

Seawater Desalination in California: Energy and Greenhouse Gas Emissions



Heather Cooley
October 3, 2013

CalDesal Annual Conference; San Diego, CA

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New Pacific Institute Analyses

- Proposed plants
- Cost and financing
- Energy use and greenhouse gas emissions
- Marine Impacts
 - Intakes
 - Discharge
- Permitting process

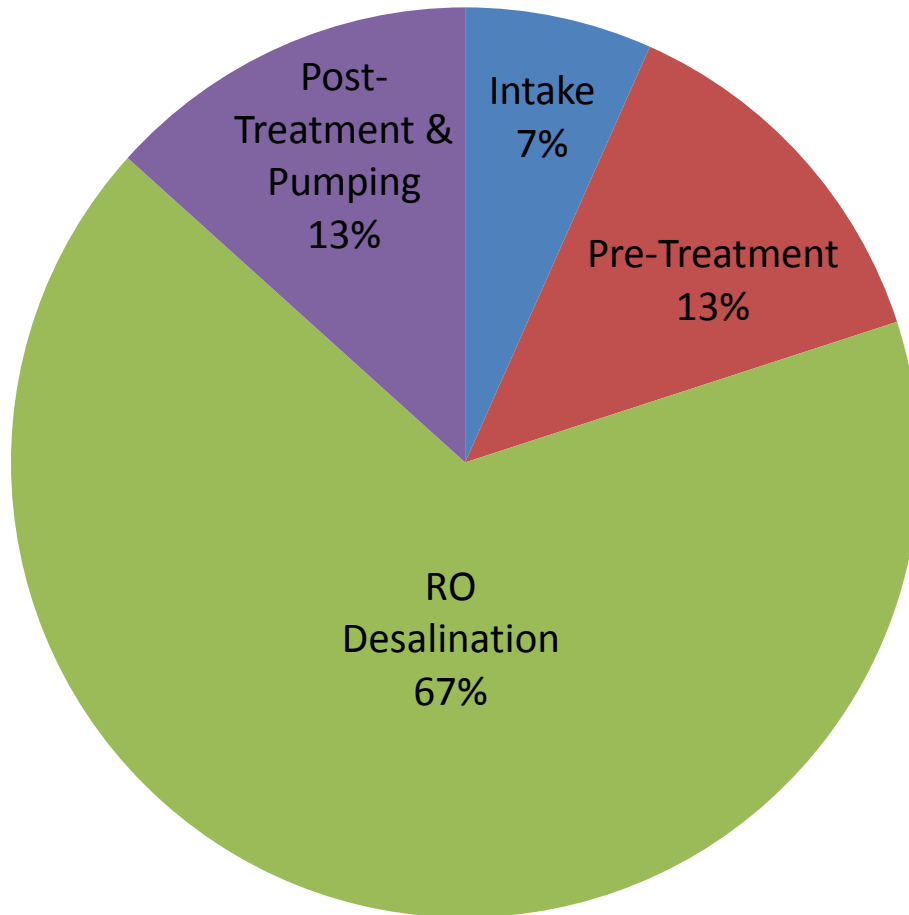
Currently Proposed Seawater Desalination Plants



**17 proposed plants
along the CA coast
and
2 in Mexico**



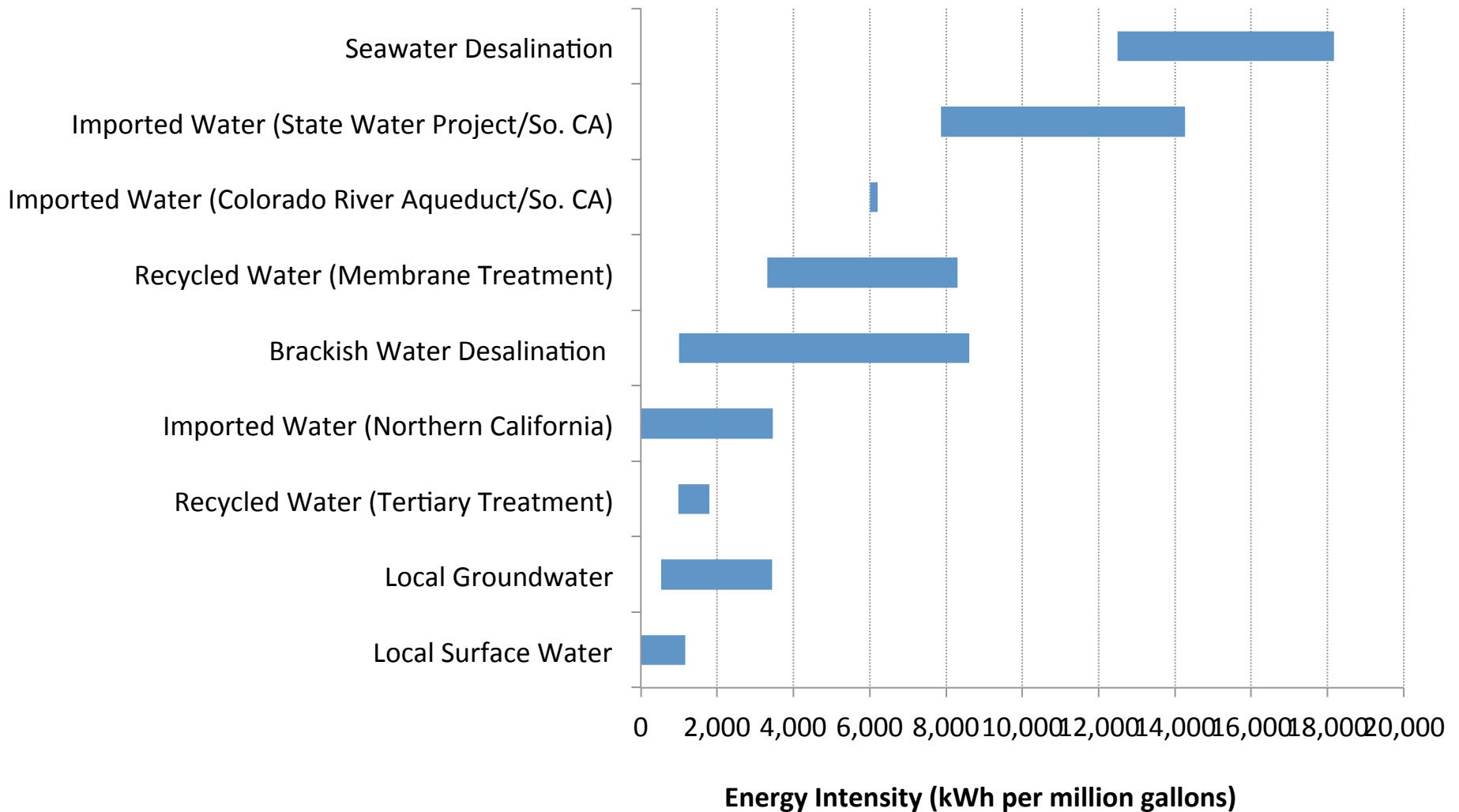
Desalination Energy Requirements



12,000-18,000
kWh per million
gallons

Theoretical minimum for RO
is around 3,400 kWh per
million gallons for 40%
recovery (for RO process
only)

Energy Intensity of California Water Supplies



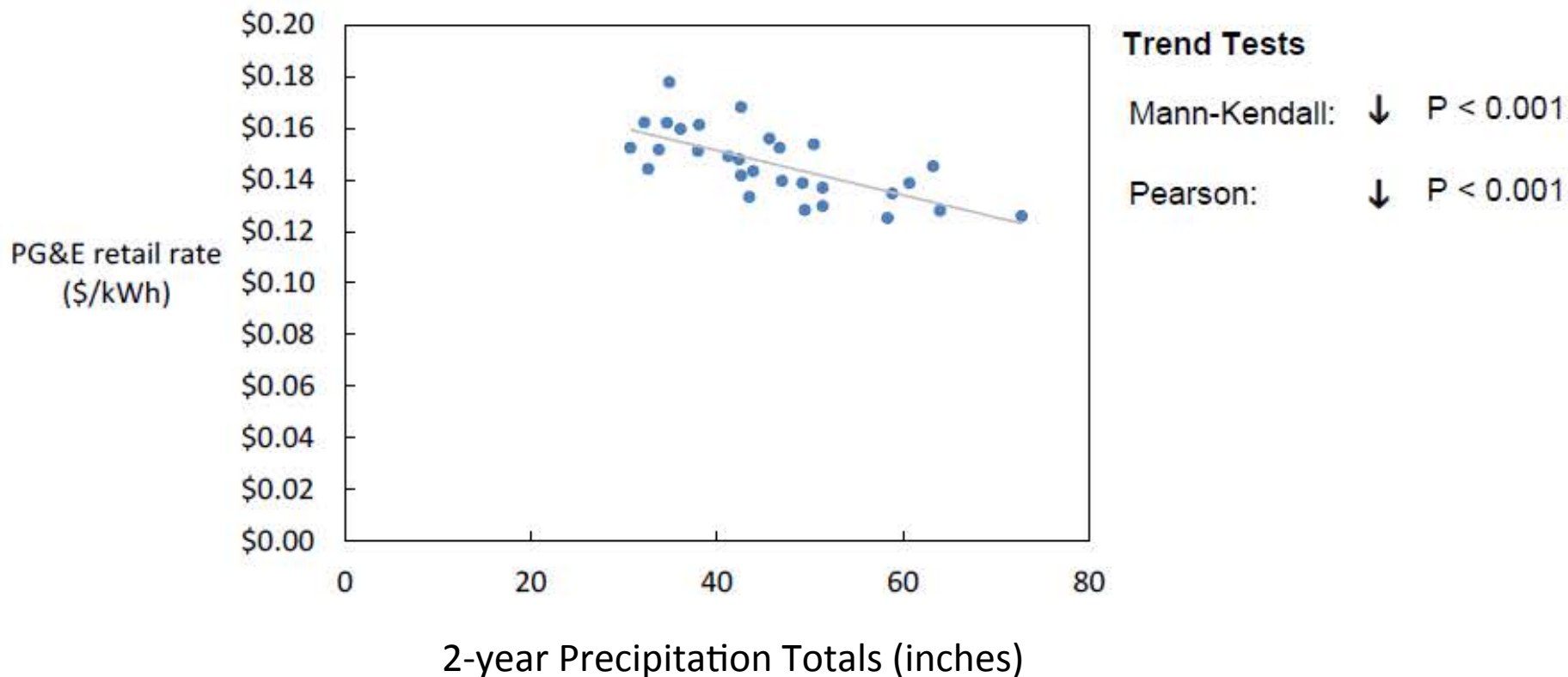
Energy and Cost

- Total energy costs are high, leading to increased exposure to short-term and long-term energy price variability
- Long-term: CPUC estimates that electricity prices will rise by nearly 27% from 2008 – 2020
- Short-term: precipitation affects costs

Correlation Between Precipitation and Retail Energy Price for Six CA Utilities

	Direction of Correlation	Correlation Coefficient	Pearson's R P-value	Mann-Kendall P-value
Pacific Gas and Electric (PG&E)	↓	-0.69	<0.001	<0.001
Southern California Edison (SCE)	↓	-0.49	0.005	0.003
San Diego Gas and Electric (SDG&E)	--*	+0.31	0.05	0.32
Los Angeles Department of Water and Power (LADWP)	↓	-0.38	0.02	0.03*
Sacramento Municipal Utility District (SMUD)	↓	-0.59	<0.001	<0.001
Burbank-Glendale-Pasadena (BGP)	--*	-0.25	0.15	0.10

PG&E's Retail Energy Rates Versus California's Two-Year Precipitation Totals for the Two Previous Years, 1982–2010



Energy and GHG Emissions

- Global Warming Solutions Act
 - California must reduce greenhouse gas emissions to 1990 levels by 2020
 - 4.8 MMTCO₂e from the water sector

Expanding the state's seawater desalination capacity by 514 MGD would:

- Increase energy use by about 2,800 GWh per year (1% increase above current electricity use)
- Generate 1.0 MMTCO₂e annually (0.2% increase above current emissions)

Measure	Reduction (MMTCO ₂ e)
Water Use Efficiency	1.4
Water Recycling	0.3
Water System Energy Efficiency	2.0
Reuse Urban Runoff	0.2
Increase Renewable Energy Production	0.9
Public Goods Charge	TBD
Total	4.8

Regulatory Framework

- California Environmental Quality Act
- California Coastal Commission
- Integrated Regional Water Management Planning Guidelines

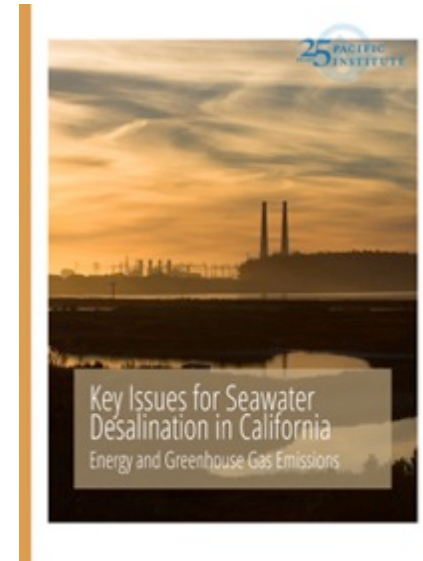
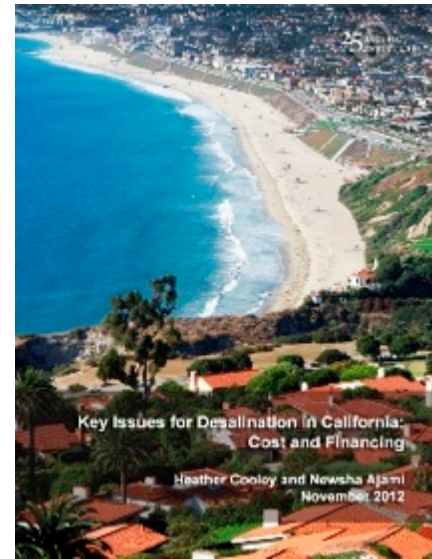
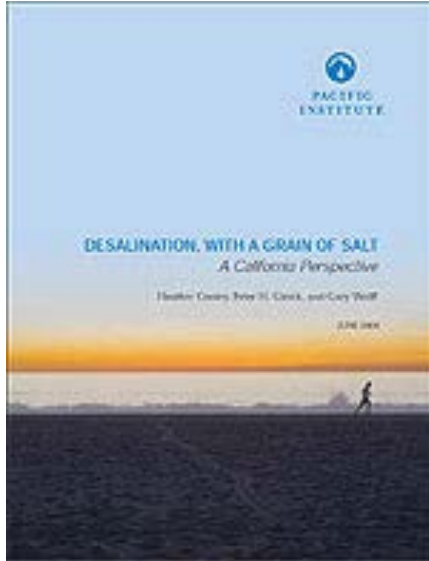
GHG Reduction Strategies: Reduce Total Energy Requirements

- More efficient pumps
- Energy recovery devices
- Higher-permeability membranes
- Utilization of waste or low-grade heat
- Hybrid membrane-thermal desalination
- Alternative desalination technologies, e.g, forward osmosis and membrane distillation

GHG Reduction Strategies: Renewables and Carbon Offsets

- Powering the plant directly with renewable energy
- Powering the plant indirectly with renewable energy
- Renewable energy carbon offsets

Thank you!



For more information, go to www.pacinst.org



654 13th Street, Preservation Park, Oakland, CA 94612

Phone: (510) 251-1600 Email: info@pacinst.org Web: www.pacinst.org