

**Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 114-E

Duluth Steam Energy Efficiency Project

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: \$ 153,360

Proposed Project Time Period for the Funding Requested: 2.5 years, July 2015 - December 2017

Summary:

Duluth Steam seeks to transform the community's energy system to higher efficiency hot water distribution, creating opportunity for local, renewable fuels, reuse of waste heat, and improved local water quality.

Name: Jim Green

Sponsoring Organization: City of Duluth

Address: 411 First St W, Room 502
Duluth MN 55802

Telephone Number: (218) 723-3601

Email jim.green@ever-greenenergy.com

Web Address www.duluthsteam.com

Location

Region: NE

County Name: St. Louis

City / Township:

Alternate Text for Visual:

The visual shows the system vision for improvements to energy efficiency and local water quality (reduced energy consumption, chemical consumption, greenhouse gas emissions, and water and sewer treatment).

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	

LCCMR 2015 Request – Duluth Steam Energy Efficiency Project

Main Proposal

The City of Duluth has been served for over 80 years by a coal-fired, once-through, steam-based district heating system that is now owned by the City. The system has served the City reliably for over eight decades but is recognized to have significant shortcomings with regards to water conservation, energy efficiency, and air emissions. Duluth is committed to upgrading the system to be a state-of-the-art community energy system that is based on locally-derived renewable fuels, distributes thermal energy via a highly-efficient hot water distribution system, and creates a thermal energy microgrid that enables waste heat sources to be recovered and beneficially utilized. The City of Duluth has already made substantial investments toward defining the vision for the system and proceeding with the improvements that will allow this vision to become a reality, including:

- Hiring Ever-Green Energy, a noted expert in development and operation of community energy systems, to operate and manage the system in Duluth.
- Commissioned a Master Plan that defines the overall system vision and the 5-year goals for transitioning the system to a state-of-the-art community energy system.
- Initiated the necessary permitting and design activities to allow locally-derived biomass to be utilized to reduce the amount of coal consumed by Duluth Steam (NextGen grant pending).
- Planning the infrastructure upgrades on the distribution network that will replace the main lines in order to reduce reliance on the less-efficient steam distribution and move to modern hot water distribution.

As the City of Duluth is successful in upgrading its distribution infrastructure to highly-efficient hot water, a whole host of renewable energy sources become options for integration into the new thermal microgrid. Deployment of these energy sources will enable substantial progress in meeting the stated goals for water conservation and the reduction of the environmental impact of the system's energy sources.

LCCMR funding is being requested to allow research and evaluation of renewable energy systems so that those systems that prove feasible can be deployed shortly after the first phase of the hot water infrastructure work has been completed. These funds will allow engineers who are experts in evaluating and deploying these renewable energy options to determine which of the many renewable and waste heat recovery options are most readily integrated. This will allow Duluth Steam to begin implementing these options as rapidly as possible so as to realize the water conservation, energy efficiency/conservation, and air quality benefits of these technologies. The engineering work will also quantify the expected benefits of each technology so that those with the largest impact on Lake Superior water conservation and wastewater reduction and fuel/energy conservation can be prioritized for implementation. Without this LCCMR funding, the personnel and financial resource commitment for the distribution infrastructure will not allow this renewable integration work to proceed in parallel and will delay by an estimated 3 years the ability to deploy these renewable technologies. Each year of delay results in a missed opportunity to:

1) enhance system efficiency through reduced distribution losses and more efficient use of thermal energy in the customer buildings, reducing overall fossil fuel inputs and energy losses, 2) reduce Lake Superior water consumption (by over 10 million gallons per year) with a commensurate reduction in water treatment at the WLSSD, and 3) reduce CO₂ emissions and sulfur dioxide by 25% through a combination of biomass integration and energy efficiency.

In order to achieve these goals, the City of Duluth, Duluth Steam, and Ever-Green Energy will focus on three primary activities: 1) the upgrade of pipe in Superior Street to convert distribution from steam to hot water, thereby increasing system efficiency and reducing water losses 2) complete a conversion of the Canal Park distribution system to hot water, and 3) integrate additional renewables into the system, further reducing the use of fossil fuels and reducing greenhouse gas emissions.

Renewable Energy Integration Evaluation**Budget: \$153,360**

Outcome	Completion Date
Determine locations for commercial-scale solar thermal array and design the interconnection systems. Determine benefits based on size/scale of the system.	December 31, 2015
Perform design and specification of a dedicated biomass boiler that will allow the Duluth Steam system to achieve 55% renewable fuel input as delineated in Section 5.2.7.1 of the Master Plan.	April 30, 2016
Evaluate feasibility and design a standard pumping arrangement to allow waste heat recovery from condensate.	July 31, 2016

1. Project Team/Partners – The Project Team will primarily consist of staff from the City of Duluth, Duluth Steam, and Ever-Green Energy. Additional stakeholders have also been engaged in the development of the Master Plan and activities related to this request, including Mayor Ness (and staff), City of Duluth City Council (and staff), City of Duluth Administration and Public Works staff, St. Louis County (staff and commissioners), and the Duluth Steam System Advisory Board. Plans were also preliminarily vetted through the City of Duluth Local Energy Action Plan process, which engaged the stakeholders already listed as well as the Sierra Club North Star Chapter, Fresh Energy, Izaak Walton League, Clean Energy Resource Teams (CERTs).

2. Project impact and Long-Term Strategy

The City of Duluth is committed to improving the efficiency of this system, integrating renewable energy, and reducing overall water waste and consumption. Improving the overall efficiency of the system, stabilizing the cost of energy for customers, and reducing greenhouse gas emissions are important goals for the community and the project. These goals are achievable on a community-wide basis through Duluth Steam improvements.

The implementation of the three primary improvements will create measureable, long-term improvements for Duluth and the local energy system. These tangible results will not only serve the Duluth area, but will serve as a blueprint for other Minnesota energy systems. There are currently over a dozen communities in the state that are evaluating district energy, combined heat and power, and biomass integration. Most of these systems are in early study stages and are somewhat constrained by the lack of viable demonstration projects in operation. The results of the Duluth Steam Energy Improvement Project will be merged with other successful projects, including Laurentian and District Energy St. Paul, to support a breakthrough in development of community energy systems. This will improve the State’s overall energy profile, improve the market for these fuels and technologies, as well as elevating Minnesota’s profile for advanced energy development.

3. Timeline Requirements

The proposed improvements for Duluth Steam and the community’s energy profile are iterative over the next 5 years and beyond. Currently, the system operators are implementing smaller efficiency projects at the plant and customer buildings. These projects are primarily funded by the rate-payers of the system. Beginning in April, Duluth Steam will be working through a Department of Agriculture NextGen grant to implement a first phase of renewable integration by displacing 25% of the coal fuel mix with biomass in the form of sawdust. The majority of the funding for this project is being provided by Duluth Steam. As it pertains to the proposed activities for this application, the Project Team will begin planning and design efforts for these projects in 2014. If the project is funded by the LCCCM, the engineering, evaluation, and analysis activities would be completed by the end of the grant period in 2018. If the project is not funded, the activities may take additional years to fund and complete, assuming funding can be secured.

2015 Detailed Project Budget

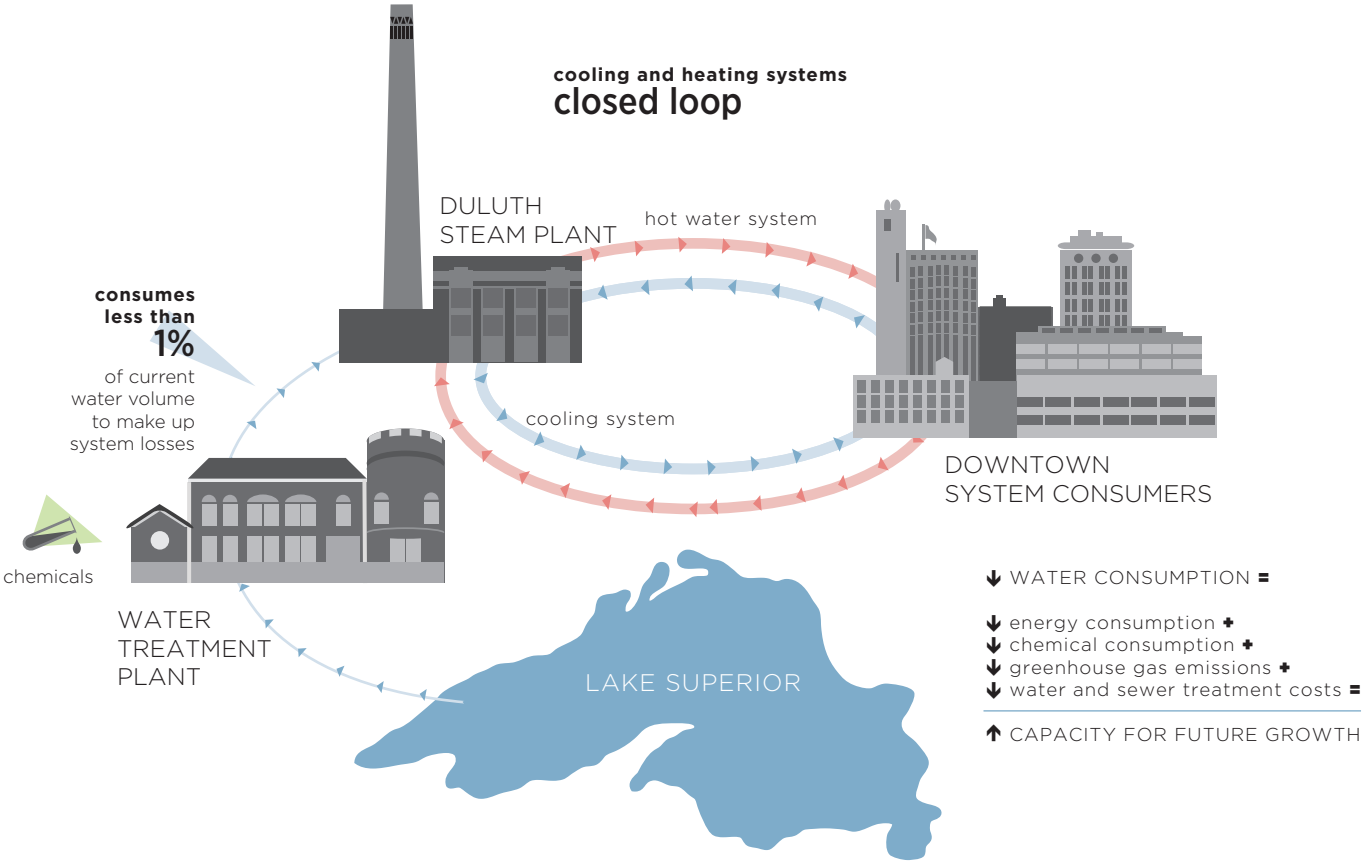
IV. TOTAL ENRTF REQUEST BUDGET - 2.2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Contracts: Energy systems consulting engineering firm Ever-Green Energy, will provide the engineering and project planning resources to complete the prescribed engineering studies.	\$ 147,000
Travel: Travel by car between Saint Paul and Duluth for the Ever-Green Energy engineering and project planning personnel who are assigned to the project.	\$ 6,360
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 153,360

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period: Duluth Steam System capital project funds which will be spent to implement renewable fuel (biomass) co-firing and expected to be completed and commissioned by December 15, 2014.	\$ 375,000	<i>Secured</i>
Other State \$ To Be Applied To Project During Project Period: None	N/A	N/A
In-kind Services To Be Applied To Project During Project Period:	\$ 19,500	<i>Secured</i>
Funding History: Minnesota Department of Agriculture NextGen grant for design and implementation of a biomass co-firing system that will utilize locally-derived biomass feedstocks and displace the use of fossil fuels (coal).	\$ 150,000	Secured
Remaining \$ From Current ENRTF Appropriation: None	N/A	N/A

**cooling and heating systems
closed loop**



LCCMR 2015 Request – Duluth Steam Energy Efficiency Project

Project Manager Qualifications and Organization Description

Project Manager – Jim Green, General Manager, Duluth Steam/Ever-Green Energy

- Over 25 years of experience leading large, complex organizations responsible for operation and maintenance of energy intensive systems.
- Led energy efficiency improvement projects across a 25 million square foot campus resulting in annual energy cost reductions of over \$3 million and carbon emission reduction of over 5%.
- Large contract procurement and administration experience for Fixed Price, Indefinite Delivery - Indefinite Quantity and Cost type contracts.
- Extensive hands-on steam plant operations and maintenance experience.

Additional Experience

- Aircraft Carrier Chief Engineer (CV64) – Responsible for the operation and maintenance of a 1,200 psi steam propulsion plant and auxiliary equipment as well as for the leadership and management of the 600-Sailor Engineering Department in USS Constellation (CV-64).
- Commanding Officer - US Navy ship repair facility – Responsible for the execution of repairs, alteration, and modernization of the world's most advanced and complex warships.

Education and Specialized Training

University of Minnesota, Bachelor of Civil Engineering
Naval Post Graduate School, Master of Mechanical Engineering
US Navy Steam Generating Plant Inspector

Organization Description

City of Duluth and Duluth Steam

The City of Duluth is a unique community, serving as a harbor to Lake Superior and a gateway to the industry and natural resources of the North Shore. Since 1932, Duluth Steam has supplied a steady flow of energy to its customers who have come to rely on its efficiency and dependability. Duluth has owned the steam plant and distribution system since 1979, when the city purchased it from General Waterworks. The city's purchase of the system saved it from decommissioning and provided for the air quality improvements needed to continue operations. The city was able to maintain this public asset and help stabilize the energy costs for the customers.

The Duluth Steam system currently serves more than 180 buildings in Canal Park and the CBD. Steam from the central plant heats and cools many local buildings, in addition to providing thermal energy for hot water heating, humidification, sterilization, dry cleaning, kitchens, and microbrewing.

Ever-Green Energy

Ever-Green Energy is one of the country's foremost experts on the advancement of community district energy systems, built upon decades of experience with system development, utility ownership and management, and engineering. Ever-Green has been the service provider to Duluth Steam since 2012 and is also the service provider to District Energy and District Cooling St. Paul.