August 31, 2004

Burl W. Haar
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

Re: RENEWABLE DEVELOPMENT FUND - SECOND FUNDING CYCLE
EVALUATION AND SELECTION REPORT
DOCKET NO. E002/M-03-1883

Dear Dr. Haar:

Enclosed you will find an original and 15 copies of the Renewable Energy Project Selection Report for the second funding cycle of the Xcel Energy Renewable Development Fund established by Minn. Stat. 116C.779. Northern States Power Company d/b/a Xcel Energy is pleased to submit this report to you for review and consideration on behalf of the Renewable Development Fund Advisory Board ("Board"). The Board has prepared the enclosed report after careful consideration of the more than 200 project proposals received in response to the Request for Proposals ("RFP") issued November 25, 2003.

Twenty-Five (25) projects were selected including seven (7) energy production proposals anticipated to generate more than 17 MW for self-use and sale to Xcel Energy and, eighteen (18) research and development projects with the majority receiving the Minnesota preference allowed in the scoring methodology and one (1) project that is sponsored by the Prairie Island Indian Community. In total, the recommended project funding award equals $22.7 million.

Projects selected in this funding cycle will benefit Minnesota ratepayers by encouraging renewable energy development and providing sources of renewable energy for instances where Xcel Energy enters into power purchase agreements or by reducing system power requirements where the generation is self-consumed. Research and development projects all have some degree of benefit to Minnesota

and the RFP evaluation criteria provided certain preferences to maximize those benefits.

The body of the report will provide a summary of the background, selection process and results along with pictorial representation of how the funds have been distributed across technologies. An appendix contains more project detail in addition to excerpted information from the evaluation report documenting the work of the Board's consultant, Princeton Energy Resources International.

With publication of the selections in this report, Xcel Energy will begin contacting these projects to setup meetings to discuss the grant contracts necessary for each project. As was decided by the Commission in its August 17th Order we will arrange meetings with the RDF Board, Department and Commission staffs to address certain grant contract issues, RDF administration and Board membership issues. We would also welcome any additional informal input and suggestions from the Department in this process.

Finally, for your use I have also enclosed a copy of the press release which provided to the media later today. If you have any questions or wish to discuss any of the information here, please contact me at 612-904-5366.

Sincerely,

DEBRA J. PAULSON
REGULATORY CASE SPECIALIST

Enclosure
c: Service List

XCEL ENERGY RENEWABLE DEVELOPMENT FUND
PROJECT SELECTION AND FUNDING REPORT
SECOND FUNDING CYCLE

PREPARED BY THE
RENEWABLE DEVELOPMENT FUND BOARD

DOCKET NO. E002/M-03-1883
AUGUST 31, 2004

INTRODUCTION

The Renewable Development Fund Board ("RDF Board") is pleased to submit to the Minnesota Public Utilities Commission ("Commission") this Project Selection and Funding Report for the second funding cycle of Xcel Energy's Renewable Development Fund.

The Report will summarize the background on the Xcel Energy Renewable Development Fund ("RDF") and its statutory framework, the timeframe and proposal selection process for the second funding cycle and, finally, describe the projects selected by the RDF Board to receive funding.

SUMMARY

As indicated below, the projects have been divided into two categories: 1) Energy Production and 2) Research and Development. 25 new projects have been selected from 204 proposals received in response to the Request for Proposals. Proposals selected for funding in this cycle are:

Selected Energy Production Proposals

Overall Rank	Label	Project Name	Technology Type	Technology Rank	Project Score	Funding Granted	Project Size (kW)
2	EP-44	Biomass Cogeneration Demonstration Plant at Central MN Ethanol Cooperative	Biomass	B-1	278	$2,000,000	959
3	EP-25	U of M Southeast Power Plant	Biomass	B-2	274	$2,000,000	3,500
5	EP-29	Ripley Dairy	Biomass	B-4	262	$399,371	400
7	EP-34	Lower St. Anthony Falls Hydroelectric Project	Hydroelectric	H-2	252	$2,000,000	8,980
9	EP-51	Diamond K and Greden's Ponderosa Dairy Digester	Biomass	B-6	248	$936,530	261
11	EP-39	St. Olaf College - Wind Self-generation	Wind	W-1	230	$1,500,000	1,650
12	EP-24	Wayzata Public School Wind Generation Project	Wind	W-2	229	$1,100,000	1,650
Total of Selected Energy Production Projects						**$9,935,901**	**17,400**

Selected Research & Development Proposals

Overall Rank	Label	Company	Technology Type	Technology Rank	Project Score	Funding Granted	Minnesota Preference
1	RD-27	Rural Advantage/ Blue Earth River Basin Initiative	Biomass	B-1	328	$318,800	Yes
2	RD-38	Gas Technology Institute	Biomass	B-2	318	$861,860	Yes
3	RD-93	National Renewable Energy Laboratory (NREL)	Solar PV	PV-1	315	$1,000,000	Yes
4	RD-78	InterPhases Research	Solar PV	PV-2	311	$1,000,000	No
5	RD-29	University of Minnesota	Biofuel	BF-1	307	$299,284	Yes
6	RD-94	Center for Energy & Environment	Biomass	B-3	307	$397,500	Yes
7	RD-110	Center for Sustainable Environmental Technologies (CSET), Iowa State U.	Biofuel	BF-2	306	$405,000	No
8	RD-56	University of Minnesota	Biomass	B-4	302	$858,363	Yes
9	RD-72	Production Specialties, Inc.	Biomass	B-5	301	$228,735	No
12	RD-87	Global Energy Concepts, LLC	Wind	W-1	296	$370,000	Yes
13	RD-34	University of Florida*	Biomass	B-8	295	$999,995	Yes

14	RD-26	Coaltec Energy USA, Inc.	Biomass	B-9	295	$450,000	No
16	RD-22	Energy Conversion Devices, Inc.	Biofuel	BF-3	292	$900,000	No
17	RD-107	National Renewable Energy Lab	Solar PV	PV-3	291	$1,000,000	Yes
19	RD-50	Energy Performance Systems, Inc.	Biomass	B-12	284	$957,929	Yes
23	RD-57	WindLogics, Inc.	Wind	W-2	268	$997,000	Yes
28	RD-37	Clipper Windpower, Inc.	Wind	W-5	263	$1,000,000	Yes
41	RD-69	Agricultural Utilization Research Institute	Hybrid	O-1	218	$760,000	Yes
Total of Selected Research & Development Projects						**$12,804,466**	

*proposal sponsored by the Prairie Island Indian Community

An overview of the allocation amounts for the selected proposals is as follows:

Energy Production Project Selections	RDF funding amounts
Hydroelectric	$2,000,000
Biomass	$5,335,901
Wind	$2,600,000
Subtotal	$9,935,901
Research and Development Project Selections	
Biomass	$5,073,182
Solar	$3,000,000
Biofuels	$1,604,284
Wind	$2,367,000
Hybrids	$ 760,000
Subtotal	$12,804,466
Total RDF Project Funding	$22,740,367

Xcel Energy submitted two proposals for consideration by the Board (one energy production proposal and one research and development proposal). The energy production proposal was a hydroelectric refurbishment proposal at an Xcel Energy facility in Wisconsin. This proposal scored highly in the evaluation process, as Princeton Energy Resources International LLC ("PERI") found that this project would employ proven technology and had a relatively low amount of risk as compared to other proposals. The Board carefully reviewed the PERI analysis and did not find any reason to reject its recommendation for selection of this project;

therefore, it was included in the selection by the Board to receive funding. However, Xcel Energy notified the Board on August 19, 2004 to indicate that it was withdrawing its proposal. The Company will be available to explain this decision to the Commission during consideration of these selections; however, because the project applicant withdrew the proposal, the Board removed this project from its recommended selections, but includes discussion of the proposal in the appendices. The second proposal involving Xcel Energy was a collaborative effort with other parties on a wind/hydrogen project. This proposal was not evaluated high enough by PERI to be selected by the RDF Board for a grant in the second round of funding.

The high number of renewable energy proposals received by the RDF Board for this second cycle of funding from the Xcel Energy RDF is encouraging. Commission approval of these project selections will allow the RDF Board and Xcel Energy to further the important renewable energy production and research and development goals of the Commission and the RDF legislation under Minn. Stat. Section 116C.779. Xcel Energy has previously reported to the Commission on its experiences in the first funding cycle, and incorporated changes based on those experiences in the second funding cycle. This report will identify some of these changes made in the second funding cycle as a result of lessons learned in the first funding cycle. In addition the RDF Board, Xcel Energy, the Department of Commerce ("Department") and Commission staff will be meeting to implement the Commission's order of August 17, 2004 in Docket No. E-002/M-00-1583. Xcel Energy and the RDF Board will be meeting and working collaboratively with the Department and Commission staff to address certain concerns raised with Grant Contracts approved in that Docket from the first funding cycle. The structure of future Grant Contracts, RDF fund administration and RDF Board membership will also be reviewed in this process with the Department and Commission.

The Request for Proposals ("RFP") as approved by the Commission for the second funding cycle set forth five eligible Energy Production technologies, including wind, solar photovoltaic, hydro, biomass and biofuels. Any wind or biomass project that receives renewable energy production incentive payments from the Department of Commerce administered incentive program was not eligible to participate for additional RDF funding in this second funding cycle. As shown below, funding for the Energy Production projects amount to $9,935,901 for Commission approval. 20 percent of this money is for hydroelectric technology, 54 percent for biomass technology and 26 percent for wind technology. Except for two Energy Production selections discussed below, all selections are well within the cost parameters for energy pricing set forth in the Request for Proposals.

In the Energy Production category, two proposals were received that did not fall into the renewable energy technology types specified in the Request for Proposals and approved by the Commission. The RDF Board's consultant, PERI, determined one to be a coal technology and the other a solar thermal technology. While the RDF Board passed these projects on the prescreening test, neither was evaluated high enough by PERI to be selected by the RDF Board for a grant in the second round of funding. Both of these proposals indicated an energy price for Xcel Energy that would be at or over the maximum price of 4.5 cents/kWh for energy and capacity and thus both would exceed Xcel Energy's current avoided cost for a qualifying facility power purchase. The coal project, according to its developer, is a statuatory innovative energy project that is eligible for RDF funding, subject to approval as required by statute. This project (called the Mesaba Energy Project) will be further discussed below, and the RDF Board seeks and requests specific guidance from the Commission at this time on future funding obligations based on the special legislation enacted regarding such innovative energy projects under Minnesota Stat. 216B.1694.

The Research and Development category evaluation and selection was based on the technology for research and development specified and approved by the Commission for the RFP. These include biomass, solar, hydroelectric, biofuels and wind. The Research and Development selections amount to a total of $12,804,466 for Commission approval. 40 percent of this money is for biomass technology research and development; 23 percent for solar technology, 13 percent for biofuel technology, 18 percent for wind technology research and development and 6 percent for an interesting hybrid of two approved technologies, biofuel and wind.

In the Research and Development Category, PERI determined seven proposals to be hybrids, not falling into a single technology type. Of these seven hybrid proposals, only the biofuel - wind proposal was scored high enough by PERI to be selected by the RDF Board.

While all Research and Development proposals have some degree of potential benefit to Minnesota, the Research and Development selections were based on established evaluation criteria. Preference was provided in scoring for the Prairie Island Indian Community – supported projects, Biomass Technologies, and Minnesota R&D and business institutions. A total of 13 winning R&D projects of the 18 selected received the Minnesota preference, including one Research and Development project submitted by the University of Florida sponsored by the Prairie Island Indian Community. This project received a preference credit per the Commission's approved preference system and indicated in the summary below.

Background on the Renewable Development Fund Program

Minnesota Statutes Section 116C.779 applies to utilities operating nuclear power plants. This Statute initially required Xcel Energy to transfer to a renewable energy fund $500,000 for each dry cask containing spent fuel that is located at Prairie Island Nuclear Generating Plan after January 1, 1999. In the 2003 Legislative Session, this statute was amended to require $16 million annual RDF funding approved by the Commission, from which up to $6 million annually is used to fund renewable small - wind and on-farm biogas energy production incentives under Minn. Stat. Section 216C.41 as approved by the Department.

The Commission's Order dated April 20, 2001 in Docket No. E002/M-00-1583 approved the criteria and set a schedule for implementing the RDF in the first funding cycle. In the second funding cycle, the Commission's Order dated July 29, 2003 in the same docket directed Xcel Energy and the Board to incorporate a number of changes to the RDF operational guidelines and oversight procedures. The RDF Board has been responsible for administering the RDF, including implementing the funding process, evaluating and selecting proposals and disbursing funds to eligible selected applicants. Most decisions of the RDF Board are made by consensus, and in the absence of consensus, decisions are decided by a majority. The Board uses technical and professional consulting resources as necessary to administer the program. Currently the RDF Board consists of two representatives of the environmental community, William Grant and Jack Keers; one representative from the Prairie Island Indian Community, Craig Wills; and two representatives from Xcel Energy, Mark McGree and Michelle Swanson.

Key Dates and Activities

The Request for Proposal process for the second funding cycle was conducted within the follow timeline:

Activity	***Completion Date***
RFP Issued by RDF Board	December 30, 2003
Pre-bid Conference	February 2, 2004
Proposals Due	March 16, 2004
Summary Update	June 28, 2004
Final Selection Report	August 31, 2004

Contents of Report

This Report to the Commission will cover the proposal solicitation process; proposal evaluation; proposal selection and next steps.

Contents of Appendix

The Appendix to the Report contains excerpts from the PERI Report on Evaluation of Proposals, full descriptions of the projects selected and excerpts from PERI's scoring of the projects selected.

PROPOSAL SOLICITATION PROCESS

RFP Release and Response

By its Order dated July 29, 2003 in this Docket, the Commission approved a revised RDF operational and oversight process including project selection. The revised RDF operational and oversight process applies to this second funding cycle. In its compliance filing dated November 23, 2003, Xcel Energy submitted the proposed selection criteria to be followed by the RDF Board based on this July 29, 2003 order. The selection criteria included the mechanism by which the board would grant preferences to biomass energy production and research and development projects and to Minnesota institutions seeking grants.

On November 25, 2003 Xcel Energy submitted to the Commission its Request for Proposals to solicit grant requests for the second cycle of RDF funding. Up to $25 million dollars in grant awards was budgeted for second cycle projects. Selection criteria and the proposal scoring methodology was provided within the RFP document.

As indicated in Xcel Energy's June 28, 2004 status update, renewable energy proposal responses were numerous. Nearly 100 people attended the pre-bid conference, and 204 proposals were received in response to Xcel Energy's Request for Proposals. This represents a threefold increase in proposals over the first funding cycle. The submitted proposals were nearly evenly divided between energy production projects and research and development projects.

Definition of Categories

One of the lessons learned from the first funding cycle concerned the overlap between grants made in the first cycle for experimental technology and research and development. This proved to be somewhat difficult to distinguish the substance of the proposals and to allocate funds between these categories. The solicitation of projects for this second funding cycle has been limited to two categories: Energy Production and Research and Development.

The RDF Board believes using two categories rather than three has resulted in an easier allocation of funds and avoided some of the first funding cycle's ambiguity in the bid screening process and evaluation of proposals.

Energy Production Projects

Energy Production projects add renewable energy to the energy marketplace and install renewable energy production technology that is not yet commercially viable. These can include wind, solar photovoltaic, hydro, biomass or biofuels. RDF funding is not meant to subsidize commercial renewable installations, but to narrow the competitive gap for emerging technologies. Any wind or biomass project receiving renewable energy production incentives through the Department are excluded from RDF funding.

Research and Development Projects

Research and development projects include both advanced stage and early stage research and development. Advanced stage research and development typically involves technologies that are between the fundamental research and fully commercial stages. Early stage research and development typically involves technologies that are in the fundamental research stage that may lead to or support commercially viable technologies. Early stage research can be five to twenty five years from commercial viability.

Goals and Preferences of the Fund

The target allocation goal of RDF funds for the Energy Production and the Research and Development categories were 60 percent and 40 percent, respectively. The RDF Board had the discretion to deviate if necessary.

As noted above, submitted proposals were fairly evenly divided between Energy Production projects and Research and Development projects. The RDF Board

received and reviewed 100 proposals for projects to produce energy from wind, biomass, biofuel, solar, coal, and hybrid combinations. They also received and reviewed 104 research and development proposals.

Selected Energy Production projects require 44 percent of the total money spent in this second funding cycle and selected Research and Development projects require 56 percent of the money.

In its November 23, 2003 compliance filing, Xcel Energy described the proposed preference mechanism for second funding cycle proposals. This preference mechanism was subsequently discussed with the Department, and as a result, modified. Sponsorship by the Prairie Island Indian Community received the highest preference bonus (10 percent). Projects proposed by Minnesota research and development or business institutions received a preference bonus (7.5 percent). Finally, biomass projects received a preference bonus (5 percent). The combined bonus preference score was calculated by aggregating these three preference criteria, and the points for the combined preference were determined by multiplying the subtotal score received by the combined bonus score. The total project score was then calculated by aggregating the points earned with the combined bonus preference score and the subtotal score.

Energy Sales to Xcel Energy

For Energy Production projects that propose to sell the electricity they produce, the RDF Board sought to provide capital-funding amounts that are sufficient to bring the price of energy down to certain target levels. 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. Project developers were required to provide an energy pricing proposal. Wind projects that qualify for Xcel Energy's small wind tariff or non-tariff rates will be paid the rate that is effective at the time of formation of the power purchase agreement (tariff rate currently $.033 per kWh). For projects other than wind, Xcel Energy would pay up to $.045 per kWH for energy and capacity delivered to Xcel Energy's system. The final negotiated price would reflect various factors such as the firmness of the product and the on-peak energy availability. In addition, generators must obtain an approved interconnection agreement, and Xcel Energy must receive appropriate network services to allow energy to be delivered into its control area. However being selected as a winning 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.

PROPOSAL EVALUATION

Proposals were screened and evaluated according to the process described in the Request for Proposals. Initial screening of all proposals was conducted by the RDF Board to determine if the proposal was fully responsive to the Request for Proposals.

Evaluation Steps

The evaluation methodology was fully set forth in the Request for Proposals as approved by the Commission. PERI, a nationally known consulting firm with expertise in this area, was retained by the RDF Board as a consultant in the evaluation and scoring process.

The evaluation process was described in the Request for Proposals. Initially, proposals were evaluated for barriers to market deployment and for soundness of technical basis. Barriers to market, such as fuel and resource availability and environmental impacts, and the sponsor's plans to overcome the barriers were reviewed. Soundness of technical basis included a critical analysis of the extent to which each sponsor demonstrated sound technical ideas, assumptions for applying or researching technology and the necessity of the proposed activity in the development of technical success and commercial use. Finally, for research and development proposals, PERI evaluated duplication with other known research and development in the field.

Proposals were then evaluated on the basic core criteria, including the project approach and work plan, the project team, and for research and development projects only, advancement of technology.

Economic development benefits were then considered. The potential levels of new employment within the Xcel Energy service territory and the potential impact of the proposed project on commercialization was also a factor, along with taxes and other economic benefits within the Xcel Energy service territory.

Emission levels of each proposal was reviewed, to determine any air and water emissions and solid waste to be produced by a project.

The use of project funds was then reviewed. This included an analysis of the size of the project budget and an assessment of reasonableness to achieve the objectives stated. Any co-funding anticipated was also reviewed for reasonableness.

Finally, for energy production projects only, proposed project financing and total resource cost review was conducted.

Scoring Methodology

PERI developed a separate scoring sheet for Energy Production and Research and Development proposals to implement the scoring criteria. A copy of the PERI scoring sheets is included in the Appendix – Tabs 4E and 4F of this report.

Upon receipt of the Energy Production proposals, the PERI team met to discuss the overall approach and process for completing the evaluation, including the calculation of Total Resource Cost as described in the RFP. PERI then worked with the RDF Board to identify any "duplicate" projects where only small differences existed. Scoring spreadsheets were then compiled, and the results of various reviews were compared to assure consistency. Master scoring spreadsheets were used to sort results by score and a matrix of scores was prepared to sort the scores by technology because the RDF Board wanted to assure technological diversity. Further review was conducted by PERI to evaluate the strengths and weakness of each project.

A slightly different process was used for the Research and Development proposals. A scoring sheet was developed to implement the scoring criteria described in the RFP. The overall approach was conducted by a team of reviewers that were subdivided by technology for consistency and standardization. The various reviews were again compared to assure consistency. The scoring data was then input into a probabilistic proposal model. Results were again ranked by technology type. Because the RDF Board wanted to assure a diversity of technologies, risk and return levels and timing of market impacts in the R&D portfolio of projects, PERI used several different quantitative indicators for these portfolio types in the project evaluation.

Proposal Scoring and Selection Results

A summary of the results used by the RDF Board to determine its selection of proposals is included in the Appendix – Tabs 4A-4D.

Guidance on Innovative Energy Projects

One of the proposals submitted for second cycle funding involved an innovative energy project as defined by Minn. Stat. Section 216B. 1694 according to the project developer Excelsior Energy LLC. Excelsior Energy added legal advocacy in its proposal to the effect that the criteria and methodology provided in the Request for Proposals do not apply to an innovative energy project. The developer maintains that the Legislature prescribed criteria for an innovative energy project in the statutes and would be accorded special treatment as a clean energy technology under Minn. Stat. Section 216B.1693 and therefore must be considered by the RDF Board in its recommendations for RDF funding.

The Legislature has indicated under Minn. Stat. Section 216B.1694, Subd. 2 (a) (8) that an innovative energy project shall be eligible for a grant from the renewable development account subject to approval of the entity administering that account, of $2,000,000 for 5 years for certain project related expenses. This new law was enacted under Laws 2003, First Special Session, Chapter 11, article 4 section 1 and became effective on May 30, 2003. The RDF Board carefully reviewed the Excelsior Energy proposal.

The RDF Board determined that the Excelsior Energy proposal was eligible for a grant as the statute provides. However, the RDF Board does not read the statute to declare that eligibility for a grant is a mandated award of the renewable development account funds under the above section of Minn. Stat. Section 216B.1694. The RDF Board must evaluate, and the Commission must approve expenditures from the RDF. The Commission's authority over expenditures is expressly set out in Minn. Stat. Sect. 116C.779 and requires a Commission order. The proposal was evaluated and scored by PERI under the same methodology and preference as stated in the Request for Proposals as approved by the Commission and was not recommended for funding comparably applying the Commission approved methodology for evaluation and selection of proposals. The RDF Board saw no compelling reason to deviate or make a special exception in its administration of the RDF for the Mesaba Energy Project proposal submitted by Excelsior Energy in this second funding cycle.

Mindful of the special legislation for innovative energy projects, the RDF Board suggests that the Commission may want to provide guidance for future RDF funding obligations for such projects, including who is obligated to seek such funding approvals for such innovative energy projects from the Commission under Minn. Stat. Section 216B.1694 and how the funds approved for such projects will affect the availability funds for projects without any special legislative treatment.

PROPOSALS SELECTION

A detailed description of the proposals selected for funding is included in the Appendix – Tabs 1 & 2 to this Report. The Board used the PERI analysis as the basis of its recommendations and applying their judgment as appropriate to arrive at specific recommendations. Issues weighed by the Board when selecting proposals for funding included: achieving an appropriate mix of energy production and research and development projects, achieving an appropriate mix and size of technologies and achieving an appropriate mix of projects regarding risk and return levels. Additionally, the Board also applied their judgment to consider factors that may not have been captured in the PERI scoring process. The Board considered both overall and technology rankings when making their decisions. The resulting selection list is shown on pages 2-3 of this report.

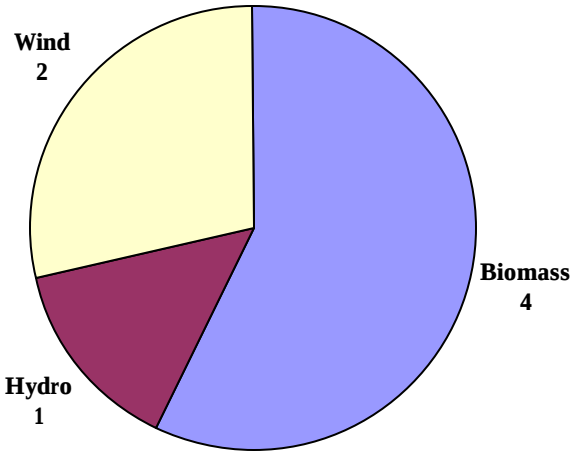
Out of the top 12 ranked energy production projects, the Board originally selected eight proposals for funding, one of which was withdrawn by Xcel Energy. Thus the final seven selections included the second highest ranked hydroelectric proposal, the top two biomass proposals (both of which were central station - type proposals) and the top two wind proposals. The remaining projects in the top 12 ranked projects were biomass (both central station and anaerobic digester technologies) and hydroelectric technologies. The Board opted to pass over the higher ranked central station biomass projects and the hydroelectric project (which the Board already had in their portfolio) to include two additional biomass projects; smaller projects using utilizing anaerobic digester technology, giving further diversification (on a technology and size basis) to its portfolio of selections. Note that the number of points separating the highest and lowest selected proposals was only 49 points, with a much smaller difference (25 points) between the selected - lower-ranked digester technologies and the bypassed, higher ranked biomass central station proposals and hydroelectric proposals.

Regarding research and development projects, out of the top 41 ranked proposals, the Board selected 18 proposals for funding. The Board's selection includes the top five biomass proposals, the top three solar proposals, the top three biofuels proposals, the top two wind proposals and the top hybrid proposal. As a part of its decision process, the Board opted to pass over certain higher-ranked projects in order to achieve a more diversified portfolio, and selected 3 additional biomass projects and one additional wind project to round out its selection of 18 projects. Almost all of the proposals that were passed over in the top 41 were for portfolio diversification reasons.

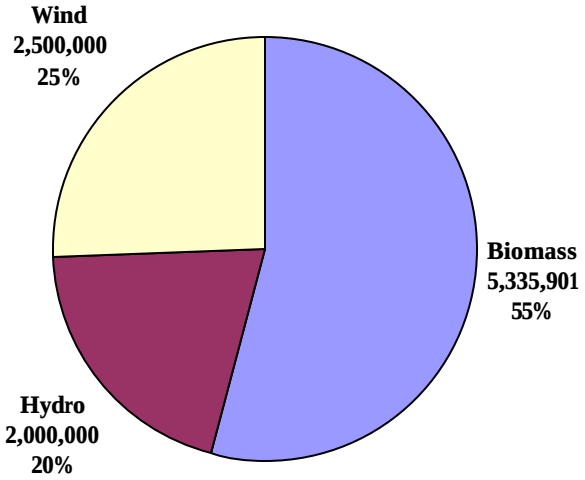
Below are charts summarizing the energy production and research and development proposals selected.

Selected Energy Production Proposals

of Proposals

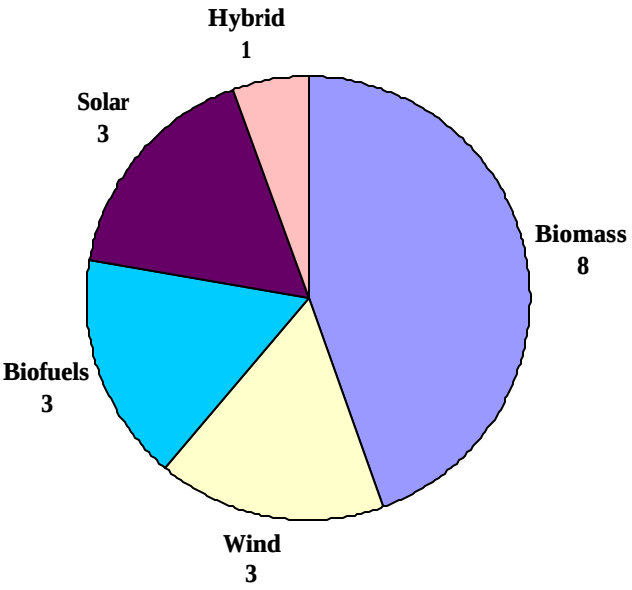


$ by Technology



Selected Research & Development Proposals

of Proposals



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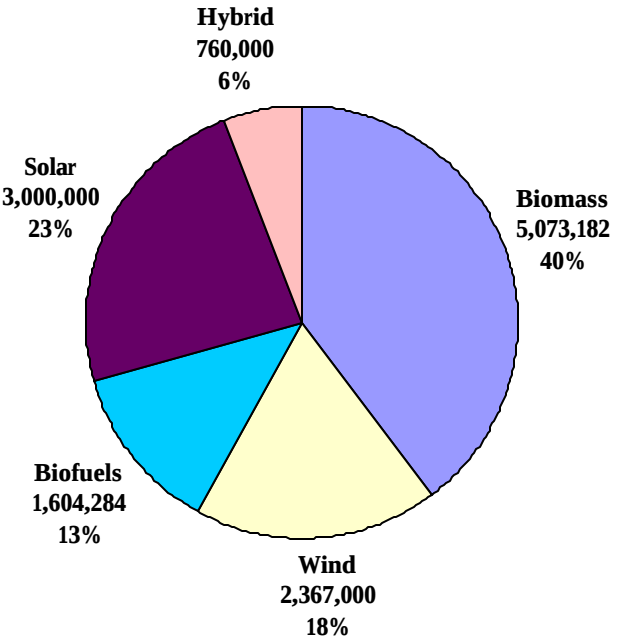
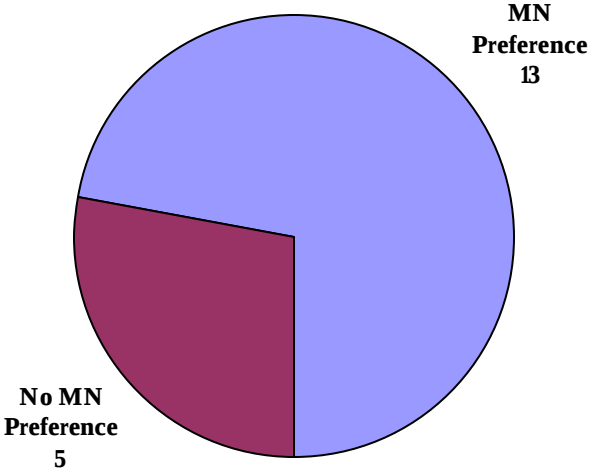
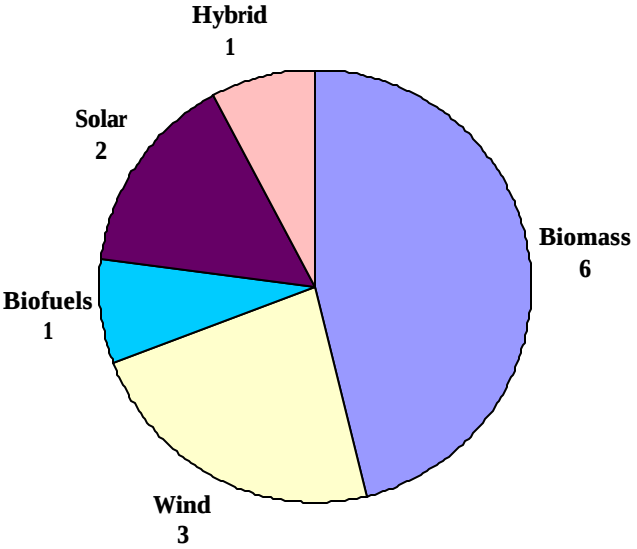


Selected Research & Development Proposals

MN Preference



MN Preference by Technology



NEXT STEPS

Negotiation of Grant Contracts

Xcel Energy will begin meeting with the selected projects in September to begin discussing the Grant Contracts. These Contracts will be structured for the requirements of each particular project including appropriate terms, conditions, milestone payment and deliverables and will incorporate any conclusions from the discussions with Xcel Energy, the RDF Board, the Department and Commission staff resulting from the Commission's August 17, 2004 order in Docket No. E-002/M-00-1583.

Grant Contract Guidelines

Xcel Energy will file all grant contracts with the Commission and the Department for compliance with the final selections.

Updates

Periodic reports will be filed by Xcel Energy on the status of the Grant Contract process. In addition, the necessary compliance filings based on the above Commission's August 17, 2004 will be made.

Commission Action Requested

The RDF Board requests that the Commission:

1. Approve the second cycle project selections and the associated RDF payments for the projects selected and described in this report in the respective amounts indicated.

2. Provide guidance with respect to future RDF funding obligations and approvals for innovative energy projects as determined by the Legislature under Minn. Stat. Section 216B.1694.

Respectfully Submitted,

Xcel Energy Renewable Development Fund Board of Directors

By _____

William Grant

By _____

Jack Keers

By _____

Mark McGree

By _____

Michelle Swanson

By _____

Craig Wills

August 31, 2004

Appendix enclosed
C: Service List

APPENDIX
Renewable Energy Project Selection and Funding Report
Second Funding Cycle
Docket No. E002/M-03-1883

This appendix includes the following information:

Tab 1 Energy Production Project Selections
- 1A. Hydroelectric Energy Production
- 1B. Biomass Energy Production
- 1C. Wind Energy Production

Tab 2 Research and Development Project Selections
- 2A. Biomass Research and Development
- 2B. Solar Research and Development
- 2C. Biofuels Research and Development
- 2D. Wind Research and Development
- 2E. Hybrid Research and Development

Tab 3 Excerpts from PERI's Report on Evaluation of Proposals
- 3A. Final Report on the Evaluation of Energy Production Proposals
- 3B. Final Report on the Evaluation of Research and Development Proposals

Tab 4 Excerpts from PERI's Scoring of Proposals Selected
- 4A. Energy Production proposals sorted by score (highest to lowest)
- 4B. Energy Production proposals sorted by technology and score
- 4C. Research and Development proposals sorted by score (highest to lowest)
- 4D. Research and Development proposals sorted by technology and score
- 4E. Energy Production scoring sheet
- 4F. Research and Development scoring sheet

TAB 1A HYDROELECTRIC ENERGY PRODUCTION

Proposal: Lower St. Anthony Falls Hydroelectric Project (EP-34)
Proposer: SAF Hydroelectric LLC
Overall Rank: 7
Technology Rank: 2
Total Score (out of 460): 252
Preferences Received: None

Funding requested: $2,000,000

The Lower St. Anthony Falls provided 8.98 MWs of clean renewable energy to the metropolitan area from 1898 until a 1987 failure of the powerhouse curtailed generation. The principal project goal is to restore this generating potential by using new Matrix turbine technology. The Matrix turbines represent a new and innovative use of existing propeller turbine technology that will place sixteen small individual turbines in a Matrix array, eliminating the need to construct a costly powerhouse and thereby allows for the economical development at existing dams to generate electricity. The Matrix turbines will be fabricated in a factory environment and will be installed in the auxiliary lock chamber at the Lower Dam. Since the Matrix unit can be removed from the waterway opening, the use of Matrix turbines does not decrease the capability of the dam to pass flood flows.

The basic performance of the individual turbine-generator units is well proven, however, the unique configuration of the turbine-generator units is different enough that most owners would prefer to see the system in commercial operation in North America before committing to a contract. Use of this technology will demonstrate how existing dams can be economically developed for renewable energy generation. A plant similar in configuration and unit capacity to the Lower St. Anthony Falls project has been successful commissioned on the White Nile in Sudan.

Several permits and approvals will be required for successful completion of the project, including obtaining a FERC license. An application for this license was submitted to FERC in January 2004, and a licensing decision is expected by the FERC in September 2005. Interconnection with the Xcel Energy system would be located near the intersection of West River Parkway and 11th Street utilizing a 13.8 kV circuit underground transmission line located on the west bank of the Mississippi River and extend upstream from the Lower St. Anthony Falls Lock and Dam. The line will be located along an existing service road between the Upper and Lower Lock structures. Interconnection from the lower service road will likely be made via an existing underground tunnel constructed in the St. Peter sandstone and

a vertical shaft. This tunnel is owned by Xcel Energy and currently is not in use. No detailed studies of this tunnel have been made. Future interconnection studies will serve to verify the condition of the tunnel. If the condition of the tunnel is poor and it cannot be used, the project will construct a 240 foot long new tunnel (directionally drilled shaft) in the St. Peter sandstone to interconnect with the Xcel Energy substation. The project will require an easement from the Minneapolis Parks and Recreation Board (MPRB) in order to construct a tunnel under the West River Parkway. Preliminary discussions with the MPRB indicate agreement that an easement will be granted.

Total capital costs of the project are estimated at almost $22 million. The project will generate over 57,000 MWHs annually which will be sold to Xcel Energy at a price of up to 4.5 cents/kwh, adjusted for inflation. The project scored high on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach) and achieved high scores in many of the secondary criteria including emissions levels, project approach and work plan and project team. The use of an array of Matrix turbines in the U.S. is novel, and demonstration in the United States is probably necessary for acceptance of the technology.

The RDF Board carefully considered this proposal in light of the current status of the Crown Hydro project in the first funding cycle. The proposal indicates that a number of licenses and approvals are required. The developer has applied for the FERC hydro license, which is pending. A FERC decision is expected in September 2005. In addition, the Minneapolis Park and Recreation Board will need to grant an easement for this project, though preliminary discussions with the Park Board indicate an easement will be granted. Appropriate contractual milestones and progress payments will be reviewed for this project once a meeting is held with the developer to gain the current status of these matters. It is currently anticipated that this will be one of the second funding cycle contractual issues discussed between the RDF Board, Xcel Energy, the Department and Commission staff in the process described in the report.

TAB 1B BIOMASS ENERGY PRODUCTION

Proposal: Biomass Cogeneration Demonstration Plant at Central Minnesota Ethanol Cooperative (EP-44)
Proposer: Central MN Ethanol Coop (CMEC), Sebesta Blomberg, Primenergy, PCL and Interstates
Overall Rank: 2
Technology Rank: 1
Total Score (out of 460): 278
Preferences Received: Biomass

Funding requested: $2,000,000

The proposed project will be the design, development and construction of a 959 kW biomass energy plant in a currently operating ethanol plant that will co-generate heat and electricity using a steam turbine based on gasification and agricultural residues. Based on preliminary studies conducted by the team and a previous project funded by the Xcel Energy Renewable Development Fund (see first funding cycle project BB03), the team has collected and analyzed operating and economic data that suggests a new approach to gasification that would significantly reduce CMEC's dependence on fossil fuels, thus reducing its operating costs. The proposed biomass cogeneration plant will be located at CMEC, located in Little Falls, MN. The CMEC plant was selected for its unique characteristics and its close proximity to a large and continuous supply of biomass in the form of forest and agricultural resources. Biomass fuels expected to be utilized include wood tree residue from the lumber industry, trimming services and poplar and pine thinning from tree farms in the immediate vicinity of the CMEC plant. Other possible biomass could be oat hulls, wheat hulls, corn stover and dried distiller grains.

The proposed process will use proven gasification technology in combination with a high pressure, superheated steam generation generator and a back-pressure steam engine to provide approximately all of CMEC's thermal needs and sell the 959 kW of power to Xcel Energy at a cost of 4.5 cents/kwh. Approximately 8,400 MWHs will be generated on an annual basis that will be wheeled through Minnesota Power (MP) and then sold to Xcel Energy.

The project team has initiated preliminary discussions with MP and the Midwest Independent System Operator (MISO) about wheeling rates and interconnection schemes. Actual interconnection and transmission costs to a new generator would be based on a specific MISO generator interconnection evaluation and facilities studies as well as a transmission service request to MISO.

Total project cost is estimated at $14.2 million. The project has already been awarded $2 million from the USDA/DOE Biomass Research and Development Initiative of 2003. The project scored very high on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach) and achieved the maximum scores in several secondary criteria areas including project approach and work plan, project team and total resource cost. This project is low risk, and if successful, the technology would have a large market potential for renewable energy in Minnesota with existing ethanol facilities.

Proposal: Southeast Power Plant Biomass Conversion (EP-25)
Proposer: University of Minnesota
Overall Rank: 3
Technology Rank: 2
Total Score (out of 460): 274
Preferences Received: Biomass

Funding requested: $2,000,000

The University of Minnesota proposes to refurbish its Southeast Steam Plant (Plant) to accommodate an increase in biomass fuel mix for the Plant's new Pyropower Circulating Fluidized Bed (CFB) boiler. With the refurbishment, an incremental 3.5 MWs of renewable energy from biomass will be generated. The original justification for the CFB boiler included the alternative use of biomass. As a result of permitting challenges and undeveloped biomass supplier relationships, only wood was specified in the operating permit. The current desire is to expand the operations of the CFB to include new biomass. The primary material of interest is oat hulls from a local cereal mill (General Mills). The University's proposed project and specific application of CFB technology are not known to be commercially proven or available in Xcel Energy's service territory but research and pilot scale testing show this potential RDF-funded project will move this type of biomass production application to a point where it is competitive with current commercial resources and set a precedent for commercial introduction elsewhere. Experimentation with oat hulls started in 2003 by blending the hulls with coal. Tests were successful up to a maximum level of 30% on a BTU basis. The proposed project includes installing a stand-alone biomass unloading and delivery system, biomass storage inside the CFB superstructure, biomass-to-boiler delivery system, dust collection systems, as well as site civil improvements. These new systems are required to increase the use of biomass in the boilers. Foster Wheeler has indicated that biomass should be able to provide up to 50% of the boilers energy, though corrosion, erosion and/or fouling have been observed on previous biomass projects around the world.

The project is anticipated to generate approximately 9,507 MW hours of additional renewable energy on an annual basis. This is a 100% self-generation project. No energy will be sold to Xcel Energy. The project scored very high on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach) and achieved the maximum scores in several secondary criteria areas including project approach and work plan, financing plan, and total resource cost. This project is low risk, and if successful, would open the door to increasing the utilization of a renewable resource that is currently land filled

and is plentifully available in Xcel Energy's service territory (for potential displacement of future capacity and energy needs).

Proposal: Ripley Dairy (EP-29)
Proposer: Ripley Dairy
Overall Rank: 5
Technology Rank: 4
Total Score: 262
Preferences Received: Biomass

Funding requested: $399,371

Ripley Dairy will be a 3,000 – Jersey cow dairy operation located in Ripley Township, Dodge County, Minnesota, approximately 80 miles south of Minneapolis.

This project would install an on-farm anaerobic digester system, from which the methane biogas will be collected and utilized for fuel in combined heat and power (CHP) gensets. The engines for this project are two Caterpillar 3406 Turbo (400 kW). Approximately 3,200 MWHs will be generated by the project on an annual basis, and 100% of the energy will be sold to Xcel Energy at 4.5 cents/kwh. Other added benefits of the project aside from renewable energy production include reduction in nutrient loading on fields, more useful liquid fertilizer to apply to growing crops, vector and fly control, methane destruction, smell reduction and waste heat to be utilized on the diary operation.

The project is estimated to cost $1.6 million. USDA Rural Development has committed approximately $400,000 to co-fund the project. This project is considered low risk as the technology is standard and has been proven successful in other states.

The project scored very high on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach) and achieved high scores in several secondary criteria, including emissions levels, project team and efficient use of project funds.

Developers for this project will be contacted by Xcel Energy to determine if there are opportunities for this project to utilize the generators from the cancelled AnAerobics project.[1]

[1] AnAerobics is now known as Ecovation, Inc.

Proposal: Diamond K and Greden's Ponderosa Dairy Digester (EP-51)
Proposer: RCM Digesters, Inc.
Overall Rank: 9
Technology Rank: 6
Total Score: 248
Preferences Received: Biomass

Funding requested: $936,530

The Diamond K and Greden's Ponderosa Dairies have decided to invest in an anaerobic digestion system for their operations. Both dairies are located in Winona County, Minnesota near the town of Altura. The two dairies are located within a quarter mile of one another. Collectively the two dairies own 1375 milling cows, 100 dry cows and 620 heifers. There are many inherent benefits of utilizing this technology, including electricity production, heat production, manure treatment cost savings, nutrient conversion, odor and pathogen control and byproduct recovery. This project will design and build a digester system on site in the Diamond K Dairy. Manure generated at Greden's Ponderosa Dairy will be collected and pumped a quarter mile to the digester. The energy produced by combusting the biogas in a pair of Caterpillar 3406 engines will offset electricity usage on the Diamond K Dairy and excess power will be sold to Xcel Energy at 4.5 cents/kwh. Total capacity of the project is 261 kW, and approximately 2,000 MWHs of energy will be generated annually.

Developers for this project will be contacted by Xcel Energy to determine if there are opportunities for this project to utilize the generators from the cancelled AnAerobics project.

The project is estimated to cost $1,170,663. The project scored nearly perfect on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach) and scored well on a number of secondary criteria. This project is low risk, and scored well in laying out a project approach and work plan. The project could be readily implemented.

TAB 1C WIND ENERGY PRODUCTION

Proposal: St. Olaf College – Wind Self – generation (EP-39)
Proposer: St. Olaf College
Overall Rank: 11
Technology Rank: 1
Total Score: 230
Preferences Received: None

Funding requested: $1,500,000

St. Olaf College proposes to install a 1.65 MW Micon wind turbine on campus property, and use the energy for its own energy needs. St. Olaf has already installed a 4.2 MW diesel generating plant that can support 100% of its present electric load. In addition, St. Olaf is a large-volume interruptible natural gas customer of Xcel Energy, and can take 100% of the heating load off of the Xcel Energy and Northern Natural Gas systems. St. Olaf's ability to handle is entire electric and heat loads independently is an important advantage for Xcel Energy as the college is able to free up capacity at times of system heavy demand. Adding wind self-generation to lower the base load energy requirements furthers this advantage. With the addition of wind self-generation to its energy portfolio, St. Olaf will have maximized the practical opportunities to help control its expenditures while at the same time has extended the ability of the campus to support its programs and serve its community and region. This could serve as a repeatable model for any college or university, significant medical complex, veteran's home, etc.

The wind-generated power will be stepped up to a 13.8 kV and fed directly into a loop connection at the tower. This physical layout means that power can be fed into the loop even if it is interrupted somewhere on the campus. The reverse current protection at the diesel generating plant protects the Xcel Energy system from any campus generated power that might otherwise be back fed. Approximately 5,300 MWHs will be produced on an annual basis.

The project is estimated to cost $1.8 million. The project scored high on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach). This project is low risk and has a unique setting. St. Olaf College appears well attuned to energy issues and their relationship to the community and the utility from an energy supply/load perspective.

Proposal: Wayzata Public Schools Wind Generation Project
Proposer: Wayzata Public Schools
Overall Rank: 12
Technology Rank: 2
Total Score: 229
Preferences Received: None

Funding requested: $1,100,000

Wayzata Public Schools proposes to construct a 1.65 MW wind turbine (NEG Micon NM82 1650 product or equivalent) on the campus of Wayzata High School, located in Plymouth, MN. The project would be unique in several ways. First, the project would be the only large wind turbine in the seven county Twin Cities Metropolitan Area. Secondly, the type of turbine to be installed is designed to operate under relatively moderate wind conditions. The project will test production and commercial viability of this product in a moderate wind area. Additionally, installation of a wind turbine is a permissible use under a recently modified ordinance in Plymouth.

A meteorological test tower was in place at Wayzata High School from November 2, 2002 to April 29, 2003. Results indicate that the site has a wind capacity factor of 23.8% at 80 meters above ground level. Approximately 3440 MWhs of energy will be produced on an annual basis and sold to Xcel Energy at 3.3 cents/kwh. A existing 34,000 volt distribution feeder line crosses the school district property. The proposed wind turbine site is approximately 400 feet from a transformer on the distribution system where physical interconnection is proposed.

The project is estimated to cost $1,754,000. The project scored well on the two primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach). This project is low risk and has a unique setting. Local zoning changed to allow the turbine to be located on the school site is a major step. The interconnection should be relatively straightforward, and they are working with Windustry as a consultant to implement the project.

TAB 2A BIOMASS RESEARCH AND DEVELOPMENT

Proposal: Feasibility of Commercially Growing Miscanthus in Minnesota (RD-27)
Proposer: Rural Advantage/Blue Earth River Basin Initiative
Overall Rank: 1
Technology Rank: 1
Total Score (out of 490): 328
Preferences Received: Biomass, Minnesota R&D institution/company

Funding requested: $318,800

This project proposes to determine the feasibility of commercially growing and converting Miscanthus to energy in Minnesota. Specifically, the study will determine the feasibility of mechanical propagation of Miscanthus, harvesting and processing the crop and verifying combustion characteristics. Miscanthus is a large perennial grass, native to Southeast Asia. This grass has several unique attributes. It is carbon neutral, grows rapidly to out-compete weeds, and is a high energy content biomass fuel source. Miscanthus seeds are sterile, so this plant cannot spread by the seeds drifting to a different area. Since this is the case, however, Miscanthus must be propagated through the tubers or rhizomes. The roots are like bulbs or potatoes. At the present time, there is no way to mechanically separate the rhizomes from the roots in order to propagate the plant; thus it must be done by hand. If done correctly, once planted, each plant should multiply itself approximately twenty times each year.

A year-round greenhouse will be built in Luverne, Minnesota so that the plant can be propagated all year. By doing this, the proposers will be able to plant enough ground to research whether these plants can be harvested with farm equipment, are winter hardy in Minnesota, how to plant and harvest mechanically, gasification tests, among other things.

The total cost of the project is $484,750, which includes the grant request from Xcel Energy and $153,950 in payments-in-kind. This project scored the highest across all technologies in the Research and Development category. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and achieved high scores in many of the secondary criteria. This is a local initiative that is low cost, and if successful, could have an important impact on biomass renewable development in Minnesota. Even if this is not successful as an energy crop, it could provide a solution to soil erosion.

Proposal: High Performance Biogas Treating (RD-72)
Proposer: Production Specialties
Overall Rank: 2
Technology Rank: 2
Total Score (out of 490): 323
Preferences Received: Biomass

Funding requested: $228,735

The economic feasibility of anaerobic digestion projects is highly dependent on the income derived from the energy produced and sold by the project. To the extent that most biomass and for that matter most plant and animal life contain modest amounts of sulfur, the waste materials generated by operations that support the plant and animal life also contain modest amounts of sulfur. When these waste materials are fed to an anaerobic digester, the sulfur bearing compounds are converted to reduced sulfur compounds, primarily hydrogen sulfide. The concentration of hydrogen sulfide in the biogas or digester gas varies and is dependent on a number of factors, with the predominant factor being the sulfur content of the waste stream.

For an enterprise to economically use the digester gas in a commercial venture, it must be delivered and utilized in a combustion device (boiler, engine, gas turbine, heater). Alternatively, if the biogas is not used as an energy source, it will have to be burned in a flare. In either event the hydrogen sulfide in the gas will be converted to sulfur dioxide during combustion. Sulfur dioxide is a pollutant, and contributes to acid rain. Combustion of digester gas with even moderate amounts of hydrogen sulfide can and is likely to result in decreased lifetime and increased maintenance of the combustion device. Once the digester gas is burned, the resulting sulfur dioxide will combine with water vapor in the exhaust stream to produce sulfurous acid (H2SO3). The sulfurous acid will raise the dew point of the exhaust gases, and upon condensation will attack metal surfaces within the combustion device (such as boiler tubes, waste heat recovery systems, turbo chargers and the exhaust system itself).

Due to the deleterious nature of hydrogen sulfide, it must be removed. There are a number of conventional methods for removing hydrogen sulfide from gas streams, however they are not economical. As a result, biogas cannot compete with conventional natural gas resources, even with higher natural gas prices. Thus, in order for biogas to be competitive with conventional natural gas resources, the cost of treating the gas for hydrogen sulfide removal must be reduced to a level less than $0.50/million btus. The proposed project will establish and demonstrate a

technology to do this, and will be carried out in two phases. The first phase will be a laboratory study to establish the operating parameters and conditions for effectively removing the hydrogen sulfide from a simulated biogas stream. In the second phase, the technology will demonstrated at a commercial anaerobic digester location by circulating the absorbent solution through two towers (contactors) with the biogas flowing in a counter current operation.

The total cost for this project is $457,470 which includes the grant request ($228,735) and matching internal funds. Successful deployment of this technology will benefit a wide variety of digester operations across the country, including commercial digesters that support food and brewery operations, municipal sewage digesters and future digester installations that process waste material from confined animal feeding operations. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and achieved high scores in many of the secondary criteria. This project has a large market potential, especially for Minnesota, given large food processing and agricultural sectors (Minnesota-based Michael Foods sent a letter of support for the project, and would benefit from the technology if successful because of its large agricultural assets). It is a low cost R&D project, and if successful, the technology could be commercialized in a short amount of time.

Proposal: Direct Hydrogen Production from Biomass Gasifier Using Hydrogen-Selective Membrane (RD-38)
Proposer: Gas Technology Institute
Overall Rank: 3
Technology Rank: 3
Total Score (out of 490): 318
Preferences Received: Biomass, R&D institution/company

Funding requested: $861,860

This project proposes to develop a clean, highly efficient and low cost hydrogen production from biomass gasification process. The Gas Technology Institute (GTI) and the Natural Resources Research Institute (NRRI – part of the University of Minnesota – Duluth institution) have developed a novel concept for direct extraction of hydrogen from biomass by incorporating a hydrogen-selective membrane within a biomass gasifier. The proposed membrane gasifier can potentially reduce the hydrogen product cost by more than 40% over conventional biomass gasification technologies. When a fuel cell is combined with the proposed hydrogen membrane gasifier technology, the system will offer a highly efficient and low cost electricity generation from biomass. The project team will select preferred candidate membranes, build a hydrogen permeation unit, commission and test the permeation unit, install a down draft biomass gasification unit, and conduct integrated testing of the hydrogen permeation unit with the down draft biomass gasifier.

Biomass represents an abundant and renewable feedstock that can be thermally processed using gasification technologies for producing hydrogen and/or power. The produced hydrogen can be sent directly to a fuel cell for highly efficient and environmentally clean power generation. Biomass offers a secure and self-sufficient way of electricity generation via gasification due to its renewable nature. However, the cost of hydrogen from biomass based on the current technologies is still uneconomical. There is a great need to develop a more efficient process to reduce the cost of hydrogen from biomass, if biomass is to become an economic and viable source of hydrogen.

GTI's hydrogen membrane gasifier concept can potentially improve the hydrogen production efficiency by more than 40% based on a preliminary thermodynamic analysis, thereby reducing the costs of the feedstock and the gasification unit for the same quantity of hydrogen produced. Moreover, it eliminates the downstream shift reactor and separation units, resulting in a significant capital cost saving and process simplification.

The biomass gasifier that will be used for the proposed project has been relocated to the research facility of NRRI in Duluth, Minnesota. The unit will be re-installed and commissioned for testing of two types of biomass feed stocks available in Minnesota; woody biomass and palletized agricultural material. The total cost of the project is $861,860 with no cost sharing. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and achieved high scores in many of the secondary criteria. This project is applied R&D, using a new approach based on existing technical information and has an experienced team. There were no project weaknesses associated with this project.

Proposal: Identifying Effective Biomass Strategies: Quantifying Minnesota's Resources and Evaluating Future Opportunities (RD-94)
Proposer: Center for Energy and Environment
Overall Rank: 7
Technology Rank: 4
Total Score (out of 490): 307
Preferences Received: Biomass, Minnesota R& D institution/company

Funding requested: $397,500

The goal of this project is to create a framework that communities and other local policymakers can use to determine the feasibility of biomass generated electricity in their region and to develop cost-effective projects that use local biomass resources efficiently. Specifically, the project will conduct a comprehensive inventory of all biomass potential in Minnesota. Based on this inventory and taking into account local conditions, the project will identify appropriate and practical technologies for generation of electricity using existing biomass resources. All major biomass and bio-waste feedstocks will be cataloged during the inventory, including major facilities that produce biomass or bio-waste. Process technologies appropriate to each feedstock will be identified and assessed using published data from actual projects whenever possible. The viability of each major feedstock and technology will be assessed primarily by the reliability of the technologies and its cost. Cost will be assessed using current costs, as well as the potential for long term cost reductions as the technology is further developed.

Existing energy infrastructure, including electric generation and transmission facilities and natural gas lines, will be mapped with a GIS system and overlayed with biomass sources and major biomass facilities. Biomass project opportunities will be identified and prioritized based on feedstock availability, scale and reliability of the technology, and cost and location of nearby infrastructure requirements. Finally, barriers to implementing biomass projects and strategies to overcome these barriers will also be identified. The project will identify organizations, businesses and institutions that could play an important role in developing viable projects. These may include utilities, major wood producers or agricultural businesses, municipal waste facilities, feed lots, economic development and state agencies. The project will develop practical actions that can be taken by these organizations to encourage viable biomass projects.

This work is important in Minnesota, because although several projects have been proposed and initiated, a comprehensive evaluation of Minnesota's biomass resources in relation to existing infrastructure and appropriate processing

technologies has not been completed. Without a common framework from which to identify and compare diverse strategies, projects are often selected for political reasons instead of for their technical and economic feasibility. This lack of a commonly accepted standard for decision making, combined with current regulatory and perceptual barriers in the biomass arena, complicates the selection process even further. This project will create a framework that communities and and other local policymakers can use to determine the feasibility of biomass generated electricity in their local region or legislative district and to provide public assistance to foster development of cost-effective projects that use local biomass resources efficiently.

The project is estimated to cost $397,500 which would be fully paid for by an RDF grant. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and achieved high scores in many of the secondary criteria. Completion of this project will result in a good tool for ranking projects, and will identify areas or centers that biomass energy generation would have the greatest likelihood of success. It is a good market, economic assessment study.

Proposal: Generating Electricity with Biomass Fuels at Ethanol Plants (RD-56)
Proposer: University of Minnesota
Overall Rank: 9
Technology Rank: 5
Total Score (out of 490): 302
Preferences Received: Biomass, Minnesota R&D institution/company

Funding requested: $858,363

There are significant opportunities to generate renewable biomass-fueled electric power at dry-mill ethanol plants. However information is needed about systems to convert biomass to energy and subsequently to electricity. This project will evaluate capital and operating costs of combustion, generation, and emission control technologies to determine overall economic feasibility of generating renewable biomass-based electric power at dry-mill ethanol plants. These opportunities are a result of increases in process energy costs in the form of natural gas at the same time that prices are decreasing for a valuable co-product, distillers dried grains and solubles (DDGS), which is normally used for livestock feed. At current prices, it may be more economical to use the DDGS as fuel to replace natural gas to provide the process heat than to sell them for feed. Since the plants operate year around, 24 hours per day, they are good candidates for combined heat and power applications. Thus, it may be economical to generate renewable biomass-based electric power, both for the plant and to the grid, while reducing the demand for fossil fuel based process heat.

The approach is to 1) analyze co-product streams from ethanol plants as well as corn stover to determine energy, emission and ash characteristics; 2) evaluate options for combustion, electricity generation and emission control; 3) develop capital and operating costs for required technologies; and 4) perform an overall economic analysis for generating electricity with biomass fuels at ethanol plants.

The University of Minnesota is the primary contractor and RMT, Inc., a part of Alliant Energy Integrated Services is the subcontractor. The University of Minnesota brings expertise in research and education related to ethanol plant economics and biomass utilization. RMT, Inc. is coordinating a group of consultants located in Madison, Wisconsin and Minneapolis, Minnesota with significant experience in combustion and related environmental issues for a range of fuels including biomass, fuel handling, electrical generation, cogeneration, and connection to the grid.

Total projects costs are $977,645, which includes a grant request of $858,363 and a cost share of $119,282 through in-kind contribution of salaries from the participants. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and scored well in many of the secondary criteria. The information that will be generated from this project will be very useful in identifying possible renewable projects at ethanol plants.

Proposal: Conversion of Biomass into Energy and Compost through Sequential Batch Anaerobic Composting (RD-34)
Proposer: University of Florida
Overall Rank: 13
Technology Rank: 8
Total Score (out of 460): 295
Preferences Received: Biomass, Minnesota R&D institution/company, Prairie Island

Funding requested: $999,995

This project will generate significant amounts of electrical energy from a renewable biomass. American Crystal Sugar Company currently has a refining by-product of sugarbeet tailings that have limited utility as an animal feed, and requires land application in surrounding fields on a continuous basis for disposal. Costs associated with the disposal of these sugarbeet tailings for just one of five plants are forecast to exceed $1.0 million for fiscal year 2004 and are subject to strict environmental regulation by the states of Minnesota and North Dakota. While disposal of the tailings is very expensive, it is the only viable option for removal of the excess byproduct at this time. The University of Florida has developed a flooded-densified Sequential Batch Anaerobic Composting (SEBAC II) system for NASA space applications that appears to have direct utility to the feedstock of sugarbeet tailings. This system differs from commercial composting technologies in that it is a modular, sequential design that is reliable, portable, requires low maintenance and is odor free. Its modular design also allows for the system to grow with increasing needs, or be reduced in size should circumstances warrant.

The project objective is to develop a demonstration facility to anaerobically digest the sugarbeet tailings and generate methane that can be converted to electric energy based on the space based prototype of the SEBAC II system. The demonstration facility would be built at the American Crystal Sugar Company facility in East Grand Forks, MN. The SEBAC II technology offers economic benefit to a wide range of industries, and preliminary research indicates that this proven technology can be commercialized and deployed at numerous locations in Xcel Energy's service area. Minnesota Technology, Inc. will develop a list of target companies in or near the Minnesota Xcel Energy service area that are potential users of the SEBAC II system.

Total cost of this project is $1,271,814, which includes a grant request of $999,995. American Crystal Sugar Company is committing internal resources to leverage with potential grant funds to ensure a demonstration facility of sufficient scale is

constructed to effectively address the volume of biomass at their East Grand Forks, Minnesota plant.

The project achieved the highest scores possible on two of the three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and achieved high scores in many of the secondary criteria. This proposal is utilizing a proven concept, as the technology was developed for NASA and has an experienced team. Official sponsorship from the Prairie Island Indian Community was indicated via a letter.

Proposal: Coaltec Energy – West Michigan Turkey Biogasifier (RD-26)
Proposer: Coaltec Energy USA, Inc.
Overall Rank: 14
Technology Rank: 9
Total Score (out of 490): 295
Preferences Received: Biomass

Funding requested: $450,000

This project will utilize a waste product from the poultry industry as the fuel to supply a solid fuel, fixed bed gasification testing facility. The goal of the project is to prove the feasibility of the technology, and also provide the testing and design details that will enable the project to move forward into commercialization. Tests will be completed using Coaltec's commercially sized gasification unit located at the Coal Research Park of Southern Illinois University, Carterville, Illinois.

The goal of this project is to prove the feasibility and economic viability of a waste to energy project utilizing poultry wastes as the fuel, and a fixed bed gasifier as the medium to convert the waste material to energy. The project will not only demonstrate the technology, but will also show the potential value of waste to energy distributive power generation systems. The project will examine the location and size of agricultural operations for producing a poultry litter feedstock, together with grid connection points or local energy loads that fall in a suitable supply area. The poultry litter operations will be surveyed for handling methods used, resulting impacts on fuel quality, and compatible fuel collection and handling systems. The fuel stream thus identified will be sampled in large scale and the material transported to Coaltec's commercial scale gasification test facility where the fuel will be run in an extended test to prove handability and performance of the fuel, characterize sensitivities in operation to variability of the fuel, and compile proven emission performance together with heat and mass balances needed for the engineering design of a distributive generation system.

The key to reaching these objectives is the test burn conducted at the demonstration facility. The test results will not only prove the feasibility of the technology, but also it will provide the data that will support the economic model and the environmental impact. The final objective is the evaluation of the potential benefits to the poultry industry throughout the Xcel Energy service area. Ideally, the concept of distributive generation could provide multiple systems located at host sites that generate the fuel supply. One of the keys to economic systems is the fuel cost. Since the fuel is a waste product, it is essentially a free fuel. Couple that with the concept that the system is located near the source of the fuel, the transportation

cost is also negligible. These factors improve the prospects of creating viable projects.

Total costs of this project is $805,000, which includes a grant request of $450,000. West Michigan Turkey, Coaltec Energy, Draco Energy and Recovered Energy Resources are contributing $355,000. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in many of the secondary criteria. This project utilizes experienced personnel, and takes advantage of an existing gasifier for testing.

Proposal: Improving the Efficiency of Planting, Tending and Harvesting Farm-Grown Trees (RD-50)
Proposer: Energy Performance Systems (EPS)
Overall Rank: 19
Technology Rank: 11
Total Score (out of 490): 284
Preferences Received: Biomass, Minnesota R&D institution/company

Funding requested: $957,929

This project's goal is to build and demonstrate new equipment and an integrated system that is capable of supplying farm grown fuel trees at a cost of $2.80/million Btu (fully loaded) or less to a power plant within 50 miles; so that biomass fired electric power generation becomes a competitive and renewable alternative to fossil fuel fired systems. This goal includes a clear demonstration that hybrid poplar yields of 25 to 30 dry tons/acre can be obtained in an operation scale planting within 5 growing seasons in Minnesota with 25 inches or more of rainfall and that is environmentally beneficial.

The project approach will include 1) the development and use of a new tree slip planter; 2) establishment of hybrid poplar tree crops in operational scale plantings with no-till site preparation at 6x6 foot spacings and tending crops of 5 years using innovative equipment; 3) testing and commercialization of a high-speed tree-harvesting machine; and 4) reports and analysis assessing and documenting the success of the tree management and harvest methods.

Total project cost is $1,146,277, which includes a grant request of $957,929 and in-kind contributions of $188,348. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in many of the secondary criteria. EPS has previously designed similar equipment to those proposed, and this equipment could be used for purposes other than the production of energy crops. The proposal includes an experienced team and personnel. If successful this project could decrease production costs significantly, increasing the market potential for these types of biomass projects. This project builds off a completed study which was funded in the first RDF cycle (BB06), in which a feasibility study was done on retrofitting a power plant to burn whole trees.

TAB 2B SOLAR RESEARCH AND DEVELOPMENT

Proposal: Inkjet Direct-Write Solar Cells (RD-93)
Proposer: National Renewable Energy Laboratory (NREL)
Overall Rank: 4
Technology Rank: 1
Total Score (out of 490): 315
Preferences Received: Minnesota R&D institution/company

Funding requested: $1,000,000

The proposed project seeks to design/develop a solar cell that would be significantly cheaper to produce than current wafer based silicon solar cells, the mainstay of the PV industry. From a cost per installed watt of about $80 in 1975, commercial PV today installs for less than $4 per watt, and that price is expected to drop even more in the next few years. The price needed to compete directly with conventional sources is thought to be below a $1/Watt, however with green credits and subsidies this may be somewhat higher. To date, the market is dominated by crystal silicon wafer based solar cells. The commercial Si solar cell has efficiencies ranging from 12-18% but costs to manufacture are high. Amorphous Si has low manufacturing costs, but also has low efficiencies, ranging from 6-8%. Thus a breakthrough is needed for some technology application to achieve high efficiencies and low cost.

CuIn(Ga)Se2 (CIGS) based thin film solar cells have demonstrated world-record efficiencies in research scale devices but, to date, have not had a significant market impact due to manufacturing difficulties and costs. Inkjet printing has been shown to be a viable approach of the deposition of electronic materials for a variety of emerging opto-electronic applications. This project proposes using liquid-precursor based atmospheric-pressure direct-write inkjet printing of complete CIGs solar cells: a radically different approach that would be simpler, lower-cost and readily scalable. Work will be done jointly at NREL and the University of Minnesota, Chemistry and Materials Science Departments.

The overall cost of this project is $1,000,000. If the project receives the full grant request, NREL will provide cost sharing corresponding to about 40% of the project, or $220,000 per year redirected from other funding to support this project. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received the maximum score in several of the secondary criteria. This project

has a highly experienced team in the subject area. In addition, the approach proposed has a very large potential for reducing photovoltaic (PV) capital costs and increasing thin film PV manufacturing throughput rates, in addition to the potential for increasing the value of PV in a variety of markets. This project is higher risk, with some potentially difficult technical barriers.

Proposal: Flexible Photovoltaic Cell for Cost-Effective Electricity Generation
Proposer: InterPhases Research (RD-78)
Overall Rank: 5
Technology Rank: 2
Total Score (out of 490): 311
Preferences Received: None

Funding requested: $1,000,000

Solar energy has the potential to fulfill energy needs in the electricity market. However, technical challenges prevent current solar cells from solving the energy problem and gaining market traction. Crystalline silicon cells at 30 cents/kWh are not cost competitive with convention electricity at 6-15 cent/kWh. These cells require government subsidies to compete and are cumbersome, fragile and difficult to mass-produce. The highly promising thin film PV cell has similar problems. The cheaper amorphous silicon or the proposed organic PV cells are very inefficient and unstable. The current research challenge is to discover a feasible process to make the solar cell simultaneously efficient, stable, cheap and can be readily manufactured in high volumes. This project will research and report on a breakthrough PV technology which will meet these challenges and create new opportunities in solar energy market. InterPhases technology features a lightweight solar cell based on n-Copper Indium Selenide (n-CIS) film, with only three layers on low-density polymer or metal substrates. It is manufactured by a 3-step, continuous roll-to-roll electrochemical method. The project will build upon current results to produce a working n-CIS flexible cell prototype.

The overall cost of this project is $1,821,700. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This project combines an extremely promising approach to simpler thin film processing with moderately high efficiency – potentially the optimum path to low PV cost in the short – to – mid-term. The project proposer has a strong background in this field of research, and combined with current research funding and clear direction, improves the chances of achieving its project goals.

Proposal: Low Band Gap Materials for Organic Photovoltaics
Proposer: National Renewable Energy Laboratory (RD-107)
Overall Rank: 17
Technology Rank: 3
Total Score (out of 490): 291
Preferences Received: Minnesota R&D institution/company

Funding requested: $1,000,000

The current barrier to wide-spread commercialization of photovoltaic (PV) technology is the high cost of PV module manufacturing. Ultimately, cost targets will be difficult to reach with existing technologies that are based on inorganic semiconductors. It is difficult with these conventional technologies to significantly increase the solar power conversion efficiencies or to dramatically reduce the costs. However, organic based devices offer the potential to be "disruptive technology" with efficiencies that approach those of conventional devices at significantly reduced manufacturing costs. Though there are scientific and technological hurdles yet to overcome, these devices offer the potential to be very low cost route to large scale PV commercialization. This proposed research work focuses on the development of these organic semiconductor based "plastic solar cells." These devices rely on polymeric and molecular organic materials as the active components for absorbing sunlight and producing useful energy. These materials consist of commonly found, non-toxic elements (carbon, hydrogen, oxygen, etc.) as opposed to hazardous elements such as cadmium or selenium. Additionally, organic semiconductors can be processed primarily with low-temperature, chemical solution based deposition techniques that do not require expensive vacuum systems. Inkjet printing and screen printing of plastic solar cells have both been demonstrated. These techniques are feasible for large scale production according to the proposers. NREL and the University of Minnesota (Materials Research Science and Engineering Center) will be conducting this research.

The work proposed in this project aims to overcome the critical limitations in these organic devices, namely the efficiency of light harvesting and the charge carrier transport in the organics. Specifically, the project proposes to develop critically needed low band gap (red light absorbing) organic material with optimized transport properties. Successful completion of this work will greatly enhance the solar power conversion efficiency of plastic solar cells, thereby significantly boosting their market potential. The ultimate goal is the integration of these optimized materials into prototype devices that will facilitate large-scale commercialization of this technology.

Total project cost is $1,000,000, which would be entirely funded by a grant from Xcel Energy. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This project approach has a very large potential for increasing organic PV efficiencies and reducing thin film PV efficiencies. The project team assembled has an extremely high level of expertise/experience in the subject area.

TAB 2C BIOFUELS RESEARCH AND DEVELOPMENT

Proposal: Biomass-Derived Fuels for Turbo-Generators (RD-29)
Proposer: University of Minnesota
Overall Rank: 5
Technology Rank: 1
Total Score (out of 490): 307
Preferences Received: Minnesota R&D institution/company

Funding requested: $299,284

The University of Minnesota (UMN), the Agricultural Utilization Research Institute (AURI) and Southwest State University (SSU) propose a 21-month study to determine if biomass-derived oils (BDOs) can be effectively used in turbo-generators. A turbo generator is an electrical generator powered by a gas turbine and is sometimes referred to as a combustion turbine. The project will focus on a determination of technical and market opportunities brought about by generating electricity with turbo-generators fueled with raw or minimally processed vegetable or recycled oils.

The UMN is currently conducting related research work, to be completed in September 2004, which will provide a valuable preliminary step to the proposed project. The existing project focuses exclusively on soybean oil and seeks to characterize the properties of two to three types and grades of soy oil to determine if these oils favorably compare with liquid petroleum fuels currently used in turbo-generators. The proposed project will significantly extend this work by analyzing and identifying BDOs for further testing, investigating the economic feasibility of using BDOs, assessing issues of storing BDOs, and testing at least 5 BDOs in a turbine engine.

The majority of biomass power operations burn plant material directly in a boiler to generate steam, which drives a traditional steam turbine. Bio-diesel is a fuel for compression ignition engines that is made from vegetable oils or waste fats and oils that have been esterified. It can be burned in diesel generators and turbines, but its use for power generation has been limited thus far because of its high cost. Under this project, it will be determined if bio-diesel and non-esterified BDOs are viable fuels for turbines that generate electricity (turbo-generators). For purposes of this project, BDOs will include crude vegetable oils (such as soybean oil), lower cost products from the vegetable oil industry (such as black oil and acid oil), recycled products from the rendering industry (such as recycled restaurant grease) and bio-diesel (if proposed federal subsidies are adopted that make bio-diesel cost

competitive with non-esterified oils). This project will also consider blending of BDOs with diesel fuels to produce lower cost turbine fuels.

Total cost of the project is $414,681, which includes an RDF grant of $299,284. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received the high scores in several of the secondary criteria. This proposal demonstrated a good approach, and follows on work to existing research and development. There is also good cost-sharing indicating a high level of interest and commitment. AURI and the Minnesota Soybean Research Council are providing additional funds, and the UMN is providing in-kind contributions as well.

Proposal: Development of a Biomass Fueled Stirling Engine for Combined Heat and Power Production (RD-110)
Proposer: Iowa State University
Overall Rank: 8
Technology Rank: 2
Total Score (out of 490): 306
Preferences Received: None

Funding requested: $405,000

This project seeks to integrate biomass conversion with Stirling engine technology into a distributed energy system. A Stirling engine converts an external source of heat into mechanical energy. The Stirling engine offers an opportunity to utilize biomass fuels that are currently unusable by combustion turbines and fuel cells or even internal combustion engines. This fuel flexibility is realized because the Stirling engine operates on an external or indirect source of heat, in contrast to directly heated technologies.

The objectives of this project are to demonstrate the operation of a 55 kW Stirling engine and assess the technical and economic parameters key to the widespread implementation of the technology. Although biomass conversion technology and Stirling engine technology are both proven concepts, a system integrating the two concepts is not commercially available. This project will integrate the two concepts to gain the technical and economic understanding of the issues needed to advance the system to commercial viability. The successful deployment of biomass-fueled Stirling engine distribution systems would be attractive to numerous organizations including municipalities, utilities, and remote power applications (distributed generation applications). However, it is anticipated that the initial application of this technology would be with agricultural processing and industrial companies who generate reasonable quantities of waste materials that have little or negative economic value.

Iowa State University will partner with Cargill Inc. and STM Power, Inc. to develop, operate, and assess the biomass-fueled Stirling engine concept. STM Power, a Stirling engine manufacturer, will work with the Iowa State University research team to procure, install, and operate a Stirling engine at the Iowa Energy Center's Biomass Energy Conversion (BECON) facility. Cargill will undertake a technical and economic analysis that will provide a design tool, an economic analysis tool, and a risk assessment tool for implementing this technology. This project will build on related work at Iowa State University, funded by the Iowa Biotechnology Byproducts consortium (BBC), that is establishing critical operating parameters for

the successful integration of a biomass thermal conversion system with a Stirling engine generator.

Total cost of the project is $520,900, which includes an RDF grant of $405,000. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This proposal builds on currently funded R&D, proving the application at a larger scale. This project has both private sector and manufacturer support, and has an experienced team. The project uses the latest engine technology developed by STM Power.

Proposal: A New Method for the Production of Hydrogen and Bioethanol/Biomethanol (RD-22)
Proposer: Energy Conversion Devices
Overall Rank: 16
Technology Rank: 3
Total Score (out of 490): 292
Preferences Received: None

Funding requested: $900,000

This project intends to research a new process for reforming renewable fuels, such as bioethanol and biomethanol to produce hydrogen gas that can be used to operate fuel cells or gas turbines for the generation of electricity. The proposed process includes alkaline materials (OH) as a reactant in the biofuel reformation system. The reformation of alcohols in an alkaline environment is potentially simpler, and can be significantly cheaper and cleaner than the standard steam reformation of these fuels. Some preliminary work in laboratories at Energy Conversion Devices Inc. (ECD) has demonstrated that the reformation of bioethanol and biomethanol in an alkaline environment to produce hydrogen could occur at temperatures as low as room temperature. This work was recently awarded a U.S. Patent in the standard existing reformers.

The goal of the proposed research project is to demonstrate at the end of two years time the ability to operate a prototype bioethanol/biomethanol reformer based on the proposed concept. Such a reformer could be used to provide hydrogen fuel to operate fuel cells or to operate gas turbines for the purpose of electrical generation. To achieve this goal the project will be divided into four categories. Two categories will focus on research to better understand the mechanisms of the reaction process and the parameters controlling its rate and efficiency. The last phase of the program will focus on economic evaluation of the proposed reformer and comparison to alternative technologies. The successful operation of the demonstration unit and showing positive results from the economic analysis will determine the overall success of the project.

Total project cost is $2,669,556, which includes a grant request of $900,000. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This proposal represents fundamental research with the potential to reduce hydrogen production costs. The

project includes an experienced team with manufacturing capability, and is taking advantage of leveraging funds by real cost-sharing.

TAB 2D WIND RESEARCH AND DEVELOPMENT

Proposal: Analysis and Development of Advanced Methods for Reducing Uncertainty in Wind Power Project Estimates (RD-87)
Proposer: Global Energy Concepts, LLC
Overall Rank: 12
Technology Rank: 1
Total Score (out of 490): 296
Preferences Received: Minnesota R&D institution/company

Funding requested: $370,000

Global Energy Concepts, LLC (GEC) and WindLogics, Inc., a Minnesota Company, propose to perform complementary research into reducing two of the major sources of uncertainty in energy estimates: uncertainty in site-wide estimates of energy production resulting from limited or low-quality sources of data, and uncertainty in long-term mean wind speeds resulting from inadequate statistical techniques or poor long-term reference sources. These two lines of research will benefit from a common underlying source of data and shared resources and methodologies.

Currently, uncertainty in long-term energy estimates is typically approximately 15% - 20% at a 95% confidence level. Uncertainties of this size are problematic to wind project investors, who are forced to either absorb an uncomfortable amount of risk and/or finance projects at rates that are unfavorable to project developers. This in turn inflates the cost of wind energy. Collection of additional data to reduce uncertainty is also unpalatable to project developers, who are frequently unwilling or unable to spend the time and money required to directly measure sufficient high-quality data to accurately characterize the wind speeds at a site. In addition, it is not feasible to collect data for a period of time comparable to the lifespan of a wind energy project, so assumptions or adjustments must be made to estimate the long-term winds that would be experienced by the site. The objective of the proposed research is to evaluate advanced statistical tools and models to reduce these uncertainties and evaluate the cost effectiveness of these advanced tools and methods.

This work will be of critical interest to wind project developers seeking to reduce the cost of capital (and therefore cost of energy) while minimizing upfront development costs. Major wind developers, including Northern Alternative Energy, FPL Energy, General Electric, and Zilkha Renewable Energy have expressed strong

support for this effort and several have agreed to supply highly confidential wind and energy data to assist with the process.

Total cost of the project and grant request is $370,000. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received very high scores in several of the secondary criteria. The need for this R&D has been recognized by industry and NREL, but is currently not being funded. The team members are national leaders in the wind energy technology and resource assessment fields. This research has a real potential to reduce costs for future wind projects in Minnesota. Validation of the model's capabilities and cost effectiveness could result in potential large business opportunities for a MN firm in national and international markets. Global Energy Concepts received funding in the first cycle to develop advanced methods for development of wind turbine models for control design (CW02).

Proposal: Utility-scale Wind Energy Forecasting System (RD-57)
Proposer: WindLogics, Inc
Overall Rank: 23
Technology Rank: 2
Total Score (out of 490): 268
Preferences Received: Minnesota R&D institution/company

Funding requested: $997,000

The goal of this project is to define, design, build and demonstrate a complete wind power forecasting system (both load-following and unit commitment time scales) for use by Xcel Energy system operators. A key objective will be to optimize the way wind forecast information is integrated into the control room environment, and to evaluate the impact of the wind forecast on control room operations.

Commercial wind power development at Buffalo Ridge and other sites within the Northern States Power (NSP)/Xcel Energy service area is currently projected to grow to a point where wind generation will no longer be a negligible fraction of the regional electric energy supply. Xcel Energy system operators will require accurate wind estimates, both in the operations scheduling and real-time operations time frames to deal with a variety of issues around meeting energy demands of customers. Variability in the wind resource makes it challenging to accurately estimate future wind power forecasts increasingly important as wind energy market penetration increases.

WindLogics, in conjunction with Everex, is currently under contract to deliver Xcel Energy a thorough technical and economic evaluation of the effects of up to 1500 MWs of wind generation on the operation of the Xcel Energy NSP control area in the year 2010. Against a projected peak demand of 10,000 MWs, that amount of wind generation would represent one of the highest penetration ratios of any North American control area. The next logical step is to develop a real-time system to forecast wind energy over all wind plants located within the entire control area. Attempting wind plant forecasting is not new, but it has not been developed with utility-scale implementation in mind. Since it is very likely that individual large wind plants in the NSP/Xcel Energy service area will be separated by hundreds of miles, it is important to have a system in place that can accurately predict how this geographical dispersion affects the aggregate output of the individual wind generation facilities.

Total project cost is $1,585,600, which includes a grant request of $997,000, and nearly $600,000 in existing technology and support services supplied by

WindLogics. The project achieved the highest scores possible on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This project holds the potential to significantly increase the value of wind projects to Xcel Energy and other market participants. The project fits well as a logical advance in national research and development activities, but is not duplicative or likely to be funded from other sources. In addition, the research team identified are nationally recognized experts with the proper skill mix and knowledge base.

Proposal: Clipper C-93 "Liberty" Turbine Prototype (RD-37)
Proposer: Clipper Windpower, Inc.
Overall Rank: 28
Technology Rank: 5
Total Score (out of 490): 263
Preferences Received: Minnesota R& D Iistitution/company

Funding requested: $1,000,000

The goal of this project is to advance the application of a new type of wind turbine in a commercial context where there are proven wind resources and measurable power out-take that will demonstrate proof of concept and commercial viability. The Clipper C-93 turbine design is the result of a Department of Energy program established to increase a Low Wind Speed Turbine. The purpose of the program is to increase the deployment range to low wind speed sites that have access to more transmission capacity. A C-93 will be located in Jackson County, Minnesota. The C-93 is a 2.5 MW turbine generator system. It is a 3 bladed, horizontal axis, upwind turbine. The blades are specially designed so that it will enable the turbine system to perform in lower wind regimes than that accessible by current technology. The turbine system also includes major innovations in many other areas of wind turbine design. Turbine performance will be monitored as well through a cooperative arrangement with NREL.

Clipper Windpower, Inc. will partner with Fagan, Inc., a Minnesota based engineering company, to support the development of the C-93 by testing the prototype in field conditions leading to future commercial applications.

Project costs total $1,431,000, which includes a grant request for $1,000,000. The project achieved high scores on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This project builds on engineering studies and component testing funded by the Department of Energy and the National Wind Technology Center. The principle staff at Clipper Windpower, Inc. have demonstrated a good track record in designing, developing and operating wind power plants. The Low Wind Speed Technology, if successful, could substantially reduce the cost of wind energy.

TAB 2E HYBRID RESEARCH AND DEVELOPMENT

Proposal: An Economic Study of "Environmentally Friendly Co-Generation" Utilizing Renewable Energy (RD-69)
Proposer: Agricultural Utilization Research Institute (AURI)
Overall Rank: 42
Technology Rank: 1
Total Score (out of 490): 218
Preferences Received: Minnesota R&D institution/company

Funding requested: $760,000

AURI, together with other participants, will conduct "An Economic Study of Environmentally Friendly Co-Generation Utilizing Renewable Energy." This research project will be conducted in two phases to assess the economic feasibility of coupling biodiesel and wind generation systems to improve the economic benefits and reliability of wind-powered electrical generation. This project will also examine the factors necessary to provide reliable or "firming" power at less than the rated capacity of the wind generation site to supplement the wind generated electric capacity. If the concept of firming wind power with biodiesel provides economically feasible at a less than rated capacity, then optimum levels would be addressed. It is crucial that this research utilize the most efficient wind generation equipment currently available to make this determination.

The project will be conducted in two phases. The first phase consists of a feasibility study to provide an economic assessment of co-generation utilizing biofuels and wind generation and the opportunities to complement these renewable energy sources. The second phase involves a research project to gather information in an actual field performance of wind and biodiesel electrical generation.

Total cost of the project is $830,000 which includes a $760,000 grant request. The project achieved high scores on all three primary criteria (Barriers to Market Deployment, Soundness of Technical Basis, Assumptions and Approach and Appropriate RDF Role vis-à-vis Degree to Technical Duplication) and received high scores in several of the secondary criteria. This study will validate economic theory with an actual planned field test. The project is keeping costs down by renting a Caterpillar diesel engine and involving Caterpillar staff. This project will look at the whole system, including equipment, fuels, emissions, economics, etc.

TAB 3A FINAL REPORT ON THE EVALUATION OF ENERGY PRODUCTION PROPOSALS

The following material is an excerpt of PERI's material provided to the Board. Exhibits are omitted from this filing but will be made available.

Final Report on the Evaluation of RDF Energy Production Proposals

Princeton Energy Resources International (PERI) received evaluation copies of proposals for grants to be awarded under the Energy Production part of Xcel Energy's Renewable Development Fund. This document provides a final report on processes used and results generated in the evaluation of those proposals.

The evaluation has been conducted according to the following steps:

Step 1:

When PERI was retained by the Board to assist in the Energy Production proposal evaluations, in addition to the previously awarded R&D Proposal evaluation contract, the first step was to develop a scoring sheet, to implement the scoring criteria described in the RFP. That scoring sheet is provided in Exhibit 1.

Step 2:

Upon receipt of the proposals, PERI assembled the following team of reviewers:

Tom Schweizer, review coordinator and wind reviewer
Larry Joseph, biomass reviewer
Nick Cheremisinoff, biomass reviewer
Cliff Carwile, solar and hydro reviewer.

The team met to discuss overall approach and processes for completing the detailed reviews. Significant time was spent on the calculation of the Total Resource Cost, as described in the RFP. Proposals were distributed among the review team and deadlines assigned.

Step 3:

The team, working with the RDF Board, identified "duplicate" projects where only small differences (sometimes amounting to only an applicant name change) existed. It was agreed that PERI would only evaluate (and bill Xcel) those duplicate projects

to the extent that they contained changes that would affect their score. While many of the wind projects were for all practical purposes identical, a number of seemingly identical biomass digester projects did require analysis, because they were structured with digesters sized to match the farm that would be hosting the project.

Step 4:

Once all completed reviews were in, and scoring spreadsheets compiled, Tom Schweizer began the job of comparing the various review efforts to ensure consistency and to remove any technology bias on the part of the reviewer. He reviewed ALL proposals, and compared his judgments with the scoring of his colleagues. In some cases, he chose to change scores, to better match the way in which he had scored the 20 wind proposals (i.e., what expectations would yield which scores). In many cases, his changes were discussed with the original reviewer. In no case did he adjust the technology experts' analysis of a technology's viability, performance, costs, etc.

Step 5:

PERI then created a master scoring spreadsheet that linked to the 48 individual spreadsheets. When a change was made to a particular project's score, the change was reflected in the master spreadsheet. A printout of the primary elements of that spreadsheet is shown in Exhibit 2. Additional data is contained in that spreadsheet, although not shown in Exhibit 2.

Step 6:

The results were sorted by their score, and a scatter plot of those scores was prepared (Exhibit 3). Notice that the scores range from nearly zero to about 400. The maximum possible score was 460, as outlined in the RFP. The exhibit shows several plateaus representing projects with essentially identical scores. Those are generally for the "duplicate" projects, where the only difference might be in the Total Resource Cost. Exhibit 4 shows the same scatter plot and a table of these projects, with the duplicate projects removed.

Step 7:

The matrix of scores (with duplicates removed) was then also sorted by technology. Because the RDF Board may well want to assure technological diversity in its awards, this sort is seen as being important. The sort yielded the scatter plot and table of these projects shown in Exhibit 5. PERI also developed qualitative

descriptors of each project, in the form of strengths and weaknesses. In addition, an assessment of project novelty and project risk was prepared. Exhibit 5 also shows boxes that identify the projects that were selected, in each technology area, by the Board.

In Exhibit 6, we present a table of the projects identified in Exhibit 5, including all duplicate projects.

Step 8:

Exhibit 7 shows the first and second tier of Energy Production projects recommended by PERI, including an assessment of the Pros and Cons of each, as drawn from the qualitative descriptors, the requested funding amount, starting with the highest scoring proposal. Both tiers total over $21 million, which is needless-to-say, well above the available funding level, but PERI is confident that it has included all of the most-worthy projects within this list.

Step 9:

PERI transmitted a preliminary report to the Board for consideration and copies of each individual evaluation spreadsheets were available for use in the project selection meetings, on May 20-21. PERI's recommended projects, as well as others advanced by members of the Xcel RDF Board, were discussed in detail during these and subsequent meetings. The Xcel RDF Board decided upon the final proposal selections and relayed these decisions to PERI for inclusion in this final report. Tables 1 and 2 on the following pages list the projects selected from the Energy Production proposals and provide a summary of these projects.

TAB 3B FINAL REPORT ON THE EVALUATION OF RDF RESEARCH AND DEVELOPMENT PROPOSALS

The following material is an excerpt of PERI's material provided to the Board. Exhibits are omitted from this filing but will be made available.

Evaluation of RDF R&D Proposals

Princeton Energy Resources International (PERI) received 110 evaluation copies of proposals for grants to be awarded under the Research & Development (R&D) part of Xcel Energy's Renewable Development Fund procurement, released December 30, 2003. This document provides the final report on processes used and results generated in the evaluation of those proposals. Of the 110 R&D proposals received, 6 were switched to Energy Production (EP) proposals, and 3 were rejected because they did not meet minimum RFP submission requirements. Of the 101 resulting proposals that were scored, 41 were in the Biomass category, 12 were in the Biofuels category, 23 were in the wind category, 17 were in the PV category, and 8 were in the "other" (sometimes referred to as the "hybrid") category.

The evaluation has been conducted according to the following steps:

Step 1:

When PERI was retained by the Board to assist in the R&D proposal evaluations, the first step was to develop a scoring sheet, to implement the scoring criteria described in the RFP. That blank scoring sheet is provided in a separate file, written in Microsoft Excel: Blank RDF R&D Score Sheet.xls.

Step 2:

Upon receipt of the proposals, PERI assembled the following team of reviewers:

Joe Cohen, review coordinator and wind and "other" reviewer
Dan Ancona, wind and "other" reviewer
John Rezaiyan, Biomass and biofuel reviewer
Cliff Carwile, solar thermal reviewer
Randy Johnson, photovoltaic technology reviewer
Tom Schweizer, wind and "other" reviewer

The team first met to discuss overall approach and processes for completing the detailed scoring sheet. Except for Mr. Cohen and Mr. Ancona, reviewers were

responsible for all proposals in their respective categories. This eliminated differences in scores due to different interpretation and application of the various criteria score descriptors within each group of technology proposal reviews. Mr. Cohen and Ancona worked cooperatively on the wind evaluations, with input from Dr. Schweizer. In addition to the initial meeting, to encourage standardization of review results, updated interpretations of criteria scoring descriptors and approaches were developed by Mr. Cohen and individual evaluators on an ongoing basis and immediately disseminated to the entire group.

Step 3:

Once all completed reviews were in, and scoring spreadsheets compiled, Mr. Cohen began the job of comparing the various review efforts to ensure consistency and to remove any technology bias on the part of the reviewer. Mr. Cohen worked with each reviewer to try to normalize differences in reviewer interpretation and application of criteria. Still, there is some unavoidable bias due to different interpretations because the evaluation of the criteria can be somewhat different for different technologies (e.g., evaluating a project that advances the assessment of a renewable resource can not be evaluated the same way as a project that aims to make cost or efficiency improvements in a specific technology).

Step 4:

PERI input the scoring data from each review to the probabilistic proposal evaluation model, written in MS Excel with the add-on simulation software @RISK. After running the model, PERI produced a summary spreadsheet of statistical results for each proposal, and linked each of those to a master spreadsheet. Using this process, the master spreadsheet is automatically updated each time a change is made to any individual proposal evaluation model results sheet. Exhibit 1 is a list of all proposals in that master spreadsheet, ranked by their mean total score. The exhibit also gives a summary of each project, followed by project strengths and weaknesses. Exhibit 2 shows the same total mean scores in a simple scatter plot. The scores range from 0 to 328, with the maximum possible score being 490. A zero overall score represents a proposal that received a 0 score in one or more of the primary criteria.

Step 5:

Exhibit 3 shows the same ranking results (ranking by overall mean score) grouped by technology type. The exhibit also displays boxes that identify the projects that were selected, in each technology area, by the RDF Board. The choice of these was

made by the Board after considering of a number of proposals that PERI had recommended as well as others suggested by members of the board, based on the total score, the timing of the R&D results in the market, the technical risk of the proposal, and the potential economic benefits from the project. Since the overall score combines all of these elements, it is one measure of a risk-adjusted cost-benefit score itself. The number of contending proposals that PERI had recommended is listed below for each technology.

Technology	Number of Proposals	Total RDF Funding Requested ($M)
Biofuels	4	2.6
Biomass	10	6.0
Hybrids ("other")	4	3.0
Solar PV	7	6.9
Wind	11	8.7
Total	36	27.2

Exhibit 4 lists the same data as Exhibit 3, except it is in tabular form (i.e., overall score rankings are grouped by technology as in Exhibit 3). It also contains the same qualitative project information as in Exhibit 1.

Step 6:

Because the RDF Board wanted to assure a diversity of technologies, risk and return levels, and timing of market impacts in its project portfolio selection, PERI used several different quantitative indicators for these portfolio characteristics. Exhibit 5 lists each of these characteristics by technology type. A definition for each characteristic is provided at the top of each exhibit page. In general, the projects identified for further consideration by the Board are those at the top of the overall ranking list (reflecting the fact that the overall score contains an evaluation of all of the individual portfolio characteristics). However, there are instances where the data in Exhibit 5 was useful to further distinguish differences between projects. First, it was helpful in deciding between proposals within the groups highlighted for further consideration. Second, as shown in the exhibit (especially PV) it was useful in identifying proposals whose elimination or inclusion was not obvious from the overall score alone. The following table demonstrates this for the PV proposals from the highest overall score to the lowest scoring proposal identified for further consideration.

PV Proposal	Timing of Market Impacts	Risk (Technical Risk)	Benefit (Economic Development Impact)	Selection Recommendation
RD-93	Short-term	H	H	Recommend
RD-78	Short-term	L	H	Recommend
RD-107	Mid-term	L	H	Recommend
RD-95	Mid-term	L	L	Eliminate
RD-83	Long-term	H	L	Eliminate
RD-89	Mid-term	H	M	Recommend
RD-11	Short-term	L	L	Recommend
RD-33	Long-term	H	L	Eliminate
RD-90	Short-term	L	L	Recommend
RD-98	Short-term	H	M	Recommend
RD-25	Mid-term	H	L-M	Eliminate

Finally, Exhibit 6 is the same information as in Exhibit 5, but only for the recommended set of proposals. The data are grouped by technology type.

Project Selection

PERI transmitted a preliminary report to the Board for consideration and copies of each individual evaluation spreadsheets were available for use in the project selection meetings, on May 20-21. PERI's recommended projects, as well as others advanced by members of the Xcel RDF Board, were discussed in detail during these and subsequent meetings. The Xcel RDF Board decided upon the final proposal selections and relayed these decisions to PERI for inclusion in this final report. Table 1 on the following page lists the projects selected from the R&D proposals.

Exhibit 7 lists all of the R&D proposals evaluated, listed in order of their proposal number (RD-001 to RD-110). Exhibit 8 is a table of all of the selected R&D proposals, with the project summary for each selected proposal given.

TAB 4A ENERGY PRODUCTION PROPOSAL SORTED BY SCORE (HIGHEST TO LOWEST)

No.	Project Name	Technology	Grand Total-Weighted Score	Size of Project (kW)	Amount Requested $1000
EP-59	Dells Hydro Plant Efficiency & Capacity Upgrade	Hydroelectric	348	5,800	2000
EP-44	Biomass Cogeneration Demonstration Plant at Central MN Ethanol Cooperative	Biomass	278	959	2000
EP-25	Southeast Power Plant Biomass Conversion	Biomass	274	3,500	2000
EP-49	Rapids Energy Center Biomass Steam Supply Refurbishment Steam Accumulator Addition & Wood Handling Upgrades	Biomass	273	2,900	1800
EP-29	Ripley Dairy	Biomass	262	400	399
EP-42	St. Croix 3MW Biomass Power Generation	Biomass	256	3,000	2000
EP-34	Lower St. Anthony Falls Hydroelectric Project	Hydroelectric	252	8,980	2000
EP-50	Little Falls Hydroelectric Upgrade	Hydroelectric	250	1,600	800
EP-51	Diamond K & Greden's Ponderosa Dairy Digester for Energy Production	Biomass	248	261	937
EP-95	Koda 10MW Biomass CHP	Biomass	231	11,215	2000
EP-39	St. Olaf College - Wind Self-generation	Wind	230	1,650	1500
EP-24	Wayzata Public School Wind Generation Project	Wind	229	1,650	1100
EP-30	Albert Lea Schools Wind Energy	Wind	223	1,650	1600
EP-26	Hilltop Farm Cooperative Wind Power Project	Wind	220	1,500	1200
EP-16	Salty Dog-I	Wind	212	1,650	311
EP-17	Breezy Bucks-I	c	212	1,650	311
EP-18	Salty Dog-II	c	212	1,650	311
EP-19	Wally's Wind Farm	c	212	1,650	311
EP-20	Windy Dog-I	c	212	1,650	311
EP-21	Roadrunner-I	c	212	1,650	311
EP-22	Breezy Bucks-II	c	212	1,650	311
EP-47	Zumbro Crest Wind Energy Conversion	Wind	212	1,650	1710
EP-15	Energy for Education (Triton)	Wind	206	1,650	1586
EP-67	Northern Star Biogas Utilization	Biomass	205	55	147

EP-31	Clark's Grove Substation Wind Turbine (CW Energy)	Wind	196	1,650	1384
EP-37	Minnesota Farmer's Wind Advantage	Wind	193	300	745
EP-81	Joal I	Wind	192	1,250	237
EP-82	Joal II	c	192	1,250	237
EP-83	Joal III	c	192	1,250	237
EP-84	South Wind Energy	c	192	1,250	237
EP-85	3 Wing Energy	c	192	1,250	237
EP-86	High Tower	c	192	1,250	237
EP-87	Free Energy	c	192	1,250	237
EP-88	Kramer I	c	192	1,250	237
EP-89	Kramer II	c	192	1,250	237
EP-90	Kramer III	c	192	1,250	237
EP-91	Kramer IV	c	192	1,250	237
EP-92	Kramer V	c	192	1,250	237
EP-93	Kramer VI	c	192	1,250	237
EP-01	Bull Wind I	Wind	192	1,250	237
EP-02	Bull Wind II	c	192	1,250	237
EP-03	Bull Wind III	c	192	1,250	237
EP-04	Bull Wind IV	c	192	1,250	237
EP-05	Bull Wind V	c	192	1,250	237
EP-06	Bull Wind VI	c	192	1,250	237
EP-28	Transforming Minnesota Markets for Small Wind	Wind	178	1,059	2000
EP-07	Valley View Wind Farm (Talsma)	Wind	175	1,650	1000
EP-08	Kathy Peterson/Krysta JT LLC	c	175	1,650	1000
EP-09	Jenna M.T.	c	175	1,650	1000
EP-10	Theresa M.T.	c	175	1,650	1000
EP-36	Lower Sioux BioDiesel Energy Project	Biofuel	174	2,000	2000
EP-13	Cass Forest Products Biomass Gasification Power Plant	Biomass	173	500	1500
EP-63	"Demonstration Plant for Ethanol, Power & Steam from Corn Stover"	Biofuel	165	4,400	2000
EP-23	Harrison Ethanol Integrated Facility	Biofuel	147	70	2000
EP-53	Large Dairy Digester	Biomass	146	200	812
EP-96	Clear Skies- Switched from RD-2		140	2,000	747
EP-97	Switched from RD-3		140	2,000	747
EP-98	Switched from RD-4		140	2,000	747
EP-99	Switched from RD-5		140	2,000	747
EP-100	Switched from RD-6		140	2,000	747
EP-43	Mesaba Energy Project	Other (coal)	136	450,000	10000

EP-33	5MW Saint Paul Biomass Project	Biomass	126	5,000	1650
EP-73	Suring Community Dairy	Biomass	125	360	871
EP-62	Saemrow Dairy Digester for Energy Production	Biomass	120	116	496
EP-70	Tidy View Dairy	Biomass	119	360	813
EP-78	Omro Dairy	Biomass	119	360	813
EP-55	Fair Oaks Dairy #4	Biomass	119	700	1407
EP-69	Fair Oaks Dairy #3	Biomass	119	700	1407
EP-71	Fair Oaks Dairy #2	Biomass	119	700	1407
EP-74	Fair Oaks Dairy #1	Biomass	119	700	1407
EP-77	Den Dulk Dairy	Biomass	119	700	1407
EP-75	Bridgewater Dairy	Biomass	119	600	1254
EP-61	Green Valley Dairy	Biomass	113	480	1042
EP-54	Meadow Rock Dairy	Biomass	113	560	1170
EP-72	Cross Roads Dairy	Biomass	113	300	772
EP-79	Pagel's Ponderosa Dairy	Biomass	113	280	788
EP-56	Central Sands	Biomass	103	1,450	2797
EP-38	John A. Johnson Wind Generator Project (Saint Paul)	Wind	101	10	150
EP-40	Rural Residential Energy Generation Project (Flower)	Wind	98	30	140
EP-58	Midway Biomass Combined Heat & Power Project	Biomass	97	12,000	2000
EP-76	Dairy Dreams	Biomass	96	280	788
EP-80	Sandy Ridge Dairy	Biomass	95	160	707
EP-48	Biomass Energy Technology Start-up	Biomass	95	1,000	2000
EP-66	The Wind Turbine Company	Wind	82	1,500	1500
EP-52	Energy Recovery Group	Biomass	80	23	131
EP-32	Shane's Wind Machine LLC	Wind	72	1,650	117
EP-14	Gamma Ventures	Wind	67	2,000	2000
EP-35	Anaerobic Digestion of Dairy and Swine Manure of Energy Production	Biomass	66	30	1336
EP-46	Solar Power Promotes Sustainability Progress	Solar PV	57	186	941
EP-11	Mark Peterson/Mark JP LLC	Wind	47	1,650	175
EP-12	Gary J.T.	c	47	1,650	175
EP-68	Powerstreams Solar Thermal Power Plant	Other (solar thermal)	35	2,200	2000
EP-94	GAA Noodinoke	Wind	34	1,500	1000
EP-57	Minnesota Solar Schools	Solar PV	27	25	210

* “c” refers to identical or “copy” proposals

TAB 4B ENERGY PRODUCTION PROPOSALS SORTED BY TECHNOLOGY AND SCORE

No.	Project Name	Technology	Grand Total-Weighted Score	Size of Project (kW)	Amount Requested $1000
EP-36	Lower Sioux BioDiesel Energy Project	Biofuel	174	2,000.0	2000
EP-44	Biomass Cogeneration Demonstration Plant at Central MN Ethanol Cooperative	Biomass	278	959.0	2000
EP-25	Southeast Power Plant Biomass Conversion	Biomass	274	3,500.0	2000
EP-49	Rapids Energy Center Biomass Steam Supply Refurbishment Steam Accumulator Addition & Wood Handling Upgrades	Biomass	273	2,900.0	1800
EP-29	Ripley Dairy	Biomass	262	400.0	399
EP-42	3MW Biomass Power Generation	Biomass	256	3,000.0	2000
EP-51	Diamond K & Greden's Ponderosa Dairy Digester for Energy Production	Biomass	248	261.0	937
EP-95	Koda 10MW Biomass CHP	Biomass	231	11,215.0	2000
EP-67	Northern Star Biogas utilization	Biomass	205	55.0	147
EP-13	Cass Forest Products Biomass Gasification Power Plant	Biomass	173	500.0	1500
EP-63	"Demonstration Plant for Ethanol, Power & Steam from Corn Stover"	Biofuel	165	4,400.0	2000
EP-23	Harrison Ethanol Integrated Facility	Biofuel	147	70.0	2000
EP-53	Large Dairy Digester	Biomass	146	200.0	812
EP-33	5MW Saint Paul Biomass Project	Biomass	126	5,000.0	1650
EP-73	Suring Community Dairy (and copies)	Biomass	125	360.0	871
EP-62	Saemrow Dairy Digester for Energy Production	Biomass	120	116.0	496
EP-56	Central Sands	Biomass	103	1,450.0	2797
EP-58	Midway Biomass Combined Heat & Power Project	Biomass	97	12,000.0	2000
EP-48	Biomass Energy Technology Start-up	Biomass	95	1,000.0	2000
EP-52	Energy Recovery Group	Biomass	80	22.5	131
EP-35	Anaerobic Digestion of Dairy and Swine Manure of Energy Production	Biomass	66	30.0	1336

EP-59	Dells Hydro Plant Efficiency & Capacity Upgrade	Hydroelectric	348	5,800.0	2000
EP-34	Lower St. Anthony Falls Hydroelectric Project	Hydroelectric	252	8,980.0	2000
EP-50	Little Falls Hydroelectric Upgrade	Hydroelectric	250	1,600.0	800
EP-43	Mesaba Energy Project	Other (coal)	136	450,000.0	10000
EP-46	Solar Power Promotes Sustainability Progress	Solar PV	57	186.5	941
EP-68	Powerstreams Solar Thermal Power Plant	Other (solar thermal)	35	2,200.0	2000
EP-57	Minnesota Solar Schools	Solar PV	27	25.0	210
EP-47	Zumbro Crest Wind Energy Conversion	Wind	244	1,650.0	1710
EP-39	St. Olaf College - Wind Self-generation	Wind	230	1,650.0	1500
EP-24	Wayzata Public School Wind Generation Project	Wind	229	1,650.0	1100
EP-30	Albert Lea Schools Wind Energy	Wind	223	1,650.0	1600
EP-26	Hilltop Farm Cooperative Wind Power Project	Wind	220	1,500.0	1200
EP-16	Salty Dog-I (and copies)	Wind	212	1,650.0	311
EP-15	Energy for Education (Triton)	Wind	206	1,650.0	1586
EP-31	Clark's Grove Substation Wind Turbine (CW Energy)	Wind	196	1,650.0	1384
EP-37	Minnesota Farmer's Wind Advantage	Wind	193	300.0	745
EP-81	Joal I (and copies)	Wind	192	1,250.0	237
EP-01	Bull Wind I (and copies)	Wind	192	1,250.0	237
EP-28	Transforming Minnesota Markets for Small Wind	Wind	178	1,059	2000
EP-07	Valley View Wind Farm (Talsma) (and copies)	Wind	175	1,650.0	1000
EP-38	John A. Johnson Wind Generator Project (Saint Paul)	Wind	101	10.0	150
EP-40	Rural Residential Energy Generation Project (Flower)	Wind	98	30.0	140
EP-66	The Wind Turbine Company	Wind	82	1,500.0	1500
EP-32	Shane's Wind Machine LLC	Wind	72	1,650.0	117
EP-14	Gamma Ventures	Wind	67	2,000.0	2000
EP-11	Mark Peterson/Mark JP LLC (and copy)	Wind	47	1,650.0	175
EP-94	GAA Noodinoke	Wind	34	1,500.0	1000

TAB 4C RESEARCH AND DEVELOPMENT PROPOSALS SORTED BY SCORE

Label	Project Title	Company	PERI- Technology Type	Grand Total-Mean
RD-27	Feasibility of Commercially Growing Miscanthus in Minnesota	Rural Advantage/ Blue Earth River Basin Initiative	Biomass	328.38
RD-38	Direct Hydrogen Production form Biomass gasifier Using Hydrogen-Selective Membrane	Gas Technology Institute	Biomass	317.58
RD-93	Inkjet Direct-Write Solar Cells	NREL	Solar PV	314.61
RD-78	Flexible photovoltaic cell for cost-effective electricity generation	InterPhases Research	Solar PV	311.48
RD-29	Biomass-Derived Fuels for Turbo-Generators	University of Minnesota	Biofuel	307.50
RD-94	Identifying Effective Biomass Strategies: Quantifying Minnesota's Resources and Evaluating Future Opportunities	Center for Energy & Environment	Biomass	307.38
RD-110		Center for Sustainable Environmental Technologies (CSET), Iowa State U.	Biofuel	306.07
RD-56	Generating Electricity with Biomass Fuels at Ethanol Plants	University of Minnesota	Biomass	301.75
RD-72	High Performance Biogas Treating	Production Specialties, Inc.	Biomass	301.42
RD-61	Design of a system for efficient procurement and handling of alternative biomass for power generation in the twin cities metropolitan area	The Green Institute	Biomass	300.85
RD-82	Plasma Gasification of Corn Stover	Phoenix Solutions Co.	Biomass	297.60
RD-87	Analysis & Development of Advanced Methods for Reducing Uncertainty in Wind Power Project Energy Estimates	Global Energy Concepts, LLC	Wind	295.77
RD-34	Conversion of Biomass into Energy and Compost through Sequential Batch Anaerobic Composting	University of Florida	Biomass	294.72
RD-26	Coaltec Energy - West Michigan Turkey Biogasifier	Coaltec Energy USA, Inc.	Biomass	294.59
RD-102	Biomass Digestion Pilot Plant: The Anaerobic Pump for Food Manufacturing	Technology Matriz Corporation	Biomass	292.46
RD-22	A New Method for the Production of Hydrogen from Bioethanol/Biomethanol	Energy Conversion Devices, Inc.	Biofuel	291.86
RD-107	Low Band Gap Material for Organic Photovoltaics	National Renewable Energy Lab	Solar PV	291.28

RD-63	Biomass Energy Projects: Applied Research to Increase Energy Yields Lower Production costs, and enhance economic returns form value	John Christopher Madole Associates, Inc.	Biomass	286.60
RD-50	Improving the Efficiency of Planting, Tending & Harvesting Farm-Grown Trees	Energy Performance Systems, Inc.	Biomass	283.79
RD-95	Crystal silicon films on template-coated glass for inexpensive photovoltaic power	National Renewable Energy Lab	Solar PV	283.23
RD-84	50kWe Modular Biopower System for Building Cooling, Heating, and Power Generation	Northland College	Biomass	281.32
RD-08	Yellow Grease	Western Colorado Power Co.	Biofuel	268.03
RD-57	Utility-scale Wind Energy Forecasting System - R&D Project	WIndLogics, Inc.	Wind	267.80
RD-80	"Wind-Vanadium Redox Battery Energy Storage System Integration & Demonstration in Minnesota"	Electric Power Research Institute	Wind	267.75
RD-12	Rotor Blade Ice Protection	Goodrich Corp	Wind	266.81
RD-40	Blandin Paper Biomass Microturbine Project	Energy & Environmental Research Center	Biomass	266.77
RD-83	"Offer to Join the Photovoltaic Innovation Partnership"	Electricity Innovation Institute	Solar PV	264.17
RD-37	Clipper C-93 "Liberty" Turbine Protoype	Clipper Windpower, Inc.	Wind	262.70
RD-55	Agricultural Biomass Collection Economics & Producer Opportunities	Agricultural Utilization Research Institute	Biomass	258.40
RD-89	Inorganic-Organic Hybrid Nano-Structured Materials: A New Frontier for Photovoltaics	State University of New Jersey	Solar PV	258.04
RD-79	Methane Production via Anaerobic Digestion of Renewable Lignocellulosic Biomass	National Renewable Energy Laboratory	Biomass	251.11
RD-91	"Hydrogen Production & Storage of Wind Energy in Minnesota"	Electric Power Research Institute	Wind	250.34
RD-43	Supercritical Hydro Conversion of High-Moisture Biomass Streams to Power	University of North Dakota-EERC	Biomass	250.20
RD-07	Methane & Industrial Products from Waste Biomass	RDE Inc.	Biomass	248.42
RD-97	Optimizing sustainability, reliability and emissions from biomass energy production	Minergy Corporation	Biomass	236.07
RD-30	Electricity From Pulp Mill Biofuel	University of Minnesota	Biofuel	231.74
RD-77	Conversion of Biogas into Hydrogen for Fuel Cells	Argonne National Laboratory	Biomass	231.40
RD-35	Biomass-to-Hydrogen: Novel, Low-cost, Sorbent Process Integrating Gasification, Reforming & Purification	Western Research Institute	Biomass	226.86

RD-88	Novel, Low-Cost Gasification Process for Power Generation and Liquid Fuel Production	Western Research Institute	Biomass	226.44
RD-31	Energy from Corn Based Ethanol Oxidation Fuel Cells	University of Minnesota	Biofuel	220.91
RD-69	An Economic Study of "Environmentally Friendly Co-Generation" Utilizing renewable Energy	Agricultural Utilization Research Institute	Hybrid	218.28
RD-58	MN Advanced Wind Resource Assessment Program	Windustry	Wind	216.05
RD-99	Ethanol Fuel Cells Utilizing Solid Acid Electrolytes	California Institute of Technology	Biofuel	212.09
RD-10	Low Emissions Multi-Fuel Combustion Technology	Applied Plasma Technologies	Biomass	211.80
RD-39	Gasification of Biomass Feedstock in an Advanced Transport Reactor System to Produce Power	University of North Dakota-EERC	Biomass	211.77
RD-11	Investigating & Improving the Reliablity and Performance of Power Electronics for Photovoltaic Systems	South Dakota State University	Solar PV	211.45
RD-33	High Efficiency Photovoltaic Systems Based on Nanoscale Quantum Dot Arrays	National Renewable Energy Laboratory	Solar PV	208.61
RD-85	Advanced Fuel Cell Components for Operation using Biomass Generated Hydrogen & Other High Temperature Applications	Colorado School of Mines	Biomass	202.44
RD-90	Next Generation Technology for Solar Electric Power Generation	RWE Schott Solar, Inc.	Solar PV	201.23
RD-59	Power-fast Pyrolysis Biorefinery	Great Plains Institute for Sustainable Development	Biofuel	191.38
RD-52	A 100% Renewable Hybrid Wind & Biodiesel Energy System	University of Minnesota	Hybrid	190.75
RD-16	A Comprehensive System Solution for Highly Efficient Wind Power Generation	Eaton Corporation Innovation Center	Wind	186.81
RD-65	An Investigation of Seasonal Predictability of the Minnesota Wind Resource - R&D Project	WindLogics, Inc.	Wind	186.16
RD-18	Biomass Gasification for Minnesota's Forest Industry	University of North Dakota-EERC	Biomass	185.24
RD-47	Design, Fabrication, & Utilization of a Lifting Platform for Wind Turbine Installations	D.H. Blattner & Sons, Inc.	Wind	181.67
RD-98	"Liquid Cyclohexasilane Enabling Innovative Processing of Si-based Electronic Materials"	North Dakota State University	Solar PV	177.27
RD-36	Self-Erecting Tower with Steel Foundation	Minnesota Technology Advancement Group	Wind	176.83

RD-25	High Efficiency (>15%) Stable, Low Cost Thin Film Si Solar Cells	MVSystems Inc.	Solar PV	171.86
RD-104	Improved Economics of Electricity from Bio Oil: Utilization of Glycerol from Biodiesel Production	NREL	Biofuel	170.45
RD-105	Advanced Biomass Gasification Power System	Emery Energy Company, LLC	Biomass	164.81
RD-62	Willow Brush Biomass Plantation	Dakota Wood-Grinding, Inc.	Biomass	163.36
RD-53	Red Lake Renewable Energy Research & Development Project	Red Lake Band of Chippewa Indians	Hybrid	161.41
RD-96	Development of Key Design Criteria for IC Engines Fueled by Biomass Producer Gas	University of North Dakota	Biomass	161.26
RD-14	Engineering Development of a Liquid Piston Heat Engine for Electricity Generation		Biofuel	156.21
RD-13	Generation of Electricity from Wind Using Flexible Piezoeletric Materials	University of Minnesota	Wind	152.65
RD-66	Mithras Microturbine	Mithras Energy Systems	Biofuel	152.53
RD-45	Low-cost Cogeneration of Electricity from Biomass in an Integrated Ethanol Production Facility	University of North Dakota	Biofuel	151.75
RD-54	The Economic & Environmental Impacts of Harvesting & Processing Corn Stover as a Renewable Biomass	New Generation Energy Cooperative	Biomass	142.39
RD-100	Regional Biomass Energy Center	Ethos Energy	Biomass	138.30
RD-23	Photo-voltaic conversion of sunlight to hydrogen using the tandem Cell	Hydrogen Solar, LLC	Solar PV	135.84
RD-60	Clean Energy Resource Teams Project Development Assistance	The Minnesota Project	Wind	135.21
RD-32	Novel Cost-Effective Reliable Utility Interface of PV Systems Using a High Efficiency Multi-Port Converter	University of Minnesota	Solar PV	133.64
RD-51	Purifying Biogas for Fuel Cell Electricity Generation	University of Minnesota	Biomass	132.98
RD-86	Winds of Change: Providing Controller, Reliable Power from Wind through Compressed Air Energy Storage	Center for Energy & Environment	Hybrid	131.20
RD-92	Mass Manufacturing of Solar Photovoltaic to Reduce Costs	Colorado State University	Solar PV	120.08
RD-44	Oxygen-Blown Combustion of Coal-Biomass Blends for Emission-Free Heat & Power Production	University of North Dakota-EERC	Biomass	117.07
RD-73	COE Reductions through Active Control of Rotor Aerodynamics	Global Energy Concepts, LLC	Wind	110.42
RD-101	High Capacity Wind Turbines	Advan Tek International, LLC	Wind	109.48

RD-103	Investigation of Utility Scale Biomass Co-firing technology Commercialization through Optimized Pairing of Coal Fired Technologies with Pre-Commercial Biomass Technologies	Black & Veatch Corporation	Biomass	105.59
RD-64	Unlocking the Grid to Bring Renewable Energy to Market	HDR Engineering, Inc.	Wind	103.35
RD-42	Biomass to Energy Via Chemical-Looping Combustion	University of North Dakota-EERC	Biomass	102.14
RD-28	Using Agricultural Materials for Renewable Energy by Molten Salt Reforming	Lynntech, Inc.	Biomass	100.04
RD-68	Study of Stability Issues and Corrective Measures for Large-Scale Development of Wind Systems	University of Minnesota	Wind	99.34
RD-21	Wind Turbine Drive Train with Integrated Storage Capability	Global Energy Concepts, LLC	Wind	97.08
RD-17	"Ethanol-Solid Oxide Fuel Cell (SOFC) System Integration and Demonstration in Minnesota"	Electric Power Research Institute	Biofuel	93.56
RD-41	Critical Component Development for a Zeero-Emission Biomass-Coal Power Plant	University of North Dakota-EERC	Biomass	91.67
RD-81	Dynamic Balance of Wind Generation & load for wind Generation Expansion & Renewable Energy Use	Excel Engineering, Inc.	Wind	90.03
RD-20	Wind Turbine Controls: Developing and Valuing Advanced Approaches	Global Energy Concepts, LLC	Wind	87.72
RD-70	An Ethanol Reforming Fuel Cell-Solar Power Hybrid System	Genesis Fuel Tech, Inc.	Hybrid	85.22
RD-74	Integrated Blade Design for Wind Turbines	Global Energy Concepts, LLC	Wind	85.11
RD-106	Integrating Biomass with Compressed Air Energy Storage for Wind Shaping Applications	Ridge Energy Storage & Grid Services, LP	Hybrid	75.74
RD-01		Virginia Tech	Solar PV	59.30
RD-24		Ionicfusion Corp.	Solar PV	40.61
RD-76	Wind Monitoring, Power Assessment & Visualization from Tall Tower Observations	South Dakota State University	Wind	35.05
RD-71	Biomass-to-Electricity Acetylene Gasification Research & Development Project	Seidel research & Development Company, LLC	Biomass	34.96
RD-109		Georgia Institute of Technology	Biomass	33.54
RD-108	Development of Integrated Renewable Energy, Distributed Generation System for Residential Installation	Farmingdale State University	Hybrid	18.80

RD-75	Development of Firm Wind Energy for Distributed Applications: prototype Development	University of North Dakota	Wind	15.24
RD-19	Distributed Generation System Using Methanol Produced From Biogas Obtained from Manure Anaerobic Digester	Anergen Corp.	Biomass	10.04
RD-15	The Advanced Wind Machine, Powered by Aerodynamic Energy	Sherman Technical Consultants	Wind	0.00
RD-48	50 kW Photovoltaic Installation Manual Project	The Sun's Warmth	Solar PV	0.00

TAB 4D RESEARCH AND DEVELOPMENT PROPOSALS SORTED BY TECHNOLOGY AND SCORE

Label	Project Title	Company	PERI-Technology Type	Grand Total-Mean	Amount of Funding Request
RD-29	Biomass-Derived Fuels for Turbo-Generators	University of Minnesota	Biofuel	307.50	299,284
RD-110		Center for Sustainable Environmental Technologies (CSET), Iowa State U.	Biofuel	306.07	405,000
RD-22	A New Method for the Production of Hydrogen from Bioethanol/Biomethanol	Energy Conversion Devices, Inc.	Biofuel	291.86	900,000
RD-08	Yellow Grease	Western Colorado Power Co.	Biofuel	268.03	58,000
RD-30	Electricity From Pulp Mill Biofuel	University of Minnesota	Biofuel	231.74	783,488
RD-31	Energy from Corn Based Ethanol Oxidation Fuel Cells	University of Minnesota	Biofuel	220.91	599,917
RD-99	Ethonal Fuel Cells Utilizing Solid Acid Electrolytes	California Institiute of Technology	Biofuel	212.09	1,000,000
RD-59	Power-fast Pyrolysis Biorefinery	Great Plains Institute for Sustainable Development	Biofuel	191.38	1,000,000
RD-104	Improved Economics of Electricity from Bio Oil: Utilization of Glycerol from Biodiesel Production	NREL	Biofuel	170.45	1,000,000
RD-14	Engineering Development of a Liquid Piston Heat Engine for Electricity Generation		Biofuel	156.21	447,700
RD-66	Mithras Microturbine	Mithras Energy Systems	Biofuel	152.53	1,000,000
RD-45	Low-cost Cogeneration of Electricity from Biomass in an Integrated Ethanol Production Facility	University of North Dakota	Biofuel	151.75	1,000,000
RD-17	"Ethanol-Solid Oxide Fuel Cell (SOFC) System Integration and Demonstration in Minnesota"	Electric Power Research Institute	Biofuel	93.56	602,911
RD-27	Feasibility of Commercially Growing Miscanthus in Minnesota	Rural Advantage/ Blue Earth River Basin Initiative	Biomass	328.38	318,800
RD-38	Direct Hydrogen Production form Biomass gasifier Using Hydrogen-Selective Membrane	Gas Technology Institute	Biomass	317.58	861,860

RD-94	Identifying Effective Biomass Strategies: Quantifying Minnesota's Resources and Evaluating Future Opportunities	Center for Energy & Environment	Biomass	307.38	397,500
RD-56	Generating Electricity with Biomass Fuels at Ethanol Plants	University of Minnesota	Biomass	301.75	858,363
RD-72	High Performance Biogas Treating	Production Specialties, Inc.	Biomass	301.42	228,735
RD-61	Design of a system for efficient procurement and handling of alternative biomass for power generation in the twin cities metropolitan area	The Green Institute	Biomass	300.85	282,899
RD-82	Plasma Gasification of Corn Stover	Phoenix Solutions Co.	Biomass	297.60	999,670
RD-34	Conversion of Biomass into Energy and Compost through Sequential Batch Anaerobic Composting	University of Florida	Biomass	294.72	999,995
RD-26	Coaltec Energy - West Michigan Turkey Biogasifier	Coaltec Energy USA, Inc.	Biomass	294.59	450,000
RD-102	Biomass Digestion Pilot Plant: The Anaerobic Pump for Food Manufacturing	Technology Matriz Corporation	Biomass	292.46	1,000,000
RD-63	Biomass Energy Projects: Applied Research to Increase Energy Yields Lower Production costs, and enhance economic returns form value	John Christopher Madole Associates, Inc.	Biomass	286.60	1,000,000
RD-50	Improving the Efficiency of Planting, Tending & Harvesting Farm-Grown Trees	Energy Performance Systems, Inc.	Biomass	283.79	957,929
RD-84	50kWe Modular Biopower System for Building Cooling, Heating, and Power Generation	Northland College	Biomass	281.32	929,155
RD-40	Blandin Paper Biomass Microturbine Project	Energy & Environmental Research Center	Biomass	266.77	1,000,000
RD-55	Agricultural Biomass Collection Economics & Producer Opportunities	Agricultural Utilization Research Institute	Biomass	258.40	350,000
RD-79	Methane Production via Anaerobic Digestion of Renewable Lignocellulosic Biomass	National Renewable Energy Laboratory	Biomass	251.11	1,000,000
RD-43	Supercritical HydroConversion of High-Moisture Biomass Streams to Power	University of North Dakota- EERC	Biomass	250.20	1,000,000
RD-07	Methane & Industrial Products from Waste Biomass	RDE Inc.	Biomass	248.42	804,510

RD-97	Optimizing sustainability, reliability and emissions from biomass energy production	Minergy Corporation	Biomass	236.07	587,597
RD-77	Conversion of Biogas into Hydrogen for Fuel Cells	Argonne National Laboratory	Biomass	231.40	1,000,000
RD-35	Biomass-to-Hydrogen: Novel, Low-cost, Sorbent Process Integrating Gasification, Reforming & Purification	Western Research Institute	Biomass	226.86	999,060
RD-88	Novel, Low-Cost Gasification Process for Power Generation and Liquid Fuel Production	Western Research Institute	Biomass	226.44	986,084
RD-10	Low Emissions Multi-Fuel Combustion Technology	Applied Plasma Technologies	Biomass	211.80	999,890
RD-39	Gasification of Biomass Feedstock in an Advanced Transport Reactor System to Produce Power	University of North Dakota- EERC	Biomass	211.77	1,000,000
RD-85	Advanced Fuel Cell Components for Operation using Biomass Generated Hydrogen & Other High Temperature Applications	Colorado School of Mines	Biomass	202.44	999,230
RD-18	Biomass Gasification for Minnesota's Forest Industry	University of North Dakota- EERC	Biomass	185.24	1,000,000
RD-105	Advanced Biomass Gasification Power System	Emery Energy Company, LLC	Biomass	164.81	1,000,000
RD-62	Willow Brush Biomass Plantation	Dakota Wood-Grinding, Inc.	Biomass	163.36	996,000
RD-96	Development of Key Design Criteria for IC Engines Fueled by Biomass Producer Gas	University of North Dakota	Biomass	161.26	270,046
RD-54	The Economic & Environmental Impacts of Harvesting & Processing Corn Stover as a Renewable Biomass	New Generation Energy Cooperative	Biomass	142.39	999,328
RD-100	Regional Biomass Energy Center	Ethos Energy	Biomass	138.30	990,800
RD-51	Purifying Biogas for Fuel Cell Electricity Generation	University of Minnesota	Biomass	132.98	616,917
RD-44	Oxygen-Blown Combustion of Coal-Biomass Blends for Emission-Free Heat & Power Production	University of North Dakota- EERC	Biomass	117.07	1,000,000
RD-103	Investigation of Utility Scale Biomass Co-firing technology Commercialization through Optimized Pairing of Coal Fired Technologies with Pre-Commercial Biomass Technologies	Black & Veatch Corporation	Biomass	105.59	260,610
RD-42	Biomass to Energy Via Chemical-Looping Combustion	University of North Dakota- EERC	Biomass	102.14	272,000

RD-28	Using Agricultural Materials for Renewable Energy by Molten Salt Reforming	Lynntech, Inc.	Biomass	100.04	999,932
RD-41	Critical Component Development for a Zero-Emission Biomass-Coal Power Plant	University of North Dakota- EERC	Biomass	91.67	1,000,000
RD-71	Biomass-to-Electricity Acetylene Gasification Research & Development Project	Seidel research & Development Company, LLC	Biomass	34.96	1,000,000
RD-109		Georgia Institute of Technology	Biomass	33.54	159,024
RD-19	Distributed Generation System Using Methanol Produced From Biogas Obtained from Manure Anaerobic Digester	Anergen Corp.	Biomass	10.04	590,000
RD-69	An Economic Study of "Environmentally Friendly Co-Generation" Utilizing renewable Energy	Agricultural Utilization Research Institute	Hybrid	218.28	760,000
RD-52	A 100% Renewable Hybrid Wind & Biodiesel Energy System	University of Minnesota	Hybrid	190.75	968,827
RD-53	Red Lake Renewable Energy Research & Development Project	Red Lake Band of Chippewa Indians	Hybrid	161.41	337,223
RD-60	Clean Energy Resource Teams Project Development Assistance	The Minnesota Project	Hybrid	135.21	160,000
RD-86	Winds of Change: Providing Controller, Reliable Power from Wind through Compressed Air Energy Storage	Center for Energy & Environment	Hybrid	131.20	998,750
RD-70	An Ethanol Reforming Fuel Cell-Solar Power Hybrid System	Genesis Fuel Tech, Inc.	Hybrid	85.22	738,000
RD-106	Integrating Biomass with Compressed Air Energy Storage for Wind Shaping Applications	Ridge Energy Storage & Grid Services, LP	Hybrid	75.74	548,463
RD-108	Development of Integrated Renewable Energy, Distributed Generation System for Residential Installation	Farmingdale State University	Hybrid	18.80	1,000,000
RD-93	Inkjet Direct-Write Solar Cells	NREL	Solar PV	314.61	1,000,000
RD-78	Flexible photovoltaic cell for cost-effective electricity generation	InterPhases Research	Solar PV	311.48	1,000,000
RD-107	Low Band Gap Material for Organic Photovoltaics	National Renewable Energy Lab	Solar PV	291.28	1,000,000
RD-95	Crystal silicon films on template-coated glass for inexpensive photovoltaic power	National Renewable Energy Lab	Solar PV	283.23	999,516
RD-83	"Offer to Join the Photovoltaic Innovation Partnership"	Electricity Innovation Institute	Solar PV	264.17	1,000,000

RD-89	Inorganic-Organic Hybrid Nano-Structured Materials: A New Frontier for Photovoltaics	State University of New Jersey	Solar PV	258.04	1,000,000
RD-11	Investigating & Improving the Reliability and Performance of Power Electronics for Photovoltaic Systems	South Dakota State University	Solar PV	211.45	923,418
RD-33	High Efficiency Photovoltaic Systems Based on Nanoscale Quantum Dot Arrays	National Renewable Energy Laboratory	Solar PV	208.61	994,780
RD-90	Next Generation Technology for Solar Electric Power Generation	RWE Schott Solar, Inc.	Solar PV	201.23	1,000,000
RD-98	"Liquid Cyclohexasilane Enabling Innovative Processing of Si-based Electronic Materials"	North Dakota State University	Solar PV	177.27	1,000,000
RD-25	High Efficiency (>15%) Stable, Low Cost Thin Film Si Solar Cells	MVSystems Inc.	Solar PV	171.86	998,202
RD-23	Photo-voltaic conversion of sunlight to hydrogen using the tandem Cell	Hydrogen Solar, LLC	Solar PV	135.84	1,000,000
RD-32	Novel Cost-Effective Reliable Utility Interface of PV Systems Using a High Efficiency Multi-Port Converter	University of Minnesota	Solar PV	133.64	236,992
RD-92	Mass Manufaturing of Solar Photovoltaic to Reduce Costs	Colorado State University	Solar PV	120.08	840,205
RD-01		Virginia Tech	Solar PV	59.30	589,056
RD-24		Ionicfusion Corp.	Solar PV	40.61	87,289
RD-48	50 kW Photovoltaic Installation Manual Project	The Sun's Warmth	Solar PV	0.00	805
RD-87	Analysis & Development of Advanced Methods for Reducing Uncertainty in Wind Power Project Energy Estimates	Global Energy Concepts, LLC	Wind	295.77	370,000
RD-57	Utility-scale Wind Energy Forecasting System - R&D Project	WIndLogics, Inc.	Wind	267.80	997,000
RD-80	"Wind-Vanadium Redox Battery Energy Storage System Integration & Demonstration in Minnesota"	Electric Power Research Institute	Wind	267.75	996,000
RD-12	Rotor Blade Ice Protection	Goodrich Corp	Wind	266.81	1,000,000
RD-37	Clipper C-93 "Liberty" Turbine Protoype	Clipper Windpower, Inc.	Wind	262.70	1,000,000
RD-91	"Hydrogen Production & Storage of Wind Energy in Minnesota"	Electric Power Research Institute	Wind	250.34	1,000,000
RD-58	MN Advanced Wind Resource Assessment Program	Windustry	Wind	216.05	228,139

RD-16	A Comprehensive System Solution for Highly Efficient Wind Power Generation	Eaton Corporation Innovation Center	Wind	186.81	999,142
RD-65	An Investigation of Seasonal Predictability of the Minnesota Wind Resource - R&D Project	WindLogics, Inc.	Wind	186.16	370,000
RD-47	Design, Fabrication, & Utilization of a Lifting Platform for Wind Turbine Installations	D.H. Blattner & Sons, Inc.	Wind	181.67	1,000,000
RD-36	Self-Erecting Tower with Steel Foundation	Minnesota Technology Advancement Group	Wind	176.83	1,000,000
RD-13	Generation of Electricity from Wind Using Flexible Piezoeletric Materials	University of Minnesota	Wind	152.65	531,312
RD-73	COE Reductions through Active Control of Rotor Aerodynamics	Global Energy Concepts, LLC	Wind	110.42	148,318
RD-101	High Capacity Wind Turbines	Advan Tek International, LLC	Wind	109.48	1,000,000
RD-64	Unlocking the Grid to Bring Renewable Energy to Market	HDR Engineering, Inc.	Wind	103.35	980,000
RD-68	Study of Stability Issues and Corrective Measures for Large-Scale Development of Wind Systems	University of Minnesota	Wind	99.34	297,340
RD-21	Wind Turbine Drive Train with Integrated Storage Capability	Global Energy Concepts, LLC	Wind	97.08	99,583
RD-81	Dynamic Balance of Wind Generation & load for wind Generation Expansion & Renewable Energy Use	Excel Engineering, Inc.	Wind	90.03	897,685
RD-20	Wind Turbine Controls: Developing and Valuing Advanced Approaches	Global Energy Concepts, LLC	Wind	87.72	119,383
RD-74	Integrated Blade Design for Wind Turbines	Global Energy Concepts, LLC	Wind	85.11	73,280
RD-76	Wind Monitoring, Power Assessment & Visualization from Tall Tower Observations	South Dakota State University	Wind	35.05	492,475
RD-75	Development of Firm Wind Energy for Distributed Applications: prototype Development	University of North Dakota	Wind	15.24	999,000
RD-15	The Advanced Wind Machine, Powered by Aerodynamic Energy	Sherman Technical Consultants	Wind	0.00	100,000
RD-02-06	Clear Skies	Wolf Wind Projects	Wind	Switched to EP-96-100	747,000

Criteria Evaluation/Scoring Matrix for Xcel Energy RDF Round 2 Project Selection **Energy Production Project** **August 31, 2004**
Prepared by: Princeton Energy Resources International, LLC

Please Identify

Proposal Name	Proposal #	Proposal Company
		Wayne Hesse

Please provide a brief project summary (in a 1-3 sentences)

Project Summary

Please provide a list of the Projects Strengths and Weaknesses (in bullet form)

Project Strengths	Project Weaknesses

Please provide a brief description of the degree to which the project proposes to use new, less-proven technology (in sentence form)

Project Novelty/Uniqueness

Please provide a qualitative assessment of the overall project risk, taking into account technical, financial, resource or other project considerations. (in sentence form)

Overall Project Risk Assessment

Total Resource Cost ($/kWh)	Score

Technology/Application Pairing			Annual Tax and Other Economic Benefits	
		Please Select Number for Appropriate Pairing from List Below	Total ($/MW)	Ranking
1	Wind	Grid Connected- Utility Connected Wind Farm	303,426	3
2		Grid Connected- Single Turbine or Clusters less than 2 MW	177,822	2
3		Grid Connected- Small Wind Turbine with Net Metering	177,822	2
4		Off-Grid- Small Wind Turbine with Energy Storage	177,822	2
5	Biomass	Utility Scale Cofiring with Coal	1,569,549	5
6		Direct Firing- Industrial/Comm/Institutional Cogen	1,569,549	5
7		Utility Scale Direct Firing Power Generation	1,569,549	5
8		Utility Scale Direct Firing- Whole Tree Burners	1,569,549	5
9		Biogasifiers with Pelletized fuels	1,569,549	5
10		Biogasifiers with locally available fuels	1,569,549	5
11		Customer Sited Biogasifiers	1,569,549	5
12		Customer Sited Digesters	1,569,549	5
13	Biofuels	Electricity and CHP from Biofuels	660,913	4
14		Biodiesel used with petroleum diesel generators	660,913	4
15		Biodiesel used with oil-fired generators	660,913	4
16	Solar PV	Utility Scale Flat Plate PV	1,372,000	5
17		Utility Scale Concentrator PV	1,372,000	5
18		Grid Connected Rooftop or Site specific PV	1,372,000	5
19		Distributed- Off-grid and Remote Applications PV	1,372,000	5
20	Hydro	Efficiency Improvements or Capacity Upgrades at existing hydro power facilities	437,500	3
21		New hydropower generation facilities less than 12MW for wholesale power	437,500	3
22		New hydropower generation facilities less than 12MW for (at least partial) self generation	437,500	3

Technology/Application Pairing			Job Creation (Man-hours/MW)				
			Manufacturing	Installation	O&M	Total	Ranking*
1	Wind	Grid Connected- Utility Connected Wind Farm	3,566	2,180	8,400	14,146	2
2		Grid Connected- Single Turbine or Clusters less than 2 MW	3,566	2,180	12,712	18,458	3
3		Grid Connected- Small Wind Turbine with Net Metering	3,566	2,180	12,712	18,458	3
4		Off-Grid- Small Wind Turbine with Energy Storage	3,566	2,180	12,712	18,458	3
5	Biomass	Utility Scale Cofiring with Coal	2,050	4,020	78,000	84,070	5
6		Direct Firing- Industrial/Comm/Institutional Cogen	2,050	4,020	78,000	84,070	5
7		Utility Scale Direct Firing Power Generation	2,050	4,020	78,000	84,070	5
8		Utility Scale Direct Firing- Whole Tree Burners	2,050	4,020	78,000	84,070	5
9		Biogasifiers with Pelletized fuels	2,050	4,020	78,000	84,070	5
10		Biogasifiers with locally available fuels	2,050	4,020	78,000	84,070	5
11		Customer Sited Biogasifiers	2,050	4,020	78,000	84,070	5
12		Customer Sited Digesters	2,050	4,020	78,000	84,070	5
13	Biofuels	Electricity and CHP from Biofuels	3,050	5,980	116,033	125,063	5
14		Biodiesel used with petroleum diesel generators	3,050	5,980	116,033	125,063	5
15		Biodiesel used with oil-fired generators	3,050	5,980	116,033	125,063	5
16	Solar PV	Utility Scale Flat Plate PV	21,418	12,612	7,154	41,184	4
17		Utility Scale Concentrator PV	21,418	12,612	7,154	41,184	4
18		Grid Connected Rooftop or Site specific PV	21,418	12,612	7,154	41,184	4
19		Distributed- Off-grid and Remote Applications PV	21,418	12,612	7,154	41,184	4
20	Hydro	Efficiency Improvements or Capacity Upgrades at existing hydro power facilities	1,274	953	11,200	13,426	2
21		New hydropower generation facilities less than 12MW for wholesale power	1,274	953	11,200	13,426	2
22		New hydropower generation facilities less than 12MW for (at least partial) self generation	1,274	953	11,200	13,426	2

Primary Criteria

	Criteria	Evaluator's Input and Scoring			Scoring Options				
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor	Criteria Weight	Comments/Questions for RDF Board
1	**Barriers To Market Deployment**	Reviewer should input one numerical score selected from the choices given			No problem or not applicable	None	1		(Assessment for determining the score is conducted with a separate evaluation sheet)
					Minimal problems, falling within acceptable limits	Minimal	0.8		
					Somewhat significant problems, but can be resolved with existing techniques	Somewhat Significant	0.6		
					Significant problems, new techniques or information is required	Significant	0.25		
					No potential solution appears feasible within next 5-10 years	Insurmountable	0		
2	**Soundness of Technical Basis, Assumptions, and Approach**	Reviewer should input one numerical score selected from the choices given			Technology being proposed is low-risk, all aspects of construction, operation, and interconnection are addressed with little uncertainty or risk.	Superior	1		
					Minor concerns about the technology, or implementation of the technology.	Good	0.8		
					Significant concerns about the technology, or implementation of the technology.	Fair	0.5		
					Significant weaknesses in the plan or major risk in the technology.	Poor	0.25		
					Fatal Flaws	Not Acceptable	0		

Secondary Criteria

	Criteria	Evaluator's Input and Scoring			Scoring Options				
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor	Criteria Weight	Comments/Questions for RDF Board
Economic Development Impact								20	
3	**Size of Energy Generation Project (MW)**	Reviewer should only enter score from the scoring options to the right, based on the size of the project.			Greater than 100 MW	Large	5		This is NOT a criterion. It is to be used as an intermediate multiplier for calculating the Job Creation and Tax & Economic Benefits in the criteria below.
					Between 50 MW and 100 MW	Medium-Large	4		
					Between 10 MW and 50 MW	Medium	3		
					Between 1 MW and 10 MW	Small-Medium	2		
					Less than 1 MW	Small	1		
4	**Timing of Potential Market Impacts**	Reviewer should input one score selected from the choices given			Evaulator should select the time period that the technology is expected to impact the market: Immediate (0-2 yrs); Short-term (3-7 yrs); Mid term (8-12 yrs) long term (Greater than 13 yrs). The Job Creation and Tax or Other Economic Benefits will be discounted to their present values at a 5% inflation adjusted discount rate for: Immediate = 0 yrs; Short-term = 5yrs; Mid-term = 10 yrs; and Long-term = 15 yrs.	Immediate	1.00		This is NOT a criterion. It is to be used in as a multiplier for discounting to present value the Job Creation and Tax & Economic Benefits in the criteria below.
						Short-term	0.78		
						Mid-term	0.61		
						Long-term	0.48		
5	**Job Creation**	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number of ranking slots to change).			**PERI developed peer-reviewed standard estimates of Jobs per unit of installed capacity (Jobs/MW)** for each technology type. These estimates will then be multiplied by the market penetration estimate, which is the product of the Likely Cost Effectiveness and Size of Potential Market Scores above, to form a dimensionless number. The model automatically selects the appropriate ranking from Table 1 above based on the technology/application pairing selected. The reveiwer need only enter a score (+/- 1 or 2 or 3) here if he/she has specific information or knowledge that the resulting ranking derived from the estimate should be modified.	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number ranking slots to change).			
						Superior	5	40	
						Good	4		
						Fair	3		
						Poor	2		
						None	1		
6	**Tax or Other Fiscal or Economic Benefits**	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number of ranking slots to change).			**PERI developed peer-reviewed standard estimates of tax or fiscal and economic benefits per-unit of installed capacity ($/MW)** for each technology type. Potential benefits will include energy cost savings, local/regional benefits, and tax revenues. These estimates will then be multiplied by the market penetration estimate, which is the product of the Likely Cost Effectiveness and Size of Potential Market Scores above, to form a dimensionless number. The model automatically selects the appropriate ranking from Table 1 above based on the technology/application pairing selected. The reveiwer need only enter a score (+/- 1 or 2 or 3) here if he/she has specific information or knowledge that the resulting ranking derived from the estimate should be modified.	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number ranking slots to change).			
						Superior	5	60	
						Good	4		
						Fair	3		
						Poor	2		
						None	1		
Emissions Levels								15	
8	**Emissions Levels Reductions- (Air, Water and Solid Waste Emissions Streams)**	Reviewer should input one score selected from the choices given			Superior air, water and solid waste emissions reductions relative to conventional generation. (i.e, No or almost no net emissions)	Superior	4		
					Good air, water and solid waste emissions reductions relative to conventional generation.	Good	3		
					Fair air, water and solid waste emissions reductions relative to conventional generation.	Fair	2		
					Poor air, water and solid waste emissions reductions relative to conventional generation.	Poor	1		
					No or negative air, water and solid waste emissions reductions relative to conventional generation.	None	0		

	Criteria	Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor	Criteria Weight	Board
Project Approach and Work Plan								15	
9	**Quality of Work Approach** (The degree to which the work approach demonstrates a clear, appropriate and complete plan for achieving program goals and objectives.)	Reviewer should input one score selected from the choices given			Plan is specific and superior, both quantitatively and qualititatively, providing a complete set of management approaches like gant charts, project milestones or other metrics for measurements of success, interim reporting or reviews, budget detailed by task and specifiec labor categories, etc.	Superior	4	15	
					Plan addresses all necessary elements at a satifsfactory level and meets all RFP minimum requirements. Small omissions that can be provided with a clarification may be allowed. Lower level of management sophistication demonstrated by lack of approaches in "superior" category.	Acceptable	3		
					Some elements of the plan are reasonable, but some are not fully described or are missing.	Incomplete	2		
					Only minimal detail is given for plan elements, and signficant elements may be missing.	Minimal	1		
					Proposal does not address how work will be conducted.	Non-existent	0		
11	**Realistic Schedule**	Reviewer should input one score selected from the choices given			Realistic, detailed (using charts, tables, lists) and complete (showing dates, and all deliverables and milestones)	Superior	4	15	
					Appears to be realistic, but level of detail leaves some room for interpretation or questions about a limited number of dates, deliverables, or milestones.	Good	3		
					Is miissing some dates, deliverables, or milestones, making it somewhat unclear when certain parts of the project are expected to be completed.	Fair	2		
					Is miissing large number of dates, deliverables, or milestones, making it difficult to know how many parts or most of the project should proceed.	Poor	1		
					No information is given.	Non-existent	0		
12	**Appropriate and Regular Reporting and Review**	Reviewer should input one score selected from the choices given			Project incorporates appropriate number and timing of reviews and progress reporting, and shows them graphically or in a list, and explicitly includes necessary funds in the budget to perform the review tasks.	Superior	4	15	
					Appropriate level of reporting, review, and budget is acknowledged, but some details are not presented. Budget appears adequate to accomplish.	Good	3		
					Some reporting and review included, but not at appropriate level. Funding not clear or inadequate.	Fair	2		
					Few or poor reviews and/or progress reports, no budget allocated to reporting and review activities.	Poor	1		
					Not addressed in proposal.	Not Responsive	0		
Project Team								15	
14	**Team Structure**	Reviewer should input one score selected from the choices given			Provides Clear Roles and Responsibilities, ensures project can stay on track, schedule, and within budget.	Superior	4	35	
						Good	3		
						Fair	2		
						Poor	1		
						Inadequate	0		
15	**Team Member Skills, Experience and Knowledge**	Reviewer should input one score selected from the choices given			Evaluation of the proposed team, with regards to the team's sufficiency in providing the requisite member skills, experience and knowledge	Superior	4	65	
						Good	3		
						Fair	2		
						Poor	1		
						Inadequate	0		
Efficient Use of Project Funds								10	

	Criteria	Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor	Criteria Weight	Board
16	**Size of Funding Leverage**	Reviewer should enter proposer cost share % -- may reduce for other factors or uncertainty			Reviewer will identify the size of funding leverage reported in the proposal.	Size of funding leverage, in percent	%	30	
17	**Appropriate Budget Level**	Reviewer should input one score selected from the choices given			The budget size and allocation is sufficient to achieve the goals, objectives, and scope, of the project, but not in excess of what is needed.	Fully Appropriate	4	70	
					There are no more than a few questions regarding the potential for relatively small overruns or shortfalls in funding.	Nearly Appropriate	3		
					There are significant questions concerning level of funding requested to meet the goals, objectives, and scope of the project.	Somewhat Appropriate	2		
					Major changes would be required to the proposed approach and/or budget level to achieve the project goals, objectives, and scope.	Largely Innappropriate	1		
					The proposed work, objectives, scope, and/or benefits are not appropriate given the proposed budget level, regardless of potential changes to the proposal.	Not Appropriate	0		
Financing Plan Status								5	
18	**Financing Plan Status**	Reviewer should input one score selected from the choices given			Letter of commitment included - equity firm	Superior	4		
					Sourcs identified and significant discussions -- "reasonably assured"	Good	3		
					Sources of equity and debt identified	Fair	2		
					Plan - but no details of sources	Poor	1		
					No finance plan	Inadequate	0		
Total Resource Cost per kWh								30	
19	**Total Resource Cost per kWh**	Reviewer should input one score selected from the choices given			TRC ranking determined in following manner: Less than $0.0149/kWh = 4 $0.015-0.0199/kWh = 3.5 $0.020-0.0249/kWh = 3 $0.025-0.0299/kWh = 2.5 $0.030-0.0349/kWh = 2 $0.035-0.0399/kWh = 1.5 Greater than $0.040/kWh = 1	Superior	4		
						Good	3		
						Fair	2		
						Poor	1		
						Inadequate	0		
Support of RFP Priorities									
							Multiplier		
20	**Prairie Island Indian Community**	Reviewer should input Yes or No				Yes	1.10		
						No	1		
21	**Biomass Technologies**	Reviewer should input Yes or No				Yes	1.05		
						No	1		

Total Score-		

Criteria Evaluation/Scoring Matrix for Xcel Energy RDF Round 2 Project Selection **R&D Project** **August 31, 2004**

Prepared by: Princeton Energy Resources International, LLC

Please Identify

Proposal Name	Proposal #	Proposal Company

Please provide a brief project summary (in a 1-3 sentences)

Project Summary

Please provide a list of the Projects Strengths and Weaknesses (in bullet form)

Project Strengths	Project Weaknesses

Table 1

Technology/Application Pairing			Resource Availability Projections		Annual Tax and Other Economic Benefits	
		Please Select Number for Appropriate Pairing from List Below	MW Potential	Ranking	Total ($/MW)	Ranking
1	Wind	Grid Connected- Utility Connected Wind Farm	4,863	4	230,463	3
2		Grid Connected- Single Turbine or Clusters less than 2 MW	356,426	5	162,317	2
3		Grid Connected- Small Wind Turbine with Net Metering	21,252	5	162,317	2
4		Off-Grid- Small Wind Turbine with Energy Storage	21,252	5	162,317	2
5	Biomass	Utility Scale Cofiring with Coal	782	2	284,848	3
6		Direct Firing- Industrial/Comm/Institutional Cogen	208	2	284,848	3
7		Utility Scale Direct Firing Power Generation	727	2	284,848	3
8		Utility Scale Direct Firing- Whole Tree Burners	379	2	284,848	3
9		Biogasifiers with Pelletized fuels	1,700	3	284,848	3
10		Biogasifiers with locally available fuels	1,228	3	284,848	3
11		Customer Sited Biogasifiers	850	2	284,848	3
12		Customer Sited Digesters	755	2	284,848	3
13	Biofuels	Electricity and CHP from Biofuels	345	2	660,913	4
14		Biodiesel used with petroleum diesel generators	239	1	660,913	4
15		Biodiesel used with oil-fired generators	1,498	3	660,913	4
16	Solar PV	Utility Scale Flat Plate PV	4,863	4	752,500	4
17		Utility Scale Concentrator PV	4,863	4	701,750	4
18		Grid Connected Rooftop or Site specific PV	77,263	5	892,500	4
19		Distributed- Off-grid and Remote Applications PV	77,263	5	892,500	4
20	Hydro	Efficiency Improvements or Capacity Upgrades at existing hydro power facilities	377	2	350,000	3
21		New hydropower generation facilities less than 12MW for wholesale power	160	1	350,000	3
22		New hydropower generation facilities less than 12MW for (at least partial) self generation	160	1	350,000	3

Technology/Application Pairing			Job Creation (Man-hours/MW)				
			Manufacturing	Installation	O&M	Total	Ranking*
1	Wind	Grid Connected- Utility Connected Wind Farm	3,566	2,180	8,400	14,146	2
2		Grid Connected- Single Turbine or Clusters less than 2 MW	3,566	2,180	12,712	18,458	3
3		Grid Connected- Small Wind Turbine with Net Metering	3,566	2,180	12,712	18,458	3
4		Off-Grid- Small Wind Turbine with Energy Storage	3,566	2,180	12,712	18,458	3
5	Biomass	Utility Scale Cofiring with Coal	2,050	4,020	78,000	84,070	5
6		Direct Firing- Industrial/Comm/Institutional Cogen	2,050	4,020	78,000	84,070	5
7		Utility Scale Direct Firing Power Generation	2,050	4,020	78,000	84,070	5
8		Utility Scale Direct Firing- Whole Tree Burners	2,050	4,020	78,000	84,070	5
9		Biogasifiers with Pelletized fuels	2,050	4,020	78,000	84,070	5
10		Biogasifiers with locally available fuels	2,050	4,020	78,000	84,070	5
11		Customer Sited Biogasifiers	2,050	4,020	78,000	84,070	5
12		Customer Sited Digesters	2,050	4,020	78,000	84,070	5
13	Biofuels	Electricity and CHP from Biofuels	3,050	5,980	116,033	125,063	5
14		Biodiesel used with petroleum diesel generators	3,050	5,980	116,033	125,063	5
15		Biodiesel used with oil-fired generators	3,050	5,980	116,033	125,063	5
16	Solar PV	Utility Scale Flat Plate PV	21,418	12,612	7,154	41,184	4
17		Utility Scale Concentrator PV	21,418	12,612	7,154	41,184	4
18		Grid Connected Rooftop or Site specific PV	21,418	12,612	7,154	41,184	4
19		Distributed- Off-grid and Remote Applications PV	21,418	12,612	7,154	41,184	4
20	Hydro	Efficiency Improvements or Capacity Upgrades at existing hydro power facilities	1,274	953	11,200	13,426	2
21		New hydropower generation facilities less than 12MW for wholesale power	1,274	953	11,200	13,426	2
22		New hydropower generation facilities less than 12MW for (at least partial) self generation	1,274	953	11,200	13,426	2

Primary Criteria

Criteria		Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
1	**Barriers To Market Deployment**	Reviewer should input one numerical score selected from the choices given			No problem or not applicable	None	1		(Assessment for determining the score is conducted with a separate evaluation sheet)
					Minimal problems, falling within acceptable limits	Minimal	0.8		
					Somewhat significant problems, but can be resolved with existing techniques	Somewhat Significant	0.6		
					Significant problems, new techniques or information is required	Significant	0.25		
					No potential solution appears feasible within next 5-10 years	Insurmountable	0		
2	**Soundness of Technical Basis, Assumptions, and Approach**	Reviewer should input one numerical score selected from the choices given			Techncial ideas and approach are sound, and proposed activity is a logical and necessary step in a technolgy development path, advancing science, technology, or market adoption.	Superior	1		
					Minor concerns about innaccuracy or ommissions concerning the understanding of technology, market, or technical approach.	Good	0.8		
					Significant, but potentially correctable flaws, innaccuracies, or omissions in technical or market understanding or approach.	Fair	0.5		
					Weak technical ideas or significant flaws in understanding or approach; correction is difficult or improbable.	Poor	0.25		
					Fatal Flaws	Not Acceptable	0		
3	**Appropriate RDF Role vis-a-vis Degree of Technical Duplication and R&D Provided By Markets**	Reviewer should input one numerical score selected from the choices given			Is not duplicative of other work, and/or compliments other work in an important way. R&D is not adequately provided by competitive or regulated markets.	Superior	1		
					Majority of R&D is not provided by markets, but a little may duplicate small parts of other work. Project still compliments other work or existing technology to increase probability of technical or market success, and the level of technology cost effectiveness and/or level of market adoption.	Appropriate	0.8		
					Competitive or regulated markets may address some, but not all aspects of proposed R&D; and/or there is some duplication of other efforts, but R&D may partially compliment other efforts. There may be some uncertainty about the level of duplication or potential marginal increase in technology advance, but the additional activity should at least increase the probabilty of technical improvement and/or market adoption.	Somewhat Appropriate	0.6		
					R&D conceivably could be provided by markets but is not currently due to any number of reasons, or R&D duplicates high risk research.	Barely Appropriate	0.25		
					R&D is provided by regulated or unregulated markets or other R&D entities or R&D duplicates low risk research or existing technology or service.	Not Appropriate	0		

Secondary Criteria

Criteria		Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
Technology Advancement								40	
4	**Technical Risk Level**	Most likely estimate, in percent			The probability that the proposed R&D activity will achieve the stated technical goals, based on the scientific/engineering complexity and stage of the technology. (Does **NOT** include market barriers or market adoption issues, or characteristics of the project team or technical approach.)		%	40	Reviewer will pick a low, most likely, and high percentage, each of which will be multiplied by 4 to obtain the values for the input distribution (e.g., a range 50% - 80%, with a most likely value of 70% would translate to values of 2.0 - 3.2 with a most likely value of 2.8. These 3 numbers would then be used to define the input distribution.)
		Low estimate, in percent							
		High estimate, in percent							
5	**Increase in Market Competitiveness**	Most likely estimate, in percent			The level of increase of cost effectiveness or any other measure of value in the market through any combination of increased energy production, decreased capital costs or annual operating expenses, increased durability or reliability, or any other characteristic that makes renewable energy more competitive in the market.		%	40	Same comment as above
		Low estimate, in percent							
		High estimate, in percent							
6	**Technical Leverage**	Reviewer should input one score selected from the choices given			The proposed R&D activity is the major or last step/activity that combines with others in an existing R&D path to bringing a technology or service to market.	Superior	4	20	
					The proposed R&D activity is one of only a few needed steps/activities in an existing R&D path to bringing a technology or service to market.	Good	3		
					The proposed R&D activity is one of several needed steps/activities in an R&D path to bringing a technology or service to market.	Fair	2		
					The proposed R&D activity is has only partial ability to combine with other other activities in an R&D path to bringing a technology or service to market.	Poor	1		
					The proposed R&D activity does not build off of, combine with, or add to other completed, current, or planned activities.	None	0		

	Criteria	Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
Economic Development Impact								20	
7	**Likely Cost Effectiveness or Payback Years (Cost Effectiveness for Grid-connected technologies and Payback Years for Customer-sited technologies)**	Most likely estimate, in decimal or years			No doubt the product or service will be cost effective in its market segment. (Cost Effectiveness for Grid-connected technologies is within 0-20% of COE of best alternative technology and Payback Years for Customer-sited technologies is 1-3 years)	Superior	0.80-1.00 or 1-3 years		This is NOT a criterion. It is to be used as an intermediate multiplier for calculating the Job Creation and Tax & Economic Benefits in the criteria below.
		Low estimate, in decimal or years			Product or service should be competitive in at least a major part of the market. (Cost Effectiveness for Grid-connected technologies is within 20-40% of COE of best alternative technology and Payback Years for Customer-sited technologies is 3-5 years)	Good	0.60-0.80 or 3-5 years		
		High estimate, in decimal or years			The product or service likely may only be able to capture limited parts of the market based on cost competitiveness, or it is unclear or unknown what potential level of cost competitiveness will be. (Cost Effectiveness for Grid-connected technologies is within 40-60% of COE of best alternative technology and Payback Years for Customer-sited technologies is 5-7 years)	Fair	0.40-0.60 or 5-7 years		
					The product or service likely may only be able to capture a small portion of the market. (Cost Effectiveness for Grid-connected technologies is within 60-80% of COE of best alternative technology and Payback Years for Customer-sited technologies is 7-10 years)	Poor	0.20-0.40 or 7-10 years		
					Cost competitiveness is likely to be too poor for product or service to penetrate the market. (Cost Effectiveness for Grid-connected technologies is within above 80% of COE of best alternative technology and Payback Years for Customer-sited technologies is greater than 10 years)	Minimal	0.00-0.20 or 10+ yrs		
8	**Size of Potential Market**	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number of ranking slots to change).			PERI has established a standard scale for market size in relative, dimensionless units for every technology/application. PERI has created separate scales for each of the 22 technologies/application pairings shown in Table 1.	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number ranking slots to change).			This is NOT a criterion. It is to be used as an intermediate multiplier for calculating the Job Creation and Tax & Economic Benefits in the criteria below.
						Large	5		
						Medium-Large	4		
						Medium	3		
						Small-Medium	2		
						Small	1		
9	**Timing of Potential Market Impacts**	Reviewer should input one score selected from the choices given			Evaulator should select the time period that the technology is expected to impact the market: Immediate (0-2 yrs); Short-term (3-7 yrs); Mid term (8-12 yrs) long term (Greater than 13 yrs). The Job Creation and Tax or Other Economic Benefits will be discounted to their present values at a 5% inflation adjusted discount rate for: Immediate = 0 yrs; Short-term = 5yrs; Mid-term = 10 yrs; and Long-term = 15 yrs.	Immediate	1.00		This is NOT a criterion. It is to be used in as a multiplier for discounting to present value the Job Creation and Tax & Economic Benefits in the criteria below.
						Short-term	0.78		
						Mid-term	0.61		
						Long-term	0.48		

Criteria		Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
10	**Job Creation**	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number of ranking slots to change).			**PERI developed peer-reviewed standard estimates of Jobs per unit of installed capacity (Jobs/MW)** for each technology type. These estimates will then be multiplied by the market penetration estimate, which is the product of the Likely Cost Effectiveness and Size of Potential Market Scores above, to form a dimensionless number. The model automatically selects the appropriate ranking from Table 1 above based on the technology/application pairing selected. The reveiwer need only enter a score (+/- 1 or 2 or 3) here if he/she has specific information or knowledge that the resulting ranking derived from the estimate should be modified.	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number ranking slots to change).			
						Superior	5	40	
						Good	4		
						Fair	3		
						Poor	2		
						None	1		
11	**Tax or Other Fiscal or Economic Benefits**	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number of ranking slots to change).			**PERI developed peer-reviewed standard estimates of tax or fiscal and economic benefits per-unit of installed capacity ($/MW)** for each technology type. Potential benefits will include energy cost savings, local/regional benefits, and tax revenues. These estimates will then be multiplied by the market penetration estimate, which is the product of the Likely Cost Effectiveness and Size of Potential Market Scores above, to form a dimensionless number. The model automatically selects the appropriate ranking from Table 1 above based on the technology/application pairing selected. The reveiwer need only enter a score (+/- 1 or 2 or 3) here if he/she has specific information or knowledge that the resulting ranking derived from the estimate should be modified.	Reviewer should only enter score if he/she has information that ranking shown in table above should be changed (+/- number ranking slots to change).			
						Superior	5	60	
						Good	4		
						Fair	3		
						Poor	2		
						None	1		
12	**Impact on Commercialization**	Most likely estimate of project R&D commercialization contribution, in percent			More than 80% of the R&D needed to bring the technology, product or service to the commercialization stage is from the proposed project.	Superior	80 - 100%		This is NOT a criterion. It is a way to apportion the benefits of the technology to the proposed activity in the case where other R&D activities are also (partly) responsible for the success of the technology in the market. The average score from the 2 categories above will be multiplied by this score.
		Low estimate of project R&D commercialization contribution, in percent			60-80% of the R&D needed to bring the technology, product or service to the commercialization stage is from the proposed project.	Good	60 - 80%		
		High estimate of project R&D commercialization contribution, in percent			40-60% of the R&D needed to bring the technology, product or service to the commercialization stage is from the proposed project.	Fair	40 - 60%		
					20-40% of the R&D needed to bring the technology, product or service to the commercialization stage is from the proposed project.	Poor	20 - 40%		
					Less than 20% of the R&D needed to bring the technology, product or service to the commercialization stage is from the proposed project.	Minimal	0 - 20%		

	Criteria	Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
Emissions Levels								15	
13	**Emissions Levels Reductions- (Air, Water and Solid Waste Emissions Streams)**	Reviewer should input one score selected from the choices given		· **Air-** · **Water-** · **Solid Waste-**	Superior air, water and solid waste emissions reductions relative to conventional generation. (i.e, No or almost no net emissions)	Superior	4		
					Good air, water and solid waste emissions reductions relative to conventional generation.	Good	3		
					Fair air, water and solid waste emissions reductions relative to conventional generation.	Fair	2		
					Poor air, water and solid waste emissions reductions relative to conventional generation.	Poor	1		
					No or negative air, water and solid waste emissions reductions relative to conventional generation.	None	0		
Project Approach and Work Plan								15	
14	**Quality of Work Approach** (The degree to which the work approach demonstrates a clear, appropriate and complete plan for achieving program goals and objectives.)	Reviewer should input one score selected from the choices given			Plan is specific and superior, both quantitatively and qualititatively, providing a complete set of management approaches like gant charts, project milestones or other metrics for measurements of success, interim reporting or reviews, budget detailed by task and specifiec labor categories, etc.	Superior	4	40	
					Plan addresses all necessary elements at a satifsfactory level and meets all RFP minimum requirements. Small omissions that can be provided with a clarification may be allowed. Lower level of management sophistication demonstrated by lack of approaches in "superior" category.	Acceptable	3		
					Some elements of the plan are reasonable, but some are not fully described or are missing.	Incomplete	2		
					Only minimal detail is given for plan elements, and signficant elements may be missing.	Minimal	1		
					Proposal does not address how work will be conducted.	Non-existent	0		
15	**Well-defined Set of Products; Usefulness of Products**	Reviewer should input one score selected from the choices given			Products are well defined and useful, and examples or other devices are used that demonstrate the proposer has thought through the aproach and outcomes, increasing the likelyhood that unanticipated problems will be avoided.	Superior	4	15	
					Products appear to be well defined and useful, but the examples or other devices required for the superior score are not present.	Good	3		
					There are only partial explanations of products and/or questions exist about their usefulness.	Fair	2		
					Very limited explanation and/or usefulness.	Poor	1		
					Not Defined	Non-existent	0		

Criteria		Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
16	**Realistic Schedule**	Reviewer should input one score selected from the choices given			Realistic, detailed (using charts, tables, lists) and complete (showing dates, and all deliverables and milestones).	Superior	4	15	
					Appears to be realistic, but level of detail leaves some room for interpretation or questions about a limited number of dates, deliverables, or milestones.	Good	3		
					Is miissing some dates, deliverables, or milestones, making it somewhat unclear when certain parts of the project are expected to be completed.	Fair	2		
					Is miissing large number of dates, deliverables, or milestones, making it difficult to know how many parts or most of the project should proceed.	Poor	1		
					No information is given.	Non-existent	0		
17	**Appropriate and Regular Reporting and Review**	Reviewer should input one score selected from the choices given			Project incorporates appropriate number and timing of reviews and progress reporting, and shows them graphically or in a list, and explicitly includes necessary funds in the budget to perform the review tasks.	Superior	4	15	
					Appropriate level of reporting, review, and budget is acknowledged, but some details are not presented. Budget appears adequate to accomplish.	Good	3		
					Some reporting and review included, but not at appropriate level. Funding not clear or inadequate.	Fair	2		
					Few or poor reviews and/or progress reports, no budget allocated to reporting and review activities.	Poor	1		
					Not addressed in proposal.	Not Responsive	0		
18	**Performance Metrics**	Reviewer should input one score selected from the choices given			The project plan incorporates an appropriate set of measurable, realistic performance metrics for assessing project progress and success.	Superior	4	15	
					Small additions or changes to the proposed metrics will result in an appropriate set.	Good	3		
					Metrics either do not cover the entire project, or are of mixed quality and usefulness.	Fair	2		
					Metrics are any combination of too few, difficult to measure, or not reflective of progress and success.	Poor	1		
					No performance metrics are included in the proposal.	Not Responsive	0		

	Criteria	Evaluator's Input and Scoring			Scoring Options			Criteria Weight	Comments/Questions for RDF Board
		Directions for Evaluator	Evaluator's Score	Evaluator's Comments	Detailed Score Descriptor	Summary Score Descriptor	Numerical Descriptor		
Project Team								15	
19	**Team Structure**	Reviewer should input one score selected from the choices given			Provides Clear Roles and Responsibilities, ensures project can stay on track, schedule, and within budget.	Superior	4	35	
						Good	3		
						Fair	2		
						Poor	1		
						Inadequate	0		
20	**Team Member Skills, Experience and Knowledge**	Reviewer should input one score selected from the choices given			Evaluation of the proposed team, with regards to the team's sufficiency in providing the requisite member skills, experience and knowledge.	Superior	4	65	
						Good	3		
						Fair	2		
						Poor	1		
						Inadequate	0		
Efficient Use of Project Funds								10	
21	**Size of Funding Leverage**	Reviewer should input one score selected from the choices given		**(Evaluator can knock down the Leverage % stated in the proposal by quartiles depending on reasons, which should be stated here. Also note the original % stated in the proposal here).**	Reviewer will identify the size of funding leverage reported in the proposal.	Size of funding leverage, in percent	%	30	
22	**Appropriate Budget Level**	Reviewer should input one score selected from the choices given			The budget size and allocation is sufficient to achieve the goals, objectives, and scope, of the project, but not in excess of what is needed.	Fully Appropriate	4	70	
					There are no more than a few questions regarding the potential for relatively small overruns or shortfalls in funding.	Nearly Appropriate	3		
					There are significant questions concerning level of funding requested to meet the goals, objectives, and scope of the project.	Somewhat Innappropriate	2		
					Major changes would be required to the proposed approach and/or budget level to achieve the project goals, objectives, and scope.	Largely Innappropriate	1		
					The proposed work, objectives, scope, and/or benefits are not appropriate given the proposed budget level, regardless of potential changes to the proposal.	Not Appropriate	0		
Support of RFP Priorities									
							Multiplier		
23	**Minnesota R&D Institutions**	Reviewer should input Yes or No				Yes	1.075		
						No	1		
24	**Prairie Island Indian Community**	Reviewer should input Yes or No				Yes	1.10		
						No	1		
25	**Biomass Technologies**	Reviewer should input Yes or No				Yes	1.05		
						No	1		

CERTIFICATE OF SERVICE

I, Carol Wallace, hereby certify that I have this day served copies of the foregoing document on the persons listed on the attached Service List by delivery by hand or by causing to be placed in the U.S. Mail at Minneapolis, MN.

Docket No. E002/M-03-1883

Dated this ___ of August, 2004

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SERVICE LIST