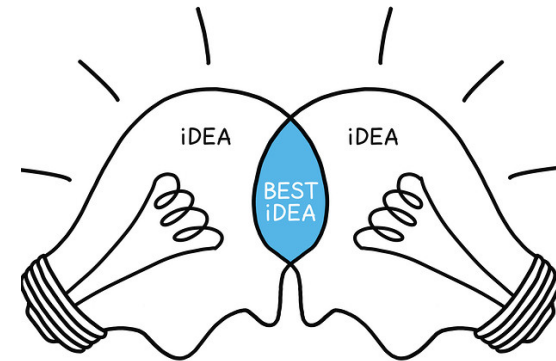




THE
**Water
Research**
FOUNDATION



Energy-Water Nexus: What's in the works at WRF?

Ashwin Dhanasekar

The Water Research Foundation

September 13th, 2023



ABOUT



MISSION

Advancing the science of water to improve the quality of life

VISION

To create the definitive research organization to advance the science of all things water to better meet the evolving needs of subscribers and the water sector

VALUES

Integrity • Leadership • Respect
Innovation • Collaboration

One Water

WRFs research benefits all areas of the water sector, as well as agriculture, energy, watershed management, and other commercial industries.



BY THE NUMBERS

AS OF 3/31/2023

SUBSCRIBERS



FUNDED RESEARCH



RESEARCH PORTFOLIO



\$.78 OF EVERY DOLLAR SUPPORTS PROGRAM SERVICES

- Leverage your research investment
- Guide the research agenda
- Collaborate with peers
- Participate in research
- Help ensure sound regulations based on science
- Receive personalized service

Comprehensive research access to:

- Free workshops and webcasts
- Unlimited employee logins
- Interim project results
- Fit-for-Purpose Resources:
 - Reports
 - Synthesis documents
 - Webtools

958 UTILITIES
63 CONSULTANTS
45 MANUFACTURERS

\$71M
FUNDED RESEARCH

245
ACTIVE PROJECTS

\$.78
OF EVERY DOLLAR
SUPPORTS PROGRAM SERVICES

427M
MEDIA REACH

61,712
SOCIAL MEDIA
FOLLOWERS

Most Visited Research Project Pages

1. [PFAS One Water Risk Communication Messaging for Water Sector Professionals \(5124\)](#)
2. [Residential End Uses of Water, Version 2 \(4309\)](#)
3. [Standardizing Methods with QA/QC Standards for Investigating the Occurrence and Removal of Antibiotic Resistant Bacteria/Antibiotic Resistance Genes... \(5052\)](#)
4. [An Enhanced Source Control Framework for Industrial Contaminants in Potable Reuse \(4960\)](#)
5. [Nitrogen Reduction Solutions for Ocean Discharges \(5117\)](#)

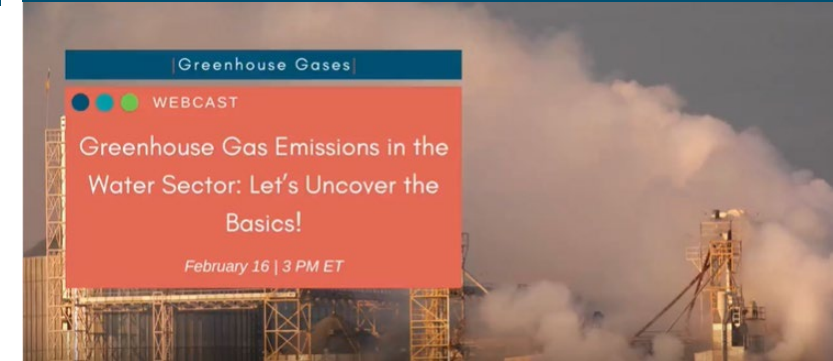
Top Visitor Countries

1. United States
2. China
3. Canada
4. Germany
5. India
6. United Kingdom
7. Australia
8. Philippines
9. Mexico
10. Singapore

Most Popular Topics

1. PFAS
2. Advanced Treatment
3. Climate Change
4. Lead and Copper
5. Biosolids
6. Integrated Planning
7. Utility Management
8. Resource Recovery
9. Energy Optimization
10. Asset Management

Most Popular Webcast



Most Visited Website Resources

1. [PFAS One Water Risk Communication Messaging for Water Sector Professionals, UCMR Toolkit \(5124\)](#)
2. [Greenhouse Gas Emissions in the Water Sector: Let's Uncover the Basics Webcast](#)
3. [PFAS One Water Risk Communication Messaging for Water Sector Professionals, One Water Toolkit \(5124\)](#)
4. [Holistic Approach to Improved Nutrient Management \(4974\)](#)
5. [Standardizing Methods with QA/QC Standards for Investigating the Occurrence and Removal of Antibiotic Resistant Bacteria/Antibiotic Resistance Genes... \(5052\)](#)

WRF in the News

[How dangerous was the Ohio chemical train derailment? An environmental engineer assesses the long-term risks](#)

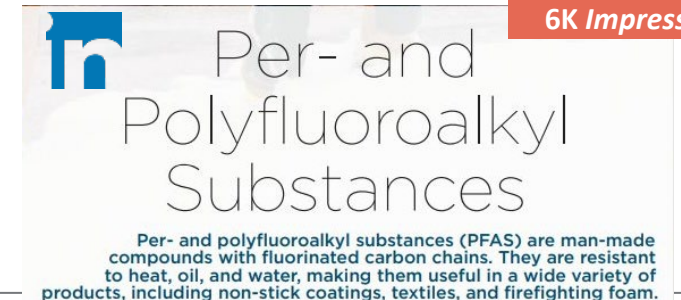
64M Reach



Top Social Media Post

[Per- and Polyfluoroalkyl Substances AWR Article](#)

6K Impressions



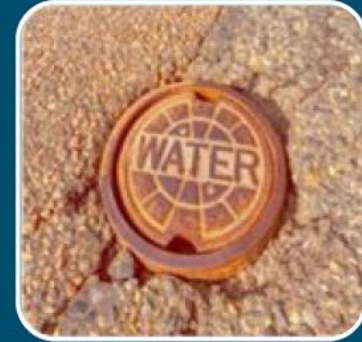
WRF Research Programs

At-a-Glance: Distinguishing Features of WRF Research Programs

Research Program & Description	% Annual Research Budget	Project Approval	Anticipated Schedule
Research Priority A strategic research program broadly relevant to the water sector	60	WRF Board-appointed Research Advisory Council (RAC)	April/March
Tailored Collaboration A matching program designed to support utility-specific/regional issues	20	WRF Board-appointed Tailored Collaboration Review Committee	Pre-proposal & proposal period starts 2 QTR project selection 3 QTR
Emerging Opportunities A program to address emerging and time critical issues; additionally, supports partnering opportunities and add-ons to current projects	10	WRF Board Executive Committee	Rolling
Unsolicited Research A program that focuses on novel, transformative research	10 [†]	WRF Board-appointed RAC	Opening in 2020
Facilitated Research A program that is fully funded by the project team	0	WRF CEO and leadership team	Rolling

[†]While research budget is allocated to this program annually, research-project funds are released every other year, starting in 2020.

Research Priority Program



Efficient Resource Use & Recovery

- Energy Efficiency, Intensification & Resource Recovery
- Climate Change Mitigation
- Nutrient Removal & Recovery
- Biosolids

Treatment Optimization & Intensification

- Treatment & Process Optimization
- Nature-Based Solutions

Resilient Infrastructure

- Asset Management
- Distribution System Integrity & Water Quality
- Collection Systems Integrity & Water Quality Impacts

Utility Operations & Management

- Supply Planning
- Workforce Management
- Digital Utility
- Financial Management

Healthy Communities & Environment





- Holistic Watershed Management & Integrated Planning
- Monitoring Tools at Watershed & Sewershed Scale
- Receiving Water Quality Management

Climate Risk Assessment & Adaptation, Communication, Environmental Justice

Research Priority Program Project Concepts

1 of 2





Approved May 2023 – RFPs now live!

Proj. #	Project Title	Budget				
			DRINKING WATER	WASTEWATER	WATER REUSE	STORMWATER
5253	Maximizing and Accounting for the Value of Natural Assets and Green Infrastructure at Watershed Scale	\$200,000				
5246	Quantifying the Performance of Source Water Protection Measures to Improve Utilities' Decision Making and Accountability	\$200,000				
5247	Case Studies for Successful Watershed and Sewershed Monitoring and Decision Making	\$150,000				
5244	Validation of an Integrated Framework of Wastewater and Stormwater Treatment Options for Source Control, Cost Effectiveness Analysis, and BMPs of CECs	\$200,000				
5254	Evaluation and Demonstration of Molecular Microbial Tools for Improved Operation and Optimization of Biofiltration	\$300,000				
5237	Ozone Nanobubbles Technologies for Water Treatment	\$350,000				
5248	Integrating Nature-based Solutions and Conventional/Gray Infrastructure to Optimize Treatment Performance	\$225,000				
5257	Advancing Nature-based Solutions through Assessing Long-term Performance of Natural and Engineered Media	\$275,000				
5251	Advancing the Understanding of the Next Largest Source of Utility GHG Emissions through Enhanced Whole-Plant Monitoring and Quantification	\$250,000				
5255	Developing GHG Emission Library for Unit Processes by Water and Wastewater Utilities and Decentralized Systems	\$250,000				

Research Priority Program Project Concepts

2 of 2

Approved May 2023 – RFPs now live!

Proj. #	Project Title	Budget	 DRINKING WATER	 WASTEWATER	 WATER REUSE	 STORMWATER
5245	Unlocking the Advantages of Internally Stored Carbon for Nutrient Removal	\$250,000				
5252	Advancing Anoxic P Uptake for Highly Efficient Simultaneous Nitrogen and Phosphorus Removal	\$200,000				
5249	Strategies to Integrate Energy Data into Utility Operations: Energy Management Challenges and Best Practices Across North America's Water and Wastewater Utilities	\$200,000				
5241	Technology and Innovation for Assessing Operability and Full Closure of High Consequence Valves	\$200,000				
5243	Advancing the Disinfection from Wet Weather-Driven Sewer Overflows: Best Practice and Case Studies	\$200,000				
5240	Enhancing Collection Systems Integrity and Capacity through Application of Emerging Assessment Methods	\$150,000				
5239	Optimization of Sensor Network and Advanced Sensing Techniques for Enhanced Collection Systems Management	\$150,000				
5256	Regionalized and Integrated Solutions for Brine Management and Recovery	\$150,000				
5250	Approaches to Build Strong Partnerships and Solidify Successful Interagency Reuse Projects	\$150,000				
5238	Best Practices to Attract and Retain a Skilled & Diverse Water Workforce	\$150,000				
5242	Residential End Uses of Water, Version 3: A Single-Family & Multi-Family Study	\$600,000				

Open RFPs



www.waterrf.org/proposals





www.waterrf.org/tailored-collaboration-program

Tailored Collaboration Program



2022 Tailored Collaboration Projects

Proposal Title	Sponsoring Utility	Submitting Organization	WRF Funds	Total Budget
A Simple and Cost-Effective Alternative Analytical Method for Monitoring and Optimizing Chloramine Chemistry in a Distribution System	East Bay Municipal Utility District	WQTS, Inc.	\$150,000	\$420,000
Cured-in-Place-Pipe (CIPP) Rehabilitation Emissions Study	DC Water	DC Water	\$150,000	\$784,520
Evolution and Characterization of Water Quality in Quarry Lakes	Denver Water	Hazen and Sawyer	\$30,000	\$85,000
Inactivation of Amoeba-internalized Legionella pneumophila by UV-LED and Multi-Barrier Approaches	Southern Nevada Water Authority	Southern Nevada Water Authority	\$150,000	\$350,000
Performic Acid Disinfection in Wastewater Effluent and CSOs In Context of Disinfection By-Products and Future Ambient Water Quality Criteria for Viruses*	Great Lakes Water Authority	Brown and Caldwell	\$150,000	\$920,445
<u>Sewer Methane Methods for Everyone</u>	Louisville MSD	Brown and Caldwell	\$130,000	\$529,300
Impact of Solid Stream Treatment on Microplastics in Biosolids	Pima County Regional Wastewater Reclamation Department	Hazen and Sawyer	\$66,000	\$251,733
Total			\$826,000	\$3,340,998

Tailored Collaboration Program 2023



- Supports **utility-specific/regional issues**
- Provides an opportunity for subscribing utilities to partner with WRF on regional research projects or projects that address issues of interest to a significant subgroup of WRF subscribers
- Offers a **1:1 match, up to \$150,000**, for every \$1 in cash that a subscriber or group of subscribers contributes
- Must be sponsored by a WRF subscribing utility, but funds from all categories of WRF subscribers are eligible for the cash match



Unsolicited Research Program

advancing the science of water®

© 2020 The Water Research Foundation. ALL RIGHTS RESERVED. No part of this presentation may be copied, reproduced, or otherwise utilized without permission.





Emerging Opportunities Program





Facilitated Research Program

advancing the science of water®

© 2020 The Water Research Foundation. ALL RIGHTS RESERVED. No part of this presentation may be copied, reproduced, or otherwise utilized without permission.





Sponsored Programs



Grants and Awards

Department of Defense (DOD)

Treatment Technologies for PFAS in Groundwater

\$990,000

Department of Energy (DOE)

Water Resource Recovery: Integration of Data-Driven Control

\$2.4 Million

Water Resource Recovery: Transforming Aeration Energy (WRF Sub)

\$28,000 WRF
(\$4.6 Million total award)

Biorecovery of Nutrients from Municipal Wastewaters (WRF Sub)

\$50,000 WRF
(\$1.1 Million total award)



THE
**Water
Research**
FOUNDATION



Energy-Water Nexus



Energy Production & Efficiency

This research area will help utilities establish and maintain a strong institutional knowledge base for energy production, consumption and management. In the next three to five years, with the help of this research area, WRF will:



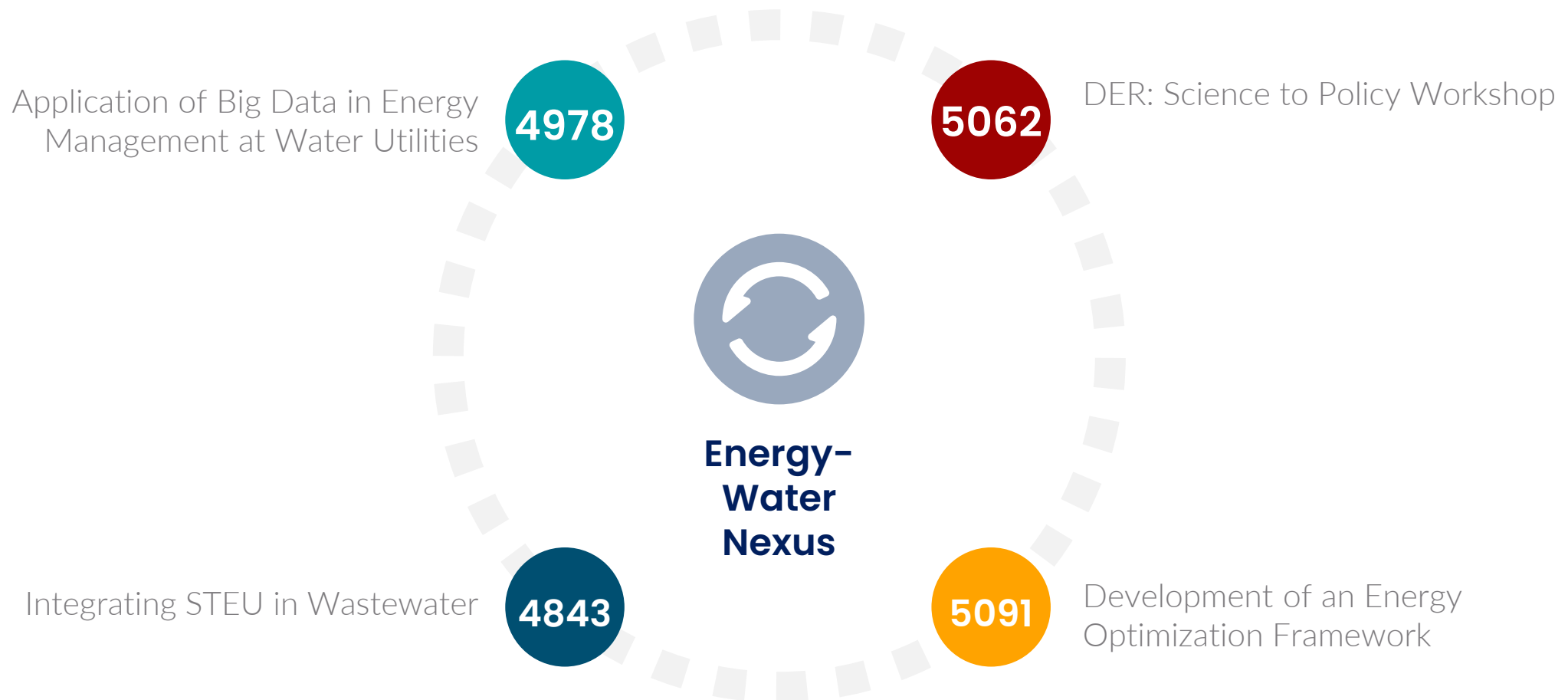
Create dramatically improved understanding of energy use, production, and optimization in the water sector.



Provide its subscribers information and products to better leverage their energy production and consumption.

Key Energy Projects

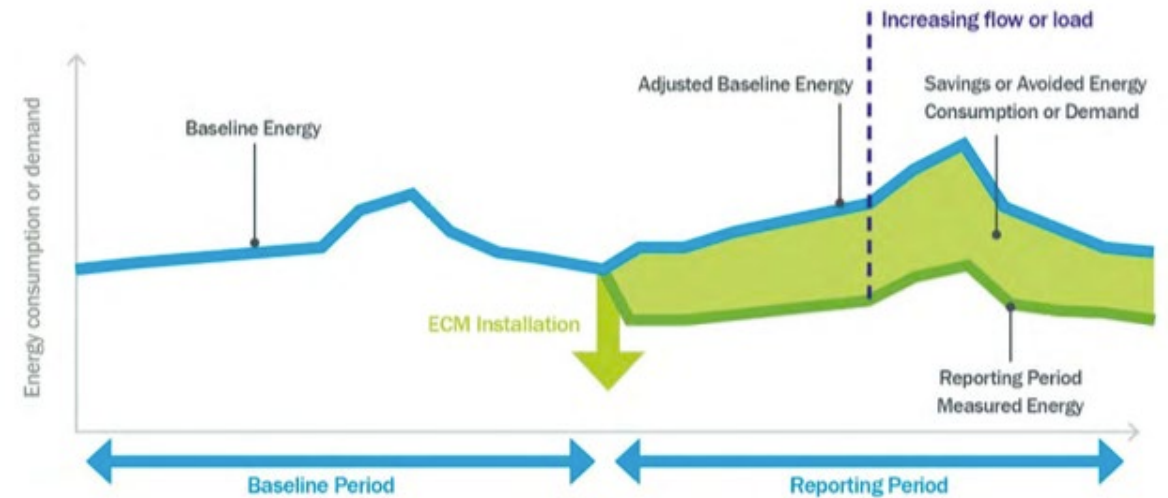
These projects are all in various stages of completion or have been recently published.



Development of an Energy Optimization Framework (WRF 5091)

Objectives

- Developing a credible reporting methodology, accounting for changes between baseline and post-project operating conditions
- Focusing on project types that can be replicated
- Communicating decision-making tools to stakeholder and broader audiences

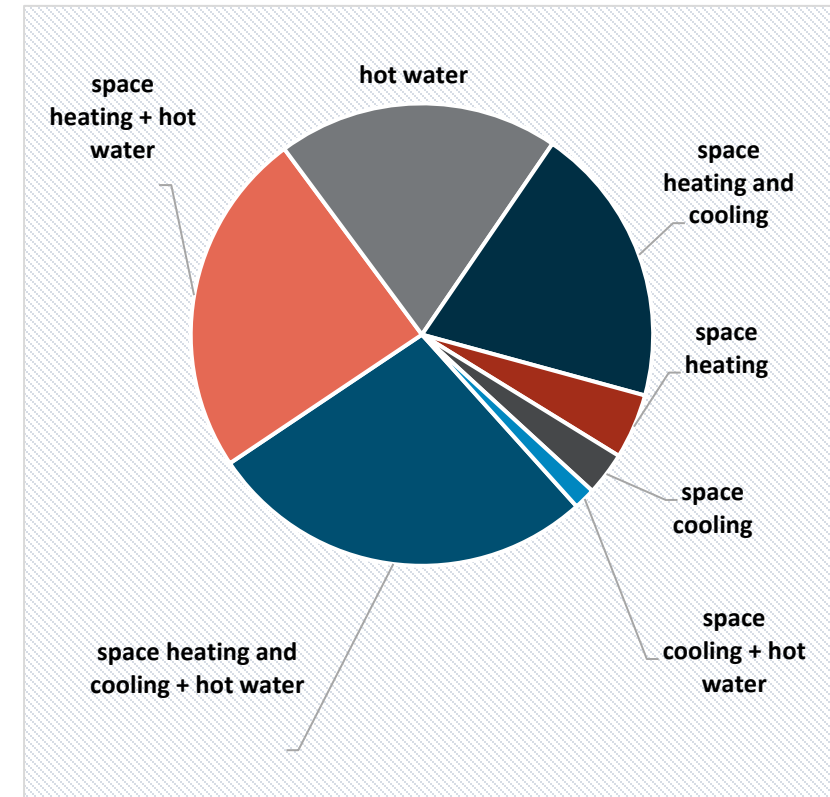


Quantifying savings following installation given fluctuating flow and load conditions
Adapted from: Efficiency Valuation Organization, IPMVP

Integrating STEU in Wastewater - Roadmap (WRF 4843)

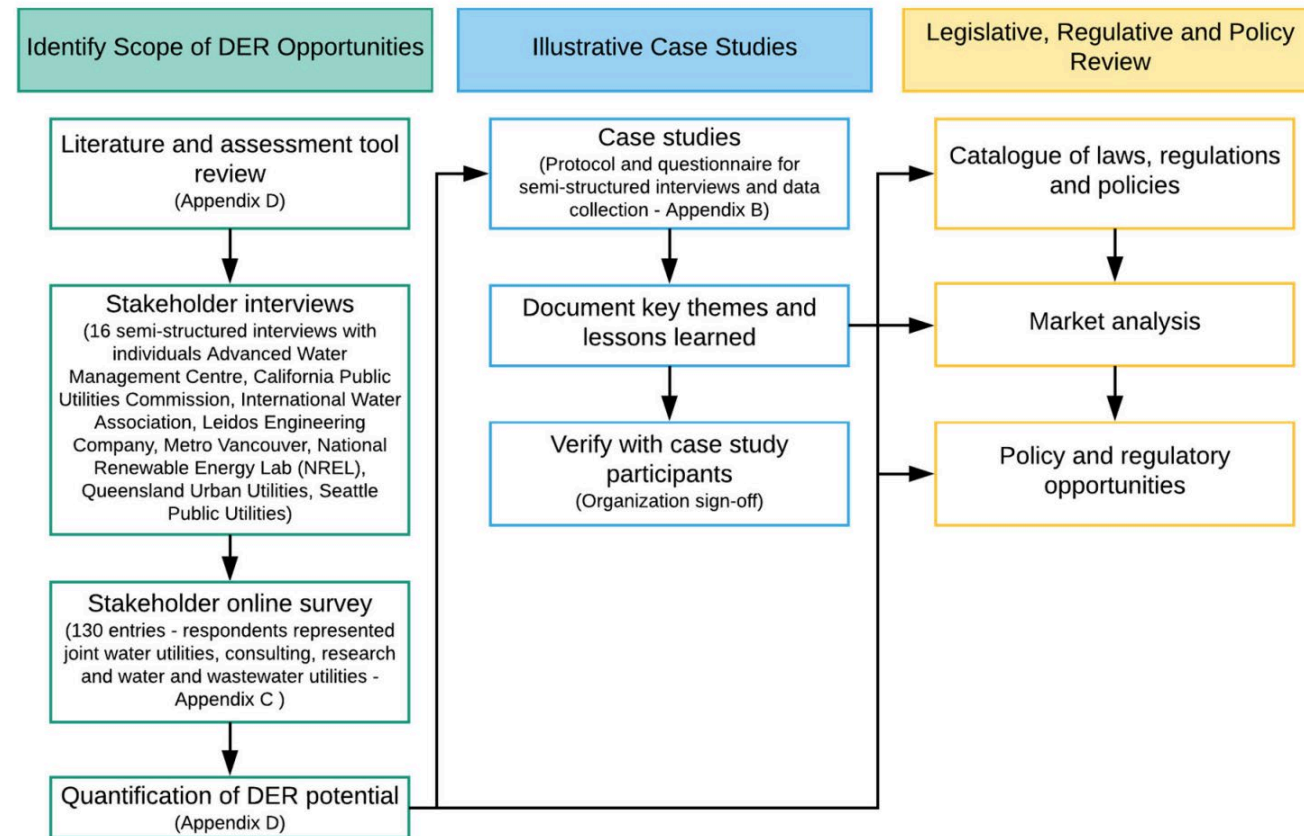
Key Facts

- Total available energy in WRRFs is more than 5x what they consume
- 20% of this energy is in chemical bonds (E.g. AD, Pyrolysis)
- 80% is in thermal energy

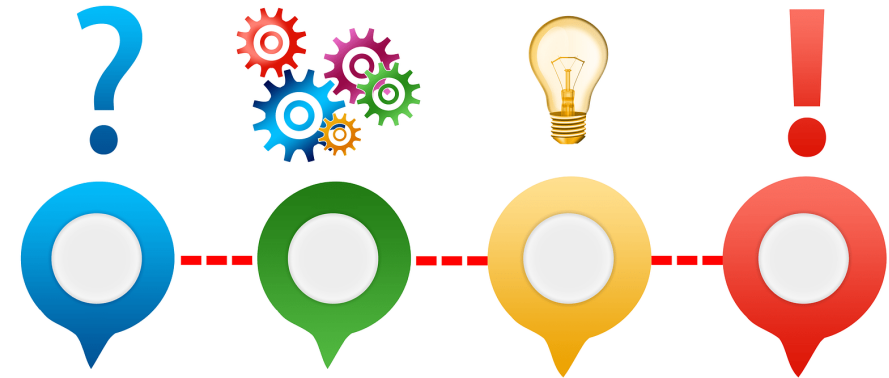
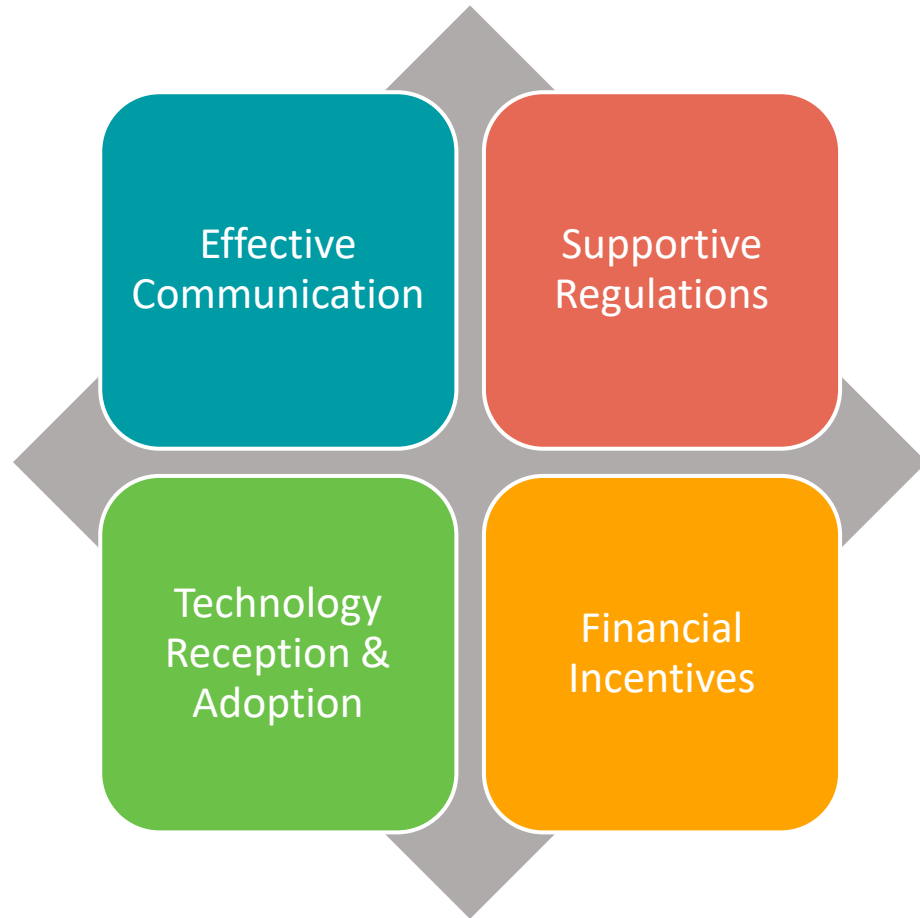


Project distribution by wastewater energy utilization
(all examples)

Opportunities and Barriers for Renewables and DER at Water Utilities (WRF 4625)



Opportunities and Barriers for Renewables and DER at Water Utilities (WRF 4625)



Application of Big Data for Energy Management at Water Utilities (WRF 4978)

BIG DATA



- Provides insights on key datasets of value to improve energy management
- Gain information on key big data analytics to improve resource efficiency
- Provide an example to water utilities on how data use can support overall energy management

What's upcoming?

- Sewage Heat Recovery
- Energy Data – Components?
- IoT / Smart Water Utility
- Decarbonization
- Energy Positive Research
- Solids Management



Energy Optimization Synthesis



Get Involved in Research



- Project Advisory Committees (PAC)
- Utility Participant in Research (UPIR)
- Research Planning Committees

www.waterrf.org/participate-research



Thanks for listening!

Connect with us. Stay in touch with the latest on Water Research.

Ashwin Dhanasekar



adhanasekar@waterrf.org