M.L. 2014 Project Abstract
For the Period Ending June 30, 2015

PROJECT TITLE: Solar PV at Minnesota's Residential Environmental Learning Centers
PROJECT MANAGER: Dale Yerger
AFFILIATION: Deep Portage, Wolf Ridge, Eagle Bluff, Laurentian, Audubon and Long Lake RELCs
MAILING ADDRESS: 2197 Nature Center Drive NW
CITY/STATE/ZIP: Hackensack, MN 56452
PHONE: (218) 682-2325
E-MAIL: portage@uslink.net
WEBSITE: www.deep-portage.org
FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: Chp. 226, Sec.2, Subd. 8h

APPROPRIATION AMOUNT: $150,000

Overall Project Outcomes and Results

Six Minnesota-made 6.15 kW tenKsolar arrays have been installed at six Minnesota Environmental Education centers. Each array has an internet-based reporting system that is hosted on the eGauge website. The device numbers are as follows:

Deep Portage	19732
Wolf Ridge	19723
Eagle Bluff	16737
Laurentian	19730
Audubon	19735
Long Lake	19742

You simply type in the device number, and various graphs and production numbers will pop up.

Teachers and students and members of the interested public will be able to monitor the production of whichever center they would like to follow; they can compare and contrast. All of the arrays are situated in public places where access to the general public is easily achieved.

We (the RELCs) believe that this project will be accessed by at least 25,000 people each year. We are the premier disseminators of Environmental Education in Minnesota, and this ability will greatly increase the knowledge and analysis of Solar Electric production in the State of Minnesota. Prior to this project, there were many arrays in Minnesota that did not have the public accessibility and analysis available to the general public. We believe that a new leaf is turning over at the RELCs in regard to Solar Electric education. These arrays should be solid producers for the next 25 years; therefore, the public will receive many years of value and top-quality dissemination.

As of August 11, 2015 the arrays have produced 12.53 megawatt hours of electricity, they have mitigated approximately 12 tons of atmospheric CO2, and are showcasing Minnesota technology and innovation. The unique reflectors of the tenKsolar arrays were formulated by Minnesota's own 3M Company.

Project Results Use and Dissemination

Vigorous dissemination has begun at Eagle Bluff, Wolf Ridge and Deep Portage.

Wolf Ridge has developed an alternative energy brochure that features the solar array and invites guests and interested members of the public to take a tour. They have also crystallized their new solar electric curriculum around the array and are excited that the Jack Piccotta Science Center has gone net zero in the summer months.

Deep Portage offered six solar energy tours this summer and also prominently featured the array in the Izaak Walton League Camp (June 28-July 3, 2015) curriculum. There were also several dozen impromptu solar energy tours, based on people walking by the array and asking, “What’s this?”

Eagle Bluff has used the array during the 2014-15 school year, as their array was activated last Fall. This past summer numerous visitors and campers were also exposed to the wonders of solar energy.

Northwoods Audubon, Long Lake and Laurentian have toured interested members of the public and will be putting great effort into this coming school year and embedding the previously developed solar energy curriculum into their school offerings.

Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2014 Work Plan Final Report

Date of Report:	August 15, 2015
Date of Next Status Update Report:	Final Report
Date of Work Plan Approval:	June 4, 2014
Project Completion Date:	June 30, 2016

PROJECT TITLE: Solar PV at Minnesota's Residential Environmental Learning Centers

Project Manager:	Dale Yerger
Organization:	Deep Portage, Wolf Ridge, Eagle Bluff, Laurentian, Audubon and Long Lake RELCs
Mailing Address:	2197 Nature Center Drive NW
City/State/Zip Code:	Hackensack, MN 56452
Telephone Number:	(218) 682-2325
Email Address:	portage@uslink.net
Web Address:	www.deep-portage.org

Location: Aitkin, Cass, Fillmore, Lake, Pine and St. Louis counties

Total ENRTF Project Budget:	**ENRTF Appropriation:**	**$150,000**
	Amount Spent:	**$150,000**
	Balance:	**$0**

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 8h

Appropriation Language:
$150,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Deep Portage Learning Center to coordinate with Audubon Center of the North Woods; Eagle Bluff Environmental Learning Center; Laurentian Environmental Learning Center; Long Lake Conservation Center; and Wolf Ridge Environmental Learning Center the installation of at least five kilowatt institutional solar arrays made in Minnesota at each of the six residential environmental learning centers as a teaching tool. Prior to the installation, the proposed placement of the solar arrays must be submitted to the Legislative-Citizen Commission on Minnesota Resources office to ensure the demonstration of the maximum educational value.

I. PROJECT TITLE: Solar PV at Minnesota's Residential Environmental Learning Centers

II. PROJECT STATEMENT:

In 2010 the collective of the six RELCs in the state implemented a diverse impact of projects with ENRTF funding. Each center implemented demonstration projects of conservation, efficiency and renewable energy educational demonstrations, yet no project included photovoltaic power generation at an institutional scale (one project included a small PV residential system). Small wind, solar hot water, envelope improvements, lighting improvements and development of energy sustainability curriculum were a few of the accomplishments of this funding. Thousands of Minnesotans have participated in a sustainable energy tour or class at an RELC.

Photovoltaic (PV) power technology has progressed dramatically in the past three years resulting in ubiquitous presence in our society, e.g. PV products are now common in home improvement stores. If we are to prepare our children to understand and embrace a future with a more sustainable lifestyle, noting PV as a central source of power, the young people we educate need to have context and connection to the technology. With over 500 schools currently using the MN RELCs for field-based learning experiences, the use of PV as a teaching tool integrates the students' understanding into not only their curriculum but also their lifestyle. At other facilities students may notice a renewable energy installation; at a RELC the renewable energy is a genuine tool of teaching. The RELCs are living laboratories of learning. The PV system each center will install will be made in Minnesota, and we will secure Minnesota contractors for this project.

Many school curriculums are including STEM education. (STEM is Science, Technology, Engineering and Mathematics.) All centers will implement on-line monitoring systems with their PV install. This system will achieve the monitoring needed to assure performance as well as document C02 impact, but it will also function as a STEM tool of education. The on-line tool available for this project is a reporting system called eGauge. eGauge will monitor on site electrical production and on site electrical use. The various graphs that this software will provide will allow for real time electrical monitoring and a hands-on understanding of a variety of STEM standards. While some centers already have PV on their site they do not have monitoring to use in education, or if they do have it, it is not able to be linked or modified to eGauge. With each center having the same monitoring system and the same size array, new web-based learning opportunities will be created for the teachers and schools to do comparative studies via the newly created state RELC PV display network. This technology will be shared with hundreds of school staff (science teachers, math, engineering) and thousands of Minnesota students and will deepen their STEM understanding.

By implementing installations of PV technology at each center—it will be at least 5 kW per center—we will produce 30,000 kWH each year, saving 36 tons of CO2. 5 kW is a common size for household installation, thus a good model for children to envision a future with PV on their home. In areas such as central Europe, it is common to see distributed electrical generation via photovoltaic arrays on nearly every home. The array will be sited at each center to maximize educational use and modeling. The tens of thousands of youth who annually attend our centers are the future of choice relative to PV solar in residences, businesses and municipal buildings. We are the environmental education experts in Minnesota. We will achieve verification of our CO2 savings by each center implementing data gathering and reporting of the function and power production of their array.

The monitoring display (eGauge brand) will be used for visiting schools to learn of the impact and value of the PV installation through incorporated use with the curriculum produced at each center with the ENRTF funding of 2010. The ability to use the latitudinal differences of our centers spread over several hundred miles, as well as examining weather patterns/cloud cover, will give students an excellent ability to see just how much impact these factors have on production. By having all the centers at the same exact size of production as well as the exact same design, we are comparing apples to apples (probably something that cannot be done with any other PV systems in the state!). This gives not only students but homeowners as well a great resource to learn from. Homeowners can also see our monthly and annual production, giving them a sense of the real performance and helping with their PV decision making.

By partnering together as a group of six centers maximization of dollars invested will come through collective purchasing with volume discounts. We have received a bid for 6.15 kW at each center of the six RELCs for $150,000. At this time we do not know the exact cost for each center, but after the appropriation is approved we will get a hard figure that **will not exceed $150,000**. Additionally we invited proposals from two other installers, thus far the greatest value is the 6.15 kW x six centers proposal. We do not anticipate having to modify our work plan as we expect a ceiling of $150,000 for six centers to be met based on previous bidding.

III. PROJECT STATUS UPDATES:

Project Status as of December 31, 2014: The contractor selected is Rural Renewable Energy Alliance (RREAL); the contract was signed August 27, 2014. The attachment submitted with our revised work plan on February 6, 2014, shows the *Google Earth* photos of campus locations for all six arrays. Eagle Bluff RELC completed its project December 5, 2014. Data for Eagle Bluff's array is up and running and can be checked at: http://egauge16737.egaug.es/ As of early December, tenKsolar has delivered arrays, panels and inverters to RREAL's warehouse in Backus, MN, for Spring 2015 installation. As shown on the attached photo, everything is plastic-wrapped and on pallets for winter storage. In early 2015, RREAL will prepare, review and discuss building permit applications and electrical interconnection applications, as well as project-specific details, with each of the five remaining project sites, in preparation for installation.

Project Status as of May 31, 2015: RREAL has made substantial progress at four centers. Deep Portage and Wolf Ridge are up next, and a completion date of June 15 is being planned for.

Project Status as of October 15, 2015:

Overall Project Outcomes and Results: Six Minnesota-made 6.15 kW tenKsolar arrays have been installed at six Minnesota Environmental Education centers. Each array has an internet-based reporting system that is hosted on the eGauge website. The device numbers are as follows:

Deep Portage	19732
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As of August 11, 2015 the arrays have produced 12.53 megawatt hours of electricity, they have mitigated approximately 12 tons of atmospheric CO2, and are showcasing Minnesota technology and innovation. The unique reflectors of the tenKsolar arrays were formulated by Minnesota's own 3M Company.

IV. PROJECT ACTIVITIES AND OUTCOMES:

The centers will collectively put out a bid for solar panels/equipment for at least 5 Kilowatts at each of the six RELCs. In order to secure bids we have conducted site analysis at the six centers and the best possible placement of the minimum 5 kW array has been determined at each center. Each center will install a minimum of 5 Kilowatt array of solar photovoltaic panels incorporated with a monitoring system to document production, thus CO2 savings, as well for educational integration into existing center.

ACTIVITY 1: Deep Portage Learning Center Installation

Description: The oldest building on the Deep Portage Learning Center campus is the Interpretive Center (Nature Center). It was constructed in 1979 and is approximately 6,000 square feet. It uses 12,000 kW hours of electricity for lighting and domestic water each year. The 5 kW array will conservatively produce 5,000 kW hours each year, and during the spring, summer and fall, it should produce nearly all of the electricity that the building uses. eGauge will track both production and usage and will demonstrate that the solar arrays at each RELC that is similar in size to a typical a solar array at Minnesota to meet most of its energy needs. Deep Portage has a history of demonstrating large scale as well as residential sized projects as evidenced by our wood biomass boilers**.** Deep Portage will participate in the collective bidding that will involve all six centers.

Summary Budget Information for Activity 1:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: June 15, 2015

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0
2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	June 15, 2015	$25,000

Amendment Request 12/31/14: The cold weather in November 2014 drove the frost deep into the ground and made Fall installation work impossible. Thus, the project has been delayed until Spring 2015.

Amendment Approved: 12/29/14

Activity Status as of December 31, 2014: Outcomes 1 and 2 have been completed. Panels, arrays and inverters have been ordered and received and are in RREAL's warehouse in Pine River, MN.

Activity Status as of May 31, 2015: Mechanical and trenching work is underway.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

ACTIVITY 2: Wolf Ridge Installation

Description: Wolf Ridge will participate in the collective bidding that will involve all six centers. The array will need to be placed appropriately to maximize educational opportunities and sun exposure as well as assure compliance with building codes and connection to the power grid. The contractor will prepare the site, construct the array, make the interconnection to the grid and install the monitoring equipment. At Wolf Ridge the anchorage for the solar array will be via tubular concrete anchors, poured in place, as footings for the foundation of the array.

Summary Budget Information for Activity 2:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: June 15, 2015

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0
2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	June 15, 2015	$25,000

Amendment Request 12/31/14: The cold weather in November 2014 drove the frost deep into the ground and made Fall installation work impossible. Thus, the project has been delayed until Spring 2015.

Amendment Approved: 12/29/14

Activity Status as of December 31, 2014: Outcomes 1 and 2 have been completed. Panels, arrays and inverters have been ordered and received and are in RREAL's warehouse in Pine River, MN.

Activity Status as of May 31, 2015: Work will start Monday, June 2, 2015.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

ACTIVITY 3: Eagle Bluff Environmental Learning Center Installation

Description: Eagle Bluff's solar PV display will be located next to the Schroeder Administration Building. This location is the hub for Eagle Bluff's renewable energy class and where most adults come to register for adult programming, therefore giving it the most exposure possible. The contractor will prepare the site, construct the array, make the interconnection to the grid and install the monitoring equipment. Eagle Bluff will participate in the collective bidding that will involve all six centers.

Summary Budget Information for Activity 3:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: December 31, 2014

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0

2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	Dec 31, 2014	$25,000

Activity Status as of December 31, 2014: Outcomes 1, 2 and 3 have been completed. The array has been completed and is operational. In Eagle Bluff's Energy's Potential class, students explore the solar array to speculate how PV works. They then play a demonstration game to further their understanding of solar electrical energy production. Then they measure and calculate how much electricity Eagle Bluff's panel will produce during the year. This is compared to the total electricity Eagle Bluff uses, as well as the average home in Minnesota. Even though it produces only a fraction of Eagle Bluff's needs, it would be enough for the average household during the year. Students are asked to think about where they would put such a solar panel where they live and then discuss pros and cons of PV and compare it to Wind, Coal, and Wood energy. Each small team of students then has to use their experience in class to envision the future of energy for their home town or neighborhood, and what types of energy might be best for the long-term sustainable future. When tenK systems are in place at the other centers, students will be able to compare production for the six systems and explore reasons why they might differ. Data from the tenK system may be viewed real-time at: http://egauge16737.egaug.es Eagle Bluff has added a second eGauge system that combines its solar production with consumption. That data can be viewed at: http://egauge16721.egaug.es

Activity Status as of May 31, 2015: Many STEM activities have occurred during the 2014-15 school year. The project is completed.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

ACTIVITY 4: Laurentian Environmental Center Installation

Description: Laurentian Environmental Center's solar installation will be the first solar PV installation at the center. It will provide at least 5 Kilowatt solar system that will produce real-time, on-site monitoring with eGauge, as well as help demonstrate the production and potential of solar energy in our alternative/renewable energy curriculum. The solar array will be installed on an easily accessible area of the center in order to help visitors get up close to the solar panels and see the core components necessary to produce the electricity. The location will also help ease snow removal and other maintenance needs. The solar electricity produced, along with conservation practices, will help reduce the center's carbon footprint. Laurentian will participate in the collective bidding that will involve all six centers.

Summary Budget Information for Activity 4:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: June 15, 2015

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0
2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	June 15, 2015	$25,000

Amendment Request 12/31/14: The cold weather in November 2014 drove the frost deep into the ground and made Fall installation work impossible. Thus, the project has been delayed until Spring 2015.

Amendment Approved: 12/29/14

Activity Status as of December 31, 2014: Outcomes 1 and 2 have been completed. Panels, arrays and inverters have been ordered and received and are in RREAL's warehouse in Pine River, MN.

Activity Status as of May 31, 2015: Mechanical work is completed; electrical is underway. eGauge is being installed.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

ACTIVITY 5: Audubon Center of the North Woods Installation

Description: Audubon Center will participate in the collective bidding that will involve all six centers. We have selected the solar photovoltaic array site to be just south of our Wildlife & Rock Climbing Barn. The Barn was built in 1910 by the original owners, the Schwyzer Family, and housed the horse stables, and hay was stored in the loft. Now it houses our non-releasable educational raptors, mammals, reptiles, amphibians and fish. Recently the 114-year-old barn was given an efficiency makeover from top to bottom, with energy efficient insulation and windows and a solar hot air panel added. We plan to install the 6.15 kW array just south of the barn to provide conservatively 5,000 kilowatt hours annually, which will provide a substantial amount of the 31,000 annual kilowatt hours the barn uses. This solar array will be the first installation of solar PV for the Marv Borrell Barn and will provide a new teaching tool with the e-Gauge monitoring and tracking capabilities. We are very excited about the educational possibilities this e-Gauge technology provides for working with students not only when they are at Audubon Center, but also remotely when at their schools, for production tracking and examining how seasonal sunlight levels and weather events affect performance. The Audubon Center of the North Woods teaches over 4,000 K-12 students annually and 10,000 participants overall annually through our programs.

Summary Budget Information for Activity 5:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: June 15, 2015

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0
2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	June 15, 2015	$25,000

Amendment Request 12/31/14: The cold weather in November 2014 drove the frost deep into the ground and made Fall installation work impossible. Thus, the project has been delayed until Spring 2015.

Amendment Approved: 12/29/14

Activity Status as of December 31, 2014: Outcomes 1 and 2 have been completed. Panels, arrays and inverters have been ordered and received and are in RREAL's warehouse in Pine River, MN.

Activity Status as of May 31, 2015: Mechanical and electrical is complete. Data monitoring is being installed.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

ACTIVITY 6: Long Lake Conservation Center Installation

Description: The solar array will be hooked into Long Lake's main housing unit, the North Star lodge. Right now Long Lake has an operating 6.15 kW solar array that is attached to the dining hall. It has a "monitoring" system that we have access to, but it provides little in educational value. The information is only accessible on one computer located in the administration office; the information is not archived but erased every 24 hours. Trending data cannot be compiled, and the information is also laid out numerically and to the fifth decimal place, making understanding by fifth graders almost impossible. The layout for this new at least 5 kW system will be viewable to every group that enters campus. With the eGauge system, Long Lake will be able to teach conservation methods and renewable energy systems within the dorm setting. This system should provide all the daylight electrical needs for that building excepting industrial pumps and air handlers. Long Lake is a multipurpose facility and serves to educate not only children but adults as well. This system, with monitoring package, will prove the feasibility of such systems in a residential setting. Long Lake will participate in the collective bidding that will involve all six centers.

Summary Budget Information for Activity 6:

ENRTF Budget: $25,000
Amount Spent: $25,000
Balance: $0

Activity Completion Date: June 15, 2015

Outcome	Completion Date	Budget
1. Site analysis for solar exposure and site chosen for installation. Analysis document to be provided by contractor.	July 15, 2014	$0
2. Existing building electrical and meter analysis. Analysis document to be provided.	July 15, 2014	$0
3. Construction of array, interconnection to grid and monitoring equipment	June 15, 2015	$25,000

Amendment Request 12/31/14: The cold weather in November 2014 drove the frost deep into the ground and made Fall installation work impossible. Thus, the project has been delayed until Spring 2015.

Amendment Approved: 12/29/14

Activity Status as of December 31, 2014: Outcomes 1 and 2 have been completed. Panels, arrays and inverters have been ordered and received and are in RREAL's warehouse in Pine River, MN.

Activity Status as of May 31, 2015: Mechanical and electrical finished. Data monitoring is being worked on.

Activity Status as of October 1, 2015:

Final Report Summary: The 6.15 kW array has been completed, e-Gauge monitoring is operational, and educational dissemination has begun.

V. DISSEMINATION:

Description: Each Center will have a link on their website to the eGauge reporting system and they will instruct visiting teachers in several STEM objective rubrics that will help their students with the analysis of the data that eGauge supplies. For instance, if the data at all six centers are checked on a given day, there will be differences in the KW hours produced. What factors are at play? Latitude, weather affects (clouds or precipitation), and the date and how much available sunshine is there. Each Center will be responsible for guiding as many teachers and students as possible through the system and software.

Status as of December 31, 2014: Eagle Bluff is up and running. Five more will be added in May/early June. In Eagle Bluff's Energy's Potential class, students explore the solar array to speculate how PV works. They then play a demonstration game to further their understanding of solar electrical energy production. Then they measure and calculate how much electricity Eagle Bluff's panel will produce during the year. This is compared to the total electricity Eagle Bluff uses, as well as the average home in Minnesota. Even though it produces only a fraction of Eagle Bluff's needs, it would be enough for the average household during the year. Students are asked to think about where they would put such a solar panel where they live and then discuss pros and cons of PV and compare it to Wind, Coal, and Wood energy. Each small team of students then has to use their experience in class to envision the future of energy for their home town or neighborhood, and what types of energy might be best for the long-term sustainable future. When tenK systems are in place at the other centers, students will be able to compare production for the six systems and explore reasons why they might differ. Data from the tenK system may be viewed real-time at: http://egauge16737.egaug.es Eagle Bluff has added a second eGauge system that combines its solar production with consumption. That data can be viewed at: http://egauge16721.egaug.es

Status as of May 31, 2015: Progress is being made. When all arrays are up and running and eGauges are reporting, significant STEM education will occur during the Summer and Fall of 2015.

Status as of October 1, 2015:

Final Report Summary: Vigorous dissemination has begun at Eagle Bluff, Wolf Ridge and Deep Portage.
Wolf Ridge has developed an alternative energy brochure that features the solar array and invites guests and interested members of the public to take a tour. They have also crystallized their new solar electric curriculum around the array and are excited that the Jack Piccotta Science Center has gone net zero in the summer months.
Deep Portage offered six solar energy tours this summer and also prominently featured the array in the Izaak Walton League Camp (June 28-July 3, 2015) curriculum. There were also several dozen impromptu solar energy tours, based on people walking by the array and asking, "What's this?"
Eagle Bluff has used the array during the 2014-15 school year, as their array was activated last Fall. This past summer numerous visitors and campers were also exposed to the wonders of solar energy.
Northwoods Audubon, Long Lake and Laurentian have toured interested members of the public and will be putting great effort into this coming school year and embedding the previously developed solar energy curriculum into their school offerings.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Explanation

Equipment/Tools/Supplies:	$150,000	6.15 kW solar array/internet reporting system installed at six RELCs.
TOTAL ENRTF BUDGET:	**$150,000**	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than $5,000: A minimum of 5 kW solar array/internet reporting system installed at six RELCs

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: N/A

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds: N/A

VII. PROJECT STRATEGY:

A. Project Partners: Deep Portage, Wolf Ridge, Eagle Bluff, Laurentian, Audubon and Long Lake RELCs

B. Project Impact and Long-term Strategy:

This project requires no future funding or on-going strategy to support its needs. The system each center installs will have a warranty of 10 years, and the panels themselves will be warranted for 25 years. No long-term funding is needed as each array will save each center $700 per year, which more than funds the annual maintenance requirements. Each center already has renewable energies located on their site, and maintenance of the array will be integrated into the maintenance protocols of the respective centers.

C. Spending History: N/A

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. VISUAL ELEMENT or MAP(S): See attached Proposal from Rural Renewable Energy Alliance (RREAL) and RELCs maps (2).

Status as of December 31, 2014: Attached is a photo of the tenKsolar equipment for the five remaining RELC projects. Everything is plastic-wrapped and on pallets at RREAL's location in Backus MN for winter storage. In early 2015, RREAL will prepare, review and discuss building permit applications and electrical interconnection applications, as well as project-specific details, with each of the five remaining project sites.

Final Report Summary: Attached are photos of the installed solar arrays at Deep Portage, Wolf Ridge, Eagle, Bluff and Long Lake RELCs. We are expecting additional photos from Laurentian and Audubon RELCs.

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than December 31, 2014, May 31, 2015, and October 1, 2015. A final report and associated products will be submitted between June 30 and August 15, 2016.

Environment and Natural Resources Trust Fund

M.L. 2014 Project Budget

Project Title: Solar PV at Minnesota's Residential Environmental Learning Centers

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 8h

Project Manager: Dale Yerger

Organization: Deep Portage, Wolf Ridge, Eagle Bluff, Laurentian, Audubon and Long Lake RELCs

M.L. 2014 ENRTF Appropriation: $ 150,000

Project Length and Completion Date: 2 Years, June 30, 2016

Date of Report: 8/15/15

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	Activity 4 Budget	Amount Spent	Activity 4 Balance	Activity 5 Budget	Amount Spent	Activity 5 Balance	Activity 6 Budget	Amount Spent	Activity 6 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	**Deep Portage Installation**			**Wolf Ridge Installation**			**Eagle Bluff Installation**			**Laurentian Installation**			**Audubon Installation**			**Long Lake Installation**				
Equipment/Tools/Supplies tenKsolar will provide 5 kW array at six RELCs, eGauge internet reporting and system integration at each location.	$25,000	$25,000	$0	$25,000	$25,000	$0	$25,000	$25,000	$0	$25,000	$25,000	$0	$25,000	$25,000	$0	$25,000	$25,000	$0	$150,000	$0
COLUMN TOTAL	**$25,000**	**$25,000**	**$0**	**$25,000**	**$25,000**	**$0**	**$25,000**	**$25,000**	**$0**	**$25,000**	**$25,000**	**$0**	**$25,000**	**$25,000**	**$0**	**$25,000**	**$25,000**	**$0**	**$150,000**	**$0**


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