

2008 Project Abstract (or 2009 Project Abstract or 2010 Project Abstract)
For the Period Ending June 30, 2012

PROJECT TITLE: Today's Leaders for a Sustainable Tomorrow.
PROJECT MANAGER: Karl Brown
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: [Insert relevant year's citation here]

APPROPRIATION AMOUNT: \$ 258,000

Overall Project Outcome and Results

In 2007, a McKinstry study was conducted at the six residential environmental learning centers in Minnesota to identify ways to reduce carbon, and energy consumption. The results of the study were used as the baseline carbon and energy use for Laurentian Environmental Center. This data was submitted as part of the LCCMR ENRTF grant request that focused on carbon reduction as a result of envelope improvements for the lodge and office buildings, and a solar hot water. In 2010, Laurentian Environmental Center (LEC) was awarded \$258,000 from the ENRTF. In late early fall of 2010, an RFP was sent out for the design work of the project. Wagner Zaun Architecture of Duluth was selected to design and manage the project. A pre-design site assessment determined the scope of work. A design package and RFP for the energy retrofit of the lodge and office was created, and sent out. Nelson Exteriors was selected to complete the project. The retrofit work included air sealing, insulation, high efficiency windows and doors, and mechanical improvements. Construction began in fall 2010, and was completed in spring 2011.

In spring 2011, design work for the solar hot water system was conducted by Wagner Zahn Architecture, and Conservation Technologies. Bid specifications were developed. Qualified contractors were identified, and invited to submit proposals. Innovative Power Systems was awarded the contract for the design and installation of the lodge solar hot water system, and Gruska Construction was awarded the contract for site preparation and slab installation. The slab was installed fall 2011. Solar installation occurred fall/winter 2011/2012.. The solar hot water system was fully operational in April 2012.. Innovative Power Systems designed and installed a solar hot water monitoring package that was below budget, and met the center needs.

The envelope improvements in the lodge and office have made a remarkable difference in the overall comfort of the buildings. Prior to the construction, it was difficult to maintain uniform temperatures. Air sealing, insulation, and operational windows have made the building extremely comfortable for groups and staff to use. Propane use in the lodge has dropped approximately 40%, due to a combination of burning more wood for heating, and the energy retrofit projects. Future energy monitoring and utility bills will likely yield continued reductions in carbon, and energy use.

Project Results Use and Dissemination

Environment and Natural Resources Trust Fund 2010 Work Program Final Report

Date of Report: 08/15/2012
Date of Next Progress Report: Final Report
Date of Work Program Approval: Final Report
Project Completion Date: 6/30/2012

I. PROJECT TITLE: **Demonstrating Sustainable Energy Practices at Residential Environmental Learning Center's (RELC's) – Laurentian Environmental Center (7d-4)**

Project Manager: Karl Brown
Affiliation: MN Coalition of Residential Environmental Learning Centers
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Location: St. Louis County

Total ENRTF Project Budget:	ENRTF Appropriation	\$258,000
	Minus Amount Spent:	<u>\$257,826</u>
	Equal Balance:	\$ 174

Legal Citation: M.L. 2010, Chp. 362, Sec. 2, Subd. 7d4

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

In 2007, a McKinstry study was conducted at the six residential environmental learning centers in Minnesota to identify ways to reduce carbon, and energy consumption at the centers. The results of the McKinstry study were used as the baseline carbon and energy for Laurentian Environmental Center. This data was also submitted as part of the LCCMR ENRTF grant request that focused on envelope improvements for the lodge and office buildings, and a solar hot water system that would supplement the lodge hot water needs.

In 2010, Laurentian Environmental Center (LEC) was awarded \$258,000 from the ENRTF. In late summer/ early fall of 2010, an RFP was sent out for the design work of the project. Wagner Zaun Architecture of Duluth was selected to design and manage the project. A predesign site visit and assessment was conducted to determine the scope of the work needed. A design package for the energy retrofit of the lodge and office was created, and an RFP for construction work was sent out, and posted on builder's exchanges. Lyle Nelson and Nelson Exteriors was selected to complete the project. The energy retrofit work included air sealing, insulation, high efficiency windows and doors, and mechanical improvements. Construction projects for the lodge and office began in early fall 2010, and were completed by early spring 2011.

In spring 2011, initial design work for the solar hot water system was conducted by Wagner Zahn Architecture, and Michael LeBeau of Conservation Technologies. Bid specifications were developed. Qualified contractors were identified, and invited to submit proposals based on successful completion of projects with the design team. No proposals were submitted by invitation group so the RFP was sent out to additional solar contractors who had positive reviews from other design firms or trusted contractors.

Innovative Power Systems of St. Paul, MN was awarded the contract for the design and installation of the lodge solar hot water system, and Gruska Construction of Cook, MN was awarded the contract for site preparation and the concrete slab installation. The slab was installed fall 2011. Solar installation occurred late fall 2011 through late winter 2012. The solar hot water system was initially commissioned in February 2012, and was fully operational in April 2012, after system leaks were corrected.

Monitoring systems were discussed with Wagner Zaun and Conservation Technologies. Quotes for monitoring packages were submitted by UHL companies, and People's Electric, both of the Twin Cities, MN area. Both quotes were significantly higher than the ENRTF budgeted amount, so both bids were rejected. Monitoring options were discussed with Innovative Power Systems, and a solar hot water monitoring package was selected that will provide monitoring data that will be helpful for operational and educational needs. The system will provide a web-based interface once internet connectivity is established in the lodge. Currently, the solar system displays real-time panel and tank incoming and outgoing temperature data.

The envelope improvements in the lodge and office have made a remarkable difference in the overall comfort of the buildings. Prior to the construction, it was difficult to maintain uniform temperatures. Air sealing, insulation, and operational windows have made the building extremely comfortable for groups and staff to use. Propane use in the lodge has dropped significantly, due to a combination of burning more wood for heating, and the energy retrofit projects.

Total Gallons of LP July 1- June 30

2007-2008= 10,131
2008-2009= 10,520
2009-2010= 8,843
2010-2011= 8,744
2011-2012= 5,845

III. PROGRESS SUMMARY AS OF: 6/15/2012 Amendment Request (06/15/2012)

An alternative for monitoring equipment was found that was less than the projected monitoring budget. We would like to request the transfer of \$4500 from the budget category of monitoring to the budget category of renewals. In the budget category of renewals the actual cost for the installation of the hot water solar system has exceeded the projected budget by \$7900 and the approval of this transfer would help offset some of the cost that will be covered by local funding.

Amendment Approved: [7/26/12]

IV. OUTLINE OF PROJECT RESULTS:

RESULT/ACTIVITY 1: Implementation of carbon and energy reduction systems for education and demonstration purposes at Laurentian Environmental Center. Budget \$258,000. Completion Date June 30, 2012.

Description: The Laurentian Environmental Center (LEC) is located on Minnesota's Iron Range north of Virginia near the town of Britt. It is owned and operated by the Mounds View Public School district since 1977 on Minnesota School Trust land. LEC serves 6000 statewide users annually.

The McKinstry Study noted that at the Laurentian Environmental Center, "Building envelopes require attention, particularly the five buildings with crawl spaces under the main level. The slab-on-grade buildings are performing better. Domestic hot water is provided primarily by propane-fired storage water heaters with some minor use of electric. Except for the Lodge kitchen, and restroom exhaust fans, there is no mechanical ventilation in the buildings. Lighting is provided by a variety of fixtures and some change out of the older magnetic ballast fluorescents and incandescents is recommended. Control systems are generally lacking and will require upgrading."

A design consultant, Wagner Zaun Architecture of Duluth, was hired (through a competitive RFP process) to create a work plan for this project, create specifications for work to be completed and to prepare bid documents for the project. Inservicing the contractor and subs, along with monitoring the work progress was also required of the design consultant.

The target of the LEC ENRTF work plan was sealing the lodge, a 1930's CCC construction project that serves as the LEC dining building. As stated in the 2008 McKinstry Study – "The envelope of the Lodge requires attention. Voids in the air barrier and inadequate insulation cause higher than necessary energy usage." Plans included adding significant levels of insulation and to re-establish a continuous air barrier in the walls connecting into the roof. All windows and doors were replaced with high efficiency units. It was concluded after construction began that the lodge had no insulation in the exterior walls, and that improper framing techniques had been used to install many windows. The crawl space and floor of the lodge were insulated and water infiltration issues were mitigated. A surprising discovery was that the ducting for the forced air furnace was in the uninsulated crawl space, which explained why

minimal heated air made it from the furnace to the registers, and why the furnace ran constantly during cold months.

A second priority was to seal the office building – a 1960's former dorm cabin that was repurposed in the 1990's. Again, as stated in the McKinstry Study – “The office lacks an adequate air barrier and requires additional insulation.” Insulating the walls and roof, along with sealing up the crawl space reduced energy consumption and began the reduction of the LEC carbon footprint. All doors and windows were replaced with high efficiency units.

In addition, the current propane heated domestic hot water systems in the lodge were enhanced with a solar system in the lodge. Original designs were to include the two restrooms in the solar hot water system, but the cost to connect the plumbing, and anticipated heat loss from long lengths of hot water pipe changed the design to include electric instantaneous water heaters for the restrooms, and the kitchen hot water needs are supplemented on cloudy days by a propane boiler that was previously installed, and integrated into the solar system. The propane boiler does not run as often or long as the solar hot water system preheats the water going into the boiler by 50-100 degrees Fahrenheit. Originally, the office buildings were to be part of the solar hot water system, but design consultants determined that the cost/benefit analysis of adding solar hot water to the office was not great enough as minimal hot water is used in the office. Instead of solar hot water, it was recommended that a low-capacity, high-efficiency electric hot water heater be installed on a timer, to only produce hot water during office hours. The office solar system will not require a back up due to the infrequent need for hot water. The solar hot water system has only been in production since April 2012. The system is generating hot water, and it is clear from the LP consumption that the energy improvements and the solar system are reducing the amount of LP needed at the center.

Monitoring equipment was installed in both buildings to monitor improvements. Monitoring systems design plans were reconfigured to fall within budget constraints. Monitoring is achieved through a combination of an integrated monitoring system as well as flow meters and gauges on the solar system, electric meters, and propane tanks. Future monitoring projects will expand the integrated systems to utilize web-based displays and data tracking. The monitoring data will be collected and shared on the LEC website as well as the Today's Leaders for a Sustainable Tomorrow (TLFAST) website. The monitoring system will further be enhanced when internet connectivity will be added in the lodge building in the fall of 2012.

Additional envelope improvements have been completed on other dorm and classroom buildings as a result of a 2009 Federal Allocation of \$300,000 and school district deferred maintenance funds. These improvements were also part of the McKinstry study, and will lead to additional carbon reduction and reduced energy consumption for years to come.

The overall significance of the carbon and energy reduction systems at Laurentian Environmental Center is great.

Total Gallons of LP July 1- June 30

2007-2008= 10,131
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In addition to the significant propane use reduction (close to 40%), which results in dramatic carbon reduction, the lodge and office buildings are much more energy efficient. The project created an excellent educational opportunity for student and adult groups to learn more about carbon reduction and energy conservation. This topic fits seamlessly into the mission of the center. The design and construction process also helped increase the knowledge of local contractors on areas of envelope improvements, current energy codes as well as build skills on energy retrofitting buildings. Future energy retrofitting projects will follow the design principle created for the ENRTF project. The education staff of the center has also worked to translate many of the complex construction techniques into simplified actions students and other visitors to the center can apply at home. These efforts should help further reduce carbon, and help people make their homes more energy efficient in safe, practical ways. Another significant result of the project is the overall comfort of the buildings after high-quality materials and construction techniques were applied. This is an improvement over other construction projects at the center over the last 20 or more years where energy codes were less stringent and/or contractors were less knowledgeable about energy efficient construction. Groups attending the center since the completion have commented on how comfortable and cool the lodge is with cross-ventilation from open windows, and how warm and draft-free the lodge is in the winter months.

The ENRTF grant was a key part in securing the 2009 \$300,000 Federal allocation at each of the 5 northern residential environmental centers. It is our hope that the center can demonstrate responsible use of taxpayer supported funds and that the projects further educate the public on energy reduction, as well as renewable energy options. The ENRTF has also been very helpful to identify Laurentian Environmental Center as one of the leaders in residential environmental education along with the other 5 RELCs in Minnesota. The collaboration as a result of the grant process has strengthened the collegial involvement between center directors and education staff. While each center needs to maintain a strong client base, the centers have strengthened their commitment to sustaining energy and environmental education in Minnesota and across the country.

Please note that Nick Temali was Director of Laurentian Environmental Center (LEC) when the original request for ENRTF funds was made. He retired in December 2010. Karl Brown assumed his position in the school district and LEC, as well as took over with the construction projects and grant reporting. Some of the information and history from the McKinstry study, and ENRTF request is unclear, but hopefully, all reporting requirements have been met, and we have been good stewards of the funds.

Summary Budget Information for Result/Activity 1:

ENRTF Budget: \$258,000
Amount Spent: \$ **257,826**
Balance: \$ 174

Deliverable/Outcome	Completion Date	Budget	Amount Spent	Estimated Carbon Reduction (#s)
1-1 Prof/Tech – Improvement Plans and Designs	6/31/11	\$26,000	\$25,826	0
1-2 Envelope Improvements in the	01/31/11	\$158,500	\$158,500	29,935

Lodge and Office				
1-3 Solar Hot Water installed for the Lodge and Office	2/29/12	\$68,000	\$68,000	18,446
1-4 Monitoring Equipment installed in the Lodge and Office	3/31/12	\$5,500	\$5,500	0

Result Completion Date: *June 30, 2012*

V. TOTAL ENRTF PROJECT BUDGET:

Contracts: Prof/tech assistance for a design consultant (through a competitive RFP process) \$26,000

Supplies: \$ 0

Capital Improvements: Lodge and Office insulation, doors and windows \$158,500
(Estimate 55% for materials and 45% for installation)
Solar Hot Water Systems \$68,500
(Estimate 60% for materials and 40% for installation)
Monitoring Equipment \$5,500
(Estimate 85% for materials and 15% for installation)

TOTAL ENRTF PROJECT BUDGET: \$258,000

Explanation of Capital Expenditures Greater Than \$3,500: The capital improvements made with these funds 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.

B. Project Impact and Long-term Strategy: This ENRTF request represents one third of the McKinstry Study improvement goal for the Laurentian Environmental Center. The centers will continue to work together to complete the McKinstry goal through state and federal resources and the assistance of foundations.

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

ITEM	Overall RELC Project	Laurentian Env. Center
In-kind Staff - \$30,000	\$30,000	\$5,000
2009 Federal Allocation - \$300,000/ctr. – 5 Northern Centers	\$1,500,000	\$300,000
Butler Family Foundation - Continue Project	\$30,000	

Development		
2010 Federal Allocation - \$300,000/ctr. – 6ctrs. – In Process	\$1,800,000	\$300,000

D. Spending History:

ITEM	Overall RELC Project	Laurentian Env. Center
Bush Foundation – McKinstry Study	\$176,000	
Butler Family Foundation – Project Development	\$30,000	

VII. DISSEMINATION:

Information about this project will be disseminated through a collaborative website that will be available to the public for learning about the process and successes of each individual centers projects. Laurentian Environmental Center (LEC) will have information available on its own website as well as the Mounds View Public Schools website. LEC will put this information out in its newsletter, email blasts, and through articles/press releases through local paper media.

LEC will enhance its “Earthwise Challenge” for our participants that have them conduct their own energy audit of the campus and their behaviors while they are here for three to five days, incorporating the ENRTF funded projects. Participants will also use components of the SEE energy program to better understand the impact of energy conservation on carbon reduction and decreased energy expenses.

It will also be discussed in all future New Energy Resource Advisor (ERA) training seminars to be held on-site at each center. The Energy Resource Advisor (ERA) certificate, developed by Winona State University, is a new curriculum designed to accelerate public understanding of energy efficiency, clean energy, carbon emissions, resource conservation, green technologies, and green jobs. This curriculum is the *first of its kind in Minnesota*. It is a non-credit, continuing education course for adults 18 years of age and older, *using online instructional technology combined with applied, field experience at one of the six Minnesota RELCs*. Participants in this class will learn about: a) the basic components of an energy audit, b) small-scale renewable energy including site suitability, system sizing, and financial incentives that are available, c) alternative building and transportation options, d) ways to “green up” the home or business, and e) the field of emerging “green” jobs. After completing this course, the successful participant may serve as an energy resource advisor and “green” consultant in the community and workplace.

Laurentian has been working with Mounds View Public Schools marketing and communications staff to explore ways to increase exposure of the center, it’s programs, and facilities. Marketing brochures that highlight educational programs have been

created. Additional work is in progress to increase the centers social networking presence on Facebook, Twitter, and YouTube. These sites will also be linked to the TLFast website , www.tlfast.org, which includes pages to all of the 6 residential environmental learning centers that have been part of the ENRTF grant. Real-time energy data from the energy monitoring system will be posted on the LEC and TLFast site once wireless upgrades are completed. The educational materials created by the TLFast group are being integrated into Laurentian school programs so that the 10,000 annual visitors to the centers will gain a better understanding of carbon reduction, energy conservation and renewable energy sources.

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.

Attachment A: Budget Detail for 2010 Projects - Summary and a Budget page for each partner (if applicable)						
Project Title: #075-B3 - Residential Environmental Learning Center's (RELC's) Sustainable Energy Project						
Project Manager Name: Karl Brown						
Trust Fund Appropriation: \$ 258,000						
2010 Trust Fund Budget	<u>Result 1 Budget:</u>	<u>Revised Result 1 Budget (6/15/12)</u>	<u>Amount Spent (date)</u>	<u>Balance (8/15/12)</u>	TOTAL BUDGET	TOTAL BALANCE
	Implementation of carbon and energy reduction systems for education and demonstration purposes.					
BUDGET ITEM						
Contracts						
Professional/technical - for a design consultant to be determined after a RFP process.	26,000		25,826	174	26,000	174
Conservation - Envelope Improvments on the Lodge and Office	158,500		158,500	0	158,500	0
Renewables - Solar Hot Water system for Lodge and Office	63,500	68,000	68,000	0	68,000	0
Momitoring - Submetering	40,000	5,500	5,500	0	5,500	0
COLUMN TOTAL	\$258,000		\$257,826	\$174	\$258,000	\$174