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Landscape Irrigation Equipment

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California Energy Commission
Efficiency Committee Workshop
2008 Rulemaking on Appliance Efficiency Regulations
Docket No. 09-AAER-1A
April 1, 2009

Overview

1. Background – Statewide IOU Codes & Standards Program
2. California's Energy-Water Nexus
3. Landscape Irrigation Equipment
   - *Water and Energy Saving Opportunities*
   - *Possible Standard Options*

1. Background

Statewide Codes & Standards Program

Codes & Standards Program

- The Statewide Codes & Standards program is funded by California ratepayers, and implemented under the auspices of the California Public Utilities Commission (CPUC).

- Since the program began in 1997, approximately 78 California energy code and standards proposed and/or supported by IOUs have been adopted by the California Energy Commission into Title 20 and 24.

2. California's Energy-Water Nexus

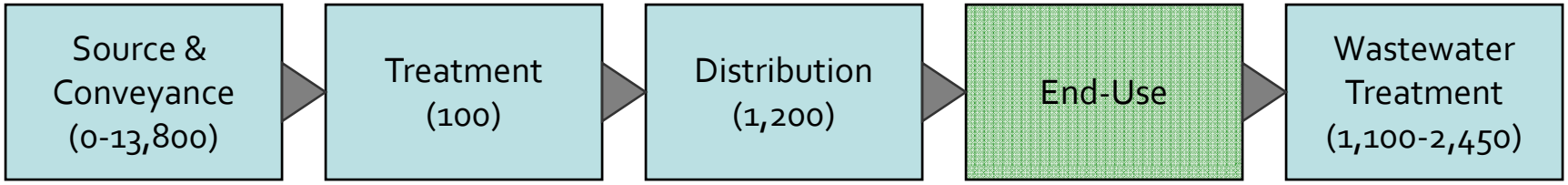
The Energy-Water Nexus

- California's water and energy systems are inextricably linked.
  - About 20% of California's electricity comes from hydropower
  - Water-related energy use consumes nearly **20**% of the state's electricity, and **30**% of its natural gas [1].

- Stages in the water-use cycle are depicted below.

(Typical ranges of energy intensities are shown, in kWh/million gallons [2])

- 8% of CA electricity is used for pumping and treating
- 12% of CA electricity is for end-uses



[1] CEC (2005). "California's Water - Energy Relationship." Prepared in Support of the 2005 Integrated Energy Policy Report Proceedings.
[2] Navigant Consulting (2006). "Refining Estimates of Water-Related Energy Use in California" Prepared for the California Energy Commission, Public Interest Energy Research Program.

Current Water-Energy Proxies

	Indoor Uses		Outdoor Uses	
	Northern California kWh/MG	Southern California kWh/MG	Northern California kWh/MG	Southern California kWh/MG
Water Supply and Conveyance	2,117	9,727	2,117	9,727
Water Treatment	111	111	111	111
Water Distribution	1,272	1,272	1,272	1,272
Wastewater Treatment	1,911	1,911	0	0
Regional Total	5,411	13,022	3,500	11,111

- A Proxy for Outdoor Use, California: **~ 8,100 kWh/MG**

(Population weighted average of Northern and Southern CA)

- Three studies that are currently underway seek to refine this relationship of statewide water-energy systems.

[1] Navigant Consulting (2006). "Refining Estimates of Water-Related Energy Use in California" Prepared for the California Energy Commission, Public Interest Energy Research Program.

3. Landscape Irrigation Equipment

Water Requirements for Irrigation

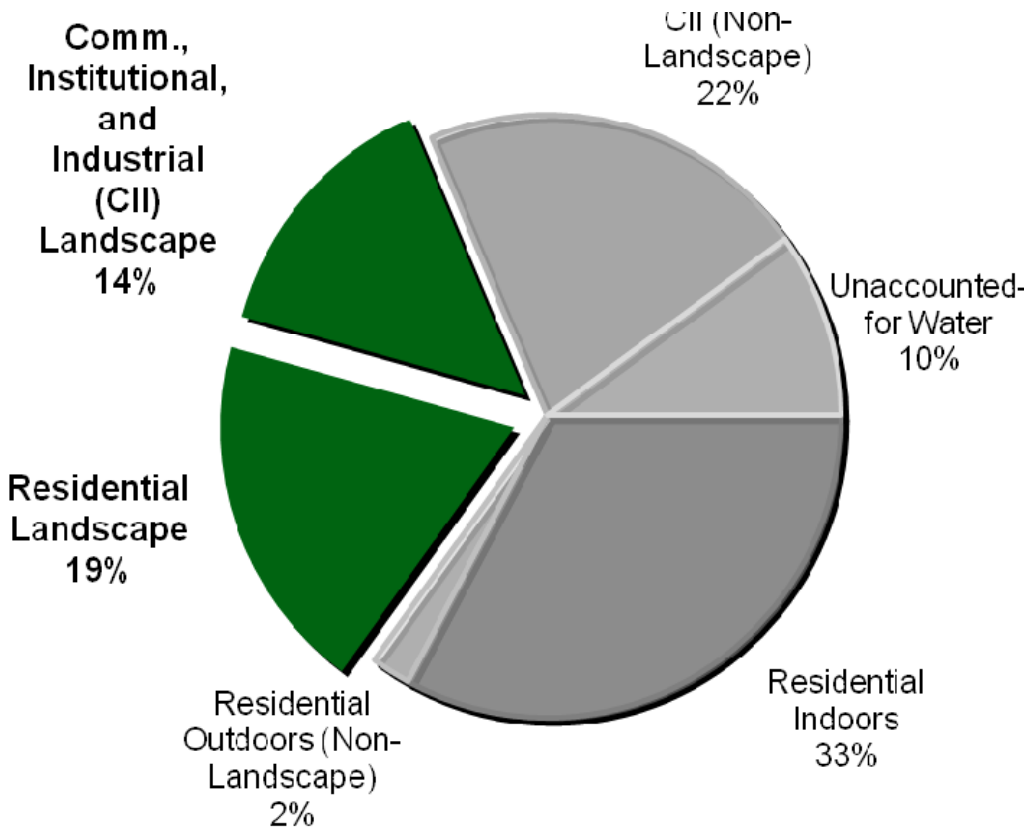
Potential Standard Options

Annual Urban Water Use: Landscape Irrigation

- California uses a total of about 43 MAF for urban and agriculture use [1].

-Urban water use is about 9 MAF or 20% of this total.

- Landscape irrigation accounts for 1/3rd or~ 3 MAF *(high uncertainty).*



Source: Estimates from [2] with further estimate that 10% of residential outdoor water use is used in other applications (e.g., pools, washing cars)

[1] CEC (2005). "California's Water - Energy Relationship." Prepared in Support of the 2005 Integrated Energy Policy Report Proceedings.
[2] Gleik, P. H. et al, (2003) "Waste Not, Want Not: The Potential for Urban Water Conservation in California." The Pacific Institute.

Potential Landscape Irrigation Savings

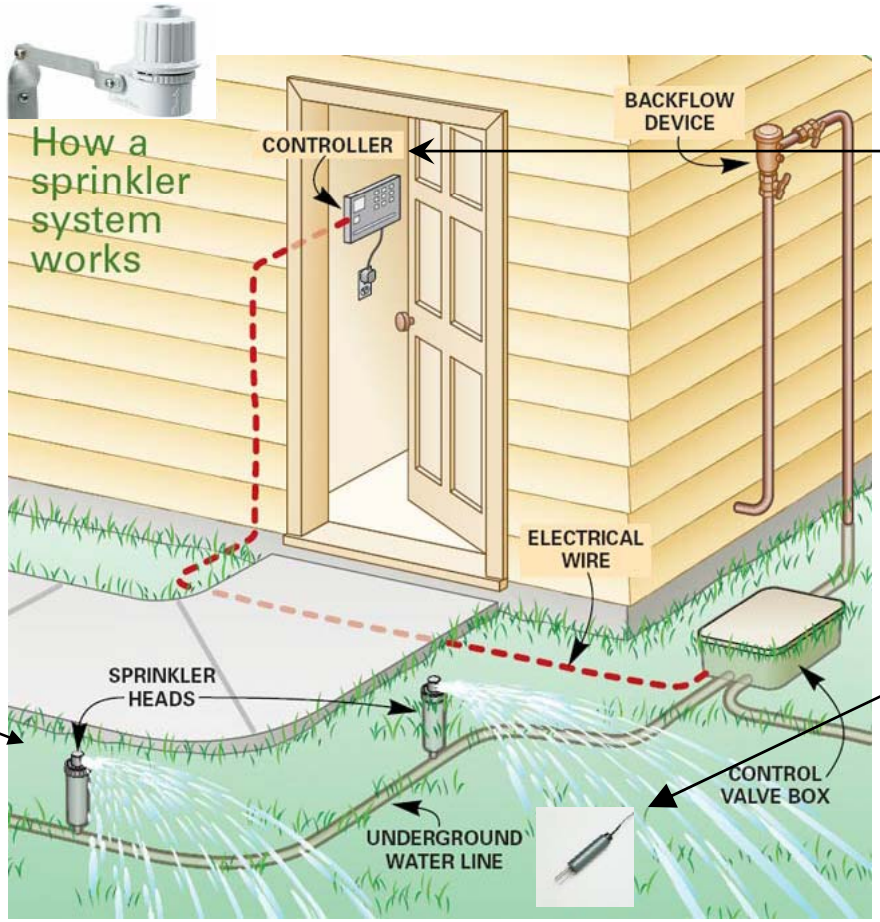
*Add a **Rain Sensor***

*Replace traditional clock-controllers with **Smart Controllers***

*Replace Nozzles with **Multi-Stream Rotating Nozzles***

*Use **check-valves** in Spray to prevent low-Head drainage*

*Install a **Soil Moisture Sensor***



The Pacific Institute (2003) estimates even a subset of available conservation and efficiency options can reduce outdoor use by 25 – 40 percent. *What can we capture through Title 20 regulations?*

Potential Standard Options:

Irrigation Controllers: Water Savings

- Require all new controllers be self-adjusting, i.e., climate- or soil-moisture based.
  - Establish min. performance levels (irrigation adequacy and irrigation access)
  - Require controllers to come with an rain sensor
  - Incorporate requirements to ensure reliability of savings, e.g., non-volatile memory
  - Testing protocols

- Preliminary Estimates of Potential Savings

(Based on results from a variety of studies, we assume 10% to 30% reduction in outdoor water)

	First Year	Stock-Turnover
Water Savings (MAF)	.02 - .06	0.30- 0.90
Embedded-Energy Savings (GWh)**	50-160 GWh	800 – 2,400 GWh

Assumes 15-year controller lifetime

**Based on estimated proxy of 8,100 kWh/MG of embedded-energy.

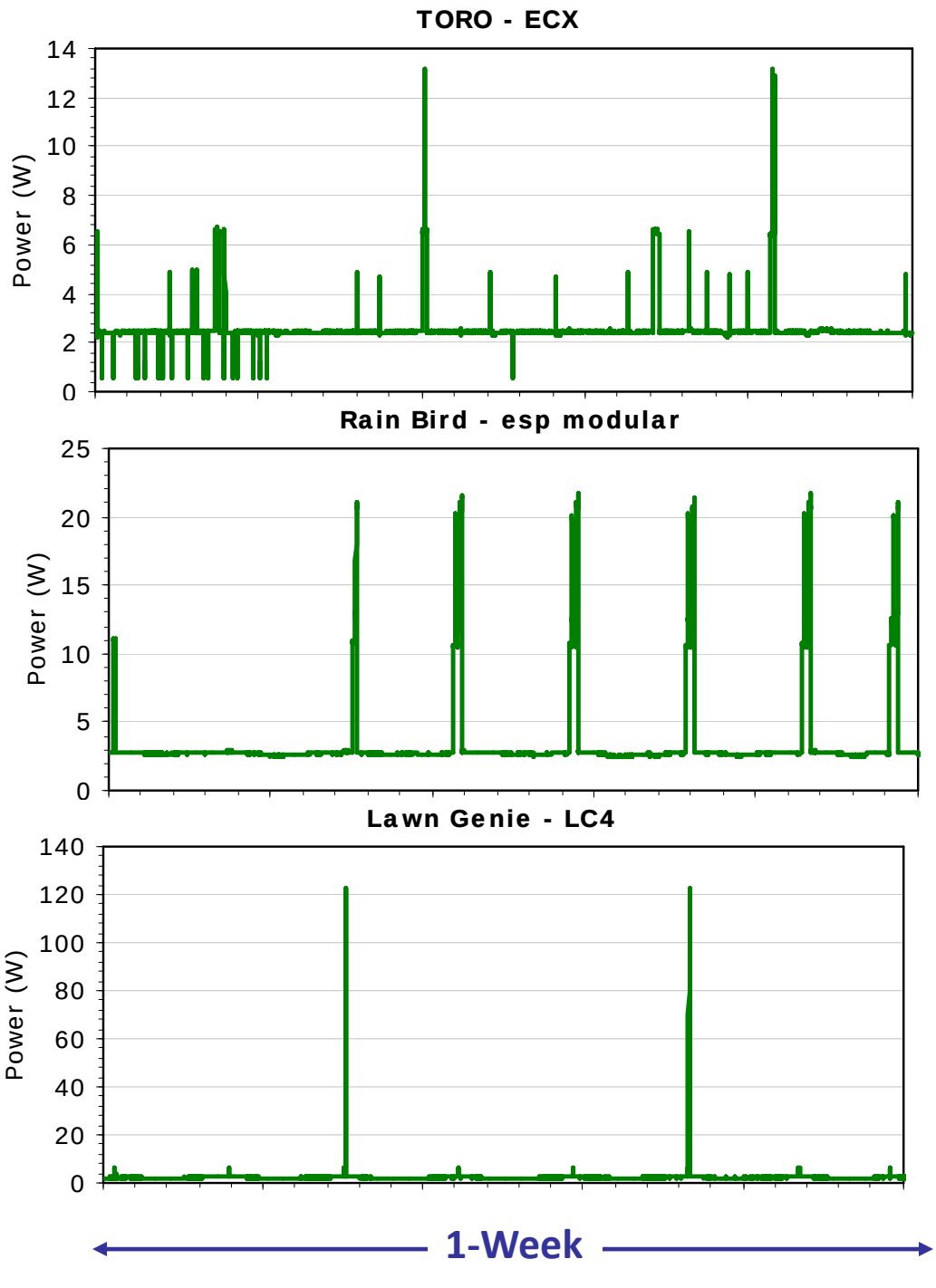
Potential Standard Options

Irrigation Controllers – Energy Use

- **Set standard for the energy use of controllers** (and potentially, related devices).

1. Controller Power Supplies: Most controllers have a 120 VAC – 24 VAC transformer.
   - *Exterior:* Covered under federal appliance regs for "single-voltage external power supply"
   - *Interior:* Not regulated

2. Plug load
   - Limited data on energy-consumption of controllers and related devices.
     - Traditional irrigation controller: ~ 24 kWh/yr
     - Plug load of more sophisticated, smart controllers???



Power Consumption Measurements of 3 Controllers [1]

- Average Standby Mode: 2.5 Watts
- Average Active Mode: 8.8 Watts

Per Unit Annual Energy Use:

Standby:	20.8 kWh
Active:	3.0 kWh
Total:	*23.8 kWh*

Estimated Annual CA Energy Use by Controllers (Residential Only):

95 - 120 GWh/yr

[1] Ecos (2006). "Energy Use of Plug Load Devices in California Homes: Field Research Report."

Potential Standard Options

- **To ensure reliability of water savings associated with smarter controller**, set performance requirements or prescriptive requirements for related equipment e.g., soil-moisture sensors, rain sensors

- **To reduce low-head drainage,** require sprinklers to come with a anti-drain check valve.

Thank you

Backup

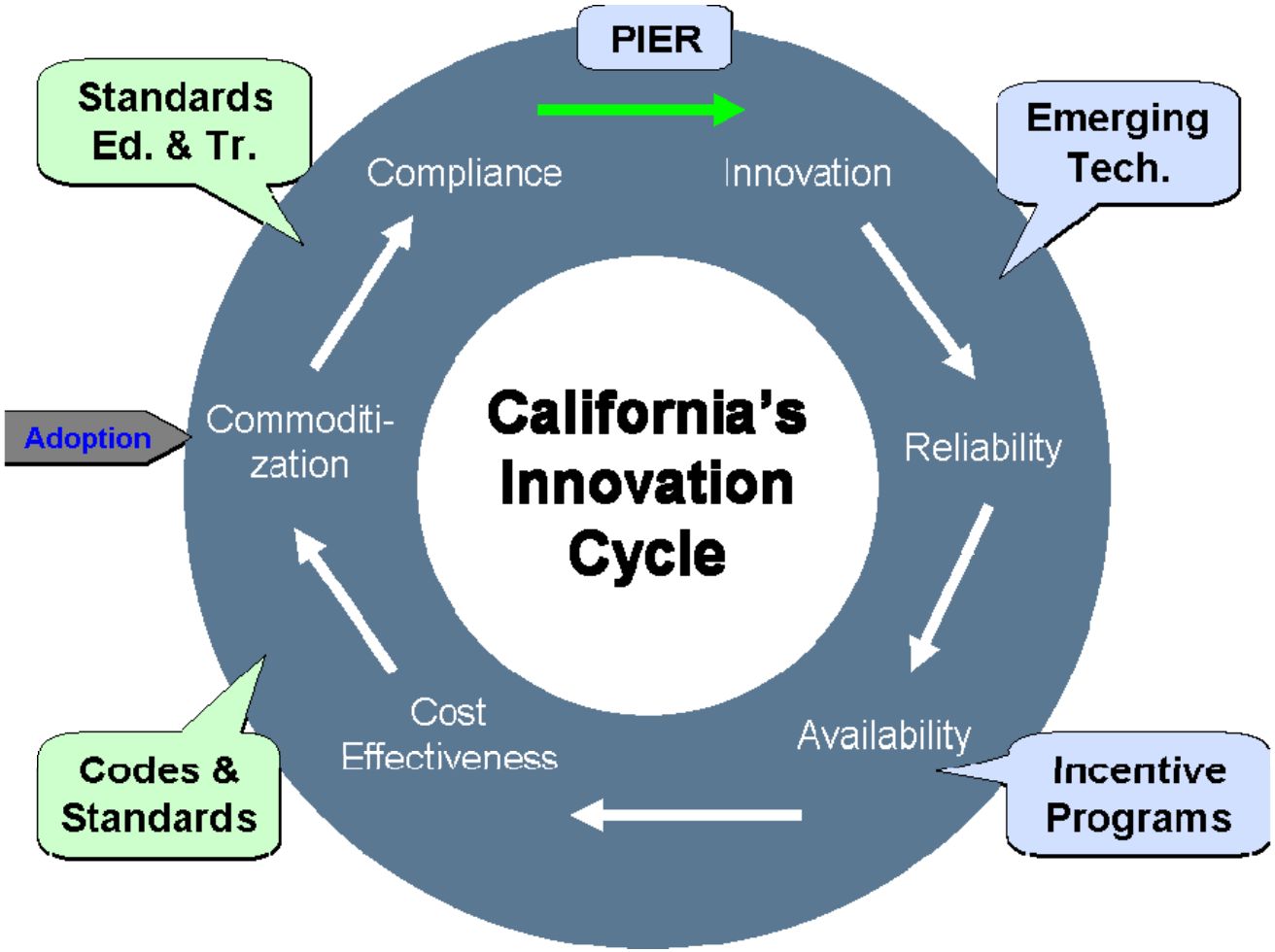
Examples of Measures Adopted into California Title 20 Appliance Standards

Commercial Refrigeration Equipment
Commercial Ice Maker Equipment
Walk-In Coolers & Freezers
Large Packaged Commercial AC
Portable Electric Spas
Pre-rinse Spray Valves
Hot Food Holding Cabinets
Single-Voltage Power Supplies
General Service Incandescent Lamps
Incandescent Reflector Lamps

Modular Furniture Lighting Fixtures
Consumer Electronics – Audio Players
Consumer Electronics – TVs
Consumer Electronics – DVD Players
Water Dispensers
Unit Heaters and Duct Furnace
Residential Pool Pumps
Portable Fixtures
Metal Halide Fixtures
Battery Chargers Test Method*

* CEC has indicated it will consider standards for battery chargers in Phase 2 of 2008 Rulemaking

Recurring Updates to Regulations Reduce Costs and Spur Innovation

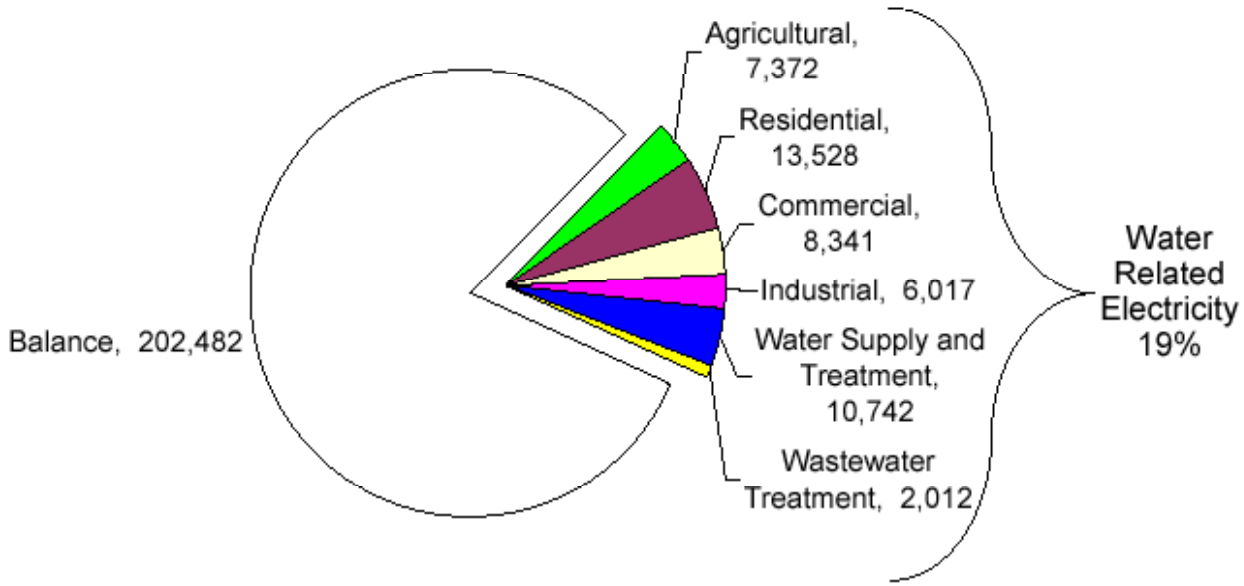


Voluntary programs such as incentive programs help support commercialization of new technologies and code readiness.

Pilot Programs on Embedded-Energy in Water

- CPUC pilot effort is studying the potential for energy-efficiency savings via embedded energy through water use-reduction measures.
  - One-year pilot program are being implemented by four IOUS (PG&E, SCE, SDG&E, and SCG) in partnership with water agencies.
  - In parallel, CPUC has approved three studies are being conducted to examine the relationship of water and energy in CA.

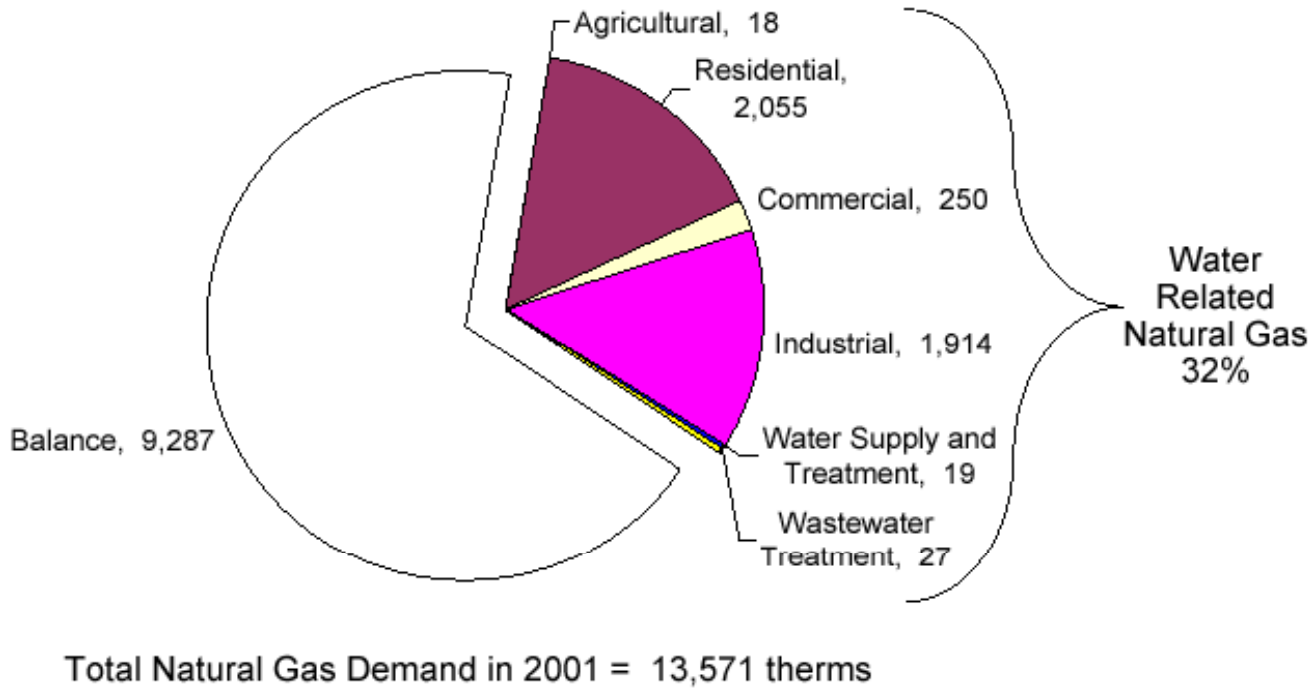
Water Related Electricity Use in California



Total Electricity Demand in 2001 = 250,454 GWh

Source: House L.W. (2009) *Nexus of Water and Energy Series: Embedded Energy in Water. Briefing for U.S. Senate Staffers*

Water Related Gas Use in California



Source: House L.W. (2009) *Nexus of Water and Energy Series: Embedded Energy in Water. Briefing for U.S. Senate Staffers*

Title 20 Regulations

"Single-voltage external AC to DC or AC to AC power supply" means a device that:

(1) is designed to convert line voltage AC input into lower voltage DC or AC output;
(2) is able to convert to only one DC or AC output voltage at a time;
(3) is sold with, or intended to be used with, a separate end-use product that constitutes the primary load;
(4) is contained within a separate physical enclosure from the end-use product;
(5) is connected to the end-use product via a removable or hard-wired male/female electrical connection, cable, cord, or other wiring;
(6) does not have batteries or battery packs that physically attach directly (including those that are removable) to the power supply unit;
(7) does not have a battery chemistry or type selector switch and an indicator light; or, does not have a battery chemistry or type selector switch and a state of charge meter;

Table U-2
Standards for Power Supplies

Effective July 1, 2008

Nameplate Output	***Minimum Efficiency in Active Mode***
<1 watt	0.5 * Nameplate Output
≥1 and ≤51 watts	0.09*Ln(Nameplate Output) + 0.5
> 51 watts	0.85
	Maximum Energy Consumption in No-Load Mode
Any output	0.5 watts
Where Ln (Nameplate Output) = Natural Logarithm of the nameplate output expressed in Watts.	