Turning up the Heat on Commercial Kitchen Water Savings

USEPA Energy-Water Workshop
March 5, 2008

Richard Harris
Manager of Water Conservation
U.S. Water and Sewer Rate Increases

Source: AWWA/Raftelis Financial Consultants, Inc.
Overview

EBMUD Commercial Food Service Programs

- Water conservation services
- Water savings
- Incentives

Research and development

- Conservation partners
- Lessons learned, challenges and barriers
- Looking forward
Partners With Business and Industry

- Water use efficiency assessments targeting high water uses
- Customized rebates for measure implementation
- WaterSmart business certification and recognition of customer achievements
Water Use Survey Methodology

- Water use process analyses
- Water consumption graphs (e.g. flow rates, equipment counts, hours of operation, etc.)
- Behavioral studies
- Leak detection mapping
- Identify conservation measures
- Landscape water use estimates
# Commercial Food Service Water Use

<table>
<thead>
<tr>
<th>Dish Room</th>
<th>Food Prep</th>
<th>Roof Top &amp; Outside</th>
<th>Refrigeration</th>
<th>Dining Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dish washers</td>
<td>Steamers</td>
<td>Evaporative-cooling</td>
<td>Water-cooled-condensing</td>
<td>Table water</td>
</tr>
<tr>
<td>Glass washers</td>
<td>Combination ovens</td>
<td>Cooling towers</td>
<td>Ice machines</td>
<td>Bathroom: Hand washing</td>
</tr>
<tr>
<td>Pot washers</td>
<td>Pasta cookers</td>
<td></td>
<td></td>
<td>Toilets</td>
</tr>
<tr>
<td>Pre-rinse nozzles</td>
<td>Steam tables</td>
<td></td>
<td></td>
<td>Urinals</td>
</tr>
<tr>
<td>Conveyor spray</td>
<td>Sinks: defrosting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual wash down</td>
<td>Sinks: food washing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposals systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Water Energy
Selling Conservation Benefits

- Lower water bills
- Reduced wastewater charges
- Lower energy costs
- Positive public image
- Improved process controls
- Reinvestment/reallocation of savings
## Avg. Customer Costs and Savings

<table>
<thead>
<tr>
<th>Product</th>
<th>Avg. Usage</th>
<th>Incr. Unit Cost</th>
<th>Projected 5-Year Water Savings (gal)</th>
<th>Potential 5-Yr Cost Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Steamers</td>
<td>2 gal/hr</td>
<td>$0 - $1,000</td>
<td>675,000</td>
<td>$26,000</td>
<td>Immed. - &lt; 1 year</td>
</tr>
<tr>
<td>Pre-rinse Valves</td>
<td>1.6 gpm; 6 hrs/day</td>
<td>$50</td>
<td>325,000</td>
<td>$5,000</td>
<td>2.6 weeks</td>
</tr>
<tr>
<td>Ice Machines</td>
<td>Per 100 lbs ice</td>
<td>$1,000</td>
<td>1,000,000</td>
<td>$5,720</td>
<td>&lt; 1 year</td>
</tr>
<tr>
<td>HET Toilets</td>
<td>1.28 gpf</td>
<td>$50-$150</td>
<td>5,000-90,000</td>
<td>$40-$600</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Irrig. Controller</td>
<td>10,000 Sq ft.</td>
<td>$400</td>
<td>125,000</td>
<td>$400</td>
<td>5 years</td>
</tr>
</tbody>
</table>
**Volume-Related Cost for Sewered Water (Oakland)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Rate per CCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>$1.83</td>
</tr>
<tr>
<td>Wastewater</td>
<td>$0.46</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>Sewer</td>
<td>$0.71</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3.00</strong></td>
</tr>
</tbody>
</table>
Customized Rebate$

- Up to 50% of the installed equipment cost (no labor)
- Cash rebate based on estimated savings and customer payback period (min. > 2 Yrs)
- Rate up to $0.75 per CCF (750 gal.) savings
- Rebate issued after implementation
  - 50% post inspection; 50% 6-12 months later
- Offsets initial customer cost
EBMUD Water Conservation Research

- Market Saturation and End Use Demand Studies
- Food Steamer Study
- Air-cooled Ice Machine Study
- Water Efficient Product Rating and Labeling
- PG&E Embedded Energy/Water in Food Processing
- WaterSmart Guidebook for Commercial Water Effic.
Commercial Conservation Partners

- Food Service Technology Center
- Pacific Gas & Electric Company
- USEPA Energy Star and WaterSense
- Consortium for Energy Efficiency
- California Energy Commission
- California Public Utilities Commission
- California Urban Water Conservation Council
- Alliance for Water Efficiency
# Commercial Market Saturation Study

<table>
<thead>
<tr>
<th>Water – Conserving Fixture</th>
<th>Percent of Market in Each Sector Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warehouses</td>
</tr>
<tr>
<td>ULFTs</td>
<td>32</td>
</tr>
<tr>
<td>Urinals</td>
<td>22</td>
</tr>
<tr>
<td>Aerators</td>
<td>72</td>
</tr>
</tbody>
</table>
8100 gpd; the landscaping accounts for 25% of the total water use (2000 gpd)
Monitoring the Landscaping

Monthly Water Use

Gallons Per Day

Summer Time Landscaping

Landscaping Water Use Increase of 3,500 gpd

Sep-00 Dec-00 Mar-01 Jun-01 Sep-01 Dec-01 Mar-02 Jun-02 Sep-02 Dec-02 Mar-03 Jun-03 Sep-03 Dec-03 Mar-04 Jun-04 Sep-04 Dec-04 Mar-05 Jun-05
Steamer Field Study
Cost Comparison

<table>
<thead>
<tr>
<th>Steamer Type</th>
<th>Boilerless Steamer (single compartments)</th>
<th>Boiler-Based Steamer (single compartments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Energy</td>
<td>$912</td>
<td>$4,822</td>
</tr>
<tr>
<td>Annual Water</td>
<td>$33</td>
<td>$979</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$945</td>
<td>$5,801</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td><strong>$4,856</strong></td>
<td></td>
</tr>
</tbody>
</table>

Based on monitoring 12 steamers with an average daily use of 6.5 hours
360 days/yr operation at $0.13/kWh & $5.00/100 cu.ft. water/sewer
Boiler Based Steamer (Not ENERGY STAR)
Average Water Usage = 40 gph
Timed vs. Manual Mode
Variation in Steamer Use

6:40 am – 3:15 pm:
- Steamer on manual mode
- 8.5 hours
- 69 kWh, 545 gallons

3:15 pm – 11:00 pm:
- Steamer on timer mode
- 5 hours energized
- 30.5 kWh, 240 gallons

Based on 360 days/yr operation at $0.13/kWh & $5.00/100 cu.ft. total water cost in Los Angeles.
Ice Machines

- Ice machines harvest ice at a rate ranging from 100-lb/24 hrs to 1800 lb/24 hr
- They represent about 10% of the overall commercial refrigeration energy
Air or Water Cooled?

- Water for Ice Maker
- Condenser Water Inlet
- Condenser Water Outlet
ARI Database

Condenser cooling water dwarfs potable water use!
Economics of open loop water-cooled ice machines not attractive!

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Consumption</td>
<td>6</td>
<td>7.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Water Consumption (gal/100)</td>
<td>156</td>
<td>28</td>
<td>20</td>
</tr>
<tr>
<td>Annual Energy Use (kWh) (^a)</td>
<td>9855</td>
<td>12483</td>
<td>9198</td>
</tr>
<tr>
<td>Annual Water Use (gal) (^a)</td>
<td>256230</td>
<td>45990</td>
<td>32850</td>
</tr>
<tr>
<td>Annual Energy Cost (^b)</td>
<td>$986</td>
<td>$1,248</td>
<td>$920</td>
</tr>
<tr>
<td>Annual Water &amp; Sewer Cost (^c)</td>
<td>$1,713</td>
<td>$307</td>
<td>$220</td>
</tr>
<tr>
<td>Total Annual Utility Cost</td>
<td>$2,699</td>
<td>$1,555</td>
<td>$1,140</td>
</tr>
</tbody>
</table>

\(^a\) Annual energy use is based on a 75% duty cycle, 365 days per year.

\(^b\) Energy costs are based on $0.10/kWh.

\(^c\) Water and sewer costs are based on $2.00/ccf and $3.00/ccf, respectively.
## Commercial Dishwashers

<table>
<thead>
<tr>
<th></th>
<th>Gal. Per Hour</th>
<th>Hours Used Per Day</th>
<th>Annual Water Costs*</th>
<th>Annual Waste Water Costs*</th>
<th>Annual Water Heating Costs*</th>
<th>Combined Annual Operating Costs</th>
<th>Annual Savings New Washer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Old washer</strong></td>
<td>500</td>
<td>8</td>
<td>$3,835</td>
<td>$5,750</td>
<td>$15,360</td>
<td>$24,945</td>
<td></td>
</tr>
<tr>
<td><strong>New washer</strong></td>
<td>214</td>
<td>8</td>
<td>$1,620</td>
<td>$2,425</td>
<td>$6,475</td>
<td>$10,520</td>
<td><strong>$14,425</strong></td>
</tr>
</tbody>
</table>

* Water, waste water, and agency fee costs of $5.00 per unit, $1.20/ therm

**5 year payback**

**Flight-type Dish Machine**
Commercial Combination Ovens

- **Annual Electric Savings – $2,300**
  - 4.2 kW, 18,000 kWh per year
- **Annual Gas Savings – $400**
  - 403 Therms per year
  - 30,000-50,000 gallons per year
- **Annual Water savings - $600**

**Costs**
- Qualifying Combination Oven Cost = $15,000
- Incremental Cost = $8,000

**Payback**
- 2.4 Years
Hidden Costs ???

Dip Well

- Water Cost = $210/yr
- Sewer Cost = $315/yr
- Energy Cost = $830/yr
- Grand Total = $1,355/yr

0.15 gpm $1.20/therm, $5.00/unit of water & sewer, 24h, 360 d/y, 140°F water
Hidden Costs ???

Evaporative Cooling

💧 Cooler’s sump overflowing into the drain line

💧 9 of 16 coolers overflowing

💧 Measured flow = 92,000 gal/yr

💧 Un-necessary $5,500 expense
WaterSmart Development Guidebook

- A reference document on CII water-use efficiency
- Applies 15+ water use technologies
- Covers 20+ different business types
  - Description of end uses
  - Water savings hardware and processes
  - Cost-benefit analyses
  - Hardware and customer profiles
  - Permit process
  - Marketing plan
  - Appendices
# Matrix of Operations

## Type of Business (20)
- Offices
- Schools
- Restaurants
- Retail
- Hotel/Motel
- Grocery
- Medical facilities
- Laboratories
- Laundries
- Manufacturing
- Vehicle washing
- Bakeries
- Automotive
- Printing

## Water Using Technology (15)
- Plumbing fixtures
- Landscaping
- Pools, spas & fountains
- Water treatment
- Alternate water sources
- Thermodynamic processes
- Food service
- Wash down & sanitation
- Laundry
- Submetering
- Process water
- Photo & film processing
- Medical & laboratory
- Vehicle wash
## Commercial Water Treatment Examples

<table>
<thead>
<tr>
<th>COMMERCIAL OPERATION</th>
<th>Sediment Filtration</th>
<th>Carbon Filtration</th>
<th>Softening &amp; Ion Exchange</th>
<th>Membrane Processes</th>
<th>Distillation</th>
<th>Disinfection</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Food Service</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>All Laundry &amp; Dry Cleaning</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals &amp; Laboratories</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Car Washes</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beverage Manufacturers</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Metal Plating</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Cooling Towers &amp; Boilers</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Pools, Spas, &amp; Water Features</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Offices and non process</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

- $0.8M seed funding from Ca. DWR and water utilities
- Select/shortlist candidate products
- Establish test procedures
- Develop directory/independent testing of certified ratings
- Develop performance specifications and labeling
- Evaluate standards and codes applications
- Establish voluntary incentive programs, clearinghouse entity

(e.g. WaterSense; Energy Star; California Urban Water Conservation Council; Alliance for Water Efficiency; CEE; etc.)
Food Service Water and Energy Efficiency
One Stop Pilot Study

- 3-year $0.8M study (2008-2010)
- EBMUD and PG&E partnership
- CPUC and CA DWR co-sponsors
- Bakeries, beverage manufacturing, packaging
- “no-cost”, “low-cost” and “investment-grade” recommendations and incentives
- Outreach/market transformation thru local green building and community-based programs
- Report on water, wastewater, energy and greenhouse gas savings
Looking Forward

Commercial WaterSmart Loan Program

- Convenient
- No up front payment for installation
- No need for source funding
- Make payments in lieu of savings from reduced water usage
- Optional payment methods

![Graph showing water usage and savings over time with payment by savings amount and 20% post-implementation savings shown.]

0 2,000 4,000 6,000 8,000 10,000
1 2 3 4 5 6

Agreed Avg. Payment by savings amount 20% post-implementation savings

Water Usage Water Savings
Looking Forward

Life-Cycle Cost/Benefit

- Interactive (present value) models

- Assist businesses in calculating the benefit of investment in water efficient equipment

- Water, sewer, and energy costs need to be considered in the model

Figure: Cooling Tower Water Requirements
Specify Water Efficient Models

Low-Flow Pre-rinse Spray Valves

A low-flow pre-rinse spray valve is one of the easiest and most cost effective energy saving devices available to the foodservice operator.

In addition to minimizing water consumption, water heating energy and sewer charges are also reduced. Replacing a typical spray valve that flows up to three gallons of water per minute (gpm) with a low-flow unit can yield the following results:

<table>
<thead>
<tr>
<th>Hours of Spray Valve Usage</th>
<th>Water Savings gallons/day</th>
<th>Waste Water Savings gallons/day</th>
<th>Gas Savings therms/day</th>
<th>Annual Dollar Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour/day</td>
<td>60 gallons</td>
<td>60 gallons</td>
<td>0.5 therms</td>
<td>$400 - $450</td>
</tr>
<tr>
<td>2 hours/day</td>
<td>120 gallons</td>
<td>120 gallons</td>
<td>1.0 therms</td>
<td>$800 - $900</td>
</tr>
<tr>
<td>3 hours/day</td>
<td>180 gallons</td>
<td>180 gallons</td>
<td>1.5 therms</td>
<td>$1200 - $1350</td>
</tr>
</tbody>
</table>

Table shows results based on spray valve water savings of 1 gallon per minute, water cost of $2.00 per unit (748 gallons), sewer cost of $3.00 per unit (748 gallons), and gas cost of $1.00 per therm.

The FSTC recommends a pre-rinse spray valve with a flow rate of 1.6 gallons per minute or less, and with a cleanliness performance of 26 seconds per plate or less, based on the ASTM Standard Test Method for Performance of Pre-Rinse Spray Valves.

The following pre-rinse spray valves have been verified by the FSTC to meet this criteria:
(Click any model for the test summary)

- Encore KN50-Y002-12
- Fisher Ultra-Spray 2949
- Niagara N2180
- Strahman Kwik-Clean II
- T&S B-0107
- T&S B.0107.C
Looking Forward

Interactive web tools

- Account histories
- Performance criteria
- Water, energy and cost savings
Looking Forward

California Energy Commission/DWR/PIER
Energy and Water Study

Source

Water Supply & Conveyance

Water Treatment

Water Distribution

Recycled Water Treatment

Recycled Water Distribution

End-use Agricultural Residential Commercial Industrial

Wastewater Discharge

Wastewater Treatment

Wastewater Collection
Water-Energy Partners Workgroup

- Voluntary venue for dialogue

Catalysts

- CEC Water-Energy Task Force
- NRDC “Energy Down the Drain” Report

First Ad-Hoc workgroup meeting – July 2006

- 5 meetings to date
- 1 public workshop – October 2006

Membership = water and energy utilities, regulators, non-profits, public interest groups, research and academia, etc.
CPUC Commissioner Gruenich Ruling

- Announced on October 16, 2006
- Energy IOUs to partner with water utilities
  - 12 month pilot study
  - $10 million statewide cost
  - No energy efficiency credits in 2006-08 program
  - EM&V key to inform 2009-11 energy efficiency portfolio
  - Proposals due Jan. 15, 2008
  - Pilot projects to start July 1, 2008
Some Energy Savings Questions

- Simplistic cost/benefit model
- Statewide vs. regional vs. sub-regional avg.
- Size of market potential
- Interregional benefits transfer
- General marketing
- Total budget
- What benefits/additions from joint programs
  - energy, water, wastewater, recycled, etc.
WEP Opportunity Matrix

- Lessons and Linkages (illuminate)
- Baseline information
- Calculating embedded energy, cost, value
- Where does energy comes from (source, facility)
- Existing funding (partners, cost estimates)
- Co-funding options (partners, grants, other)
- Regional differences (north-south, urban-ag, etc.)
WEP Opportunity Matrix (cont.)

How large is potential market?
- Transformation
- Physical scale
- Efficiency, recharge, recycled, water management

Diversity and differences
- Customer
- Technology
- Project
- regional
WEP Opportunity Matrix

Multiple benefits/partners
- Resource
- Funding
- Environmental
- Green house gases

Evaluation, Monitoring & Verification
- Methodologies
- Estimated savings (energy + water)
- Geographic implications
## WEP Pilot Program Concepts

<table>
<thead>
<tr>
<th>PG&amp;E</th>
<th>Edison</th>
<th>SCG</th>
<th>SDG&amp;E</th>
</tr>
</thead>
</table>
| • CII target  
• Schools/landscaping  
• Manufacturing (processes, food processing)  
• Wastewater  
• Measurement is key  
• Identify where energy originates from  
• In discussions w/SCWA EBMUD SCVWD, | • 6-8 ideas  
• Low-income direct install (MWD)  
• Educational outreach (Alliance to Save Energy)  
• Industrial  
• Large landscape (golf course retrofit)  
• no competitive solicitation  
• ramp-up exist water programs | • Low-income MF residential  
• Marketing  
• 80/20 split implementation vs. EM&V  
• $10.8M | • HETs  
• Recycled water  
• Large landscapes  
• Large CII audits  
• General marketing (acct. execs, smaller utilities)  
• $14M |
**Potential WEP Sub-Workgroups**

<table>
<thead>
<tr>
<th>Regional Focus</th>
<th>Technical Focus</th>
<th>Policy Focus</th>
<th>Workshops/Outreach</th>
</tr>
</thead>
</table>
| • Source(s) of marginal supply | • Measurement methodologies (water + energy savings)  
- Pilot partners  
- Matrix  
- Uniform terminology  
- Data collection standards  
- Portfolio diversity  
- Emerging technologies  
- Quantifying end use opportunities | • Water-Energy Partners (WEP)  
- EM&V (methodology, metrics, responsible parties, funding) | • Facilitation – different focus groups + engage additional key stakeholders  
- Report writing (consensus docs)  
- Non-pilot opportunities |
Looking Forward - Resource Partners

Green Building in Alameda County

Conventional building and remodeling practices use a lot of natural resources and create a lot of waste. In fact, debris from building construction and demolition accounts for more than 21% of the materials disposed in Alameda County landfills.

To reduce this waste, the Green Building in Alameda County Program provides residents, construction industry professionals and public agencies with a wide range of green building resources and services.

What is green building? In a nutshell, green building means taking steps to create buildings that are safe and healthy for people and that protect our environment. While specific methods and products may vary from project to project, the basic principles of green building apply to all types of new construction and renovation, from remodeling a kitchen to constructing a courthouse.
Looking Forward - Retail Partnerships

High Efficiency Plumbing Offer

East Bay WaterSmart™ Toilet Rebate Program

EBMUD customers can receive rebates for the purchases of qualifying WATERSMART™ toilets. Rebate amounts are up to $100 for an approved High-Efficiency Toilet (HET) or up to $25 for an approved Ultra-Low-Flush Toilet (ULFT).

- Customer purchases and installs the WaterSmart™ toilet.
- Replacement toilet must be on the current EBMUD approved list of qualifying toilets on the date of toilet purchase.
  - For a current EBMUD approved list, visit abmud.com or call 1-866-403-2683.
- Approved toilet must be installed within the EBMUD service area and must replace toilets designed to use more than 1.6 gpf.
- Customer mails in the application (including account number) with original receipt to EBMUD. The application must be postmarked within 90 days of the purchase.
- Sites may be subject to inspection by the Water Conservation staff.

Click here to get details including application and eligibility rules.

Find this and other qualifying toilets at our Everyday Low Prices at your local Lowe's.
Questions?

Richard Harris
Water Conservation Manager
rharris@ebmud.com
(510) 287-1675