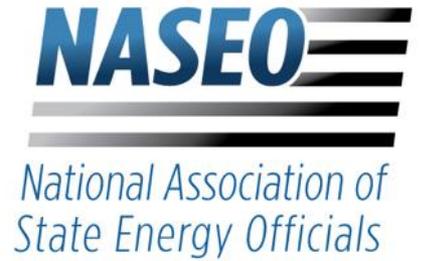


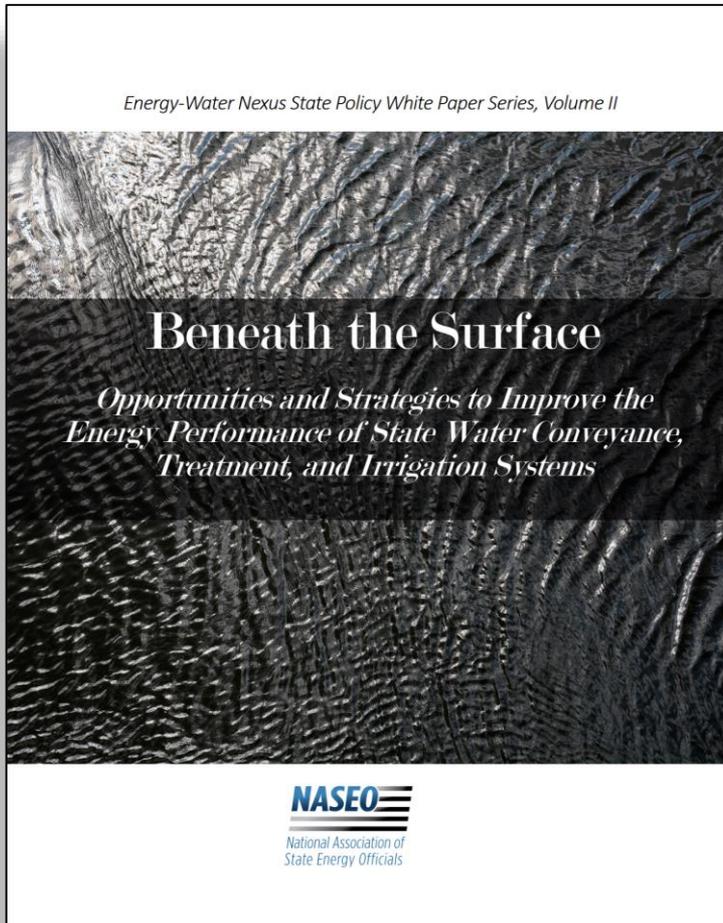


# WATER TREATMENT, CONVEYENCE, AND IRRIGATION SYSTEMS: OPPORTUNITIES AND CHALLENGES FOR GESPCS



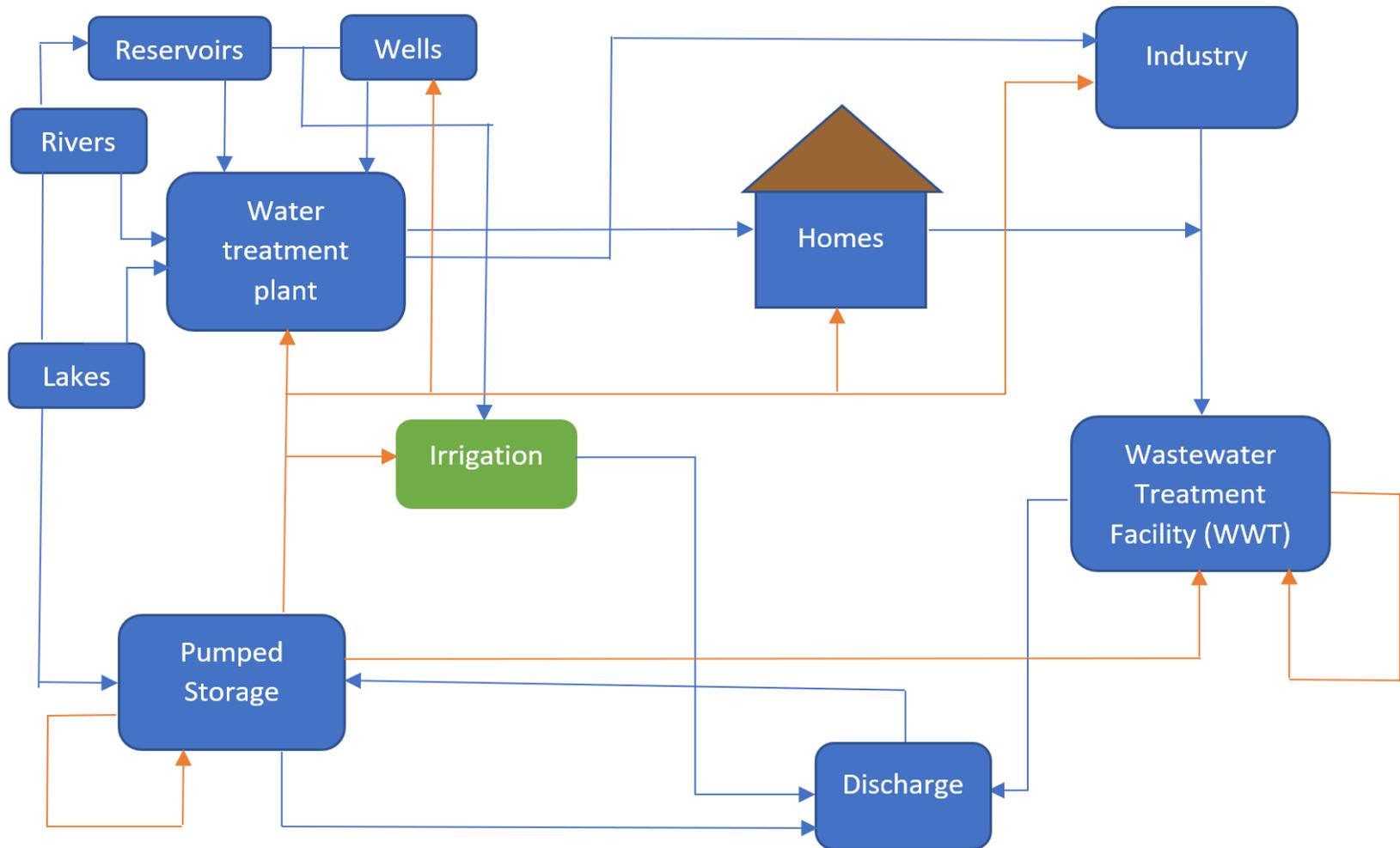
Samuel Cramer, Senior Program Manager, National Association of State Energy Officials  
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# + Overview of Paper



- One of a series of three DOE-funded papers looking at various aspects of the energy-water nexus in the United States
  - Water Infrastructure, Treatment, and Irrigation
  - Water Use for Power Generation
  - Water Use in Oil & Gas Development
- Structured to provide an overview of key upgrades that can be made to different areas of water infrastructure systems, the roles that key decisionmakers take during the process of designing policies to support these upgrades, and case studies from states active in improving the nexus in these areas. Main focus is on decisionmaker and stakeholder institutions/actors in contrast to being a technical analysis.
- Case studies from: CA, CO, MO, NE, TX, VA, WI

# + The Energy-Water Nexus in Water Treatment, Conveyance, and Irrigation Systems





# Elements of Water Infrastructure and Opportunity Areas



## ■ Extraction, Conveyance, and Distribution

- *Illustrative Opportunities:* installation of variable frequency drives (VFDs), correcting pipe sizes, installing in-line turbines, leak reduction

## ■ Water Resource Recovery Facilities (WRRFs)

- *Illustrative Opportunities:* upgrading pumps and blowers, utilization of CHP, installing renewables on-site, utilizing demand response measures and developing tariffs to incent additional demand response. Many potential opportunities for performance contracts and energy-as-a-service contracts here.

## ■ Water Treatment

- *Illustrative Opportunities:* Reductions of energy use up to 28% at desal, installing on-site generation, optimizing treatment schedules, pumps, aeration systems. Many performance contracting opportunities here as well.

## ■ Pumped Storage

- *Illustrative Opportunities:* upgrading pumps, improve automation and control systems, optimizing generation scheduling

## ■ End-Uses

- *Illustrative Opportunities:* **increasing efficiency of water heaters, installing automated meter reading (AMR) systems**, perform water audits, reducing pressure on water systems, increasing appliance standards
- *Agriculture-specific:* irrigation scheduling, drip irrigation, tailwater return systems, better lining and canal structure, remote monitoring and control systems, using rain gauges and soil moisture sensors, including irrigation in demand response pilot programs



# Key Decisionmakers and Their Roles in Policy/Program Creation



## ■ State Agencies

- State Energy Offices, Department of Natural Resources, Public Health, the Environment, Consumer Affairs, Licensing, Office of State Engineer, State Geological Survey, Public Utility Commissions (PUCs)

## ■ Water Utilities

- Make decisions around water pricing structures, maintain water infrastructure

## ■ State and Local Taxing and Financing Entities

- Irrigation districts, environmental infrastructure banks
- Provide financing to water infrastructure projects, determine water use in irrigation areas

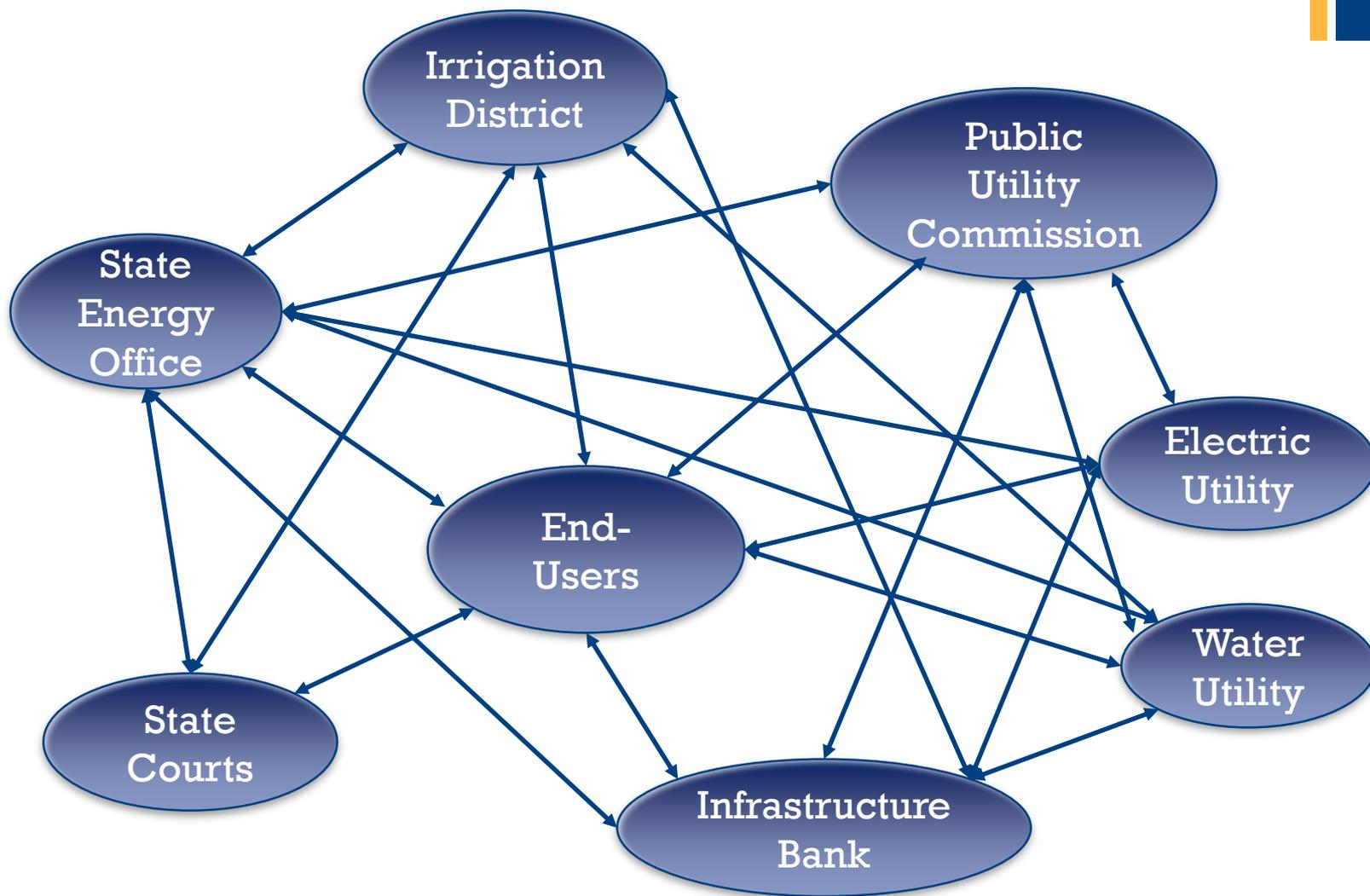
## ■ State Courts

- Impact water use due to adjudication of water rights disputes

## ■ Water Brokers

- Buy/sell water rights and make markets

# + Agency Interactions...It's a complicated landscape!





# State Case Studies



- **California:** Improving Agricultural Water Efficiency and Electric Grid Resilience Through Demand Response Pilot Programs
- **Colorado:** Increasing Electricity Generation from Water Transportation and Delivery Infrastructure
- **Missouri:** Increasing the Use of Supply and Demand-Side Efficiency Measures for Water Infrastructure
- **Nebraska:** Reducing Energy Use on Irrigation Pivot Systems and Improving Efficiency at Water Resource Recovery Facilities
- **Texas:** Enabling Water Efficiency Through Energy Savings Performance Contracts and Leading By Example Through Water Conservation Standards in Public Buildings
- **Virginia:** Supporting the Development of Pumped Storage Projects Through Reform to the Permitting Process
- **Wisconsin:** Focusing on Energy Through Power Generation at Water Resource Recovery Facilities

# + Colorado: Increasing Electricity Generation from Water Transportation and Delivery Infrastructure

- What was the opportunity?
  - Thousands of potential opportunities for small hydropower generation by replacing pressure reducing valves with small hydropower systems, offering potential generation capacity of 25 MW.
- What did the Energy Office do?
  - CEO sponsored workshops to help utilities spot potential hydropower projects for water delivery systems within their service territories and offered assistance in completing FERC permit forms and in receiving financing from the Colorado Water Resources and Power Development Authority.
- What was the outcome?
  - Denver Water, one of the state's water utilities, began exploring a few possibilities to develop small hydropower projects in its service territory. Private developers' interest in these types of projects increased, leading CEO to be invited to present on its research at various conferences around the state.

# + California: Improving Agricultural Water Efficiency and Electric Grid Resilience Through Demand Response Pilot Programs

- What is the opportunity?
  - Reduce the energy and water intensity of Californian farmers' irrigation systems.
- What did the state do?
  - Partnering with Polaris Energy Services on an agricultural system software communications pilot program in the Central Valley.
  - As the software matures, it is expected to discriminate among available wholesale electricity market prices, agricultural tariff changes, and Time-of-Use and demand response signals from utilities, and to incorporate them to adjust the load on water pumps. Farmers will then be able to meet their irrigation needs while reducing water use, energy use, and costs.
- Opportunities for performance contracting?
  - Integration of demand response software as part of deeper agricultural retrofits can provide additional energy and water savings to leverage for larger performance contracts.

# + Wisconsin: Focusing on Energy Through Power Generation at Wastewater Treatment Plants

- What is the opportunity?
  - Reducing energy and water use at the state's wastewater treatment facilities
- What did the state do?
  - Worked on benchmarking all publicly-owned water utilities and wastewater utilities in the state. The wastewater aspect of this project was a two-year collaborative effort between OEI, Focus on Energy, and the Wisconsin Department of Natural Resources.
- What were the results?
  - Utilities began to install variable speed drives and pumps that increased plant efficiency, reducing energy use and saving money.
  - Utilities began to conduct peak analyses of their water flows and install wireless submeters on their pumps.
  - Data from those meters provided information allowing for operational improvements that could provide additional energy savings
- Opportunities for performance contracting?
  - Potential for energy savings at many smaller wastewater treatment facilities. Aggregating these projects can achieve economies of scale and make them more attractive to pursue.

# + What Does This Mean for Performance Contracting? Lessons Learned

- Be creative when looking at opportunities for water efficiency, as there are many possible areas for retrofits beneath the surface
- Bundling energy and water efficiency improvements can lead to greater savings in each, resulting in deeper retrofits
- The regulatory landscape is complex...develop strong contacts with many different state agencies
- Work with your state's Energy Office! They know the state regulatory landscape well and can assist in making connections

# + Contact Us



Sam Cramer  
Senior Program Manager  
[scramer@naseo.org](mailto:scramer@naseo.org)  
(703) 299-8800 x 111