Saving Watts to Save Drops: Research to Document Best Practice Utility Programs

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2018 Annual NEUAC Conference

June 26, 2018

ACEEE

American Council for an Energy-Efficient Economy

The American Council for an Energy-Efficient Economy is a nonprofit 501(c)(3) founded in 1980. We act as a catalyst to advance energy efficiency policies, programs, technologies, investments, & behaviors.

Our research explores economic impacts, financing options, behavior changes, program design, and utility planning, as well as US national, state, & local policy.

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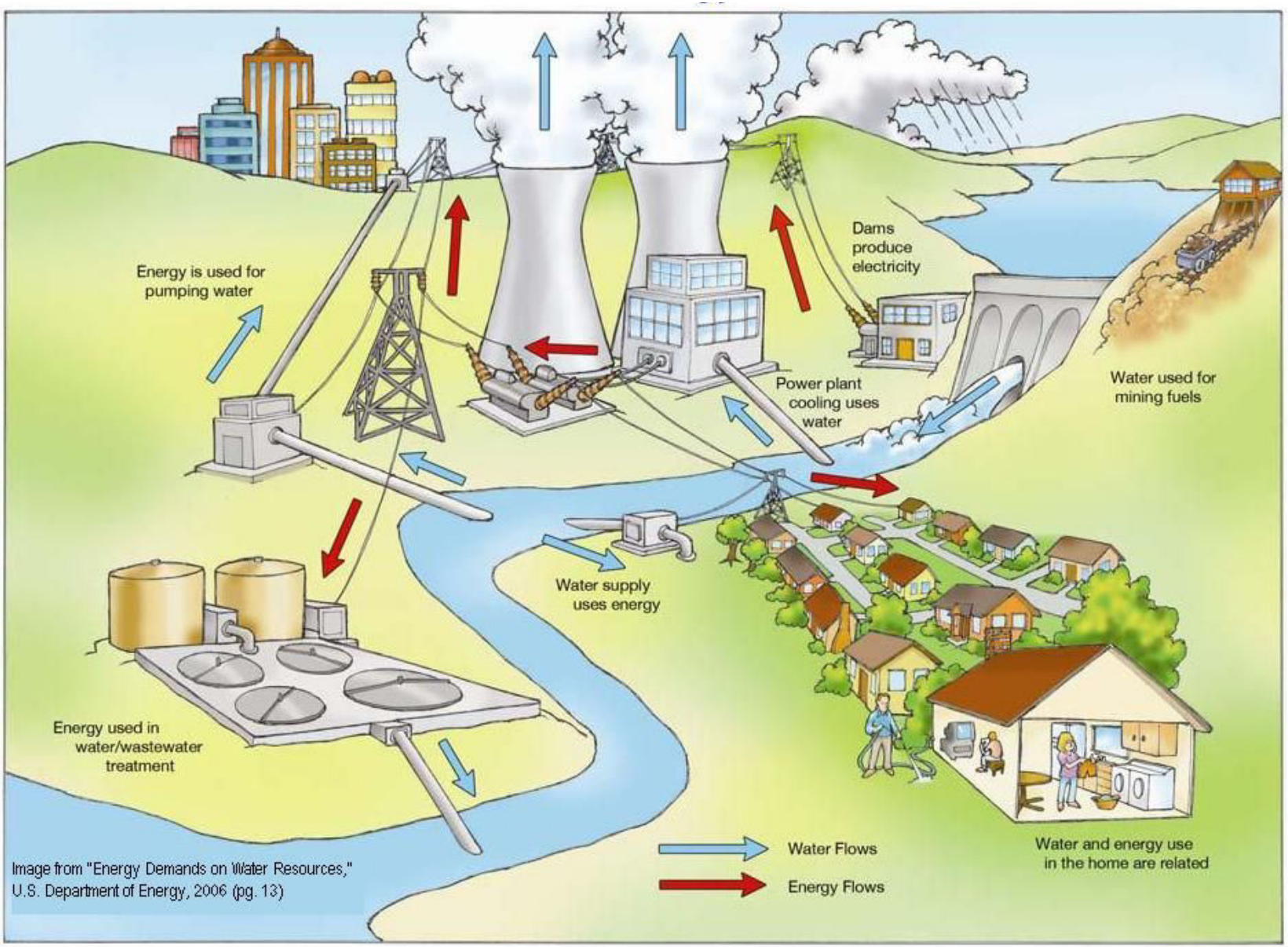
Outline

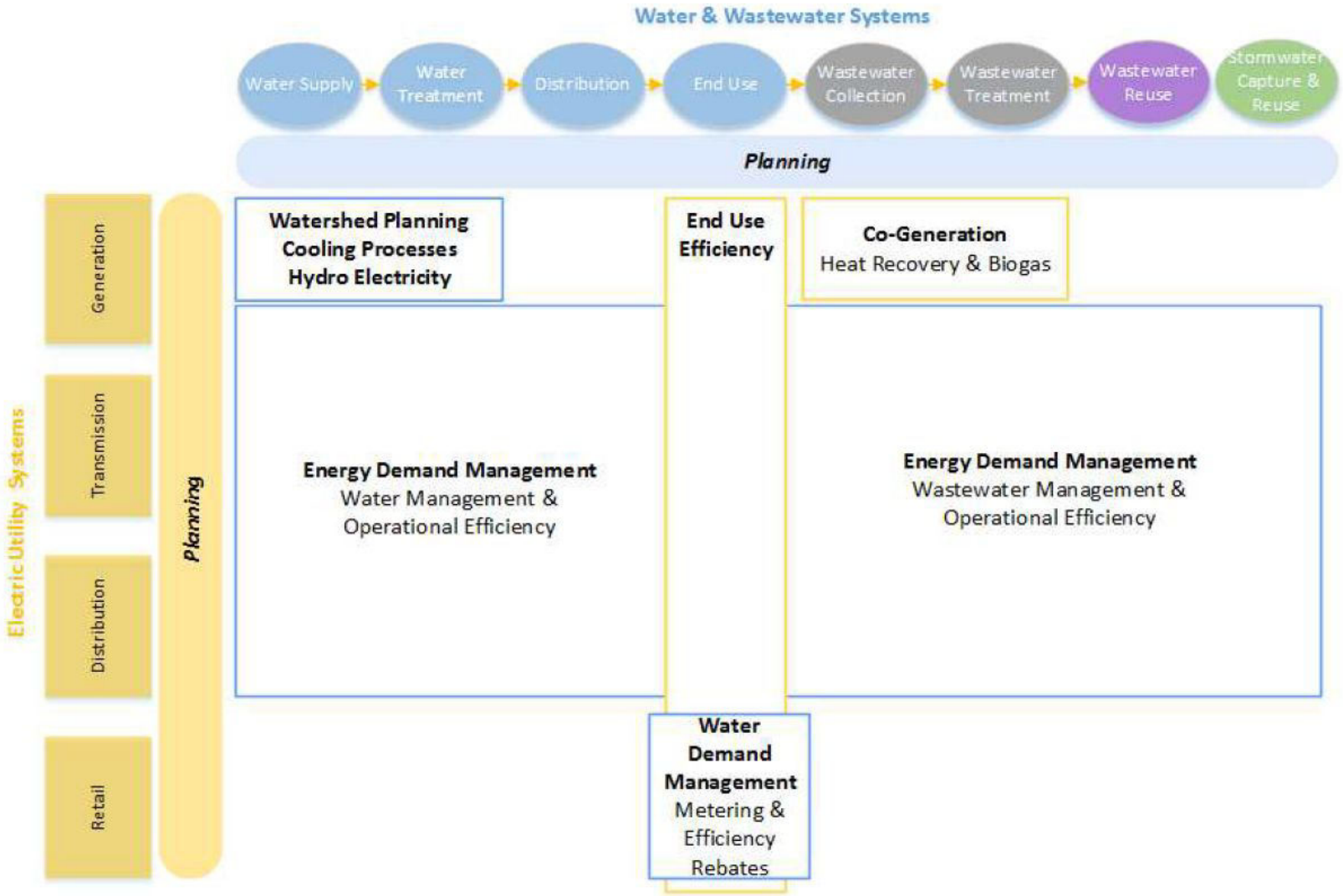
- Overview of the energy-water nexus
- Past research on successful joint energy/water programs
- Research aims: ‘Saving Watts to Save Drops’
- Highlighted best practice programs
- Policies driving savings at the E-W Nexus
- Barriers to Implementation
- Avoided water costs in C/E Screening
- Findings


Energy is used for pumping water
Dams produce electricity
Power plant cooling uses water
Water used for mining fuels
Water supply uses energy
Energy used in water/wastewater treatment
Water and energy use in the home are related
Water Flows
Energy Flows
Image from "Energy Demands on Water Resources," U.S. Department of Energy, 2006 (pg. 13)

Why focus on the energy-water nexus?

- Water for Energy:
  - 38% of total US freshwater withdrawals go to thermoelectric generation
- Energy for Water
  - California Energy Commission found that water-related energy uses 19% of the state's electricity and 32% of its natural gas
  - Regional variations in water-related energy use: surface vs groundwater, level of treatment, distance to treatment facilities/end users
- The end-use phase of the water-utilization cycle provides the greatest opportunity to save energy and water
- Measures implemented the end-use stage can achieve savings both upstream and downstream

Water-Energy Pathways



Conrad, Steve A, Steven J. Kenway, and Maria Jawad. "Water and Electric Utility Integrated Planning." Water Research Foundation, American Water Works Association, the New York State Energy Research and Development Authority, 2017.

Other E-W Nexus Research

- ACEEE. 2013. *Saving Water and Energy Together: Helping Utilities Build Better Programs*.
  - Excess of unrealized potential for joint end-use water and EE utility programs where collaboration would be mutually beneficial
    - Greater benefit per customer, sharing the financial burden
    - Dual water and energy audits, rebate programs, education/outreach reduce # of knocks on door
    - Leveraging a larger pool of contacts (manufacturers, retailers, etc.)
    - Sharing data to increase understanding of the water-energy nexus
    - Leverage water utility's local connections
    - Leak detection- waste both water and energy required to pump and process lost water

- ACEEE. 2014. *Watts in a Drop of Water: Savings at the Water-Energy Nexus*.
  - Reviewed reports from California Energy Commission, EPRI, ISAWWA, River Network to develops national estimates of energy savings associated with water savings
    - Water services (kWh/MG by water source, by utility size)
    - Heating Water
    - Wastewater Services
  - Saving Energy through Water Conservation
    - Calculated magnitude of savings embedded in water under 30% of hot/cold water scenarios
    - 39 million MWh (hot), 14.9 million MWh (cold)
    - Lack of end-use information means more work must still be done to further explore and quantify the energy-related benefits of the water-energy nexus

Best practice programs from past research

- Boulder, Colorado
  - Energy Performance Contracting Program
  - Combined with grant/rebate opps to reduce payback period
  - Includes integration of EMS and behavioral/ops training
- Darden Restaurants
  - Darden Sustainability—15 X 15
  - Lighting retrofits, equipment replacement, thermostat/power-up settings, low flow washers, drip irrigation
- Massachusetts Water Resources Authority (MWRA)
  - Long Term Sustainability Program
  - Customer Water Efficiency, system optimization for water/energy EE, efficient energy generation from water
  - Elimination of need for Connecticut River diversion and reduction in size of new drinking water treatment plant

ACEEE. 2018. *Saving Watts to Save Drops: Inclusion of Water Efficiency in Energy Efficiency Programs*.

Research Scope

- While energy efficiency programs save water, it is unclear to what degree many energy utilities account for water savings from their programs
- Reviewed selected utility-sector programs to:
  - Identify efforts to track and report water savings from EE programs
  - Summarize guidance for quantifying water savings from EE programs
  - Highlight best practice programs
  - Identify and document factors contributing to/impeding success

ACEEE. 2018. *Saving Watts to Save Drops: Inclusion of Water Efficiency in Energy Efficiency Programs*.

Program Sectors

Residential

(e.g. high efficiency clothes washer rebate program)

Commercial

(e.g. whole building retrofit program)

Industry

(e.g. strategic energy management programs)

Agriculture

(e.g. irrigation and agriculture efficiency program)

Water and Wastewater

(e.g. energy efficiency improvements in treatment plants)

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Methodology

- Circulated online survey to utilities
- Conducted interviews with program administrators
- Reviewed annual utility DSM reports

Criteria

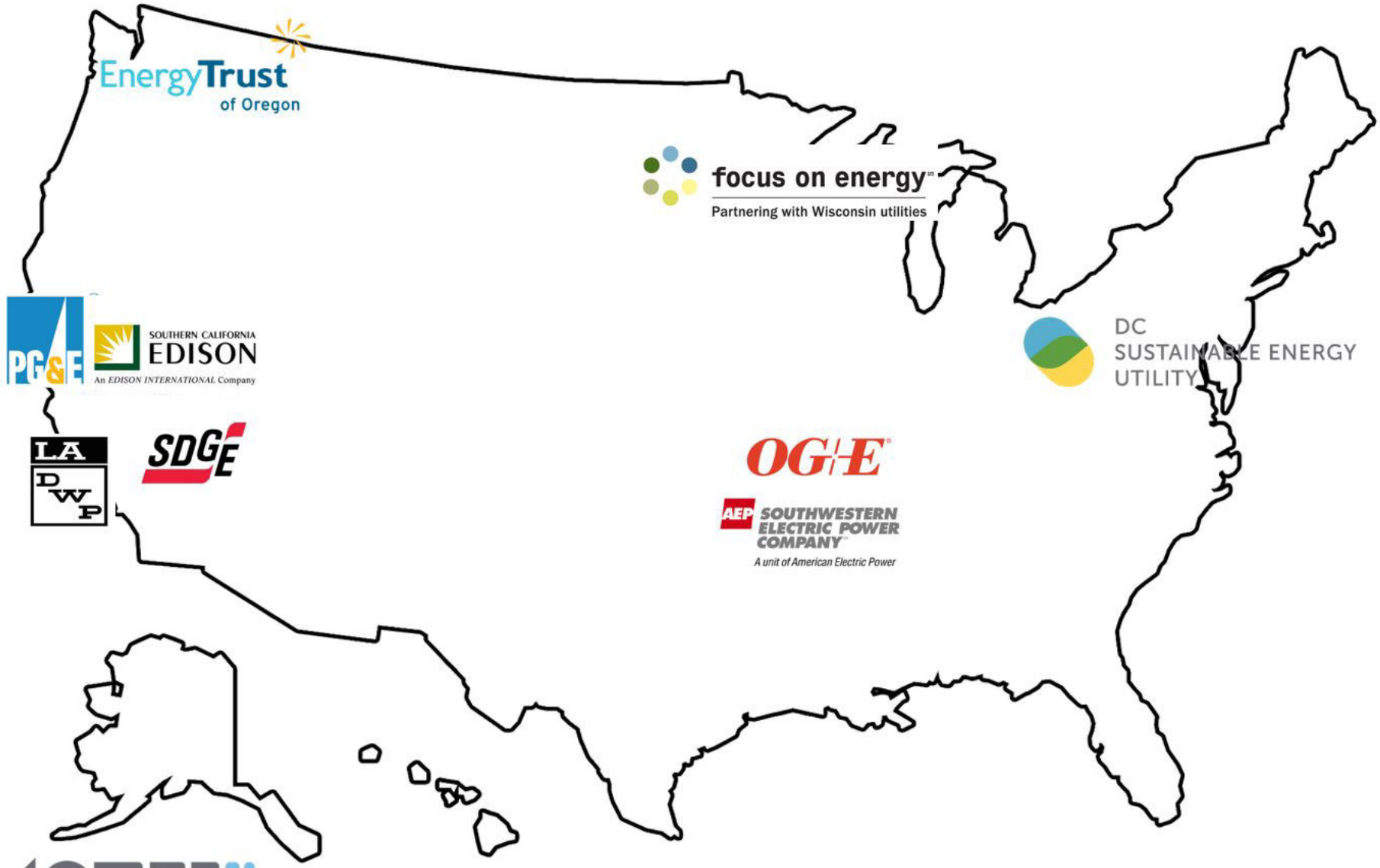
- Robust tracking of water savings
- Goal-setting for energy-water savings
- Incorporation of avoided cost of water savings in C-E screening
- Consideration of energy-water savings in long-term planning
- Fostering collaboration between energy/water utilities
- Promoting innovating equipment and program designs
- Calculating life-cycle embedded energy savings

Conservative estimates of water savings

- Review of EE programs from investor-owned utilities munis found that in cases where water savings are calculated, these valuations are typically conservative estimates
  - Simple calculations of avoided costs for aerator/low-flow fixtures based on average water/sewer rates (most common)
  - More intensive efforts to calculate upstream and downstream savings (WI, California Energy-Water Calculator)
  - Efforts to utilize smart technologies to promote water-saving behavioral changes by accessing real-time consumption data
  - Irrigation modernization/piping canals (Energy Trust of Oregon)

- PAs often described avoided costs of water as marginal, but acknowledged that value of water considered in cost-benefit test does not capture full value
- True cost of water often not reflected in customers' rates, and hence not reflected in C/E tests
- Impedes utilities' recovery of actual costs of providing/treating water

Highlighted Programs



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Highlighted Programs

- Advanced Meter Infrastructure Partnership Pilots (California IOUs)
  - Nov 2015 CPUC Ruling directs IOUs to identify technical issues of piggybacking water data on existing AMI infrastructure
  - PG&E: Behavior-based – customers receive AMI meter data/notifications through online portal
  - SCE: Behavior-based – using Green Button technology to report use to customers
  - SoCalGas: transfers water data over SoCalGas Advanced Meter Network
  - SDG&E: tests integration of RMWD's water metering/leak detection devices with Smart Meter Network

- Energy Trust of Oregon
  - 2016 – 1.66 billion gallons of water 'saved'
    - 1.4 billion gallons from custom irrigation measures
    - 263 million gallons from residential / multifamily measures
  - Irrigation Modernization Initiative accounts for highest reduction in water use
    - Replaces open canals with pressurized pipe
    - Conserves water lost to seepage and evaporation
    - Harnesses gravity to pressurize pipe, reducing the need for water pumps & enabling generation of hydroelectric power

Highlighted Programs

- SWEPCO, OG&E - Arkansas
  - Beginning in 2016, TRM Version 6.0's Protocol L2 provides guidance calculating the value of avoided water/wastewater based on marginal retail water/sewer rates
  - Separate values based on customer class and usage volume price tiers are also given.
  - Program administrators may use alternative water costs if they are more appropriate for the electric and gas service territory and are transparent in PSC filings.

- Focus on Energy - Wisconsin
  - Began considering embedded energy savings from water in 2014, during the early stages of the 2015–2018 Quadrennial Planning cycle
  - 2015 – PSC authorized Focus to claim credit for indirect energy savings achieved by installing water-reducing measures
  - *Water and Wastewater Energy Best Practice Guidebook* (2006) – provided calculations of simple ration of energy use per gallon of water processed for water utilities and WWTPs
  - Water: Surface vs groundwater
  - Wastewater: Activated sludge vs aeration lagoons vs oxidation ditches

Reported Water Savings – Highlighted Programs

- PG&E
  - CPUC Energy-Water Nexus proceeding (R. 13-12-011)
  - 2013-2014 - efforts to roughly account for water savings began as part of a statewide effort to address drought conditions and show relationship between water conservation and energy efficiency
  - 2016 - Now uses deemed savings values from California's Database for Energy Efficiency Resources (DEER) to track data on gallons of water for a variety of prescriptive measures.
  - 2017 - updates its internal reporting protocol and IT system to derive embedded energy savings associated with sourcing, treatment, and transport of water using the CPUC's Water Energy Calculator.
  - Efforts ongoing to resolve technical questions related to formally incorporating the calculator into program cost-effectiveness tests, including IOU and non-IOU savings attribution issues.
  - Project developers will likely use the calculator on a relatively limited basis until utilities receive CPUC approval.

Policies Driving Savings at the Energy-Water Nexus

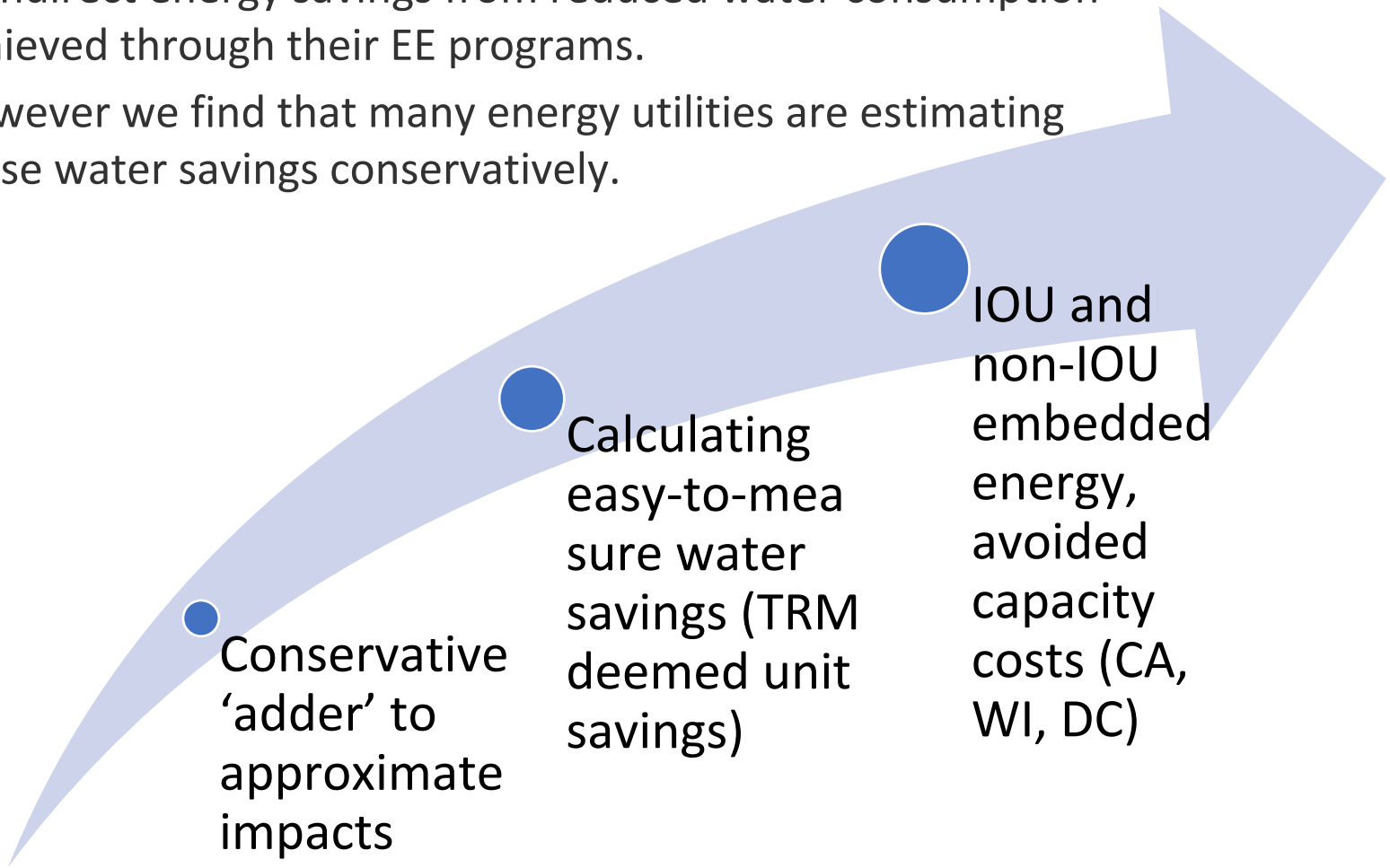
- Most reported savings attributed to easily measured residential efficiency programs
- Savings from commercial and industrial programs were assumed to be high but less likely to be calculated or reported
- Western states and others with a history of drought or increasing competition for water resources were more likely than others to cite specific water conservation goals as a key driver
  - SBX7-7 (2009)- requires the state to achieve a 20% reduction in urban per capita water use by December 31, 2020
  - 2016 Future Energy Jobs Act – Illinois
- Encouraging water-energy collaboration at early stages of planning cycle (Wisconsin)

Barriers to Implementation

- Shortage of data on water/wastewater energy intensity
- Limited funding for water utility participation
- Lack of regulatory guidance
- Disjunction in policy levers between energy/water utilities
- Fragmentation of water utility landscape
  - 75% of US population served by large energy IOUs
  - Most of U.S. served by smaller public water systems with fewer than 4,000 customers

Avoided Water Costs in C-E Screening

- Utilities in at least a dozen states account for avoided costs or indirect energy savings from reduced water consumption achieved through their EE programs.
- However we find that many energy utilities are estimating these water savings conservatively.



Avoided Water Costs in C-E Screening

State	Avoided costs of water savings are quantified and included in benefit-cost testing	Deemed gallons saved values/calculations provided for certain energy efficiency measures within TRM	Guidance provided for calculating avoided costs/kWh from water saved	TRM	Additional information
Arizona	Yes	Yes	No	Utility-specific	Arizona Public Service Company (APS) has quantified and reported water savings (in millions of gallons saved) in annual DSM progress report. However no guidance has been provided for including avoided cost of water savings from the Arizona Corporation Commission.
Arkansas	Yes	Yes	Yes	Arkansas Technical Reference Manual 7.0	Arkansas TRM Version 6.0 (2016) introduced Protocol L2, which assesses statewide water rates/sewer rates to provide an average proxy value for all avoided water usage benefits.
California	Low-income programs only	Yes	Yes	California Database for Energy Efficiency Resources (DEER)	Under the direction of the CPUC, investor-owned utilities began reporting embedded energy savings from water savings in 2017 using the CPUC's water–energy calculator; however ongoing questions regarding savings attribution and incorporating avoided water capacity costs must be resolved before these savings are claimed.
Colorado	Yes	Yes	No	Utility-specific	No statewide TRM. However utility-specific TRMs include avoided costs of water savings as part of participant nonenergy operations and maintenance (O&M) benefits.
Connecticut	Yes	Yes	No	Connecticut Technical Reference Manual	Eversource calculates and includes avoided costs from water savings in its TRC test, but not its Utility Cost Test (UCT). The utility relies on water and sewer cost provided by the Tighe & Bond Water & Sewer Rate Surveys (Tighe and Bond 2017).
Delaware	Yes	Yes	Yes	Delaware Technical Reference Manual (2016)	Avoided costs of water estimated at $5 per $1,000 according to studies by University of Delaware (2014) and AWWA (2015)
District of Columbia	Yes	Yes	Yes	DC SEU Technical Reference Manual	The Vermont Energy Investment Corporation (VEIC) maintains the DC SEU TRM. DC SEU calculated avoided costs of water at $10.25/ccf in 2017. The utility also claims embedded energy savings of 2.07 kWh/ccf based on analysis by VEIC of energy use associated with drinking water and wastewater treatment.

Findings

- States and Utilities
  - PSC leadership helped the states and utilities that are making the most progress in tackling the energy–water nexus.
  - Commissions have the power to set utility priorities, convene stakeholders in service of those goals, and standardize guidance according to utility and other stakeholder input.

  - Partnership/coordination a challenge among large IOUs and local water providers
    - Some municipalities where energy and water utilities report through the same governance structure and have similar service territories have the most favorable conditions for coordination
    - Fewer legal hurdles to resolve, stakeholders among which to build consensus, and data-sharing barriers

Findings

- Comprehensive assessment of energy embedded in water use can be highly complex depending on the scope and level of accuracy desired.
  - Building consensus on energy data assumptions
  - Reaching agreement on the appropriate policies and guidance for valuing and claiming savings
- Calculations of avoided costs of water do occur in at least a dozen states. Calculation of embedded energy savings is far less common.
- Though less likely to be reported, greatest savings realized from large custom industrial programs, leak detection initiatives, irrigation efficiencies
- Need remains for additional data and data sharing of potential embedded energy savings for a wide range of technologies, as well as for examples of successful cost-effective programs.

Conclusions

- Many examples available of utilities incorporating conservative estimates of water savings from EE programs based on average water/sewer rates
  - Examples of more advanced tracking of water savings/embedded energy savings in California, DC, and Wisconsin

- PUCs have the power to set utility priorities, convene stakeholders in service of goals, and standardize guidance according to input from utilities and stakeholders
  - Early stages of EE planning cycle and TRM development present opportunities to formally incorporate water tracking and reporting
  - California IOUs offer successful example of water utility partnerships

- while practices are well established for some measures, the need remains for additional data and data sharing of potential embedded energy savings for a wide range of technologies

Questions?

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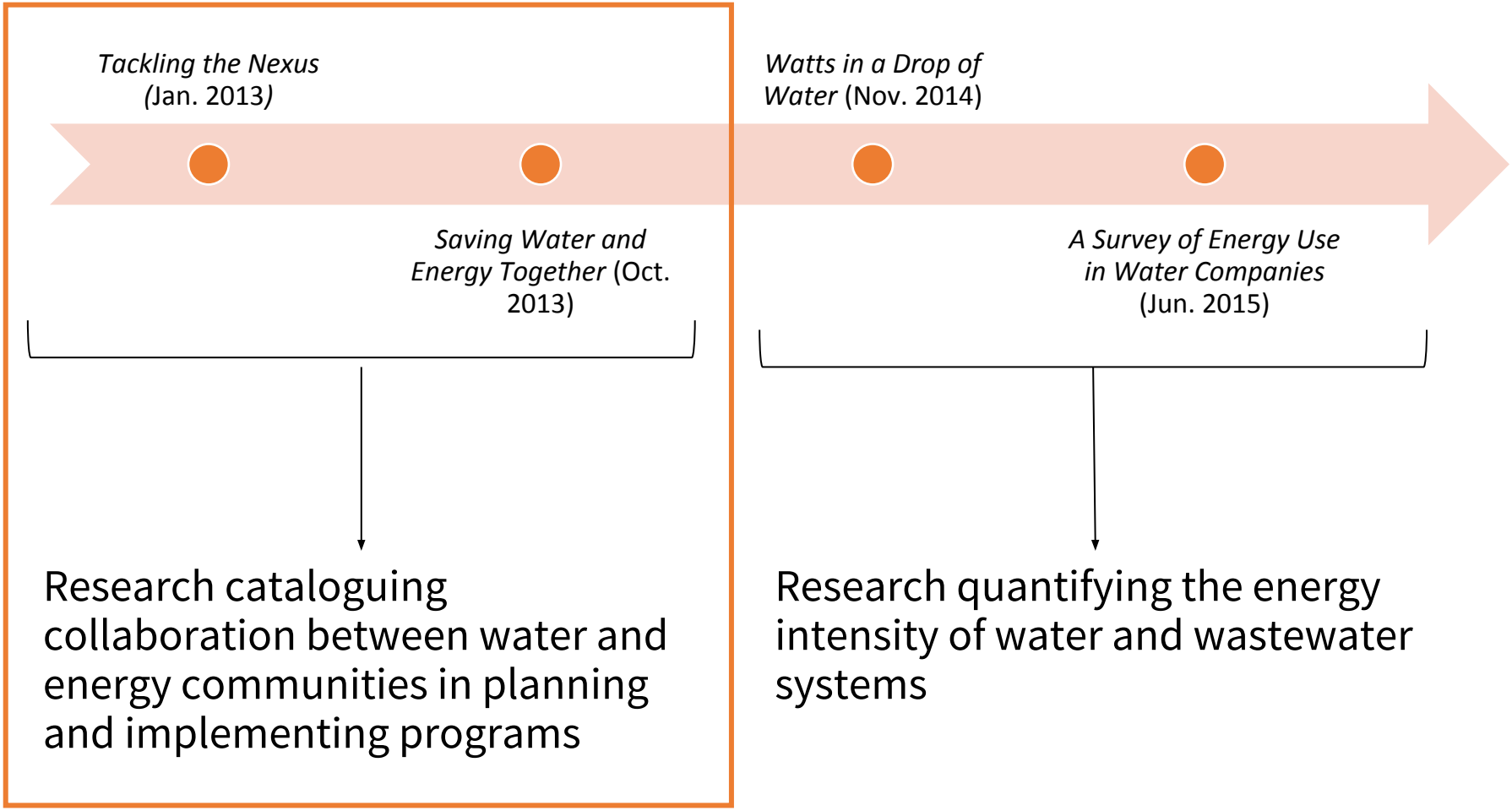
Energy-Water Nexus

- Interdependence of energy and water resources: energy production requires water, and water transport and treatment need energy
- Past ACEEE Research
  - AWE (Alliance for Water Efficiency) and ACEEE. 2011. *Addressing the Energy-Water Nexus: A Blueprint for Action and Policy Agenda*.
  - AWE. 2013. *Water-Energy Nexus Research: Recommendations for Future Opportunities*.
  - Young, R. 2013. *Saving Water and Energy Together: Helping Utilities Build Better Programs*.
  - Young, R., and E. Mackres. 2013. *Tackling the Nexus: Exemplary Programs that Save Both Energy and Water*.
  - Young, R. 2014. *Watts in a Drop of Water: Savings at the Water-Energy Nexus*.

Recent ACEEE publications



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http://aceee.org/sites/default/files/pdf/energy-water-nexus.pdf