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Minneapolis, Minnesota 55401

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July 29, 2013

—Via Electronic Filing—

Burl W. Haar
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota 55101

RE: SELECTION REPORT
RENEWABLE DEVELOPMENT FUND - CYCLE 4
DOCKET NO. E002/M-12-1278

Dear Dr. Haar:

Northern States Power Company, doing business as Xcel Energy, submits the enclosed Renewable Development Fund Cycle 4 Selection Report in compliance with Ordering Paragraph 6 (e) of the Minnesota Public Utilities Commission's February 6, 2013 ORDER APPROVING REQUESTS FOR PROPOSALS AND STANDARD CONTRACTS AS MODIFIED in the above-referenced Docket.

Specifically, we request Commission approval of:

- Our recommended Cycle 4 grant awards for energy production projects and research and development projects as identified in the selection report;
- Our recommended Cycle 4 Tier I and Tier II Reserve Projects as identified in the selection report;
- The authority to terminate contract negotiations that we reasonably believe have reached an impasse and move forward with a project on the Tier I and Tier II Reserve Projects list; and
- Our recommended awards for the higher education block grants, subject to the amounts and limitations detailed in the selection report.

While the request for approvals listed above is specifically from the Company, the requests are made with the input and advice of the RDF advisory group. We believe it is accurate to state that the advisory group is in full agreement with the Company on

all of our recommendations with only one area of difference—the order of the projects on the reserve list.

With respect to the projects that are on the list of reserve projects, the list of projects on the list is supported by the advisory group, however, there is difference in view amongst the individual advisory group members as to the order of projects on the list. In addition, the Company's decision to create a Tier I and Tier II level of reserve projects has created some reservations from some advisory group members.

Despite these differing viewpoints on the order of the projects on the reserve list, the Company is pleased that all projects recommended for funding, as well as the projects on the reserve list should RDF funds become available for them, are supported by both the Company and the advisory group.

It is our understanding the Commission may issue a Notice of Comment Period after this Selection Report is filed. Parties wishing to file comments typically have 30 days from the date the Notice is issued to file their written comments and reply comments are generally due 15 days after the initial comments. Given the interest of parties who eagerly wish to proceed with their respective project if they receive an RDF grant award, it would be much appreciated if the Commission could take action on this report in approximately 90 days after its filing. Also, pursuant to Ordering Point 6 (g) of the February 6, 2013 Order, and at the discretion of the Commission, the Company stands ready to organize a question-and-answer session for the Commission with stakeholders, potential grantees selected by Xcel Energy, and members of the RDF advisory group.

This report contains information marked as trade secret pursuant to Minn. Stat. § 13.37, subd. 1(b). In particular, the information designated as Trade Secret derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use.

We have electronically filed this document, and served copies of the public version on the parties on the attached service lists.

If you have any questions regarding this filing please contact me at (612) 330-7529 or paul.lehman@xcelenergy.com.

Sincerely,

/s/

PAUL J LEHMAN
MANAGER, REGULATORY COMPLIANCE AND FILINGS

Enclosures
cc: Service List
Applicants

**XCEL ENERGY RENEWABLE DEVELOPMENT FUND
PROJECT SELECTION REPORT
CYCLE 4**

**PREPARED BY
XCEL ENERGY**

**Docket No. E002/M-12-1278
July 29, 2013**

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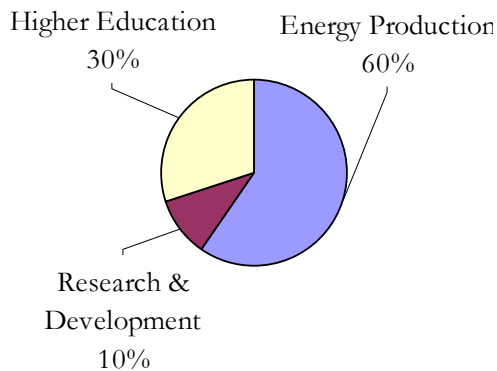
Sargent & Lundy Final Report	Attachment A
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Higher Education Block Grant Scoring Results	Attachment D
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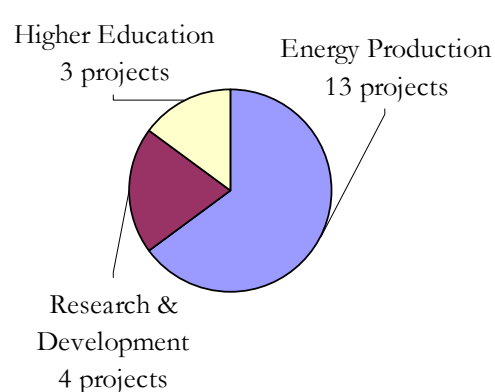
I. Executive Summary

Northern States Power Company is pleased to submit this Renewable Development Fund (RDF) Cycle 4 grant award selection report and respectfully requests the Commission approve our RDF Cycle 4 project recommendations as well as the associated awards as described in this report. In this report, we will summarize the extensive review process that took place, as well as our rationale for selection and a description of the benefits of the RDF grant awards we are recommending for approval by the Minnesota Public Utilities Commission. We are recommending a total of \$30,122,346 in grant awards for 20 projects and programs including 13 Energy Production projects, four Research and Development projects, and three Higher Education block grant programs.¹ We are also proposing a Reserve List of 13 projects in the event a recommended project cannot or does not come to fruition.

Funding Distribution (\$30.1 M)



Funding Distribution (20 Projects)



There are many differences between this RDF grant cycle and the previous three cycles. It has been six years since the RDF Cycle 3 grant process was initiated and the renewable energy landscape has changed greatly since that time. Today, there is heightened interest in solar photovoltaic (PV) technology and growing support for distributed generation projects. At the same time, there is continued interest in wind technology and biomass technology improvements.

In addition, in 2012, the Minnesota Legislature made several important changes to the RDF program. These changes include a shift in final responsibility from

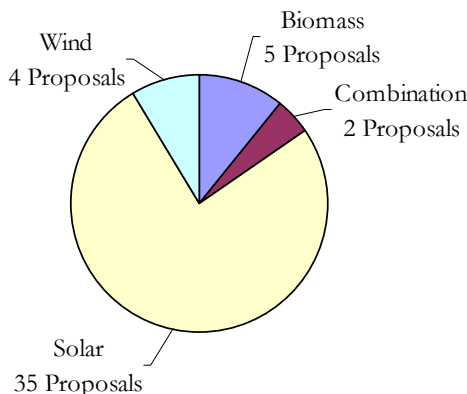
¹ As we will describe later in this report, we recommend full funding for one Higher Education block grant program and hold in abeyance an amount of about \$3.5 million for block grants to the other two institutions, subject to negotiations.

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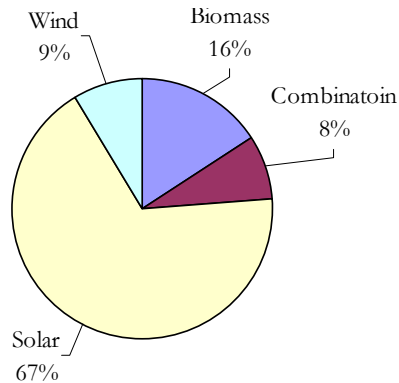
the RDF advisory group to the Company for making RDF grant award recommendations. Also, the Minnesota Legislature placed a greater emphasis on projects located in Minnesota that provide ratepayer benefits and included a higher educational institution block grant component within the RDF program. (See Section II of this report.) Further, we are making a number of improvements to the RDF program based on the lessons learned in conjunction with past funding cycles. Given all of these changed circumstances, the 4th RDF grant cycle is considerably more robust and dynamic, which has made the selection process even more challenging.

The Cycle 4 Request for Proposals issued in February 2013 generated 67 qualifying proposals and a total funding request of about \$133.5 million, including three higher education block grant proposals.² As indicated in our RFP, we have about \$30 million unencumbered and available for RDF Cycle 4 grants. The 67 proposals included 46 Energy Production projects requesting \$91.8 million, 18 Research & Development projects requesting \$18.7 million, and three Higher Education block grant proposals requesting \$14.6 million.

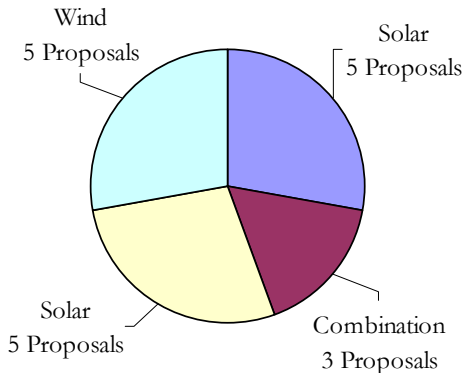
Energy Production (46 Proposals)



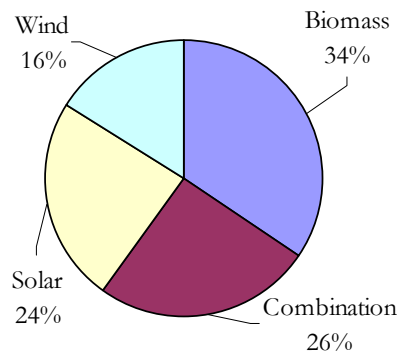
Energy Production (\$91.8 million)



Research Development (18 Proposals)



Research Development (\$18.7 million)



² A total of 71 proposals were received but 4 proposals did not meet the eligibility criteria.

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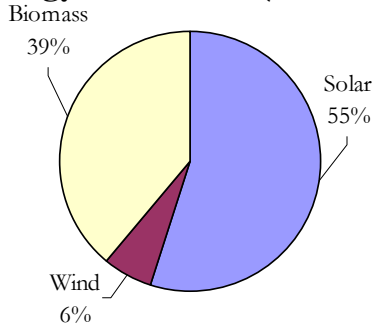
Due to the changes in electric energy landscape and in the RDF's implementing legislation as well as the lessons learned from Cycle 3, our RFP for Cycle 4 provided parameters for proposals we believed would help ensure that bids were targeted to meet the RDF's purpose. All of the qualifying 67 bids appear to support the goals of the RDF program. That said, due to the overwhelming interest in obtaining RDF funding, the Company can only recommend a portion of the proposals we received for funding. Further, the significant interest in solar PV installations, the rigor of our selection process and the input from the RDF advisory group made it clear that there was significant value in evaluating projects based not only on objective scoring provided by our independent evaluator, but also on unquantifiable subjective merits as well. Particularly, the substantial interest in solar PV installations led to material discussions amongst the advisory group and Company as to which installations were best selected for funding based on such a holistic review. We believe that the general consensus between the Company and the RDF advisory group on these project recommendations supports our use of subjective criteria in addition to objective scoring.

This report will provide a summary of the process, and the rationale, used in reaching a final list of recommended projects. The process included an extensive review by an independent evaluator (*see* Section III of this report), followed by valuable input from the RDF advisory group (*see* Section IV of this report). The Company then considered the independent evaluator's review and the RDF advisory group's input prior to making our final recommendations. As a result, the Company is recommending a diverse group of projects that will enable us and the project sponsors to explore the new dynamics in play today and move forward with projects that have the potential to provide significant benefits. Our recommendations include:

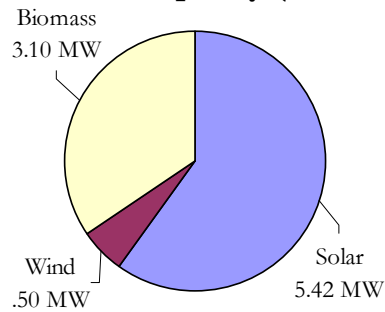
- \$6,030,221 for seven solar PV projects to be used for self-generation
- \$3,825,250 for three solar PV projects with the output sold to the Company
- \$1,106,600 for one small wind project with output to be used for self-generation
- \$7,000,000 for two biomass projects with the output to be used for self-generation or sold to the Company
- \$3,160,275 for four research and development projects
- \$9,000,000 for three higher educational institution block grants

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Energy Production (\$18.0 million)



Installed Capacity (9.0 MW)



We are also recommending an additional 13 projects to be placed in Reserve Status for a possible RDF grant award. Specifically, the Company is designating three proposals to be placed on a Tier I reserve projects list and 10 proposals to be placed on a Tier II reserve projects list. The Company is seeking approval to award Tier I projects if funds become available before Tier II projects. As discussed in Section IV, several of the projects recommended for an RDF grant award are in a position to execute our new standard RDF grant contract if the Commission approves our project recommendations.³ A number of other recommended projects, however, have proposed special conditions or are facing circumstances that will take additional time to resolve. As we have learned in past RDF grant cycles, some negotiations will not lead to a satisfactory resolution. The Company is requesting explicit authority to terminate negotiations that we reasonably believe have reached an impasse and proceed by replacing it with one of the Reserve Projects. In the event that a Reserve Project does not enter into a standard contract, we will submit a non-standard contract to the Department of Commerce for review and approval prior to proceeding with the project.

As mentioned earlier, one of the new features of the RDF grant program is the creation of a Higher Educational Institution block grant program. Under the 2012 RDF statute, RDF monies can be used to fund various research activities at any Minnesota higher educational institution (public or private). We were pleased to see proposals from the University of Minnesota, the Minnesota State College and University (MnSCU) System and the University of St. Thomas. Again, we sought input from the RDF advisory group regarding those proposals.⁴ We are recommending approval of a \$5.5 million RDF grant award for the MnSCU proposal. We are not currently in a position to submit a

³ Docket No. E002/M-12-1278, MPUC ORDER APPROVING REQUESTS FOR PROPOSALS AND STANDARD CONTRACTS AS MODIFIED, dated February 6, 2013.

⁴ The independent evaluator was not tasked to review the Higher Education proposals.

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recommendation regarding a specific dollar amount for the University of Minnesota and University of St. Thomas proposals. There are intricate issues such as patent royalty sharing and grid accessibility associated with the proposals. We are requesting an additional 120 days to reach a resolution of such concerns with the involved parties. The Company has set aside about \$3.5 million in total for these two proposals if our concerns can be resolved. If successful, the Company requests the ability to fund both of these higher education proposals but at a reduced level of funding from the proposal, subject to submitting the final RDF grant contract to the Department of Commerce for review and approval.

The tables below summarize our proposed recommendations:

**Table 1. Recommended EP Projects
(In Numerical Order/Not By Rank)**

ID Number	Applicant	Type	Amount Recommended⁵	Total Project Cost
EP4-3	Edison High School	Solar (485 kW)	\$917,250	\$1,949,002
EP4-4	SGE Partners, LLC	Biomass (1,100 kW)	\$5,000,000	\$14,847,764
EP4-5	School Sisters of Notre Dame	Solar (907 kW)	\$900,000	\$1,811,857
EP4-7	Anoka Ramsey Community College	Solar (458 kW)	\$828,900	\$1,825,976
EP4-9	Mondovi Energy Systems	Biomass (2,000 kW)	\$2,000,000	\$13,220,683
EP4-11	Innovative Power Systems, Inc.	Solar (967 kW)	\$1,850,000	\$2,698,200
EP4-13	Metropolitan Airport Commission	Solar (1,180 kW)	\$2,022,507	\$4,189,000
EP4-20	Target Corporation	Solar (350 kW)	\$583,513	\$1,060,933
EP4-22	Minneapolis Park & Recreation Board	Solar (200 kW)	\$969,741	\$1,119,133
EP4-24	Bergey Windpower	Wind (500 kW)	\$1,106,600	\$3,191,745

⁵ The RDF advisory group and the Company recommend fully funding the amounts requested for projects instead of only a portion of the requested funding.

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EP4-39	Goodwill Solar, LLC	Solar (700 kW)	\$1,075,250	\$1,525,250
EP4-42	Aurora St. Anthony, LLC	Solar (252 kW)	\$398,000	\$911,798
EP4-43	Cornerstone Group	Solar (152 kW)	\$310,310	\$705,250
Total			\$17,962,071	\$49,056,591

**Table 2. Recommended R&D Projects
(In Numerical Order/Not By Rank)**

ID Number	Applicant	Type	Amount Recommended	Total Project Cost
RD4-2	U. of Minnesota	Wind/Solar	\$982,408	\$982,408
RD4-12	U. of Minnesota	Wind	\$625,102	\$625,102
RD4-13	U. of Minnesota	Wind	\$1,391,684	\$1,391,684
RD4-14	Barr Engineering	Wind	\$161,081	\$161,081
Total			\$3,160,275	\$3,160,275

**Table 3. Tier I Reserve Projects
(In Numerical Order by Category/Not By Rank)**

ID Number	Applicant	Type	Amount Recommended	Total Project Cost
EP4-15	MN Renewable Energy Society	Solar (1,000 kW)	\$2,661,320	\$4,036,420
EP4-34	City of St. Paul	Solar (104 kW)	\$555,750	\$741,000
RD4-8	City of Red Wing	Refuse Derived Fuel	\$1,999,500	\$6,896,939
Total			\$5,216,570	\$11,674,359

**Table 4. Tier II Reserve Projects
(In Numerical Order by Category/Not By Rank)**

ID Number	Applicant	Type	Amount Recommended	Total Project Cost
EP4-6	Best Power	Solar	\$172,213	\$414,033
EP4-21	Farmamerica	Solar/Wind	\$600,000	\$600,000
EP4-29	Dragonfly Solar, LLC	Solar	\$1,650,000	\$2,650,000
EP4-36	City of Austin	Solar	\$3,565,000	\$6,545,000
EP4-41	City of Hutchinson	Solar	\$958,369	\$1,742,489
EP4-48	Oak Leaf Energy Partners, LLC	Solar	\$2,000,000	\$2,864,810
RD4-4	Xcel Energy	Solar	\$390,000	\$505,000
RD4-5	U. of Florida	Biomass	\$1,109,538	\$1,109,538

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RD4-7	Interphases Solar	Solar	\$1,000,000	\$1,095,000
RD4-11	U. of Minnesota	Biomass	\$1,899,449	\$2,345,502
Total			\$13,344,569	19,871,372

II. Project Review and Recommendation Process

A. 2012 Statutory Framework

In 2012, the Minnesota Legislature approved a number of significant revisions to the RDF statute (Minn. Stat. § 116C.779) and some of those changes altered the Cycle 4 selection process compared to previous grant award cycles. In particular, the 2012 legislation emphasized that:

- RDF funds should be used to develop near-commercial and demonstration scale renewable electric project or near-commercial and demonstration scale electric infrastructure delivery projects if those delivery projects enhance the delivery of renewable electric energy.
- The process of determining the scope and subject and in evaluating responses to RFPs must strongly consider, where reasonable, the potential benefit to Minnesota citizens and businesses and Xcel Energy ratepayers.

The 2012 legislation also revised the role of the RDF advisory group and the Company in making the selection and final recommendation regarding responses to RFPs. In past funding cycles, the RDF advisory group was responsible for making the final recommendations to the Commission regarding possible grant awards. The 2012 statute specified that the Company has full and sole authority to determine which proposals should be submitted to the Commission for approval. The 2012 statute, however, also specifies that the Company must consult with the RDF advisory group and should attempt to reach agreement with them in determining final proposal selections and recommendations.

Throughout the Cycle 4 process, the Company has made a concerted effort to collaborate with the RDF advisory group in shaping the RFP itself and in the review and recommendation of Cycle 4 RFP responses. As evident later in this selection report, input from the RDF advisory group has been highly valuable and incorporated into the selection process. The Company and the RDF

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advisory group are in agreement with most of the grant award recommendations, with three possible exceptions that will be discussed in Section V of this report.

B. Selection and Review Process

In its February 6, 2013 Order, the Commission approved the following Ordering Point specifying the procedural steps for RDF Cycle 4 and for all future RDF cycles until such time as the Commission approves revisions:

- a. The Commission reviews and approves selection criteria as proposed by Xcel Energy with input from the Advisory Group.
- b. With input from the Advisory Group, Xcel Energy develops and files an RFP based on approved selection criteria. Xcel Energy files the proposed RFP and standard form contracts with the Commission and the Department. If no comments are received within 30 days and unless otherwise directed by the Commission, Xcel Energy issues the proposed RFP.
- c. With input from the Advisory Group, Xcel Energy oversees the project selection process and makes a final project selection recommendation to the Commission.
- d. Xcel Energy utilizes an independent third-part expert to evaluate project proposals for EP and RD projects. The Company may also decide whether to retain an independent third-party to assist in the review of responses to the RFP for institutions of higher education.
- e. Within 60 – 90 days of receiving project proposals in response to both RFPs, Xcel Energy -submits its final project selections to the Commission for approval. The final selection report shall include a detailed explanation of any deviations from the rankings for EP, RD and institutions of higher education projects provided by an independent third-party evaluator or other evaluator.
- f. If within 90 days of the project proposal receipt date the Company's final project selections are not filed with the Commission, Xcel Energy shall file a letter with the Commission explaining the reasons for the delay and shall continue to file such a letter every 30 days until the final project selection is submitted to the Commission.
- g. At the discretion of the Commission, prior to formal Commission consideration of Xcel Energy's final project selection, the Company shall organize a question-and-answer session for the Commission with

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- stakeholders, potential grantees selected by Xcel Energy and members of the RDF Advisory Group.
- h. Once the Commission approves a final selection of project, Xcel Energy may execute grant contracts with the approved projects. All finalized grant contracts must be filed with the Commission prior to the start of the project or program.
 - i. If a grant contract executed with a winning bidder contains no changes from the standard form contract for EP and RD projects, the grant contract shall be filed with the Commission (and in the docket) for informational purposes only. However, if a final grant contract deviates from the standard form contract, the grant contract shall be filed with the DOC (and in the docket) for DOC compliance review. If the DOC identifies issues that cannot be resolved, it will bring the contract to the Commission for review. Otherwise, the DOC will file a letter with the Commission indicating compliance review approval. Xcel Energy shall provide a red-lined version of any grant contract that differs from the standard form contract at the time the contract is filed for compliance review.
 - j. Xcel Energy shall file with the Commission for approval all grant contracts executed with institutions of higher education resulting from the separate RFP.
 - k. Xcel Energy shall submit annual progress reports to the Minnesota House and Senate energy committees and to the Commission addressing the operation of the RDF program as required by statute. The annual report should also include the information required by the Commission in the current biennial report.
 - l. Xcel Energy shall continue to file quarter informational and progress reports on on-going RDF projects and grant contracts with the Commission.
 - m. Xcel Energy shall post all final reports, mid-project status reports, and RDF account financial reports on the Commission-designated public website. All projects must provide a written final technical report and a clearly written summary for non-technical readers.

Our 2013 Cycle 4 RFP process started during the summer of 2012 after passage and enactment into law of the RDF statutory changes made by the 2012 Minnesota Legislature. The first step was the compilation of our Cycle 3 lessons learned report, which addressed such issues as:

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1. Open-ended schedules and how to deal with projects that are not moving forward in a timely manner;
2. Co-applicant conflicts and how to resolve same when project sponsors are engaged in a dispute regarding project rights and responsibilities;
3. The value of an RDF standard contract in order to move forward with a Commission-approved project in a more timely manner; and
4. How to resolve changes in proposing energy pricing by a project sponsor from the time an RDF application is submitted to the time a power purchase agreement is negotiated.

With input from the RDF advisory group, these and other lessons learned were included in our Cycle 4 RFP filing submitted to the Commission in this docket on November 29, 2012. The filing also included the selection criteria developed by the Company and the RDF advisory group for Cycle 4 grant awards. These criteria were proposed to be more holistic than in prior cycles to account for the intent of the 2012 legislative changes to the RDF statute.

Subsequent to Commission approval of the Cycle 4 RFP in its February 6, 2013 Order, the Company issued the RFP on February 15, 2013 and proposals were due on April 1, 2013.

In conformance with the process established by the Commission, the Company also took the following steps:

1. Issued an RFP and selected an independent evaluator to review each of the RFP responses based on the criteria submitted in this docket and approved by the Commission. The Company selected the firm Sargent & Lundy for this purpose. See Section III for further details regarding the independent evaluation process.
2. The Company decided to use the RDF advisory group as the independent evaluator for the review of responses to our Higher Education institution block grant RFP. See Section IV part D for further details regarding their review of the proposals.
3. The independent technical evaluation was completed by Sargent & Lundy on June 11, 2013 and submitted to the Company and the RDF advisory group for review.
4. Each RFP response was reviewed in depth by a minimum of two members of the RDF advisory group.
5. The RDF advisory group conducted an all-day meeting on June 12, 2013 to develop recommendations to the Company for the allocation of funds

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to energy production, research and development and higher education initiatives. Their review included consideration of the technical scoring completed by the independent evaluator, input from assigned RDF advisory group reviewers, and a certain degree of subjective consideration in order to achieve in the best manner possible to achieve the overall mission and goals of the RDF program as identified in the statute.

6. The Company carefully considered the independent evaluator's report and the comments of the RDF advisory group in making its recommendation to the Commission.

C. Recommendation Qualifiers

There are three recommendation qualifiers we wish to bring to the Commission's attention:

1. While the technical review by Sargent & Lundy was sound and helpful, we wish to emphasize it represents only one factor in the overall selection and recommendation process. An equally important step was the input from the RDF advisory group, which did not score the proposals but instead took a more holistic approach to their review. The RDF advisory group looked at the proposals in terms of accomplishing the overall RDF mission and the unique and less quantifiable aspects of the proposals such as:

- The creative or innovative application of renewable technologies
- The current state of renewable technology in Minnesota today such as aging wind towers and obstacles to small wind deployment
- The rural (agricultural) and urban (redevelopment) challenges and opportunities found within the state today
- The ability to reach out to, and educate, student populations as well as the general public
- The opportunity to deploy renewable technology in high visibility areas
- The potential for combining the use of different renewable technologies
- The opportunity to leverage the technology transfer capabilities of a project sponsor
- A mix of installing solar PV arrays on commercial and multi-unit residential properties

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2. As anticipated, there was strong interest in the RDF Cycle 4 funding cycle and we received significantly more proposals than we have the dollars to support. For this and other reasons, the Company and the RDF advisory group have established a Reserve Status list of projects that would produce significant benefits if they received an RDF grant award. Based on our lessons learned from past funding cycles, we know that not all of the projects initially selected and recommended for a grant award may be able to proceed with development activities. This may be due to reasons such as securing site access for a specific project or it may be due to an impasse in negotiating a contract with various parties including a power purchase agreement with the Company.

We put various safeguards into our RFP to preclude such delays but we also know that not all projects proceed as planned. Given the number of very good projects the Company and the RDF advisory group have placed in Reserve Status, we are requesting explicit Commission authority to terminate negotiations for good cause with any project sponsor of a recommended project if an impasse or stalemate has been reached and cannot be resolved in a reasonable timeframe.

3. We note that one of principals involved in the application by the University of St. Thomas for a Higher Education block grant proposal is on sabbatical and currently employed on a consulting basis by Xcel Energy. The principal works in our distribution system engineering department, and was not involved in the review of any RDF proposals. The RDF advisory group and Company representatives involved in reviewing the UST proposal were not aware of this relationship at the time their proposal was reviewed. We do not consider this matter to be a conflict of interest; after all, the Company is allowed by statute to apply for RDF grant funds just like other eligible parties. Nevertheless, we have informed the RDF advisory group of this matter and we also wish to bring it to the Commission's attention.

III. Independent Evaluator Report

On January 22, 2013 Xcel Energy issued an RFP for evaluation services of Cycle 4 proposals by an independent, third-party vendor. Five vendors responded to the RFP closed which closed on February 23, 2013. As a result of the RFP, Sargent & Lundy was chosen to provide proposal evaluation and reporting services. Sargent & Lundy was the Company's highest rated bidder based on the evaluation of weighted criteria. The prime categories were technical competence, pricing, and strength of the vendor. Subsequent to

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selection, an interview was performed to confirm that the vendor fully understood the work effort and had responded accurately to all criteria.

Sargent & Lundy developed its evaluation report based on the framework and criteria outlined in the RFP. Scoring focused on proposal completeness, technical feasibility, project technical and financial risk and benefits to Xcel Energy ratepayers. The highest possible score that any project could receive was 230 points based on the following Core Criteria and Point System:

Table 5. Core Criteria and Point System

Core Criteria	Maximum Possible Points	
	RD Projects	EP Projects
Project Method, Scope & Deliverables	20	20
Technical Requirements	70	70
Management Team, Schedule and Cost	30	30
Potential Benefits to Minnesota and Ratepayers	80	20
Total Resource Cost per kWh (EP Only)	0	60
<i>Core Criteria Score</i>	200	200
Maximum Bonus Points Allowed*	30	30
Overall Total	230	230

*Bonus points were awarded for the following preferences:

1. Projects supported by the Prairie Island Indian Community
2. Projects located within the Energy Innovation Corridor
3. Projects structured to receive RDF grant payment as a lump-sum amount upon completion
4. Projects located within Xcel Energy's service territory in Minnesota and Wisconsin
5. R&D projects that demonstrate a high likelihood of royalty return and propose a larger royalty ratio
6. Projects sponsored by a K-12 school or local unit of government to construct a solar PV facility
7. For anaerobic digester systems, projects that propose to use non-agricultural residue for a feedstock

Please see Attachment A for the Sargent & Lundy technical evaluation report and Attachment C for their final scoring results. The RDF advisory group used the independent evaluator's report to help guide its initial evaluation of the projects.

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IV. Advisory Group Input

A. Energy Production and Research & Development Proposals

On June 12, 2013, the RDF advisory group conducted an all-day meeting to discuss and reach a recommendation regarding the Cycle 4 RFP responses. Sargent & Lundy representatives were in attendance to review their report and respond to technical questions. RDF administration was also in attendance.

Prior to the meeting, each proposal was assigned for review by two RDF advisory group members. One member declared a conflict of interest in reviewing proposal EP4-13 and that proposal was transferred to a different advisory group member for review.

The following is a brief summary of the projects recommended by the RDF advisory group, along with a brief explanation of their rationale for such selections. Please see Attachment E for a more detailed description of each project and the RDF advisory group perspective:

1. Solar Projects

Minneapolis Public Schools: Edison High School Green Campus Solar Project (EP4-3)

This 485 kW solar PV project will significantly advance Edison's leadership role as a green campus with a hands-on "classroom" to be integrated with the school's curricula and serve as a model for K-12 schools throughout Minneapolis and the entire state. Their new ballpark uses LED lighting and they have a good math and science curriculum. Edison will be working closely with Minnesota-based tenKsolar to demonstrate advanced solar PV technologies. The project includes an educational and research component. It will also help reduce school operating costs and contribute to net school revenues. The project received a score of 141.6 points from Sargent & Lundy, and strong support from the RDF advisory group for several reasons including its inner-city location and the school's focus on sustainability.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

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Best Power Int'l, LLC: School Sisters of Notre Dame Solar Park Project (EP4-5)

This 907 kW solar PV project, to be located in Mankato, Minnesota, is part of the sponsor's "Green Habit Campaign." The Solar Park project will utilize a higher voltage (1000 Vdc) system (most systems operate on a voltage of 600 Vdc). This higher voltage system can produce savings in terms of wire size and other components as well as reduce installation time. The technology has been deployed in California and Europe but has not yet been used in Minnesota. The project is in a good location for solar production, and it will be the first RDF project in the Mankato area. The project will provide local electrical inspectors with the opportunity to become more familiar with the unique wiring requirements of the 1000 Vdc technology. The project received a score of 149.0 points from Sargent & Lundy, and strong support from the RDF advisory group due to its use of new technology and related educational benefits. The project may have scored higher but the application lacked detail on project interconnection plans/costs.

Project generation will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

Anoka Ramsey Community College: Research Coordinated Solar PV Demonstration Project (EP4-7)

This 458 kW solar PV project, sponsored by Anoka Ramsey Community College, will include a ground-mounted array and roof-mounted array on a job training center. The project will be used for job skills development as well as energy-related coursework and research. The solar PV system will be connected to a carport and solar electric vehicle charging station. The project will use solar PV panels from Minnesota-based tenKsolar. The project received a score of 151.8 points from Sargent & Lundy, and strong support from the RDF advisory group due to its educational component although concern was expressed regarding the need to better define and develop their proposed training curriculum.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

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Innovative Power Systems, Inc.: Green Line Solar Corridor (EP4-11)

This 967 kW solar PV project, to be located within the Energy Innovation Corridor, will demonstrate a public-private tax equity investment structure. The project will consist of five different solar PV arrays roof-mounted on five commercial buildings along University Avenue. Three of the arrays will be “off-azimuth,” which should provide for greater solar output later in the day when loads are at or near peak levels. The project will use new and larger solar modules, rated at 410 or 440 watts, manufactured by Minnesota-based tenKsolar. The project will demonstrate tenKsolar’s RAIS-WAVE module architecture. The project received a score of 158.3 points from Sargent & Lundy, and strong support from the RDF advisory group due to the high project visibility and use of five different sites.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

Metropolitan Airport Commission: Solar PV Parking Ramp Peak Production Project (EP4-13)

This 1.18 MW solar PV project, to be located on the upper deck of a parking ramp at Terminal One of the Minneapolis-St. Paul International Airport, will be configured for future integration with an energy storage system, electric vehicle charging stations, and demand management technologies. Some of the solar PV panels will be placed “off-azimuth” to shift as much of the output as possible to the most critical periods of the day for peak power demand. This project may be the first of several at the airport. The project received a score of 163.3 points from Sargent & Lundy, and strong support from the RDF advisory group due to its potential for replication at the host airport and many other airport locations.

Project generation will be consumed on site. The applicant has requested special conditions including possible ownership of renewable energy credits that precludes use of the standard RDF grant contract. The Company has not agreed to such special conditions in previous cycles.

Target Corporation: Target Midway Solar PV Project (EP4-20)

This 350 kW solar PV project will be located at a high visibility store location in the Midway area of St. Paul within the Energy Innovation Corridor and adjacent to the Central Corridor light rail system. This will be the first solar PV project for the Target Corporation and, if successful, could be repeated at

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several of their other store locations. Target Corporation has excellent marketing capabilities. The project will include an educational program including displays at the store to increase solar awareness. The project received a score of 182.9 points from Sargent & Lundy, and strong support from the RDF advisory group due to its high visibility and inner-city customer base.

Project generation will be consumed on site. The applicant has requested special conditions regarding default and termination that will require negotiation. The standard RDF grant contract will not be used.

Minneapolis Park and Recreation Board: Minneapolis Park and Recreation Board Solar Commercial Demonstration Project (EP4-22)

This 200 kW solar PV project will consist of one 150 kW roof-mounted installation at a high visibility Park Board location to be determined and five smaller installations at various locations with high traffic and/or pedestrian patterns such as restaurants with outdoor seating canopies and carports. The solar PV panels will be provided by Minnesota-based tenKsolar and Silicon Energy. The project will include a public interpretive and educational program. The project received a score of 123.0 points from Sargent & Lundy, and strong support from the RDF advisory group due to its public education component. There was some concern about the total project cost and low cost-share.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

Goodwill Solar, LLC: Goodwill Solar Project (EP4-39)

This 700 kW solar PV project will be roof-mounted at the Goodwill Easter Seals corporate headquarters in St. Paul, Minnesota. It is a highly visible location within the Energy Innovation Corridor. The project will deliver energy to Xcel Energy through a power purchase agreement, and will provide data to aid in the research and development of accurate energy and capacity pricing for solar technologies. The project received a score of 160.7 points from Sargent & Lundy, and strong support from the RDF advisory group due to the financial and technical credibility of the developer and the highly visible location in a diverse community.

Project generation will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

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Aurora St. Anthony Limited, LLC: Old Home Plaza Solar Energy Project (EP4-42)

This 252 kW solar PV project is designed to demonstrate the contribution that on-site solar PV generation can make to permanent affordability housing. The developers (Aurora St. Anthony Limited, LLC) are renovating the former Old Home Milk Dairy to create 57 units of rental housing, commercial space and parking. Seven of the units will be used to serve the long-term homeless. The project is located within the Energy Innovation Corridor. The project will demonstrate the design and ownership structure for solar energy that can be integrated with other affordable housing and urban redevelopment projects. The solar PV panels will be provided by Minnesota-based tenKsolar and the project will demonstrate their RAIS-WAVE module architecture. The project received a score of 155.9 points from Sargent & Lundy, and strong support from the RDF advisory group because of the credibility of the developer and integration of solar energy with affordable housing, although there was some concern about the total project cost.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

Cornerstone Group: Lyndale Gardens Solar Project (EP4-43)

This 152 kW solar PV project, developed by the Cornerstone Group, will be located at the former Lyndale Garden Center in Richfield, Minnesota. The solar PV project will be installed in conjunction with a solar carport to demonstrate a “gas station of the future” including an energy storage component and an electric vehicle charging station. The project will showcase a holistic sustainable development in an excellent urban location as part of a combined retail, mixed income housing and expansive public place connected to Richfield Lake Park. The solar PV panels will be provided by Minnesota-based tenKsolar and the project will demonstrate their RAIS-WAVE module architecture. The project received a score of 171.5 points from Sargent & Lundy, and strong support from the RDF advisory group. The RDF advisory group found the project cost to be reasonable but also expressed concern that there is a risk of potential delay since the project is part of a larger redevelopment project.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

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2. Biomass Projects

SGE Partners, LLC: South St. Paul Anaerobic Digestion and Electrical Generation (EP4-4)

This 1.1 MW project, located in South St. Paul, Minnesota, is a large-scale and multi-faceted endeavor. Based on existing technologies, the anaerobic digestion facility will process non-agricultural organic materials derived from an animal rendering facility as well as organic waste from restaurants and food processing facilities. The biogas produced from the project will be used in part as a fuel source to generate electricity as well as being delivered to the gas pipeline grid and used at the animal rendering facility owned by Sanimax Industries. The project could be a model for future urban waste reduction and energy needs. The project has the support of the St. Paul Port Authority. The project received a score of 129.1 points from Sargent & Lundy, and strong support from the RDF advisory group due to the potential for future model for using organic waste and long-term job creation.

Project generation not required for on-site needs will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has requested special conditions such as ownership of carbon-offset credits from gas production that precludes use of the standard RDF grant contract. A power purchase agreement will also be needed.

Mondovi Energy Systems: Installation of a Community Based Anaerobic Digester in Mondovi, Wisconsin (EP4-9)

This 2.0 MW project, located in Xcel Energy's service territory in Wisconsin, will use community organic wastes to generate electricity and heat. Feedstocks will be derived from several sources including a wastewater treatment plant, manure from several dairy farms, a pet food company, several meat processing plants, a dairy processing plant and organic food waste from several area restaurants, schools and other businesses. The project appears to be cost-effective and it will be the first RDF project in Wisconsin. The project sponsors intend to generate carbon offset credits tradable to companies or individuals that wish to reduce their carbon footprint. The project received a score of 135.0 points from Sargent & Lundy, and strong support from the RDF advisory group due to use of waste from multiple sources and its cost-effectiveness, although there was some concern regarding the lack of detail in their financial plan.

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Project generation will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

3. Wind Projects

Bergey Windpower Co.: Minnesota Clustered Small Wind Project (EP4-24)

This 500 kW project, developed by Bergey Wind Power Co., consists of the installation of fifty 10 kW wind turbines in Stearns, Benton and Meeker counties in Minnesota. The Guyed-Lattice towers used for the project will be 120 feet in height and the turbine blades will have a 23-foot diameter. Wind generation data from the project will be posted in real-time to a publicly accessible web site. Project output will be consumed on-site, although specific sites have not yet been identified. The wind turbines can produce power at wind speeds of five miles per hour or greater. Minnesota is home to three small wind turbine manufacturers. However, small wind technology has some image problems in Minnesota and this project could help demonstrate small wind viability. The project received a score of 129.6 points from Sargent & Lundy, and strong support from the RDF advisory group due to its uniqueness and the credibility of the project sponsors. Sargent & Lundy indicated the developer is reputable and the score could have been higher but the application lacked detail on the arrangements required with the property owners of potential project sites.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

4. Research Projects

University of Minnesota: Optimizing Renewable Electric Energy Generation on Minnesota Dairy Farms (RD4-2)

The goal of this project is to increase the use of renewable electric energy generation on Minnesota dairy farms by establishing a model “net-zero” energy use dairy parlor. The research will focus on effective methods to integrate on-site small wind and solar PV generation, conduct economic and life cycle analysis, and disseminate the results through a web site, regional workshops and other communication measures. The research will be done at the University of Minnesota’s dairy operation at their West Central Research and Outreach Center in Morris, Minnesota. The Center milks between 150 and 200

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cows and it is representative of a mid-size Minnesota dairy farm. The project received a score of 123.7 points from Sargent & Lundy, and strong support from the RDF advisory group due to the novel idea of combining solar and wind energy in a dairy farm, high visibility, and applicability to the many other dairy farms in Minnesota.

The applicant has requested special contract conditions such as full ownership of patent royalties that will require negotiation.

University of Minnesota: Wind Turbine Generated Sound: Targeted Research to Improve Measurement, Analysis, and Annoyance Thresholds Based on Measured Human Response (RD4-12)

The goal of this project is to quantify infrasound annoyance and better understand noise emissions from wind turbines to identify potential health concerns and provide a basis for regulatory and permitting requirements. This research, if successful, could help the industry understand the characteristics of turbine sounds and better respond to the public about potential health impacts. The University states that there is little or no scientific data existing to confirm or refute the extent of the negative effects of turbine infrasound and only limited data regarding human tolerance of infrasound from any source. The current research on wind turbine noise impacts is of limited value. Wind developers and regulatory authorities are very interested in the kind of research proposed by this project. The project will use data to recreate the audible sound and infrasound in a laboratory and measure the physical, emotional and psychological responses on human subjects. The project received a score of 126.9 points from Sargent & Lundy, and strong support from the RDF advisory group due to its potential value to the wind industry and state regulatory/local zoning authorities.

The applicant has requested special contract conditions such as full ownership of patent royalties that will require negotiation.

University of Minnesota: Virtual Wind Simulator with Advanced Control and Aeroelastic Model for Improving the Operation of Wind Farms (RD4-13)

This project will build upon the successful results of an RDF Cycle 3 grant award to the University of Minnesota (RD3-42 “The Development of a High Resolution Virtual Wind Simulator for Optimal Design of Wind Energy Projects”). The project will develop, demonstrate and transfer into practice a numerical simulation model that can be used by industry for optimization of wind farm operational planning, performance and financial decision-making.

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The research project may provide a useful strategy to reduce unsteady loads and blade deformation at new wind farms that will lead to reduced noise and environmental impacts. The project is about practical implementation of a detailed simulation model to assess performance and turbulence in wind farms. The project received a score of 135.1 points from Sargent & Lundy, and strong support from the RDF advisory group due to its potential value to the wind industry.

The applicant has requested special contract conditions such as full ownership of patent royalties that will require negotiation.

Barr Engineering Co.: Development of Health Assessment Tools for Utility-Scale Wind Turbine Towers and Foundations (RD4-14)

The goal of this project is to design a simpler, more user-friendly and portable sensor system to measure wind turbine tower and foundation health and life expectancy by assessing factors such as strain and tilt. The assessment tool will be tested on wind turbines that are part of Xcel Energy's Grand Meadow and Nobles wind farms. Many turbines in Minnesota are currently 20 years old and may be experiencing fatigue. This project has the potential for valuable application given the extensive wind development that has taken place in Xcel Energy's service territory and throughout Minnesota.

The project received a score of 63.0 points from Sargent & Lundy, and strong support from the RDF advisory group. The project is initial research. It will not include the actual development of a portable sensor system, and there is no patent royalty sharing. However, the RDF advisory group acknowledged that the project has good potential for resulting in a tool with commercial value.

The applicant has requested special contract conditions to accommodate requirements requested by a subcontractor, the University of Minnesota, which will require negotiation.

B. Timeframe for Energy Production & Research Projects

The Company greatly appreciates the Commission's approval of our proposed standard contracts for Cycle 4 energy production projects as well as research and development projects. We believe these standard contracts will help all parties move forward with approved projects in a timely manner.

We wish to note, however, that it will still take a number of months of effort prior to the actual execution of the standard contracts. Based on past

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experience, we anticipate that the due diligence process requires 90–120 days to complete. During this time period, the project sponsor must provide a more specific work plan with clearly established milestones for project activities leading to completion. The project sponsor also may need to provide documentation such as insurance coverage, corporate authorization to enter into the contract, the ability to provide the necessary project cost share, and identification/qualifications of key project personnel.

The same due diligence is required for project sponsors that wish to enter into a non-standard contract. The negotiation of a non-standard RDF contract can take an additional 90–120 days, although such efforts can sometimes be conducted in parallel with fulfillment of some routine due diligence requirements. In addition, the Cycle 4 RDF projects that propose to enter into a power purchase agreement (PPA) with the Company will require additional time to complete that process. The PPA process includes negotiating and entering into a PPA, preparing and submitting a PPA petition to the Commission; and regulatory review and approval of the PPA petition. This process generally takes around nine months to complete.

There are also less manageable factors in setting a timeframe for the initiation and completion of approved Cycle 4 projects. For example, specific project sites need to be identified and secured. We note, for example, that the following projects still need to resolve their site locations:

- The Minneapolis Park and Recreation Board Solar Demonstration Project
- The Minnesota Clustered Small Wind Project
- The Green Line Solar Corridor Project
- The Minnesota Renewable Energy Society Community Solar Garden Project (a reserve list project)

Further, there are factors beyond the control of the project sponsor such as being part of a larger redevelopment project (the Old Home Plaza Solar Energy Project, and Lyndale Garden Solar Project) or obtaining the private financing for upgrading a production plant (the South St. Paul Anaerobic Digestion and Electrical Generation Project).

We note the Cycle 4 RFP specified that all projects have a limited timeframe for development and should be completed within three years. We will make all reasonable efforts to work with involved parties to meet this goal. However,

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we also know some delays are inevitable and we will keep the Commission informed of such matters through our RDF quarterly reports.

C. Reserve Projects

At the June 12, 2013 RDF advisory group meeting, 13 proposals were selected for placement on a Reserve Projects List. The proposals were later ranked by the RDF advisory group to determine the possible order of selection if funding becomes available: The proposals in rank order are:

1. Minnesota Renewable Energy Society (EP4-15)
2. Oak Leaf Energy Partners Ohio, LLC (EP4-48)
3. City of St. Paul/St. Paul Saints Ballpark (EP4-34)
4. Xcel Energy (RD4-4)
5. FarmAmerica (EP4-21)
6. Dragonfly Solar, LLC (EP4-29)
7. University of Minnesota (RD4-11)
8. Best Power International, LLC (EP4-6)
9. Interphases Solar (RD4-7)
10. University of Florida (RD4-5)
11. City of Austin (EP4-36)
12. City of Hutchinson (EP4-41)
13. City of Red Wing (RD4-8)

After review and recommendation by the RDF advisory group, the Company reviewed all the projects in detail. The Company did not make any changes to the projects recommended for funding, but determined that some changes to overall ranking of the reserve projects was warranted. The Company created two tiers of projects to identify the order in which it believes reserve projects should be funded. Tier I includes the Minnesota Solar Garden Project, the City of St. Paul/St. Paul Saints Ballpark, and the City of Red Wing.

Minnesota Renewable Energy Society: Minnesota Solar Garden Project (EP4-15)

This 1.0 MW project by the Minnesota Renewable Energy Society (MRES) will explore the urban and rural aspects of solar gardens to determine their market acceptance and barriers to development. This will be the first large-scale community solar project in Minnesota. MRES will work with the Clean Energy Collective, who will have initial ownership of the installation before it is sold to cooperative subscribers. The project is consistent with the goals of the

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Omnibus Energy Act (2013 Minnesota Session Law, Chapter 85, Articles 8-12) recently approved by the Minnesota Legislature. The solar gardens concept has been very popular and successful in Xcel Energy's service territory in Colorado. The project received a score of 90.7 points from Sargent & Lundy, and was favored by the RDF advisory group since it supports the idea of community involvement. However, the application lacked details regarding the schedule, scope, interconnection requirements and community involvement. The lack of detail may be partly explained by the fact that the solar garden concept is new to Minnesota.

Project generation will be sold to Xcel Energy at a price of [**Trade Secret Begins** **Trade Secret Ends**]. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

Oak Leaf Energy Partners Ohio, LLC: Blue Lake Wastewater Treatment Plant Solar Project (EP4-48)

This 1.0 MW solar PV project will be installed at the Metropolitan Council's Blue Lake wastewater treatment plant (WWTP) located near Shakopee, Minnesota. This project will be one of the largest demonstrations of a behind-the-meter solar farm in the state (the IKEA solar project in Bloomington, Minnesota is slightly larger). The WWTP is a critical infrastructure asset and is served by two Xcel Energy feeders. The solar PV system will be designed to allocate a portion of its output to one feeder, and the remaining portion to the second feeder. This is a unique methodology to meeting the electrical needs of a critical infrastructure facility, and it could be a model for many other such facilities. The project includes a public outreach and education component. The project received a score of 180.2 points from Sargent & Lundy, and was favored by the RDF advisory group due to its use of novel technology and high visibility. The project will also help reduce the costs of wastewater treatment.

Project generation will be consumed on-site. The applicant is requesting special contract conditions such as the assignment of collateral to lenders and investors as well as the possible limitation to step-in-rights that will require negotiation. The standard RDF grant contract will not be used.

City of St. Paul: Lowertown Ballpark Solar Project (EP4-34)

This 105 kW solar PV project, to be located at the new St. Paul Saints ballpark in St. Paul, will consist of two separate arrays. The first array will be situated

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over a group spectator terrace which can be seen by visitors throughout the ballpark. The second array will be located on a car canopy over a parking lot adjacent to the ballpark. Public awareness of the solar PV project and its benefits will be enhanced by providing informational messaging on the ballpark scoreboard between innings. The project received a score of 118.0 points from Sargent & Lundy, and was favored by the RDF advisory group due to high visibility and public education component. The RDF advisory group noted that the application lacked some detail regarding total project costs, which are somewhat high.

Project generation will be consumed on site. The applicant has agreed to use the standard RDF grant contract.

Xcel Energy: IT Infrastructure Development to Enable Community Solar Gardens (RD4-4)

The goal of this project is to develop the information technology to provide customers with valuable information regarding their participation in the anticipated development and operation of solar garden projects throughout the Company's service territory. Customers who participate in community solar gardens are keenly interested in reducing their carbon footprint and they are astute in analyzing the benefits of subscribing to renewable energy generation sources. This project will develop the technology to provide customers with monthly reports as part of their billing statements that include the energy produced from their share of a solar garden project. The technology will also help the Company track the subscription and production data necessary to comply with state regulatory requirements. The project received a score of 103.9 points from Sargent & Lundy, and was favored by the RDF advisory group.

The applicant is unable to use the standard RDF grant contract. An agreement will be developed similar to that used for Xcel Energy's Wind2Battery project, which received a Cycle 3 RDF grant award.

Farmamerica: Combined Solar, Wind and Battery for Energy Self-Sufficiency Project (EP4-21)

This 120 kW solar/wind project will be designed to achieve a net zero non-combustion based energy production system at the Farmamerica interpretive center and significantly reduce their carbon footprint. The project will include a 50 kW fixed axis solar PV array, a 40 kW dual axis tracker array, and up to a

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20 kW wind turbine. The project will also include a battery storage bank for any project output not used on-site and the storage system will be linked to an electric vehicle charging station. The project will include a public education component. The project received a score of 106.3 points from Sargent & Lundy, and was favored by the RDF advisory group. Although the total cost seems high and there is no cost-sharing, the project will be highly visible in a rural area.

The applicant has agreed to use the standard RDF grant contract.

Dragonfly Solar, LLC: Solar Addition to Existing Dodge Center Wind Farm Project (EP4-29)

This 998 kW solar PV project will take advantage of an interconnection and infrastructure systems in place at the existing Garwin McNelius wind farm near Dodge Center, Minnesota. The project will use next generation solar modules that may be their first application in the U.S. While an upgrade to existing interconnection facilities is not anticipated, a Midcontinent Independent Transmission System Operator study may be required to verify there are no constraints with adding this resource to the system. This project is not within Xcel Energy's service territory. The project received a score of 156.8 points from Sargent & Lundy, and was favored by the RDF advisory group due to its use of technology that will be a first in the U.S.

Project generation will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

University of Minnesota: Demonstrating the Potential for Distributed Power Generation Using Converted Biomass (RD4-11)

This project will develop an effective and efficient solid biofuel that has the potential for direct, stand-in use at large and small power generation facilities in a distributed generation environment to support local power supply needs using rural biomass as a fuel stock. The University will employ a bifurcated approach to develop an integrated biomass conversion system and a modern steam-based electric generation. Timber from the local area will be utilized as the source of fuel during the demonstration. This project will adapt South American technology to be used in the U.S. market. The project received a

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score of 136.4 points from Sargent & Lundy, and was favored by the RDF advisory group due to the experience of the project sponsor and the introduction of new technology to the state.

The applicant has requested special contract conditions such as full ownership of patent royalties that will require negotiation.

Best Power Int'l, LLC: St. John's Solar Farm Expansion Project (EP4-6)

This 198 kW solar PV project will expand the current RDF solar project at St. John's University and incorporate an on-site side-by-side comparison of competing solar technologies including linear axis tracking system in place today and a new fixed tilt system. The current PPA and existing inverter system anticipated a maximum power rating of 500 kW. Consequently, increasing the size of the solar PV system can be done in a relatively short period of time and at a minimal cost. The project received a score of 162.2 points from Sargent & Lundy, and was favored by the RDF advisory group due to its side-by-side comparison benefits, minimized risk, and low cost.

Project generation will be sold to Xcel Energy at a price of **[Trade Secret Begins Trade Secret Ends]**. The applicant has agreed to use the standard RDF grant contract. A power purchase agreement will also be needed.

InterPhases Solar: New CIS Solar Cells with All-Solutions-Based Roll-to-Roll Processing (RD4-7)

This project will advance the production of thin film manufacturing outcomes achieved from an RDF Cycle 2 and RDF Cycle 3 grant award by taking the next step toward commercializing and marketing a simplified manufacturing process that also improves the output efficiency of solar PV cells. The project received a score of 156.8 points from Sargent & Lundy, and was favored by the RDF advisory group due to credibility of the project sponsor and likely potential for a royalty return to Xcel Energy ratepayers.

The applicant has agreed to use the standard RDF grant contract.

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University of Florida: A Mobile, Self-Contained, Pilot Anaerobic Digester Facility for Conversion of Non-Agricultural Residues in Minnesota to Electricity (RD4-5)

This project will promote the use of anaerobic digestion technologies that uses non-agricultural biomass residues. The project will demonstrate biogasification at two sites: the SunOpta Grains and Food facility in Alexandria, Minnesota and the Denco II corn ethanol facility in Morris, Minnesota. A mobile, self-contained, and flexible design pilot-scale digester will be deployed at each site for demonstration purposes. The digester will be operated for one year at each site to collect operational and production data. This project will develop further research funded by RDF Cycle 3, focusing on optimizing the feedstock characteristics and other process components. The project received a score of 136.4 points from Sargent & Lundy, and was favored by the RDF advisory group due to its Minnesota-based demonstration sites and benefits of mobile units under proper circumstances.

The applicant has requested special contract conditions that may be difficult to negotiate such as full ownership of patent royalties that will require negotiation.

City of Austin: Austin Wastewater Treatment Facility Biogas Renewable Energy Project (EP4-36)

This 1.0 MW biomass project will consist of two 500 kW internal combustion engines which will be fueled by a biogas generator from the existing anaerobic digester at the City of Austin wastewater treatment facility. The plant consists of two treatment facilities – one for domestic wastewater and one for industrial wastewater from the Hormel Foods pork-processing facility. This project will increase the efficiency and production of the City's current anaerobic digester system. The City has already completed a feasibility of the project, with the support of funding received from the St. Paul Port Authority. Project generation will be consumed on-site. This project is not within Xcel Energy's service territory. The project received a score of 164.3 points from Sargent & Lundy, and was favored by the RDF advisory group due to its potential to reduce greenhouse gas emissions and wastewater treatment costs.

The applicant has agreed to use the standard RDF grant contract.

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City of Hutchinson: Municipal Landfill Solar Energy Demonstration Project (EP4-41)

This 402 kW solar PV project intends to be a model for how to cost-effectively develop a significant solar energy resource on a closed landfill that would otherwise have little or no economic value. The solar PV facility will be owned by the City, subject to a long-term capital lease with a project-specific limited liability corporation established by Ameresco. This financing arrangement will allow the project to access federal tax incentives. The project will use solar modules provided by Minnesota-based tenKsolar. Project generation will be consumed on-site. This project is not within Xcel Energy's service territory. The project received a score of 126.5 points from Sargent & Lundy, and was favored by the RDF advisory group due to its creative use of a closed, capped landfill space.

The applicant has agreed to use the standard RDF grant contract.

City of Red Wing: City of Red Wing Refuse Derived Fuel Production Facility (RD4-8)

This project will demonstrate the production of a cleaner refuse derived biomass fuel including the recovery of more recyclables, the removal of fuel contaminants and a corresponding reduction in fuel hauling costs. The City will add dual-stage, shear-shredding equipment to its existing facility at the City's waste campus. The solid waste shredding process will include the sorting and removal of potential fuel contaminants such as plastics containing chlorine compounds that contribute to acid gases during combustion. The refuse derived fuel from this project will be used at Xcel Energy's Red Wing generation station. The project received a score of 113.8 points from Sargent & Lundy, and it was favored by the RDF advisory group. The score was somewhat low since the technology is not new or novel and there is some opposition to the existing statutory treatment of landfill waste as a renewable fuel source.

The applicant has agreed to use the standard RDF grant contract.

D. Higher Education Block Grants

All members of the RDF advisory group members reviewed and collectively scored the three higher education proposals. The independent evaluator (Sargent & Lundy) was not involved in reviewing and scoring of the higher

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education proposals. The RDF advisory group discussed the proposals at length and recommended a funding amount for each institution, subject to resolving certain issues with the University of Minnesota and the University of St. Thomas proposals.

Scoring criteria under which a total maximum score of 200 points was possible included:

- Program Goals, Scope and Deliverables (10%)
- Program Methodology and Research Approach (35%)
- Management Team, Schedule and Cost (15%)
- Potential Benefits to Minnesota and Ratepayers (40%)

The table below summarizes the scoring and funding recommendations by the RDF advisory group for the three proposals:

Higher Education Block Grant Proposals				
Project ID	Institution	Grant Request	Score	Grant Recommendation
HE4-1	MnSCU	\$5,500,000	145.01	\$4,500,000
HE4-2	U. of St. Thomas	\$2,157,215	120.00	\$1,500,000
HE4-3	U. of Minnesota	\$6,900,300	117.96	\$3,000,000

Please see Attachment C for the scoring results regarding these proposals.

A brief description of each proposal and the input from the RDF advisory group follows:

Minnesota State Colleges and Universities (MnSCU)

The goal of the MnSCU block grant proposal is to solicit and select high quality research projects that will ensure the growth, development, and delivery of renewable electric energy technologies throughout the State of Minnesota. Research proposals will be solicited from MnSCU’s 31 institutions including 24 two-year colleges and seven state universities. Proposals will be distributed through two funding cycles over three years with the intent of funding up to a maximum of 14 research projects. All proposals will be reviewed by a Peer Review Committee (PRC) and a Merit Committee (MC) established by MnSCU. The PRC provides a comprehensive review of a proposal for eligibility and responsiveness to the program goals and objectives. The MC evaluates the proposals for intellectual and research merit and impact. MnSCU’s Minnesota Energy Center (MnEC), established in the fall of 2012,

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will select, oversee, and implement the block grant program within the MnSCU system. Research projects supported by the RDF block grant will be chosen based on their ability to improve and stimulate the use of renewable electric energy technologies throughout Minnesota. Based on the research interests of the colleges and universities, MnSCU has the potential to focus on a wide variety of renewable electrical energy technologies such as wind, solar, biomass and range from feasibility initiatives to generating algorithmic tools for diagnostics and prognostics of energy generation facilities.

The RDF advisory group strongly supported providing a \$4.5 million block grant for the MnSCU proposal. The RDF advisory group believes the proposal has the potential for the development of a coordinated and well-managed program to solicit research projects that are relevant to Minnesota and also the ability to have the research incorporated into a jobs training program. The statewide aspect is very attractive and the proposal anticipates beneficial partnerships/linkages between academics, industry, agriculture, existing workforce specialists, students currently enrolled in workforce training programs, and local community stakeholders. The program also allows researchers at smaller campuses to compete for funds.

University of St. Thomas (UST)

The goal of the University of St. Thomas block grant proposal is to install a sustainable 0.25 MW peak, multi-purpose micro grid at the Gainey Conference Center in Owatonna, Minnesota. The primary objective of the facility will be to promote the collaboration between private industry and the academic community in the design/build/testing and validation of near commercial concepts in the field of electricity generation and micro grid/substation control. In the second and third year of the program, an RFP will be issued for industry/academic collaboration using an Engineering Senior Design Clinic model. The Clinic has a record of success in the design/build/testing of major equipment for industry in the region, as well as assisting with several new business starts. An ancillary benefit of the project is that it provides a platform for power systems engineering education for undergraduate and graduate students in the School of Engineering.

The RDF advisory group strongly supported RDF funding of \$1.5 million on the condition that the project location is moved to a location within Xcel Energy's service territory. The RDF advisory group and the Company believe a micro-grid project on our system would provide more direct benefits to Xcel Energy ratepayers.

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University of Minnesota (U of MN)

The goal of the University of Minnesota block grant proposal is to support a three-year research initiative which will strengthen and expand the renewable energy industry in Minnesota that will benefit Xcel Energy ratepayers now and in the future. The proposal is designed to directly satisfy the statutory requirements of the Renewable Development Fund, especially the directive to “stimulate research and development within the state into renewable electric energy technologies” and “promote the start-up, expansion, and attraction of renewable electric energy projects and companies within the state.” The program would be managed by the Institute on Environment (IonE). IonE will solicit detailed proposals from University of Minnesota faculty for three-year research projects in one or more of the following renewable electricity fields:

- Wind generation
- Hydropower generation
- Photovoltaic generation
- Alternative biofuels
- Power electronics, power systems and transmission
- Thermal generation
- Energy storage
- Legal and policy barriers to renewable energy generation and integration

Proposals will be evaluated by peer researchers outside the University of Minnesota and funds will be awarded on the basis of their recommendations. Renewal after the first and second years will be subject to researchers meeting strict criteria determined by IonE in conjunction with an advisory board. IonE expects that many of the proposals competing for funding will be built upon past and current research funded by the RDF program. However, IonE stated in their proposal that any projects supported by an RDF block grant will explore new avenues and will not be simply a continuation of prior funded activities. The University of Minnesota did not offer to share any portion of potential patent royalties. The University indicated royalty sharing was not possible due to the Universities Minnesota Innovation Partnerships Program, which handles the Universities intellectual property, does not offer similar arrangements with other partners. Therefore, the University indicated royalty sharing would not be fair and equitable to other research sponsors. In addition, since the University is not charging their full indirect rate for this project, the University argues it is in effect subsidizing the research.

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The RDF advisory group strongly supported RDF funding for the University of Minnesota at \$3 million on the condition that patent royalty issues can be resolved and that funding will not be used for general policy work, the review efforts of the peer review group, and speaker/travel costs.

V. Xcel Energy Recommendations

A. EP and R&D Concurrence and Adjustments

Xcel Energy greatly appreciates the considerable time and thoughtful efforts of the RDF advisory group. We are pleased to concur with their selection recommendations for all of the EP and R&D projects listed in Table I and Table II, above.

We also concur with the RDF advisory group regarding which projects should be placed on a reserve funding list. However, we are proposing an adjustment to the ranking of the reserve projects. As indicated in Section IV, the RDF advisory group proposed a single list of projects and ranked those projects for possible funding in the event that a Commission-approved project listed in Table 1 or 2 is not able to move forward. Rather than one ranking list for reserve projects, the Company is proposing a Tier I set of reserve projects and a Tier II set of reserve projects. We are including the following projects in the Tier I category:

- The MRES community solar gardens proposal
- The City of St. Paul/St. Paul Saints ballpark proposal
- The City of Red Wing refuse derived fuel proposal

Our rationale is as follows:

MRES Community Solar Gardens – While the solar gardens concept is new to Minnesota, it is not new to Xcel Energy. Working with key stakeholders in our Colorado service territory, we now have about 13 MW of solar PV community solar garden projects under various stages of construction in Colorado. We have formed partnerships with non-profit organizations, community groups, contractors and elected officials as part of this effort. Based on this experience, we have learned many valuable lessons on how to implement solar garden projects and we can transfer this knowledge to a solar gardens initiative in our Minnesota service territory.

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Further, the solar gardens concept is a high priority in Minnesota for state policy-makers, the solar industry, and the renewable energy community. In response to the Omnibus Energy Act recently approved by the Minnesota Legislature, the Company is currently preparing a plan to operate a community solar garden program. The plan shall be filed with the Commission by September 30, 2012. We believe an RDF grant award to the MRES will go hand-in-hand with our community solar garden goals, and help move this concept closer to reality in a timely manner. The MRES is in an excellent position to serve in a leadership role regarding solar gardens development. MRES can provide direction and input, as well as disseminate information to other stakeholders regarding our joint efforts. However, MRES financial resources are limited and timing is critical. An RDF grant award can provide the MRES with the support necessary to achieve our common goals. It is for these reasons that the Company would like to elevate this reserve project to Tier I status.

St. Paul Saints Ballpark – A new ballpark for the St. Paul Saints is an exciting project in itself. The facility will be an important part of the city’s efforts to revitalize the Lowertown area, and it will compliment the already successful completion of the St. Paul Union Station renovation project. Notably, both the new Saints ballpark and the Union Depot are part of the Energy Innovation Corridor. The City of St. Paul is a highly valuable partner in our efforts to design a clean energy future, and a solar PV project with the support of an RDF grant at the Saints ballpark holds value beyond the kWh it will produce. However, timing is critical. We wish to elevate this reserve project to Tier I status so that stadium planners can design and build into their plans the addition of this solar PV system. Similar to the solar PV project at the Minneapolis Convention Center, a solar PV project at a highly visible site like the new Saints ballpark will provide significant public education benefits.

City of Red Wing – One of the drivers behind the 2012 legislation modifying the RDF statute was to better align the use of Xcel Energy ratepayer dollars with projects that benefit ratepayers. It is difficult to draw a link between basic research and ratepayer benefits, and it can take a decade or more before such benefits are realized. Consequently, in 2012, the state legislature placed a greater emphasis on the use of RDF dollars for production projects. We believe the City of Red Wing project, perhaps more so than any of the other reserve list projects, is consistent with the goal of using RDF ratepayer funds to benefit ratepayers.

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The City of Red Wing is an important host community for both our Prairie Island nuclear power plant and also for our 20 MW biomass generation facility that uses refused-derived fuel. The plant was built in the 1940s as coal-fired generating unit and was converted in the late 1980s to burn refuse-derived fuel using processed municipal solid waste. This low-cost fuel alternative is defined by statute as a renewable fuel source and it helps reduce the amount of material going to landfills. The plant uses best available control technology including scrubbers with fabric filter bag houses to meet its emissions permit requirements. We have an RDF fuel supply contract for the Red Wing plant through the end of 2017 and we are exploring a 10 year fuel contract extension (through the end of 2027) with our RDF fuel supply contractor. In March 2010, we completed a life extension study to assist in the determination of whether to continue to operate the Red Wind plant beyond 2012. The study did not identify any issues for the Red Wing plant that would require major additional capital investment for operation through 2017. Consequently, we are assuming continued operation of the Red Wing plant beyond 2017, pending an adequate supply of refuse-derived fuel at a reasonable cost.

The RDF grant proposal by the City of Red Wing will support the operation of our Red Wind power plant and, consequently, provide direct benefits to our ratepayers. In order to achieve these benefits sooner rather than later, we believe elevating the City's proposal to the Tier I reserve list is warranted.

B. Reserve Funding Allocation

We intend to use any funds available for reserve projects for the "next in line" proposal regardless of whether it is an EP project or an R&D project. In other words, if a proposal that did not move forward was an EP project and those grant dollars can be used for a reserve project, those dollars may be used for another EP project or an R&D project. We will not maintain separate EP and R&D "buckets" of funding linked to whether the proposal that did not move forward was an EP or R&D initiative.

If funding becomes available for Tier II reserve projects, we will follow the rankings of the RDF advisory group to the maximum extent possible. However, the selection of a Tier II reserve project will also depend on factors such as the amount of funding available for the next RDF grant award, the readiness of the project sponsor, and whether the technology proposed has diminished in value since the RDF grant award application was submitted.

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C. Higher Education Adjustment

Although the RDF advisory group recommended a \$4.5 million block grant award to MnSCU, the Company is proposing Commission approval of MnSCU's request for \$5.5 million. The RDF advisory group and the Company are proposing RDF grants awards for EP and R&D projects in the full amount requested by the applicants, and propose to do the same for MnSCU. The Company believes MnSCU's proposal is exemplary and their grant request should also be fully funded. If the Commission approves a grant award for MnSCU, we will then enter into a RDF grant contract with the institution and submit it to the Department of Commerce for review and approval.

We also wish to clarify that, subject to Commission approval, we will hold in abeyance an amount of about \$3.5 million available for block grants to the University of Minnesota and the University of St. Thomas. We wish to work with both institutions to address the concerns of the RDF advisory group. If we are able to reach an agreement regarding the terms and amount of a grant award during our 120 day negotiation period, we will notify the Commission and submit an RDF grant contract to the Department for review and approval. If we are unable to reach an agreement, we will also notify the Commission and use those dollars to move forward with a reserve project.

VI. Conclusion

In summary, we recommend a total of \$30,122,346 in grant awards for 20 projects and programs including 13 Energy Production projects, four Research and Development projects, three Higher Education block grant programs and 13 Reserve Projects. Our review process was thorough and incorporated feedback from an independent evaluator, the RDF advisory group, and Xcel Energy. Our recommendations incorporate the recent legislative changes, lessons learned from previous funding cycles, and are accompanied by supporting rationale as well as project descriptions. Xcel Energy respectfully requests that the Commission approve our RDF Cycle 4 project recommendations as well as the associated awards as described in this report.



Xcel Energy Renewable Development Fund
4th Cycle Evaluation Approach
Sargent & Lundy project no. 13125-001
July 2013

SUMMARY

Sargent & Lundy, L.L.C. (Sargent & Lundy) conducted an evaluation of the proposals that were submitted to Xcel Energy seeking funding from Xcel Energy's Renewable Development Fund (RDF) in the 4th funding cycle. We developed an evaluation approach based on a framework developed by Xcel Energy, performed numerical scoring of each of the Energy Production (EP) and Research and Development (RD) proposals, and ranked the proposals. The following report describes the tasks performed to complete our evaluation.

Approach

The following broad tasks were conducted during the evaluation process of the EP and RD proposals:

- Task 1: Prepare Scoring and Evaluation Methodology
- Task 2: Technical Evaluation and Scoring of Proposals
- Task 3: Ranking of Proposals
- Task 4: Recommendation of Proposals

TASK 1: PREPARE SCORING AND EVALUATION METHODOLOGY

Based on the evaluation metrics and scoring framework found in the RDF Program's 4th Cycle Request for Proposals (RFP) issued February 15, 2013, Sargent & Lundy developed a set of objective scoring interpretations that focused on proposal completeness, technical feasibility and completeness, project technical and financial risk, and benefits to Xcel Energy ratepayers. The following core criteria areas and maximum point values are shown in Table 1. More details on the metrics that make up each core criteria and bonuses are found in Xcel Energy's RFP.

Table 1 — Core Criteria and Point System

Core Criteria	Maximum Possible Points	
	RD Projects	EP Projects
Project Method, Scope, and Deliverables	20.00	20.00
Technical Requirements	70.00	70.00
Management Team, Schedule, and Cost	30.00	30.00



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Core Criteria	Maximum Possible Points	
	RD Projects	EP Projects
Potential Benefits to Minnesota and Ratepayers	80.00	20.00
Total Resource Cost per kWh (EP only)	0.00	60.00
Core Criteria Score	200	200
Maximum Bonus Points Allowed	30	30
Overall Total	230	230

Xcel Energy provided numerical scoring ranges, point value descriptions, and weighting factors for each metric. The following figure shows the point value descriptions used to evaluate each metric.

Figure 1 — Description of Metric Ratings and Points

Metric Ratings	Evaluation Definitions	Points Awarded
Superior	Demonstrates exceptional level of performance and provides something extra or innovative	4
Excellent	Effective response that can achieve all requirements. No obvious risks or issues.	3
Good	Response minimally supports the requirement, some issues exist that may impact results.	2
Fair	Contains weakness that will limit achievement of requirement or poor plan to mitigate risk.	1
Unsatisfactory	Cannot be achieved due to a critical issue or no response.	0

The Sargent & Lundy project team reviewed and discussed the ratings prior to scoring to establish a common understanding; for example, we used the rating of “excellent” for evaluation criteria that had no issues or risks; this rating served as our ‘starting point’. For any evaluation criteria in which we identified flaws or critiques, we assigned a rating (and respective points) of “good”, “fair”, or “unsatisfactory” depending on the risk significance and/or lack of response. We decided to use ratings of “superior” on responses that were above expectations and/or contained extra levels of detail. To simplify the granularity of scoring, only whole number points were awarded during evaluation. These rating decisions were



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adopted by the Sargent & Lundy evaluation team so as to evaluate using a high level of objectivity and consistency. All but two of the metrics were evaluated on a proposal-by-proposal basis (i.e. the awarded points did not depend on the outcome of the other proposals). The cost sharing metric and total resource cost (on a \$/kWh basis for EP proposals) were evaluated as a group of either EP or RD proposals (discussed further in the following pages).

Several metrics required a different type of scoring system. For these cases, supplemental definitions of each rating were developed in order for consistent evaluation across technologies and evaluators. For example, the metric that covers “the extent to which the proposed project financing is based on sources of debt and equity” was given the following supplemental rating definitions shown in the following table:

Figure 2 — Sample of Supplemental Rating Definitions for Project Financing Risk

Points Awarded	Description
4	Complete lump sum RDF grant disbursement at end of project completion
3	Grant amount is disbursed throughout the project after demonstrated project milestone completions, and percentage of payment is reasonable with the milestone completed.
2	Grant amount is disbursed throughout project after demonstrated project milestone completions but percentage is not reasonable with milestones completed.
1	Grant amount is disbursed throughout project before completion of project milestones
0	Lump sum grant disbursement requested up front.

The metrics for cost sharing and total resource cost (TRC) were appraised as a group (either within EP or RD) on a quantitative basis. The comparison of cost sharing and TRC of the entire group gave the resulting distinction between the awarded points for these metrics.

Cost sharing, as a percentage of total project (construction and equipment) cost funded by sources other than the RDF grant, was evaluated where higher cost sharing resulted in higher awarded points (i.e. 0% cost sharing was awarded 0 points and higher percentages of cost sharing were awarded from 1 up to 4 points). More details on the point breakdown are found in the Task 3 Section of this write-up.

Total resource cost, as a measure of the levelized cost of energy on a \$/kWh basis over the project development, construction and operation, was calculated for each EP proposal. The contributors to the TRC are: development, construction, and equipment costs; PPA costs (measured as the difference between PPA price and market energy price); emissions costs (for biomass proposals); and operations and



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maintenance costs. A discount rate of [REDACTED] and a marginal energy price of [REDACTED] per MWh were used as directed by Xcel Energy. A 15 year evaluation period was used because nearly all of the proposals requested 15 year PPAs. Several proposals requested shorter PPA durations, but the maximum allowed PPA under this evaluation was 15 years.

The difference between the requested PPA energy price and the marginal energy price was evaluated based on the generation of the project and percentage of energy sold to Xcel Energy. Operating costs, when included in a proposal, were levelized over the PPA duration. When operating costs were not included in a proposal, O&M costs as shown in Table 2 were assumed for a project and applied over the PPA duration. The O&M costs shown in Table 1 are from publicly available studies/reports and were inflated to 2013 dollars based on the Gross Domestic Product Implicit Price Deflator.¹ Emissions costs (for biomass proposals) were evaluated based on the submitted emissions rates (lb/kWh) found in the grant application and the emissions costs (\$/ton) found in Table A of the Xcel Energy RFP.

Table 2 — O&M Costs by Technology Type

Technology Type	Fixed O&M (2013\$/kW-yr)	Variable O&M (2013\$/MWh)	Source
Biomass		98.58	(1)
Solar	24.73		(2)
Wind	20.54		(3)

1. USDA. October 2007. An Analysis of Energy Production Costs from Anaerobic Digestion Systems on U.S. Livestock Production Facilities
2. U.S. Department of Energy. February 2012. SunShot Vision Study.
3. American Wind Energy Association. 2011 U.S. Small Wind Turbine Market Report.

All components of the TRC were levelized, summed, and evaluated over the amount of generation expected during the PPA. A resulting TRC per kWh allows for comparison amongst all EP proposals.

Each of the five bonus criteria (worth 20 points each) were evaluated and given either a “yes” or “no”. The total bonus score was summed according to the RFP where a proposal could receive a maximum score that was lesser of 15% of the core criteria score or the sum of the bonuses.

¹ Gross Domestic Product: Implicit Price Deflator. U.S. Department of Commerce: Bureau of Economic Analysis. May 30, 2013



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TASK 2: TECHNICAL EVALUATION AND PRELIMINARY SCORING

All proposals were evaluated and scored by the Sargent & Lundy team using the evaluation methodology described in Task 1. The six members of the Sargent & Lundy project team are all degreed engineers, most of who are also licensed Professional Engineers (in Illinois). The biomass and wind proposals were evaluated by our biomass expert and wind expert, respectively. The remaining solar proposals were split amongst the team. Daily discussions and periodic internal meetings were held during the several week evaluation period to fine-tune the scoring methodology to achieve consistency in the evaluations. To further ensure objectivity and quality of work, one of the Sargent & Lundy team members independently evaluated and scored several proposals that had already been scored. All evaluation scores and comments were tracked in a common model so all evaluators could view completed proposal evaluations and compare the individual metric scores. Final scoring that includes the impact of cost sharing and total resource cost is discussed in Task 3.

TASK 3: FINAL SCORING AND RANKING OF PROPOSALS

We compiled the level of cost sharing and total resource cost of all of the proposals into a database and evaluated these criteria by sorting and ranking them. The cost sharing and total resource cost metrics were awarded points based on where they fell in the distribution of the values.

The cost sharing metric for EP proposals was awarded points according to the following breakdowns in Table 3. The breakdowns were based on reasonable groupings of proposals in the cost sharing ranges as shown.

Table 3 — Scoring of Cost Sharing for EP Proposals

Cost Sharing Range	Points Awarded	Number of Proposals
70% or greater cost sharing	4	6
45% – 70%	3	21
25% – 45%	2	9
10% – 25%	1	4
0% – 10%	0	6

The cost sharing metric for RD proposals was awarded points according to the following breakdowns in Table 4. The breakdowns were based on reasonable groupings of proposals in the cost sharing ranges as shown.



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Table 4 – Scoring of Cost Sharing for RD Proposals

Cost Sharing Range	Points Awarded	Number of Proposals
70% or greater cost sharing	4	1
45% – 70%	3	2
15% – 45%	2	3
1% – 15%	1	2
0% – 1%	0	10

The total resource cost metric for EP proposals was awarded points on the difference between the respective proposal's TRC and the average TRC of the group. The points were awarded based on standard deviations from the average as shown in Table 5. The average (excluding several outliers) TRC for the EP proposals was \$0.187 per kWh.

Table 5 — Scoring of Total Resource Cost for EP Proposals

Total Resource Cost Range (\$ / kWh)	Standard Deviation Range	Points Awarded	Number of Proposals
0 – 0.134	-2 to -1	4	4
0.135 – 0.187	-1 to 0	3	21
0.188 – 0.241	0 to 1	2	8
0.242 – 0.295	1 to 2	1	6
0.296+	2+	0	7

The final TRC values from lowest to highest are shown in the following table with the awarded point score.

Table 6 — Total Resource Cost Results

Points Awarded	TRC (\$ / kWh)	Points Awarded	TRC (\$ / kWh)
4	0.120	3	0.185
	0.125		0.186
	0.126	2	0.191
	0.127		0.194
3	0.134		0.195
	0.137		0.196
	0.141	0.196	
	0.143	0.209	
	0.146		0.224

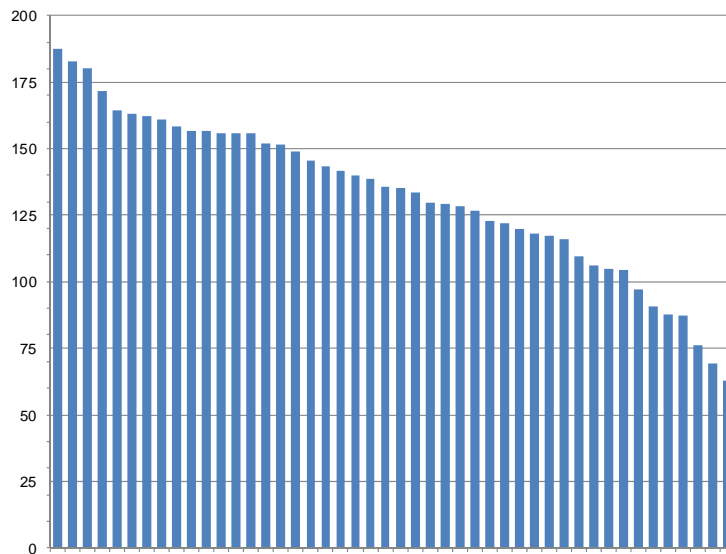


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Points Awarded	TRC (\$ / kWh)	Points Awarded	TRC (\$ / kWh)
	0.146		0.231
	0.148		0.244
	0.149		0.251
	0.149	1	0.259
	0.151		0.270
	0.153		0.277
	0.155		0.285
	0.164		0.299
	0.164		0.339
	0.167		0.504
	0.170	0	0.562
	0.173		0.965
	0.178		3.062
	0.179		3.774

Once we completed the scoring, we ranked the EP and RD proposals by overall score. The final scoring distributions for EP and RD proposals are shown in Figure 3 and Figure 4, respectively.

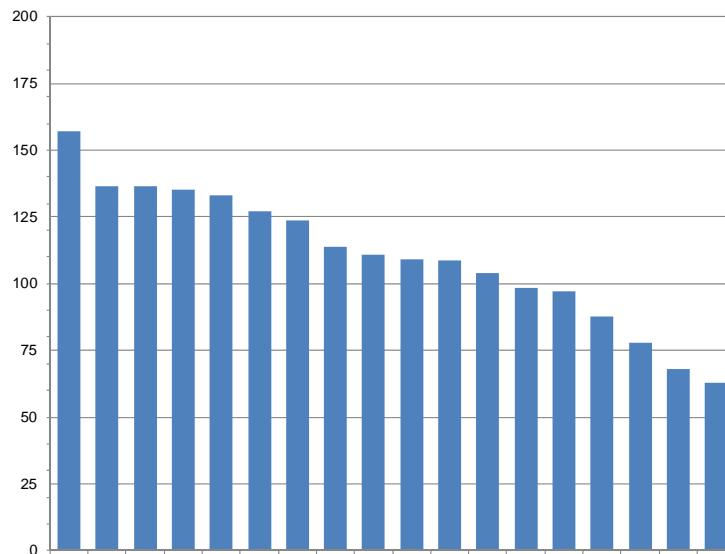
Figure 3 — Final Scoring Distribution for EP Proposals





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Figure 4 — Final Scoring Distribution for RD Proposals



TASK 4: RECOMMENDATION OF PROPOSALS

The overall scores provide an objective means to rank the proposals. We also categorized the proposals as “top tier” and “lower tier”. The top tier list includes proposals that Sargent & Lundy believed to be reasonably complete in project scope and definition, technically sound, financially viable, and consistent with the RDF program goals and requirements. The lower tier list includes proposals that scored poorly. The most common causes of poor scores were: uncompetitive pricing; low portion of cost sharing; and poorly defined project approach, scope, or deliverables.

Sargent & Lundy ensured that the order of final proposal ranking also was consistent with the our recommendations (i.e., the final proposal ranking order from largest score to smallest score also lined up with the order from “top tier” to “lower tier”).

RFP – Scope and Bid Meeting Summary

Background on the Renewable Development Fund Program

The RDF was established in 1994 by the Minnesota legislature. Project funding is provided solely by Minnesota and Wisconsin electric customers of Xcel Energy. Expenditure of RDF funds is authorized by Minn. Stat. § 116C.779 and approved by the Minnesota Public Utilities Commission (MPUC). The RDF program is administered by Xcel Energy. An RDF advisory group, formerly known as the Advisory Board, is consulted with respect to the general scope of expenditures in designing the Cycle 4 RFP and in evaluating proposals submitted in response to this RFP.

Minn. Stat. § 116C.779 prescribes the types of expenditures for which RDF funds may be used: (1) to increase the market penetration within the state of renewable electric energy resources at reasonable costs; (2) to promote the start-up, expansion, and attraction of renewable electric energy projects and companies within the state; (3) to stimulate research and development within the state into renewable electric energy technologies; and (4) to 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. Results of RDF projects must be made available to the public. Consistent with this legislative mandate, and upon an MPUC Order on February 6, 2013, Xcel Energy solicited proposals for projects within these categories.

Over the years, experience gained through RDF bidding and grant administration has been incorporated by the RDF advisory group, Xcel Energy and the Commission into improvements in the RDF operational guidelines and oversight procedures in place today. On November 29, 2012, Xcel Energy filed an Intent to Issue a RDF Cycle Four RFP and Petition for approval of a Standard Grant Contract in this docket. Contained within this petition were Cycle 3 lessons learned and best practices which were incorporated into the Cycle 4 solicitation, selection process, and contract.

Xcel Energy has overall responsibility for administering the RDF including implementing the funding process, selection of an independent evaluator, and selecting Cycle 4 proposals to receive RDF grant funds. The role of the RDF advisory group is to provide input regarding project selections.

Decisions of the RDF advisory group are made first by consensus and if necessary, by a majority vote if consensus cannot be reached. The seven-member Board consists of two representatives of the environmental community, Eric Jensen and Lynda Taylor; one representative from the Prairie Island Indian Community, Heather Westra; one representative of Xcel Energy residential ratepayers, Lise Trudeau of the Minnesota Department of Commerce; one representative of Xcel Energy commercial rate payers, Ben Gerber of the Minnesota Chamber of Commerce; and two representatives from Xcel Energy, Tami Gunderzik and Kevin Schwain.

Goals and Preferences of the Fund

Xcel Energy's Cycle 4 proposal selections are intended to reflect 2012 legislative modifications and also incorporate lessons learned from prior project and RDF contract experiences. In addition, the Company's recommendations reflect Minn. Stat. § 116C.779 preferences which include:

- While evaluating responses to the RFP, Xcel Energy must strongly consider, where reasonable, the potential benefit to Minnesota citizens, businesses, and Xcel Energy's ratepayers.
- Consultation with the RDF advisory group but the utility has full and sole authority to determine which expenditures shall be submitted to the Commission for approval.
- Renewable electric energy generation projects must, when feasible and reasonable, give preference to projects that are the most cost-effective for a particular energy source.
- Proposals must focus on renewable electric energy.

Xcel Energy's selections for proposal funding are based upon these preferences as well as the limitation of resources available to fund worthwhile and appropriate initiatives and concepts. The technical scores were used as a tool by the RDF advisory group and Xcel Energy to determine technical strengths or weaknesses of proposals submitted. During the selection process the RDF advisory group also discussed intangible benefits that may be associated with a prospective project in conjunction with the technical score.

As with Cycle 3, Xcel Energy and the RDF advisory group believes that RDF support is not meant to subsidize commercial renewable installations, but to narrow the competitive gap for emerging renewable resources and technologies. Consequently, selected proposals reflect initiatives that will facilitate the movement of new

renewable electric energy into the marketplace which are also cost-affective for that energy concept.

To achieve its goals for energy production and research and development projects, Xcel Energy sought proposals for: near commercial-scale demonstration projects that produce and/or deliver renewable electric energy; renewable energy projects that will increase the market penetration of renewable electric energy in the state at reasonable cost; and projects to stimulate research and development into renewable energy technologies within the state. To achieve its goals for higher education programs, Xcel Energy sought proposals that demonstrate maximum flexibility to design and implement programs that work within the educational institutions existing systems and culture.

In accordance with the February 6, 2013 Order, the technical scores reflected the value associated with several preference criteria that were established Xcel Energy and the advisory group. These preferences included:

- a. Support of the Prairie Island Indian Community for the project
- b. Projects located within the Energy Innovation Corridor (EIC)
- c. Projects that are structured to receive a lump-sum payment grant payment upon project completion
- d. Energy production (EP) project proposing to use electricity on-site located within Xcel Energy's service territories in Minnesota and Wisconsin
- e. Research and development (RD) projects that demonstrate a high likelihood of royalty returns and propose a larger royalty sharing with the RDF
- f. Projects sponsored by a K-12 school or local unit of government to construct a solar photovoltaic (PV) facility
- g. For proposed anaerobic digester systems, proposals that use non-agricultural residue as feedstock

These preferences were also considered by the RDF advisory group during the discussion of award recommendations. In some cases, proposals that received a lower technical score may have been reconsidered for a grant award due to preference criteria.

Key Dates and Activities

The Request for Proposal process for Cycle 4 included the following timeline:

<i>Activity</i>	<i>Completion Date</i>
RFP Issued by Xcel Energy	February 15, 2013
Pre-bid Conference	March 11, 2013
Proposals Due	April 1, 2013
Advisory group review of proposals	June 12, 2013

RFP Release and Response

By its Order dated February 6, 2013 in Docket E002/M-12-1278, the Commission approved the release of a Cycle 4 Request for Proposals (RFP) including selection preferences, the standardization of RDF grant contracts, and RDF proposal selection procedural steps. In accordance with the Order, two RFPs were approved, one RFP solicited proposals related to energy production and research and development and a second RFP solicited proposals from Minnesota institutions of higher education for renewable energy research and development.

On February 15, 2013 Xcel Energy issued the RFP's to solicit project proposals to be funded from grants from the Cycle 4 RDF funding. Press releases were sent to various media outlets, 482 notifications were sent via email, 272 notifications were sent through postcards in the U.S. mail, and the availability of the Cycle 4 RFP was posted on the RDF website. The RDF notification lists consists of past and present RDF project participants and others who had shown interest in the RDF granting process. Selection criteria, proposal preparation and scoring methodology were provided within the RFP document that was available to download from the RDF web site and also available via U.S. mail by request.

A Cycle 4 public forum was held on March 11, 2013 at Xcel Energy Corporate Offices. The event was attended by 62 participants. RDF advisory group members, RDF administrative staff, and legal representatives described the Cycle 4 funding priorities and information regarding proposal preparation and submission. Prospective applicants' questions were answered at the conference and a summary of questions as well as responses was posted on the RDF web site. In addition, RDF

staff fielded questions regarding the Cycle 4 application process via the RDF toll free telephone number as well as through the RDF web site staff contact page.

In accordance with the Order, on January 22, 2013 Xcel Energy issued an RFP for evaluation services of Cycle 4 proposals by an independent, third-party vendor. Five vendors responded to the RFP which closed on February 23, 2013. As a result of the RFP, Sargent & Lundy was chosen to provide proposal evaluation and reporting services. Sargent & Lundy was the highest rated bidder as determined by the evaluation of weighted criteria. The prime categories were technical competence, pricing, and strength of the company. Subsequent to selection, an interview was performed to confirm that the vendor fully understood the work effort and had responded correctly to all criteria.

Energy Sales to Xcel Energy

Depending on the type, size and location of the project facility, the sale of electricity may occur through an existing tariff program or a negotiated power purchase agreement. All power produced by RDF energy production projects must either be consumed on site by the customer within Xcel Energy's Minnesota or Wisconsin service territory or delivered to the Xcel Energy system for sale to Xcel Energy. Project developers were required to provide an energy price that is binding if the proposal is selected for RDF funding. The proposed price is to reflect factors such as the firmness of the product, on-peak energy availability, and the value of any renewable energy attributes. In addition, generators must obtain a distribution or transmission interconnection agreement with Xcel Energy or other transmission service provider. However, approval of an RDF grant award for an Energy Production project does not obligate Xcel Energy to purchase electricity beyond the requirements of Minn. Rules 7835.0100 through 7835.9910 (Cogeneration and Small Power Production) or similar "PURPA" types laws applicable in other states.

Response to RFP

All proposals received on April 1, 2013 or were documented as being submitted on April 1, 2013 were opened on April 5, 2013. At that time the proposals were assigned a label in the chronologic order in which they were recorded and sorted according to project type (EP, RD or HE) and logged into a database. A total of 71 proposals were received which consisted of 47 Energy Production (EP) proposals, 21 Research and Development (RD) proposals, and three Higher Education (HE) proposals. The solicitation generated a request for \$133.5 million of grant funds. In accordance with

the eligibility screening process described in the RFP, RDF administration reviewed all the proposals to assure eligibility requirements were met. One energy production and three Research and Development proposals were identified as ineligible to receive Cycle 4 funding. With concurrence from the RDF advisory group, these proposals were determined to be ineligible for funding and withdrawn from further evaluation. The RFP described eligibility requirements and criteria that proposals must meet to be considered for RDF funding. Ineligibility issues include:

- ✓ Did not describe how the proposed activity is consistent with utilization of renewable resources as described in Minn. Stat. § 116C.779
- ✓ Incomplete proposal
- ✓ Did not describe the focus of the project, the goals and objectives to be achieved, and the products that will result from successful completion
- ✓ Did not describe how the proposed project will advance the market penetration of renewable electric energy technology

Letters of ineligibility were sent to the applicant which included an explanation of ineligibility. The result of the eligibility screening was 46 eligible Energy Production proposals, 18 eligible research and development proposals, and three eligible higher education proposals were evaluated and scored.

The RDF advisory group met on June 12, 2013 to review RDF Cycle 4 proposals and recommend funding priorities. The group reviewed the 64 eligible EP and RD project specific proposals that had been evaluated by Sargent & Lundy and the three HE program specific proposals. The RDF advisory group sought a diverse mix of projects that bring a value to Xcel Energy electric ratepayers with a consideration to location, technologies, and costs.

The RDF advisory group first identified proposals that would be discussed in depth. All top tier proposals were the initial basis of proposals to be discussed. Low scoring proposals of interest from the advisory group were also added to the list for a more extensive discussion. The RDF advisory group reviewed and discussed the proposals, with input from Sargent & Lundy regarding project technical scores. After considerable discussion, proposals were selected for possible funding and proposals were selected for the reserve projects list if RDF monies are available.

With the input of Sargent & Lundy and the RDF advisory group, the Company's funding recommendation of \$30,122,346 is consistent with the goal to award up to

\$30 million for qualified projects and higher education programs selected and recommended in response to our Cycle 4 RFP.

In Cycle 4, selected Energy Production proposals represent 60 percent of the total available funds, selected Research and Development proposals represent 11 percent of the total available funds, and Higher Education proposals represent 29 percent of the total available funds. The proposed split of available funds between the three categories of EP, RD, and HE is close to the original targets of \$20 million for EP or RD proposals and up to \$10 million for HE proposals. Allocations of funding recommendations were identified by the RDF advisory group during the regular October 2012 and November 2012 RDF advisory group meetings. Due to the much larger number of submissions and the ability to measure tangible benefits related to EP proposals, the RDF advisory group increased the EP awards and slightly reduced the RD and HE awarded amounts.

PUBLIC DOCUMENT
TRADE SECRET DATA EXCISED

Scoring Results

Proposal	Organization	Technology	Type	Project Description	Requested Grant Amount	Project Cost	Portion Funded by Applicant	Indirect Costs	Indirect Cost Percentage	Jobs Created (person-years)	Criterion A S&L Score- Project Method, Scope, and Deliverables	Criterion B S&L Score - Technical Requirements	Criterion C S&L Score - Management Team Schedule and Deliverables	Criterion D S&L Score - Potential Benefits to Minnesotans and Ratepayers	Criterion E S&L Score - Total Resource Cost per kWh (EP only)	Criterion F S&L Score - Bonus Preferences (Max 15% of Core Criteria Score)	S&L Total Score	S&L Category*	Advisory Group Recommendation	Advisory Group Award Amount RECOMMENDED	Advisory Group Award Amount RESERVE	Total Resource Cost (EP Only)	Total Resource Cost \$/kWh (EP Only)	Specific Cost (\$/kWh) (EP Only)	First Year Energy Generation (MWh) (EP Only)	Annual Energy Generation (MWh) (EP Only)	% of Total Energy Sold to Xcel Energy (MWh) (EP Only)	Proposed PPA Price (\$/MWh) (EP Only)
EP4-001	ECCOORP	biomass	EP	Construction of 14 MW biogas anaerobic digestion facility in Sleepy	\$ 2,000,000	\$ 66,692,000	97.00%	\$ -	0.00%	2375	5.00	42.00	15.75	8.33	45.00	17.41	133.50	2	No Funding			\$ 286,567,628	\$ 0.17	\$ 4,764	-	121,000.00	93%	TRADE SECRET BEGINS
EP4-002	City of Hopkins	solar	EP	475 kW Solar PV installations on the rooftop of four municipal building	\$ 798,204	\$ 1,629,554	56.54%	\$ -	0.00%	1.3	12.50	42.00	18.75	13.33	45.00	19.74	151.32	1	No Funding			\$ 1,633,139	\$ 0.17	\$ 3,431	624.62	659.30	0%	
EP4-003	Minneapolis Public School	solar	EP	Installation of 485 kW solar at high school, including 300 kW roof-mo	\$ 917,250	\$ 1,949,022	52.94%	\$ -	0.00%	1.8	12.50	38.50	16.67	13.33	30.00	14.47	141.64	1	Recommend	\$ 917,250		\$ 1,933,487	\$ 0.19	\$ 4,019	665.00	665.00	0%	
EP4-004	SGE Partners LLC	biomass	EP	South St. Paul Anaerobic Digestion and Electrical Generation	\$ 5,000,000	\$ 14,847,764	66.32%	\$ -	0.00%	400	12.50	42.00	18.75	12.50	30.00	16.84	129.09	2	Recommend	\$ 5,000,000		\$ 21,099,194	\$ 0.20	\$ 13,498	7,708.80	7,708.80	100%	
EP4-005	Best Power, Int'l, LLC	solar	EP	536 kW Accredited Solar PV ground mounted installation at School S	\$ 900,000	\$ 1,811,857	50.33%	\$ 24,000	1.32%	2.8	12.50	38.50	20.25	13.33	45.00	19.44	149.02	1	Recommend	\$ 900,000		\$ 2,260,116	\$ 0.14	\$ 2,499	433.81	1,138.41	100%	
EP4-006	Best Power, Int'l, LLC	solar	EP	158 kW solar PV expansion proposal	\$ 172,213	\$ 414,033	58.41%	\$ 24,000	5.89%	10.0	12.50	49.00	19.50	15.00	45.00	21.15	162.15	1	Reserve		\$ 172,213	\$ 560,526	\$ 0.15	\$ 2,620	140.32	250.47	100%	
EP4-007	Anoka Ramsey Community College	solar	EP	458 kW Solar PV ground-mount, rooftop, and electric vehicle charge	\$ 828,900	\$ 1,825,376	54.81%	\$ 18,124	0.99%	1.3	13.75	42.00	18.75	12.50	45.00	19.80	151.80	1	Recommend	\$ 828,900		\$ 1,812,392	\$ 0.18	\$ 3,984	672.46	672.46	0%	
EP4-008	Salvation Army	solar	EP	250 kW Solar PV with energy storage for emergency preparedness	\$ 460,000	\$ 1,075,362	57.22%	\$ -	0.00%	1.0	13.75	42.00	18.75	13.33	30.00	17.67	135.51	2	No Funding			\$ 1,062,632	\$ 0.20	\$ 4,300	358.25	358.25	0%	
EP4-009	Mondovi Energy Systems	biomass	EP	Installation of a Community based Anaerobic Digester in Mondovi, WI	\$ 2,000,000	\$ 13,220,683	84.87%	\$ 806,890	6.10%	51	10.00	35.00	15.75	11.67	45.00	17.61	135.03	2	Recommend	\$ 2,000,000		\$ 35,378,343	\$ 0.16	\$ 6,610	4,500.00	15,518.80	95%	
EP4-011	Innovative Power Systems, Inc.	solar	EP	Install combined 967 kW of 5 Solar PV capacity systems roof mounte	\$ 1,850,000	\$ 2,698,200	31.44%	\$ 33,750	1.25%	8.8	11.25	45.50	21.75	14.17	45.00	20.65	158.32	1	Recommend	\$ 1,850,000		\$ 2,776,908	\$ 0.15	\$ 3,282	50.00	1,300.00	100%	
EP4-012	Xcel Energy Services, Inc.	solar	EP	Proposal to utilize RDF funds to replace existing Solar Rewards Prog	\$ 10,800,000	\$ 10,834,100	1.23%	\$ 160,600	1.47%	0.0	7.50	28.00	9.00	5.83	45.00	14.30	109.63	3	No Funding			\$ 23,669,217	\$ 0.14	\$ 3,215	5,782.50	11,507.18	100%	
EP4-013	Metropolitan Airports Commission	solar	EP	Parking Garage Rooftop solar PV at Minneapolis-St. Paul Internatio	\$ 2,022,507	\$ 4,189,000	51.72%	\$ 50,000	1.19%	2.6	15.00	49.00	21.75	12.50	45.00	20.00	163.25	1	Recommend	\$ 2,022,507		\$ 4,112,514	\$ 0.17	\$ 4,176	140.91	1,682.49	0%	
EP4-014	Murphy Warehouse Company	solar	EP	Roof-mounted 650-kw solar array installation on company warehouse	\$ 2,016,118	\$ 2,122,229	5.00%	\$ -	0.00%	2	13.75	35.00	15.75	15.00	45.00	18.67	143.17	1	No Funding			\$ 2,134,377	\$ 0.18	\$ 3,265	81.27	843.27	0%	
EP4-015	MN Renewable Energy Society	solar	EP	1 MW DC PV installation with a split ownership plan (customers will	\$ 2,681,320	\$ 4,036,420	34.07%	\$ 207,847	5.15%	11.0	8.75	31.50	12.75	10.83	15.00	11.82	30.66	3	Reserve		\$ 2,681,320	\$ 4,477,364	\$ 0.26	\$ 5,242	102.01	1,224.18	100%	
EP4-016	OS&M, Inc.	solar	EP	Cogeneration - Solar and Organic Rankine Cycle	\$ 1,750,000	\$ 1,750,000	0.00%	\$ -	0.00%	1.6	13.75	45.00	18.75	14.17	0.00	13.60	104.27	3	No Funding			\$ 1,656,137	\$ 0.50	\$ 17,500	219.00	219.00	0%	
EP4-017	MN Department of Natural Resources (DNR)	solar	EP	84 kW Solar PV charging stations for electric vehicles at multiple MN	\$ 641,000	\$ 962,150	33.38%	\$ -	0.00%	2.5	11.25	42.00	19.50	11.67	0.00	12.66	97.08	3	No Funding			\$ 866,334	\$ 0.56	\$ 11,454	60.00	105.53	5%	
EP4-018	Gustavus Adolphus College	solar	EP	269 kW Solar PV installation at Gustavus Adolphus College	\$ 480,000	\$ 875,071	45.15%	\$ 24,000	2.74%	2.0	13.75	45.50	22.50	11.67	45.00	20.00	155.92	1	No Funding			\$ 880,314	\$ 0.15	\$ 3,253	67.74	425.04	0%	
EP4-019	Adornis Eco-Housing	solar	EP	230 kW Solar PV modules to be installed across 200 homes (1 kW p	\$ 2,046,673	\$ 14,346,673	85.73%	\$ 304,636	2.12%	16.0	12.50	31.50	18.00	14.17	0.00	11.42	87.59	3	No Funding			\$ 13,133,694	\$ 3.78	\$ 71,733	120.20	239.92	100%	
EP4-020	Target Corporation	solar	EP	350 kW Solar PV rooftop installation at Target's Midway store.	\$ 583,513	\$ 1,080,533	45.00%	\$ -	0.00%	1.7	13.75	42.00	18.75	12.50	60.00	23.85	192.85	1	Recommend	\$ 583,513		\$ 1,072,976	\$ 0.13	\$ 3,031	210.14	590.84	0%	
EP4-021	FarmAmerica	solar/wind	EP	Installation of 10-20 kW Wind Turbine, 90-100 kW Tracking/Non-track	\$ 600,000	\$ 600,000	0.00%	\$ -	0.00%	1.0	13.75	38.50	13.50	11.67	0.00	13.86	106.28	3	Reserve		\$ 600,000	\$ 559,649	\$ 0.28	\$ 6,000	35.43	141.70	0%	
EP4-022	Minneapolis Park and Recreation Board (MPR)	solar	EP	200 kW solar PV installation on rooftops and sun shade canopies at	\$ 969,741	\$ 1,119,133	13.35%	\$ 50,000	4.47%	0.8	16.25	42.00	19.50	14.17	15.00	16.04	122.95	2	Recommend	\$ 969,741		\$ 1,030,730	\$ 0.29	\$ 5,596	11.13	256.52	0%	
EP4-023	Green Peak Solar LLC	solar	EP	3 kw Solar Trackers in use of 100 distributed throughout neighborhood	\$ 2,300,000	\$ 6,500,000	64.62%	\$ -	0.00%	60.0	12.50	28.00	10.83	10.83	0.00	9.95	76.28	3	No Funding			\$ 2,244,005	\$ 0.87	\$ 24,528	500.00	500.00	100%	
EP4-024	Benergy Windpower Co	wind	EP	Installation of 50-10kW, 23-ft diam, 120 ft. hub height wind turbine	\$ 1,106,600	\$ 3,191,745	65.33%	\$ -	0.00%	20.0	13.75	56.00	18.75	9.17	30.00	16.90	129.57	2	Recommend	\$ 1,106,600		\$ 3,075,002	\$ 0.27	\$ 6,363	500.00	775.00	0%	
EP4-025	Hince Farms, Inc.	solar	EP	100 kW solar PV installation on dairy farm	\$ 350,000	\$ 425,415	17.73%	\$ -	0.00%	7.5	7.50	38.50	14.25	11.67	30.00	15.29	117.20	3	No Funding			\$ 438,992	\$ 0.20	\$ 4,254	150.00	150.00	40%	
EP4-026	Positive Energy Systems, LLC	solar	EP	1-MW solar PV installation for Small town energy usage.	\$ 2,000,000	\$ 3,849,112	48.04%	\$ -	0.00%	20	10.00	28.00	9.75	13.33	30.00	13.66	104.75	3	No Funding			\$ 4,148,726	\$ 0.20	\$ 3,849	-	1,500.00	100%	
EP4-027	Positive Energy Alternatives	solar	EP	1 MW Solar PV ground-mounted installation	\$ 2,000,000	\$ 3,849,112	48.04%	\$ -	0.00%	23.5	5.00	31.50	11.67	11.67	45.00	15.89	121.90	3	No Funding			\$ 3,828,517	\$ 0.17	\$ 3,849	1,380.00	1,500.00	0%	
EP4-028	Future Force Inc	wind	EP	Refurbish an existing 440kW wind turbine and deliver 530kW of powe	\$ 2,778,400	\$ 2,778,400	0.00%	\$ 414,000	14.90%	20.0	5.00	0.00	6.67	60.00	0.00	11.31	86.73	3	No Funding			\$ 2,481,440	\$ 0.13	\$ 30,871	327.14	1,308.57	100%	
EP4-029	Dragonfly Solar, LLC	solar	EP	1 MW PV facility added to existing wind farm which will utilize exist	\$ 1,650,000	\$ 2,650,000	37.74%	\$ 144,720	5.46%	9.0	13.75	45.50	18.75	13.33	45.00	20.45	156.78	1	Reserve		\$ 1,650,000	\$ 3,446,351	\$ 0.19	\$ 3,118	326.68	1,302.70	100%	
EP4-030	Getco Corporation db/a GE Fleet Services/D	solar	EP	515 kW Accredited Capacity Solar PV installation including roof-mou	\$ 3,129,400	\$ 3,129,400	0.00%	\$ 103,000	3.29%	6.5	8.75	35.00	18.75	11.67	30.00	15.62	119.79	3	No Funding			\$ 3,073,815	\$ 0.23	\$ 4,814	87.20	968.62	0%	
EP4-031	Helical, LLC	solar	EP	Forward Solar EIC: A Distributed Generation Strategy to Move Solar	\$ 1,999,481	\$ 2,996,000	30.96%	\$ 230,000	7.94%	16	12.50	28.00	20.25	15.83	30.00	15.99	122.57	2	No Funding			\$ 3,272,330	\$ 0.19	\$ 3,861	245.60	1,222.00	100%	
EP4-032	Emerald HB, LLC (in partnership with Norfolk	wind	EP	Installation of a 1-MW fuel cell as a utility peaking resource powered	\$ 1,984,977	\$ 19,955,663	90.05%	\$ 822,127	4.12%	103.0	8.75	29.00	8.75	8.33	0.00	8.22	63.06	3	No Funding			\$ 19,014,774	\$ 3.06	\$ 19,956	70.59	438.29	100%	
EP4-033	PowerWorks Wind Turbines	wind	EP	Installation and operation of 10 refurbished 100-kW PowerWorks wi	\$ 1,998,416	\$ 2,237,487	10.88%	\$ 239,072	10.68%	20.0	15.00	45.50	15.00	60.00	20.00	22.66	173.75	1	No Funding			\$ 2,513,175	\$ 0.09	\$ 2,237	310.07	2,000.00	100%	
EP4-034	City of St. Paul	solar	EP	100 kW Solar PV generating facility at Lowertown Ballpark	\$ 555,750	\$ 741,000	25.00%	\$ 59,280	8.00%	6.5	13.75	56.00	19.50	13.33	0.00	15.39	117.97	3	Reserve		\$ 555,750	\$ 668,511	\$ 0.34	\$ 7,410	79.46	134.37	0%	
EP4-035	Renier Cattle Company	other	EP	PV-Biogas Hybrid system on farm and feedlot for power generation i	\$ 6,786,225	\$ 10,394,192	35.00%	\$ 142,552	1.37%	150.0	6.25	42.00	15.00	12.50	0.00	11.36	87.11	3	No Funding			\$ 9,695,170	\$ 0.30	\$ 42,253	2,160.00	2,160.00	100%	
EP4-036	City of Austin	biomass	EP	Electricity production equipment added to WWTF facility	\$ 3,565,000	\$ 6,545,000	45.53%	\$ -	0.00%	70	13.75	45.50	15.00	10.00	60.00	20.00	164.25	1	Reserve		\$ 3,565,000	\$ 11,989,713	\$ 0.13	\$ 6,545	1,639.23	6,556.91	0%	
EP4-037	Natural Systems Utilities, LLC	biomass	EP	Anaerobic digestion installation at Michael Foods facility in Chaska, M	\$ 2,000,000	\$ 9,138,276	78.11%	\$ -	0.00%	90	13.75	42.00	21.00	9.17	0.00	17.39	133.30	2	No Funding			\$ 12,184,574	\$ 0.25	\$ 18,860	1,148.33	3,445.00	0%	
EP4-038	Minnesota Go Solar, LLC	solar	EP	20 separate 1 MW (ac) PV Projects utilizing fixed tilt racking system.	\$ 7,439,000	\$ 87,200,000	86.99%	\$ 994,975	1.74%	745.0	16.25	59.50	24.75	17.50	45.00	24.45	187.45	1	No Funding			\$ 81,316,151	\$ 0.16	\$ 2,860				

Higher Education Block Grant Scoring Results

Evaluation Criteria	Point Range	MnSCU	St. Thomas	U of M
Core Criteria				
- Program scope is clear, appropriate, and complete	0 - 4	3.14	3.11	2.93
- Program goals are clear and aligned with RDF mission	0 - 4	3.00	2.71	3.04
- Schedule is clear and realistic	0 - 4	2.96	3.39	3.21
- Products and deliverables are well defined, specific, and consistent with objectives	0 - 4	3.07	2.96	2.79
- Performance metrics are clear and measurable	0 - 4	2.93	2.96	2.50
Program Goals, Scope, and Deliverables (10%) - 20 POINT MAXIMUM		15.11	15.14	14.46
- Article submission process to scientific journals	0 - 10	6.14	4.75	7.32
- Identificaiton of quality control procedures	0 - 10	7.50	6.32	6.07
- Protocols for research solicitation and selection are clearly defined	0 - 10	8.75	6.18	7.50
- Protocols for research performance review are clear and objective	0 - 10	7.86	5.79	7.50
- Protocols for research evaluation and validatoin are clear and objective	0 - 10	7.50	6.32	7.68
- Peer review process is objective and clear	0 - 10	7.95	5.79	7.50
- Reporting process is appropriate and provides transparency	0 - 10	8.13	6.50	5.54
Program Methodology and Research Approach (35%) - 70 POINT MAXIMUM		53.82	41.64	49.11
- Proposal clearly identifies project team and responsibilities	0 - 3.75	2.95	3.04	2.54
- Qualifications of primary team members are clearly identified	0 - 3.75	3.01	3.17	2.34
- Grantee has successfully demonstrated prior experiences and capabilities	0 - 3.75	2.68	2.66	2.95
- Describes strategy for appropriate project oversight and performance evaluation	0 - 3.75	2.95	2.71	2.48
- Describes efficient use of project funds	0 - 3.75	2.61	2.77	2.34
- Budget detail is sufficient and appropriate, including indirect costs	0 - 3.75	2.88	3.04	2.28
- Cost sharing is appropriate	0 - 3.75	2.01	2.09	2.08
- Block grant payment distribution and timing is supported	0 - 3.75	2.95	2.44	2.61
Management Team, Schedule, and Cost (15%) - 30 POINT MAXIMUM		22.03	21.93	19.62
- High likelihood of royalty returns and significant royalty ratio	0 - 13.33	8.45	4.67	0.48
- Benefits to Minnesota electric ratepayers are clearly identified and measurable	0 - 13.33	8.34	5.53	5.72
- Targeted research technology is appropriate for Minnesota	0 - 13.33	10.00	10.43	9.53
- Describes how projgram objectives can reduce key barriers to market deployment	0 - 13.33	9.29	8.76	8.34
- Defines economic benefits (tax, fiscal, local and regional impacts, etc.)	0 - 13.33	9.76	7.81	6.43
- Defines and supports emission reductions and environmental benefits	0 - 13.33	8.22	4.10	4.29
Potential Benefits to Minnesota and Ratepayers (40%) - 80 POINT MAXIMUM		54.05	41.29	34.77
(200 POINT MAXIMUM) Total Score		145.01	120.00	117.96

Proposal Summaries

Proposal: EP4-3

Proposer: Minneapolis Public Schools

Title: Edison High School Green Campus Solar Project

Overall Rank: 20

Technology Rank: S-18

Total Score (out of 230): 141.64

Preferences Received: Located in MN and WI service territories of Xcel Energy
Sponsored by K-12 school/local government

RDF Funding Requested: \$917,250

Total Project Costs: \$1,949,002

Installed Capacity: 485 kW_{DC}

Project Goal: To develop a green campus demonstration model that serves as a hands-on “classroom” to be integrated with the school’s science, math, and technology curricula.

Project Description: Thomas Edison High School in Northeast Minneapolis will construct and operate a comprehensive solar energy project as part of its “green campus” initiative that also includes demonstrations of other sustainability measures, such as urban storm water management. This project will significantly advance Edison’s leadership role as the green campus demonstration model among Minneapolis public schools and K-12 schools around the state. The solar facility will serve as a hands-on “classroom” that will be integrated with the school’s science, math, and technology curricula. The facility will also be a public demonstration of solar energy technology in the Holland Neighborhood of Minneapolis. Edison High is an inner-city public school with a high percentage of students from lower-income homes and students of color. Often, these students are less likely to be exposed to hands-on demonstrations of advanced technologies such as solar energy. As an educational and research component of this project, Edison will work closely with tenKsolar to demonstrate the latest tenKsolar technology. Over the life of the project, in addition to educating students and the public about solar energy, these solar energy installations will save operating costs for school facilities and contribute net revenues to the school budget. Electricity generated will be consumed on site.

The photovoltaic (PV) facility will include a 300 kW roof-mounted array that uses tenKsolar panels, two 20-watt solar electric vehicle charging station demonstrations

with energy storage, a 50 kW roof-mounted array on the Firemen's Museum on the school campus, and a 112 kW solar array that will be incorporated into awnings on school buildings. Edison will enter into a design-build contract with Sundial Solar whereby Sundial will guarantee system performance and perform all operation and maintenance on the system for at least the first five years. Sundial will establish a project-specific limited liability corporation for the project in conjunction with a tax equity partner to access federal tax incentives for solar energy installations.

Anticipated Benefits: The project has been specifically designed to evaluate the ability of solar, and in some cases electric energy storage, to be integrated with a school's facility. This knowledge will be transferable to other school facilities in Minnesota. As a community institution in Northeast Minneapolis, Edison is in a strong position to educate the general public, as well as its students, about solar energy and renewable electric utilization.

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions

Measurable Outcomes:

- Certification of 485 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Educational outreach efforts
- Reduced school operating costs/contribution to net revenues

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project due to Edison High School as an inner-city high school with a focus on sustainability and also a good math and science curriculum. Incorporating solar PV panels into the awnings is expensive, which resulted in a lower technical score, but it is a unique feature for the project. Using electric vehicle charging stations as an energy storage concept was also identified as a unique feature for the project.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-4

Proposer: SGE Partners LLC

Title: South St. Paul Anaerobic Digestion and Electrical Generation

Overall Rank: 27

Technology Rank: B-5

Total Score (out of 230): 129.09

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment
Utilizes non-agricultural residues for a feedstock

RDF Funding Requested: \$5,000,000

Total Project Costs: \$14,847,764

Installed Capacity: 1.1 MW_{AC}

Project Goal: To design, engineer, construct, and commission a commercial anaerobic digester and generator to convert biogas to electricity which will demonstrate the viability of an urban biodigester utilizing nonagricultural residue.

Project Description: Sanimax Industries Inc. (Sanimax) and Green Energy Partners Inc. (GEP) have partnered to form SGE Partners LLC (SGE) for the construction and operation of a commercial anaerobic digestion in South St. Paul, Minnesota, adjacent to the existing Sanimax rendering facility. The anaerobic digester will be based on existing technologies and will be designed to process approximately 150,000 tons per year of non-agricultural source separated organic materials from the rendering process as well as organic waste from restaurants and food processing companies within the metropolitan area. Following the biological digestion, approximately 400,000 dekatherms per year of pipeline quality, green natural gas will be produced. Using a 1.1 MW generator, a portion of the biogas will be converted to electricity while the remaining biogas will be processed and delivered to the pipeline grid and to the Sanimax rendering facility to be used in the rendering process. Electricity generated will be sold to Xcel Energy.

The facility will be relatively large compared to many anaerobic digester projects; it will have notable flexibility in the range of materials that can be processed and in the range of end uses for the produced biogas. The facility will be designed to aggressively control emissions and odor by keeping all feedstock storage, loading, and unloading indoors and under reverse air flow. The scale, urban setting, and anticipated diversity

of feedstock materials will require a tailored design. SGE plans to use a “mixed plug-flow” type digester. This is a proven technology that has been widely deployed in facilities around the world. With this type of design, material is continuously added at the inlet of the digester, while effluent is continuously pumped at the outlet. When compared to a “continuous mixing” type digester, there is little to no agitation inside the plug-flow reactor and the new material added to the digester pushes material through the digestion process. Throughout this process, biogas is collected from the top of the reactor to be cleaned and compressed.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Provide baseload renewable electric generation
- Emission reductions
- Improve air quality
- Utilizes variety of feedstocks that are available within the community
- Scalable model for future anaerobic installations
- Incorporates 1,100 kW genset from RDF Cycle 1

Measurable Outcomes:

- Certification of 1.1 MW_{AC} installed capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Amount of biogas produced annually

RDF Advisory Group Perspective: The RDF advisory group strongly supported this proposal because it was an innovative urban biogas project that may prove to be a future model for urban waste reduction and energy needs. The project would also be a significant urban biomass initiative that could provide good visibility for sustainable renewable energy development. The project will foster long-term job creation and enhance the tax base in South St. Paul.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-5

Proposer: Best Power Int'l, LLC

Title: School Sisters of Notre Dame Solar Park Project

Overall Rank: 17

Technology Rank: S-15

Total Score (out of 230): 149.02

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$900,000

Total Project Costs: \$1,811,857

Installed Capacity: 907 kW_{DC}

Project Goal: To provide an increased knowledge of solar by installing a solar PV facility that will operate on a 1,000 V_{DC} system, versus a 600 V_{DC} system, and provide a process for local electrical inspectors to understand a 1,000 V_{DC} system

Project Description: A ground-mounted photovoltaic (PV) facility will be constructed on the School Sisters of Notre Dame (SSND) campus in Mankato, Minnesota. The Mankato campus of the Central Pacific Province of the SSND, located on Good Counsel Hill in Mankato, Minnesota is where the proposed solar park would reside. The campus has strongly pursued sustainability for many years. They have a "Green Habit Campaign" which is an initiative of the SSND Green Team to recognize and promote sustainable living practices. By having a large-scale solar park built on their campus, the school will be able to lead and teach sustainability to their local community. The campus is located near the northwest quadrant of US Highway 14 and North Victory Drive. Best Power Int'l, LLC (BPI), will lease approximately five acres of land from SSND over a 20-year period. BPI will own, operate, and maintain the system. Electricity generated will be sold to Xcel Energy.

The Solar Park will consist of approximately 3,020 polycrystalline silicon PV panels. The panels will be supported by a foundation consisting of driven galvanized steel piles. The racking will be fixed, facing at an angle of 190 degrees from north to increase the amount of energy produced in the afternoon that will provide more benefit to Xcel Energy ratepayers than a south-facing array. The Solar Park will be the first large-scale solar project to be implemented utilizing a higher operating voltage of 1,000 V_{DC}. By switching to operating as a PV system at 1,000 V_{DC}, from the typical

600 V_{DC}, savings are incurred in wire size and other facility components, as well as a reduction in installation time, to drive down the cost of solar.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions
- Introduction of new 1,000 V_{DC} technology
- Availability of production data and cost data for educational and research opportunities

Measurable Outcomes:

- Certification of 907 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Cost benefit analysis of a 1,000 V_{DC} solar system over a 600 V_{DC} solar system
- Post-construction interview with local electrical inspector

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project based on the price of energy and a certain degree of novelty. The 1000 V_{DC} technology has been shown to be promising in other places (i.e. California, Europe, and Canada) and this facility may help move the regional solar industry into new areas and possibly contribute to higher efficiencies. The location in Mankato would also provide high solar energy visibility.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-6

Proposer: Best Power Int'l, LLC

Title: St. John's Solar Farm Expansion Project

Overall Rank: 8

Technology Rank: S-6

Total Score (out of 230): 162.15

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding requested: \$172,213

Total Project Costs: \$414,033

Installed Capacity: 198 kW_{DC}

Project Goal: To expand the St. John's Solar Farm and incorporate an on-site side-by-side comparison of competing solar technologies: linear axis tracker technology currently in place and fixed tilt technology of the new array.

Project Description: A static, ground-mounted photovoltaic (PV) facility will be constructed adjacent to the existing St. John's Solar Farm in Collegeville, Minnesota. The project will be an expansion of an existing 400 kW_{DC} PV facility that was funded from the 3rd RDF cycle and was completed in 2009. The array will utilize approximately 660 panels which will be mounted on racking supported by driven galvanized steel piles. The new array will utilize the existing interconnect agreement and existing PPA with Xcel Energy. These agreements as well as the existing inverter, were originally planned and permitted to deliver a maximum power rate of 500 kW_{AC}. The existing capacity is currently 400 kW_{DC} or 320 kW_{AC}. The incremental capacity added to the system will be 198 kW_{DC} or 158 kW_{AC} which will result in a total installed capacity of 478 kW_{AC} when the addition is completed.

The St. John's Solar Park will continue to be owned, operated and maintained by Best Power Int'l, LLC (BPI). BPI has a 20-year lease in place with St. John's Abby. BPI currently has a valid PPA with Xcel Energy which will expire in 2030 to sell the energy produced by the entire facility up to 500 kW. Data obtained from the two arrays will be made public to allow researchers and developers to evaluate which technology is best suited for energy needs and constraints of a particular interconnection location.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions

Measurable Outcomes:

- Certification of 198 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Comparative production data from linear axis tracker technology and fixed tilt technology

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that it be placed on a reserve list. The existing PPA, lease agreements, and interconnection minimize risks but the concept of a facility expansion is not particularly innovative. The technology should provide a good comparison to the technology on the Minneapolis Convention Center and there will be good public awareness through data sharing via the website

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-7

Proposer: Anoka Ramsey Community College (ARCC)

Title: Research Coordinated Solar PV Demonstration Project

Overall Rank: 15

Technology Rank: S-13

Total Score (out of 230): 151.80

Preferences Received: Located in MN and WI service territories of Xcel Energy
Sponsored by K-12 school/local government

RDF Funding Requested: \$828,900

Total Project Costs: \$1,825,976

Installed Capacity: 458.38 kW_{DC}

Project Goal: To demonstrate three types of solar energy deployment which will be a living, hands-on laboratory for research and skills development.

Project Description: ARCC will be installing two photovoltaic (PV) arrays, a unique ground-mount array and a roof-mounted array on its Training Center, as well as a solar electric vehicle (EV) charging station that is integrated with a carport outside its main administrative building. The solar arrays and the EV charging station will be monitored for performance data and will also be hands-on laboratories integrated with solar energy related coursework and energy research activities at ARCC. The training center itself will self-generate about 70 percent of the building energy demand from the roof-mounted solar array. The solar EV charging station will demonstrate a stand-alone model for recharging electric vehicles by integrating energy storage with solar PV generation. The facility will be used in the evaluation of the possible development of a micro-grid renewable energy system for the campus. Electricity generated will be consumed on site.

The largest of the PV arrays will be a 355.88 kW_{DC} ground-mounted array adjacent to the ARCC Training Center at the main entrance to the campus which is often the first stop for new students and visitors to the campus. A roof-mounted array of 77.08 kW_{DC} will be installed on the roof of the Training Center. The solar EV charging station will be located in the parking lot immediately adjacent to the ARCC's main administration building and will include 25.42 kW_{DC} capacity. One EV charger and two 9.2 kW Silent Power energy storage units will also be integrated into the carport structure. The ground-mount and roof-mount arrays will include standard Solar Log monitoring systems linked to computers in the Training Center for tracking of real-

time and historical output from the facility. There may be an opportunity, working with tenKsolar, to orient some or all of the ground-mounted panels west or east of due south or “off-azimuth” in order to measure shifts in time-of-day production from the systems and impacts on total output. This off-azimuth positioning could be changed periodically to test different models of solar shifting. ARCC will use Titan tenKsolar solar modules that are rated at 410 watts and 440 watts. These panels, when combined with the reflective gain from the integrated reflective racking system manufactured by 3M Company will give modules some of the highest output in the industry. Standard Solar Log monitoring systems will collect time-of-day production for research and analysis purposes.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Demonstrate demand management from distributed solar generation
- Renewable electric generation during periods of peak power
- Emission reductions
- Support better workforce training and evaluate the cost-effectiveness of various solar technologies in Minnesota
- Provide a practical and applied component to ARCC training initiatives

Measurable Outcomes:

- Certification of 458.38 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Evaluation of “off-azimuth” power production

RDF Advisory Group Perspective: With the exception that the scope of work needs to clarify that curriculum development consists of how to integrate students, training development, and the utilization of the charging station in education; the RDF advisory group strongly supported this project. Of the proposals that use tenKsolar, the ARCC proposal has the greatest opportunity to provide a solar awareness platform.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-9

Proposer: Mondovi Energy Systems

Title: Installation of a Community Based Anaerobic Digester in Mondovi, Wisconsin

Overall Rank: 23

Technology Rank: B-2

Total Score (out of 230): 135.03

Preferences Received: Located in MN and WI service territories of Xcel Energy
Utilizes non-agricultural residues for a feedstock

RDF Funding Requested: \$2,000,000

Total Project Costs: \$13,220,683

Installed Capacity: 2.0 MW_{AC}

Project Goal: To divert various community organic wastes from landfills and convert these wastes to usable products that can offset waste management costs.

Project Description: Mondovi Energy Systems, LLC will install a community-based anaerobic digester and co-fermentation biogas plant to utilize organic wastes that will generate electricity and heat. The City of Mondovi and its environs have several sources of substrates that will be used as feedstock for co-fermentation at the biogas plant. This includes a wastewater treatment plant, dairy manure, meat processing bi-products, dairy and cheese processing plants, commercial businesses that produce food waste, a hospital, a nursing home, other food processing plants, and several schools. There is a garbage collection service in the city that can be utilized to collect the food waste and other input substrates from businesses each day for delivery to the biogas plant. Electricity generated will be sold to Xcel Energy.

Waste will be sorted and screened to remove inorganic or hazardous materials such as metals and plastics. Material to be digested will be shredded to increase the surface area available to microbes in the digesters and increase the speed of digestion. The various feedstock materials are combined at a predetermined ratio and mixed together prior to being pumped into the digesters. The complete and continuous mix action within the digesters sustains an optimal environment for bacteria to digest these high energy materials. A pump or screw conveyor will feed raw materials into the digesters. Automated feeding regulates input of material to ensure optimal digestion and reduces labor required for operating the system. The biogas facility will have four cylindrical reinforced-concrete digesters with heating pipes embedded in the walls and floor. The

walls will be insulated and clad with weatherproof panels. The digesters will be built above ground to reduce costs and facilitate maintenance, and their cylindrical shape ensures maximum engineering and thermal soundness. The retention time of the mixture in the tank would be approximately 60–90 days at 95 degrees Fahrenheit. During this process several sets of bacteria work to breakdown the biodegradable waste, in the absence of oxygen, into biogas. Mondovi will generate electricity and utilize heat produced for nearby factory buildings. The waste from the digester will be separated into liquid and solid by a separator. The solid and liquid manure from the separator will be rich with nutrients and sold as organic fertilizer. The process will generate carbon offset credits that will also be marketed.

Anticipated Benefits:

- Creation of jobs during construction and for operation and maintenance
- Distributable renewable electric generation
- Emission reductions
- Produce marketable products that can be utilized in the community (i.e., fertilizer, bedding for cattle, potting soil, etc.)
- Reduce surface and groundwater contamination
- Improve air quality
- Utilizes variety of feedstocks that are available within the regional community
- Demonstration of technology to industry groups, educational institutions, and elected officials

Measurable Outcomes:

- Certification of 2.0 MW_{AC} installed capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Carbon off-set credits produced
- Number of marketable products created from waste residue

RDF Advisory Group Perspective: The RDF advisory group strongly supported this proposal because it is cost effective for biomass and the facility has the ability to operate when needed during peak-demand. The technology is unique and may help Minnesota learn more about the biogas industry. It also will be the first RDF energy production project in Wisconsin. There was some concern about the lack of detail in financial plan.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-11

Proposer: Innovative Power Systems, Inc.

Title: Green Line Solar Corridor

Overall Rank: 10

Technology Rank: S-8

Total Score (out of 230): 158.32

Preferences Received: Project located within the Energy Innovation Corridor
Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$1,850,000

Total Project Costs: \$2,698,200

Installed Capacity: 967.27 kW_{DC}

Project Goal: To demonstrate a development process for solar energy through a public-private tax equity investment structure, performance monitoring to build a baseline for solar project financing, and demonstrate that these benefits can be achieved using locally-manufactured products.

Project Description: The project will include five photovoltaic (PV) power systems, roof-mounted on commercial buildings within the Energy Innovation Corridor. Power produced by each PV system will be fed into the host building's electrical service with surplus generation supplied to the grid. The equipment chosen for this project is the latest generation of RAIS-WAVE™ PV system manufactured by tenKsolar in Bloomington, Minnesota. Revenue-grade metering and performance monitoring equipment supplied by Solar-Log will compare data from a variety of solar installations against total building demand as a way to measure the aggregate impact of solar PV.

All five buildings have flat roofs, which make them perfect candidates for the tenKsolar RAIS-WAVE solar array with its added reflected illumination from a technology developed jointly by tenKsolar and 3M. Power generated by each PV array will be fed into the electrical service of its host building, with inverters for each system sized to match the specific phase and voltage available at the building. At some of the buildings, a service upgrade will be necessary to accommodate the output of the PV array. Three of the solar arrays will face approximately 30° west of south, due to the orientation of three of the buildings to University Avenue, as it runs west-northwest

from Fairview Avenue to the western boundary of St. Paul. Based on research supplied by tenKsolar, this “off-azimuth” positioning will provide more solar capacity later in the day when peak loads occur. A significant barrier to the larger-scale deployment of solar PV power systems in Minnesota are the high installed cost, relative to other energy sources. This project will utilize the new, larger tenKsolar modules, rated at 410 or 440 watts, which more than doubles the DC rating per module, and significantly reduces the labor and hardware costs to install the system.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Demonstrate demand management from distributed solar generation
- Renewable electric generation during periods of peak power
- Emission reductions
- High-visibility area for Twin Cities’ residents and visitors that will have access to performance data through host websites, lobby kiosks at the participating buildings, city visitor centers, schools, and other gathering areas

Measurable Outcomes:

- Certification of 967.27 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project due to the high project visibility and use of five different sites.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-13

Proposer: Metropolitan Airport Commission (MAC)

Title: Solar PV Parking Ramp Peak Production Project

Overall Rank: 7

Technology Rank: S-5

Total Score (out of 230): 163.25

Preferences Received: Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$2,022,507

Total Project Costs: \$4,189,000

Installed Capacity: 1,180 kW_{DC}

Project Goal: The facility is to serve as a prototype for future solar projects at the airport which showcase energy innovations and focus public awareness. The MAC also seeks to continue as a leader among major airports on sustainability issues and innovation.

Project Description: Install roof-mounted photovoltaics on the upper deck of the Gold Parking Garage at Terminal One of the Minneapolis-St. Paul International Airport (MSP). The solar equipment will be installed on structural support so as to maintain current parking spaces on the upper deck. It will be configured for future integration with energy storage, electric vehicle (EV) charging and other demand management technologies. MAC experiences significant time-of-day and seasonal peak energy loads at Terminal One (Lindbergh) resulting in large demand charges on its energy bills. Solar photovoltaic (PV) installations on the Gold Ramp will be designed to maximize the economic value of its power production to the MAC by targeting production to reduce these peak loads. By reducing load the facility will also benefit the larger grid and distribution system serving MSP and surrounding area by producing solar energy during the peak period defined by Xcel Energy as 9 a.m. to 9 p.m. on non-holiday weekdays. Electricity generated will be consumed on site.

The solar equipment will be built on a structural support that raises it above the surface of the roof deck and allows parking on that level to be maintained. A standard panel configuration would likely be positioned facing directly south or towards the azimuth to achieve maximum annual power production. However, based on the production-based incentive for peak power that is a key part of this proposal, panels will be placed “off-azimuth” to shift as much of the system’s output as possible to the

most critical period for peak power demand. Analysis of interval use data indicates that the most critical peaks occur at early morning and early evening, which is generally consistent with peak load factors across the grid system. Positioning some of the solar panels with more of a southeast orientation and some more southwest may be the most cost-effective strategy for shifting solar output to those periods. MAC will retain control of the solar assets developed at MSP and receive the full benefit of the energy production. However, the MAC also expects to enter into a 20-year agreement with a to-be-chosen solar developer for development and operation of the solar projects, and structure that agreement to allow the solar developer to access the federal tax benefits for installation of solar energy.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Immediate market for replication
- Model to analyze impacts of demand management
- Renewable electric generation during periods of peak power
- Emission reductions
- Potential integration of charging stations for electric vehicles at the Gold Ramp encourages the use of hybrid or all-electric vehicles

Measurable Outcomes:

- Certification of 1,180 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project due to the highly visible location at MSP and because it can serve as a prototype for future solar projects. This project may be the first of several at MSP for future integration of energy storage, advanced metering, EV charging, and other demand side management strategies.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-15

Proposer: Minnesota Renewable Energy Society (MRES)

Title: Minnesota Solar Garden Project

Overall Rank: 41

Technology Rank: S-18

Total Score (out of 230): 90.66

Preferences Received: Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$2,661,320

Total Project Costs: \$4,036,420

Installed Capacity: 1,000 kW_{DC}

Project Goal: To provide the opportunity for homeowners or business owners who cannot have solar on their roofs to participate in solar power generation and to research best practices for Community Solar in Minnesota through a demonstrable, replicable, and scalable pilot project.

Project Description: There are many people who would like to participate in renewable electric energy generation but are unable to purchase and install solar on their residence or business. Reasons for not participating include physical factors like shading, lack of roof space, and poor roof orientation. Other factors include lack of upfront financing, non-ownership or living in a multi-family housing that make it difficult to install a system on a shared roof. To overcome these barriers the MRES will build a solar community garden modeled after the solar gardens in Colorado. This would be a large installation in Xcel Energy's Minnesota service territory that would allow the community to purchase solar panels from a community solar array and receive a discount on their utility bill. Electricity generated will be sold to Xcel Energy.

The photovoltaic (PV) facility will consist of approximately 4,000 panels, each rated at 250 watts. Equipment details, such as the panel manufacturer, will be determined upon award of this project MRES will work in partnership with Clean Energy Collective (CEC). CEC will control initial ownership of the installation and the energy produced by before it is sold to the public. As the subscribers begin to buy-in, ownership will transfer to the individual purchasers of energy, so the project will truly be a cooperative ownership system. As subscribers wish, they may resell their panels to other Xcel Energy customers or donate them to continue the cooperative ownership model. MRES would like to explore the urban versus rural aspect of solar gardens to determine what barriers to market acceptance arise when the panels get

more distanced from a large market. Investigating if this is a barriers and, if identified, how to overcome them will be an important part of the work as the first large scale community solar project in Minnesota. MRES will first survey people interested in community solar to determine barriers and identify solutions.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance.
- Emission reductions
- Development of “Best Practices” for future community solar initiatives
- Demonstrate an alternative financing and ownership structure for solar energy

Measurable Outcomes:

- Certification of 1,000 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- 100% of facility capacity subscribed by community ownership
- A “best practices” report on establishing solar gardens

RDF Advisory Group Perspective: The RDF advisory group favored this project. The project can serve as a model that demonstrates another alternative to renewable energy ownership and participation in Minnesota. The community concept and structure identified was also the best that had been proposed, in the view of the RDF advisory group. The partnership is established and best practices can be established for the future. The proposal scored poorly due to limited detail (the scope and definition were light) and there were no interconnection costs in the budget. Another concern that was raised identified that there is no site specified, which has the potential to create delays and increase project costs. Also, there was a concern whether the RDF is the right structure to fund this type of ownership incentive.

Company Perspective: The Company understands there are some deficiencies in how the proposal was defined but these can be resolved during the due diligence process. This may be the largest solar garden project in Minnesota and is modeled on the solar gardens approach in Colorado. The Company has extensive experience with solar gardens in our Colorado service territory and we can use this knowledge to help ensure the successful implementation of solar gardens in Minnesota.

Proposal: EP4-20

Proposer: Target Corporation

Title: 350 kW Target Midway Solar PV Project

Overall Rank: 2

Technology Rank: S-2

Total Score (out of 230): 182.85

Preferences Received: Project located within the Energy Innovation Corridor
Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$583,513

Total Project Costs: \$1,060,933

Installed Capacity: 350 kW_{AC} (418 kW_{DC})

Project Goal: To maximize on-site renewable energy production during peak hours at Target's Midway Saint Paul retail location; to construct an energy-dense, cost-efficient solar array in Minnesota; to educate the community on the benefits of commercial-scale solar; and to reduce Target Midway's greenhouse gas footprint.

Project Description: Installation of a roof-mounted photovoltaic (PV) facility at the Super Target Midway store on University Avenue in St. Paul. The facility would be first solar array for Target in Minnesota, and one of the largest solar installations in the state. The array will be located in the Energy Innovation Corridor along the light rail line. Target will own and operate the array which is estimated to produce 591 MWh of electricity in its first year of production and 8,599 MWh over 15 years of operation. Electricity generated will be consumed on site.

The solar array will feed power to two inverters which will be interconnected with the store's existing power distribution system. One inverter will be a Solectria SGI 300 and the second will be a Solectria PVI 50. The facility has been sized to meet the electric load of the store and is optimally designed to avoid exporting power to Xcel Energy. The solar field will be comprised of 1,638 Suniva MVX 255W solar modules. The modules are 60-cell polycrystalline units mounted on a fixed racking system. The system will be oriented due south at a 30° tilt with a racking system manufactured by Sunlink.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance.
- Emission reductions
- Renewable electric generation during periods of peak power
- Generation of applied data on the potential of developing commercial facilities that incorporate both high energy efficient designs and on-site distributed generation.
- Serve as a showcase facility on the Energy Innovation Corridor (EIC) website and aligns Target with the larger green initiatives fostered by the EIC and has the opportunity to reach many in the local community who have had little to no contact with solar energy.

Measurable Outcomes:

- Certification of 350 kW_{AC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. Although the concept was not especially innovative, the facility uses proven technology and will have a lot of visibility. Midway Target serves a diverse, inner-city customer base and is one of the most visible roof tops in the EIC, with high visibility from light rail. This is the first Target store solar installation, if it is successful, they will probably implement more. Educational programs and displays at store will increase solar awareness.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-21

Proposer: Farmamerica

Title: Combined Solar, Wind and Battery for Energy Self-Sufficiency Project

Overall Rank: 37

Technology Rank: C-1

Total Score (out of 230): 106.28

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$600,000

Total Project Costs: \$600,000

Installed Capacity: 100 kW_{AC} (120 kW_{DC})

Project Goal: To achieve a net-zero non-combustion based energy production system at the Farmamerica interpretive center and significantly reduce the facility's carbon footprint.

Project Description: This project is to install two different solar electric arrays: a fixed array of approximately 50 kW_{DC} and a tracker array of approximately 40 kW_{DC}. A small wind turbine between 10 kW_{AC} to 20 kW_{AC} will also be erected. Surplus electricity that can-not be consumed on site will be stored in a 20 kW to 30 kW battery bank in the form of an electric vehicle charging station. The design of this facility is to control the energy usage and demand to stay within the production levels of the renewable energy system. The electricity produced from this system will be consumed at Farmamerica. There are not many battery-based demand and energy systems, or solar tracker and solar fixed array system comparisons, visible to the public. Through the internet, the public will have access to the facility monitoring and data log showing the combined operation and benefits of the project.

Through a combination of photovoltaic (PV) and small wind technology, at least 100 kW_{AC} (120 kW_{DC}) would be installed at the Farmamerica agricultural interpretive center near Waseca, Minnesota. The facility would operate in conjunction with a 20 kW to 30 kW battery bank to store power that cannot be consumed on site. The facility will serve as a demonstration for area school districts and local governments to consider as a feasible alternative to reduce utility costs. There will be a web-based monitoring system for organizations and communities to follow the energy production results. This project will involve a request for bids process to local area

renewable energy contractors, installers, and students from Riverland College who are in the electrical construction program. Green Energy Products of Springfield, Minnesota is the recommended provider of solar tracker devices. It is intended that Minnesota manufacturers will provide of the solar PV panels. Midwest wind turbine manufacturers will also be the preferred supplier.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions
- Public accessibility to performance data to assess the value of a full tracker designed system and/or the combination of trackers and fixed solar arrays
- Provide a better strategy for utility load control through the use of battery banks

Measurable Outcomes:

- Certification of 80 kW_{AC} installed PV capacity and 20 kW_{AC} installed wind capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Comparative production data from fixed PV technology and PV tracker technology
- A public information and education component

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. The proposal received a low technical score due to very limited information on the desired battery bank technology, as well limited technical information on wind turbines and the solar PV system. The specific technology that will be installed will be commercially available so the functionality of the equipment is not a critical limitation. The combination of multiple renewable energy generation technologies and storage provides an interesting approach to putting these technologies into practice. The location of the interpretive center will provide good visibility for this demonstration of how these various technologies work together.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-22

Proposer: Minneapolis Park and Recreation Board (MPRB)

Title: Minneapolis Park and Recreation Board Solar Demonstration Project

Overall Rank: 30

Technology Rank: S-23

Total Score (out of 230): 122.95

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$969,741

Total Project Costs: \$1,119,133

Installed Capacity: 200 kW_{DC}

Project Goal: To install a solar photovoltaic (PV) system utilizing Minnesota Made solar panels, to demonstrate the effectiveness of alternative solar designs such as carports and canopies when roof-mounted designs are not feasible, and promote solar power through educational and interpretive programs.

Project Description: 200 kW solar PV installations on rooftops and sun shade canopies at municipal parks owned by the MPRB. A 150 kW system will be roof mounted on either MRPB's Parade Ice Garden (600 Kenwood Parkway, MRPB's headquarters (2117 West River Road) or MRPB's maintenance facility (3800 Bryant Avenue South). The additional five sites will be chosen utilizing a solar assessment tool developed in conjunction with park board staff, a solar consulting firm, and community advisory committee input. These facilities will demonstrate the effectiveness of alternative solar designs such as carports and outdoor restaurant seating canopies when roof mounted solar systems are not feasible due to structural, historical, or other barriers to traditional solar installations. Electricity generated will be consumed on site.

The 150 kW array will consist of 376 Minnesota Made Titian 410 watt panels from tenKsolar. Sustainable Energy will manufacture the 27 inverters and the solar energy data monitoring equipment will be a Solar Log 500 or equivalent. The additional 50 kW installations will use either tenKsolar or Silicon Energy panels, depending on the location and type of application. tenKsolar panels will be used in flat roof applications while the Silicon Energy panels will be used for pitched roof and canopy applications.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Emission reductions
- Renewable electric generation during periods of peak power
- Development of assessment tool that can be adopted by other public and private organizations. This tool may save time and money on future solar installations
- Education outreach to lower income and minority youth who are less likely to be exposed to solar PV systems and the benefits provided

Measurable Outcomes:

- Certification of 200 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Creation of Solar Assessment tool
- Public interpretive and education program

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. Solar PV roof installation will showcase to the community the benefits and feasibility of roof-mounted solar devices. The project will include community member participation to help in decision making which will increase education of renewable sources in the community. An emphasis will be on placing PV systems in high use park facilities to showcase solar, again increasing recognition in the community. There were some concerns about the total project cost and low cost-share.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-24

Proposer: Bergey Windpower Co.

Title: Minnesota Clustered Small Wind Project

Overall Rank: 26

Technology Rank: W-2

Total Score (out of 230): 129.57

Preferences Received: Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$1,106,600

Total Project Costs: \$3,191,745

Installed Capacity: 500 kW_{AC}

Project Goal: To increase the market penetration of small wind turbines within Minnesota, to expand the business activities of an established Minnesota small business and provide market momentum for future growth, to create an easily accessible public database of actual system performance, to promote American-built small wind turbines with critical components built in Minnesota, and to restore confidence in small wind products and vendors.

Project Description: Fifty 10 kW wind turbines will be installed in Stearns, Benton and Meeker Counties. Bergey indicates that they currently have fifty confirmed farms and small rural business for the project. The turbines will be installed on 120-foot Guyed-Lattice (GL) towers with sub-surface “deadman” anchors. The 120-foot GL tower is the tallest tower in common usage in the small wind industry. The project will use Excel 10 wind turbines, which have a 23-foot blade diameter and 120-foot hub height. The turbines begin producing power with wind speeds at 5 miles per hour and reach 10 kW at 26 miles per hour. Peak power is over 14 kW. The turbines are each projected to produce an average of 15,500 kWh per year, for a project total of 775,000 kWh per year. The turbines are expected to produce power 82 percent of the time. Electricity generated will be consumed on site.

Each system will be monitored using a web-enabled APRS World PS2Tap system that will provide the owners with real time and historical performance data. The data will also be posted in real time to a publicly accessible project web site.

Anticipated Benefits:

- Development of best practices and policies for small wind in Minnesota
- Minnesota is home to three small wind turbine manufacturers, so a successful project could potentially see increased local sales
- Emission reductions

Measurable Outcomes:

- 50 commissioned 10 kW wind turbines
- Certification of 129.57 kW_{AC} installed wind capacity
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. Small wind has some image problems in Minnesota and Bergey would provide the proper image and quality product for possible small wind in Minnesota. Funding a wind energy production project would provide some diversification of the project types funded from RDF Cycle 4.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-29

Proposer: Dragonfly Solar, LLC

Title: Solar Addition to Existing Dodge Center Wind Farm Project

Overall Rank: 11

Technology Rank: S-9

Total Score (out of 230): 156.78

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$1,650,000

Total Project Costs: \$2,650,000

Installed Capacity: 997.5 kW_{DC}

Project Goal: To take advantage of existing interconnection and infrastructure systems by installing a solar photovoltaic facility on an existing wind farm.

Project Description: A ground-mounted photovoltaic (PV) facility will be constructed near the northern edge of the existing GarwinMcNelius wind farm (GM Solar) near Dodge Center, Minnesota. The array will utilize approximately 3,990 Solar World panels which will be supported by metal piers. Solar Edge optimizers and inverters are to be used and a step-up transformer will be installed to bring the facility voltage up to the line voltage of 34.5 kV. The facility will utilize web-based monitoring. The racking design will allow for an increased pitch for snow sloughing and lower sun angles as well as a higher elevation from the ground to avoid snow cover and any risk of spring flooding.

GM Solar would retain ownership and Dragonfly Solar would assume project design and implementation control in concert with GM Solar. The existing turbines are connected with a 34.5 kV collector system owned by GM Transmission which connects to a substation also owned by GM Transmission. GM Transmission has an existing interconnection agreement with MISO and NSP for the existing wind project at the Dodge Center substation. It is expected that the current interconnection agreement is sufficient to accommodate the additional solar energy expected, although MISO may need to study the proposed additional power.

Anticipated Benefits:

- Utilizing existing collection system and interconnection of wind farm can serve as an example for lower costs when integrating renewable systems
- Renewable electric generation during periods of peak power
- Emission reductions
- Improved stability of output from facility as compared to only wind generation

Measurable Outcomes:

- Certification of 997.5 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Demonstration of lower installed cost per kW

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. Although the concept is not novel, the lower installation cost and co-location with existing facilities would limit possible risks. There is some innovation in using Solar World modules which are a next generation technology with only recent application in the United States market. Utilizing an existing collection system and interconnection with a wind farm can serve as an example of potential for lower costs when integrating renewable systems. MISO may need to study proposed additional power.

Company Perspective: The Company concurs with the advisory group. A MISO study may result in a significant increase in the time necessary to complete the permitting process prior to construction but ratepayers are protected because RDF funding would be in a lump-sum upon completion of the project.

Proposal: EP4-34

Proposer: City of St. Paul

Title: Lowertown Ballpark Solar Project

Overall Rank: 34

Technology Rank: S-27

Total Score (out of 230): 117.97

Preferences Received: Project located within the Energy Innovation Corridor
Located in MN and WI service territories of Xcel Energy
Sponsored by K-12 school/local government

RDF Funding Requested: \$555,750

Total Project Costs: \$741,000

Installed Capacity: 104.5 kW_{DC}

Project Goal: To maximize solar energy production during peak hours, to hedge against electric costs and reduce peak electric demand, to promote the benefits of solar through direct engagement with ballpark spectators, and to reduce the ballpark's greenhouse gas and pollution footprint.

Project Description: The project will consist of constructing two separate photovoltaic (PV) arrays. One array will be a 20 kW shade pavilion over a group spectator terrace which can be seen by visitors throughout the ballpark and the second will be an 80 kW array on a car canopy over a parking lot adjacent to the ballpark. Both arrays will produce a combined total of 134 MWh of electricity in the first year of production and 1,947 MWh over 15 years of operation. The facility has an estimated lifetime of 25 years. Electricity generated will be consumed on site.

The solar array will be integrated into the new 7,000-seat regional ballpark located in Lowertown, St. Paul. The location of the new ballpark is currently a polluted former industrial site that will be cleaned up as part of the ballpark project. The car canopy array will have solar modules flush-mounted on a 20-degree solar rack attached to a shade structure over the parking lot northeast of the ballpark. To maintain design efficiency and cost effectiveness, the array will be oriented with the angle of the parking lot so that the array is facing southwest at a 34-degree azimuth angle. That will prove to be the most efficient installation for 80 percent of the array. The shade pavilion array will be over a portion of the spectator seating with solar modules

mounted in rows angled at a 20 degree tilt to maintain module efficiency and minimize wind loading stresses. The modules will face due south.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Emission reductions
- Renewable electric generation during periods of peak power
- Public awareness to a local community who have had little to no contact with solar energy

Measurable Outcomes:

- Certification of 104.5 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group favors this project. There is the potential for high public awareness due to the visibility at a high traffic recreational facility which can capture ratepayer attention. This awareness is enhanced further by displaying details of the solar PV facility on the scoreboard between innings. The advisory group was concerned about the high cost, which lowered the overall technical score, but attributed this to racking for canopy installations. These installations are more expensive than the simpler racking associated with ground- or roof-mounted arrays.

Company Perspective: The Company strongly supports this project due its high visibility and marketing potential.

Proposal: EP4-36

Proposer: City of Austin

Title: Austin Wastewater Treatment Facility Biogas Renewable Energy Project

Overall Rank: 6

Technology Rank: B-1

Total Score (out of 230): 164.25

Preferences Received: Utilizes non-agricultural residues for a feedstock

RDF Funding Requested: \$3,564,000

Total Project Costs: \$6,545,000

Installed Capacity: 1,000 kW_{AC}

Project Goal: To install two 500-kW internal combustion engines which will be fueled by biogas generated from the existing anaerobic digester at the City of Austin wastewater treatment facility which reduces the carbon footprint of the facility and reduces the facility's power cost to produce savings to the City's rate payers.

Project Description: In 2012, the City of Austin received funding from the St. Paul Port Authority (SPPA) to evaluate the feasibility of alternative energy generation via anaerobic digestion from the waste streams produced by their wastewater treatment facility (WWTF). The feasibility study identified improvements needed to the existing municipal anaerobic digesters to maximize anaerobic digestion and biogas production. The feasibility study also analyzed renewable energy generation through a combined heat and power (CHP) generation system using biogas as a fuel source and recommended utilization of two 500-kW internal combustion (IC) engines. Because the generation potential is less than the total demand at the facility, the power generated would be used on site and not sold to the utility. The engines will also produce 3 MMBtu/hour of thermal energy which will be utilized to heat the digesters. Excess biogas will be flared.

The WWTF consists of two wastewater treatment plants located on the same site, a municipal facility which treats domestic wastewater and an industrial facility which treats wastewater from a pork-processing facility owned by Hormel Foods. Biogas production will be increased by improvements to the existing digester heating and mixing systems. With improved heating and mixing, the City is expected to increase their biogas production from 28,500 cf/d to 31,800 cf/d. Also, the project will help reduce leakage, which is estimated to be approximately 12,000 cf of biogas per day. In

addition to the anaerobic digester improvements, two 500-kW IC engines will be installed as well as biogas clean-up equipment required to reduce the hydrogen sulfide concentration of the biogas and remove moisture.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions

Measurable Outcomes:

- Certification of 1,000 kW_{AC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Increased production in biogas production and capture
- Production of power at a cost below the cost of retail electricity

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. Since the project will not be in Xcel Energy's service area there will not be a loss of sales but Xcel Energy's ratepayers will benefit by receiving all the Renewable Energy Credits generated. Because of the feasibility study, a lot of the initial ground work and planning has been completed. The concept has potential to reduce green gas emissions and wastewater treatment costs which have applications throughout the state. The size of the grant requested is significant.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-39

Proposer: Goodwill Solar, LLC

Title: Goodwill Solar Project

Overall Rank: 9

Technology Rank: S-7

Total Score (out of 230): 160.71

Preferences Received: Project located within the Energy Innovation Corridor
Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$1,075,250

Total Project Costs: \$1,525,250

Installed Capacity: 700 kW_{DC}

Project Goal: To develop a photovoltaic (PV) generating system at the lowest cost possible to increase capacity and deliver energy to the Xcel Energy grid while simultaneously providing data that will aid in the research and development of accurate energy and capacity pricing for solar technologies.

Project Description: The project is the installation of a roof-mounted PV facility that will be located at the Goodwill Easter Seals corporate headquarters in St. Paul, Minnesota. The Goodwill site consists of a large commercial building and parking lot area with over 150,000 square feet of usable roof area. The primary components of the system include approximately 2,400 photovoltaic modules and associated racking. The balance of system components consist of electrical conduit, wire, ballast, and a central inverter system located within the distribution center. The project site has multiple options for interconnection due to its proximity to Xcel Energy's Prior Substation. The project will either connect directly to the substation or the feeder line located just south of the project site. Determination of the point of interconnection will be made during final engineering. Electricity generated will be sold to Xcel Energy.

Goodwill Solar, LLC, is a special purpose entity that will own and operate the solar facility and will be the grant recipient. Geronimo Energy will be an owner and the managing member of Goodwill Solar, LLC. Both parties have agreed to the terms and length of the lease agreement. Geronimo Energy will negotiate a power purchase agreement and obtain an interconnection agreement with Xcel Energy for the project.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Provides an innovative financial vehicle that will efficiently monetize Federal Income Tax Credits and tax savings through depreciation
- Emission reductions

Measurable Outcomes:

- Completion of a Installed Capacity Test to certify 700 kW_{DC} capacity
- Point-In-Time Verification test
- Generation of electricity consistent with stated performance characteristics in proposal

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. The project cost is very reasonable for a solar facility of this size and the proximity to an Xcel Energy substation would minimize interconnection concerns. The location within the Energy Innovation Corridor would provide good visibility within a diverse community that shows strong support for the project. The proposal is also financially and technically very sound.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-41

Proposer: City of Hutchinson

Title: Municipal Landfill Solar Energy Demonstration Project

Overall Rank: 29

Technology Rank: S-22

Total Score (out of 230): 126.5

Preferences Received: None

RDF Funding Requested: \$958,369

Total Project Costs: \$1,742,489

Installed Capacity: 401.8 kW_{DC}

Project Goal: To be a model in Minnesota for how to cost effectively develop a significant solar energy resource on a closed, capped landfill that would otherwise have little or no economic value.

Project Description: A ground-mounted photovoltaic (PV) facility that uses tenKsolar RAIS-WAVE equipment and panels will be constructed on a capped municipal landfill site adjacent to the City's wastewater treatment plant in Hutchinson, Minnesota. This project would be the first of its kind in Minnesota on a closed landfill site. tenKsolar's system design will allow the project to be built without any penetration into the surface of the landfill. This project could be a model for other landfill sites in the state that may wish to develop a similar solar energy installation. Fifth generation Titan solar modules will be installed. The redundant cell architecture used in RAIS-WAVE modules enables the efficient construction of larger modules with an anticipated corresponding reduction in labor hours for installation. Standard Solar Long monitoring will be included at the site for recording output data.

The solar project will be owned by the City of Hutchinson subject to a long-term capital lease with a project-specific limited liability corporation established by Ameresco. This financial structure will allow the project to access substantial federal tax incentives for solar energy – federal support that would otherwise not be available to the City as a non-taxpaying entity. Operation and maintenance of the system during the 12-year period of the capital lease will be the responsibility of Ameresco. The City of Hutchinson owns and has site control of the landfill location that will be used for this project. The City and Ameresco have also verified that despite use restrictions on the site, no further environmental assessment will be required by the Minnesota Pollution Control Agency. The ballasted design of the solar system will not require

penetration of the existing grade, which allows system construction and operation to occur without disturbing any of the waste material in the landfill.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions
- Capturing the lessons learned to share with other communities that may wish to develop solar energy project on closed landfill sites
- Leverage federal tax incentives to stimulate local economy

Measurable Outcomes:

- Certification of 401.8 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Demonstration of lower installed cost per kW

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. Although the proposal technical score was low, the advisory group considered the proposal for discussion due to the utilization of a municipal landfill site which may have applications for other landfill sites in Minnesota. Although there may be some financing concerns, the project would demonstrate how to use a capped landfill in a positive way. Landfills are typically a non-usable property.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-42

Proposer: Aurora St. Anthony Limited, LLC

Title: Old Home Plaza Solar Energy Project

Overall Rank: 12

Technology Rank: S-10

Total Score (out of 230): 155.92

Preferences Received: Project located within the Energy Innovation Corridor
Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$398,000

Total Project Costs: \$911,798

Installed Capacity: 252 kW_{DC}

Project Goal: To demonstrate the contribution that on-site solar energy generation can make to permanent affordability housing.

Project Description: The project is the installation of a roof-mounted photovoltaic (PV) facility that will use tenKsolar panels and be located at the Old Home Milk Dairy property on the Central Corridor Light Rail Transit line at Western Avenue in St. Paul. Aurora is renovating 30,000 square feet of the former Old Home Milk Dairy and adding 96,000 square feet of new construction to create 57 units of rental housing, commercial space, and parking. Seven units will be used to serve the long-term homeless. Electricity generated will be consumed on site

The facility will utilize the fifth generation Titan solar modules from tenKsolar which are rated from 410 to 440 watts. At the core of this technology is the RAIS-WAVE module architecture where cells in each module are interconnected in a mesh rather than series. When combined with a digital control algorithm the module virtually eliminates serial constraints present in conventional modules. The Old Home Plaza project will specifically demonstrate designs and ownership structure for solar energy that can be integrated with affordable housing projects and urban redevelopment projects generally.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Emission reductions

- Financing structure will bring federal tax incentive monies into Minnesota
- Evaluate the ability of solar to enhance permanent affordability for publicly – supported housing projects

Measurable Outcomes:

- Certification of 252 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Educational outreach efforts
- Analysis of impact on housing affordability

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. The location within the Energy Innovation Corridor provides high visibility for solar awareness and the project can be used as a model for future solar implementation in similar settings. Installation of solar project designed for maximum energy density at an urban redevelopment site will be an effective test to contribute to market data that will increase market readiness of the next generation of solar equipment. The group also liked the concept to demonstrate solar energy with the integration of solar tax credits and federal tax credits as a strategy for affordable housing. Redevelopment of the site in conjunction with affordable housing and historic renovation provides a good story for integrating renewable energy resources in urban development. Also, the proposal is technically sound.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-43

Proposer: Cornerstone Group

Title: Lyndale Gardens Solar Project

Overall Rank: 5

Technology Rank: S-4

Total Score (out of 230): 171.45

Preferences Received: Grant award disbursed as single, lump sum payment.
Located in MN and WI service territories of Xcel Energy

RDF Funding Requested: \$310,310

Total Project Costs: \$705,250

Installed Capacity: 152 kW_{DC}

Project Goal: To showcase holistic sustainable development with a solar installation as its most-visible touchstone.

Project Description: To be located at the former Lyndale Garden Center, this facility will be a component of a redevelopment project to create a long-sought Town Center for Richfield by combining retail, mixed income housing, and an expansive public place connected to Richfield Lake Park. A roof-mounted solar photovoltaic (PV) array will be installed as well as a solar carport to demonstrate a “gas station of the future” with energy storage and an electric vehicle charging station. The array will utilize Titan solar modules from Minnesota-based tenKsolar. Electricity generated will be consumed on site

The components of this solar energy project include 112 kW solar array on the roof of multi-family housing and 40 kW integrated as the solar carport. The system will also include Solar Log monitoring technology. At the core of the tenKsolar technology is the RAIS-WAVE module architecture where cells in each module are interconnected in a mesh rather than series. When combined with a digital control algorithm the module virtually eliminates serial constraints present in conventional modules. The RAIS-WAVE module control technology and stepped-pulse transformer technology are ideal configurations for integrating energy storage directly into the system without additional electronics or infrastructure. The modules deliver a controlled voltage to the storage and the Cornerstone Group will negotiate a design-

build contract with Sundial Solar Consultants who will also perform all operations and maintenance on the system for at least the first five years. All components of the solar facility will be owned by Cornerstone, or an entity established by Cornerstone and its projects partners for ownership of Lyndale Gardens.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Emission reductions
- Electricity generated is strategically position to meet peak energy demand
- Financing structure will bring federal tax incentive monies into Minnesota

Measurable Outcomes:

- Certification of 152 kW_{DC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- Educational outreach efforts

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project. As part of a large redevelopment effort, the location provides a high project visibility for solar awareness. The project is a creative attempt to integrate solar technology in both commercial and residential urban settings and could serve as model or provide lessons learned for future installation in similar settings. Project costs are reasonable; any risk is associated with the success of the larger redevelopment plan.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: EP4-48

Proposer: Oak Leaf Energy Partners Ohio, LLC

Title: Blue Lake Wastewater Treatment Plant Solar Project

Overall Rank: 3

Technology Rank: S-3

Total Score (out of 230): 180.17

Preferences Received: Located in MN and WI service territories of Xcel Energy
Grant award disbursed as single, lump sum payment

RDF Funding Requested: \$2,000,000

Total Project Costs: \$2,864,810

Installed Capacity: 1,000 kW_{AC} (1,232 kW_{DC})

Project Goal: To install a photovoltaic (PV) array at the Metropolitan Council's Blue Lake wastewater treatment plant (WWTP) located in Shakopee, Minnesota.

Project Description: Oak Leaf will use 5,220 Yingli 295-watt, 72 cell polycrystalline modules on a Schletter, 30 degree fixed tilt racking system. The array will be designed to have 10 modules per string and 25 strings per combiner box. Advanced Energy's 250 kW and 500 kW inverters will be utilized which have historically performed exceptionally well in colder climates. A Cooper transformers will step up the voltage to Xcel Energy's interconnection of 13.8 kV at this location. The racking structure will consist of pre-manufactured, pre-galvanized tables mounted on driven piers. Inverters, however, typically require upgrades every 12 to 15 years. An operations and maintenance plan includes twice-yearly preventive maintenance visits to analyze power plant output, verify connections via thermal imaging, clean modules as necessary and test inverter throughput. The system is monitored 24/7 via the internet so technicians can be dispatched if the power plant experiences problems.

The venture is a public/private partnership between Oak Leaf, the owner of the solar farm, and Metropolitan Council, the buyer of the electricity. Because the Blue Lake WWTP is a critical infrastructure facility, it is electrically served by two Xcel Energy feeders. Oak Leaf will fund the installation of an additional 250 kW_{AC} capacity. For that reason, 750 kW_{AC} of the array will feed one side of the WWTP and 500 kW_{AC} will feed the other side. Oak Leaf indicates that this methodology for supplying critical infrastructure facilities is unique and will act as a model for future distributed generation systems in Xcel Energy's territory. The proposal also includes a turnkey,

remote data acquisition/monitoring solution that will provide comprehensive data to monitor, analyze and display historical and live solar electricity data. For public outreach and education purposes, the monitoring solution will provide password-free access to system performance through a web-based solution. Oak Leaf will operate and maintain the monitoring system.

Anticipated Benefits:

- Economic benefits through the creation of jobs during construction and for operation and maintenance
- Renewable electric generation during periods of peak power
- Emission reductions
- Illustrate how critical infrastructure facilities like the Blue Lake WWTP can employ on-site, renewable generation through dual feed designs

Measurable Outcomes:

- Certification of 1,000 kW_{AC} installed PV capacity
- Generation of electricity consistent with stated performance characteristics in proposal
- A public information component to provide solar farm performance data

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. The scope is clear and complete, deliverables are defined in the schedule, and milestone performance measurements are specific. The financing/ownership model is similar to the structure for the Minneapolis Convention Center which received Cycle 3 funds. The project will be visible and reduce the costs of waste water services, which will benefit the City of Shakopee. There are likely to be some contractual issues that will need to be resolved when negotiating the RDF grant contract (e.g., assignment of collateral and limitation to step-in-rights).

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-2

Proposer: University of Minnesota

Title: Optimizing Renewable Electric Energy Generation on Minnesota Dairy Farms

Overall Rank: 7

Technology Rank: C-2

Total Score (out of 230): 123.67

Preferences Received: None

RDF Funding Requested: \$982,408

Total Project Costs: \$982,408

Project Goal: To increase renewable electric energy generation on Minnesota dairy farms by establishing a model net-zero energy dairy parlor.

Project Description: The research will focus on effective methods to integrate and control on-site small wind and solar photovoltaic (PV) generation, conduct economic feasibility and life cycle analysis, and then disseminate the results through the web, regional meetings, and a hands-on statewide workshop and tour. To conduct performance testing, two on-site generation facilities will be designed and installed: a 20 kW small wind turbine and a 54 kW solar PV array. To allow for time shifting of the wind generation, solar generation, and control systems, these systems will be integrated with a thermal storage tank combined with a heat pump. The hybrid wind/solar PV energy system will be mounted on an innovative, self-raising monopole to be tested and evaluated. The tower uses an assembled foundation that can be installed in one day without a poured concrete foundation. The tower can also be easily folded down for turbine maintenance. Life cycle analysis will be performed on conventional and new generation systems within the dairy.

The research will be conducted at the dairy operation of the University of Minnesota West Central Research and Outreach Center (WCROC) in Morris, Minnesota. The Center milks between 150 and 200 cows twice daily and is representative of a mid-size Minnesota dairy. This location provides an ideal testing opportunity to evaluate and demonstrate the effect of renewable energy generation on fossil fuel consumption and greenhouse gas emissions. The milking parlor currently consumes about 110,000 kWh per year in electricity and 4,000 therms per year in natural gas. One of the unique features of this proposal is storing electricity as hot water using a heat pump. Small wind turbines generate a sizable portion of their electricity at night when it is not

needed. Shifting energy output to the time it is most needed could improve the economic performance of a small-scale wind turbine, especially if time of day pricing for electricity is in effect. A similar situation exists with solar generated electricity. Excess electricity generated between milkings can either be sold to the grid or converted to heat. If time-of-day pricing is in effect the electricity can be sold to the grid when it is most valuable and less expensive off-peak electricity can be purchased at night to run the heat pump.

Anticipated Benefits:

- Integration of small-wind, solar PV, and thermal storage will increase the cost effectiveness of both generation technologies
- Large potential for replication of model at other dairies and Minnesota farms
- Minimal management of solar and wind, compared to anaerobic digestion, does not take farmers away from their core business
- Renewable energy training of four under-graduate interns
- Renewable electric generation during periods of peak power
- Emission reductions

Measurable Outcomes:

- Certification of 20 kW_{AC} installed wind capacity and 54 kW_{DC} installed PV capacity
- Optimization variables to achieve “net-zero” energy consumption
- Scalability of findings from Life Cycle Analysis

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project due to its high visibility at the WCROC and the potential for market deployment. Targeting dairy farms provides a level of novelty since they are typically associated with biomass. The combination of pairing solar and wind into a demonstration is favored as well as the model is applicable to many farms, not just dairy. The research component also appears to be very solid.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-4

Proposer: Xcel Energy

Title: IT Infrastructure Development to Enable Community Solar Gardens

Overall Rank: 12

Technology Rank: S-4

Total Score (out of 230): 103.92

Preferences Received: None

RDF Funding Requested: \$390,000

Total Project Costs: \$505,000

Project Goal: Develop the information technology (IT) which will allow customers to view on their billing statement the energy produced from their share of a solar garden, track unsubscribed energy produced and credit the solar garden operator for that energy, and automatically verify subscriber eligibility as outlined in governing legislations or regulations.

Project Description: An IT system will be developed and tested that will logically link community solar garden production and the associated economic benefits for subscribers back to the subscriber's energy use and billing statement. The system will resolve issues associated with non-automated verification of subscriber eligibility and will enable potential customer participation in several community solar gardens while ensuring that any and all subscriber and solar garden requirements and regulations are met.

The IT system will be tested and verified across all the metering, tariff, and customer service variables to enable an accurate system interaction for solar garden operators and subscribers across a variety of customer classes. Building and testing an IT system with early pilot community gardens will lay the necessary foundation for Xcel Energy to support a solar garden model of energy generation on a larger scale.

Anticipated Benefits:

- Cost effective means for Xcel Energy to support solar gardens
- Improved efficiency and reduction in errors associated with non-automated billing practices

Measurable Outcomes:

- Verification that the system is accurate and usable
- Completion of training with solar garden users
- Final product is an IT system capable of connecting individual's shares of a community solar garden to their electric bills

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. The cost for IT development would also be eligible for cost recovery through rates. With the development of more solar gardens, utilities will need the ability to account for these customer billing needs and the legislative mandates for more renewable solar energy will increase the needed technology. The proposal includes a billing system, integration, and testing associated with new renewable mandates but there will be no double-recovery through base rates if this effort is funded through the RDF. Funding the IT development with RDF funds would be a transparent way to pay for solar through the regulatory process. Xcel Energy is trying to set the best practice for an initiative that may be an administrative burden to track and verify. However, the advisory group also raised concerns whether this project is suitable for funding from the RDF, since it may be required by law and the costs can be recovered from electric rates

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-5

Proposer: University of Florida

Title: A Mobile, Self-contained, Pilot Anaerobic Digester Facility for conversion of Non-Agricultural Residues in Minnesota to Electricity

Overall Rank: 2 (tie)

Technology Rank: B-1 (tie)

Total Score (out of 230): 136.37

Preferences Received: Utilizes non-agricultural residues for a feedstock

RDF Funding Requested: \$1,109,538

Total Project Costs: \$1,109,538

Project Goal: To promote the uptake of anaerobic digestion technologies that use non-agricultural biomass residues by extended demonstration of a pilot-scale anaerobic digester.

Project Description: The project would be designed to demonstrate a mobile, self-contained, flexible design, pilot-scale digester for the biogasification of organic wastes from two sites. One site will be the SunOpta Grains and Food facility in Alexandria, Minnesota and the other demonstration site will be the Denco II corn ethanol facility in Morris, Minnesota. The mobile unit will have the capability of handling both solid and liquid feedstock. The feedstock for the digester will be the waste streams from each of the processing facilities. At each site the unit will be operated for one year to evaluate seasonal variations in feedstock quality and characteristics. The two sites will be operated sequentially. This demonstration at industrial sites will complement laboratory studies. Based on the outcomes of the operation of the mobile digester, a design for a full-scale commercial system will be developed and estimates of capital and operating costs established. This project will develop further research funded by RDF Cycle 3, focusing on optimizing the feedstock characteristics and other process components.

The digester facility will include a feed storage tank, pumps for moving materials between feed tanks and digester, and an effluent storage tank. Heating jackets will maintain an ideal temperature in the digester for biomass growth. A screen will be installed prior to the digester to remove solids in feedstocks. Based on laboratory scale studies on the feedstocks to be tested, the digester will be operate ether at a mesophilic temperatures of 38° C or a thermophilic temperature 55° C. On line pH

measurement and biogas metering devices will be incorporated into the system. All pumps and valves will be remotely operable from a control room. A biogas clean up system will be incorporated into the biogas storage tank. The facility will be operated by a standalone diesel/biogas generator and the electrical energy consumption of the system monitored. Biogas produced by the system will be used as a fuel for electricity generation, to assess how much diesel can be displaced. The biomass residues will be in the form of a compost material. The operation of the pilot plant will be complemented by laboratory scale studies on the feedstock. The studies will assess the methane potential of the feedstocks and the best temperature for operating the system. As part of the project, workshops and educational programs will be conducted in Minnesota to disseminate outcomes of the project and technology.

Anticipated Benefits:

- Reduce costs associated with the disposal of process byproducts in the form of biomass
- Provides a fuel that can be converted to electric power as needed
- Potential for producing a revenue stream from the resultant organic compost

Measurable Outcomes:

- Digester methane yields and methane content
- Operating stability of digester and labor requirements
- Energy requirements and affordability to operate plant
- Reduction in wastes and environmental impacts

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. There is some concern regarding the practicality of mobility but these units can be beneficial under the proper circumstances if they are affordable. It is beneficial that the University will partner with Enterprise MN to identify markets and to market the product to users.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-7

Proposer: InterPhases Solar

Title: New CIS Solar Cells with All-Solutions-based Roll-to-roll Processing

Overall Rank: 1

Technology Rank: S-1

Total Score (out of 230): 156.83

Preferences Received: High likelihood of royalty returns and large royalty ratio

RDF Funding Requested: \$1,000,000 Total Project Costs: \$1,095,000

Project Goal: To advance the production of thin film manufacturing outcomes achieved from RDF Cycle 2 and 3 projects to the next stage on the market by simplifying the manufacturing process and also improve the efficiency of the PV cells.

Project Description: This project builds upon research and development achievements achieved through grant awards in RDF Cycle 2 and Cycle 3. Moving forward in Cycle 4, alternate copper indium selenide (CIS) based device structures will be developed to incorporate and deposit all the necessary single-step electrodeposition (SSE) processes for the photovoltaic (PV) device components into a single roll-to-roll (R2R) manufacturing line. The line will include a new fast flow R2R plating tank for SSE of CIS, an ultrafast laser recrystallization tool, and spray deposition systems, all customized for efficient and cost-effective production of solar cells. The approach will lead to an endless flexible PV roll that can be cut and directly integrated in products or made into modules of variable shapes, sizes, and electrical outputs.

Having established the R2R manufacturability and scalability of electrodeposited CIS solar absorbers in Cycle 3, the Cycle 4 proposal addresses the next logical and necessary steps on the path to the overall technology's technical success and commercial use to develop and implement the new tools, procedures and device configurations. It will include R2R spray-coating processes for special oxides, such as graphene oxide (GO). The materials will serve as electrode contacts and transparent conducting oxide (TCO) top layers in new solar cell structures. Precursor solutions or suspensions of the oxides will be prepared by new sol-gel methods to be developed in this project. At the same time, a high speed flow cell for CIS SSE will be installed in the R2R line to better synchronize with other processes. The processes will be

combined into a single R2R line capable of depositing all the cell component layers, An ultrafast laser annealing tool will also be installed in line to recrystallize CIS films.

Anticipated Benefits:

- Module cost of \$0.32/W at 15% efficiency
- 2% of sale revenue from solar modules for 15 years as royalty to Xcel Energy
- Lead to a sustainable solar industry and foster a robust local manufacturing base for Minnesota-made solar panels

Measurable Outcomes:

- Large area uniformity of greater than 90%
- Repeatable CIS film morphology & composition
- Decomposition and film integrity similar to industry standards
- 50% increase in photocurrent
- Cost reduction of more than 30% compared to vacuum manufacturing process
- Annealing rate greater than 3 meter²per minute
- Continuous operation of the R2R manufacturing for more than 5 hours
- Functional flexible PV modules (6 inch x 6 inch)

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. The quality of the proposal along with performance parameters is very good; the project will build upon and enhance prior RDF-supported research. There is also a high likelihood of royalty returns, which would be based on net revenue and easily tracked. However, the project cost is high and the value to Minnesota is minimized if the concept is not put into practice by a Minnesota manufacturer.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-8

Proposer: City of Red Wing

Title: City of Red Wing Refuse Derived Fuel Production Facility

Overall Rank: 8

Technology Rank: B-3

Total Score (out of 230): 113.75

Preferences Received: None

RDF Funding Requested: \$1,999,500

Total Project Costs: \$6,896,939

Project Goal: To demonstrate production of a cleaner refuse derived biomass fuel which will recover more recyclables, remove fuel contaminants, and reduce fuel hauling costs.

Project Description: The City of Red Wing will add dual-stage, shear-shredding equipment to the existing facilities and equipment at the City's Waste Campus to produce refuse derived fuel for the Xcel Red Wing generation station. A primary shredder will be installed to size reduce solid wastes to 12 to 18 inches and open garbage bags, providing access to more recyclables and fuel contaminants. This will allow the City recover a higher percentage of recyclables and wastes that contaminate the fuel, such as electronics. A secondary shredder will also be installed to properly prepare and size the fuel to Xcel Energy specifications for the generation station. The fuel will then be delivered to the generation station. The improved facility at the Red Wing Waste Campus will reduce transportation of the fuel from an 80-mile round trip from Newport, Minnesota to an eight-mile round trip.

The two-stage, slow-speed, shear shredding of the solid wastes will include the use of mechanical and manual sorting for the removal of potential fuel contaminants such as metals, electronic wastes, and recyclable materials that are of greater value being recycled rather than combusted. Some of the recyclables include plastics containing chlorine compounds that contribute to acid gases during combustion. After all material has been homogenized, the operational focus is on recovering ferrous and non-ferrous metals from the shredded solid waste which leaves some contamination in the fuel produced.

Anticipated Benefits:

- Elimination of hauling fuel to Newport for processing should result in a cost savings of approximately \$8 to \$9 per ton of biomass
- Improve the economies of scale for Xcel Energy at the Red Wing Generation Station and improve efficiency due to reduced down time due to lack of fuel which occasionally occurs
- Enable the City of Redwing to implement energy recovery initiatives over landfilling
- Eliminate need for water treatment and emissions chemicals and supplies
- Eliminate need for annual emissions and stack testing
- Increase in the recovery of recyclable materials thereby decreasing landfilling and a reduced potential for groundwater contamination

Measurable Outcomes:

- Percentage improvement in weight and types of recyclables recovered
- Percentage improvement in weight and types of electronics and other potential fuel contaminants recovered
- Percentage reduction in waste delivered to the landfill for disposal
- Reduction in transportation costs and delivery of fuel to Xcel Energy

RDF Advisory Group Perspective: The RDF advisory group favored this project because the end-use product will be directly beneficial to the Xcel Energy Red Wing station and recommended that the proposal be placed on a reserve list if funding is available. The City is utilizing a renewable waste resource to promote renewable power. The project could serve as an example for the conversion of municipal solid waste into refuse-derived fuel with a low technological risk. Instead of burning waste on-site, Red Wing is proposing to process and shred waste on-site and then haul to Xcel Energy's burning station. There was some concern that this concept is not a novel idea, research quality for combusting garbage is minimal, and whether solid waste should be treated as a renewable fuel source.

Company Perspective: The Company acknowledges the concern of some advisory group members regarding the use of refuse derived fuel as the feedstock and the research value of the project. However, refuse derived fuel is recognized in Minnesota statutes as an eligible renewable energy technology (Minn. Stat. § 216B.1691). The Company supports the project because it will directly benefit Xcel Energy ratepayers and provides proficiencies in feedstock processing. The project is a full-scale demonstration of the technology.

Proposal: RD4-11

Proposer: University of Minnesota

Title: Demonstrating the Potential for Distributed Power Generation Using
Converted Biomass

Overall Rank: 2 (tie)

Technology Rank: B-1 (tie)

Total Score (out of 230): 136.37

Preferences Received: Project located within the Energy Innovation Corridor

RDF Funding requested: \$1,899,449

Total Project Costs: \$2,345,502

Project Goal: To develop effective and efficient solid biofuel that has potential for direct, stand-in use at power generation facilities large and small, and to develop distributed generation in rural environments to boost base load power supply using rural biomass as fuel.

Project Description: The University proposes a bifurcated approach: development of an integrated biomass conversion system and a modern steam-based electricity generator. This combined research process will include the development of a seven-ton per day biomass conversion reactor and a 100 kW steam-electric generator. The demonstration-scale system will be designed to be contained on three separate skids: a feed handling skid, a conversion reactor skid, and a product handling skid. The conversion reactor skid will also house any necessary heat exchangers and other ancillary equipment. The three skids of equipment will be erected at the Natural Resources Research Institute's (NRRI's) Coleraine research facility. NRRI will work with SynGas Technology, LLC (ST) in equipment assembly and in equipment commissioning. NRRI possesses the necessary equipment to supply the conversion reactor with dried biomass material as well as move products to the densification circuit for final production of fuel agglomerates.

Once commissioned, the conversion technology will be fully characterized in processing various biomass materials under different conditions of time and temperature. The results of this work will establish processing conditions for steady state operation. Once optimum conditions are identified, various campaigns will be conducted to produce fuel products in bulk quantities for use in the biomass boiler generator system that will also be located in Coleraine. A high-efficiency steam-electric boiler generator system will be constructed to utilize the densified fuel. The

prototype will be an automated, 100 kW boiler system capable of burning raw biomass and processed, solid, liquid, or gaseous biofuels.

Anticipated Benefits:

- Research is not on the “lab” scale, rather it is pre-production and prototype in nature
- Development of a low-noise, steam-based electricity generating system
- Reduced biomass grinding energy as compared to green or dry wood materials
- Reduced ash generation and favorable ash chemistry compared to traditional biomass and coal
- Increased energy efficiency on a per-kg fuel-usage basis
- Improved combustion reactivity

Measurable Outcomes:

- Achieve a thermal efficiency greater than 90% for the biomass reactor
- Establish operational control for a variety of raw material inputs
- Determine emissions profiles while at steady-state operation of both the conversion reactor and boiler-generator system
- Demonstrate that the new system can be operated cost effectively through modern process automation and control techniques

RDF Advisory Group Perspective: The RDF advisory group favored this proposal and recommended that the proposal be placed on a reserve list if funding is available. This proposal develops an innovative biomass boiler and densification system which is linked to an electric generator, the adaption of South-American technology to the United States. The mobility of the unit can be marketed to the Minnesota forestry and agriculture sectors although it may have limited practicality. Much of the project costs are associated with the equipment to build the boiler and steam-run generator.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-12

Proposer: University of Minnesota

Title: Wind Turbine Generated Sound: Targeted Research to Improve Measurement, Analysis, and Annoyance Thresholds Based on Measured Human Response

Overall Rank: 6

Technology Rank: W-2

Total Score (out of 230): 126.92

Preferences Received: None

RDF Funding Requested: \$625,102

Total Project Costs: \$625,102

Project Goal: To quantify infrasound annoyance and better understand noise emissions from wind turbines to identify potential health concerns effects and provide a basis for regulatory and permitting requirements.

Project Description: Among the many public concerns about wind turbines is the annoyance from low-frequency sound and infrasound, the latter of which humans cannot hear, although it may potentially cause imbalance in some people. The main issue is not loudness, but rather the annoyance from modulating audible frequencies of sound and potentially from infrasound. Few studies have been completed to date on either the exact sources or quality of turbine sound or on the thresholds or mechanisms for potential health impacts on humans. The research will first analyze and characterize low-frequency sound and infrasound from data gathered at the University of Minnesota's research wind turbine site at UMore Park and at selected Minnesota winds turbine farms. This data will be used to recreate the audible sound and infrasound in the laboratory and measure the physical, emotional and psychological responses of human subjects. The study will expose participants to simulated turbine audible sound and infrasound and measure physical and emotional responses.

An expert panel, consisting of regulators, industry experts and laymen, will monitor and help guide this process to provide the wind-energy industry, regulators, and the public with the information they need to understand how the research was completed and to better assess potential health concerns. Public opposition raises permitting costs and constitutes a long-term barrier to the growth of the wind energy industry. If public opposition is not addressed, costs associated with permitting delays, additional

financing and additional monitoring by the Minnesota Public Utilities Commission will be transferred to ratepayers.

Anticipated Benefits:

- Provide providing better information, in a public forum, about the sources, impacts, and potential mitigation of turbine sound—and improved public awareness of the science
- Provide a better understanding of the impact of turbine generated noise on humans and provide science-based guidelines for how to effectively monitor and protect humans from these impacts

Measurable Outcomes:

- Provide guidelines for noise monitoring and human impacts of acoustic and infrasound noise
- Qualification of turbine sounds characteristics that are most negative for listeners
- Policy and regulatory recommendation for sound abatement and mitigation strategies

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project due to the ability to help the industry understand the characteristics of turbine sounds and better respond to the public about potential health concerns. There is value to reduce the barrier of public opposition to wind farms by educating public on effects of noise emissions on humans. This research could be very helpful when deciding on sites for turbines and will also inform debate on turbine noise. The University states that there is little controlled evidence regarding the sources of human annoyance for wind turbine noise and infrasound. There is little to no scientific data existing to confirm or refute the extent of the negative effects of turbine infrasound and only limited data regarding human tolerance of infrasound from any source. The results of this study would help in developing set-back regulations, distance requirements, and night-time shutdown rules.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-13

Proposer: University of Minnesota

Title: Virtual Wind Simulator with Advanced Control and Aeroelastic Model for
Improving the Operation of Wind Farms

Overall Rank: 4

Technology Rank: W-1

Total Score (out of 230): 135.08

Preferences Received: None

RDF Funding Requested: \$1,391,684

Total Project Costs: \$1,391,684

Project Goal: To develop, demonstrate, and transfer into practice an industry-leading numerical simulation model for optimization of performance, financial decision making and operational planning.

Project Description: This project will leverage and build upon research findings from the recently completed Cycle 3 RDF project RD3-42 “Development of a High Resolution Virtual Wind Simulator for Optimal Design of Wind Energy Projects” which developed and validated the Virtual Wind Simulator software (VWS). Research supported by a Cycle 4 grant will extend the capabilities of this first-generation modeling tool to include the ability to simulate aeroelastic loading of the blades and incorporate current industry standards and advanced turbine control methods and technologies. The University will demonstrate these capabilities via comparisons with data from utility-scale wind turbines and wind farms.

The VWS will be enhanced by incorporating blade aeroelastic models and advanced wind turbine controls. This involves development of new advanced modeling techniques in which fluid flow models are coupled together with dynamic structural models to accurately simulate the bending and twisting of rotating blades in turbulent air flow (i.e., aeroelastic modeling). The enhanced VWS will be tested and validated against utility-scale field and performance data collected at the University of Minnesota’s EOLOS facility in Rosemount. The EOLOS turbine will be upgraded by replacing the existing turbine control unit with a programmable PLC-based controller. This upgrade will provide the necessary flexibility to implement and evaluate various advanced control algorithms. Environmental field data (wind speed, direction, turbulence, etc.) as well as operational and structural data from sensors embedded in the blades of the EOLOS turbine will be collected under both basic control as well as advance control strategies. Performance data will be used to validate the accuracy of

the improved VWS model. Specific wind farms will be selected to validate the model. Candidate wind farms are the Grand Meadow and the Nobles facilities.

Anticipated Benefits:

- Provide detailed information on the relationships between wind conditions, sensing and control strategies, turbine loads, and power output to recommend performance adjustments to reduce operation and maintenance costs of wind farms
- Detection method to reduce unsteady loads and blade deformation at new wind farm locations that will lead to reduce noise and environmental impacts
- Will enable efficient testing of new sensor technologies, such as LIDAR, and new turbine control algorithms that take advantage of these sensors to quantify how different sensing and control strategies impact both power output and loadings to the drive train and structure of a wind turbine
- Improve wind farm performance and reduce operational costs

Measurable Outcomes:

- The accuracy and predictive capabilities of VWS+ by detail comparison with data from the EOLOS 2.5 MW wind turbine and the Xcel Energy wind farm
- The accuracy improvement in predicting power increase and blade load reduction in the EOLOS wind turbine using the advanced control algorithm relative to the existing control
- The increase in the productivity (energy output) of wind farms using the VWS+, compared with that obtained using simpler, standard models

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project because the research may provide a useful strategy to reduce unsteady loads and blade deformation at new wind farm locations that will lead to reduced noise and environmental impacts. The project focuses on practical implementation of a detailed simulation model to assess performance and turbulence in wind farms. This has real applications, since the computer simulator will be used at the University of Minnesota EOLOS wind turbine and also at Xcel Energy's wind farm.

Company Perspective: The Company concurs with the RDF advisory group.

Proposal: RD4-14

Proposer: Barr Engineering Co.

Title: Development of Health Assessment Tools for Utility-Scale Wind Turbine
Towers and Foundations

Overall Rank: 18

Technology Rank: W-5

Total Score (out of 230): 63.00

Preferences Received: None

RDF Funding Requested: \$161,081

Total Project Costs: \$161,081

Project Goal: Reduce the cost of wind energy by giving wind farm owners and operators a cost-effective means of assessing the health and life expectancy of towers and foundations.

Project Description: Barr Engineering proposes to develop a simpler, portable version, of an existing sensor system that will be easily deployable on wind-turbine towers and foundations. The system is portable enough to be moved from foundation to foundation with relative ease and efficiency. The sensors will measure strain and tilt which are used to assess the turbine health and life expectancy. Strain measurements enable researchers to characterize the behavior of the turbine tower and the loads it exerts on the foundation under a variety of conditions. Barr will develop an economically viable, deployable system of sensors that can take the measurements required for foundation and tower health assessments. These would include rotational stiffness, overturning moment, and foundation load. Barr will also develop a method of interpreting these measurements to estimate the health and remaining useful life of the wind turbine tower and foundation. The sensor system and estimation methods would first be tested on the University of Minnesota's EOLOS Research Wind Turbine which is currently instrumented with a robust tower-and-foundation-performance measurement system. In the future, the system will be tested on wind turbines that are part of Xcel Energy's Grand Meadow and Nobles wind farms and the knowledge and findings will be published in a report. The project involves initial research and will not include the actual development of the portable sensor system.

When wind turbine foundations are designed, engineers are given design loads by the wind turbine manufacturer. The engineers are also given a tolerance of how much the foundation is allowed to rotate under an applied load. This tolerance is called the

rotational stiffness of the foundation. The minimum rotational stiffness of the foundation is provided by the turbine manufacturer and must be met by the foundation design. Measurements of the overturning moment applied by the tower to the foundation can be measured using strain gauges applied to the steel in the turbine tower. Strain gauges measure how much the steel stretches due to an applied load. If the thickness of the steel in the tower, the diameter of the tower, and the type of steel are known, it is possible to use strain measurements to compute the load that was applied to the tower to create that strain. This load can then be used to compute the overturning moment that is applied to the foundation. The strain gauges can also be used to assess the health of the steel tower. The tower behavior is dominated by static and dynamic loads. The dynamic loads manifest themselves as a periodic tower oscillation at the resonant frequency of the tower. The strain that results from these oscillations can be significant and are the primary cause of tower fatigue.

Anticipated Benefits:

- Provide a tool that can effectively estimate the remaining useful life of wind turbine foundations and towers
- Increase the probability that wind farms will be able to be utilized for their full design life
- Proper monitoring will help protect the health of the large investment in wind energy projects

Measurable Outcomes:

- Publication of findings in a scientific periodical
- Peer reviewed product
- Certification of measurement accuracies

RDF Advisory Group Perspective: The RDF advisory group strongly supported this project because the results would help to develop a user-friendly and better product than what is currently available. A wind farm owner would buy one sensor, and move it from turbine to turbine. Many turbines in Minnesota are currently 20 years old, so the research topics to be investigated as part of this study are timely. The technical scores were low because the proposal did not give enough data and background information and the definition of deliverables was not very strong.

Company Perspective: The Company concurs with the RDF advisory group.

CERTIFICATE OF SERVICE

I, SaGonna Thompson, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota

xx electronic filing

**Docket No. E002/M-12-1278 and
Special Service-4th Cycle List**

Dated this 29th day of July 2013

/s/

SaGonna Thompson
Records Analyst

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Julia	Anderson	Julia.Anderson@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota St St. Paul, MN 551012134	Electronic Service	Yes	OFF_SL_12-1278_Official
John J.	Carroll	jcarroll@newportpartners.com	Newport Partners, LLC	9 Cushing, Suite 200 Irvine, California 92618	Electronic Service	No	OFF_SL_12-1278_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 500 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_12-1278_Official
Burl W.	Haar	burl.haar@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_12-1278_Official
Lynn	Hinkle	lhinkle@mnseia.org	Minnesota Solar Energy Industries Association	2512 33rd Ave South #2 Minneapolis, MN 55406	Paper Service	No	OFF_SL_12-1278_Official
Mara	Koeller	mara.n.koeller@xcelenergy.com	Xcel Energy	414 Nicollet Mall 5th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_12-1278_Official
John	Lindell	agorud.ecf@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	Yes	OFF_SL_12-1278_Official
SaGonna	Thompson	Regulatory.Records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_12-1278_Official
Jason	Willett	N/A	Metropolitan Council	390 Robert St N Saint Paul, MN 55101-1805	Paper Service	No	OFF_SL_12-1278_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John	Alexander	john.alexander@af-energy.com	AF-Energy Corporation	2447 Emerald Trail, Ste 100 Minnetonka, MN 55305	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Julia	Anderson	Julia.Anderson@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota St St. Paul, MN 551012134	Electronic Service	Yes	SPL_SL_12-1278_4th Cycle List
Charles	Barela	charles.G.Barela@xcelenergy.com	Xcel Energy Business Systems	414 Nicollet Mall Minneapolis, MN 55401	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Mike	Bauer	Mbauer@ci.rogers.mn.us	City of Rogers	22350 South Diamond Lake Rd. Rogers, MN 55374	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Mike	Bergey	mbergey@bergey.com	Bergey Windpower Co	2200 Industrial Blvd Norman, OK 73069	Paper Service	No	SPL_SL_12-1278_4th Cycle List
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Ryan	Brandt	rbrandt@ecocheck.com	Natural Systems Utilities, LLC	11347 North Avenue Chisago City, MN 55013	Paper Service	No	SPL_SL_12-1278_4th Cycle List
John J.	Carroll	jcarroll@newportpartners.com	Newport Partners, LLC	9 Cushing, Suite 200 Irvine, California 92618	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Duane	Carrow	duane.carrow@mnwest.edu	Minnesota West Community & Technical College	1593 11th Avenue Granite Falls, MN 56241	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jeremy	Carter	jcarter@ci.hutchinson.mn.us	City of Hutchinson	111 Hassan St SE Hutchinson, MN 55350	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Bruce	Chamberlain	bchamberlain@minneapolis-sparks.com	Minneapolis Park and Recreation Board	2117 West River Road North Minneapolis, MN 55411	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Laura	Cina	laurac@mnrenewables.org	MN Renewable Energy Society	2928 5th Ave S Minneapolis, MN 55408	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Leslie	Delroy	leslied@posengalt.com	Poitive Energy Alternatives	518 24th Avenue W Menomonie, WI 54751	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Jerry	Dempsey	proposals@oati.net	Open Access Technology International	3660 Technology Drive NE Minneapolis, MN 55418	Paper Service	No	SPL_SL_12-1278_4th Cycle List
James	Dontje	jdontje@gustavus.edu	Gustavus Adolfus	800 West College Avenue St. Peter, MN 56082	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Brian	Dooley	brian.dooley@target.com	Target Corporation	1000 Nicollet Mall Minneapolis, MN 55403	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Nick	Fatibene	nicholas.fatibene@ge.com	Gelco	3 Capital Drive Eden Prairie, MN 55344	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 500 Saint Paul, MN 551012198	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Nathan	Franzen	nathan@geronimoenergy.com	Geronimo Energy	7650 Edinborough Way Suite 725 Edina, MN 55435	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Roger	Freeman	roger.freeman@anokaramsey.edu	Anoka Ramsey Community College	11200 Mississippi Blvd NW Coon Rapids, MN 55433	Paper Service	No	SPL_SL_12-1278_4th Cycle List
James	Gibson	james.gibson@farmamerica.org	Farmamerica	7367 360th Avenue Waseca, MN 56093	Paper Service	No	SPL_SL_12-1278_4th Cycle List
D. Thomas	Griep	tgriep@murphywarehouse.com	Murphy Warehouse Company	701 24th Ave SE Minneapolis, MN 55414	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Burl W.	Haar	burl.haar@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	Yes	SPL_SL_12-1278_4th Cycle List
Michael	Hahm	michael.hahm@ci.stpaul.mn.us	City of St. Paul	25 West 4th Street St. Paul, MN 55102	Paper Service	No	SPL_SL_12-1278_4th Cycle List
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Linda	Hince	hincefarms@posengalt.com	Hince Farms	N3902 130th St Plum City, WI 54761	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Lynn	Hinkle	lhinkle@mnseia.org	Minnesota Solar Energy Industries Association	2512 33rd Ave South #2 Minneapolis, MN 55406	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Ian	Houmas	AEH@q.com	Adonis Eco-Housing	1955 University Ave W, Ste 201 St. Paul, MN 55014	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Phillip	Hutton	philliphutton@gmail.com	Angel Alternative Energy	503 S. 5th Street Grand Forks, ND 58201	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John	Ingersoll	jgingersoll@ecocorp.com	ECOCORP	1211 S Eads St, Ste 803 Arlington, VA 22202	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Dwight	Jelle	dkjelle@gmail.com	Best Power International, LLC	P.O. 5126 Hopkins, MN 55343	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Kerry	Klemm	kerry.r.klemm@xcelenergy. com	Xcel Energy Services, Inc	414 Nicollet Mall Minneapolis, MN 55401	Paper Service	No	SPL_SL_12-1278_4th Cycle List
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Subba	Kodigala	kodigala@gmail.com	Solar Cell & LED Technology	730 Arcturus Avenue Oxnard, CA 93033	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Mike	Koebbe	mk@powerwors.com	PowerWorks Wind Turbines	15850P Jess Ranch Road Tracy, CA 95377	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Mara	Koeller	mara.n.koeller@xcelenergy .com	Xcel Energy	414 Nicollet Mall 5th Floor Minneapolis, MN 55401	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Christopher	Kopchynski	ckopchynski@barr.com	Barr Engineering Co.	4700 West 77th St, Ste 200 Minneapolis, MN 55401	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Dennis	Kowalke	dennie.kowalke@mspmac. org	Metropolitan Airports Commission	6040 28th Avenue South Minneapolis, MN 55450	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Steven	Lang	slang@ci.austin.mn.us	City of Austin	500 4th Ave NE Austin, MN 55912	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John	Lindell	agorud.ecf@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	Yes	SPL_SL_12-1278_4th Cycle List
Christopher	Little	chris.little@ecosrenewable.com	Ecos Energy	222 S 9th St Suite 1600 Minneapolis, Minnesota 55402	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Kyle	Makarios	kmakarios@ncsrcc.org	North Central Regional Council of Carpenters	70 Olive Street St. Paul, MN 55130	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Teresa	Marxen	tmarxen@reviercattle.com	Revier Cattle Company	75382 350th St Olivia, MN 56277	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Michael	McCabe	mike@oakleafp.com	Oak Leaf Energy Partners Ohio, LLC	2645 East 2nd Avenue W Suite 206 Denver, CO 80206	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Kevin	McKoskey	awards@umn.edu	Regents of the University of MN	450 McNamara 200 Oak Street SE Minneapolis, MN 55455	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Shalini	Menezes	smenezes@interphases.com	InterPhases Solar	668 Flinn Avenue Moorpark, CA 93021	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Robert	Messerich	b.messerich@gmail.com	Dragonfly Solar, LLC	10583 102nd St West Lakeville, MN 55044	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Greg	Mowry	gsmowry@stthomas.edu	University of St. Thomas	2115 Summit Avenue St. Paul, MN 55105	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Chris	Osowski	chris_osowski@usc.salvationarmy.org	Salvation Army	2080 Woodlynn Avenue Maplewood, MN 55109	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Dan	Ostrenga	dan.ostrenga@sanimax.com	SGE Partners LLC	2099 Shawano Avenue Green Bay, WI 54307	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Eric	Pasi	ericp@ips-solar.com	Innovative Power Systems Solar	1413 Hunting Valley Road St. Paul, MN 55108	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Patrick	Pelstring	ppelstring@natrs.com	National Renewable Solutions, LLC	294 Grove Lane East, Ste 240 Wayzata, MN 55391	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Beth	Pfeifer	bpfeifer@tcgmn.com	Cornerstone Group	7661 Bush Lake Dr Bloomington, MN 55438	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Nieeta	Presley	nieeta@aurorastanthy.org	Aurora St. Anthony Limited, LLC	774 University Avenue West St. Paul, MN 55104	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Pratap	Pullammanappallil	pcpratap@ufl.edu	University Of Florida	219 Grinter Hall PO Box 115500 Gainesville, FL 32611-5500	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Lowell	Rasmussen	rasmuslc@morris.umn.edu	University of Minnesota- Morris	600 East 4th Street Morris, MN 56267	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Jeff	Schneider	jeff.schneider@ci.red-wing.mn.us	City of Red Wing	315 West 4th Street Red Wing, MN 55066	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Steve	Stadler	sstadler@hopkinsmn.com	City of Hopkins	11100 Excelsior Blvd Hopkins, MN 55343	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Louis	Sudheimer	historiclou@gmail.com	Green Peak Solar LLC	1415 Hunting Valley Road St. Paul, MN 55108	Paper Service	No	SPL_SL_12-1278_4th Cycle List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jeff	Swanson	jeffswanson99@hotmail.com	Community Energy Solutions	15020 Evelyn Lane Minnetonka, MN 55345	Paper Service	No	SPL_SL_12-1278_4th Cycle List
SaGonna	Thompson	Regulatory.Records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	SPL_SL_12-1278_4th Cycle List
Mike	Tkadlec	mike@futureforceinc.net	Future Force Inc.	2387 Hamlet Ave N Oakdale, MN 55128	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Jason	Willett	N/A	Metropolitan Council	390 Robert St N Saint Paul, MN 55101-1805	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Chris	Williams	chris.williams@mpls.k12.mn.us	Minneapolis Public Schools	1250 West Broadway Ave Minneapolis, MN 55411	Paper Service	No	SPL_SL_12-1278_4th Cycle List
David	Winkelman	dw@ecowerc.com	Small Wind Technologies	9081 County Road 23 Brainerd, MN 56401	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Robert	Woods	Robertwoodsjr2013@gmail.com	Business and Real Estate Investment, LLC	1129 Washington Avenue S. Minneapolis, MN 55415	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Sharon	Zachow	zachows@posengalt.com	Mondovi Energy Systems	518 24th Avenue West Suite 4 Menomonie, WI 54751	Paper Service	No	SPL_SL_12-1278_4th Cycle List
Sherif	Zukic	s01733841064@binternet.com	Sherif Zukic	Whittlesey Petersborough, Cambridgeshire PET2b2 Unknown	Paper Service	No	SPL_SL_12-1278_4th Cycle List