2019 Project Abstract
For the Period Ending June 30, 2021

PROJECT TITLE: Minerals and Water Research - Subproject 4: Accelerate high capacity/low cost energy storage options for Minnesota
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APPROPRIATION AMOUNT: $150,000
AMOUNT SPENT: $150,000
AMOUNT REMAINING: $0

Sound bite of Project Outcomes and Results
The purpose of this project was to provide a technology survey and a geographical recommendation of potentially feasible, non-battery, long-duration energy storage technology concepts that can utilize Minnesota's various topographies, geologies, and infrastructure to facilitate the state's renewable energy and greenhouse gas reduction goals. Numerous technology concepts with related siting recommendations are reported for consideration by state leaders.

Overall Project Outcome and Results
Achievement of Minnesota's renewable energy transition and associated greenhouse gas reduction goals requires development and installation of both short- and long-term energy storage capability. Battery storage options (lithium batteries) readily provide 2-4 hour duration storage. Longer-term (>8hr), high-capacity (35-200 milliwatt) storage can better facilitate capture of available renewable energy and potentially eliminate the need for natural gas-based peaking plants to provide a more stable electrical supply when intermittent resources (e.g., solar or wind) cannot supply the necessary electricity. Non-battery options harnessing physical principles involving gravity, compressed gas, waste heat and chemical processes can offer storage options with long lifetimes that do not require access to critical minerals and may offer safety improvements. Many of these options are in the development or demonstration phase and can take advantage of Minnesota's natural and man-made (former mine workings) topographical and geological features.

The project consisted of two parts. The first was a thorough survey of existing and emerging long-term, high-capacity, non-battery storage technologies with potential for applications in Minnesota. This entailed engagement with technology leaders, onsite concept evaluations and discussions with energy industry collaborators to characterize each technology. Identified technologies ranged from concepts that take advantage of mineland topographic features in northern Minnesota to others that could be deployed in municipalities or metropolitan areas. This information was collated into a summary format including industry contacts for each concept to facilitate follow-up by the state and/or industry.

The second part of the project entailed development of an interactive mapping tool to identify areas in the state where each identified technology might best be suited, considering the local topography, geology, and proximity to distribution infrastructure, industry, and applicable brownfield areas. This tool shows that there are multiple non-battery storage options in regions across Minnesota, primarily located in the vicinity of distribution infrastructure.

Project Results Use and Dissemination

The full report and three appendices are publicly available on the University of Minnesota Duluth Natural Resources Research Institute (NRRI) Website. NRRI:

- collaborated with Clean Energy Resource Teams (CERTs) personnel to organize two presentations to state stakeholders (agency, industry, academia, government) to communicate report findings and solicit feedback;
- presented to DER Energy Storage Workgroup meeting with Great River Energy and support from CERTs;
- was presented at a Minnesota House Climate and Energy Finance and Policy Committee hearing on renewable energy generation and storage; and
- Continues conversations with Minnesota Department of Commerce in conjunction with CERTs and University of Minnesota colleagues to model energy storage opportunities.