Ensure Effective Water Delivery and Optimize Energy Use: 
Enabling data driven choices with smart software

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Agenda

- California’s changing energy sector
- Energy demand-side management
- How water distribution utilities can shift energy load
- CWEE's energy demand management system software
Let’s take a poll!

Operational Challenges

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<th>Intermittent</th>
<th>Non-Dispatchable</th>
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Increased Renewable Integration

Primarily Solar

Figure from Clean Coalition 2013

Changing Energy Sector
Pursued Energy Sector Solution:

Energy Demand-Side Management

Figure from CAISO 2013

Shifting Energy Loads

Energy Load Shaping

- **Long-term** behavior change

- Energy market incentive:
  - Static Time-of-Use (TOU) Energy Rates

Energy Load Shifting

- More *immediate* response to market request

- Energy market incentive:
  - Energy Demand Response
  - Dynamic Energy Pricing

Shape vs. Shift Energy Loads
- Water utilities can manage energy load by changing pump operations.
- Water utilities with water storage can further shift operations and energy load.
- This is an expansion on previous research Energy/Cost/Water Quality pump operation optimization schemes.
When performing Energy Demand Management, water distribution systems must take into account:

- Water quality
- Minimum system pressures
- Hydraulic limitations
- Operational limitations

Decision Support Tool for Water Utility Operators that assists in Energy Demand Management
• Water utility management and optimization software

• Forecasts future hydraulic simulations to evaluate a variety of water network operation scenarios

• Recommends or tests the necessary operating controls to help operators make daily decisions based on user-defined objectives.

EDMS in a Nut Shell

Optimized Rule-Based Controls

Real-Time Forecasts

The EDMS Provides
Previous research focused on optimizing pump schedules.

Example:

EDMS will optimize Rule-Based Controls.

Example:

- Pump **on** if tank level **is less than** 10 feet.
- Pump **off** if tank level **is greater than** 25 feet or time is between **4 and 8 pm**.
Rule-Based operating recommendations based on:
- SCADA system data
- A hydraulic model (EPANET)
- Energy rate program participation

Quality EPA Hydraulic Model
- Built as an extended period simulation
- Can run without crashing
- Calibrated to ensure the results are accurate

Excess Water Storage
- For energy load shifting
- Not necessarily for energy load shaping
Scenario Choices

• Base (how utility currently operate)
• Optimized for various objectives
• Operator designed

For each scenario the EDMS provides

• Full hydraulic simulation for a given time period
• Operating policies, and
• Energy, energy cost, and estimated GHGs

Select a Scenario to operate to.
For the selected scenario the EDMS provides

- A week ahead forecast of the full hydraulic model simulation and
- Operation policies/controls to implement
Water-Energy Efficiency Project

Lindsey Stuvick, Water Efficiency Manager
August 29, 2019

About Moulton Niguel

- Water, Recycled Water & Wastewater Services
- Serve 6 Cities in South Orange County
- Population Served: 172,000
- 7 Board Members
- 158 Employees
- Water Budget Based Rate Structure
- AAA Rated by Fitch and S&P
- Data-Driven Utility
Energy Efficiency Project

- Partnered with UC Davis Center for Water-Energy Efficiency (CWEE)
- $3 million grant funded by California Energy Commission
- Explore opportunities for demand response in the water sector to take advantage of Time-Of-Use (TOU) Rates
  - Evaluate if MNWD can participate in the wholesale grid’s load-shifting scheme to obtain incentives to shift energy use
- Develop and implement Energy Demand Management System (EDMS)

Opportunity for Load Shifting

![Diagram showing water demand and energy demand over time with options for load shifting and pump supply only.]
Project Objectives

- Quantify energy intensity of PW & RW systems
- Explore operational changes to manage energy loads differently
  - Ramp up & shift energy use
  - Respond to different energy rate programs
  - Maintain safe water system
- Reduce energy costs & generate revenue
- Reduce GHG intensity of energy use

Project Status

- Completed energy intensity analyses
  - Potable and recycled water systems
  - Refining potable hydraulic model
  - Installing energy meters at active pump stations
  - Utilizing existing communication infrastructure
  - UC Davis developing water utility specific EDMS technology
Next Steps: EDMS Development and Testing

- Configure EDMS technology to MNWD systems
- Develop Operation Guide for using EDMS technology
- Pilot the EDMS technology for 12 months

The California Water Efficiency Partnership (CalWEP) and CWEE will build, maintain and support an EDMS user group.

EDMS User Support Group
Managed by CalWEP

Outreach and Widespread Adoption

Long Term User Support
Utilities interested in joining Energy DMS user group

Utilities interested in using the Energy DMS and piloting water specific energy rates

Questions?

moulton niguel water district

UC Davis Center for Water-Energy Efficiency

Q&A Session
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Reference:
