



REQUEST FOR PROPOSALS (RFP)

Tradeoffs Between Process Optimization, Greenhouse Gas Mitigation, and Energy Efficiency (RFP 5288)

Date Posted

Monday, September 9, 2024

Due Date

Proposals must be received by 3:00 pm Mountain Time on Thursday, November 14, 2024.

WRF Project Contact

Harry Zhang, PhD, PE, hzhang@waterrf.org

Project Sponsors

This project is funded by The Water Research Foundation (WRF) as part of WRF's Research Priority Program.

Project Objectives

- Develop a framework for integrated evaluation of the benefits (e.g., reduction of greenhouse gas (GHG) emissions and enhancement of energy efficiency) and costs (e.g., capital expenditure (CAPEX), operating expenditure (OPEX), social cost of GHG emissions, and operational complexity) that wastewater and water utilities can apply at a unit operations and systems level.
- Provide a harmonized benchmarking framework to assess the value of existing treatment systems within the current regulatory construct and framework. This objective recognizes that the future frameworks for evaluation may be different, due primarily to non-stationarity in the systems from climate impacts.
- Offer recommendations for reducing GHG emissions through the utilization of energy-efficient technologies, process optimization, and/or implementation of new treatment processes.

Budget

Applicants may request up to \$200,000 in WRF funds for this project.

Background and Project Rationale

There is a need to effectively transform existing wastewater treatment facilities into sustainable water resource recovery facilities (WRRFs). Such a transformation will require optimization of current processes to reduce energy usage and related greenhouse gas emissions, maximization of existing assets, and integration of resource recovery centers within WRRFs to extract value

from the incoming raw materials (e.g., wastewater, nutrients, biogas, diverted organics, fats, oils and grease (FOG), and industrial streams). Optimizing and upgrading existing processes, unit operations, and systems is essential to reducing energy consumption for treatment and operation while managing growth and ensuring reliability. These strategies may include novel processes such as carbon diversion, nitrogen and phosphorus recovery, and biosolids treatments like gasification, pyrolysis, hydrothermal liquefaction (HTL), and supercritical water oxidation (SCWO). Implementing enhanced operating strategies, such as integrated dissolved oxygen (DO)-ammonia aeration strategies and sidestream nutrient treatment, as well as process intensification methods (e.g., integration of membrane aerated bioreactors (MABRs), advanced primary treatment, granular sludge treatment, etc.), can also play a significant role. However, in some cases, enhancing resource recovery may require increased energy input and potentially higher GHG emissions.

In other cases, the tradeoffs primarily result from the need for increased staff or instrumentation and controls juxtaposed with the resulting energy or GHG benefits or social cost (e.g., UV-advanced oxidation process (AOP) dose optimization in potable reuse). Navigation of these tradeoffs will be a critical element in the roadmap for utilities moving forward. Efforts will be required to build an integrated framework for utilities to assess these tradeoffs.

Recommendations for reducing GHG emissions through the utilization of energy-efficient treatment processes are needed. For instance, to compare aeration control to step feed for partial denitrification anammox (PdNA) and assess the efficacy of employing low dissolved oxygen (DO) versus high DO processed for internal carbon storage purposes. This project will benefit all utilities with an interest in developing and evolving Integrated Resource Management approaches for whole-system optimization.

Research Approach

Many North American water and wastewater utilities are embarking on a journey of adding treatment processes, systems, and components to address current challenges and future aspirations. However, these utilities are taking different methodological approaches. While this is reasonable for local or regional utilities, it is important that the water sector have a unified approach to account for elements such as time-value impacts, operational complexity vis-a-vis workforce evolution, OPEX implications, greenhouse emissions, etc.

The proposed research approach needs to achieve desired outcomes for a readily accessible peer-to-peer framework for medium and long-term planning. This would include the range of non-stationarity considered for aspects such as social cost of carbon (SCC), climate change scenarios, changing electric grid emissions factors, adoption of artificial intelligence (AI) and machine learning (ML), energy mix transitions, technology evolution, among others. One of the example frameworks is Monte-Carlo based framework, which can be employed with rigorous uncertainty analysis to facilitate more uniform applications across the water sector.

The proposal must include the following elements in the research approach:

- Literature Synthesis (peer reviewed journal papers, grey literature, reports, etc.): Conduct a critical review of the range of methodologies employed to do trade-off analyses in water and adjacent industries. Synthesize case studies including through a broad utility survey.
- Framework & Tool Development: Conduct conceptualization and development of a modular framework for widespread wastewater utility across the water sector. This will borrow from approaches established by the National Academy of Sciences, Engineering, and Medicine (NASEM) and others (e.g., Integrated Assessment Models (IAMs) such as Policy Analysis for the Greenhouse Effect (PAGE), Climate Framework for Uncertainty, Negotiation and Distribution (FUND), or Dynamic Integrated Climate-Economy Model (DICE)).
- Framework & Tool Assessment and Validation: Develop a model and framework that will be tested with multiple use-cases by utilities (including those already or currently being implemented) to assess value to the water sector. Prepare a utility-facing guidance document.
- Carry-out promotion and outreach of the framework and tool for broad application through webinars, conference presentations, and fact sheets.

Expected Deliverables

Expected deliverables for this project include:

- Literature review synthesis document, including documentation and collection of data using a broad spectrum of configurations and related energy efficiency of mechanical equipment.
- Summary of case studies and utility survey.
- A user-friendly, utility-facing guidance document, including design and operational guidelines for minimizing GHG emissions from existing technologies and through optimization of treatment processes. In addition, it should include a summary of mathematical process modeling on GHG emissions.
- Recommendations for future research needs including a list of preliminary research concepts.
- Webinars, conference presentations, and fact sheets.
- Submission of one open access peer-reviewed journal paper.

Communication Plan

Please review WRF's [Project Deliverable Guidelines](#) for information on preparing a communication plan. Conference presentations, webcasts, peer-reviewed publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration

The anticipated period of performance for this project is 24 months from the contract start date.

References and Resources

The following list includes examples of research reports, tools, and other resources that may be helpful to proposers. It is not intended to be comprehensive, nor is it a required list for consideration.

Andrews, N., E. Bronstad, and J. Ross. 2024. *Developing a Framework for Quantifying Energy Optimization Reporting*. Project 5091. Denver, CO: The Water Research Foundation.

McGuckin, R., J. Oppenheimer, M. Badruzzaman, A. Contreras, A., and J. G. Jacangelo. 2013. *Toolbox for Water Utility Energy and Greenhouse Gas Emission Management*. Project 4224. Denver, CO: The Water Research Foundation.

Rennert, K., F. Errickson, B. C. Prest, L. Rennels, R. G. Newell, W. Pizer, C. Kingdon, J. Wingenroth, R. Cooke, B. Parthum, D. Smith, K. Cromar, D. Diaz, F. C. Moore, U. K. Müller, R. J. Plevin, A. E. Raftery, H. Ševčíková, H. Sheets, J. H. Stock, T. Tan, M. Watson, T. E. Wong & D. Anthoff. 2022. Comprehensive Evidence Implies a Higher Social Cost of CO₂. *Nature*, Volume 610, 687–692 (2022). <https://www.nature.com/articles/s41586-022-05224-9>

The Water Research Foundation (WRF). 2024. WRF Climate Change Related Projects. <https://www.waterrf.org/serve-file/WRF-Climate-Change-Project-List.pdf>

Proposal Evaluation Criteria

The following criteria will be used to evaluate proposals:

- Understanding the Problem and Responsiveness to RFP (maximum 20 points)
- Technical and Scientific Merit (maximum 30 points)
- Qualifications, Capabilities, and Management (maximum 15 points)
- Communication Plan, Deliverables, and Applicability (maximum 20 points)
- Budget and Schedule (maximum 15 points)

PROPOSAL PREPARATION INSTRUCTIONS

Proposals submitted in response to this RFP must be prepared in accordance with WRF's [Guidelines for Research Priority Program Proposals](#) and [Instructions for Budget Preparation](#). These guidelines contain instructions for the technical aspects, financial statements, indirect costs, and administrative requirements that the applicant must follow when preparing a proposal.

Proposals that include the production of web- or software-based tools, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for web tools presented in the [Technology Deliverables Guidance](#).

Eligibility to Submit Proposals

Proposals will be accepted from both U.S.-based and non-U.S.-based entities, including educational institutions, research organizations, governmental agencies, and consultants or other for-profit entities.

WRF's Board of Directors has established a [Timeliness Policy](#) that addresses researcher adherence to the project schedule. Researchers who are late on any ongoing WRF-sponsored studies without approved no-cost extensions are not eligible to be named participants in any proposals. Direct any questions about eligibility to the WRF project contact listed at the top of this RFP.

Administrative, Cost, and Audit Standards

WRF's research program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget (OMB) Uniform Grants Guidance (UGG), 2 CFR Part 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, and 48 CFR 31.2 Contracts with Commercial Organizations. These standards are referenced in WRF's [Guidelines for Research Priority Program Proposals](#) and include specific guidelines outlining the requirements for indirect cost negotiation agreements, financial statements, and the Statement of Direct Labor, Fringe Benefits, and General Overhead. Inclusion of indirect costs must be substantiated by a negotiated agreement or appropriate Statement of Direct Labor, Fringe Benefits, and General Overhead. Well in advance of preparing the proposal, your research and financial staff should review the detailed instructions included in WRF's [Guidelines for Research Priority Program Proposals](#) and consult the [Instructions for Budget Preparation](#).

Budget and Funding Information

The maximum funding available from WRF for this project is \$200,000. The applicant must contribute additional resources equivalent to at least 33% of the project award. For example, if an applicant requests \$100,000 from WRF, an additional \$33,000 or more must be contributed by the applicant. Acceptable forms of applicant contribution include cost share, applicant in-kind, or third-party in-kind that comply with 2 CFR Part 200.306 cost sharing or matching. The applicant may elect to contribute more than 33% to the project, but the maximum WRF funding available remains fixed at \$200,000. Proposals that do not meet the minimum 33% of the

project award will not be accepted. Consult the [Instructions for Budget Preparation](#) for more information and definitions of terms.

Period of Performance

It is WRF's policy to negotiate a reasonable schedule for each research project. Once this schedule is established, WRF and its sub-recipients have a contractual obligation to adhere to the agreed-upon schedule. Under WRF'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.

Utility and Organization Participation

WRF encourages participation from water utilities and other organizations in WRF research. Participation can occur in a variety of ways, including direct participation, in-kind contributions, or in-kind services. To facilitate their participation, WRF has provided contact information, on the last page of this RFP, of utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their particular proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their particular proposal.

Application Procedure and Deadline

Proposals are accepted exclusively online in PDF format, and they must be fully submitted before 3:00 pm Mountain Time on Thursday, November 14, 2024.

The online proposal system allows submission of your documents until the date and time stated in this RFP. To avoid the risk of the system closing before you press the submit button, do not wait until the last minute to complete your submission. Submit your proposal at <https://forms.waterrf.org/cbruck/rfp-5288>.

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Harry Zhang, PhD, PE; hzhang@waterrf.org. Questions related to proposal submittal through the online system may be addressed to Caroline Bruck at 303.347.6118 or cbruck@waterrf.org.

Utility and Organization Participants

The following utilities have indicated interest in possible participation in this research. This information is updated within 24 business hours after a utility or an interested organization submits a volunteer form, and this RFP will be re-posted with the new information. **(Depending on your settings, you may need to click refresh on your browser to load the latest file.)**

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