Is California's Energy System Resilient to Climate Change?
What is the State Government Doing?

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Outline

• Historical Perspective
• California’s Fourth Climate Change Assessment
• CPUC/CEC Adaptation Working Group
• What is next?
State-Sponsored Research

California begins supporting regional climate change science again in 2001.

Research draws on and informs national research efforts.

California creates the CA Climate Change Center – a virtual organization tasked with implementing 2003 research plan.

Research informs policy and long-term climate planning.
Electricity

LONG-TERM IMPACTS
• Need for More Generation on Hottest Days
  • Decreased Gas Plant Generation Efficiency
    • Need additional GW (8%)
  • Peak Period Demand (90%tile)
    • 21% higher cooling demand
    • Need additional GW (27%)
• Substation Loss
  • 2.7% higher losses
  • Need more GW (3.6%)
• Total Required Generation Capacity:
  • Need 39% more capacity GW
• Need for More Transmission Capacity
  • Transmission lines
    • 7% - 8% loss of peak period capacity (static rating)
    • Need up to 31% additional transmission capacity

NEAR-TERM IMPACTS
• Same as long-term but at a lesser degree. For example:
  • Additional capacity of 1.6 GW in the next 10 years (IEPR)

Source: Sathaye et al., 2013
Hydropower

- **Multiple studies** (low and high elevation units)

- **Figure illustrates modeling work by UC Davis** (high elevation ~75% MWh)
  - 56 reservoirs
  - 85 run-of-river hydropower plants
  - 16 variable head hydropower plants
  - 125 diversion channels
  - 106 instream flow requirement points
  - Weekly time step

- **General results:**
  - Overall reductions in generation
  - Less generation available in the summer. Shift to generation in the winter

Viers et al., 2012
Natural Gas System

- The Sacramento-San Joaquin Delta is protected by levees. Delta islands are below sea level.

- Energy Facilities:
  - Underground natural gas reservoirs
  - Transmission lines
  - Natural gas pipelines

- Prof. Radke (UC Berkeley) worked very closely with PG&E.

Source: PPIC 2007
Coastal Impacts

• Potential risks to coastal power plants and substations.

Source: Heberger et al., 2012
Wildfires would affect transmission lines

<table>
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<tr>
<th>End of century change in the probability a wildfire affects a transmission line</th>
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<td><strong>B1 Scenario</strong></td>
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<td><strong>A2 Scenario</strong></td>
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**Climate Change, Growth, and California Wildfire**
Publication Number: CEC-500-2012-057

**Estimating Risk to California Energy Infrastructure from Projected Climate Change**
Publication Number: CEC-500-2009-046-F

![Map of California showing wildfire risk](image-url)
California’s Fourth Climate Change Assessment

- Funded by CNRA and CEC
- Directed by CNRA, OPR, and CEC
- About 30 commissioned studies (~15 on energy issues)
- Statewide, regional, and topical reports
- To be released in the Fall of 2018
CPUC/CEC Adaptation Working Group

• Co-Chaired by CEC Chairman Weisenmiller and CPUC Commissioner Randolph. Includes representatives from the Natural Resources Agency, Governor’s Office of Planning and Research, and the Office of Emergency Services.

• Meets every quarter to coordinate climate adaptation related activities.
What is next?

• More discussions on how to make CEC research activities more actionable. It is no longer enough just to show that there is a need to adapt.

• It would be almost impossible to support actionable science without a direct connection to stakeholders (IOUs) and ratepayers. However, the IOUs must become comfortable with sharing data and information with the researchers.

• Research results would inform rate cases to finance climate adaptation.
Thank you!

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