REDUCING GREENHOUSE GAS IMPACTS IN CALIFORNIA’S URBAN WATER CYCLE

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SOURCE: David Carle, “Introduction to Water in California”
University of California Press, 2004 (redrawn from Hundley, 2001)
GHG REDUCTION TARGETS

Bali 2007:
• 20-40% below 1990 levels by 2020

AB-32 2006:
• return to 1990 levels by 2020
• 80% below 1990 levels by 2050

Santa Rosa 2005:
• 25% below 1990 by 2015

= 50% below 2005
CUSTOMERS HAVE THE LARGEST GHG IMPACT IN THE URBAN WATER CYCLE
2005 GHG Emissions from Santa Rosa’s Urban Water Cycle

~10 times more than the inventory for water and wastewater

END-USERS: 102,000 tons-CO2/year

WATER SUPPLY

WHOLESALE WATER

COGEN BIOGAS: 5,500 tons-CO2/year

WASTEWATER TREATMENT

END-USERS: 102,000 tons-CO2/year
2005 Unit GHG Emissions from Santa Rosa’s Urban Water Cycle

~9 times more than the inventory for water and wastewater

- Water Supply: 0.1
- Wholesale Water: 0.3
- Wastewater Treatment: 1.5
- End-Users: 13.6
2005 Water-Related Unit Energy Costs for Santa Rosa’s Urban Water Cycle

- Water Supply: $160
- Wastewater Treatment: $410
- End-Users: $3,500

~6 times more than water and wastewater
MANY COST-EFFECTIVE GHG REDUCTIONS IN WATER/WASTEWATER SYSTEMS

but not enough to meet GHG reduction target
GHG Reductions from Energy Efficiency Projects in the Wastewater System

$253 SAVED per ton CO₂ REDUCED

200 tons-CO₂/yr (2.1%) reduced from reclamation pumps

750 tons-CO₂/yr (7.9%) reduced from aeration blowers
MEETING GHG TARGETS IN THE URBAN WATER CYCLE REQUIRES IMPROVING CUSTOMERS’ WATER/ENERGY EFFICIENCY
GHG Reductions from Santa Rosa’s Urban Water Cycle with High-Performance End-Use Efficiency

end-use reductions ~2X water/wastewater footprint

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GHG Reductions from Santa Rosa’s Urban Water Cycle with High-Performance End-Use Efficiency and Solar Energy

47% reduction efficiency + solar

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SAN DIEGO
Southern California
SAN DIEGO REGIONAL WATER SUPPLY PLAN WITH DEFICITS

- Annual Water Supply AF/yr

- 1990: 70,000
- 2000: 56,000
- 2010: 70,000
- 2020: 150,000

- Import Deficit
- Seawater Desalination
- Water Recycling
- Conservation
- Groundwater Recovery
- Groundwater
- Surface Water
- Canal Lining Projects
- Water Transfers
- CRA
- East SWP

30% CRA
30% SWP
COMPARISON OF POSSIBLE OPTIONS TO ADDRESS 150,000 AF/yr DEFICIT IN 2020
(30% reduction each from the State Water Project and the Colorado System)

1. Increase seawater desalination beyond Carlsbad

2. Mandated 20% reduction in water use + Carlsbad desalination

3. High-performance water/energy efficiency upgrades + Carlsbad desalination + 60% wastewater reclamation
2020 WATER SUPPLY OPTIONS TO RESOLVE IMPORT DEFICITS

- **Increase Desalination (Carlsbad x2)**: 112,000 AF/yr
- **20% Mandated Water Efficiency Improvement with Carlsbad Desalination**: 56,000 AF/yr
- **30% Water Efficiency Improvement with Carlsbad Desalination and 60% W/W Reclamation**: 56,000 AF/yr

Annual Water Supply AF/yr

- **26% less than Regional Master Plan**
- **28% less than Regional Master Plan**
- **59% less than Regional Master Plan**

Water Supply Options:
- Seawater Desalination
- Water Recycling
- Conservation
- Groundwater Recovery
- Groundwater
- Surface Water
- Canal Lining Projects
- Water Transfers
- CRA
- East SWP
2020 GHG EMISSIONS FOR OPTIONS TO RESOLVE IMPORT DEFICITS

- **Seawater Desalination**
- **Water Recycling**
- **Conservation**
- **Groundwater Recovery**
- **Groundwater**
- **Surface Water**
- **Canal Lining Projects**
- **Water Transfers**
- **CRA**
- **East SWP**

**Increase Desalination (Carlsbad x2)**

**20% Mandated Water Efficiency Improvement with Carlsbad Desalination**

**30% Water Efficiency Improvement with Carlsbad Desalination and 60% WW Reclamation**

- **114,000 ton-CO2/yr for 56,000 AF/yr**
- **137,000 ton-CO2/yr for 147,000 AF/yr**

*only 15% more GHGs for 3X more water*
2020 GHG EMISSIONS FOR OPTIONS TO RESOLVE IMPORT DEFICITS

- Increase Desalination (Carlsbad x2): 387,000 AF/yr at 1.14 MWh/AF
- 20% Mandated Water Efficiency Improvement with Carlsbad Desalination: 302,000 AF/yr at 1.14 MWh/AF
- 30% Water Efficiency Improvement with Carlsbad Desalination and 60% W/W Reclamation: 244,000 AF/yr at 2.13 MWh/AF

Wastewater treatment has a significant GHG impact.

Tertiary treatment for more reclamation.

Wastewater Treatment
Seawater Desalination
Water Recycling
Conservation
Groundwater Recovery
Groundwater
Surface Water
Canal Lining Projects
Water Transfers
CRA
East SWP
CUSTOMERS HAVE THE LARGEST GHG IMPACT IN THE URBAN WATER CYCLE
2020 GHG EMISSIONS FOR OPTIONS TO RESOLVE IMPORT DEFICITS

- Increase Desalination (Carlsbad x2): 3,050,000 reduction
- 20% Mandated Water Efficiency Improvement with Carlsbad Desalination: 2,430,000
- 30% Water Efficiency Improvement with Carlsbad Desalination and 60% W/W Reclamation: 2,030,000

end-use reductions LARGER THAN water/wastewater footprint
SUMMARY

End use efficiency is the largest GHG opportunity in the California urban water cycle.

Solar hot water doubles the opportunity.

Additional water reductions to increase the opportunity:
- landscape changes
- greywater
- dual plumbing for reclaimed wastewater
- BEHAVIOR..

GHG reductions in water/wastewater facilities can SAVE MONEY:
- Energy efficiency
- Optimizing biogas/cogeneration
- Process optimization

...BUT ARE TOO SMALL TO MEET GHG TARGETS...
END-USE EFFICIENCY IS ESSENTIAL FOR MEETING AB-32 TARGETS WATER SUPPLY DEFICITS and probably very cost-effectively!
RESISTANCE

• End-users not in my scope (or water, wastewater, energy)
• Budget too full with “compliance”
• Water savings = revenue erosion
• You want to “throw out” 20-yrs of planning/EIRs?!!
• Solar is so easy - and “rewarding”
• Agriculture is bigger
• Efficiency is growth-inducing
• ... etc, etc, etc...

NEXT STEPS

• Pilot implementation
• Economic/financial “proof of concept”
  • avoided infrastructure costs (capital & operating)
  • efficiency costs (installation & maintenance)
  • climate change projections and uncertainties
  • revenue/rates