

2010 Project Abstract

For the Period Ending June 30, 2012

PROJECT TITLE: Demonstrating Sustainable Energy Practices at RELCs – Eagle Bluff

PROJECT MANAGER: Jerome “Joe” Deden

AFFILIATION: Eagle Bluff Environmental Learning Center

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FUNDING SOURCE: Environment and Natural Resources Trust Fund

LEGAL CITATION: MN Laws 2010, Chapter 362, Sect 2, Sub 7d1

APPROPRIATION AMOUNT: \$350,000

Overall Project Outcome and Results

Minnesota’s six accredited Residential Environmental Learning Center’s undertook a collaborative project, “Today’s Leaders for a Sustainable Tomorrow,” with the intent of acting as a public resource for information regarding energy use and energy technologies. This was accomplished by demonstrating geographically appropriate technologies for reducing energy use and providing public access to energy information through formal education programs and a web presence. In-depth information on each center’s energy reduction demonstrations are found in their individual reports. A bulleted summary of each demonstration is as follows:

- **Eagle Bluff Environmental Learning Center – Lanesboro, MN:** Installed deep energy reduction retrofit, solar thermal, and a solar hot water heater.
- **Audubon Center of the North Woods – Sandstone, MN:** Installed geothermal heat pump, solar arrays, solar panels, and a wind generator.
- **Deep Portage Learning Center – Walker, MN:** Installed wood gasification system and lighting upgrades (CFLs to LEDs and T12s to T8s).
- **Laurentian Environmental Learning Center – Britt, MN:** Installed building envelope improvements, energy conservation technologies, and a solar hot water heater.
- **Long Lake Conservation Center – Palisades, MN:** Installed building envelope improvements, a solar hot water heater, and lighting upgrades (trail lighting and T12s to T8s).
- **Wolf Ridge Environmental Learning Center – Finland, MN:** Installed biofuel heating system, solar arrays, wind generation, and lighting upgrades (trail lighting and T 12s to T8s).

Eagle Bluff implemented a deep energy reduction retrofit on its most inefficient building, the staff residence. The building was super insulated using the Cold Climate Housings Research Center’s REMOTE (Residence Exterior Membrane Outside-insulate Technique). Solar thermal heat was added for domestic hot water and building heating. A 5.6 Kw solar photovoltaic system provides green power for the heating system. As a result of the retrofit, the building became the 9th house in North America to receive ACI’s 1000 Home Challenge for reducing energy consumption by over 78%. A pdf describing the project is available from Eagle Bluff.

All centers collaborated in developing over 20 new units of educational curriculum based on the following seven areas: biomass, conservation, efficiency, energy basics, food and energy, solar power and wind power. An activity toolbox was designed for use at the RELC’s and in the formal classroom. They range from formal lessons to informal tours to an energy choice challenge and are currently in practice at the RELC’s collectively reaching nearly 60,000

visitors/students annually. In order to determine the efficacy of the educational materials and program, an external assessment was done which evaluated the knowledge and behaviors of visitors to the RELC who participated in the activities. The results showed that 88.5% of children and 50.6% of adults had an increase in knowledge and 70.2% of children and 52.6% of adults increased their energy conserving behaviors while visiting an RELC.

Project Results Use and Dissemination

Homeowners, commercial businesses, educators and the general public can access the educational materials, assessment results, demonstration information, and current energy use/production on the Today's Leaders for a Sustainable Tomorrow website at: www.tlfast.org.

In addition, this project has allowed the centers the opportunity to collaborate with Winona State University to offer an Energy Resource Advisor course which is part of Continuing Education program and a core course in WSU's Sustainability major.

Using the TLFAST demonstrations and curriculum as the framework, the centers are also now positioned to collaborate on an innovative program funded by the National Science Foundation which focuses on providing informal STEM (Science-Technology-Engineering-Math) experiences for K-12 students.

In the upcoming year and upon the total completion of the project, the centers' will be participating in tours, conferences, or workshops to share the success of the project and publicize the resources available to the public as a result of the project.

Environment and Natural Resources Trust Fund (ENRTF) 2010 Work Program Final Report

Date of Report: 8/15/2012
Final Report
Date of Work Program Approval: 9/8/2010
Project Completion Date: 6/30/2012

I. PROJECT TITLE: Demonstrating Sustainable Energy Practices at Residential Environmental Learning Centers (RELCs) – Eagle Bluff (7d-1)

Project Manager: Joe Deden
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Web Site Address: www.eagle-bluff.org

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

Total ENRTF Project Budget:	OVERALL & EAGLE BLUFF PORTION (7d-1)
	ENRTF Appropriation \$350,000
	Minus Amount Spent: <u>\$349,415.01</u>
	Equal Balance: \$ 584.99

ALL PORTIONS	
7d-1: Eagle Bluff	\$ 350,000
7d-2: Audubon	\$ 206,000
7d-3: Deep Portage	\$ 212,000
7d-4: Laurentian	\$ 258,000
7d-5: Long Lake	\$ 240,000
7d-6: Wolf Ridge	<u>\$ 234,000</u>
TOTAL APPROPRIATION:	\$1,500,000

Legal Citation: M.L. 2010, Chp.362, Sec.2, Subd. 7d1

Appropriation Language:

\$1,500,000 is from the trust fund to the commissioner of natural resources for agreements as follows: \$206,000 with Audubon Center of the North Woods; \$212,000 with Deep Portage Learning Center; \$350,000 with Eagle Bluff Environmental Learning Center; \$258,000 with Laurentian Environmental Learning Center; \$240,000 with Long Lake Conservation Center; and \$234,000 with Wolf Ridge Environmental Learning Center to implement renewable energy, energy efficiency, and energy conservation practices at the facilities. Efforts will include dissemination of related energy education.

II. and III. FINAL PROJECT SUMMARY

Minnesota's six accredited Residential Environmental Learning Center's undertook a collaborative project, "Today's Leaders for a Sustainable Tomorrow," with the intent of acting as a public resource for information regarding energy use and energy technologies. This was accomplished by demonstrating geographically appropriate technologies for reducing energy use and providing public access to energy information through formal education programs and a web presence. In-depth information on each center's energy reduction demonstrations are found in their individual reports. A bulleted summary of each demonstration is as follows:

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All centers collaborated in developing over 20 new units of educational curriculum based on the following seven areas: biomass, conservation, efficiency, energy basics, food and energy, solar power and wind power. An activity toolbox was designed for use at the RELC's and in the formal classroom. They range from formal lessons to informal tours to an energy choice challenge and are currently in practice at the RELC's collectively reaching nearly 60,000 visitors/students annually. In order to determine the efficacy of the educational materials and program, an external assessment was done which evaluated the knowledge and behaviors of visitors to the RELC who participated in the activities. The results showed that 88.5% of children and 50.6% of adults had an increase in knowledge and 70.2% of children and 52.6% of adults increased their energy conserving behaviors while visiting an RELC.

IV. OUTLINE OF PROJECT RESULTS:

RESULT/ACTIVITY 1: Implementation of carbon and energy reduction systems for education and demonstration purposes at Eagle Bluff. Budget \$245,000. Completion Date June 30, 2012.

Description: Eagle Bluff is the only RELC located in southeastern Minnesota near the town of Lanesboro. We have about 20,000 users a year and teach them about the ecology of "Bluff Country".

Overall, the McKinstry Energy Audit for Eagle Bluff documented that all six of our buildings need envelope improvements to both conserve energy and improve energy efficiency. Three buildings are excellent candidates for solar hot water applications with five of the buildings benefiting from instantaneous domestic hot water backup. All four of our more public buildings would benefit from upgrading mechanical air handling and ventilation systems. McKinstry recommends converting our natural gas heating system to either electronic heat storage or geothermal systems depending on the availability of an on-site green electric power source. They recommend the establishment of a small scale wind turbine on-site for educational purposes. Outdoor and indoor lighting improvements will help reduce our electric energy use. And lastly, the sub-metering of all buildings to collect baseline energy use and to monitor improvements.

Our McKinstry audit and subsequent recommendation confirmed that our oldest buildings are indeed our most energy in-efficient buildings. The target of our LCCMR work plan is the Eagle Bluff's residence which was built in 1973. The retrofitted building will become the centerpiece for our Energy Resource Advisor (ERA) educational activities.

We have assembled a design and builder team with remodeling and energy related experience and have been meeting since the spring of 2008 and plan to have finished plans by July 2010. The funding for the design phase came from internal Eagle Bluff funds and a \$15,000 grant from the Beim Foundation.

Our plans are to improve the envelope utilizing the Cold Climate Housing Research Center's recommendations including the re-establishment of a continuous air barrier in the walls and ceilings. All windows and door will be replaced with high efficiency units. Plans include installing a heat recovery ventilator to achieve good interior air quality and to prevent mold.

We also plan to install solar hot water and solar photo-voltaic panels.

Monitoring equipment is already in place to establish base data and monitor improvements.

The reasons these improvements were chosen from the McKinstry report is because they: 1) have the ability to reduce Eagle Bluff's carbon production considerably while

improving efficiency, 2) utilize a renewable energy source (solar), and 3) serve as a visible demonstration for educating users on the benefits of energy conservation and efficiency, and renewable energy.

Summary Budget Information for Result/Activity 1:

ENRTF Budget:	\$245,000.00
Amount Spent:	\$244,766.56
Balance:	\$233.44

Deliverable/Outcome	Completion Date	Budget	Estimated Carbon Reduction (#s)
1-1 Envelope & Mechanical Improvements will be completed	12/31/10	\$188,000	7,755
1-2 Solar Hot Water will be installed	12/31/10	\$25,000	6,000
1-3 Solar Photovoltaic will be installed	12/31/10	\$32,000	TBD depending on size

Final Report Summary: 7/15/2012 A deep energy reduction retrofit was completed on the Eagle Bluff residence, our most energy in-efficient building before the process began. The outside envelope walls have been sealed with a bituminous membrane, super insulated with either six inches of extruded polystyrene (XPS) or six inches of polyisocyanurate (PIC). The inside ceilings were foamed with six inches of PIC foam. A whole house air handling system was installed complete with an environmental recovery unit to recapture waste heat and humidity. All windows and doors were replaced with Loewen Windows with an R value of 8. A blower door test was completed. Results have improved from being unpressurizable in 2007 to 212 cubic feet per minute at 50 Pascals of pressure or from greater than 6 air exchanges per hour to 0.45 air exchanges per hour.

A solar thermal system was installed including: 200 square feet of Heliodyne collectors, an ICM controller and a 400 gallon storage tank. Heat from this system provides primary heat for domestic hot water and secondary, supplemental heat for a hydronic home heating system.

5.44 Kw of solar power was brought online by Winona Renewable Energy to provide power. Data from the Enphase monitoring system is available on Eagle Bluff's website.

Promotion for the project has been ongoing with articles appearing in regional newspapers. Other events include: a builder's tour, a grand opening, participating in the Midwest Builders Conference held in Menomonie, WI March 2011. Ongoing tours of the project occur at least twice monthly.

The project became the 9th home in North America and the first home in Minnesota to complete ACI's 1000 Home Challenge by documenting an energy reduction of over 78% over the past year. See appended ACI letter.

The unspent \$233.44 was for a monitoring controller for the solar thermal system that was delayed by the manufacturer and is being installed after the grant period expired.

RESULT/ACTIVITY 2: Measurement and oversight as a basis for education and information sharing. Budget \$30,000 Completion Date June 30, 2012

Description: Overall Project Coordination: Managing architect - Kirk Program Management, Inc. (KPM) who supervised the McKinstry Study will help all six centers prioritize their energy projects matching their needs with current technologies, provide advice for contracting for design and construction services, review and critique proposed design solutions and perform periodic on-site observations of the work in progress and contribute updates, provide background information for the website and education materials.

Summary Budget Information for Result/Activity 2:

ENRTF Budget:	\$30,000
Amount Spent:	\$30,000
Balance:	\$0

Deliverable/Outcome	Completion Date	Budget
2-1 Scope of Work & Technical Teams will be established for each center. Centers will be assisted in going out for, receiving, and evaluating procurement options.	12/31/10	\$20,000
2-2 Progress on Work Plans will be monitored at each center.	6/31/2012	\$10,000

Final Report Summary: Ronald Kirk, Consulting Architect, 7/15/2012

The six Environmental Learning Centers have submitted detailed reports summarizing the work performed and results achieved as a result of the LCCMR approved grant. These summary reports record the timeline of activities culminating with the completion of the work by the end of June 2012, a description of the energy efficiency measures implemented, moneys spent and information on the outcomes in terms of performance and other relevant impacts. I refer the reader to these reports for detailed information. This summary report will focus on the some of the process strategies that were designed to produce predictable high value outcomes and to highlight some of the outstanding accomplishments of this important effort as a result of the LCCMR funded work.

Any funding source wants to have some assurances that the money awarded achieved the stated goals of the request for funding. Much attention was devoted from the beginning of the planning effort to implement proven “project success” strategies to ensure that each energy efficiency and carbon reduction strategy implemented was designed and installed in accordance with appropriate professional standards of care and quality construction methodologies. Several key “project success” strategies were incorporated into this effort.

PROJECT SUCCESS STRATEGIES

1. It was imperative to select highly qualified design professionals with demonstrated successful experience in the work and familiarity with current building science knowledge. A detailed Request for Proposal was prepared for each project outlining the scope of work to be designed, a detailed scope of service and quality assurance measures that were to be implemented and the format for submittals. Interviews were conducted with each firm submitting a proposal and a finalist selected based on a ranking of each firm. The interview process allowed the client to evaluate the individuals assigned to perform the work and to make an informed choice. The firms selected were highly qualified to execute the design services at a high level of professional competence throughout the design process and during the construction process in administering the contract requirements and providing on site observation of the work. The quality of the final finished work is testament to the careful selection of the firms and their highly professional approach to the work.
2. To the extent possible with public sector bidding requirements it was imperative to be able to select highly qualified construction firms to carry out the on-site work. Particularly in more rural areas this objective can be a challenge but with carefully prepared bidding documents with clear qualification criteria the centers were successful in being able to utilize qualified firms. It is acknowledged that not all firms were familiar with current building science based best practices at the beginning of the construction process but with active and close involvement and coaching by the design professionals throughout the construction process the construction firms learning curve not only allowed the work to be completed in accordance with documents and quality construction standards but provided the construction firms with considerable best practice experience that they will now be able to incorporate into their future work. We successfully utilized “Best Value” alternative procurement procedures as approved by the legislature in 2007 to be used by all school districts in Minnesota at one of the centers for work funded by other sources.
3. Implementing quality assurance measures throughout the construction process was believed to be key to achieving desired outcomes. Each project used a variety of approaches and strategies to ensure ultimate project success. Some firms incorporated “stop signs” which were signals to the construction firms to stop the work at key points to allow detailed and timely observation of the work in process to ensure the work was being installed properly. Regular on site pre-construction

meetings were conducted to make sure the construction firms and their personnel understood the requirement of the work and were ready with appropriate on site crews to properly execute each phase of the work prior to commencement of the work.

Blower door tests were conducted prior to commencement of the on-site envelope improvement work to establish a base line point and then after completion of the envelope improvement work to verify that the work was completed properly. For example, on the Eagle Bluff residence project the house had such a high air leakage level that the initial blower door test was not even able to create enough pressurization to record data. After completion of the envelope work the data indicated very little leakage and the measured natural gas use before and after indicated a remarkable 93% reduction in heating energy use.

In a couple cases the solar thermal systems initially experienced some overheating but again these issues were addressed during the commissioning process. One of the lessons learned as a result was that for applications where a wide variation in occupancy and subsequently highly varied hot water demand such as environmental learning centers with smaller occupancy levels during the summers and several days where occupancy levels can be quite low proper provisions for dealing with the excessive generation of hot water by the solar panels has to be given careful attention. Sometimes our best educational opportunities arise in these types of situations and can be very helpful in helping others avoid problems.

SUMMARY HIGHLIGHTS OF ACTUAL OUTCOMES

It is important to note that partially as a result of the LCCMR approved grant several of the centers were able to acquire additional funding to expand the scope of their energy efficiency measures and to be able to achieve even greater carbon footprint reductions.

Not all of the energy efficiency measures were completed in time to be able to record a full year of actual energy use to compare to the original 2007 data used to calculate the initial carbon footprint. It is instructive however to highlight some of the initial data that is available.

Deep Portage with a combination of the LCCMR approved funds and other funding has been able to make the claim of having reached carbon neutral through a reduction of propane use, solar and wind renewable systems and with the purchase of green credits for all of their electricity use. Their actual 2011 propane use compared to the 2007 benchmark data reflects an amazing 77% reduction while their electrical energy use reached a 13% reduction level for an overall on site carbon reduction of 43%. The purchase of green credits for the remaining electrical use allows them to claim a carbon neutral achievement. The early 2012 data suggest a possible even larger carbon reduction level may be achieved.

Eagle Bluff was able to record a 93% reduction of natural gas usage from the 2010 usage data prior to completion of the envelope improvements. This outstanding

accomplishment allowed them to become the first deep energy retrofit in the state of Minnesota to receive the Affordable Comfort Institute 1000 Home Challenge award.

Laurentian has achieved a 42% reduction in propane usage from the July 1-June 30 2011/2012 heating season compared to the same period of the 2007/2008 heating season. This is a dramatic impact and one that is also felt and recognized by all visitors in the obvious change in comfort levels especially in the Lodge and Office buildings which were the primary focus of this effort.

The Audubon Center results are somewhat complicated because of a problem with their electric driven geothermal system which was not operational from April to July of 2011 which necessitated the use of propane backup boilers which of course increased the propane use above normal operations. Even with this anomaly propane use in 2011 was reduced by 10% from the 2010 usage. When comparing the Jan-April 2012 period with the Jan-April 2011 period the propane use data indicates an 80% reduction. The annual results won't be available until December 2012 but the reduction in propane use is expected to be very dramatic as a result of envelope improvements and the solar thermal domestic hot water system installed and fully operational.

Wolf Ridge completed their LCCMR approved funded work by the June 2012 deadline but actual energy and carbon reduction information is not yet available. Engineering calculations for projected impact for the East Dormitory suggests close to a 50% reduction in propane usage. Converting the trail lighting to LED lighting is projected to achieve a 74% reduction in electrical usage. An additional 33% reduction of campus electrical lighting energy usage is projected from the conversion of T12 fluorescent fixtures to the newer T8 technology.

Long Lake

The solar system was only recently completed so no actual production data is available. Again, partially as a result of this funding Long Lake was able to receive additional federal funding to implement significant envelope improvement measures in several of their campus buildings. No engineering calculations were performed to project a realistic estimate but based on comparable other project experience the combination of the new solar system and envelope improvements are expected to make a significant reduction in energy use and subsequent carbon footprint reductions.

In addition to the above center specific highlights each of the centers either has installed or is in the process of installing energy monitoring systems. These systems will have the capability to record energy production of the solar photovoltaic and solar thermal systems. Some of the more extensive systems will be able to record actual energy usage of various systems and/or buildings which in addition to recording energy use will also enable staff to trouble shoot system problems and allow them to identify when systems are using more energy than intended and thus allow the staff to reduce the amount of wasted energy used at each center. Numerous studies around the world have indicated that as much as 40% of a buildings energy use is actually wasted by malfunctioning equipment or improperly controlled mechanical and lighting systems that are running when not needed or desired.

All six centers have collaborated in developing over 20 new units of educational curriculum units based on the following eight areas: biomass, climate change, conservation, efficiency, energy basics, food and energy, solar power and wind power. Each of the centers provide tours of their energy improvements and have incorporated lessons learned into their educational curriculum thus helping to transform the knowledge base of Minnesota students and residents related to these critical energy issues.

The training of local firms in the latest building science construction techniques was a side objective of this effort and will hopefully benefit future construction efforts in the local areas of each of the six centers.

In summary it is this author's opinion that the LCCMR approved funds have been invested wisely and have achieved and will continue to achieve significant energy and carbon footprint reductions for years to come. The joint development of new energy related educational curriculum units by the six centers will lead to evidence based energy and climate education for generations to come for students and other citizens able to experience the examples set by these six centers. It is this author's opinion that it is essential that the citizens of Minnesota understand in an unbiased, scientific, non-political manner the critical energy and climate issues of this period in our planet's history. This citizen awareness and understanding of the palette of proven solutions as demonstrated by the results of this effort could well help establish the state of Minnesota as a national leader in solving the complex energy and climate related challenges that desperately need creative, smart and proven effective solutions.

In closing I would like to commend and express appreciation for the LCCMR's support for this important effort in helping the joint coalition of residence based environmental learning centers make tremendous progress in their pursuit of their goal to reduce their collective carbon footprint by 80%. Much work remains to accomplish this goal but thanks to the LCCMR attainment of this goal is now within sight.

RESULT/ACTIVITY 3: Development of significant public education on energy choices. Budget \$60,000 Completion Date June 2011

Description: Overall Project Coordination: Eagle Bluff will coordinate the development of appropriate K-12 curriculum and activities, on-site signage, take-home materials, web interaction and the development of center specific workshops and training seminars will be completed under the guidance of an educational consultant.

3.1 Lessons on Sustainability and Renewable Energy delivered at each RELC

We will develop, pilot test, and teach classes centered on renewable energy and sustainable lifestyles. These lessons will be large-group presentations and interactive classes for groups of 15-20 students, all of varying time lengths to fit each RELC's needs.

3.2 Participation in sustainable lifestyle activities at the RELC.

As part of the lessons being designed, all students will be asked to live a more sustainable lifestyle during their RELC visit. This may include, but is not limited to: reducing food waste, composting food, reducing electricity use, reducing water use, recycling, etc.

3.3 Interactive web-based tools

We will develop and maintain interactive web tools to complement the pre- and post-visit lessons that students will complete at their own school before and after their visit to the RELC. This curriculum will be a matching in-kind donation to the program.

3.4 Assessment

We will develop and implement an assessment tool that will measure the change in behavior and/or knowledge of students who participate in our program.

Summary Budget Information for Result/Activity 3:

ENRTF Budget:	\$60,000.00
Amount Spent:	\$59,648.45
Balance:	\$351.55

Deliverable/Outcome	Completion Date	Budget
3-1 K-12 curriculum will be developed	6/30/2011	\$40,000
3-2 On-site signage recommendations will be completed, designed and printed	6/30/2011	\$4,000
3-3 Interactive web-based tools will be developed and implemented	6/30/2011	\$6,000
3-4 Assessment Tools will be developed	6/30/2011	\$10,000

Final Report Summary: 7/15/2012

A curriculum designer was hired to produce the suite of activities that would make the energy education program at the RELC's. During the fall, the contractor visited the RELCs to meet with their staffs, tour the grounds, and see what each site is already doing with regards to renewable energies and sustainability practices. The staffs were able to tell her which topics, within the disciplines of renewable energies and sustainability practices, they would need activities to create new curricula or incorporate into existing curricula. The contractor then vetted existing sustainability and energy-related curriculum currently available which allowed her to see what trends exist in energy education, what common approaches are used with students, and their potential application at the RELC's. Based on the goals laid out by the RELC's and with respect to existing related curriculum, the contractor developed a specialized curriculum for use at the RELC's. A set of 24 activities in the themes of: biomass, climate change, conservation, efficiency, energy basics, food & energy, solar power, and wind power

were designed. The activities are a mixture of games, simulations, and hands-on experimentation that address a variety of Minnesota state standards in science, math, social studies, language arts, technology, and physical education. The activities are designed to not only instruct the students about renewable energy and sustainability topics, but to give the students opportunities to develop and implement strategies for changing behaviors. The staff from the six RELCs met to review the activities which gave the RELC staffs an opportunity to experience what the activities were like and how to lead them, but it also gave feedback on how to improve the activities as well as pilot test the evaluation tool the sites would use as they tried out the activities. Currently, the RELC's have made the TLFast activities part of their curriculum, collectively reaching nearly 60,000 students and visitors annually.

"Energy Action" cards were designed as way to help students remember what kinds of things they can do to support sustainable behaviors. Students are being engaged to live a more sustainable lifestyle during their RELC visit which includes, but is not limited to: reducing food waste, composting food, reducing electricity use, reducing water use, recycling, etc. An RFP was circulated and a graphic illustrator was hired to produce these materials. Posters and reminder cards are being utilized at each RELC and can be downloaded from the TLFast website for schools to or other organizations to use.

The tools that were created/compiled for TLFast are accessible via the state-side composite website: www.tlfast.org for individuals seeking to teach about energy and sustainability. The energy action cards that visitors to the RELC's encounter are also available to download from the site. Lastly, a compilation of relevant mobile apps and online calculators are featured which complement the classroom and RELC activities.

An RFP was circulated and an assessment contractor was hired to evaluate the materials outlined in Result 3.1. In general the results of the assessment found that: "A clear trend of improvement was shown for material taught in the RELC classes. In the 10 different classes, a total of 89 questions were asked of the 550 students and 134 adults who participated in the pre and post testing. Students demonstrated improvement in choosing the correct answer in 79 of the 89 questions showing 88.8% improvement for students overall. Adults provide a little different story, and do not reflect as great a change in the number of participants selecting the correct answer. They arrive with a generally greater set of knowledge prior to the teaching in classes, so the trend among adults showed improvement in 45 of 89 questions for 50.6% improvement overall." The full report as well as the assessment instrument can be found in the Appendix.

RESULT/ACTIVITY 4: Establish and maintain center specific websites to share information and knowledge with all interested individuals and groups. Budget \$15,000 Completion date June 2012.

Description: Overall Project Coordination: The centers are committed to collecting real time data that can be used on their websites and also for research on the efficiency of the various selected solutions. It will also be used to monitor the results of construction

and the accuracy of projections. The websites will have similar background information, photos and essays on the project as it develops, and real time monitoring of the energy savings. The six individual center sites will be linked together.

Summary Budget Information for Result/Activity 4:

ENRTF Budget:	\$15,000
Amount Spent:	\$15,000
Balance:	\$0

Deliverable/Outcome	Completion Date	Budget
4-1 Web consultant will be selected & appropriate technologies will be determined	9/1/2011	\$3,000
4-2 Center websites will be upgraded	7/15/2011	\$10,000
4-3 State-wide composite site recommendations will be completed	1/15/2012	\$2,000

Final Report Summary: 7/15/2012

Web designers were interviewed, a web consultant hired, and work completed on a site featuring the partnership of the six centers. During the late 1990's, the six centers worked together to raised \$27,000,000 for capital expansion at our centers. This capital campaign was called "Project EarthSense". The group decided to build on the name recognition of this project and to organize together as the EarthSense Alliance. A recommendation was made to build a website that would be a this partnership on a site which would act as a portal for our collective projects such as TLFAST and a standalone TLFAST site linked to the umbrella EarthSense Alliance site. The sites were built to allow members of the TLFAST project to edit the site thus eliminating the need to hire a webmaster site and incur further costs.

Visitors to the RELC's websites can learn about the TLFAST project through their respective links to the state-wide composite site. These links can be found at:

- Eagle Bluff) <http://www.eagle-bluff.org/top/projects/energy/>
- Deep Portage) <http://www.deep-portage.org/renewable-energy.html>
- Audubon Center) <http://www.audubon-center.org/energy.htm>
- Wolf Ridge) http://www.wolf-ridge.org/campus/renewable_energy.shtml
- Long Lake) <http://www/llcc.org>
- Laurentian Center) <http://laurentiancenter.org>

The state-wide composite site can be found at: www.tlfast.org. In addition to being connected to each center's sites, a link to the TLFAST site can be found on the www.earthsensealliance.org site under the PROJECTS menu. www.tlfast.org features the energy conservation measures employed by each center as well as current energy use for those with real-time monitoring. In addition, visitors can access curricular materials, web tools, and view the results from the education program assessment.

V. TOTAL ENRTF PROJECT BUDGET:

Contracts: \$101,000

Overall Project Coordination \$30,000 Ron Kirk, Kirk Program Management Technical Advice

K-12 Curriculum development \$40,000. The professional contractors will be determined through a competitive bidding process.

Interactive web-based tool design \$6,000 The professional contractors will be determined through a competitive bidding process.

Assessment tools development \$10,000 The professional contractors will be determined through a competitive bidding process.

Web Development \$15,000 The professional contractors will be determined through a competitive bidding process.

Supplies: \$4,000

On-Site Signage \$4,000. On-site signage will be determined by the successful curriculum consultant hired in consultation with the project members.

Capital Improvements: \$245,000

TOTAL ENRTF PROJECT BUDGET: \$350,000

Explanation of Capital Expenditures Greater Than \$3,500:

Envelope and Mechanical Improvements \$170,000 (60% materials, 40% installation)

Solar Hot Water \$25,000 (60% materials, 40% installation)

Solar Photovoltaics \$50,000 (60% materials, 40% installation)

The capital improvements made with these funds indicated above are fixed capital assets and will remain in place and will continue to be used for the same program through its useful life.

VI. PROJECT STRATEGY:

A. Project Partners: Audubon Center, Sandstone; Deep Portage, Walker; Eagle Bluff, Lanesboro; Laurentian, Britt; Long Lake, McGregor; and Wolf Ridge, Finland.

7d-1: Eagle Bluff	\$ 350,000
7d-2: Audubon	\$ 206,000
7d-3: Deep Portage	\$ 212,000
7d-4: Laurentian	\$ 258,000
7d-5: Long Lake	\$ 240,000
7d-6: Wolf Ridge	\$ 234,000
TOTAL APPROPRIATION:	\$1,500,000

B. Project Impact and Long-term Strategy: The RELCs sustainable energy campaign has two phases or main goals. Phase 1 is to retrofit our campuses using conservation, efficiency, and renewable resources to reduce the RELCs collective carbon emissions by 80% and lower energy costs. The ENRTF funds will be used to implement one quarter of the Phase 1 goal and sets the stage for our Phase 2 educational programs. The Eagle Bluff will continue to seek funds until all of the Phase 1 work identified in the McKinstry report is completed.

Phase 2 is to create and implement education efforts that compliment the building improvements done in Phase 1, thus using the campuses as models for sustainable retrofitting and practical carbon-neutral lifestyles. The ENRTF funds will allow us to complete a deep energy reduction on the Eagle Bluff residence, adding renewable energy use with solar hot water and solar photovoltaics. The completed project will become the centerplace of educational activities with the ERA-Energy Resource Advisor program.

B. Funding Sources	Overall RELC Project	Eagle Bluff
LCCMR 2010 Request - Pending	\$1,500,000	
2009 Federal Allocation - \$300,000/ctr – 5 Northern Ctrs - Pending		1,500,000
2010 Federal Allocation - \$300,000/ctr – 6 ctrs – In Process		\$1,800,000
MN DEED – Energy Related - Deep Portage - Received		\$135,000
Federal Stimulus EECBG Grant – Long Lake – Under consideration		\$100,000

C. Other Funds Proposed to be Spent during the Project Period:

C. Other Funds	Overall RELC Project	Eagle Bluff
In-kind Staff - \$30,000		\$5,000 per ctr
2009 Federal Allocation - \$300,000/ctr – 5 Northern Centers		\$1,500,000

D. Spending History:

D. Spending History	Overall RELC Project	Eagle Bluff
Bush Foundation – McKinstry Study	\$176,000	
Butler Family Foundation – Project Development	\$90,000	
AURI – Biomethane Study at Eagle Bluff		\$65,000
Beim Foundation - Deep Energy Reduction		\$15,000

Design Team at Eagle Bluff		
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VII. DISSEMINATION:

Homeowners, commercial businesses, educators and the general public can access the educational materials, assessment results, demonstration information, and current energy use/production on the Today's Leaders for a Sustainable Tomorrow website at: www.tlfast.org.

In addition, this project has allowed the centers the opportunity to collaborate with Winona State University to offer an Energy Resource Advisor course which is part of Continuing Education program and a core course in WSU's Sustainability major.

Using the TLFast demonstrations and curriculum as the framework, the centers are also now positioned to collaborate on an innovative program funded by the National Science Foundation which focuses on providing informal STEM (Science-Technology-Engineering-Math) experiences for K-12 students.

In the upcoming year and upon the total completion of the project, the centers' will be participating in tours, conferences, or workshops to share the success of the project and publicize the resources available to the public as a result of the project.

VIII. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than 01/15/2011, 7/15/2011, and 1/15/2012 A final work program report and associated products will be submitted between June 30 and August 1, 2012 as requested by the LCCMR.

Project Title: Residential Environmental Learning Center's (RELC's) Sustainable Energy Project - Summary

Dated Material: 10/31/2012

Attachment A: Final Budget Detail for 2010 Projects															
Project Title: Demonstrating Sustainable Energy Practices at Residential Environmental Learning Centers (RELCs) - Eagle Bluff 7d-1															
Project Manager Name: Joe Deden															
Trust Fund Appropriation: \$1,500,000		Eagle Bluff's 7d-1 Portion:				\$350,000									
2010 Trust Fund Budget	Result 1 Budget:	Result 1 Budget: 9/9/10	Amount Spent (6/30/12)	Balance (6/30/12)	Result 2 Budget:	Amount Spent (6/30/12)	Balance (6/30/12)	Result 3 Budget:	Amount Spent (6/30/12)	Balance (6/30/12)	Result 4 Budget:	Amount Spent (6/30/12)	Balance (6/30/12)	TOTAL BUDGET	TOTAL BALANCE
	Implementation of carbon and energy reduction systems for education and demonstration purposes.				Measurement and oversight as a basis for education and information sharing.			Developmen of significant public education on energy choices.			Establish and maintain a website to share information and knowledge with all interested individuals and groups				
BUDGET ITEM															
Contracts															
Professional/technical	\$0	\$0	\$0	\$0	\$30,000	\$30,000	\$0	\$60,000	\$59,648	\$352	\$15,000	\$15,000	\$0	\$105,000	\$352
Capital equipment over \$3,500															
Conservation - Envelop Improvements 70%materials/30%installation	\$150,000	\$168,000	\$168,000	\$0										\$168,000	\$0
Conservation - Envelop Improvements 70%materials/30%installation	\$20,000	\$20,000	\$20,000	\$0										\$20,000	\$0
Renewables - Solar Hot Water 80%materials/20%installation	\$25,000	\$25,000	\$24,767	\$233										\$25,000	\$233
Renewables - Solar Photovoltaic 80%materials/20%installation	\$50,000	\$32,000	\$32,000	\$0										\$32,000	\$0
COLUMN TOTAL	\$245,000	\$245,000	\$244,767	\$233	\$30,000	\$30,000	\$0	\$60,000	\$59,648	\$352	\$15,000	\$3,252	\$11,748	\$350,000	\$585