

Climate Change Strategic Initiative

REQUEST FOR PROPOSALS

DRINKING WATER PUMP STATION DESIGN AND OPERATION FOR ENERGY EFFICIENCY (RFP 4308)

Climate Change Strategic Initiative

The Water Research Foundation Strategic Research Initiatives Program focuses resources on critical drinking water issues through a coordinated, long-term research effort that comprises multiple projects. This sustained approach allows for a continuing momentum of research in selected topic areas, and projects within an initiative serve as discrete steps toward a common strategic objective. The program also fosters a more complete and timely research response to key issues than does a collection of stand-alone projects.

The Foundation has undertaken the Climate Change Strategic Initiative to develop integrated projects focused on understanding the climate change impacts on water supply, as well as to help utilities minimize water supply contribution to greenhouse gas emissions. The Foundation will commit up to \$1.0 million in funding per year for the initiative, which is expected to be substantially leveraged with partner co-funding and researcher in-kind contributions. The initiative will be sustained until the strategic initiative objectives outlined below are achieved; the target timeframe for the initiative is 5-7 years.

Applicants are encouraged to review additional information about the Climate Change Strategic Initiative at

<http://www.waterresearchfoundation.org/theFoundation/ourPrograms/ResearchProgramSIClimateChange.aspx>

Objective

The objective of this research is to develop a guidance manual focused on drinking water pump station design and operation to minimize the energy consumption and associated greenhouse gas emissions of a water utility. This manual will allow pump station designers to:

1. Improve pump wire-to-water efficiency in the water industry

2. Design pump stations to ease periodic pump efficiency testing, and/or provide for continuous real time pump efficiency readings and understand the benefits thereof,
3. Address the appropriate design/application of variable speed drives, and
4. Estimate the potential annual energy, cost, and carbon savings from pump station efficiency improvements.

This project is specifically intended to support the Climate Change Strategic Initiative objective of providing water utilities with a set of tools to assess and minimize their carbon footprint
See

<http://www.waterresearchfoundation.org/theFoundation/ourPrograms/ResearchProgramSIClimateChange.aspx>
for a description of this goal and for additional information.

Background

While water utilities will experience the negative impacts of global climate change, it is recognized that they also contribute to greenhouse gases emissions, primarily from electricity consumption. Between 80-90% of the average water utility's carbon footprint comes from their electricity use. The Water Research Foundation project, *Energy Index Development for Benchmarking Water and Wastewater Utilities* (2008) notes that about 99% of the electricity use at ground water plants and 91% of the electricity use at surface water plants is for pumping. Testing of over 11,000 water utility pumps through Southern California Edison's Hydraulic Services (Pump Test) Program found an average wire-to-water efficiency of about 55%. Current standard design calls for wire-to-water efficiencies be greater than 80%. This points to a huge opportunity for the water industry to improve pump efficiency, and reduce energy consumption, greenhouse gas emissions, and cost. The primary causes of sub-optimum pump efficiency includes: poor or overly conservative initial design, change from the original design operating condition (e.g. decreased system operating pressure or falling aquifer water levels), corrosion of pump wetted parts, use of inefficient variable speed drives (VSDs), inappropriate use of VSDs, and mechanical wear of moving parts. Historically, new pump stations are 2-4% less efficient than designed due to the sum of conservative estimates during design and the tendency to oversize the pumping capacity and head.

Although pumps are typically purchased as individual components, they provide a service only when operating as part of a system. The energy used by a system depends on the design of the pump, the design of the installation, and the way the system is operated. These factors are interdependent. They must be matched to each other, and remain so throughout their life cycle to ensure the lowest energy and maintenance and costs and equipment life.

Water utilities would benefit from guidance on optimal pump design and specification, particularly for VSDs.

Research Approach

This project will result in a guidance manual for pump station design and testing. The manual will provide designers the guidance they need to address each of the sources of sub-optimum pump station operating efficiency. The project will:

1. Consider communications between distribution system owners/operators and pump station designers in terms of how their interactions can contribute to poor energy performance of pump stations.
2. Create a model of improved communication between distribution system owners/operators and pump station designers that facilitates the design of pumping systems that minimize energy use in the system.
3. Evaluate current standard design practice and provide specific guidance/methodologies to design pump stations that optimize energy efficiency. The guidance should include discussions on:
 - factors that affect pump selection for energy efficiency
 - embedding the concept of Specific Energy
 - defining a list of archetypical pumping problems and the corresponding best-practice low-energy design methodology
4. Evaluate current standard operating procedures and best practice for pump station operation, providing specific guidance to improve operational pumping efficiency
5. Provide guidance on the proper application of variable speed drives
6. Ensure that pump stations designers are aware of the requirements to facilitate periodic efficiency testing by identifying best practices such as:
 - Installing suction and discharge pressure taps during construction of all pump installations.
 - Providing flow metering capabilities for each pump
 - Providing power metering on each pump, or ability to easily obtain the same
 - Providing guidance for utilities on monitoring the efficiency of and retrofitting old pumps, in addition to providing design criteria for new pumps.
7. Provide guidance on retrofitting existing pump stations to facilitate the testing described in Item 6 above and research the potential benefits of doing so. It is often difficult to conduct wire-to-water efficiency testing in existing pump stations due to difficulties in measuring individual pump flows (e.g., no individual pump flow meters, insufficient straight lengths of pipe for “strap on” flow meters, etc.). Similar, but less severe problems exist in measuring pump electrical power draw and accurately measuring pump suction and discharge pressures. This guidance is critical to meeting the project objectives in that the majority of existing pump stations were not designed with regular or continuous wire-to-water efficiency measurement in mind.
8. Identify tradeoffs in energy efficiency vs. other system design criteria

This project will further the ability of the average utility to conduct these analyses and make improvements by ensuring that plants:

1. are performing their design function with the lowest possible energy use
2. are at their Best Efficiency Point (BEP) on day one (not off by 2-4%)

3. minimized their energy use with the appropriate use of variable speed drives
4. are designed to facilitate periodic pump performance testing or give continuous real-time pump performance data to operators

The research team will review recent professional literature on pump station design for initial efficiency, maximum life cycle operational efficiency, and design and construction to support ease of efficiency testing or continuous measurement. Among these sources is the considerable work the European Union and United Kingdom Water Industry Research has completed on this subject. The research team will consult with industry experts regarding the state of the art in pump station design and operation, appropriate application and design of variable speed drives, in-plant pump efficiency testing, and providing continuous real-time pump efficiency data to operators. The research team will provide estimates of life cycle costs and benefits of their prescribed pump station design, annual testing, and continuous real-time pump efficiency data guidance.

The research team will develop a software tool to assist water utilities to evaluate pump station design and operating practices for energy efficiency, and to estimate the potential annual savings on energy consumption, energy cost, and avoided carbon emissions from pump station efficiency improvements.

A guidance manual will accompany the tool that engineers can use to design, select, and operate pump stations for energy efficiency. The manual will help utilities improve the life-cycle performance of the pump station to result in reduced energy consumption, cost savings and less greenhouse gas emissions. The research team will also develop a communication plan to include: a Water Research Foundation webcast, course materials that can be used for a two-hour training seminar that will meet the requirements for continuing education unit (CEU) credits, and presentation of the project results at least one major water industry conference.

Proposal Preparation Instructions

Proposals submitted in response to this RFP must be prepared in accordance with the Water Research Foundation “Guidelines for Solicited Proposals.” The most current version of these guidelines is available at

<http://www.waterresearchfoundation.org/research/projectAdmin/proposalGuidelines.aspx>.

The guidelines contain instructions that the applicant must follow when preparing a proposal.

Eligibility to Submit Proposals

This RFP solicits proposals from all technically qualified U.S. based or non-U.S. based applicants, including educational institutions, research organizations, federal or state agencies, local municipalities, and consultants or other for-profit entities.

The Foundation’s Board of Trustees has established a Timeliness Policy that addresses researcher adherence to project schedule. The policy can be reviewed at

<http://www.waterresearchfoundation.org/research/projectAdmin/policies.aspx>.

Researchers who are late on any ongoing Foundation-sponsored studies without an approved no-cost extension are not eligible to be a named participant in any proposal. If you have any questions about your eligibility for Foundation projects, please contact your current Foundation project manager directly.

Budget and Funding Information

The maximum funding available from the Foundation for this project is \$250,000. A minimum 25 percent of the total project value must be contributed by the applicant (i.e. the applicant's minimum contribution must equal one-third of Foundation funds requested). Therefore, the minimum total value of this project is \$333,333.00. (\$250,000 in Foundation funds and \$83,333 in applicant contribution). Acceptable forms of applicant contribution include cost-share, applicant in-kind or third-party in-kind that meet Code of Federal Regulation (CFR) requirements in 2 CFR Part 215.23, or the requirements of Office of Management and Budget (OMB) Circular A-102.24. The applicant may elect to contribute more than 25 percent to the project but the maximum Foundation funding available remains fixed at \$250,000. Proposals that request less than \$250,000 from the Foundation need only contribute 25 percent of the total project value.

Indirect costs are allowable based on the rate approved by the applicant's cognizant federal agency, or an independent CPA audited statement or an independent accountants' compiled Statement of Direct Labor, Fringe Benefits and General Overhead. Detailed budget preparation instructions are provided in the "Guidelines for Solicited Proposals."

Period of Performance

The proposed project schedule should be realistic, allowing ample time for the preparation of final reports and for review of project results. It is the Foundation's policy to negotiate a reasonable schedule for each research project. Once this schedule is established, the Foundation and its contractors have a responsibility to adhere to the agreed-upon schedule. Under the Foundation's No-Cost Extension Policy, a project schedule cannot be extended more than nine months beyond the original contracted schedule, regardless of the number of extensions granted. The policy can be reviewed at <http://www.waterresearchfoundation.org/research/projectAdmin/policies.aspx>.

Project Oversight

This project will be conducted under the Climate Change Strategic Initiative. The strategic initiative is overseen by an Expert Panel that develops and administers the long-term research plan for the initiative and recommends projects to the Foundation Board of Trustees for funding. As part of the strategic initiative process, an annual review is held in which PIs for all ongoing projects under the initiative to present findings and upcoming project activities to the Expert Panel. The annual review is supplemental to the Project Advisory Committee (PAC) process described in the "Guidelines for Solicited Proposals." It is expected that the PI for this project will participate in these annual reviews during the research phase of the project. Travel costs for the PI to participate in the annual reviews should be included in the proposed budget for the

project. Additional information concerning the annual review process is available at <http://www.waterresearchfoundation.org/research/projectAdmin/proposalGuidelines.aspx>

Utility Participation

The Foundation is especially interested in receiving proposals which include both participation and contribution of resources from water utilities in the research effort. Information on utilities that have indicated an interest in participating in this research project is attached. While the Foundation makes utility participation volunteers known to applicants, it is the applicant's responsibility to negotiate utility participation in their particular proposal, and the utilities are under no obligation to participate.

Application Procedure and Deadline

Proposals must be postmarked or date-stamped by the carrier on or before July 26, 2010. Seven copies, plus one unbound copy (8 copies total) of the proposal should be sent to:

**Proposals – RFP 4308
Water Research Foundation
6666 W. Quincy Avenue
Denver, CO 80235**

Questions to clarify the intent of this Request for Proposals may be addressed to the project manager, Traci Case at (303) 347-6120 or by e-mail at tcase@waterresearchfoundation.org.

4308 - UTILITY VOLUNTEERS

The following utilities have indicated an interest in possible participation in this research. This information is updated within 12 business hours when a utility submits a volunteer form and this RFP will be re-posted with the new information. **(Depending upon your settings, you may need to click refresh on your browser to load the latest file.)**

No volunteer submissions have been received at this time.