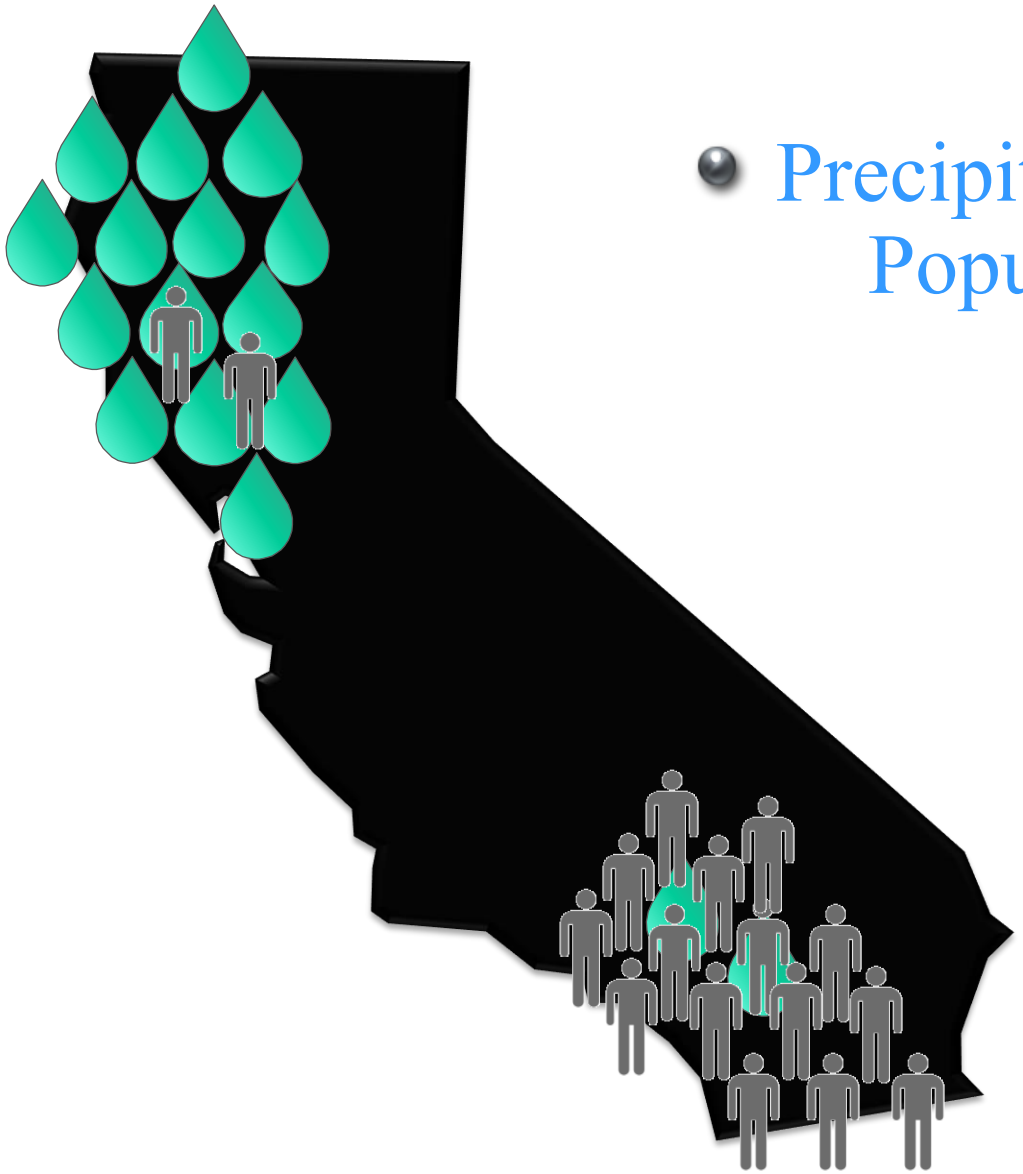
California Desalination Policy and Energy Impacts

Rob Oglesby
Executive Director
California Energy Commission

U.S. Department of Energy
Workshop on Energy Optimized Desalination Technology Development
San Francisco
November 6, 2015



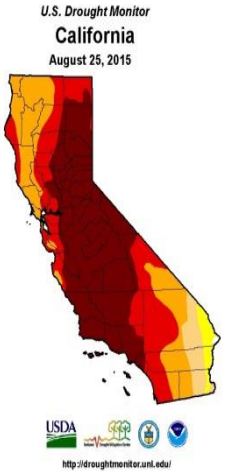
- Precipitation vs. Population

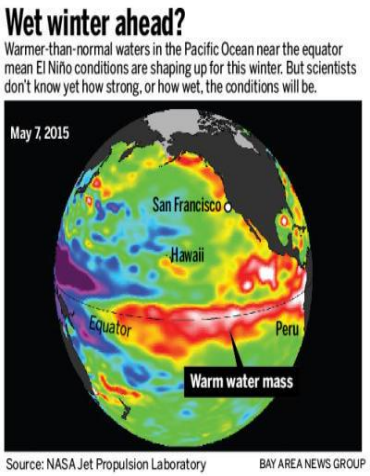
Major Water Projects

- Federal – Central Valley Project (CVP)
- State – State Water Project (SWP)
- Local – Many other projects throughout state, including Colorado River system, Hetch Hetchy, EBMUD, Owens Valley

Source: Water Environment Foundation

INTEGRATING DESAL INTO THE STATE'S RESOURCE MIX





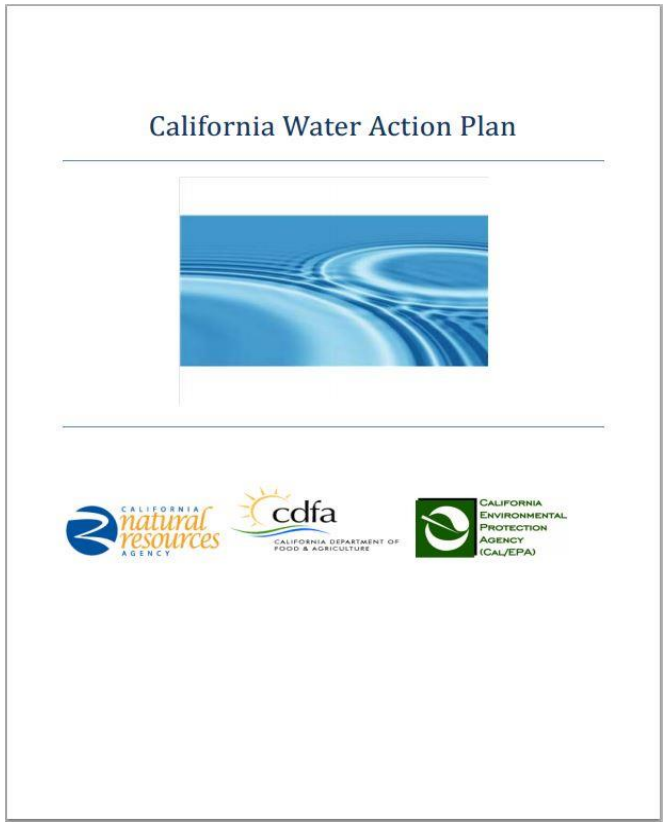
Drought → Godzilla of a wake up call

California's future depends upon an ever diversifying water portfolio: *"all of the above"*

Climate change, population growth *and* drought conditions

Seawater and brackish groundwater desalination can provide reliable local water supply options.

California Water Action Plan



- Make Conservation a California Way of Life
- **Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government**
- Achieve the Co-Equal Goals for the Delta
- Protect and Restore Important Ecosystems
- Manage and Prepare for Dry Periods
- Expand Water Storage Capacity and Improve Groundwater Management
- Provide Safe Water for All Communities
- Increase Flood Protection
- Increase Operational and Regulatory Efficiency
- Identify Sustainable and Integrated Financing Opportunities

INTEGRATING DESAL INTO THE STATE'S RESOURCE MIX

- While desalinated water currently is one of California's lowest volume drinking-water supplies it has an increasing role in our future.
- For many, but not all, California water suppliers, more cost-effective water supply options are available in the short run, with less energy/environmental challenge.
- Desalination is being considered more frequently as water supplies become constrained and desalination becomes more cost effective.
- California water suppliers required to evaluate desalination as a method to meet their water resource management goals.

POTENTIAL OPPORTUNITIES FOR DESALINATION

- The drought, and a plan, created the political consensus necessary to pass a $7.5 billion water bond last year.

- Bond focuses on supply, including $100 million for desalination, $100 million for conservation, $200 million for stormwater capture, $625 million for recycling, and $800 million for groundwater remediation.

SWRCB'S SEAWATER DESALINATION REGULATIONS

- First scoping meeting in 2007.
- Adopted May 6, 2015 as an amendment to the California Ocean Plan.

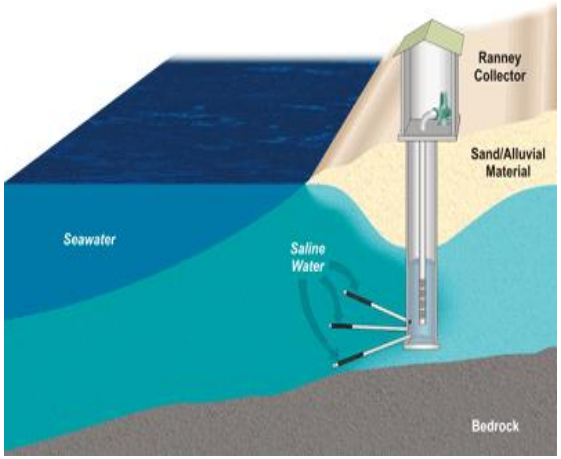
.

- Implemented through the regional water board permits.

CALIFORNIA'S SEAWATER DESALINATION REGULATIONS

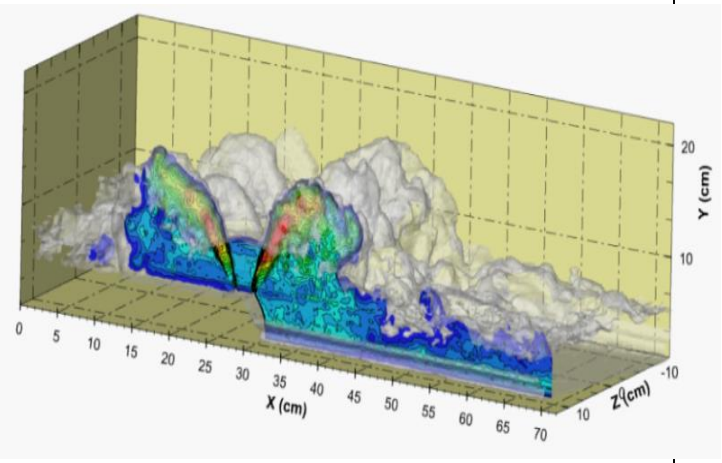
- The amendment needed adequate flexibility to account for site-specific considerations and future technological innovations.

- The amendment allows flexibility for intake designs and brine disposal methods that provide equivalent protection to preferred technologies.



Kennedy/Jenks

Intake Screens Inc.

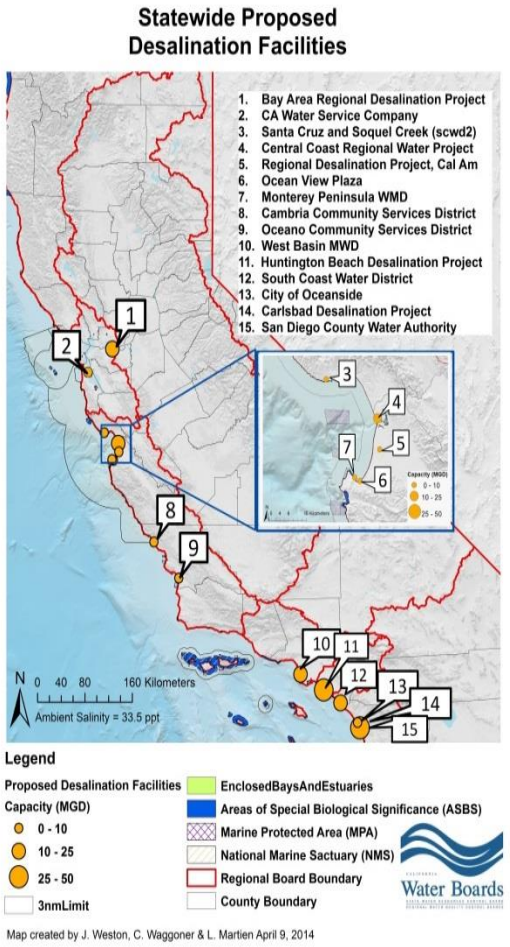


Roberts

CALIFORNIA'S SEAWATER DESALINATION REGULATIONS

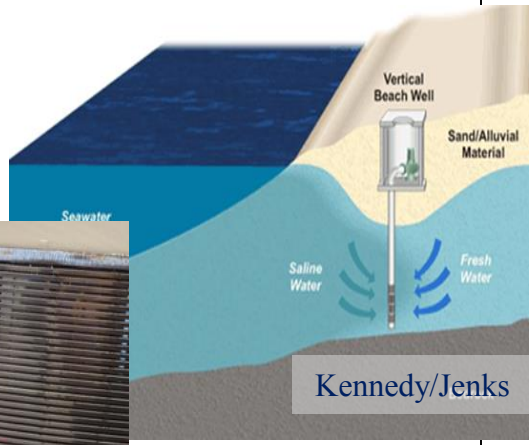
- Regional water boards will determine the best available site, design, technology, and mitigation measures feasible for each new or expanded seawater desalination facility.

- Regional water boards will use the desalination amendment as guidance to determine what is best for each individual facility.

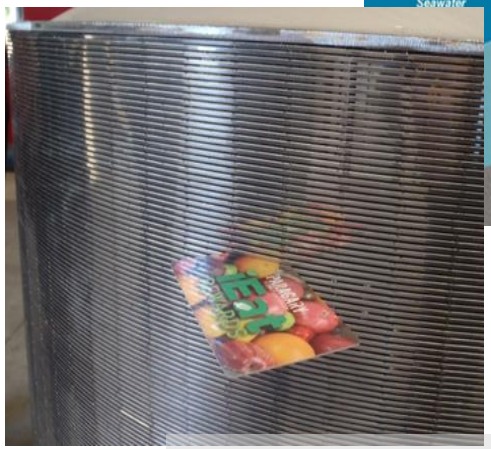


CALIFORNIA'S SEAWATER DESALINATION REGULATIONS: INTAKES

- Subsurface intakes required unless not feasible.
- "*'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors*."
- Surface intakes must be screened with a 1.0 mm slot-sized screen.
- Opportunity to apply to use an alternative screening technology.



Kennedy/Jenks


Intake Screens, Inc.

CALIFORNIA'S SEAWATER DESALINATION REGULATIONS: DISCHARGES

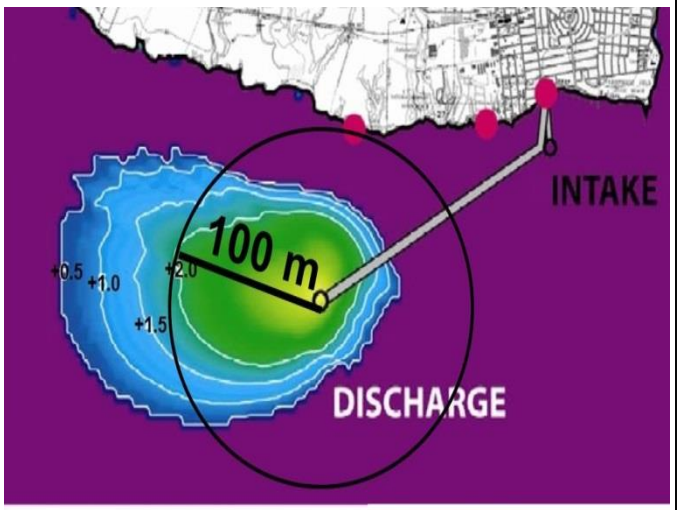
- Commingling brine with wastewater preferred.
- Multiport diffusers are the next best method for diluting brine when wastewater is unavailable.
- Flow augmentation is prohibited except at Carlsbad.
- Other technologies may be used if an owner or operator can demonstrate the technology provides a comparable level of protection as preferred technologies.

CALIFORNIA'S SEAWATER DESALINATION REGULATIONS: SALINITY LIMIT

- Applicable to all desalination facilities:

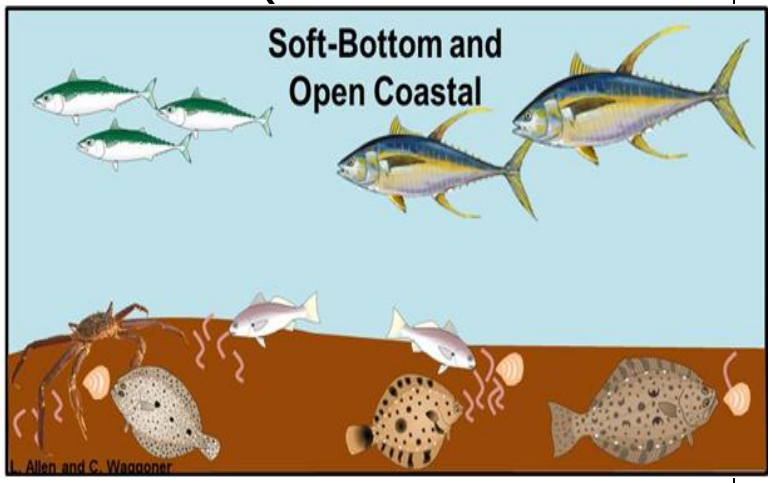
  "Discharges shall not exceed a daily maximum of 2.0 parts per thousand above natural background salinity measured no further than 100 meters (328 ft) horizontally from each discharge point. There is no vertical limit to this zone."

- An owner or operator may submit a proposal to the Regional Water Board for approval of an alternative (more than 2 ppt at 100 m) salinity receiving water limitation.



CALIFORNIA'S SEAWATER DESALINATION REGULATIONS: MITIGATION

- Mitigate for mortality of marine life associated (construction and operation).
- Out-of-kind mitigation only for:
  - soft-bottom
  - open ocean
- Mitigation ratios:
  - Based on relative productivity of habitats
  - Can be adjusted to account for uncertainty
- Conditionally permitted or expanded facilities:
  - Account for previously-approved mitigation projects
  - Require additional mitigation when making a new 13142.5(b) determination



MONITORING

- Monitoring and Reporting:
  - Standard Ocean Plan monitoring requirements.
  - Compliance monitoring with the receiving water limit for salinity.
  - Monitor for negative impacts associated with the discharge.
  - Facility-specific monitoring is required until the Regional Water Board determines regional monitoring is appropriate.

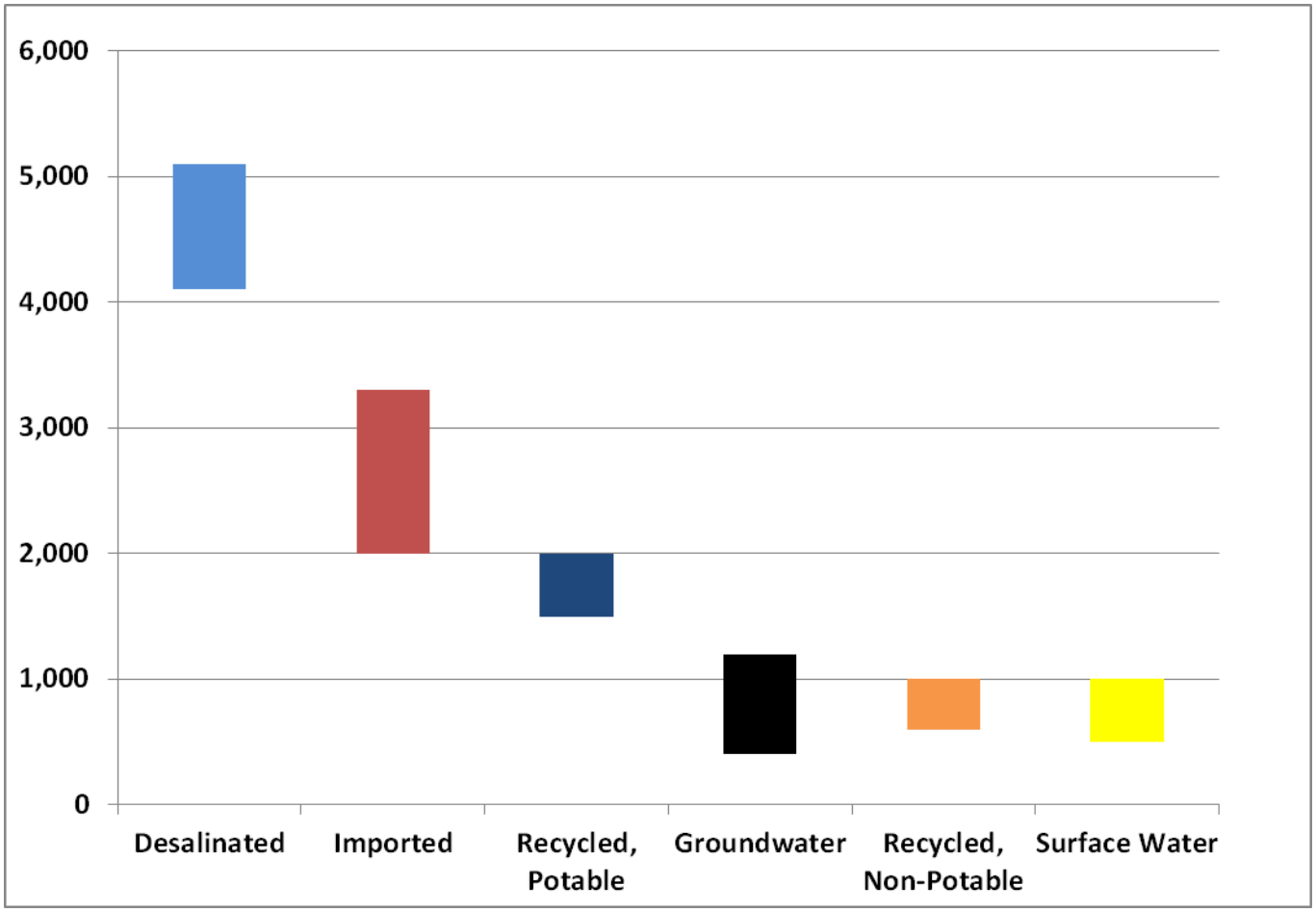
DESALINATION AND ELECTRICITY GRID IMPACTS

DESALINATION ENERGY REQUIREMENTS DECREASING

- **1980:** 36 MWh / acre-foot desalinized water produced

- **2013:** 4 -5 MWh / acre-foot

ENERGY INTENSITY
(ESTIMATED kWh/Acre-Foot)



ENERGY INTENSITY

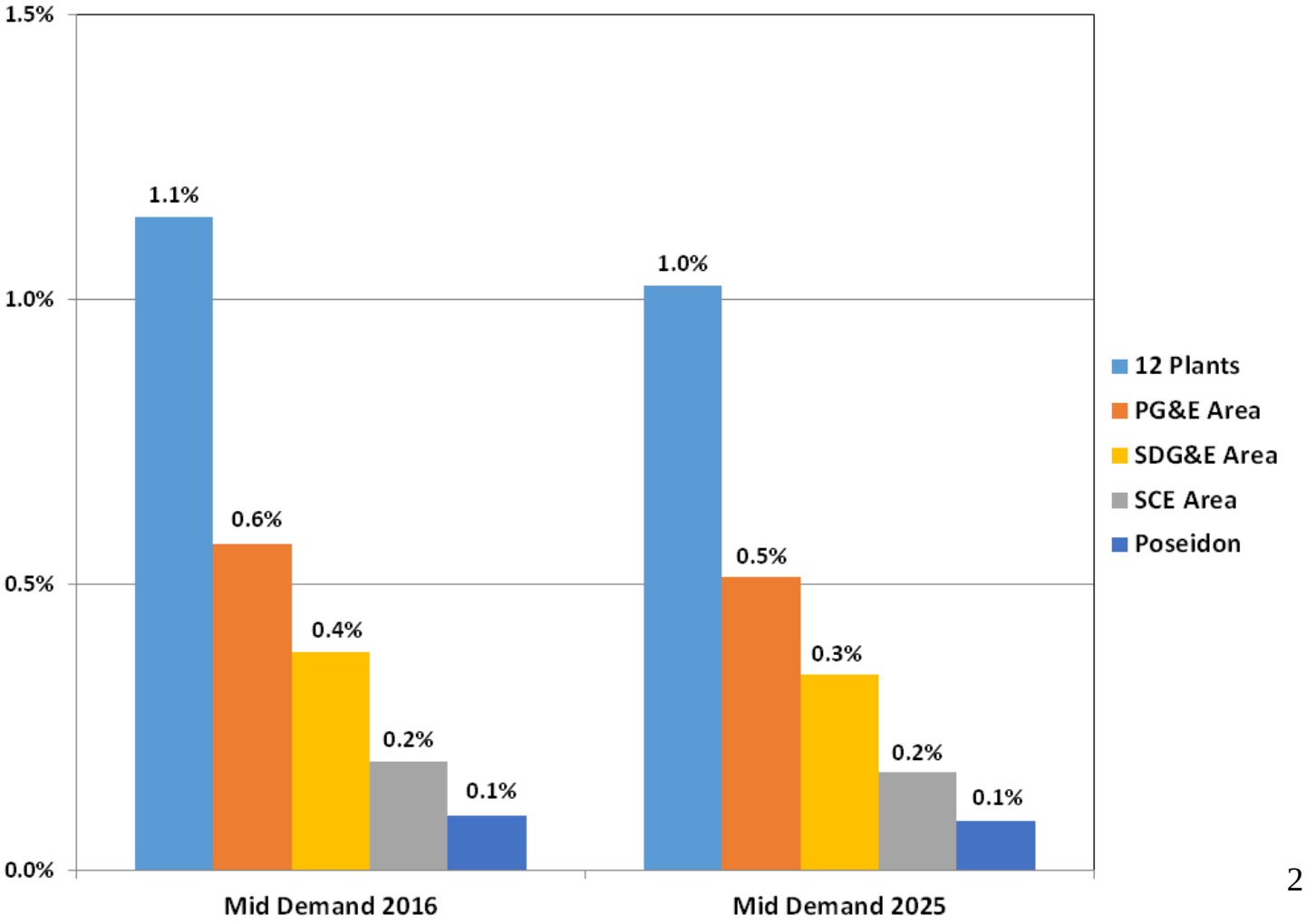
(ESTIMATED kWh/Acre-Foot)

• Conservation	Negligible
• Surface water	500 - 1,000
• Groundwater	400 - 1,200
• Recycled non-potable	600 - 1,000
• Recycled potable	1,500 - 2,000
• Imported water	2,000 - 3,000
• Seawater desalination	4,100 - 5,100

CALIFORNIA'S – DESALINATION ELECTRICAL ENERGY CONTEXT

- **Statewide Consumption:** 287,311 GWh in 2016 growing to 320,862 GWh by 2025
- Poseidon: 35 MW ; 274 GWh estimated
- 12 Poseidons = 3,288 GWh

DESALINATION AS PERCENTAGE OF STATEWIDE ELECTRICITY CONSUMPTION



SAN DIEGO COUNTY'S WATER SITUATION

- Dependent on imported water supplies from the Colorado River (64%) and State Water Project (19%)
- Long distance transport expensive
- No local aquifer to provide supply
- Interest in desalination long before drought
- Water bills average $75/month now
  - Expected to increase $5-7/month with Poseidon

POSEIDON'S CARLSBAD FACILITY

- Baseline load of approximately 30-35 MW
- Projected electricity use is about 4 MWh / acre-foot
- Less than 1% of San Diego Gas & Electric's forecasted coincident peak load in 2025
- Annual projected power use (274,400 MWh/yr) approximately 1% of SDG&E's forecasted consumption in 2025
- Provide 7-8% of San Diego County's water needs
- SDG&E - Additional 56 MVA (voltage stability), installation of two 12 kV circuits with meters

SO, WHAT'S THE PROBLEM?

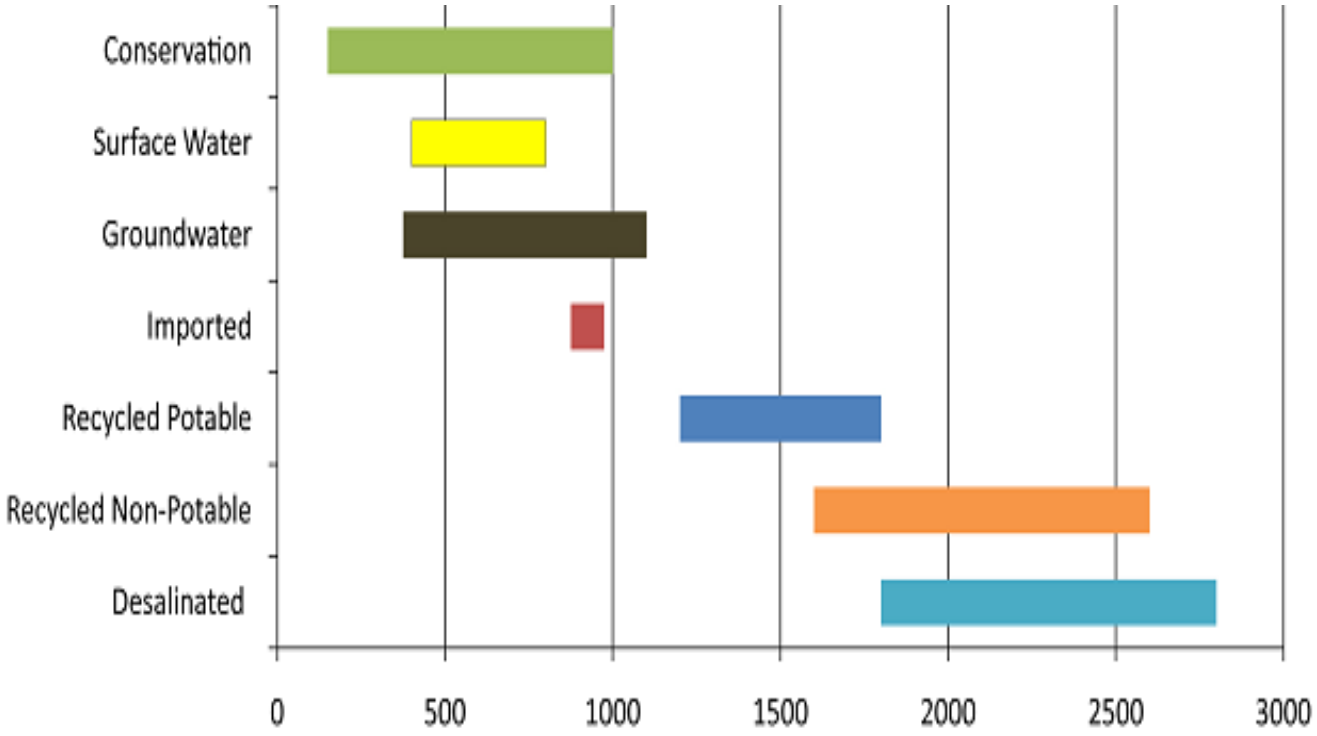
✓ Environmental Rules

✓ Grid Impacts

? Cost

RANGE OF MARGINAL COST FOR WATER

(ESTIMATED $/ACRE-FOOT)



WATER ALTERNATIVES COST COMPARISONS

Marginal Costs of Water in San Diego County ($/AF)

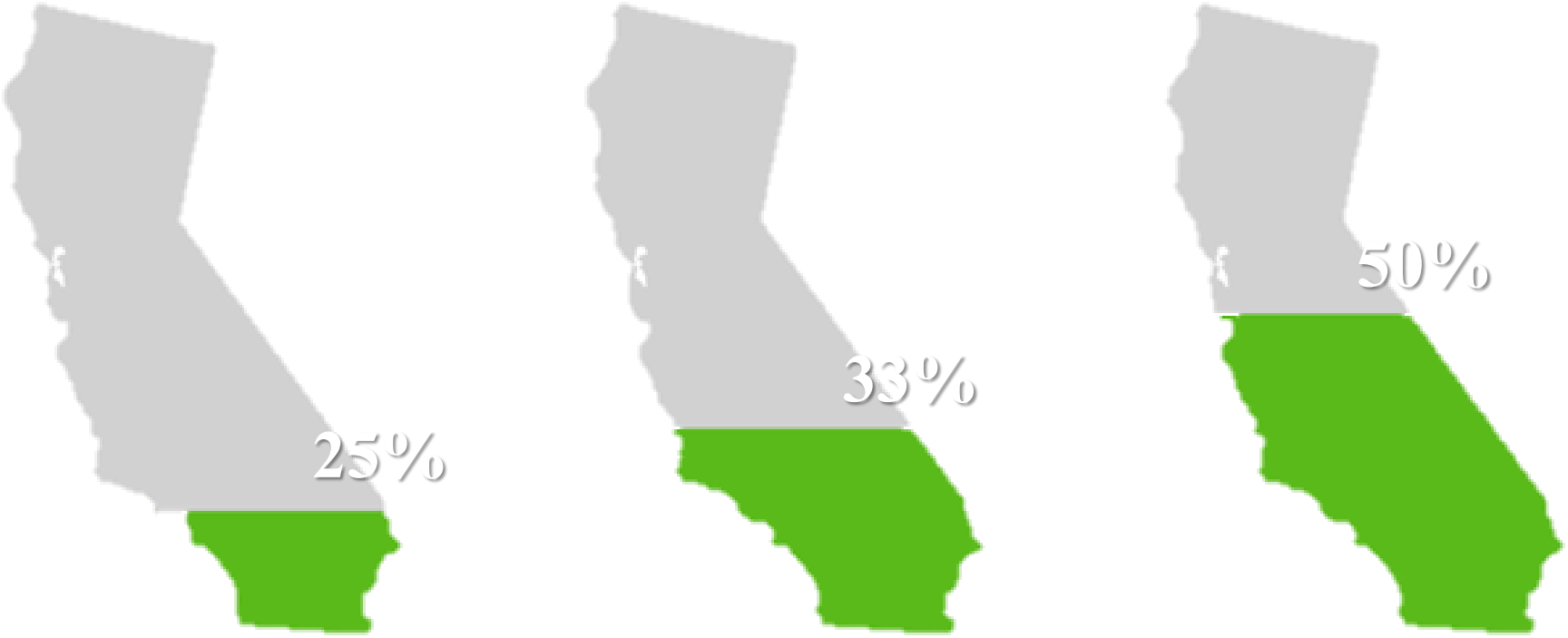
• Water efficiency/conservation	150-1,000
• Groundwater	375-1,100
• Surface water	400-800
• Imported water	875-975
• Recycled water (potable)	1,200-1,800
• Recycled water (non-potable)	1,600-2,600
• Seawater desalination	1,800-2,800

2010 dollars

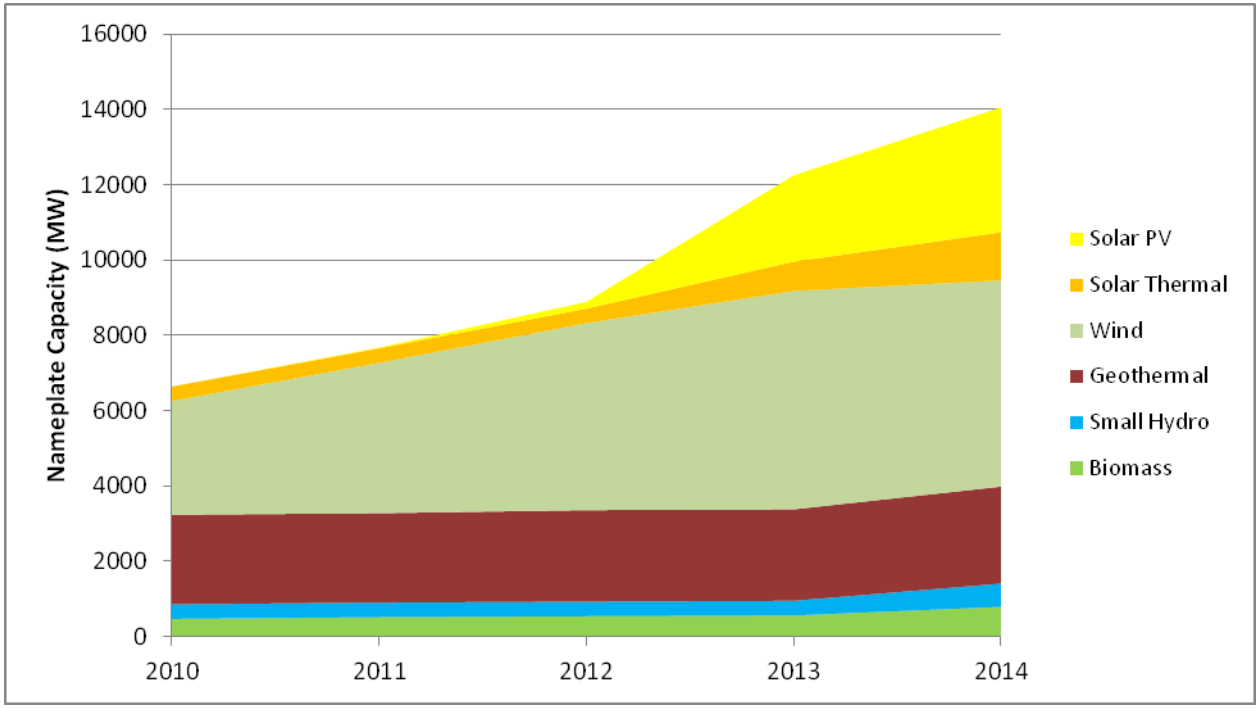
1 acre-foot equals 325,000 gallons

CAN RENEWABLES HELP LOWER THE COST OF DESALINATION?

California Renewable Goals



UTILITY-SCALE RENEWABLES OPERATING IN CALIFORNIA FROM 2010 THROUGH 2014



Sources: Energy Commission staff using QFER, source [8]; CPUC RPS contract database [D1]; California SO facility interconnections; and POU S-2 and S-5 Forms for 2014 [D2]. QFER collects data 45 days after each calendar quarter for power plants 10 MW and larger and annually for plants from 1-10 MW. Plants under 1 MW are not required to report under QFER. The data depict facilities on-line as of December 30, 2014. Updated June 30, 2015

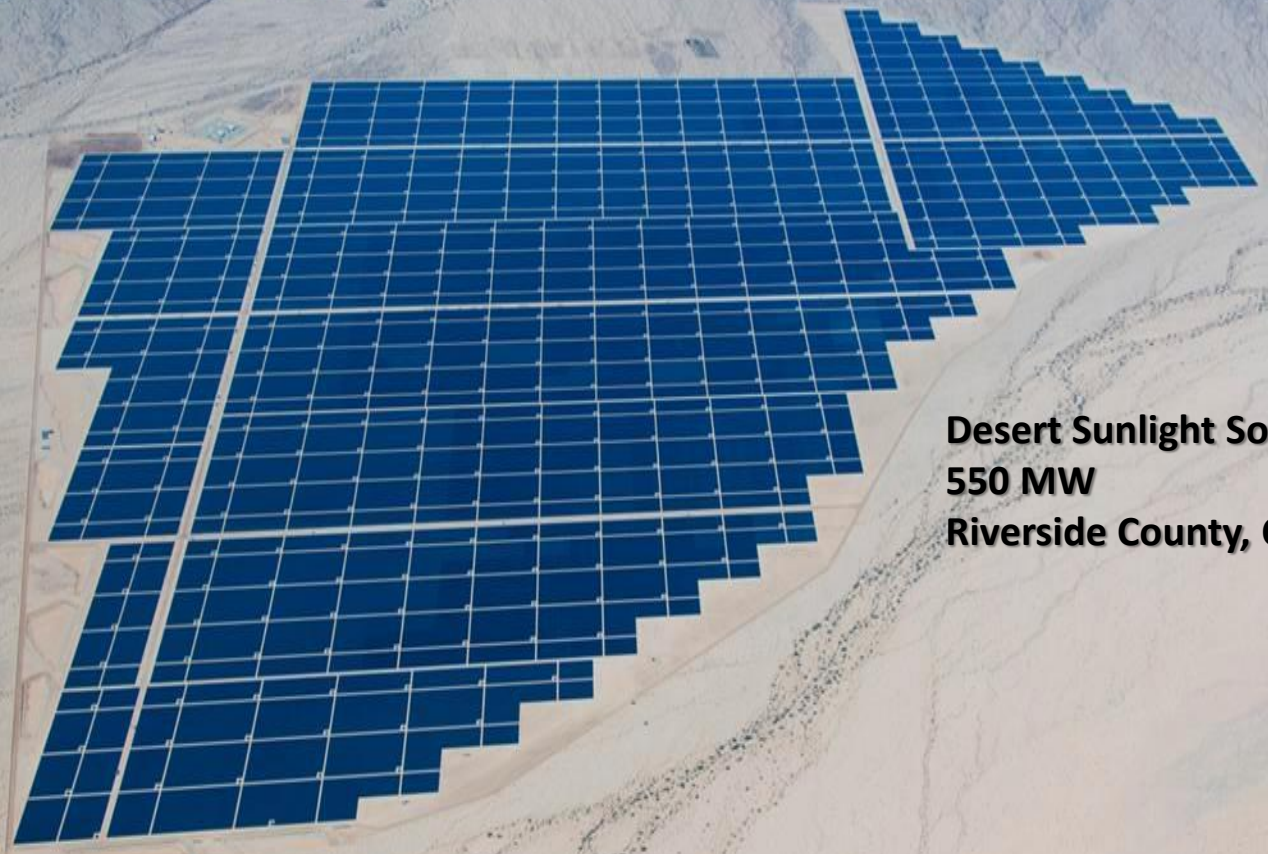
The World's Largest Wind Project

Alta Wind Energy Center
1550 MW
Kern County, CA

The World's Largest Geothermal Power Plant

Geysers Geothermal Power Plant
955 MW
Lake County, CA

The World's Largest Thin Film Solar PV Project



Desert Sunlight Solar Project
550 MW
Riverside County, CA

The World's Largest Silicon PV Project

The World's Largest Solar Thermal Power Plant (Tower)

Ivanpah Solar Thermal Project
393 MW
San Bernardino County, CA

The World's Largest Solar Thermal Power Plant (Trough)

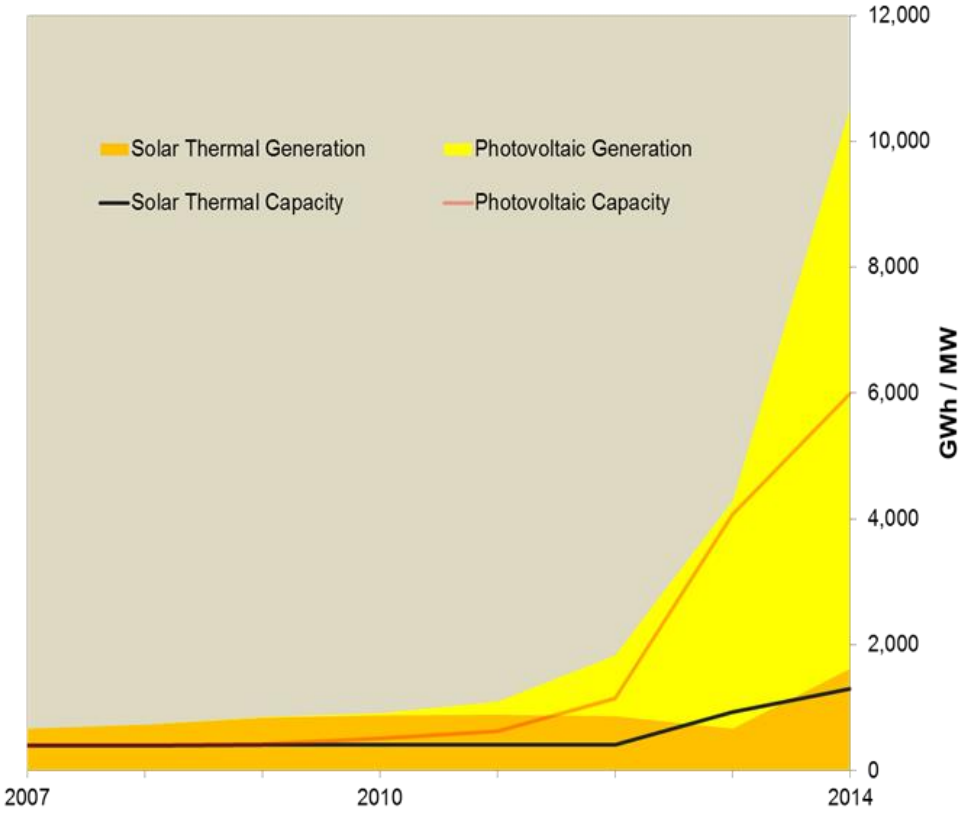
Solar Energy Generating System (SEGS)
354 MW
San Bernardino County, CA

CA Leads in New Solar Home Construction

Zero Energy Community
Rocklin, CA

27% of New Homes in Southern CA Being Built with Solar

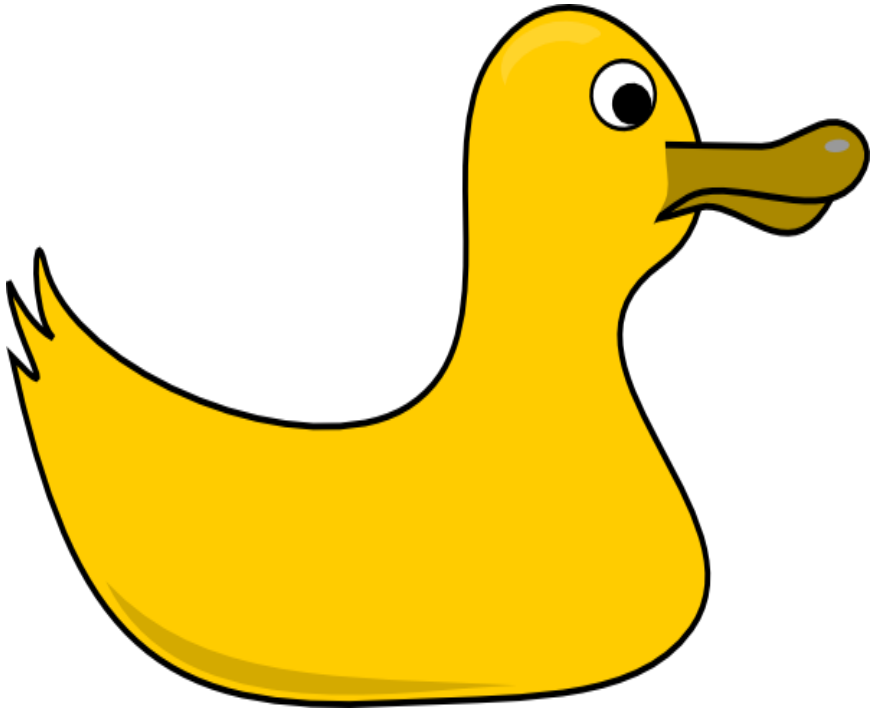
CALIFORNIA SOLAR GENERATION AND CAPACITY ADDITIONS 2007 THROUGH 2014



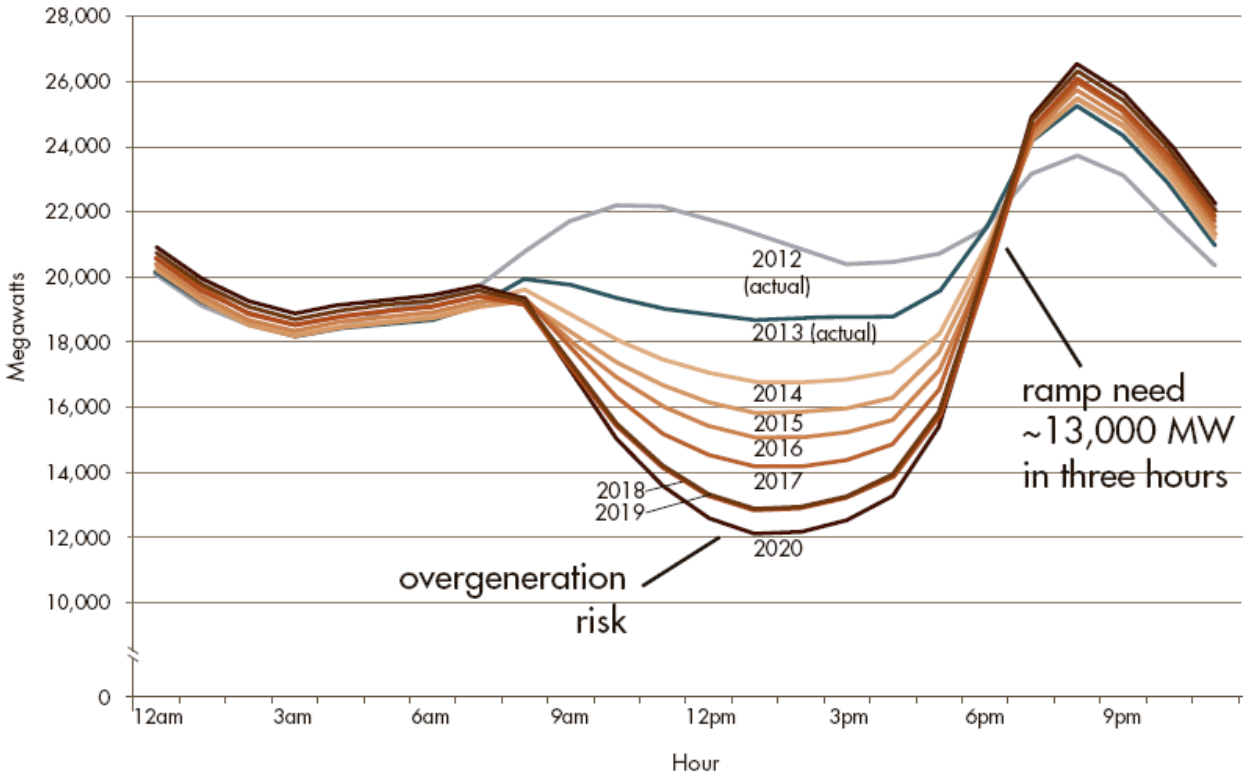
Renewable Integration Challenges

- Intermittency
- Load management
- Cost
- Over generation in the afternoon

Duck Chart



Cal ISO Duck Chart

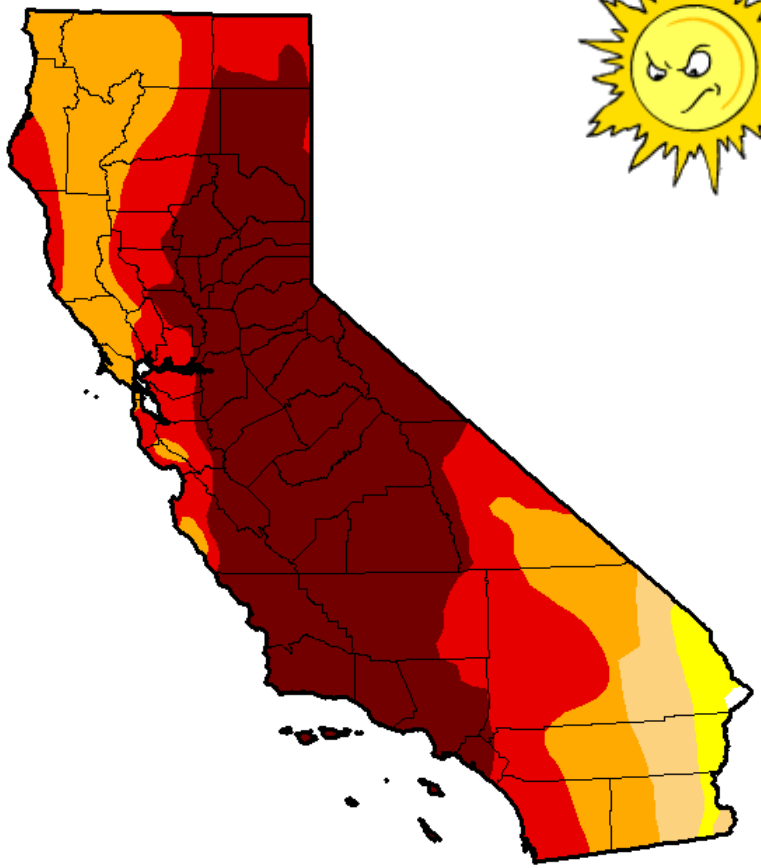


Source: California ISO

OPTIONS FOR OVER GENERATION

- Regional Grid Management
- Storage
- Electric Vehicles
- Waste Water treatment
- Desalination

At least it isn't humid!



Thank you