul
RD3-1	$992,989	RD	3	Biomass	MN02	Rahr Malting	MN04	U of M, St. Paul
District 5								
AH-01	$5,100,000	EP	1	Hydro	MN05	Crown Hydro, Minneapolis	MN05	Crown Hydro, Minneapolis
EP3-10	$2,000,000	EP	3	Solar	MN07	Outland, Slayton	MN05	Outland, Minneapolis
EP3-11	$2,000,000	EP	3	Solar	MN05	Minneapolis Convention Center	MN05	City of Minneapolis
EP3-13	$894,000	EP	3	Solar	MN05	Ft. Snelling State Park	MN04	MN DNR, St. Paul
RD3-42	$999,999	RD	3	Wind	MN05	St. Anthony Falls Laboratory	MN05	U of M, Minneapolis
EP4-5	$900,000	EP	4	Solar	MN01	School Sisters, Mankato	MN05	Best Power, Hopkins
EP4-5	$172,213	EP	4	Solar	MN06	St. John's University, Collegeville	MN05	Best Power, Hopkins
EP4-24	$1,106,600	EP	4	Solar	MN05	Minneapolis regional parks	MN05	Minneapolis Park & Rec Board
District 6								
EP3-13	$894,000	EP	3	Solar	MN06	Wm O'Brien State Park	MN04	MN DNR, St. Paul
EP4-6	$172,213	EP	4	Solar	MN06	St. John's University, Collegeville	MN05	Best Power, Hopkins
EP4-22	$969,741	EP	4	Wind	MN06	Stearns, Benton & Meeker Co.	OK	Bergey Windpower, Norman

Appendix D - Location of RDF Projects by Congressional District (continued)

RDF Projects (1/1/2013-12/31/2014) continued								
RDF Contract	Grant	Type	Cycle	Renewable Category	Host Site		Project Sponsor	
					District	Location	District	Organization
District 7								
RD-50	$957,929	RD	2	Biomass	MN07	Traverse County area	MN03	EPS, Rogers
EP3-10	$2,000,000	EP	3	Solar	MN07	Outland, Slayton	MN05	Outland, Minneapolis
EP3-13	$894,000	EP	3	Solar	MN07	Lake Sheteck & Lac qui Parle SP	MN04	MN DNR, St. Paul
RD3 28	$979,082	RD	3	Biomass	MN07	U of M, Morris	MN07	U of M, Morris
RD3-69	$1,000,000	RD	3	Biomass	MN07	MnVAP, Priam	MN07	MnVAP, Raymond
EP4-22	$969,741	EP	4	Wind	MN07	Stearns, Benton & Meeker Co.	OK	Bergey Windpower, Norman
District 8								
EP3-13	$894,000	EP	3	Solar	MN08	Wild River State Park	MN04	MN DNR, St. Paul

Minnesota Department of Natural Resources photovoltaic installation —Wild River State Park

Appendix E - RDF Information Sheets (Examples)

CONNECT

INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Investing in Renewable Energy

MINNEAPOLIS CONVENTION CENTER SOLAR PROJECT

Executive Summary

The city of Minneapolis installed a 600 kilowatt photovoltaic (PV) array on the roof of the Minneapolis Convention Center. The array produces approximately 750,000 kilowatt hours per year. Energy generated is completely used on site and is approximately 4.3 percent of the convention center's electric needs. The system was commissioned on Nov. 24, 2010 and by April 2012 had generated one gigawatt hour of electricity.

Project Description

The most visible parts of the array are the 2,613 PV modules fixed to the convention center's roof and cover an area larger than two and a half football fields. Electricity is fed directly to the convention center, where it can be used or sent to the grid if it's not needed. The array is designed to maximize energy during the time of the day when energy consumption is at its peak. To more closely match the marketplace load, two-thirds of the modules were placed so that they face due south and a third of the modules were placed so that they face southwest which extends the solar production later in the day. Production can be tracked by 15-minute intervals to determine system performance and to analyze the affect the facility has on the power grid.

Methodology

- The ideal panel tilt to maximize energy generation for Minnesota is approximately 37 degrees. The panels were tilted 30 degrees to reduce wind load at only a minimal loss of generation.
- To preserve the integrity of the convention center's rooftop, a UniRac racking system was utilized because it had no extra weight from ballast and minimal attachment points.
- Incorporation of wind shields allow for protection from continuous winds of up to 90 miles per hour.

Grantee: City of Minneapolis
Project Dates: 7/15/2010 – 1/15/2013
RDF Funding Cycle: 3
Project Funding: $2,000,000 RDF Grant (Total project cost $3,096,756)
Project ID: EP3-11
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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RENEWABLE DEVELOPMENT FUND | INVESTING IN RENEWABLE ENERGY

INFORMATION SHEET

MINNEAPOLIS CONVENTION CENTER SOLAR PROJECT

Benefits

- PV electrical generation produces no air emissions
- Generation data will be used to examine the effects of solar energy on peak load reductions and the usefulness of distributed generation.
- Project provided 30 fulltime jobs for Minnesota-based PV installers over the course of four months.
- Project has been extensively covered in both print and television coverage to educate the public about Minnesota's solar resource.
- Professionals from around the state have visited the site to review installation techniques, design and overall constructability.
- Roof mounted panels protect a roof from damaging solar irradiance, which can increase the life of the roof covering.

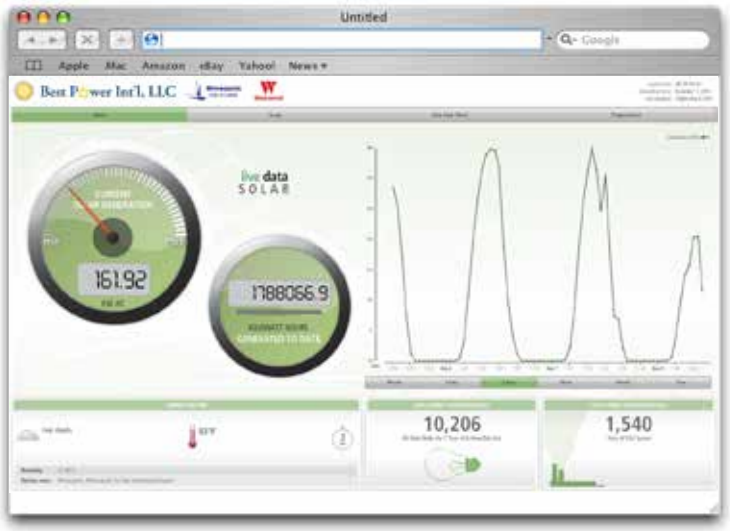
Lessons Learned

- Continuous operation of the solar array has demonstrated the functionality of a large-scale PV array in Minnesota.
- Rooftop placement of a PV array must compensate for wind and snow load on the building structure.
- Construction process was extended to educate local contractors on installation techniques for a large-scale solar array.
- Panels were placed at a 30-degree tilt to optimize solar capture and output while limiting wind affects. The ideal configuration for this latitude would be a 35-degree tilt to shed snow.

Outcomes

- The PV array will produce approximately 750 megawatt hours per year of renewable electric energy which counts towards Xcel Energy's Renewable Portfolio Standard.
- A training seminar was attended by more than 50 solar industry trades people and professionals.
- A northern climate design included placing modules more than a foot off the roof deck to keep clear of snow accumulation and reduce snow-drifting.
- A project website has been created for the general public to view the 'live' production and environmental conditions. It can be found at: **http://live.deckmonitoring.com/?id=minneapolis_convention_center**

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



Appendix E - RDF Information Sheets (Examples)

INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Investing in Renewable Energy

SLAYTON SOLAR FACILITY

Executive Summary

Historically solar electricity in Minnesota has been generated primarily for self use through small photovoltaic (PV) arrays. This energy production project was to demonstrate the cost effectiveness of large-scale solar electric generation for sale in Minnesota. Co-locating the facility in the vicinity of wind energy generation is intended to improve the overall use and cost effectiveness of both the interconnection and transmission assets. The project also demonstrates the capacity of Minnesota's solar resources and ability to provide clean energy during peak demand hours.

Project Description

Renovo installed a 2.0 megawatt direct current (MWDC) PV array adjacent to the town of Slayton, Minn.. The array will produce approximately 2,620 megawatt hours per year, which is enough energy to power approximately 226 homes annually. The system was commissioned on Jan. 4, 2013, becoming the largest solar generation facility in the state.

Methodology

The 2.0 MWDC facility is a ground mounted array made up of 7,040 solar modules covering an area equal to approximately 7 ½ football fields. By locating the facility near Slayton, operational and production data can be obtained and analyzed along with nearby wind resources to determine the complementary nature of wind and solar power. This would include how Minnesota's seasons affects intermittent generation, compatibility of generation patterns with peak load conditions, and impacts on system reliability. The modules are mounted on embedded piers and fixed at 37 degrees to minimize loss in energy (versus an optimal 35 degree tilt) while optimizing the angle at which snow slides off.

Grantee: Renovo Renewable Energy ("Renovo")
Project Dates: 9/14/2011 – 4/1/2013
RDF Funding Cycle: 3
Project Funding: $2,000,000 RDF Grant (Total project cost $6,972,605)
Project ID: EP3-10
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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INFORMATION SHEET

SLAYTON SOLAR FACILITY

Benefits

- Expected carbon dioxide emission reductions of 2,133 tons/year.
- Generation of Renewable Energy Credits that are estimated to be $1,746 per year.
- All electric energy generated will qualify toward NSP's renewable portfolio mandate.
- Siting a large-scale solar facility in the same area as wind facilities will help evaluate and quantify how to better integrate these renewable resources.

Outcomes

- Features in the Star Tribune, Twin Cities Finance and Commerce, and local newspapers focused attention on solar resources in the state of Minnesota.
- Results demonstrate that large-scale PV facilities require subsidies to be economically viable in today's electric energy market.
- Public can view the facility's performance and production at www.slaytonsolar.com.

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

Lessons Learned

There are many variables to take into account to determine at what size a solar facility becomes economically viable to interconnect directly to a transmission level circuit. Interconnecting renewable generation to a transmission line is costly and time consuming, therefore many systems are connected at the distribution level.

- A 2 MWDC solar project, on its own, is not economically viable to interconnect to a 69 kV transmission line.
- The point of interconnection should be as close to load as possible.
- A 12 kV distribution circuit is capable of handling a distributed generation solar facility between 1 to 5 MWDC.
- The amount of distributed generation that any single distribution circuit can handle is dependent upon not only capacity but also load

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