UC DAVIS
CENTER FOR WATER-ENERGY EFFICIENCY

Advisory
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Advancing water utility data analytics for energy efficiency

Background

Around the world, water and energy resources are increasingly stressed by dwindling conventional sources, escalating demand, aging infrastructure, environmental degradation, and expanding regulatory pressures. The infrastructures that deliver and treat water and produce and distribute energy are intertwined and interdependent; however, our ability to measure, monitor, and control these tightly coupled water-energy systems is underdeveloped. By learning how to use data streams and analytics to coordinate our use of energy and water, we can help optimize the efficiency of both.

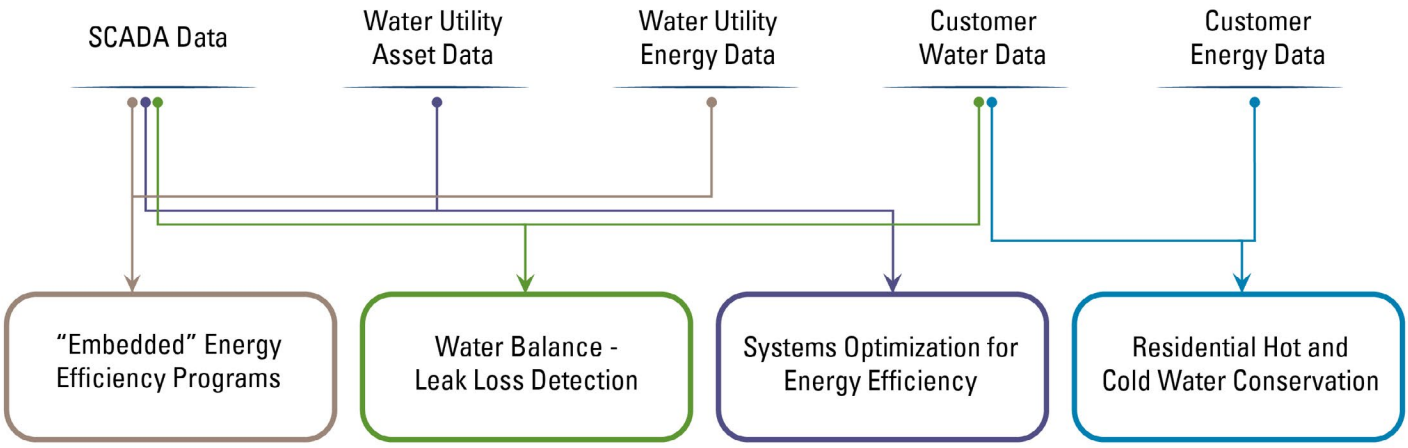
Data analytics

The Center for Water-Energy Efficiency (CWEE) at UC Davis is developing a data-driven approach to encourage greater water-sector energy efficiency. With this approach, water utilities are better able to understand their baseline energy use, set realistic targets for both water and energy conservation, and monitor progress towards those goals. Often, information technology (IT) limitations within water utilities present a bottleneck that hampers extraction and analysis of cumbersome and disparate data files. Hence, developing a holistic computing platform offers great potential to streamline data capture, storage, and analysis, enabling system efficiency optimization.

Our proposed computational architecture will flexibly draw data from utilities' existing and emerging data streams, including Supervisory Control And Data Acquisition (SCADA) data, energy billing data, asset management software, and meter data (including "smart meter" data as these systems are rolled out). This will enable high-resolution energy intensity evaluation of water agencies, allow for real-time energy use and carbon emissions tracking, and provide informatics for ongoing monitoring and verification of water-energy efficiency program savings. Further, this data platform could easily be expanded to accommodate additional innovations, such as real-time water balancing (to identify system leaks), calculating energy and cost savings from system-wide pump optimization, and improving estimation of residential hot and cold water consumption.

The energy intensity case

CWEE partnered with Pacific Gas & Electric (PG&E) to develop a high-resolution assessment of the energy used by the East Bay Municipal Utility District (EBMUD) to provide water to over 1.3 million people. By developing a detailed characterization of when and where energy is being used across the EBMUD system, the water utility is better able to understand its baseline energy use, set realistic targets for both water and energy conservation, and monitor progress towards those goals.



Integrating data streams to enable advanced water and energy efficiency programs

Importantly, our work with EBMUD does not require deploying smart meters or new sensors throughout its infrastructure. Instead, we rely on existing data streams typically only used for water systems' daily operational control (SCADA system data), leveraging these bits and bytes for a new purpose—environmental planning and tracking.

This approach not only enhances energy management within a water utility, but also provides insight into energy flows at enough resolution to enable direct partnership with energy utilities. In other words, effective measurement and verification of energy savings in the water system can enable water agencies to pursue a new revenue stream via energy efficiency programs offered by energy utilities.

Next steps

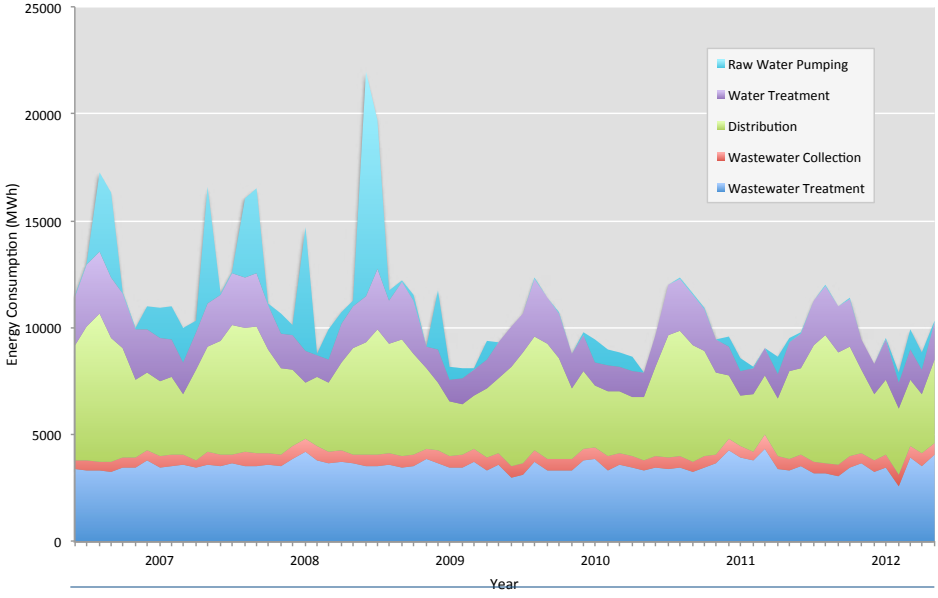
We believe this approach has vast potential to encourage greater water and energy efficiency, but for the IT limitations within water agencies that prevent extraction and analysis of the relatively cumbersome SCADA data files. A cloud-based computing platform for addressing water utilities' big-data challenges promises great value and immense opportunity. Further, water utilities' computational footprint in the cloud (both storage and analytic) can grow organically to meet the accelerating data challenges associated with massive deployments of smart meters and a broader smart water grid.

CWEE is working with water utilities to advance this type of information technology (IT) platform to streamline integration of their existing data streams towards new operational objectives, such as maximizing water-energy efficiency. We aim to develop and deploy the IT analytics using real data from utility partners including East Bay Municipal Utility District (EBMUD), PG&E, the Los Angeles Department of Water and Power, San Diego Gas & Electric, and the City of San Diego. Engagement in this project affords these utility partners the opportunity to identify relevant data streams, characterize key analytical outputs, and assess their own systems for early-mover water-energy opportunities.

Principal investigators

Frank Loge, Ph.D., P.E.
Director, CWEE
(530) 754-2297
fjloge@ucdavis.edu

Ned Spang
Program Manager, CWEE
(530) 754-5447
esspang@ucdavis.edu



EBMUD monthly energy consumption by category (June 2006–June 2012)