Xcel Energy
Renewable Development Fund (RDF)

Annual Report to the Minnesota State Legislature

February 15, 2016

Introduction and 2015 Highlights

- This report summarizes projects and programs that support progress towards the mission of the Renewable Development Fund (RDF) – to increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology. Over the past year, RDF activity included the following accomplishments:
    - $20.6 million was spent on incentives for wind, hydro, biomass, and solar renewable energy generation.
    - Construction activity occurred on seven solar projects totaling 5.4 MW capacity. These solar facilities each have unique features that either showcase renewables - such as the arrays at CHS Field in downtown Saint Paul (see Photo 1) and at Minneapolis St Paul International Airport - or facilities that demonstrate a best use of land with limited development potential - such as solar installations on a closed landfill in the City of Hutchinson (see Photo 2) or adjacent the Blue Lake Wastewater Treatment facility in Shakopee.
    - A new facility on the School Sisters of Notre Dame campus in Mankato was the first large-scale solar facility to utilize a new, higher voltage operating system that can reduce installation and maintenance costs.
    - Projects funded from the RDF resulted in $13 million in economic activity, involving construction and research, within Minnesota during the past year.

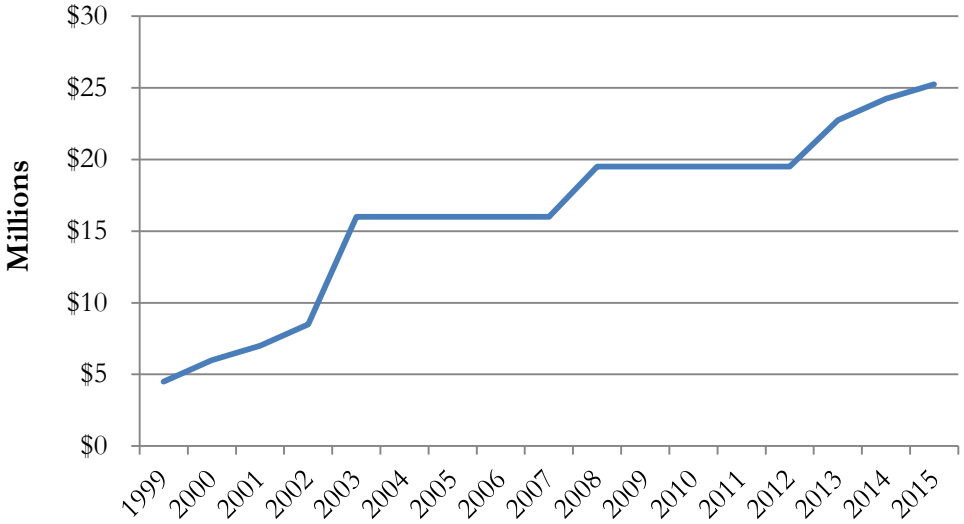
Photo 1: 103.5 kW_{DC} array behind left field at CHS Field in St. Paul

Photo 2: 400 kW_{DC} array on a closed municipal landfill in Hutchinson

Background

The RDF was authorized by the Minnesota Legislature in 1994 as a condition of storing spent nuclear fuel in dry casks at Prairie Island. In 2007, the statute was further amended to add an assessment for dry casks stored at our Monticello nuclear generating plant in Monticello, Minnesota. The initial annual obligation in 1999 to the RDF was $4.5 million, increasing over the past 17 years to $25.6 million in 2015. A cumulative total of $276.1 million has been set-aside in the RDF. Figure 1 below shows the increase in annual funding for the RDF since 1999.

Figure 1: Annual Funding Obligation to RDF



According to the RDF statute (Minn. Stat. §116C.779), the RDF is a program administered by Xcel Energy with oversight by the Minnesota Public Utilities Commission. The RDF's mission was established in an October 5, 2006 Commission

Order and was revised to incorporate statutory requirements from the 2012 legislature. The current RDF mission statement directs that the overall purpose of the fund is to:

- *Increase the market penetration of renewable electric energy resources at reasonable costs in the state;*
- *Promote the start-up, expansion and attraction of renewable electric energy projects and companies in the state;*
- *Stimulate renewable electric energy research and development in the state;*
- *Develop demonstration scale renewable electric energy projects of near-commercial renewable electric generation or near-commercial electric infrastructure delivery technology that enhance the delivery of renewable electric energy within the state; and*
- *Provide benefits to Minnesota citizens, businesses and Xcel Energy's electric ratepayers.*

The RDF statute also states that Xcel Energy must submit an annual report to the chair and ranking minority member of the Minnesota legislative committees with jurisdiction over energy policy about projects funded by the RDF account. The report is to itemize the actual and projected financial benefit to Xcel Energy's electric ratepayers of each project. Attachment A includes a complete list of projects that have received RDF grant awards and the associated benefits.

A seven-member advisory group, representing the interests of various stakeholder perspectives, assists Xcel Energy in evaluating and recommending grant project proposals to Xcel Energy and the Commission. Further details on the members of the advisory group can be found in Attachment B.

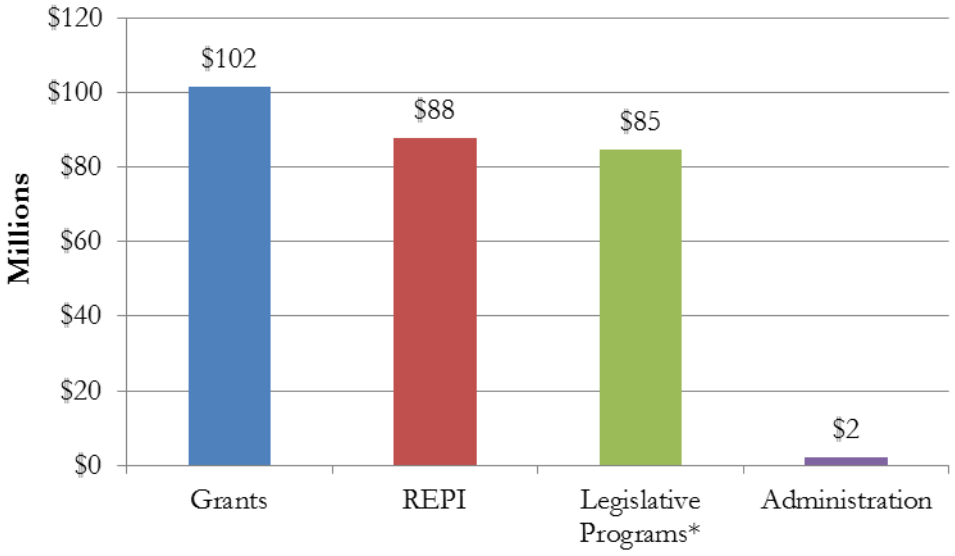
The RDF program expenses allocated to Minnesota are recovered through an adjustable surcharge on our customer bill statements as part of their monthly charges for electricity. In 2016 the RDF charge is $0.000902 per kWh. For a typical residential customer using 750 kWh per month, the RDF cost per month is $0.68.

RDF Grant Program Summary

Since its inception, the RDF program has provided $276.1 million for renewable energy initiatives including $87.8 million for Renewable Energy Production Incentive (REPI) payments, $84.5 million for legislatively-mandated projects and programs, and $2.3 million for general program support. The legislatively-mandated programs included the appropriation of $25 million to the University of Minnesota for the Initiative for Renewable Energy and Environment (IREE). The balance of $101.5

million has been awarded over four grant cycles to 90 projects. Attachment C to this report is a Financial Statement which summarizes the RDF cost distribution since 2001. Figure 2 below illustrates the distribution of RDF costs between these programs and grants.

Figure 2: Distribution of RDF Costs



* - Includes IREE

As Table 1 below shows, 62 projects have been completed since the RDF's inception and seventeen are currently active, including fifteen new Cycle 4 projects. Eleven Cycle 4 grants which were awarded RDF grants have not executed grant contracts and therefore project activity has not begun.

Table 1: Summary of RDF Project Status

Type	Completed	Active as of December 31, 2015	Total
Energy Production	19	10	29
Research	43	7	50
Total	62	17	79

Legislative RDF Program Summary

In 2003, legislation was passed to create the REPI program to provide production incentives for electricity generated by wind, biogas, and hydro. In 2015, $4.7 million in RDF funds were disbursed for REPI payments.

Legislation in 2010 created the Solar*Rewards program to provide rebates to owners of qualified properties for installing solar photovoltaic modules. In 2015, $4 million in RDF funds were disbursed for Solar*Rewards rebates.

Two new programs were created as a result of 2013 legislation to receive funds from the RDF. The first program is a "Made in Minnesota" solar energy production incentive account to provide production incentives for residential and commercial installations. In 2015, $12 million in RDF funds were disbursed to fund this account. The second program created in 2013 is a solar energy incentive program to replace the original Solar*Rewards program and focus on small facilities of up to 20 kW. In 2015, $40,000 in RDF funds were disbursed to fund the new Solar*Rewards program.

RDF Project Benefits

The many benefits of RDF projects can be seen at both the local and regional level through the purchase of goods and services, as well as the expansion of employment opportunities. Other benefits associated with the RDF include the fostering of new or expanded business opportunities to maintain and support the new facilities or research. In cases where permanent energy production facilities are constructed, RDF investments can also expand the property tax base for a community.

Energy Production:

RDF projects that construct electric generation facilities provide a combination of environmental and economic benefits. As shown in Table 2, the eighteen completed electric production projects that received RDF grants have resulted in the installation of 26.8 MW of renewable energy nameplate capacity and have overall generated a total of 405 GWh of energy over the life of the facilities.

Table 2: RDF Electric Production Projects Summary

Type	Investment	Facilities	Installed Capacity (MW)	2015 Energy Production (MWh)	Total Energy Production (MWh)
Biomass	$27,887,976	1	0.30	906	1,733
Hydro	$44,145,119	1	9.18	37,680	151,063
Solar	$27,075,846	12	7.37	5,866	28,815
Wind	$13,075,483	4	9.95	20,264	223,478
Total	$112,184,424	18	26.8	64,716	405,089

For every construction dollar spent from the RDF, there has been an additional $2.86 spent from outside investors. Therefore, the $31.7 million investment of RDF funds for energy production has leveraged an additional $90.8 million. This total investment has resulted in the creation of approximately 1,309[1] construction jobs to design and build facilities in Minnesota.

As shown in Table 3 below, the environmental benefits from these RDF facilities are recognized in marketable Renewable Energy Credits (RECs) from qualifying facilities, an estimated 284[2] tons in carbon dioxide emissions reduction, avoided costs to build conventional facilities, and avoided replacement costs for electricity generated.

Table 3: Cumulative RDP Project Environmental Benefits

Value of RECs	Value Emission Reductions[3]	Avoided Capacity Value	Avoided Energy Value	Total Value
$312,072	$1,113	$5,670,077	$11,633,323	$17,616,585

Research and Development:

The RDF has provided a boost in the development of new renewable electric energy concepts and designs through the investment in renewable energy research and development. Research and development projects typically do not have as easily-quantifiable direct benefits or extensive capacity for leveraging benefits that energy production projects do because the funding is predominately applied to personnel rather than construction and material costs.

Nevertheless, economic models estimate that this total investment has resulted in the need for over 500[4] research- related jobs. Some of these jobs were within the non-profit and commercial industry that received funding for demonstration-style

[1] Source: National Renewable Energy Laboratory Jobs and Economic Development Impact Model
[2] Carbon emissions reduction assumptions are based on the energy generation from RDF projects (in MWh), multiplied by the Upper Midwest Emissions Rates (in lbs/MWh) reported in our most recent 2014 Corporate Responsibility Report. Our methodology for calculating that rate is based on the U.S. Environmental Protection Agency greenhouse gas emissions reporting protocol, and is verified by The Climate Registry..
[3] The value of emissions reductions is based upon current values provided by the Minnesota Public Utilities Commission on the costs of certain types of emissions: SO_2, CO_2, NO_X and Pb, provided in its May 27, 2015 Notice of Updated Environmental Externality Values. The Company used the average of the high and low value for urban customers as a proxy of Xcel Energy's largely urban Minnesota electric service territory.
[4] Source: National Renewable Energy Laboratory Jobs and Economic Development Impact Model

research, and many other jobs were created for students in the academic world. This serves as an investment in the next generation that will design new renewable electric energy facilities. As can be seen in Table 4, research and development projects contributed to the development of articles, workshops, and patent applications. In addition, research and development RDF grant dollars leveraged $0.49 for each grant dollar invested.

Table 4: RDF Research and Development Projects Results

Technology	Total Investment	Published Articles	Presentations/ Workshops	Patent Applications
Biomass	$29,844,964	24	59	3
Solar	$7,772,240	8	21	0
Wind	$8,093,471	12	49	2
University Research	$1,000,000	0	0	0
Total	$46,710,675	44	129	5

Conclusion

Xcel Energy appreciates this opportunity to provide this report summarizing the projects and programs funded by the RDF through 2015. 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. We look forward to working with the Minnesota Legislature and the Minnesota Public Utilities Commission to continue to improve the RDF program moving forward. Further, we remain committed to making certain the RDF program provides maximum benefits for those individuals who most directly make it possible—our electric customers.

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Jess Hopeman
Legislative Reference Library
645 State Office Bldg.
St. Paul, MN 55155

SUMMARY OF ALL RDF PROJECTS
(1/1/2002 to present)

Project Name	Contract	Project Site: City	Project Site: Zone	Project End Date	Status	Type	Cycle	Resource	Project Description	Funding: RDF Award	Funding: Grant Funds Disbursed	Funding: Leverage Funds	Funding: Total Costs	Funding: Current Grant Balance	Funding: Deobligated Funds	Jobs	Power Development: Capacity (kW)	Power Development: Generation (MWh)	REC's	Externalities: Enviro	Externalities: Avoided Capacity	Externalities: Avoided Energy	Intellectual Property: Articles	Intellectual Property: Presentations	Intellectual Property: Patent Apps
CENTRAL REGION																									
Bergey Windpower Company	EP4-24	St. Cloud area	Central	11/24/17	current	EP	4	Solar	Install 500 kW small wind capacity in the jurisdictions of Stearns, Benton, and Meeker counties by constructing 50 distributed 10 kW microturbines.	$1,106,600	$0	$2,085,145	$2,085,145	$1,106,600	$0	1									
City of Hutchinson	EP4-41	Hutchinson	Central	6/19/16	current	EP	4	Solar	Installed 400 kW photovoltaic fixed-tilt array on a capped municipal landfill and use the power at the adjecent wastewater treatment facility.	$958,369	$0	$784,120	$784,120	$958,369	$0	9	400	16		$0	$17,931	$460			
University of Minnesota (Dairy)	RD4-2	Morris	Central	6/2/18	current	RD	4	Solar/Wind	Model a "net-zero" energy dairy parlor at the West Central Research and Outreach Center by integratingrol 20 kW wind and 54 kW solar with storage.	$982,408	$0	$0	$0	$982,408	$0	0									
Best Power Int'l (St. John's Expansion)	EP4-6	Collegeville	Central	3/16/15	complete	EP	4	Solar	Installed a 182 kW photovoltaic fixed-tilt array at St. John's solar farm for a side-by-side comparison with the existing 400 kW single-axis tracking array.	$172,213	$172,213	$363,613	$535,826	$0	$0	6	182	254	$233	$1	$8,151	$7,429			
Best Power Int'l (St. John's)	EP3-3	Collegeville	Central	5/8/10	complete	EP	3	Solar	Installed a 400 kW photovoltaic facility at St. John's University to demonstrate commercial viability of solar power in Minnesota.	$1,994,480	$1,994,480	$1,188,823	$3,183,303	$0	$0	35	400	3,499	$2,708	$10	$71,741	$102,972			
University of Minnesota	RD3-23	Morris	Central	8/1/11	complete	RD	3	Biomass	Evaluated economic and technical issues related to biomass fuel and integrated gasification combined cycle technology.	$819,159	$729,717	$0	$729,717	$0	$89,442	8							6	28	
University of North Dakota (Digester)	RD3-68	Princeton	Central	4/30/12	complete	RD	3	Biomass	Field demonstration of a hydrogen sulfide reduction process at the anaerobic digester on the 1,000-acre Haubenschild Dairy Farm.	$970,558	$970,480	$0	$970,480	$0	$78	11								1	
Minnesota Valley Alfalfa Producers	RD3-69	Priam	Central	7/15/15	complete	RD	3	Biomass	Researching application of kinetic disintegration technology to produce biomass pellets from feedstocks with varying levels of moisture.	$1,000,000	$825,489	$286,499	$1,111,988	$0	$174,511	12									
Energy Performance Systems	RD-50	Graceville	Central	2/19/13	complete	RD	2	Biomass	Built and demonstrated equipment for an integrated system to supply farm grown trees as a biomass feedstock to a power plant.	$957,929	$957,929	$1,997,606	$2,955,535	$0	$0	32								1	
Blattner and Sons	BW-06	Avon	Central	12/15/02	complete	RD	1	Wind	Developed a platform that would climb the tower to eliminate that need for crane to construct very tall wind turbines.	$68,470	$62,346	$0	$62,346	$6,124	$6,124	1									
									Economic Benefits for West Central Region	**$9,030,186**	**$5,712,654**	**$6,705,806**	**$12,418,460**	**$3,053,501**	**$270,155**	**113**	**981**	**3,768**	**$2,941**	**$10**	**$97,823**	**$110,862**	**6**	**30**	**0**
NORTH REGION																									
University of Minnesota (Torrefaction)	RD4-11	Coleraine	North	9/3/2017	current	RD	4	Biomass	Demonstrate a prototypic torrefaction bioconversion process and distributed electric generation.	$1,899,499	$0	$446,003	$446,003	$1,899,499	$0	5									
West Central Telephone Assoc.	RD3-58	Menahga	North	5/12/10	complete	RD	3	Wind/Solar	Designed and tested configurations and specifications of a hybrid wind/solar power system for distributed generation in remote locations.	$137,000	$137,000	$96,926	$233,926	$0	$0	3									
University of North Dakota (Liguifaction)	RD3-66	Duluth	North	4/10/12	complete	RD	3	Biomass	Designed and demonstrated a mobile biomass liquefaction system that can utilize high moisture wood waste.	$999,065	$998,697	$995,800	$1,994,497	$0	$368	22								1	
Mesaba/Excelsior Energy	EP-43	Taconite	North	6/24/10	complete	EP	2	Innovative	To design the basis of a base load Integrated Gasification Combined-Cycle (IGCC) power generation facility.	$10,000,000	$10,000,000	$365,621	$10,365,621	$0	$0	113									
CMEC	EP-44	Little Falls	North	3/12/11	complete	EP	2	Biomass	Designed 959-kW gasification plant to utilized distillers grains and local biomass. Refractory issues prevented completion of the facility.	$2,000,000	$400,000	$16,462,472	$16,862,472	$0	$1,600,000	183									
University of Florida	RD-34	Moorhead	North	5/16/09	complete	RD	2	Biomass	Demonstrated two-stage anaerobic digester at American Crystal Sugar in Moorhead, MN to generate methane for conversion to electricity.	$999,995	$996,875	$0	$996,875	$0	$3,120	11							3	1	1
Gas Technology Institute	RD-38	Coleraine	North	10/12/07	complete	RD	2	Biomass	Developed a method to extract hydrogen from biomass gasification using membrane separation technologies.	$861,860	$861,860	$3,121	$864,981	$0	$0	9								1	
									Economic Benefits for Northeast Region	**$16,897,419**	**$13,394,432**	**$18,369,943**	**$31,764,375**	**$1,899,499**	**$1,603,488**	**345**	**0**	**0**	**$0**	**$0**	**$0**	**$0**	**3**	**3**	**1**
STATEWIDE																									
MN DNR	EP3 - 13	Afton, Ft. Snelling, Lake Shetek, Lac qui	Statewide	3/12/13	complete	EP	3	Solar	Installed 114 kW of solar photovoltaic generation at various state parks and developed a renewable energy strategy for future DNR facilities.	$894,000	$878,966	$39,312	$918,278	$0	$15,034	10	114	553	$508	$2	$12,037	$16,151			
									Economic Benefits for Statewide Projects	**$894,000**	**$878,966**	**$39,312**	**$918,278**	**$0**	**$15,034**	**10**	**114**	**553**	**$508**	**$2**	**$12,037**	**$16,151**	**0**	**0**	**0**
SOUTHEAST REGION																									
Coaltec Energy USA	RD3 - 77	Northfield	Southeast	4/22/16	current	RD	3	Biomass	Demonstrated the feasibility of biomass gasification on a commercial turkey farm to generate electricity and heat.	$1,000,000	$850,000	$274,511	$1,124,511	$150,000	$0	12									
Diamond K	EP-51	Altura	Southeast	5/18/14	complete	EP	2	Biomass	Installed a 300 kW of biomass generated and anaerobic digester at the Diamond K Dairy in Winona County, Minnesota.	$936,530	$936,530	$2,688,974	$3,625,504	$0	$0	39	300	1,733	$1,732	$5	$6,650	$44,396			
AnAerobics, Inc	AB-07	Montgomery	Southeast	6/3/03	complete	EP	1	Biomass	Was to install a 1.7 MW genset and study removal of hydrogen sulfide created during anaerobic digestion but had site control issues.	$1,300,000	$1,100,000	$6,300,000	$7,400,000	$0	$200,000	80									
									Economic Benefits for Southeast Region	**$3,236,530**	**$2,886,530**	**$9,263,485**	**$12,150,015**	**$150,000**	**$200,000**	**132**	**300**	**1,733**	**$1,732**	**$5**	**$6,650**	**$44,396**	**0**	**0**	**0**
SOUTHWEST REGION																									
Best Power Int'l (School Sisters)	EP4-5	Mankato	Southwest	10/28/15	complete	EP	4	Solar	Installed a 849 kW solar facility at the Mankato campus of the Central Pacific Province of the School Sisters of Notre Dame.	$900,000	$900,000	$681,901	$1,581,901	$0	$0	17	849	192		$1	$89,657	$5,613			
Outland Renewable Energy	EP3-10	Slayton	Southwest	4/1/13	complete	EP	3	Solar	Installed 2 MW photovoltaic facility near Slayton, MN to demonstrate the benefits of utility scale use of photovoltaics in Minnesota.	$2,000,000	$2,000,000	$4,972,605	$6,972,605	$0	$0	76	2,000	7,549	$7,311	$21	$89,712	$220,702			
Xcel Energy	RD3-12	Beaver Creek	Southwest	12/19/11	complete	RD	3	Wind	Installed a 1.0 MW sodium sulfur battery adjacent a wind farm to validate the value of energy storage for greater wind energy penetration.	$1,000,000	$1,000,000	$3,247,181	$4,247,181	$0	$0	46								31	
Hilltop	EP-26	Edgerton	Southwest	3/2/09	complete	EP	2	Wind	Installed a 1.5 MW General Electric wind turbine in Lyon County with 100 percent of the electricity sold to Xcel Energy.	$1,200,000	$1,200,000	$2,670,126	$3,870,126	$0	$0	42	2,000	25,517	$17,016	$69	$93,163	$701,329			
St. Olaf	EP-39	Northfield	Southeast	4/30/07	complete	EP	2	Wind	Installed a 1.65 MW Micon wind turbine on campus.	$1,500,000	$1,500,000	$1,063,377	$2,563,377	$0	$0	28	1,650	23,442	$17,645	$64	$108,957	$751,250			
Rural Advantage	RD-27	Luverne	Southwest	4/12/09	complete	RD	2	Biomass	Demonstrated the commercial production of Miscanthus as a biomass fuel for electric generation.	$318,800	$318,800	$348,887	$667,687	$0	$0	7									1
Ag. Utilization Research Institute	RD-69	Beaver Creek	Southwest	9/8/08	complete	RD	2	Biomass	Conducted a feasibility study to couple bio-diesel and wind generation systems to "firm" wind power.	$760,000	$760,000	$8,829	$768,829	$0	$0	8									
Project Resource Corp	AW-03	Chandler	Southwest	5/31/06	complete	EP	1	Wind	Installed 5.4 MW of wind energy with a new landowner investment model that limits development risk of community shareholders.	$900,000	$900,000	$2,700,000	$3,600,000	$0	$0	39	5,400	151,627	$118,542	$412	$2,280,570	$4,518,506			
Pipestone Jasper School	AW-10	Pipestone	Southwest	12/31/04	complete	EP	1	Wind	Installed a 900 kW wind turbine adjacent to the Pipestone-Jasper Public High School.	$752,835	$752,835	$204,000	$956,835	$0	$0	10	900	22,892		$62	$1,021,422	$789,857			
									Economic Benefits for Southwest Region	**$9,331,635**	**$9,331,635**	**$15,896,906**	**$25,228,541**	**$0**	**$0**	**274**	**12,799**	**231,219**	**$160,514**	**$629**	**$3,683,481**	**$6,987,257**	**0**	**31**	**1**
METRO REGION																									
Crown Hydro	AH-01	Minneapolis	Twin Cities	1/20/16	current	EP	1	Hydro	Install 3.2 MW of hydroelectric capacity on the Mississippi River in downtown Minneapolis.	$5,100,000	$1,538,591	$2,612,647	$4,151,238	$3,561,409	$0	45									
Innovative Power Systems	EP4-11	St. Paul	Twin Cities	9/1/17	current	EP	4	Solar	Install 967 kW of solar capacity at four sites within the Innovative Energy Corridor.	$1,850,000	$0	$848,200	$848,200	$1,850,000	$0	9									
Metropolitan Airports Commission	EP4-13	Bloomington	Twin Cities	12/1/16	current	EP	4	Solar	Installed a 1.471 MW fixed-tilt solar facility on the Blue parking ramp at Terminal One of MPS airport.	$2,022,507	$0	$2,166,493	$2,166,493	$2,022,507	$0	24	1,471	40		$0	$65,983	$1,160			
Minnesota Renewable Energy Society	EP4-15	Minneapolis	Twin Cities	5/17/17	current	EP	4	Solar	Install both a rural and urban solar garden totaling 1.0 MW of photovoltaic capacity to observe differences in subsciber interest.	$2,661,320	$0	$1,375,100	$1,375,100	$2,661,320	$0	15									
Target Corporation	EP4-20	St. Paul	Twin Cities	6/1/16	current	EP	4	Solar	Install a 350 kW roof-mounted,fixed-tilt photovoltaic facility on the Target Superstore.	$583,513	$0	$47,420	$47,420	$583,513	$0	1									
Minneapolis Park & Rec. Board	EP4-22	Minneapolis	Twin Cities	4/28/16	current	EP	4	Solar	Install 200 kW of PV capacity at seven locations within the Minneapolis park system to demonstrate the effectiveness of alternative solar designs.	$969,741	$0	$149,392	$149,392	$969,741	$0	2									
City of St. Paul	EP4-34	St. Paul	Twin Cities	6/9/17	current	EP	4	Solar	Install a 105 kW fixed-tilt photovoltaic facility at CHS Field.	$555,750	$0	$185,250	$185,250	$555,750	$0	2									
Oak Leaf Energy	EP4-48	Shakopee	Twin Cities	1/26/17	current	EP	4	Solar	Install a 1,000 kW fixed-tilt photovoltaic facility at the Blue Lake Wastewater Treatment Plant.	$2,000,000	$0	$864,810	$864,810	$2,000,000	$0	9									

SUMMARY OF ALL RDF PROJECTS
(1/1/2002 to present)

Project Name	Contract	Project Site: City	Project Site: Zone	Project Site: Project End Date	Status	Type	Cycle	Resource	Project Description	Funding: RDF Award	Funding: Grant Funds Disbursed	Funding: Leverage Funds	Funding: Total Costs	Funding: Current Grant Balance	Funding: Deobligated Funds	Jobs	Power Development: Capacity (kW)	Power Development: Generation (MWh)	REC's	Externalities: Enviro	Externalities: Avoided Capacity	Externalities: Avoided Energy	Intellectual Property: Articles	Intellectual Property: Presentations	Intellectual Property: Patent Apps
Universisty of Minnesota (Noise)	RD4-12	Minneapolis	Twin Cities	9/2/18	current	RD	4	Wind	Research the sources and quality of wind turbine sound and the thresholds of potential health impacts on humans.	$625,102	$0	$0	$0	$625,102	$0	0									
University of Minnesota (VWS)	RD4-13	Minneapolis	Twin Cities	6/2/20	current	RD	4	Wind	Augment the predictive capabilities of the Virtual Wind Simulator by adding an aeroelastic model and integrating advanced turbine control algorithms.	$1,391,684	$0	$0	$0	$1,391,684	$0	0									
University of St. Thomas	HE4-2	Chisago City	Twin Cities	8/12/18	current	RD	4	Wind	Install a 0.25 MW peak, multi-purpose microgrid in Chisago City to establish an Engineering Senior Design Clinic for microgrid research and testing.	$2,157,215	$0	$0	$0	$2,157,215	$0	0									
University of Minnesota (REMF)	HE4-3	Minneapolis	Twin Cities	8/20/18	current	RD	4	Wind	Create Renewable Electricity for Minnesota's Future ("REMF") which will fund and support research in renewable electric energy generation.	$3,000,000	$1,000,000	$0	$1,000,000	$2,000,000	$0	11									
Merrick	EP3-2	Vadnais Heights	Twin Cities	12/22/08	complete	EP	3	Solar	Installed a roof-mounted 100 kW solar photovoltaic facility on a non-profit adult day training and habilitation center.	$735,000	$735,000	$52,000	$787,000	$0	$0	9	100	557	$421	$2	$22,909	$16,446			
City of Minneapolis	EP3-11	Minneapolis	Twin Cities	1/15/13	complete	EP	3	Solar	Installed a 600 kW photovoltaic facility on the Minneapolis Convention Center.	$2,000,000	$2,000,000	$1,096,756	$3,096,756	$0	$0	34	600	3,575	$3,013	$10	$82,221	$104,505			
freEner-g	EP3- 12	Metro Area	Twin Cities	2/17/11	complete	EP	3	Solar	Installed 280 kW photovoltaic capacity through a leasing and service package for residential and small businesses.	$1,488,922	$1,488,922	$777,170	$2,266,092	$0	$0	25	280	1,129	$923	$3	$40,004	$33,082	1		
University of Minnesota (Koda)	RD3-1	Shakopee	Twin Cities	1/22/15	complete	RD	3	Biomass	Development of a production, pre-processing and delivery system for biomass feedstock's from prairie and grasslands.	$992,989	$976,743	$1,391,643	$2,368,386	$0	$16,246	26							1	4	
SarTec Corporation	RD3-2	Anoka	Twin Cities	7/11/11	complete	RD	3	Biofuel	Researched the growth of algae fed on CO2 from flue gas and extracted the algae oils for conversion into a marketable biodiesel product.	$350,000	$350,000	$0	$350,000	$0	$0	4									
Bepex International	RD3-4	Minneapolis	Twin Cities	7/28/11	complete	RD	3	Biomass	Demonstrated torrefaction and densification as processes to reduce transportation and storage costs associated with biomass feedstock.	$924,671	$924,671	$0	$924,671	$0	$0	10									
University of Minnesota (Nanocrystals)	RD3- 25	Minneapolis	Twin Cities	12/26/11	complete	RD	3	Solar	Developed techniques for controlling microstructures of hydrogenated silicon and improving the grain size of microcrystalline silicon PV films.	$732,032	$732,032	$0	$732,032	$0	$0	8							3	8	
University of Minnesota (Cropping)	RD3-28	St. Paul	Twin Cities	9/22/13	complete	RD	3	Biomass	Developed guidelines for accurate management of biomass removal and maintenance of soil quality.	$979,082	$979,048	$0	$979,048	$0	$34	11							4	7	
University of Minnesota (Wind)	RD3-42	Minneapolis	Twin Cities	8/7/13	complete	RD	3	Wind	Developed and tested a Virtual Wind Simulator to provide accurate wind turbulence predictions.	$999,999	$999,598	$286,199	$1,285,797	$0	$401	14							11	13	
Lower St. Anthony Falls	EP-34	Minneapolis	Twin Cities	1/31/12	complete	EP	2	Hydro	Restored 9.176 MW hydroelectric generating capacity at the Lower St. Anthony Falls by using run-of-river technology.	$2,000,000	$2,000,000	$37,993,881	$39,993,881	$0	$0	434	9,176	151,063	$142,019	$421	$406,820	$3,870,228			
University of Minnesota	RD-29	Minneapolis	Twin Cities	9/24/08	complete	RD	2	Biomass	Researched operation of turbo-generators using biomass-derived oils.	$299,284	$299,284	$0	$299,284	$0	$0	3									
University of Minnesota	RD-56	St. Paul	Twin Cities	4/16/08	complete	RD	2	Biomass	Developed model to evaluate options to optimize combustion and electricity generation in ethanol plants.	$858,363	$803,246	$0	$803,246	$0	$55,117	9							7	7	
Windlogics	RD-57	St. Paul	Twin Cities	11/11/08	complete	RD	2	Wind	Defined, designed, built and demonstrated a complete wind power forecasting system.	$997,000	$997,000	$141,437	$1,138,437	$0	$0	12								1	
Center for Energy Environment	RD-94	Minneapolis	Twin Cities	10/12/07	complete	RD	2	Biomass	Developed two web-based programs for planning and development of biomass resources in Minnesota.	$397,500	$397,500	$42,115	$439,615	$0	$0	5									
MN Dept. of Commerce	AS-05	St. Paul	Twin Cities	9/1/08	complete	EP	1	Solar	Provided rebates of up to $8,000 for small photovoltaic installations that are wired into the electrical grid.	$1,150,000	$1,150,000	$0	$1,150,000	$0	$0	12	960	11,329		$31	$1,250,219	$443,805			
Science Museum	AS-06	St. Paul	Twin Cities	12/31/03	complete	EP	1	Solar	Installed a 9 kW solar roof to demonstrate a Zero Energy Building for the Minnesota Science Museum.	$100,000	$100,000	$63,300	$163,300	$0	$0	2	9	124		$0	$1,930	$5,430			
Sebesta Blomberg	BB-03	Roseville	Twin Cities	9/30/03	complete	RD	1	Biomass	Examined the feasibility of a gasification system using the byproducts of an ethanol facility to provide heat and power.	$738,654	$738,654	$184,663	$923,317	$0	$0	10									
Energy Performance Systems	BB-06	Rogers	Twin Cities	12/15/02	complete	RD	1	Biomass	Conversion design of the NSP Granite Falls coal-fired facility to a biomass system capable of utilizing whole trees.	$266,508	$257,247	$85,056	$342,303	$0	$9,261	4									
University of Minnesota	CW-06	Minneapolis	Twin Cities	12/31/06	complete	RD	1	Wind	Designed a flywheel battery system to enhance the ability to dispatch wind energy with inertial storage.	$654,309	$654,309	$0	$654,309	$0	$0	7									1
									Economic Benefits for Metro Region	**$39,581,145**	**$19,121,845**	**$50,363,532**	**$69,485,377**	**$20,378,241**	**$81,059**	**755**	**12,596**	**167,816**	**$146,376**	**$467**	**$1,870,086**	**$4,474,657**	**27**	**40**	**1**
OUT OF STATE																									
Northern Plains Power Tech.	RD3-21	Brookings, SD	Out of State	11/11/12	complete	RD	3	Solar	Developed a loss-of-mains detection based on harmonic signature and synchrophasor data.	$493,608	$493,608	$240,665	$734,273	$0	$0	8								4	1
Interphases Solar	RD3-53	Moorpark, CA	Out of State	7/20/12	complete	RD	3	Solar	Demonstrated a manufacturing process to produce lightweight, thin-film solar cells.	$1,000,000	$1,000,000	$666,021	$1,666,021	$0	$0	18							1	5	
University of North Dakota	RD3-71	Grand Forks, ND	Out of State	3/23/12	complete	RD	3	Biomass	Demonstrated a thermally integrated biomass gasification systems with a 30 kW low-Btu gas turbine.	$999,728	$999,438	$0	$999,438	$0	$290	11							1	1	
Energy Conversion Devices	RD-22	Rochester Hills, MI	Out of State	10/12/07	complete	RD	2	Biomass	Researched processes to reform bio-ethanol and bio-methanol into hydrogen for use in a fuel cell or gas turbine to generate electricity.	$900,000	$900,000	$1,390,015	$2,290,015	$0	$0	25								6	
Coaltec	RD-26	Carterville, IL	Out of State	1/12/07	complete	RD	2	Biomass	Studied handling, performance and emissions to assess feasibility of poultry waste as a sustainable feedstock for a fixed-bed gasifier.	$450,000	$450,000	$378,500	$828,500	$0	$0	9									
Production Specialties	RD-72	Oklahoma City, OK	Out of State	11/16/09	complete	RD	2	Biomass	Investigated a technology to selectively remove hydrogen sulfide (H2S) from biogas without generating a waste stream.	$228,735	$228,735	$263,767	$492,502	$0	$0	5								1	
Interphases Research	RD-78	Moorpark, CA	Out of State	10/14/08	complete	RD	2	Solar	Developed a concept to manufacture flexible photovoltaic modules in a continuous roll-to-roll electro-deposition process.	$1,000,000	$1,000,000	$821,700	$1,821,700	$0	$0	20								6	
Global Energy Concepts	RD-87	Lowell, MA	Out of State	5/7/09	complete	RD	2	Wind	Analyzed and developed advanced methods for reducing uncertainty in wind power estimates.	$370,000	$370,000	$28,236	$398,236	$0	$0	4									
NREL - Inkjet Solar Cells	RD-93	Golden, CO	Out of State	11/11/08	complete	RD	2	Solar	Designed and developed a thin-film solar cell that will use a direct-write inkjet printing process.	$1,000,000	$949,005	$0	$949,005	$0	$50,995	10									
NREL-Low Band Gap-Solar	RD-107	Golden, CO	Out of State	12/9/08	complete	RD	2	Solar	Overcome limitations in organic-based solar cells by developing low band gap (red light absorbing) materials.	$1,000,000	$944,452	$0	$944,452	$0	$55,548	10							6	2	
Iowa State University	RD-110	Ames, IA	Out of State	7/12/07	complete	RD	2	Biomass	Performance testing of a particulate filtration clean-up system for the producer gas from a biomass gasifier.	$405,000	$98,343	$0	$98,343	$306,657	$306,657	1									
University of ND - Cofiring	BB-09	Grand Forks, ND	Out of State	3/31/05	complete	RD	1	Biomass	Measured operational and component impacts of co-firing biomass with coal in an indirect fired combined-cycle pulverized-coal furnace.	$444,478	$444,443	$296,219	$740,662	$35	$35	8									
Community Power Corp.	BB-10	Littleton, CO	Out of State	3/24/05	complete	RD	1	Biomass	Designed, developed, and tested a centrifugal filter capable of removing sub micron particles and aerosols from a hot producer bio-gas stream.	$638,635	$548,692	$133,054	$681,746	$89,943	$89,943	7									
University of ND - SCR Performance	BB-12	Grand Forks, ND	Out of State	6/30/06	complete	RD	1	Biomass	Examined the rates and mechanisms of catalyst deactivation within the emissions from a biomass co-fired utility boiler.	$60,000	$59,973	$340,000	$399,973	$27	$27	4									
Colorado School of Mines	CB-07	Golden, CO	Out of State	12/31/07	complete	RD	1	Biomass	Developed a fuel cell prototype for use in ambient or high temperatures.	$1,116,742	$1,116,742	$0	$1,116,742	$0	$0	12									
University of ND - SOFC	CB-08	Grand Forks, ND	Out of State	10/31/07	complete	RD	1	Biomass	Incorporated solid oxide fuel cells (SOFCs) and gasification into one integrated system to produce electricity.	$1,250,142	$1,250,142	$885,928	$2,136,070	$0	$0	23									1
NREL	CS-05	Golden, CO	Out of State	7/9/07	complete	RD	1	Solar	Design and develop of solutions and techniques to use an inkjet printing process for the manufacturing of thin-film solar cells.	$934,628	$924,757	$0	$924,757	$9,871	$9,871	10									
Global Energy Concepts	CW-02	Lowell, MA	Out of State	10/1/03	complete	RD	1	Wind	Translated the effects of a turbine's rotating flexible blades into a linear model for use in wind turbine design software.	$75,000	$73,239	$0	$73,239	$1,761	$1,761	1									
									Economic Benefits for Out of State Area	**$12,366,696**	**$11,851,569**	**$5,444,105**	**$17,295,674**	**$408,294**	**$515,127**	**188**	**0**	**0**	**$0**	**$0**	**$0**	**$0**	**8**	**25**	**2**
									TOTAL ALL PROJECTS	**$91,337,611**	**$63,177,631**	**$106,083,089**	**$169,260,720**	**$25,889,535**	**$2,684,863**	**1,816**	**26,791**	**405,089**	**$312,072**	**$1,113**	**$5,670,077**	**$11,633,323**	**44**	**129**	**5**

RDF advisory group

- Ben Gerber[1], 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[2], energy coordinator
  Izaak Walton League
  Representing the environmental community

- Michelle Rosier[3], senior campaign and organizing manager
  Sierra Club North Star Chapter
  Representing the environmental community

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

- Joseph Sullivan[4], manager strategic relations
  Center for Energy and Environment
  Representing the environmental community

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

- Heather Westra
  Representing Prairie Island Indian community

RDF Administration

- Amy Fredregill, program manager

- Mark Ritter, grant administrator

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[1] Resigned from RDF advisory group as of October 13, 2015. Vacant position on December 31, 3015
[2] Resigned from RDF advisory group as of November 10, 2015.
[3] Appointed by Minnesota Environmental Partnership as of January 13, 2015.
[4] Appointed by Minnesota Environmental Partnership as of December 8, 2015.

RENEWABLE DEVELOPMENT FUND FINANCIAL STATEMENT
As of December 31, 2015

	2001 - 2014	2015	Since RDF Inception (2001-2015)
Total RDF Credits	**$250,500,000**	**$25,600,000**	**$276,100,000**
Excelsior	$10,000,000	$0	$10,000,000
Energy Production Grants	$20,675,324	$1,072,213	$21,747,537
Research Grants	$29,692,455	$1,737,551	$31,430,006
Total RDF Grant Payments	**$60,367,780**	**$2,809,764**	**$63,177,544**
Administrative Costs	**$2,241,621**	**$15,741**	**$2,257,362**
University of Minnesota	**$25,000,000**	**$0**	**$25,000,000**
REPI	**$83,146,277**	**$4,652,960**	**$87,799,237**
Solar Rebates	**$7,995,985**	**$16,031,951**	**$24,027,936**
Other Legislative Mandates	**$25,451,809**	**$0**	**$25,451,809**
Total RDF Costs	**$204,203,473**	**$23,510,416**	**$227,713,889**

SUMMARY OF RDF PROGRAM FUNDS

Total Amount Credited to RDF	(+)	$276,100,000
Total RDF Payments	(-)	$227,713,889
Total Amount of Grant Awards	(-)	$110,168,352
Total Amount of RDF Grants Paid	(+)	$63,177,544
Unencumbered Cumulative Balance	(=)	$1,395,303

Active RDF Projects by Congressional Districts (1/1/2015 - 12/31/2015)

RDF Contract	Grant	Type	Cycle	Renewable Category	Host Site		Project Sponsor	
					District	Location	District	Organization
District 1								
EP4-5	$900,000	EP	4	Solar	MN01	SSND, Mankato	MN03	Best Power, Hopkins
District 2								
RD3-77	$1,000,000	RD	3	Biomass	MN02	P & J Farms, Northfield	IL	Coaltec Energy USA, Carterville
EP4-48	$2,000,000	EP	4	Solar	MN02	BLWWTP, Shakopee	CO	Oak Leaf Energy, Denver
RD4-2	$982,408	RD	4	Solar/Wind	MN02	WCROTC, Morris	MN05	U of M, Minneapolis
District 3								
EP4-5	$900,000	EP	4	Solar	MN01	SSND, Mankato	MN03	Best Power, Hopkins
EP4-6	$172,213	EP	4	Solar	MN06	SJU, Collegeville	MN03	Best Power, Hopkins
EP4-12	$2,022,507	EP	4	Solar	MN03	MAC, Bloomington	MN03	MAC, Bloomington
District 4								
RD3-1	$992,989	RD	3	Biomass	MN02	Rahr Malting	MN04	U of M, St. Paul
EP4-11	$1,850,000	EP	4	Solar	MN04	EIC, St. Paul	MN05	IPS, Minneapolis
EP4-20	$583,513	EP	4	Solar	MN04	Midway Superstore, St. Paul	MN05	Target, Minneapolis
EP4-34	$555,750	EP	4	Solar	MN04	CHS Field, St. Paul	MN04	City of St. Paul
HE4-2	$2,157,215	HE	4	All	MN06	Winehaven, Chisago City	MN04	UST, St. Paul
HE4-3	$3,000,000	HE	4	All	MN04	U of M, St. Paul	MN05	U of M, Minneapolis
District 5								
AH-01	$5,100,000	EP	1	Hydro	MN05	Crown Hydro, Minneapolis	MN05	Crown Hydro, Minneapolis
EP4-11	$1,850,000	EP	4	Solar	MN04	EIC, St. Paul	MN05	IPS, Minneapolis
EP4-15	$2,661,320	EP	4	Solar	TBD	TBD	MN05	MRES, Minneapolis
EP4-20	$583,513	EP	4	Solar	MN04	Midway Superstore, St. Paul	MN05	Target, Minneapolis
EP4-22	$969,741	EP	4	Solar	MN05	MPRB, Minneaoplis	MN05	MPRB, Minneapolis
RD4-2	$982,408	RD	4	Solar/Wind	MN02	WCROTC, Morris	MN05	U of M, Minneapolis
RD4-12	$625,102	RD	4	Wind	MN05	U of M, Minneapolis	MN05	U of M, Minneapolis
RD4-13	$1,391,684	RD	4	Wind	MN05	U of M, Minneapolis	MN05	U of M, Minneapolis
HE4-3	$3,000,000	HE	4	All	MN04	U of M, St. Paul	MN05	U of M, Minneapolis
District 6								
EP4-6	$172,213	EP	4	Solar	MN06	SJU, Collegeville	MN03	Best Power, Hopkins
EP4-24	$1,106,600	EP	4	Wind	MN06	Stearns, Sherburne, Meeker	OK	Bergey Windpower, Norman
HE4-2	$2,157,215	HE	4	All	MN06	Winehaven, Chisago City	MN04	UST, St. Paul
District 7								
RD3-69	$1,000,000	RD	3	Biomass	MN07	MnVAP, Priam	MN07	MnVAP, Raymond
RD3-41	$958,369	EP	4	Solar	MN07	City of Hutchinson	MN07	City of Hutchinson
District 8								
RD4-11	$1,899,449	RD	4	Biomass	MN08	NRRI, Coleraine	MN05	U of M, Minneapolis