



East Bay Municipal Utility District

Turning up the Heat on Commercial Kitchen Water Savings

USEPA Energy-Water Workshop

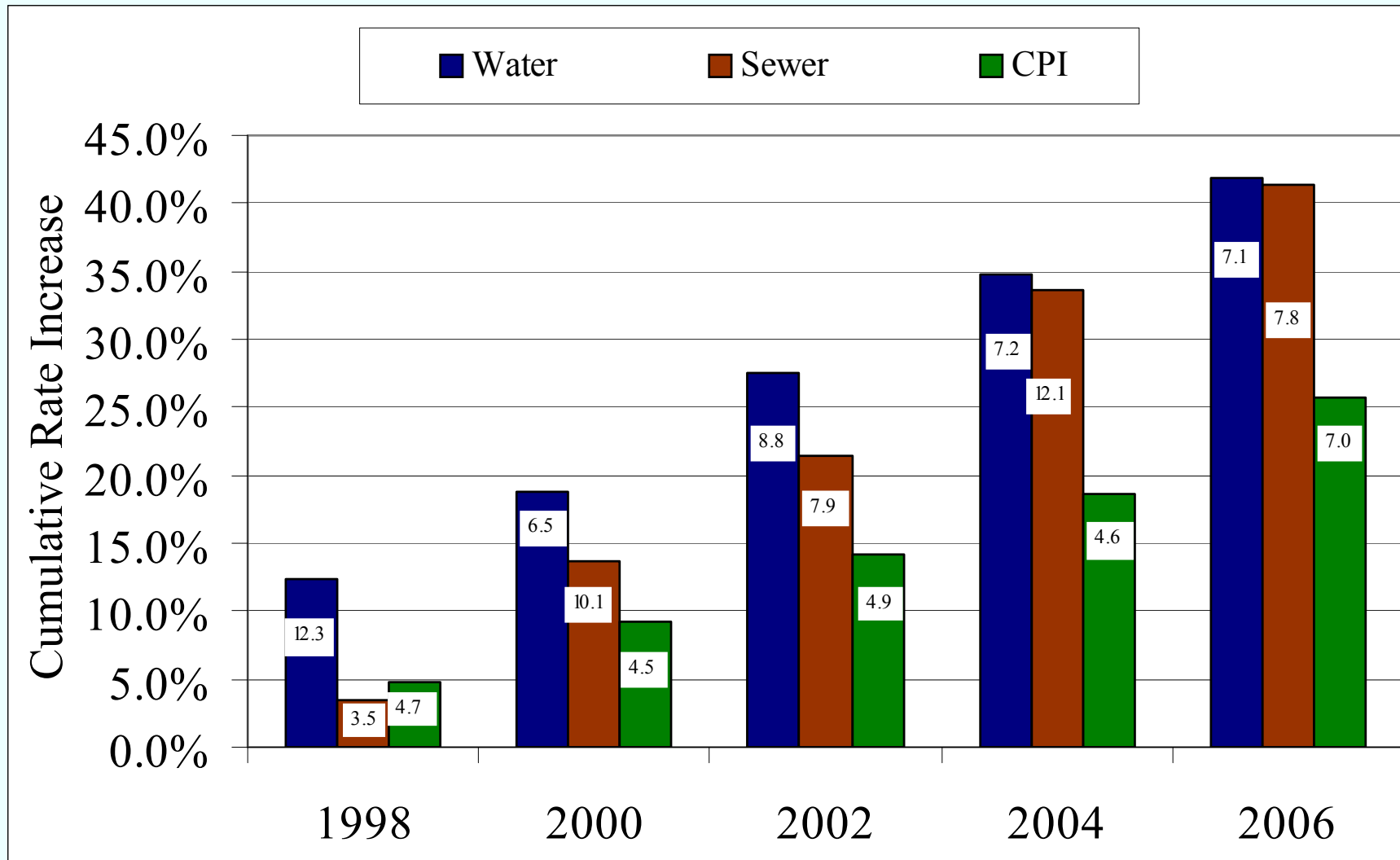
March 5, 2008

Richard Harris

Manager of Water Conservation



U.S. Water and Sewer Rate Increases



Source: AWWA/Raftelis Financial Consultants, Inc.

Overview

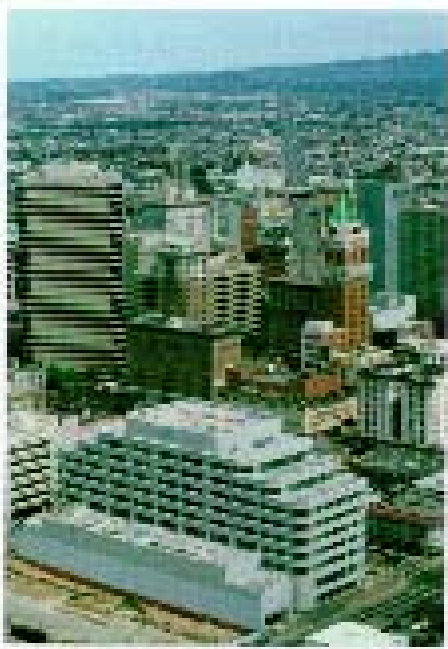
💧 EBMUD Commercial Food Service Programs

- Water conservation services
- Water savings
- Incentives

💧 Research and development

- Conservation partners
- Lessons learned, challenges and barriers
- Looking forward

Partners With Business and Industry



WATER CONSERVATION REBATES FOR BUSINESS & INDUSTRY

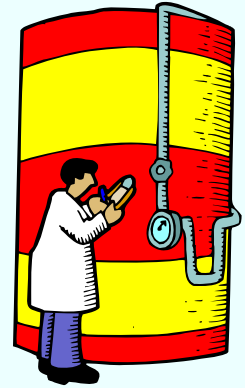
East Bay Municipal Utility District
Water Conservation Division
P.O. Box 24055, MS 48
Oakland, CA 94623



- 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

Dish Room	Food Prep	Roof Top & Outside	Refrigeration	Dining Room
Dish washers Glass washers Pot washers Pre-rinse nozzles Conveyor spray Manual wash down Disposals systems	Steamers Combination ovens Pasta cookers Steam tables Sinks: defrosting Sinks: food washing	Evaporative-cooling Cooling towers ----- Landscaping Cleaning	Water-cooled-condensing Ice machines	Table water Bathroom: Hand washing Toilets Urinals

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

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

Volume-Related Cost for Sewered Water (Oakland)

Component	Rate per CCF	
Flow	\$1.83	\$2.35
Wastewater Treatment	\$0.46	\$6.37
Sewer	\$0.71	\$0.96
Total	\$3.00	\$9.68

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



**Water –
Conserving
Fixture**

**Percent of Market in Each Sector
Surveyed**

Warehouses

Retail

Food Sales

Fast Food

Restaurants

Offices

ULFTs

32

45

47

68

44

50

Urinals

22

6

24

22

23

24

Aerators

72

66

61

60

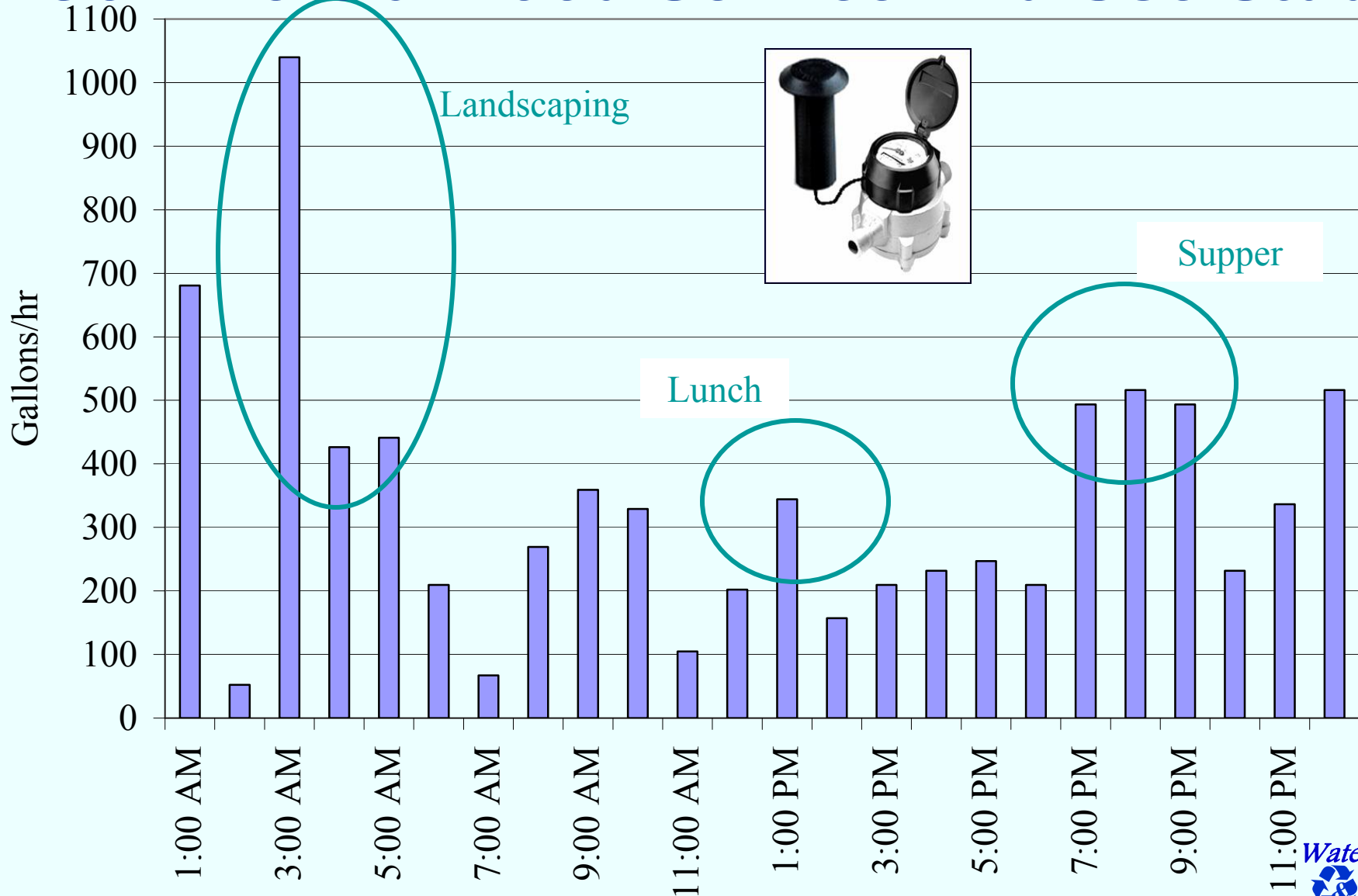
58

78



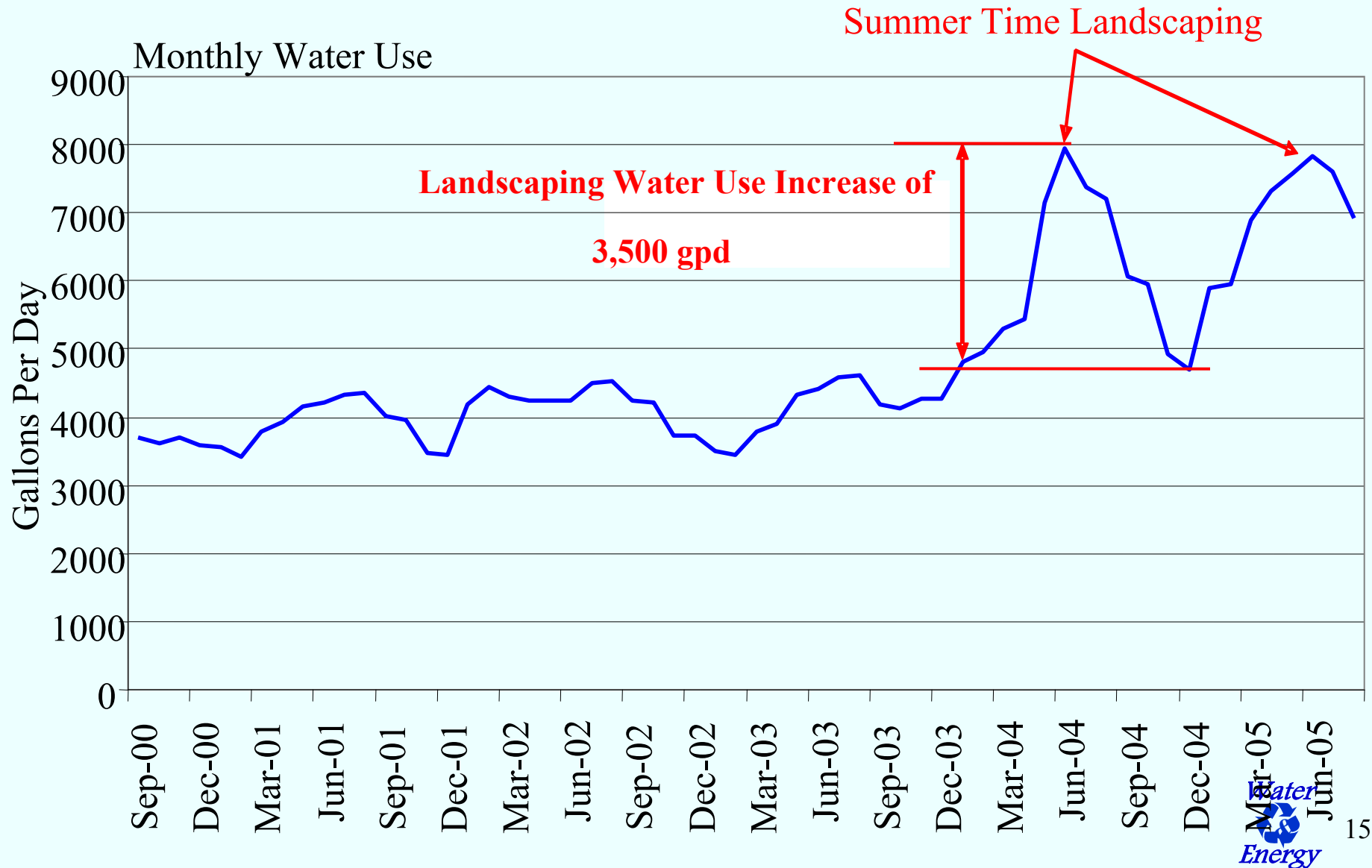
Water
Energy

Commercial Food Service End Use Study



8100 gpd; the landscaping accounts for 25% of the total water use (2000 gpd)

Monitoring the Landscaping



Steamer Field Study Cost Comparison



Steamer Type	Boilerless Steamer (single compartments)	Boiler-Based Steamer (single compartments)
Annual Energy	\$912	\$4,822
Annual Water	\$33	\$979
Total Costs	\$945	\$5,801
Savings	\$4,856	

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



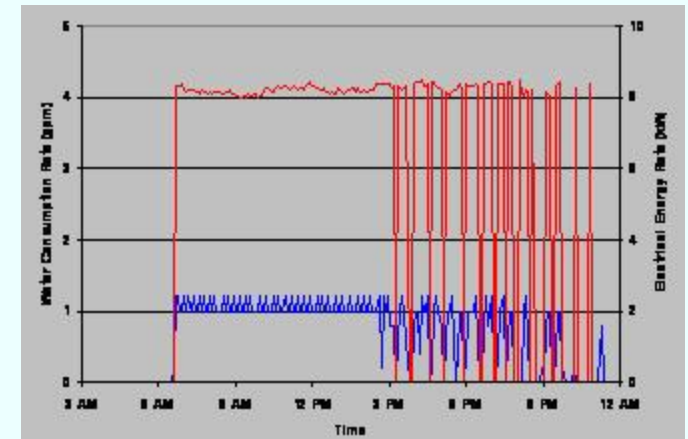
**Boiler Based Steamer (Not ENERGY STAR)
Average Water Usage = 40 gph**

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

AM: \$4540 / year

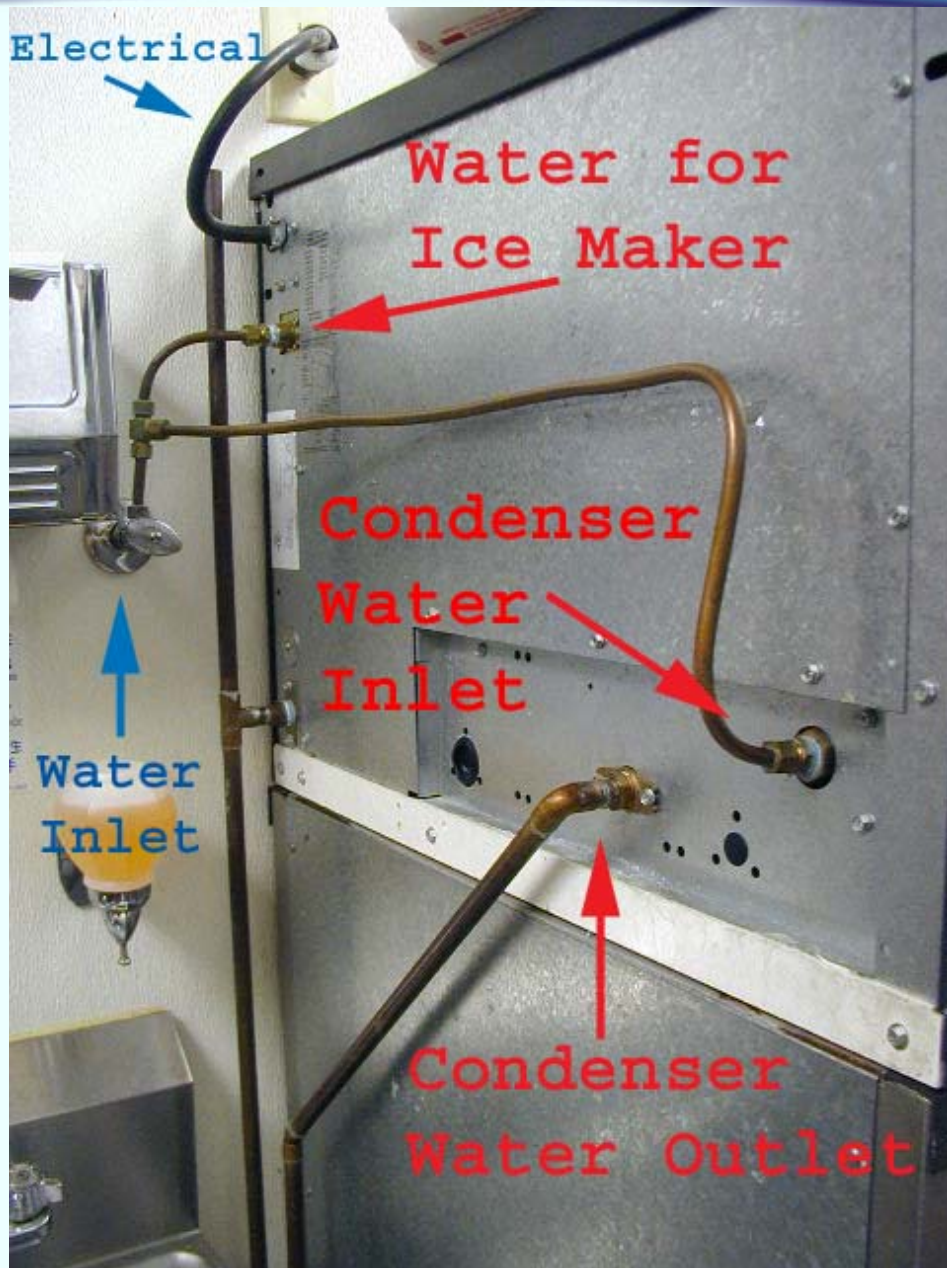
PM: \$2005 / year

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

Ice Machines

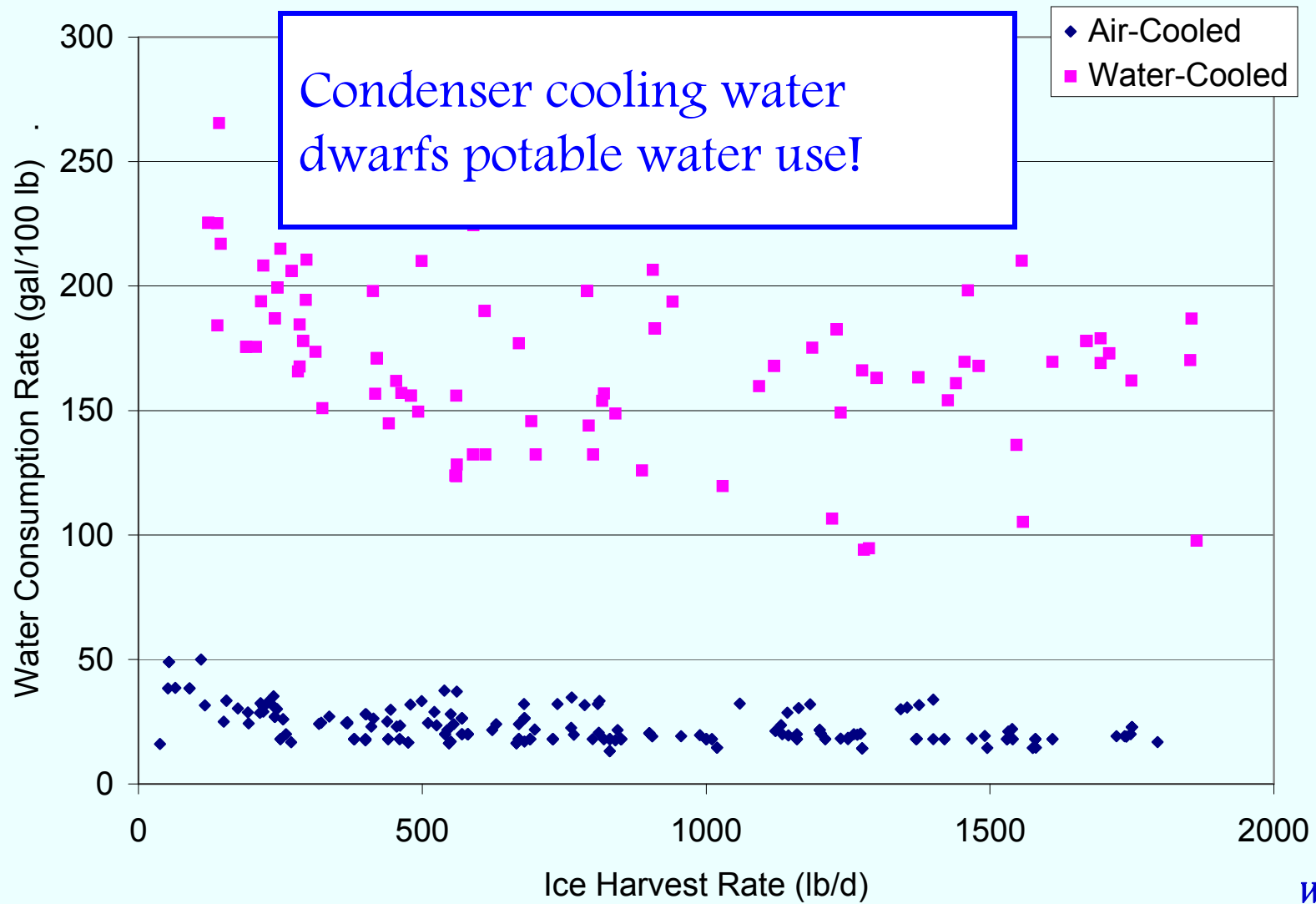
- Ice machines harvest ice at a rate ranging from 100-lb/24 hrs to 1800 lb/24 hr
- They represent about 10% of the overall commercial refrigeration energy



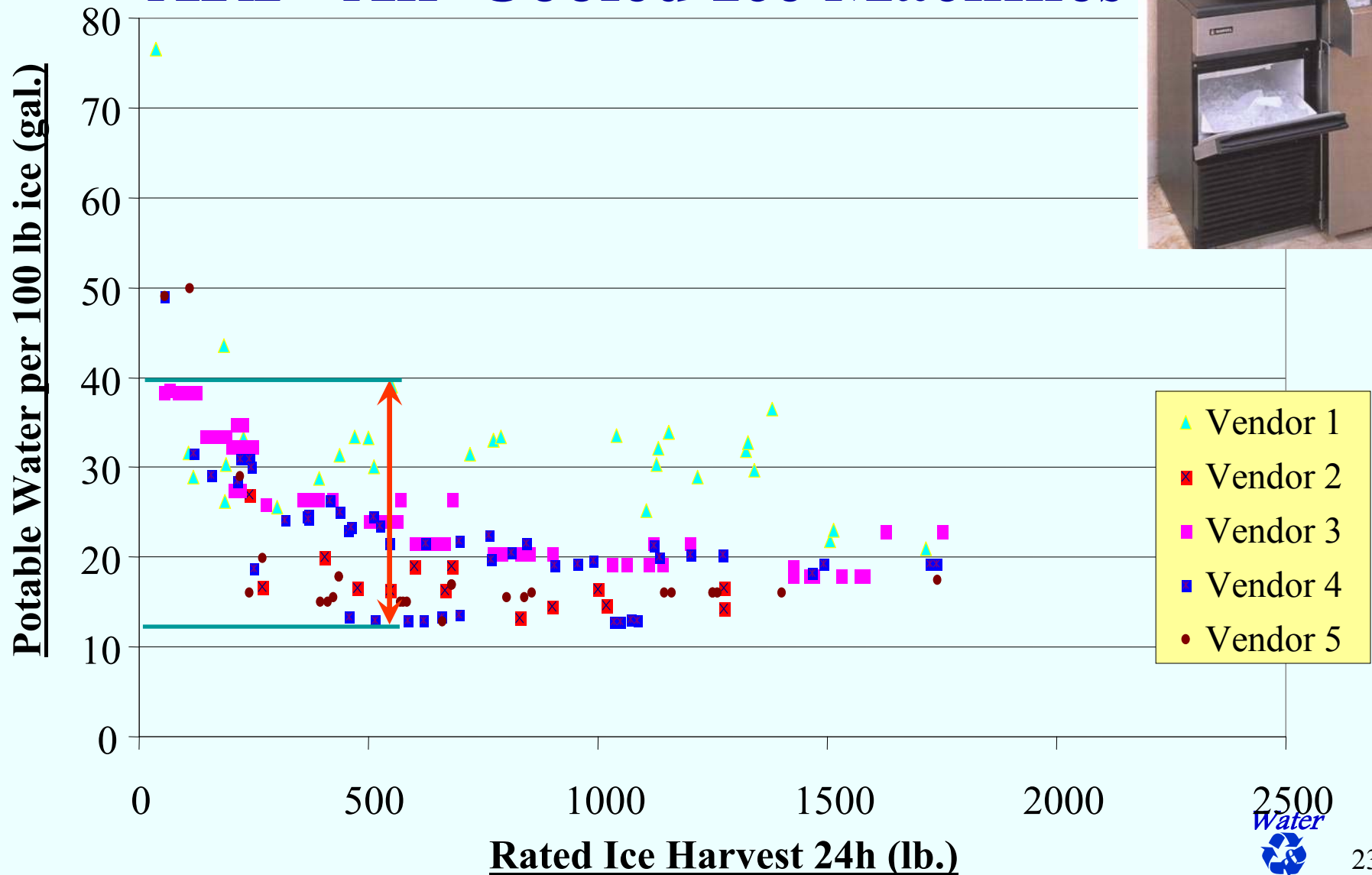


Air or Water Cooled?

ARI Database



ARI - Air-Cooled Ice Machines



Source: Food Service Technology Center

Economics of open loop water-cooled ice machines not attractive!

Performance	Standard	Standard	Energy (& Water) Efficient
	Water-Cooled Model	Air-Cooled Model	Air-Cooled Model
Energy Consumption	6	7.6	5.6
Water Consumption (gal/100)	156	28	20
Annual Energy Use (kWh) ^a	9855	12483	9198
Annual Water Use (gal) ^a	256230	45990	32850
Annual Energy Cost ^b	\$986	\$1,248	\$920
Annual Water & Sewer Cost ^c	\$1,713	\$307	\$220
Total Annual Utility Cost	\$2,699	\$1,555	\$1,140

^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

	Gal. Per Hour	Hours Used Per Day	Annual Water Costs*	Annual Waste Water Costs*	Annual Water Heating Costs*	Combined Annual Operating Costs	Annual Savings New Washer
Old washer	500	8	\$3,835	\$5,750	\$15,360	\$24,945	
New washer	214	8	\$1,620	\$2,425	\$6,475	\$10,520	\$14,425

5 year payback



Flight-type Dish Machine

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

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

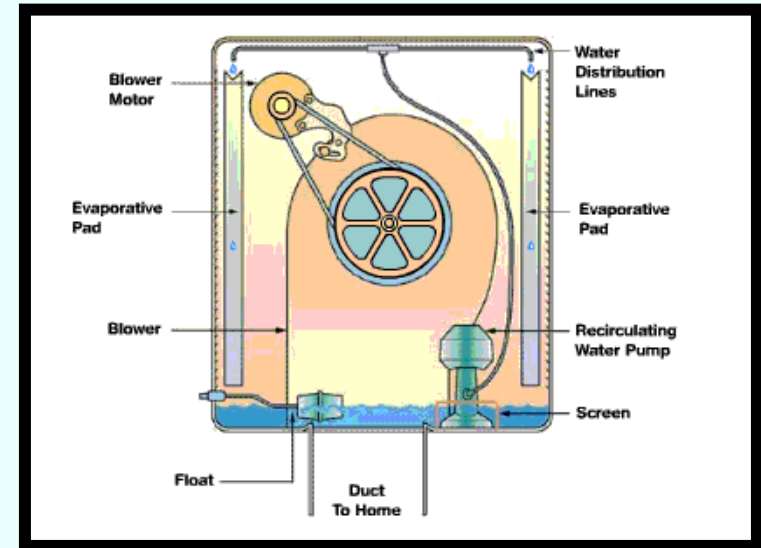
- 💧 Water Cost = \$210/yr
- 💧 Sewer Cost = \$315/yr
- 💧 Energy Cost = \$830/yr
- 💧 Grand Total = \$1,355/yr

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



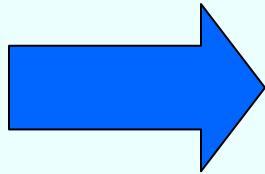
WaterSmart Development Guidebook

- 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

COMMERCIAL OPERATION	Treatment Process						
	Sediment Filtration	Carbon Filtration	Softening & Ion Exchange	Membrane Processes	Distillation	Disinfection	Other
All Food Service	X	X	X	X			X
All Laundry & Dry Cleaning	X		X				
Hospitals & Laboratories	X	X	X	X	X	X	X
Car Washes	X		X	X			
Beverage Manufacturers	X	X	X	X		X	
Metal Plating	X	X	X	X			X
Cooling Towers & Boilers	X		X	X		X	X
Pools, Spas, & Water Features	X					X	
Offices and non process	X	X	X			X	X

California Water Efficient Product Rating and Labeling Initiative (2008-2010)

- 💧 \$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.*)

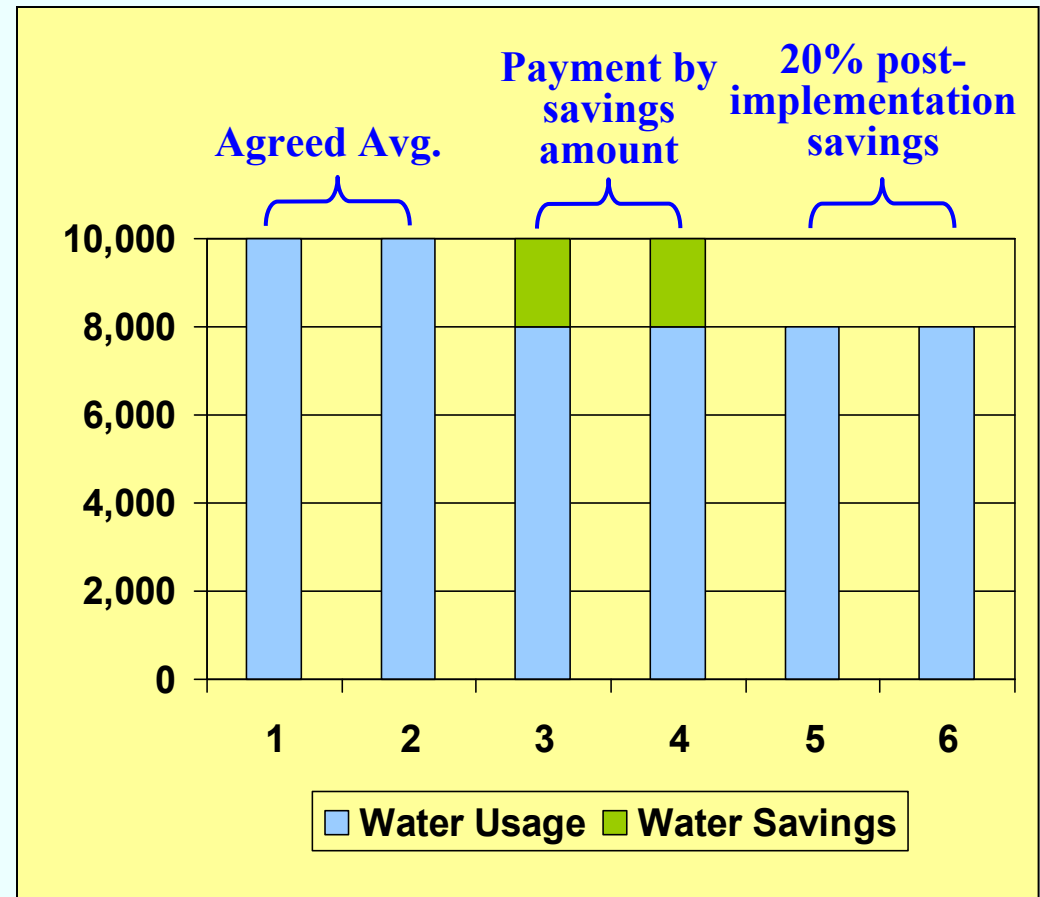
Food Service Water and Energy Efficiency One Stop Pilot Study

- 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

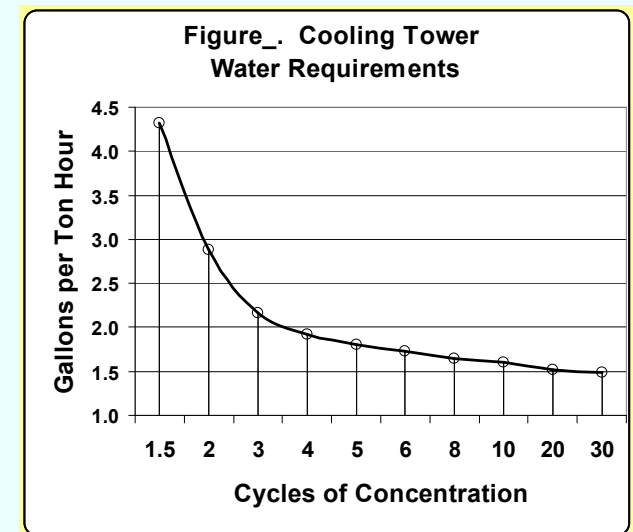
- 💧 Convenient
- 💧 No up front payment for installation
- 💧 No need for source funding
- 💧 Make payments in lieu of savings from reduced water usage
- 💧 Optional payment methods



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



Specify Water Efficient Models



Online Toolbox

Food Service
Technology
Center

- About Us**
 - Overview
 - Test Lab
- Appliances**
 - Types
 - Test Methods
 - Performance
 - Testing
- Education**
 - Seminars
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 - ENERGY STAR®
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 - Ventilation Lab
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 - Outdoor Air
 - Load Calculator
 - Pre-Rinse Spray
 - Valve Calculator
 - Life-Cycle &
 - Energy Cost
 - Calculators
- Contact**
 - People
 - Directions
 - Lodging
- Links**
 - Industry
 - General
 - Advisory Group
- Search Site:**

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:

Hours of Spray Valve Usage	Water Savings gallons/day	Waste Water Savings gallons/day	Gas Savings therms/day	Annual Dollar Savings
1 hour/day	60 gallons	60 gallons	0.5 therms	\$400 - \$450
2 hours/day	120 gallons	120 gallons	1.0 therms	\$800 - \$900
3 hours/day	180 gallons	180 gallons	1.5 therms	\$1200 - \$1350

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 \$1.60 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 cleanability 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

} Test Data

Looking Forward

Interactive web tools

- 💧 Account histories
- 💧 Performance criteria
- 💧 Water, energy and cost savings

Food Service Technology Center

Promoting Energy Efficiency in Commercial Food Service

January 29, 2007

About Us
Overview
Test Lab

Appliances
Types
Test Methods
Performance
Testing

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Presentations

Save Energy
ENERGY STAR®
Rebates
Energy Tips
Spray Valves
ESMP
Site Surveys

Publications
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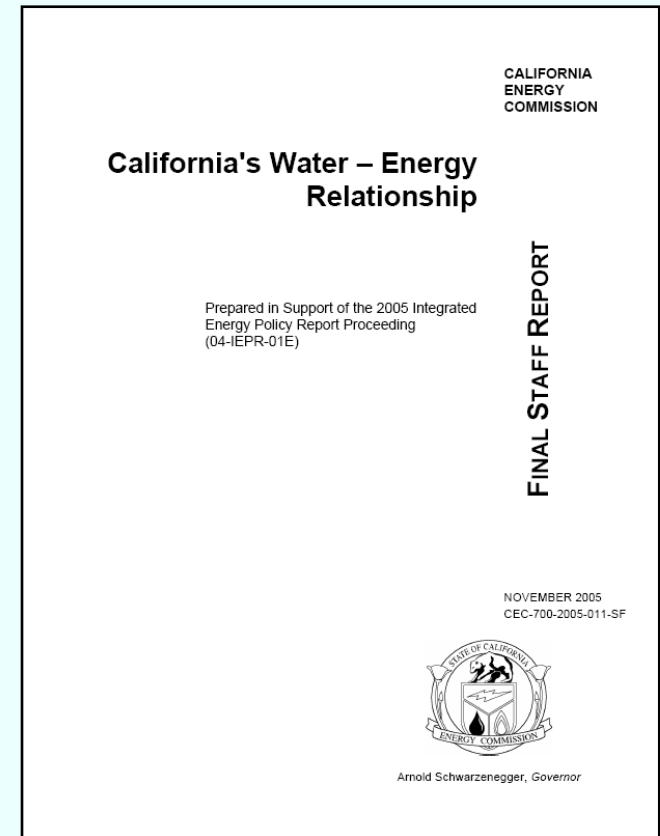
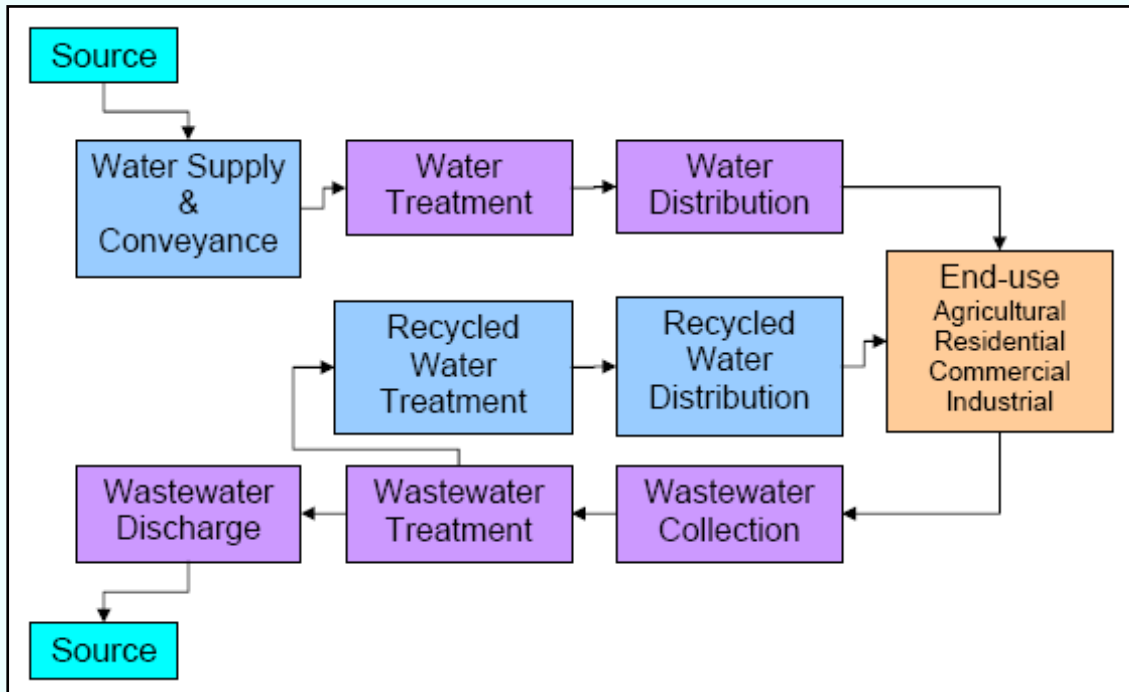
Ice Machine Life-Cycle Cost Calculator

[About this calculator]

User Inputs		
Ice Machine Performance (Based on ARI Standard 680. Click here for the ARI Ice Machine Database)		
Condenser Type	<input checked="" type="radio"/> Air Cooled <input type="radio"/> Water Cooled	[Default] [Help]
Ice Harvest Rate	<input type="text" value="600.0"/> lbs/d	[Default] [Help]
Energy Consumption	<input type="text" value="6.4"/> kWh/100lb	[Default] [Help]
Potable Water Consumption	<input type="text" value="24.0"/> gal/100lbs	[Default] [Help]
Condenser Cooling Water Consumption	<input type="text" value="150.0"/> gal/100lbs	[Default] [Help]
Ice Machine Usage		
Pounds of Ice Made per Day	<input type="text" value="450.0"/> lbs/day	[Default] [Help]
Operating Days per Year	<input type="text" value="305"/> d/year	[Default] [Help]
Utility Cost and Lifespan		
Electric Cost per kWh	<input type="text" value="0.100"/> \$/kWh	[Default] [Help]
Electric Demand Charge per kW	<input type="text" value="0.00"/> \$/kW	[Default] [Help]
Water/Sewer Cost per CCF (100 ft ³)	<input type="text" value="5.00"/> \$/CCF	[Default] [Help]
Lifespan of Ice Maker in Years	<input type="text" value="10.0"/> years	[Default] [Help]
Discount Rate	<input type="text" value="3.10"/> %/year	[Default] [Help]
<input type="button" value="Calculate"/>		[Default All]
Results: Energy Cost		
Base	<input type="text" value=""/>	High

Looking Forward

California Energy Commission/ DWR/PIER Energy and Water Study



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

PG&E	Edison	SCG	SDG&E
<ul style="list-style-type: none"> •CII target •Schools/landscaping •Manufacturing (processes, food processing) •Wastewater •Measurement is key • Identify where energy originates from •In discussions w/SCWA EBMUD SCVWD, 	<ul style="list-style-type: none"> •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 	<ul style="list-style-type: none"> •Low-income MF residential •Marketing •80/20 split implementation vs. EM&V •\$10.8M 	<ul style="list-style-type: none"> •HETs •Recycled water •Large landscapes •Large CII audits •General marketing (acct. execs, smaller utilities) •\$14M

Potential WEP Sub-Workgroups

Regional Focus	Technical Focus	Policy Focus	Workshops/ Outreach
<ul style="list-style-type: none"> ● <i>Source(s) of marginal supply</i> 	<ul style="list-style-type: none"> ● <i>Measurement methodologies (water + energy savings)</i> ● Pilot partners ● Matrix ● Uniform terminology ● Data collection standards ● Portfolio diversity ● Emerging technologies ● Quantifying end use opportunities 	<ul style="list-style-type: none"> ● Water-Energy Partners (WEP) ● <i>EM&V (methodology, metrics, responsible parties, funding)</i> 	<ul style="list-style-type: none"> ● Facilitation – different focus groups + engage additional key stakeholders ● Report writing (consensus docs) ● Non-pilot opportunities

Looking Forward - Resource Partners

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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 landfill.

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



Find this and other qualifying toilets at our Everyday Low Prices at your local [Lowe's](#).

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 [ebmud.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.](#)

Questions?

Richard Harris

Water Conservation Manager

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