Saving Water to Save Energy

the Water-Energy Nexus

Speaker:
Paul W. Lander, PhD, ASLA, LEED AP
dakota ridge partners

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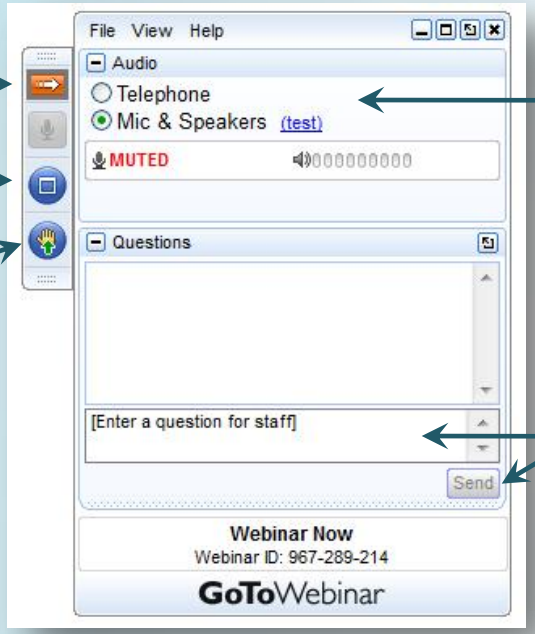

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Beth Tompkins
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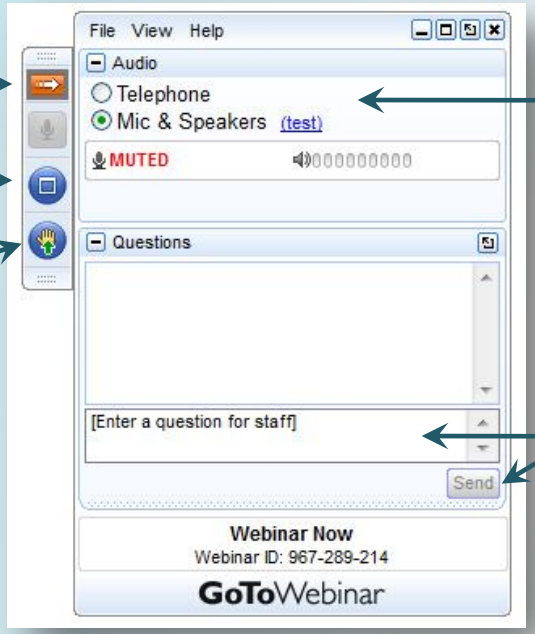

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Paul W. Lander, PhD, ASLA, LEED AP

dakota ridge partners

- Chair of the American Society of Landscape Architects Water Conservation Professional Network
- Chair of the Alliance for Water Efficiency Outreach and Education Committee
- Chair of the AWWA WaterWiser Committee
- Advisory board member of the Lane Community College, Oregon Water Conservation Technician Program

Saving Water to Save Energy

Water and Energy Efficiency- Links and Leads in the Nexus

- The Energy-Water Nexus – What is it?
- Where are the connections?
- Where are the opportunities?
- Next Steps
- Questions

A Quick Poll…


STANT'S
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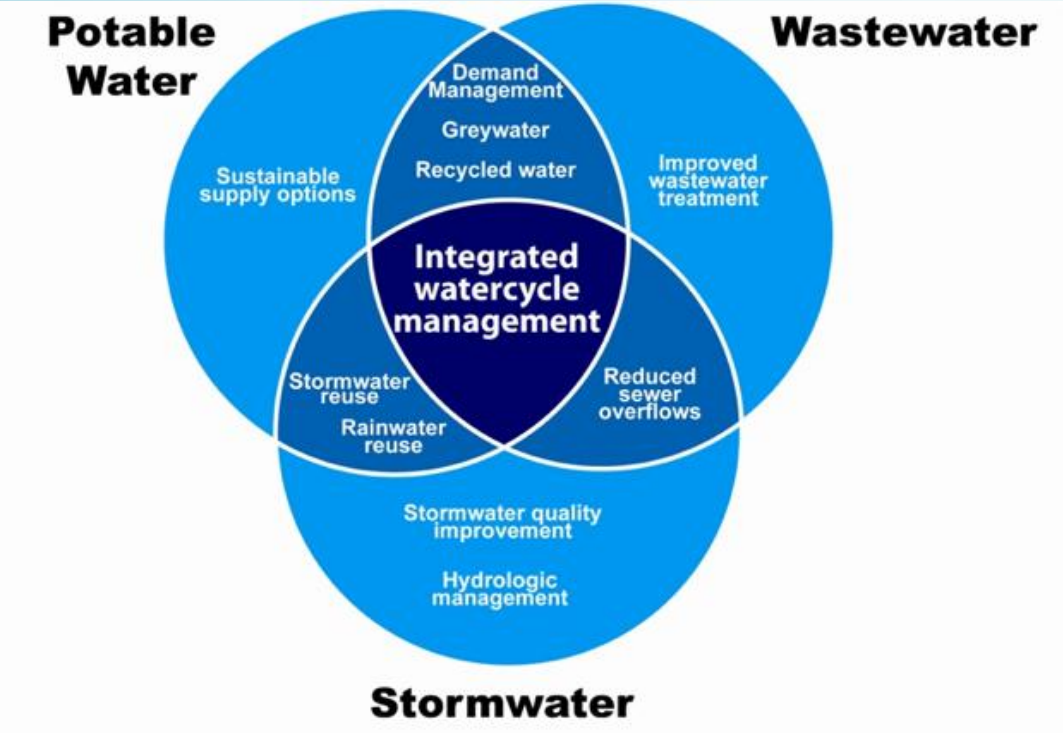
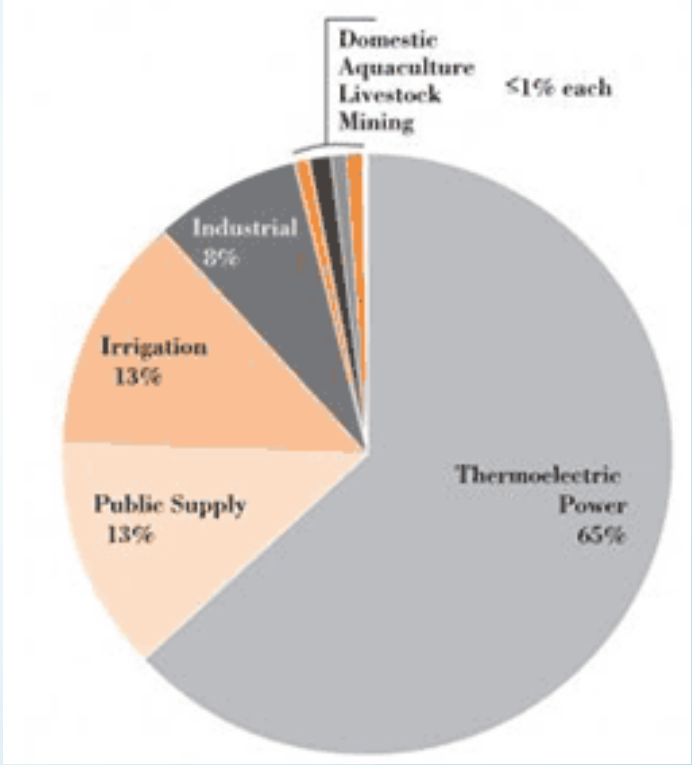
UH-
OH.....

What Is The Water-Energy Nexus? Where are the connections?

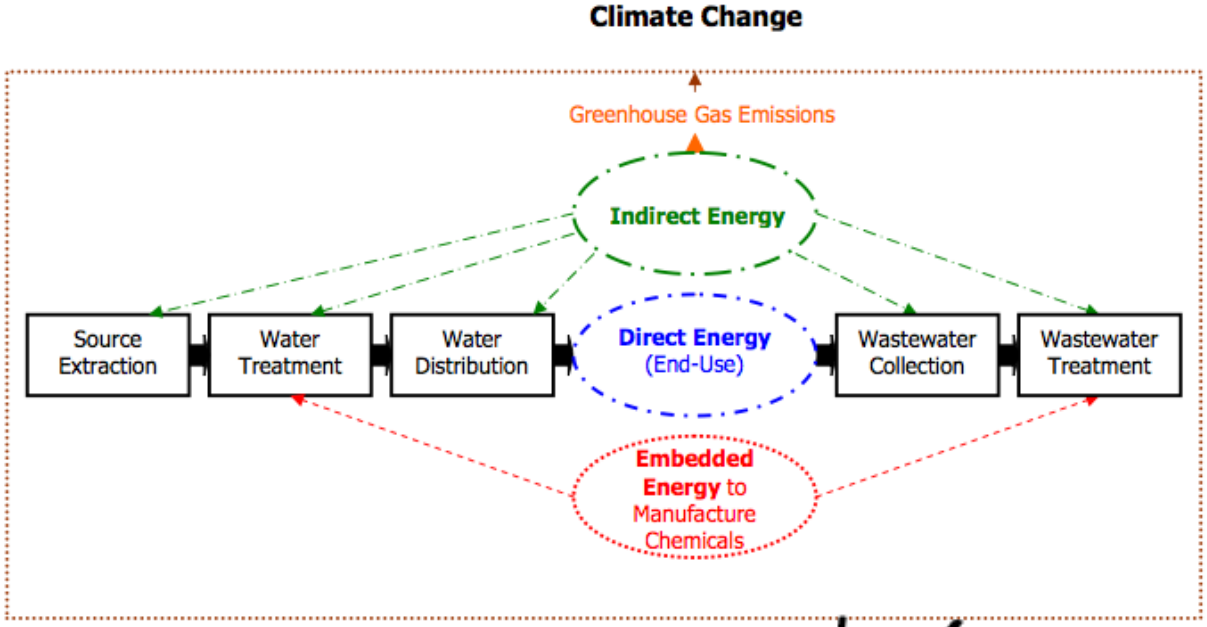


AUS National Water Commission



waterandwastewater.com, 2011

Figure 1. Components of the Urban Water Use Cycle, including Energy Inputs within the context of Climate Change

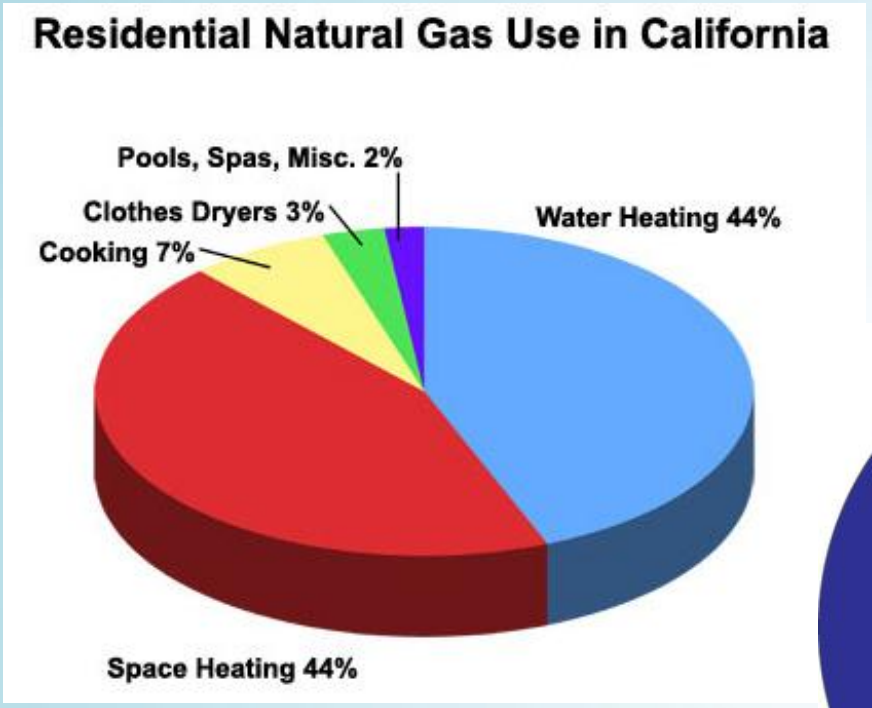


Source: Adapted from Cohen et al. (2004)

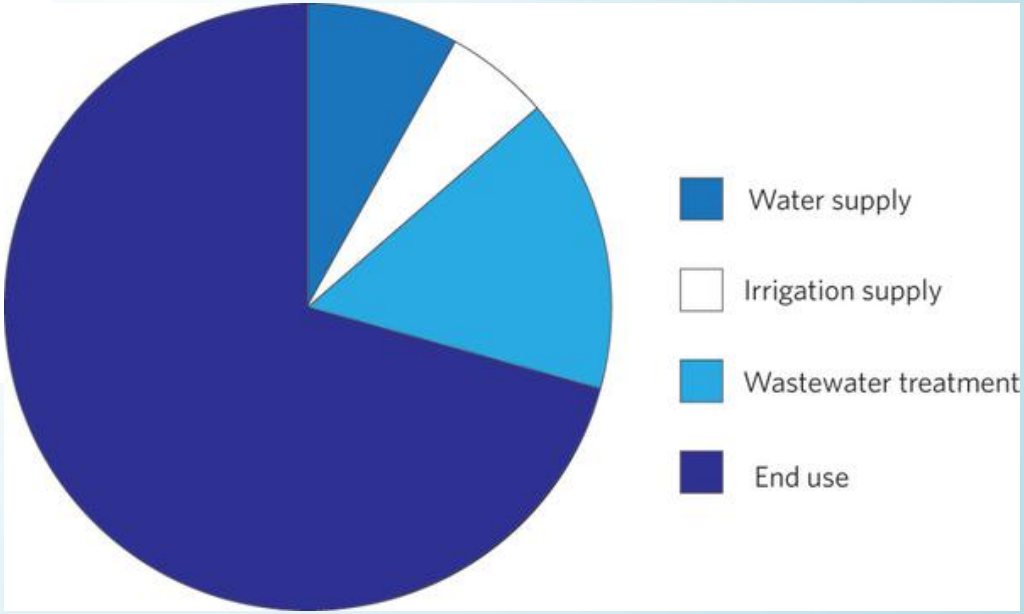
POLIS Project GrHouse Gases & WC 2009

fypower.org, 2011

Energy Used in Water Systems

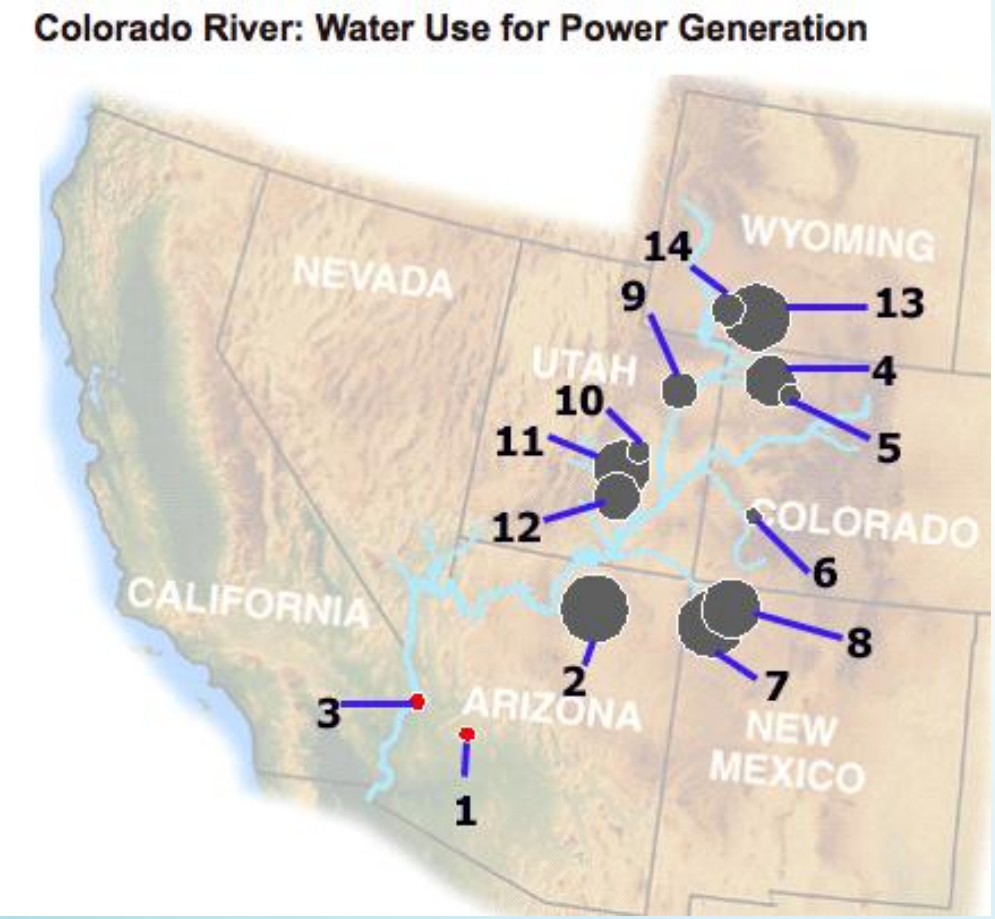


tanklesswaterheater.com, CA data, 2011

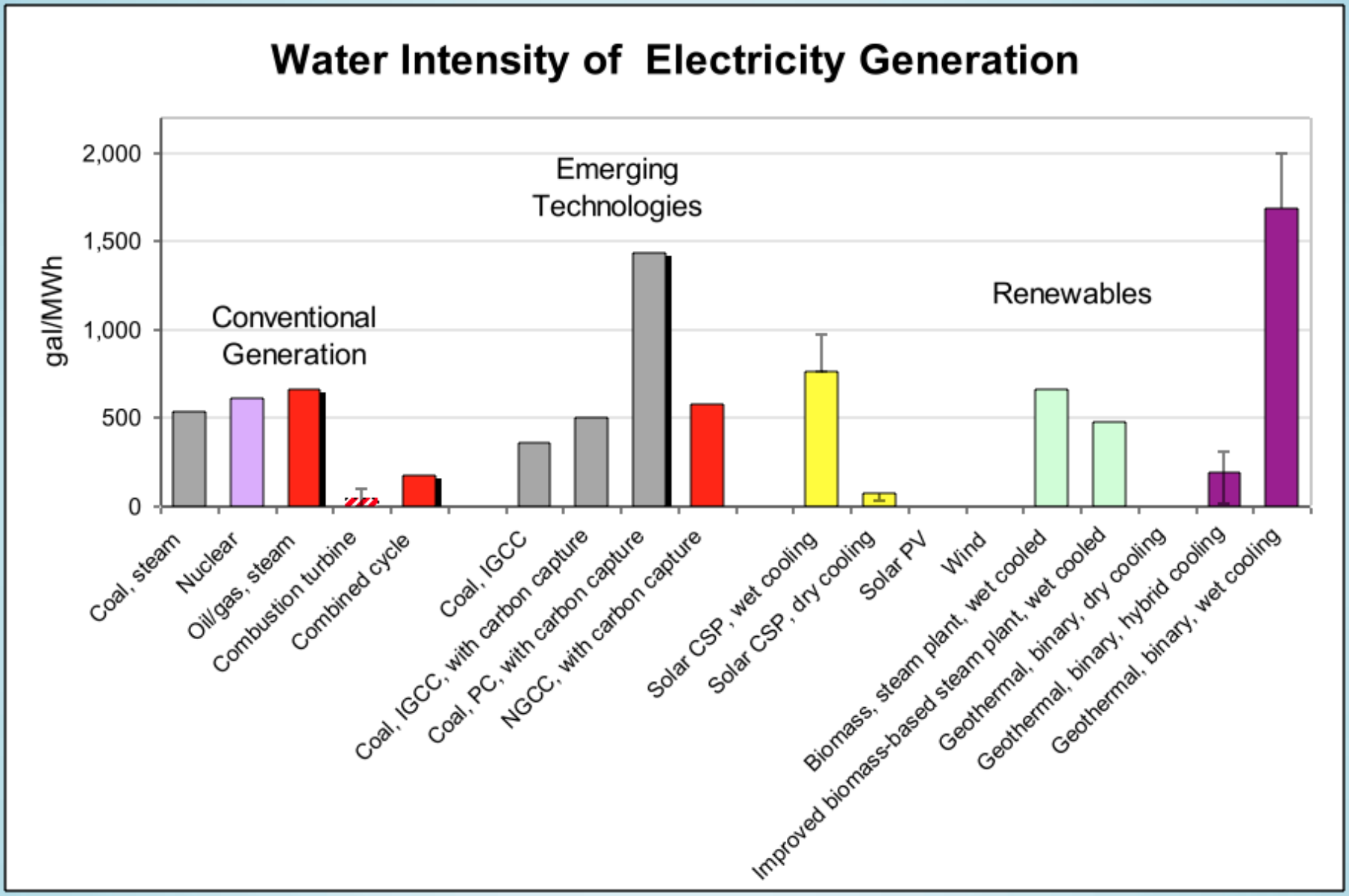


nature.com, 2011

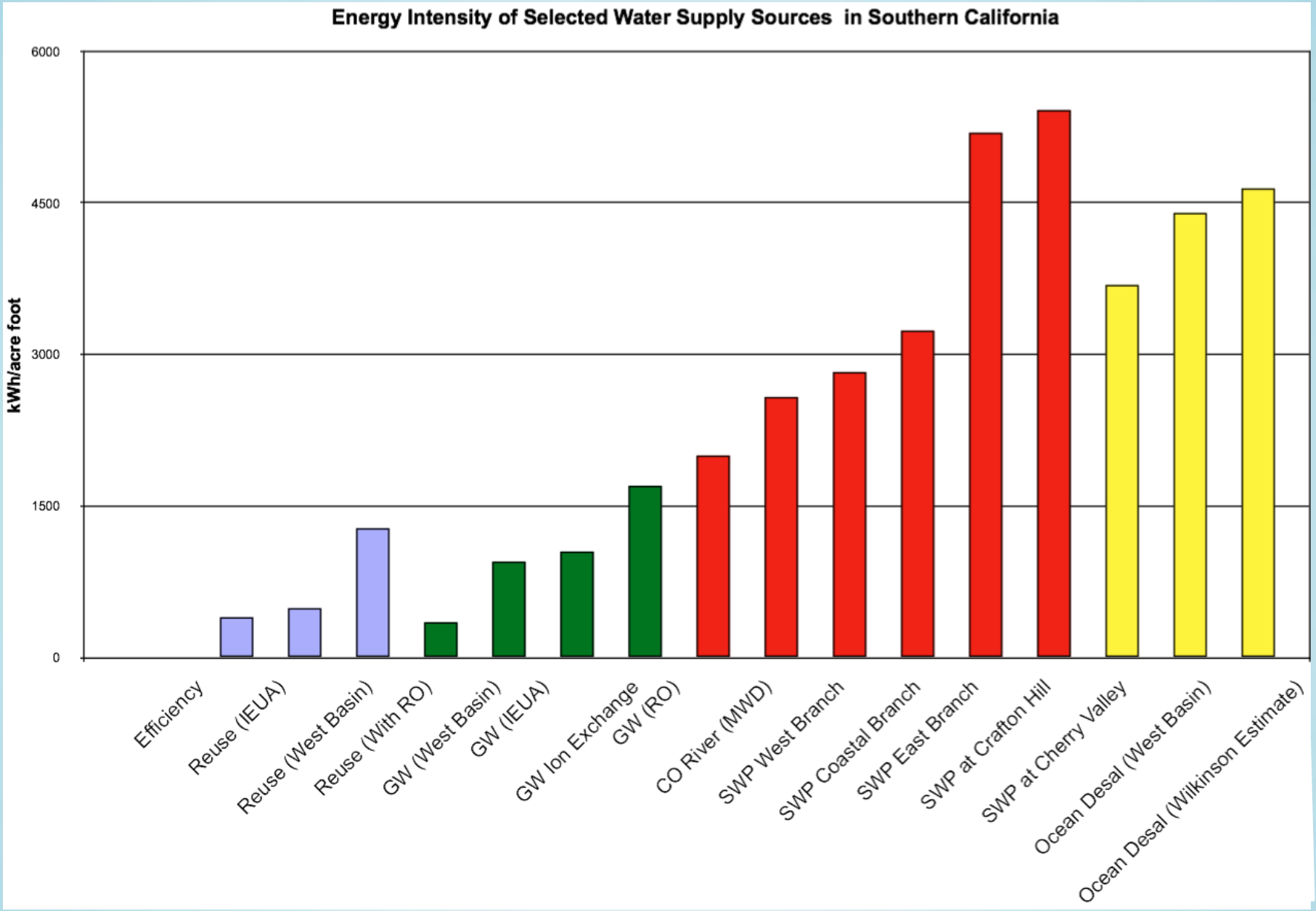
What are the connections between water and energy?



167,000 AF/year in CO River Basin. WRA, 2011



Western Resource Advocates, 2010



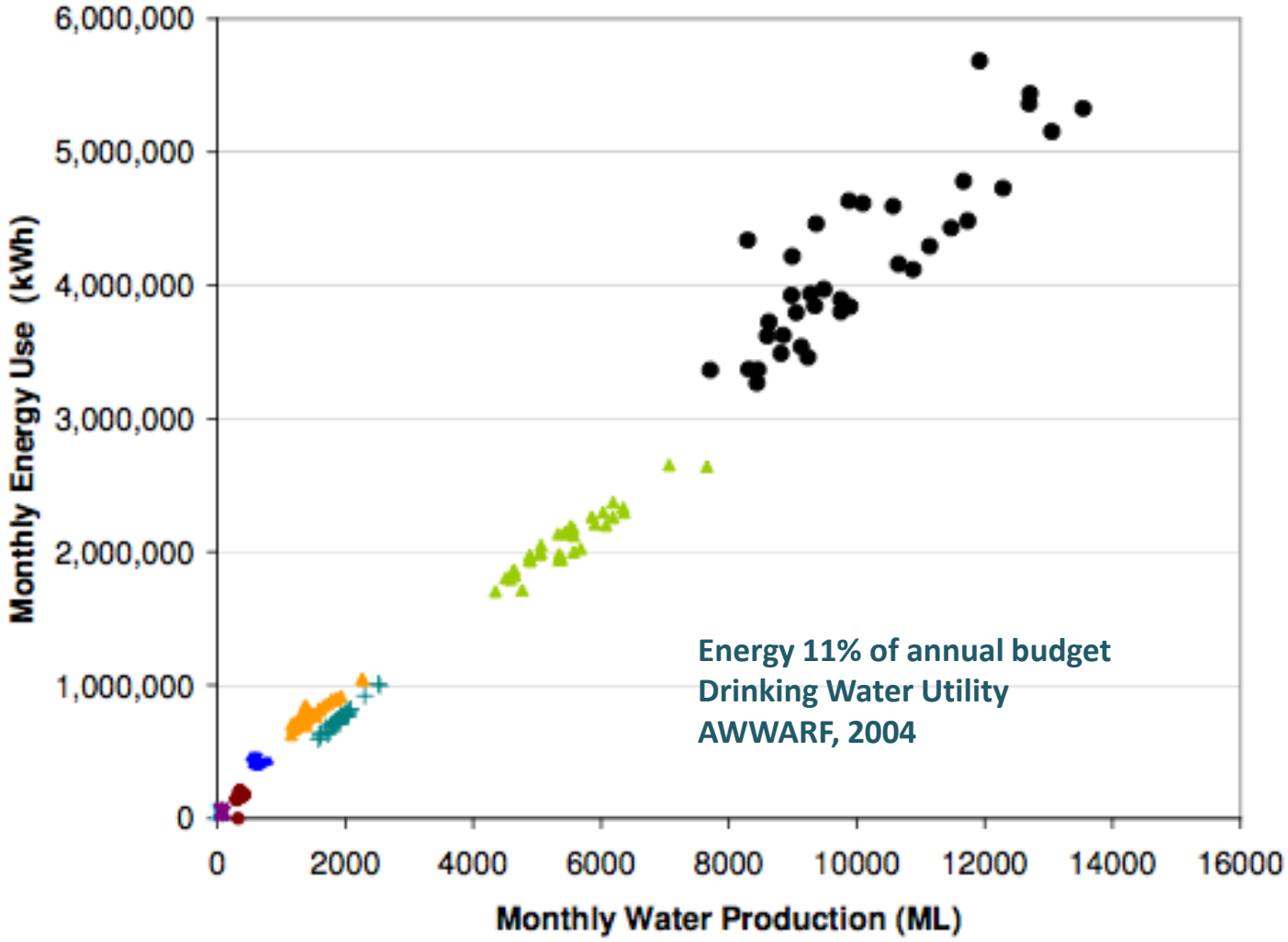
CA Energy-Water 08

A Quick Poll…

What are the opportunities?

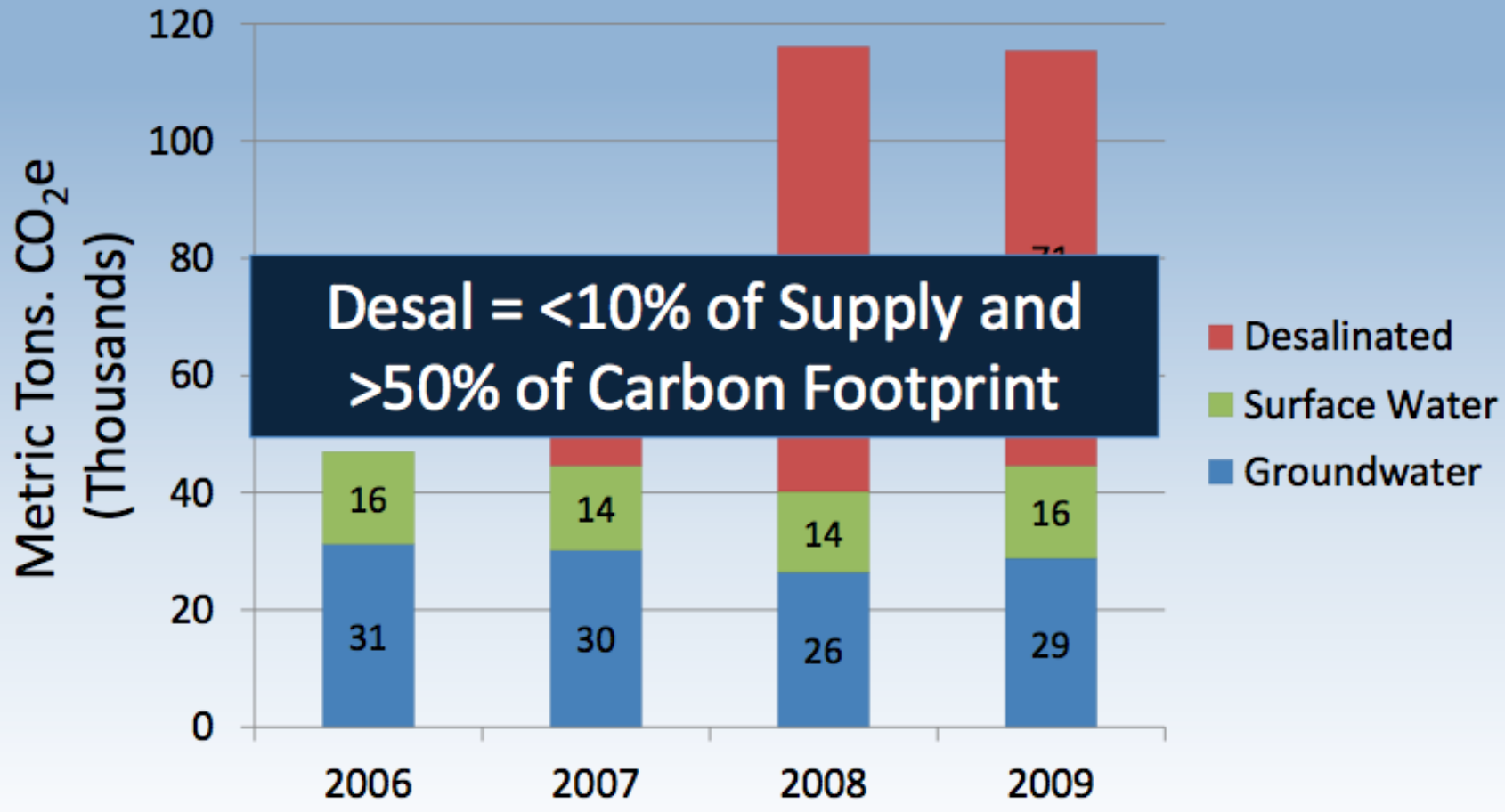
- Identifying the Connections
- Developing Standards
- Implementing Programs
- Monitoring and Evaluation

Figure B-1. Monthly Water Treatment Plant Production vs. Energy Use



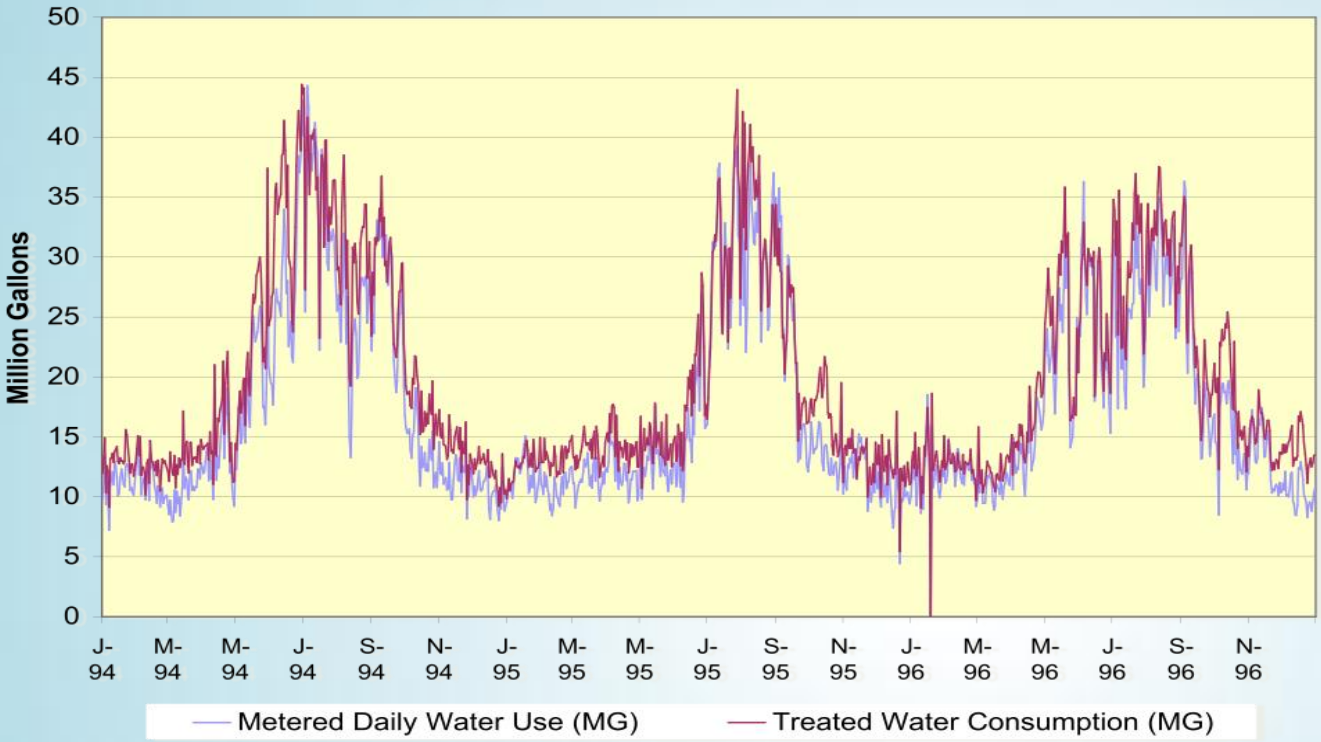
POLIS Project GrHouse Gases & WC 2009

Carbon Footprints by Supply Type



UF PREC | Emerging Energy Issues and Topics IST | 09.29.11

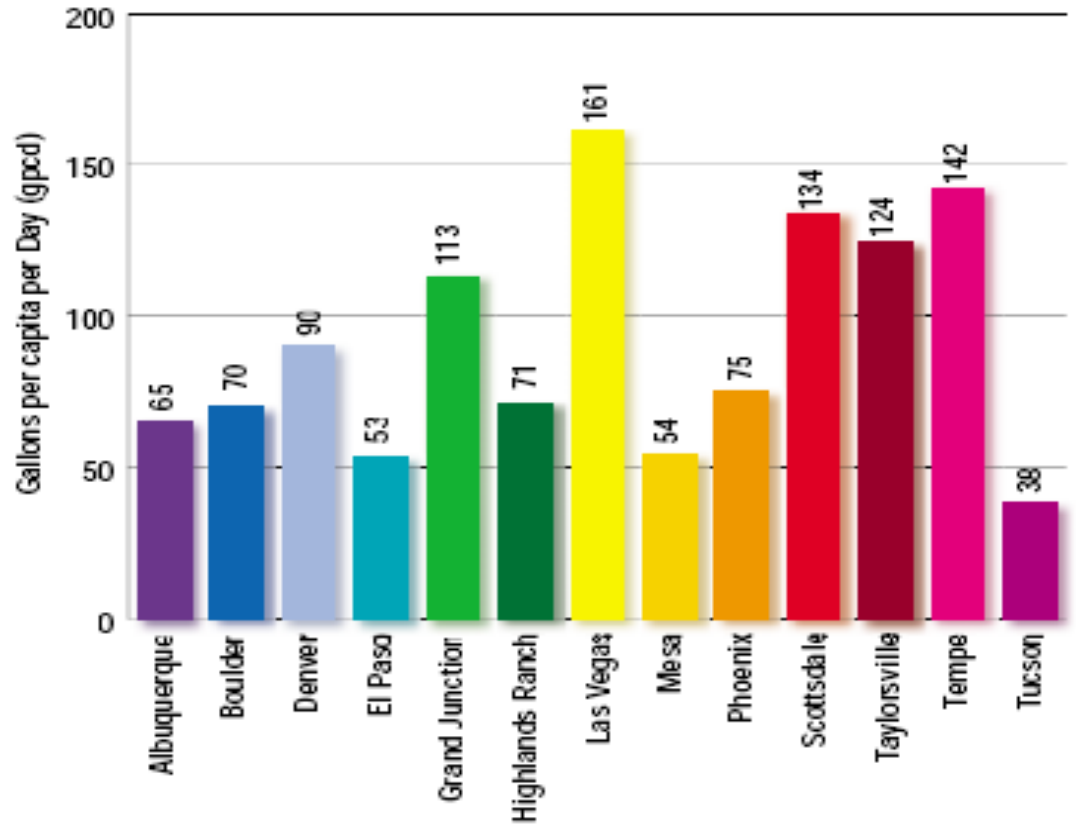
Treated Drinking Water Demand



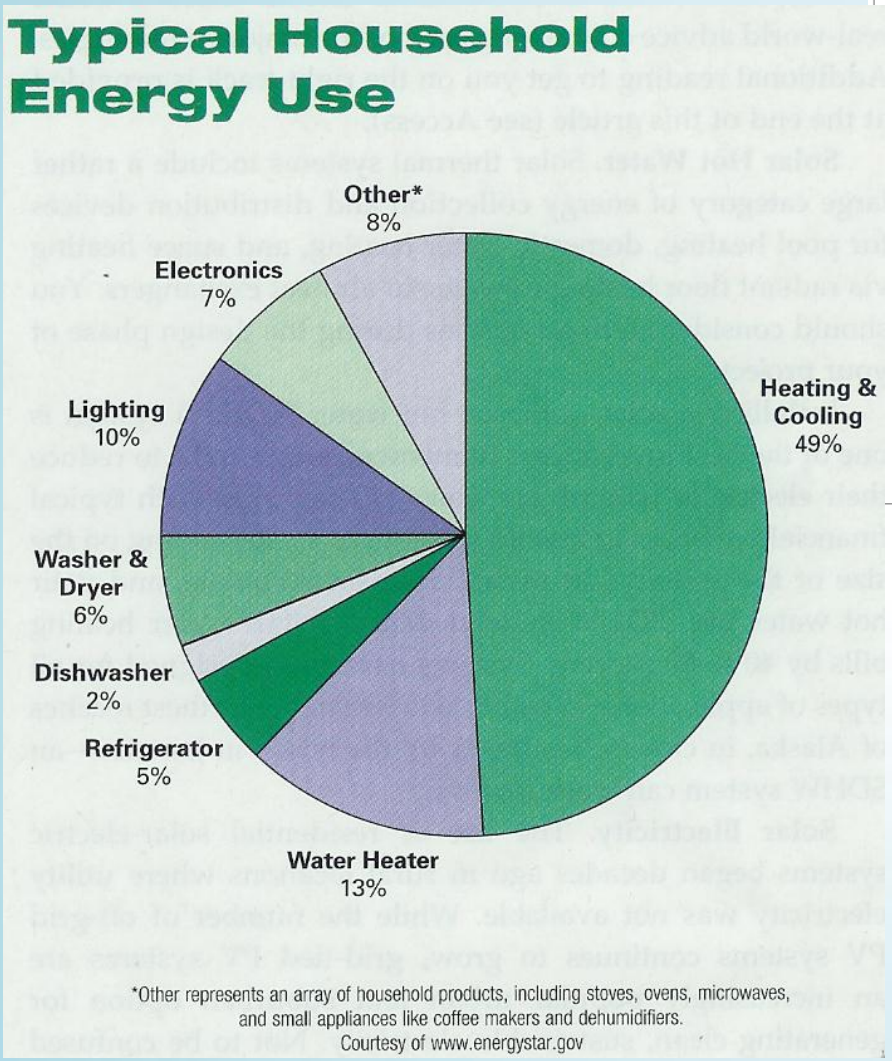
Social Factors

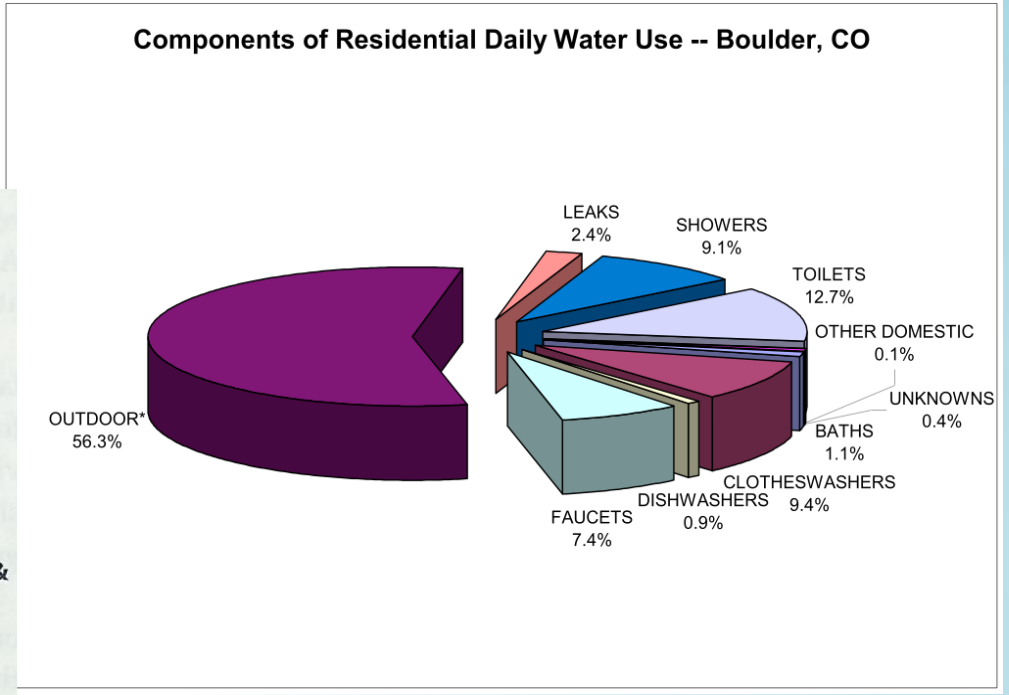
Figure 3.5

2001 Estimated Single-Family Residential Outdoor Use, Represented as a Daily per capita Use

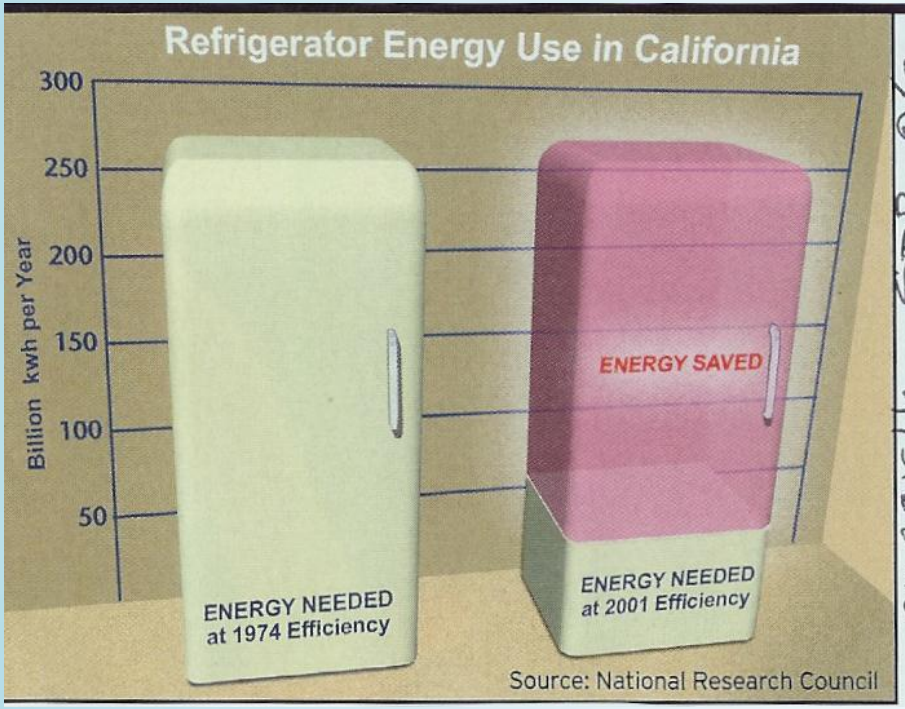


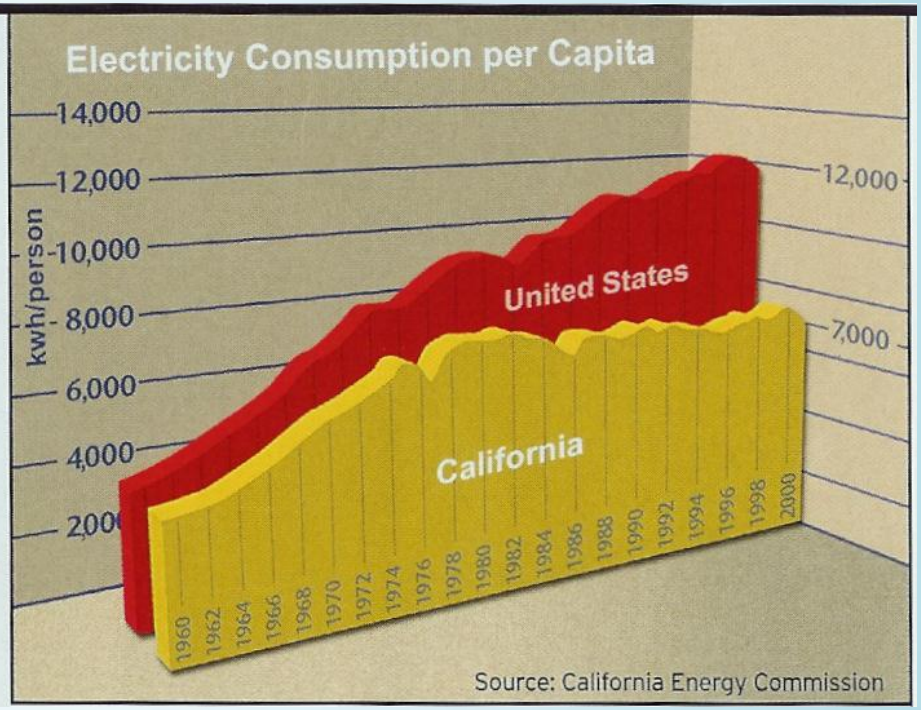
SMART WATER, Western Resource Advocates, 2003


Typical Household Energy Use
Other* 8%
Electronics 7%
Lighting 10%
Heating & Cooling 49%
Washer & Dryer 6%
Dishwasher 2%
Refrigerator 5%
Water Heater 13%
*Other represents an array of household products, including stoves, ovens, microwaves, and small appliances like coffee makers and dehumidifiers.
Courtesy of www.energystar.gov

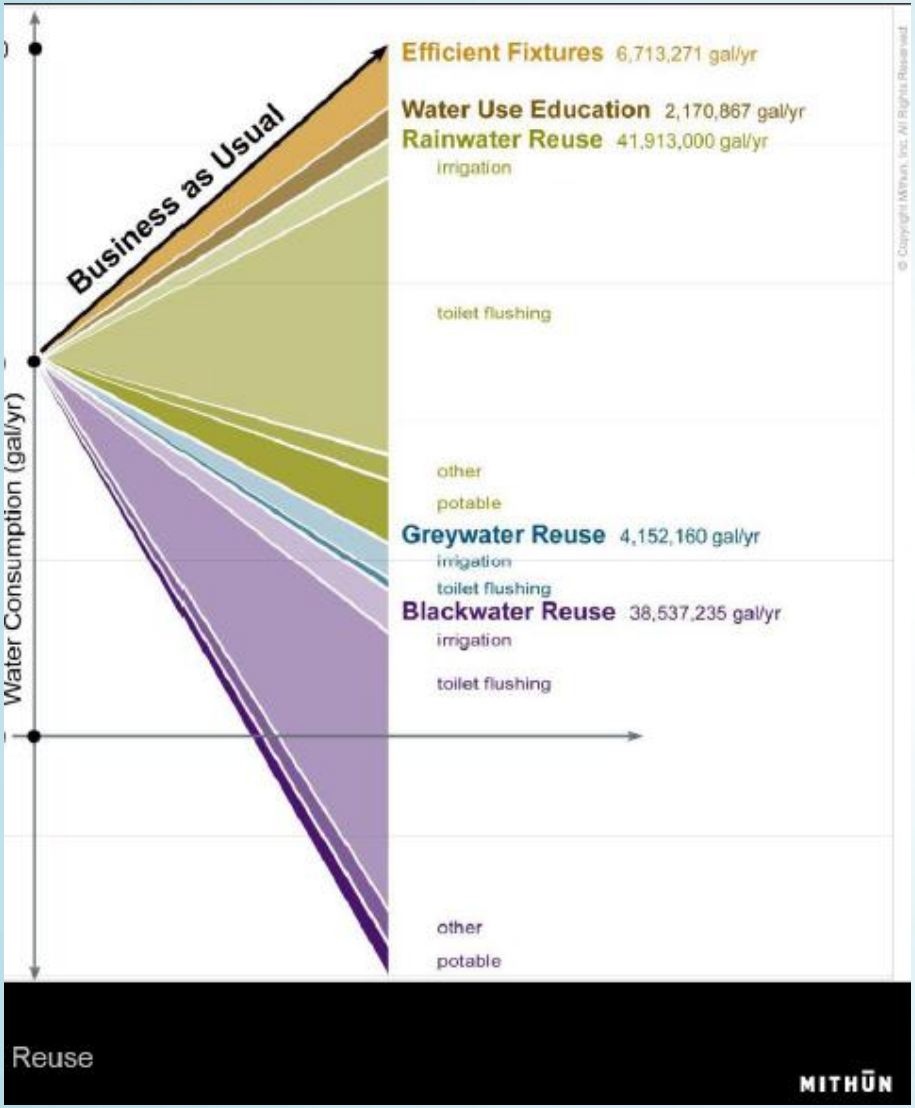

Components of Residential Daily Water Use -- Boulder, CO
OUTDOOR* 56.3%
LEAKS 2.4%
SHOWERS 9.1%
TOILETS 12.7%
OTHER DOMESTIC 0.1%
UNKNOWNS 0.4%
BATHS 1.1%
CLOTHESWASHERS 9.4%
DISHWASHERS 0.9%
FAUCETS 7.4%

Developing Standards





Non-Traditional Opportunities



- Condensate Water for Irrigation
- Roof Water for Toilets

“In audits of 150 facilities…identified energy savings of over 30%...”

K. Moraff, EPA Region 1 (Boston), Oct. 2011

Table 2. Measures to Improve Efficiency in Water Supply and Wastewater Treatment and Illustrative Payback Periods

Area	Function	Typical Payback Period (years)
Electricity Rates	Reduce demand during periods of peak electricity rates	0 – 2 depending on storage capacity
Electric installations	Power factor optimization with capacitors	0.8 – 1.5
	Reduction in voltage imbalance	1 – 1.5
Operations and maintenance	Routine pump maintenance	2
	Deep well maintenance and rehabilitation	1 – 2
Production and Distribution	Use automation (such as telemetry, SCADA, and electronic controllers on modulating valves), for example to control pressure and output in the networks, and to optimize the operation of pumping equipment	0 – 5
	New efficient pump	1 – 2
	New efficient motor	2 – 3
	Replace Impeller	0.5
	Optimize the distribution network (e.g., by removing unnecessary valves, sectoring, and installing variable speed drives and regulating valves)	0.5 – 3
End Use	Incentive program for the use of efficiency technologies	1 – 3
	Effective metering of consumption	1 – 2

watergy.org, 2011

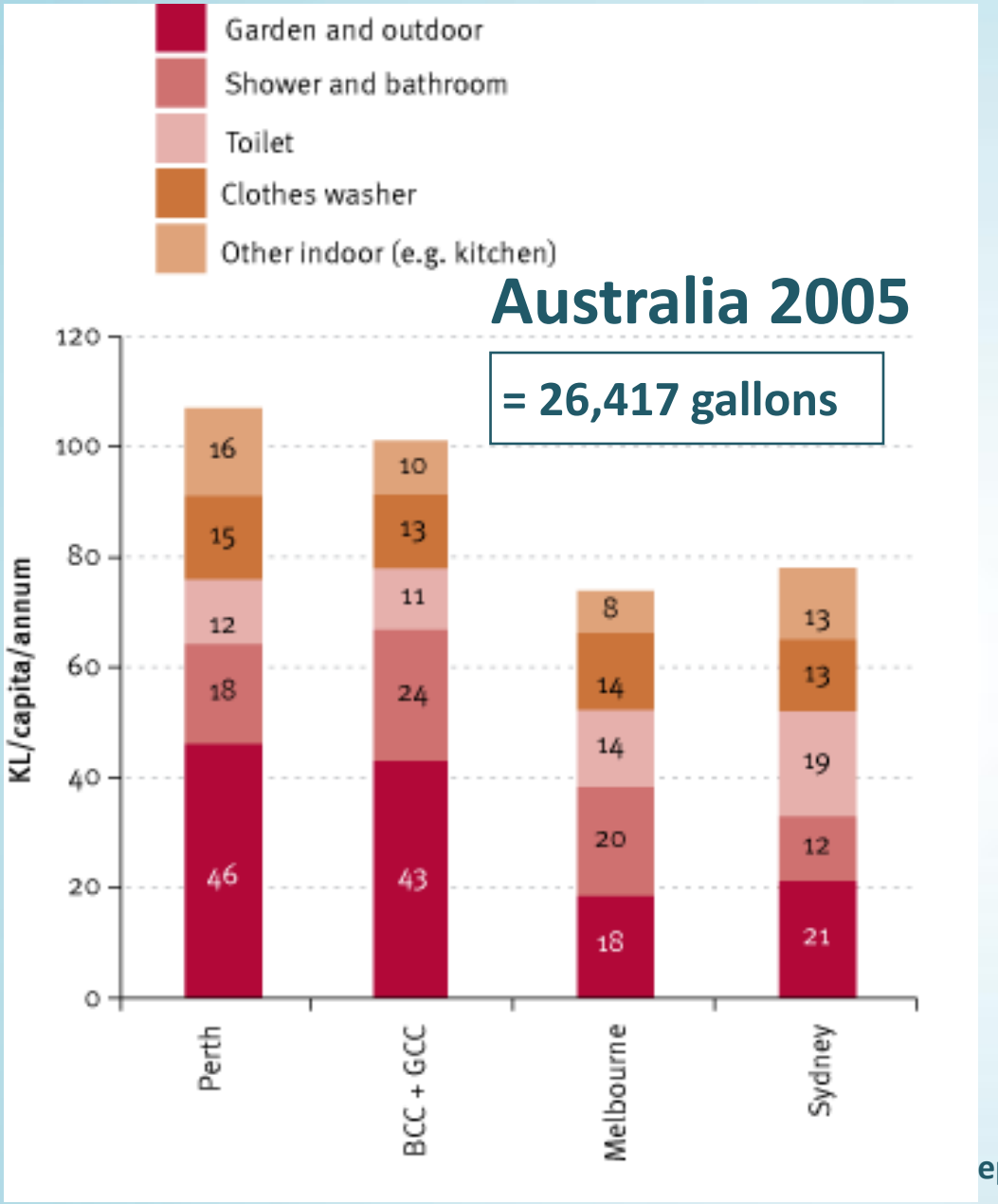
Implementing Programs

Table 4-1: Energy Value of Saved Water Due to Implementation of 2004 BMP Measures

	Annual Savings		Useful	Life-Cycle Electricity	NPV Electric
Statewide	**Water (MG)**	**Electricity (kWh)**	**Life (Years)**	**Savings (kWh)**	**Avoided Cost ($)**
BMP 1 Water Survey Programs MF/SF	1,897	17,114,500	5	85,572,500	6,220,866
BMP 2 Residential Plumbing Retrofit	311	2,814,000	5	14,070,000	1,022,865
BMP 4 Metering & Commodity Rates	1,587	14,317,200	11	157,489,200	9,472,790
BMP 5 Large Landscape Conservation Programs	5,320	34,595,450	10	345,954,500	21,149,701
BMP 6 High-Efficiency Washing Machine Rebate	317	2,860,100	15	42,901,500	2,346,888
BMP 9 Conservation Programs CII	4,814	43,433,300	12	521,199,600	30,567,522
BMP 9a CII ULFT	258	2,328,300	25	58,207,500	2,522,363
BMP 14 Residential ULFT	12,987	117,184,600	25	2,929,615,000	126,950,010
Statewide Total	27,492	234,647,450		4,155,009,800	200,253,005

Source: California Urban Water Conservation Council (CUWCC) Reporting Database, April 2005 with 86 of 269 Reporting Units (32%) reporting BMP expenditures in 2004. Reporting Units include: water utility districts, water agencies, irrigation districts, city and county water departments and water service companies implementing BMPs.

CA Energy Commission, 2005



In Comparison:
SF Boulder County avg/year:
> 120,000 gallons

epa.qld.gov (accessed Sep 09)

Green Infrastructure Benefits and Practices

This section, while not providing a comprehensive list of green infrastructure practices, describes the five GI practices that are the focus of this guide and examines the breadth of benefits this type of infrastructure can offer. The following matrix is an illustrative summary of how these practices can produce different combinations of benefits. Please note that these benefits accrue at varying scales according to local factors such as climate and population.

Benefit	Reduces Stormwater Runoff				Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Community Livability					Improves Habitat	Cultivates Public Education Opportunities
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture		
Practice																		
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◒	●	◒	◒	●	●
Tree Planting	●	●	●	●	○	◒	○	●	●	●	●	●	●	●	●	◒	●	●
Bioretention & Infiltration	●	●	●	●	◒	◒	○	○	●	●	●	●	●	◒	◒	○	●	●
Permeable Pavement	●	●	●	●	○	◒	●	◒	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◒	○	◒	◒	◒	○	○	○	○	○	○	○	●

● Yes ◒ Maybe ○ No

75% savings from Energy >

Benefit	Annual Benefit ($) per 5,000 SF green roof (Example Demonstration 1)	Annual Benefit ($) from scaled green roof program (= annual benefit per roof * 240 converted roofs)
Reduces Stormwater Runoff	$6.53	$6.53 * 240 = $1,567.20
Reduces Energy Use	$107.60 + $444.75= $552.35	$552.35 * 240 = $132,564.00
Improves Air Quality *Note: The figures used here only account for the benefits of reduced NO_2. Similar steps should be performed for the other criteria pollutants, when possible.*	$100.83	$100.83 * 240 = $24,199.20
Reduces Atmospheric CO_2	$49.04	$49.04 * 240 = $11,769.60
Total Annual Benefit (Σ Annual Benefits)	**$708.75**	**$708.75 * 240 = $170,100.00**

Center for Neighborhood Technology, 2010

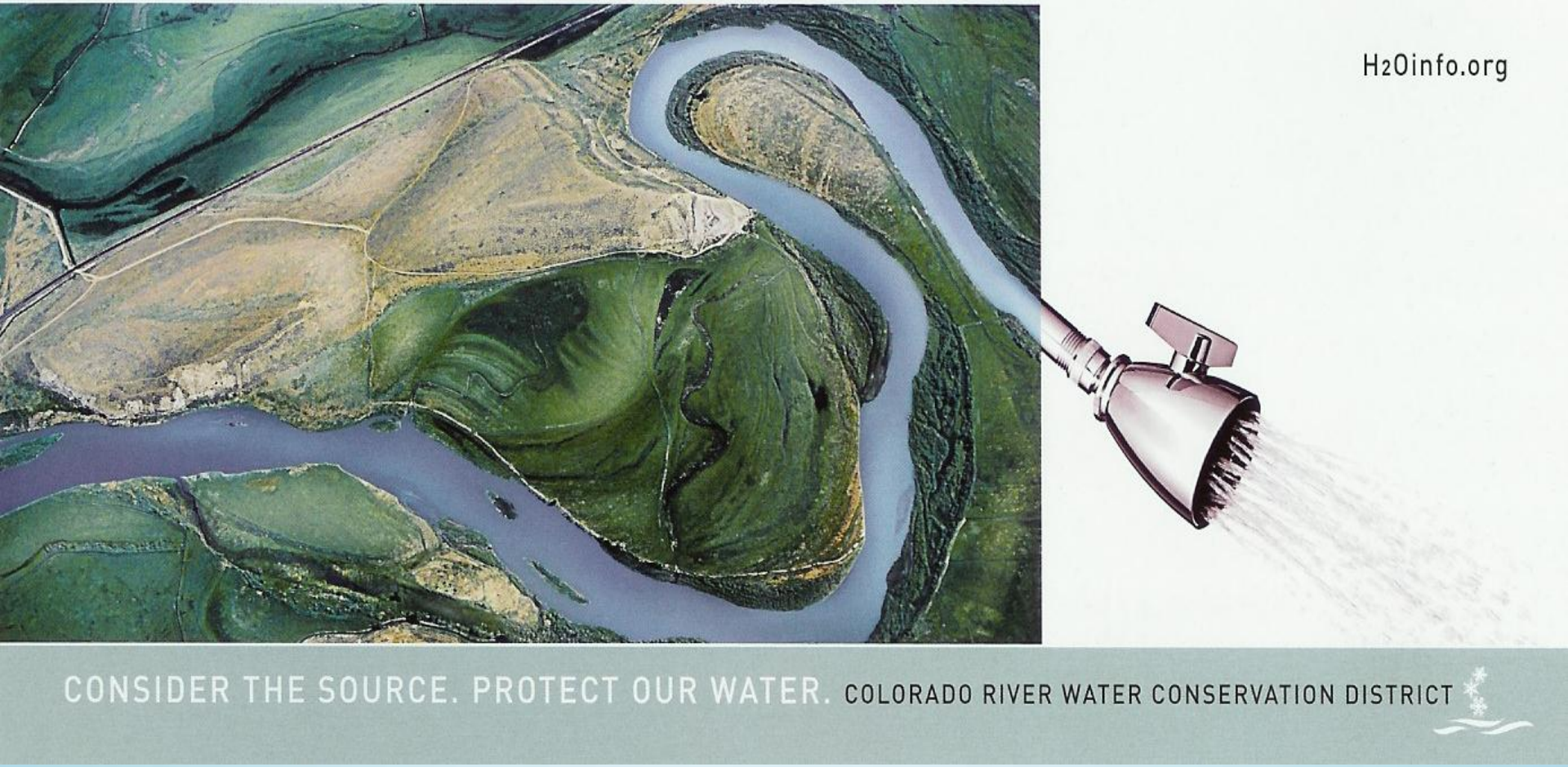
Focus on *service*, not on gallons or kWh.

Next Steps

- **Baseline Data**
- **Identify Connections** ➡ ***Opportunities***
- **Cost Benefit**
- **Implement**
- **Measure and Monitor** ➡ ***Adaptive Management***

Promote Water Efficiency to Save Energy

CA Energy Commission, 2005



Resources

- **Publications**
  - WaterSmart Guidebook, 2008. East Bay Municipal District, CA.
  - Water Efficiency Improvement Self Assessment Guide, Oct 2011. South FL Water Mgmt District
  - Water and Energy Efficiency Audit Field Guidance Document, April 2009. U.S.B.O.R.
- **Websites**
  - Alliance for Water Efficiency, AW4E.org
  - Watergy.org

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