



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2016 Work Plan

Date of Report: September 14, 2016

Date of Next Status Update Report: February 1, 2017

Date of Work Plan Approval:

Project Completion Date: June 30, 2020

Does this submission include an amendment request? No

PROJECT TITLE:

Project Manager: Ellen Anderson

Organization: Energy Transition Lab, Minnesota Energy Storage Alliance, University of Minnesota

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Location: Statewide

Total ENRTF Project Budget:

ENRTF Appropriation: \$500,000

Amount Spent: \$0

Balance: \$500,000

Legal Citation: M.L. 2016, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

I. PROJECT TITLE: Community-Scale Energy Storage Guide for Clean Energy [Note I would like to change the title from “Clean Energy” to “Renewable Energy”—can I do this now?]

II. PROJECT STATEMENT: More and more cities, campuses, nonprofit entities, and businesses across Minnesota are using wind and solar technology to produce cleaner energy. To reach high levels of renewable energy, significantly reduce their emissions, and achieve energy independence, they will need to include energy storage in their energy systems. Currently there are few examples of “community scale” energy storage projects, and often these entities lack the technical knowledge needed to select and optimize the best energy storage system. We propose a Community-Scale Energy Storage Guide and 3 exemplar Demonstration Projects to provide the tools and knowledge for community-scale energy customers to choose the best energy storage solutions. For this project, we will:

- 1) create a research-based, user-friendly print and web-based guide to energy storage in Minnesota;
- 2) select 3 representative small-scale local energy customers with renewable energy installation and provide them with a battery energy storage system;
- 3) assess results and share the results broadly through public engagement, site tours, and dissemination of web and print knowledge tools.

Our criteria for selecting the Demonstration Projects are:

- 1) geographically dispersed (1-northern MN, 1-central/southern MN, 1-metro),
- 2) on-site renewable energy,
- 3) local-scale, customer-controlled energy system (examples: hospital, municipal buildings, college campus);
- 4) project funds will cover the cost of a battery storage system up to approximately 50 kW (with market changes, prices may be lower, allowing larger system by the time of purchase in 2017).

The overall goal is to expand community-based, locally-produced renewable energy, mitigate climate change, and reduce air emissions to improve the environment, all under LCCMR funding priority E.

Energy storage is a linchpin to a more innovative, clean, and efficient energy system, but its many uses and technology choices are complicated. Only a few, mostly large-scale projects exist in Minnesota, and virtually all are utility-funded and utility-scale projects. Community-scale energy users need the knowledge tools created by this project to achieve important outcomes: 1) community-scale renewable energy projects will be more productive and valuable, 2) community-scale customers will understand how to use storage to reduce their energy costs and emissions (for example, by reducing peak demand), and 3) community-scale customers with high-ambition goals for carbon-neutrality or 100% renewable energy will have a crucial tool to achieve them. Many community-scale sites could be microgrids with the addition of storage. Our definition of microgrid for purposes of this project is that the community-scale sites are grid-connected, produce on-site renewable energy, and have the ability to “island” or function independently of the grid if needed.

Our goal is to use these 3 demonstration projects and the accompanying guide and knowledge advancement to create models that community-scale energy users across the state of Minnesota can adopt. Dissemination of the information and tools is a critical part of the project. Besides individual local energy customers and community members, we will invite stakeholders such as utilities, policymakers, regulators, and local governments to provide input and participate in site visits for these projects.

The Energy Transition Lab (ETL) founded and convenes the statewide Minnesota Energy Storage Alliance (MESA), which includes more than 100 stakeholders from the public, private, nonprofit, and community sectors along with University experts, with the mission of accelerating smart deployment of energy storage in Minnesota and the Midwest. ETL and MESA will provide expert advisors, host the web-based tool, and broadly disseminate results. Please see the Energy Transition Lab website for more information about ETL and MESA: www.energytransition.umn.edu.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of February 1, 2018:

Project Status as of July 1, 2018:

Project Status as of February 1, 2019:

Project Status as of July 1, 2019

Project Status as of February 1, 2020:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1:

Description: Community Scale Energy Storage Guide Preparation, Testing, & Publication Develop the Minnesota Energy Storage Guidebook, a plain English, user-friendly print and web-based information resource, including a decision-making flow chart tool for selecting the most appropriate, cost-effective technologies for energy users’ proposed goals. The Beta version will be evaluated by an expert advisory group and focus groups and tested by users. The final version will be broadly disseminated and hosted on ETL’s website.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 114,350

Amount Spent: \$ 0

Balance: \$ 114,350

Outcome	Completion Date
1. Research completed on technology, economics, value streams of storage	Dec. 31, 2017
2. Beta version of guidebook with print and basic web version of user-friendly information resources and decision flow process graphics completed	March 31, 2018
3. Expert advisory group convened; expert review comments incorporated into guidebook	May 31, 2018
4. Representative energy customers focus groups convened; guidebook information and decision tools evaluated	Oct. 31, 2018
5. Print and Web-based guide and decision flow tools revised and published/online	Jan. 15, 2019

Activity Status as of Feb. 1, 2018:

Activity Status as of July 1, 2018:

Activity Status as of Feb. 1, 2019:

Activity Status as of July 1, 2019:

Activity Status as of Feb. 1, 2020:

Final Report Summary:

ACTIVITY 2:

Description: Community Scale Energy Storage & Renewable Energy Demonstrations

Develop protocol for characteristics of 3 Exemplar Demonstration Projects, which will be examples of representative community scale energy customers with on-site renewable energy resources, control over their microgrid or local energy system, and widely replicable. The Guidebook’s tool will help pick the appropriate technology type and applications, and technical assistance will be provided for proper installation and operation.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 385,650

Amount Spent: \$ 0

Balance: \$ 385,650

Outcome	Completion Date
1. Potential sites for 3 Exemplar Demonstration Projects have been evaluated via research, site visits	Dec. 31, 2017
2. Exemplar Demonstration Projects hosts selected	April 30, 2018
3. Project team has met with Exemplar Demonstration Projects hosts, presented guidebook and decision tools information	July 31, 2018
4. Post-Doctoral fellow and Advisory Group provides technical support for installation of storage system and controls	May 31, 2019
5. Field Day site tours of 3 projects, presentations by customer and experts, completed	June 30, 2020
6. Demonstration projects assessment report completed	June 30, 2020

Activity Status as of Feb. 1, 2018:

Activity Status as of July 1, 2018:

Activity Status as of Feb. 1, 2019:

Activity Status as of July 1, 2019:

Activity Status as of Feb. 1, 2020:

Final Report Summary:

V. DISSEMINATION:

Description: Broad dissemination is an integral part of the project. Our tangible outcomes--the Energy Storage Guidebook, 3 Exemplar Demonstration Projects, and public “Field Days” will be designed and implemented to reach as many community-scale energy users as possible in Minnesota. In addition, the project work will be disseminated by the Advisory Group of key expert-stakeholders and the Minnesota Energy Storage Alliance, as part of MESA’s efforts to accelerate understanding and deployment of energy storage in Minnesota for a cleaner and more efficient grid. We will highlight this project at ETL/MESA’s annual Energy Storage Summit, host knowledge tools on our website, and share it with stakeholders and our many partners from across the Midwest. The experience and knowledge gained can be a replicable model for small-scale microgrids and

community-based energy customers across our region, and inspire ongoing dissemination, implementation and further research.

Status as of Feb. 1, 2018:

Status as of July 1, 2018:

Status as of Feb. 1, 2019:

Status as of July 1, 2019:

Status as of Feb. 1, 2020:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Overview Explanation
Personnel:	\$ 248,754	1 project manager at 20% FTE year 1 and 15% FTE year 2 and 3; 1 graduate research assistant at 50% FTE in year 1 and 2, 12% in year 3; 1 post-doc research fellow at 100% FTE for 1 year.
Professional/Technical/Service Contracts:	\$4000	Technical assistance to create user-friendly web-based guide for community-scale energy storage
Equipment/Tools/Supplies:	\$300	Office supplies for meetings, advisory group, focus group, field days.
Capital Expenditures over \$5,000:	\$225,000	3 battery energy storage systems at \$75,000 each
Printing:	\$3,861	Printing of energy storage guidebook drafts for review, final copies for dissemination, and field day promotional materials
Travel Expenses in MN:	\$18,085	Travel and meals in-state covers project team, demonstration site participants, advisory and focus group meetings, and field days.
Other:	\$	
TOTAL ENRTF BUDGET:	\$500,000	

Explanation of Use of Classified Staff:

Explanation of Capital Expenditures Greater Than \$5,000: Three community-scale sites will be selected (Northern MN, West/Southwest MN, and Metro); locations such as college campuses, municipal buildings, and nonprofit organizations) to install battery system. Each will be integrated into host site’s energy system and evaluated during the project. After the project ends, the system will continue to be used for similar energy services, and we will request the sites continue to provide project data for interested researchers. Battery systems degrade over time depending on usage profiles, and our expectation of host sites will be for eventual upcycling or recycling of the components. The cost of the systems may be lower than estimated depending on market changes. Our goal is to provide the best system for the site within budget constraints.

Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation: 2.62 FTEs

**Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF
Appropriation: .05 FTEs**

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
McKnight Foundation	\$30,000	\$	Supports ½ time Energy Storage Project Manager position at Energy Transition Lab, to assist Ellen Anderson.
State			
University of Minnesota Serendipity Grant	\$9,000	\$	A portion of this grant goes to research identifying characteristics of optimal energy storage projects in Minnesota.
TOTAL OTHER FUNDS:	\$39,000	\$	

VII. PROJECT STRATEGY:

A. Project Partners: Energy Transition Lab Executive Director Ellen Anderson will lead the project. Ellen leads the Minnesota Energy Storage Alliance, which includes University experts Dr. Massoud Amin, Prof. Hari Osofsky; experts from electric utilities Xcel Energy, Minnesota Power, and Great River Energy, wind and solar energy industry experts, 3M, Mortenson Construction, NGO experts Fresh Energy and Great Plains Institute, and many other industry experts. An Advisory Group will be formed from this group to advise the project team and project hosts.

Project partners receiving Funds:

- Ellen Anderson \$66,470: Project lead, staff supervision, engagement of project partners and advisors
- UMN Graduate Research Assistant \$112,144: Research, writing, web development, logistics
- Post-Doc Research Fellow \$70,140: Technical support, written assessment of demonstration projects
- Exemplar Demonstration Project Hosts TBD \$225,000: Install energy storage project, share learning

Project partners not receiving Funds:

- Advisory Group and other stakeholder experts, other advisory University faculty

B. Project Impact and Long-term Strategy: Our state’s transition to clean energy depends upon broad adoption of local renewable energy resources, but small-scale energy users often lack the resources or knowledge to vet complex technology choices. Community-scale renewable energy producers can add value to their energy production and reduce their grid energy costs if they add an energy storage system. This project will help these community-scale renewable energy generators gain the technical expertise to deploy energy storage, as well as understand how to make the projects cash flow and how to optimize benefits. The projects will be designed to illustrate valuable use cases for energy storage, and where possible, to “stack” multiple value streams to improve the projects’ return on investment. For example, the projects will show how to get more value from variable renewable energy generation, by extending or shifting the hours wind or solar energy is available. This project is structured to learn from demonstration projects with community-scale energy customer-producers and to share that knowledge broadly so it can be adopted by many others across Minnesota. Once we can demonstrate the viability of these projects, project financing becomes easier for future projects. With new technology adoption, it’s important to have successful, replicable models to help attract financing, develop a robust market, and eventually reach economies of scale. Ultimately, if energy storage is deployed broadly and intelligently across Minnesota in conjunction with distributed renewable energy projects, this will help to expand community-based renewable energy, reduce emissions, and improve air quality.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
		\$
		\$
		\$

VIII. VISUAL COMPONENT: See attached graphic.

IX. REPORTING REQUIREMENTS:

- The project is for 3 years, will begin on July 1, 2017 and end on June 30, 2020.
- Periodic project status updates will be submitted Feb. 1 and July 1 of each year.
- A final report and associated products will be submitted between June 30 and Aug. 15, 2020.

Environment and Natural Resources Trust Fund

M.L. 2017 Project Budget



Project Title: Community-Scale Energy Storage Guide for Renewable Energy

Legal Citation:

Project Manager: Ellen Anderson

Organization: Energy Transition Lab, University of Minnesota

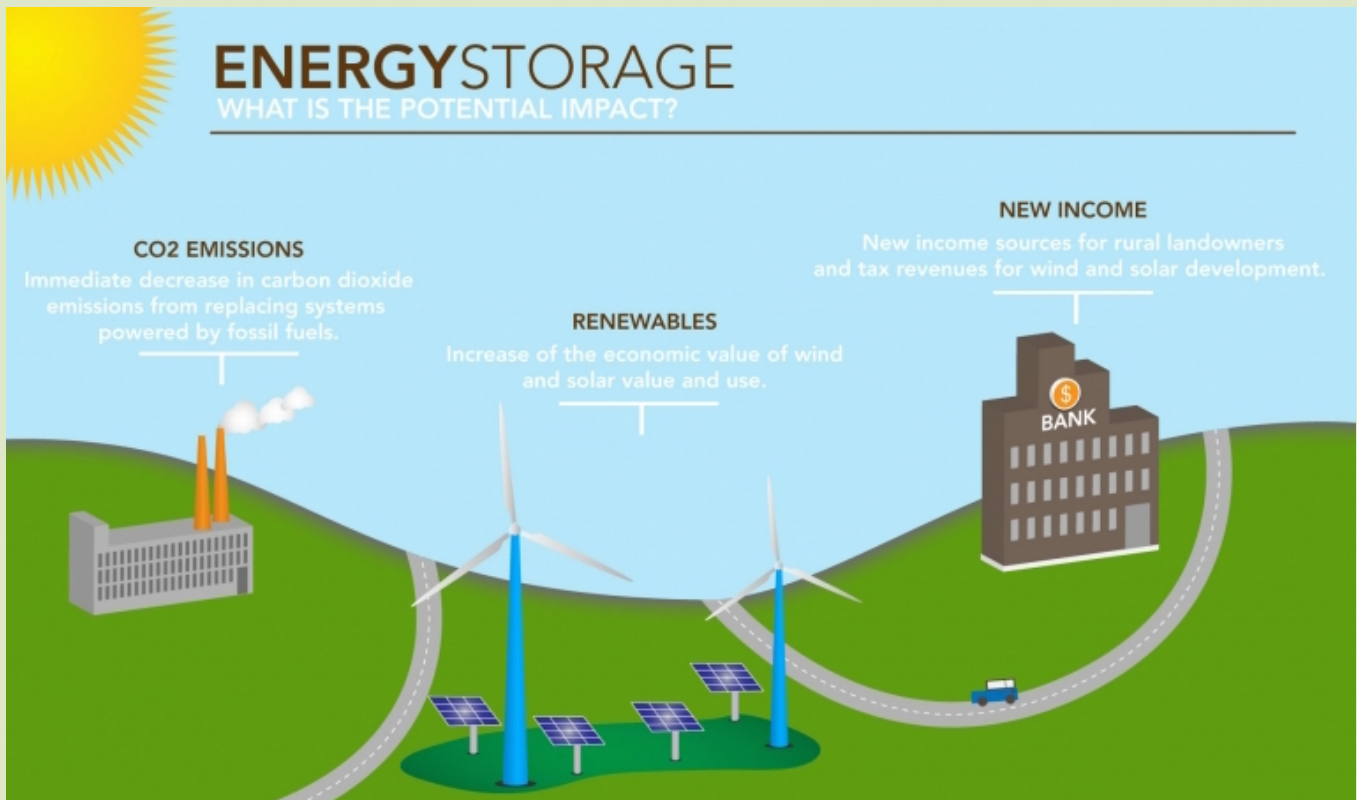
M.L. 2017 ENRTF Appropriation: \$500,000

Project Length and Completion Date: 3 years, June 30, 2020

Date of Report: 9/14/16

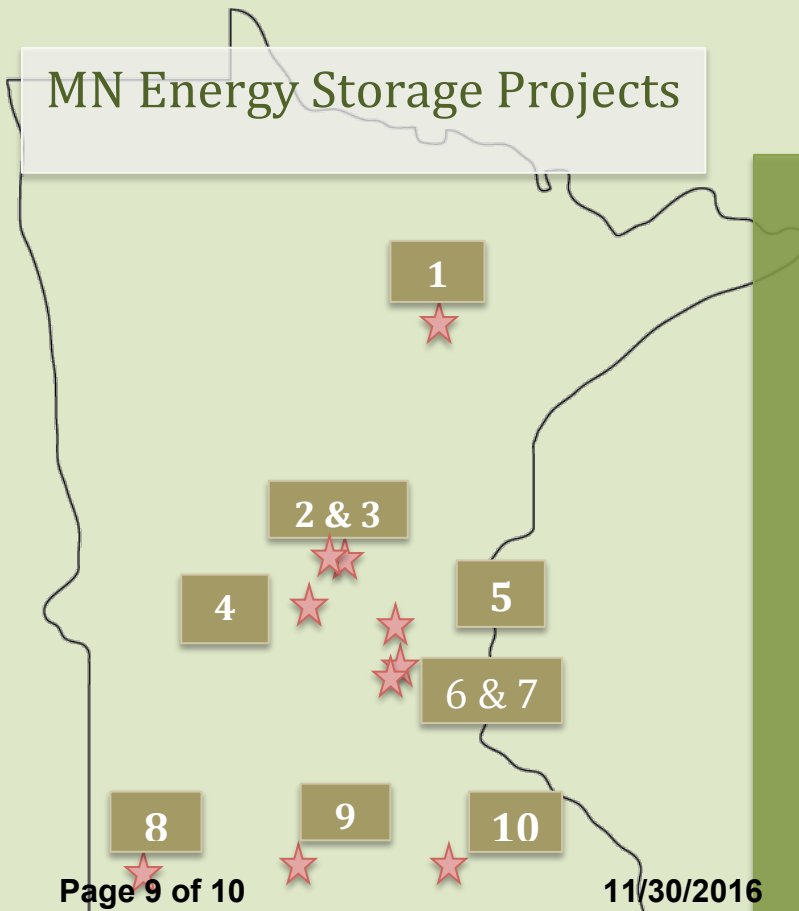
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Prepare, test, publish energy storage guide</i>			<i>Demonstration Projects</i>			<i>Fill in your activity title here.</i>				
Personnel (Wages and Benefits)	\$102,264		\$102,264	\$146,490		\$146,490				\$248,754	\$248,754
Ellen Anderson, Project Manager: \$66,470 (76% salary, 24% fringe); 20% FTE for year 1, 15% FTE for year 2 and 3.											
Graduate Research Assistant, \$112,144 (60% salary, 40% fringe); 50% FTE in year 1 and 2; 12% FTE in year 3.											
Post-Doc Research Fellow: \$70,140 (86% salary, 14% fringe); 100% FTE for 1 year only.											
Professional/Technical/Service Contracts											
Technical assistant to create user-friendly web-based guide for community-scale energy storage based on Activity 1 and learning from Activity 2.	\$4,000									\$4,000	\$4,000
Equipment/Tools/Supplies											
Office supplies and copying for materials for meetings, advisory group, and field days.	\$200			\$100						\$300	\$300
Capital Expenditures Over \$5,000											
3 Energy Storage systems including batteries and installation of system at maximum \$75,000 each (with potential additional funds to be added by host sites)				\$225,000						\$225,000	\$225,000
Printing											
Printing of guidebooks drafts and final copies and field day promotion materials	\$1,800			\$2,060						\$3,860	\$3,860
Travel expenses in Minnesota											
In-state travel and meals for project team, project advisors and focus group of representative customers in Activity 1, in-state travel and meals for project team, host site participants, advisory group, and field day participants in Activity 2. Total: Mileage, \$6,640; Meals, \$7,895; Lodging for overnight travel, \$3550.	\$6,085			\$12,000						\$18,085	\$18,085
Other											
<i>Describe the expense—one row per type/category. Add rows as needed. Be specific.</i>											
COLUMN TOTAL	\$114,350			\$385,650						\$500,000	\$500,000

Community-Scale Energy Storage Guide for Clean Energy



Source: energy.gov

MN Energy Storage Projects



1. Mesabi Range Pumped Hydro (PHES)
2. Wright-Henn. Solar + Storage
3. National Rural Electric Co-Op - Rockford
4. National Rural Electric Co-Op - Litchfield
5. National Rural Electric Co-Op - Shakopee
6. National Rural Electric Co-Op - Jordan
7. National Rural Electric Co-Op
8. XCEL Wind to Battery
9. National Rural Electric Co-Op - Jackson
10. Austin Utilities ES Pilot

