



Climate Resilient Planning For the Energy System In California

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Outline

- Brief introduction about the California Energy Commission (CEC)
- Description about CEC work related to climate adaptation for the energy sector
- Adaptation to climate variability using satellite products

California Energy Commission

- The CEC is the lead energy planning agency in California.
- The CEC manages the following programs:
 - Permitting of thermal power plants larger than 50 MW.
 - Setting and enforcing of CA energy standards for buildings and appliances.
 - Support of energy efficiency and renewable programs with grants and loans for all the components of the energy sector.
 - Support energy research with a total budget of more than \$200 million a year.

CEC and Energy Adaptation

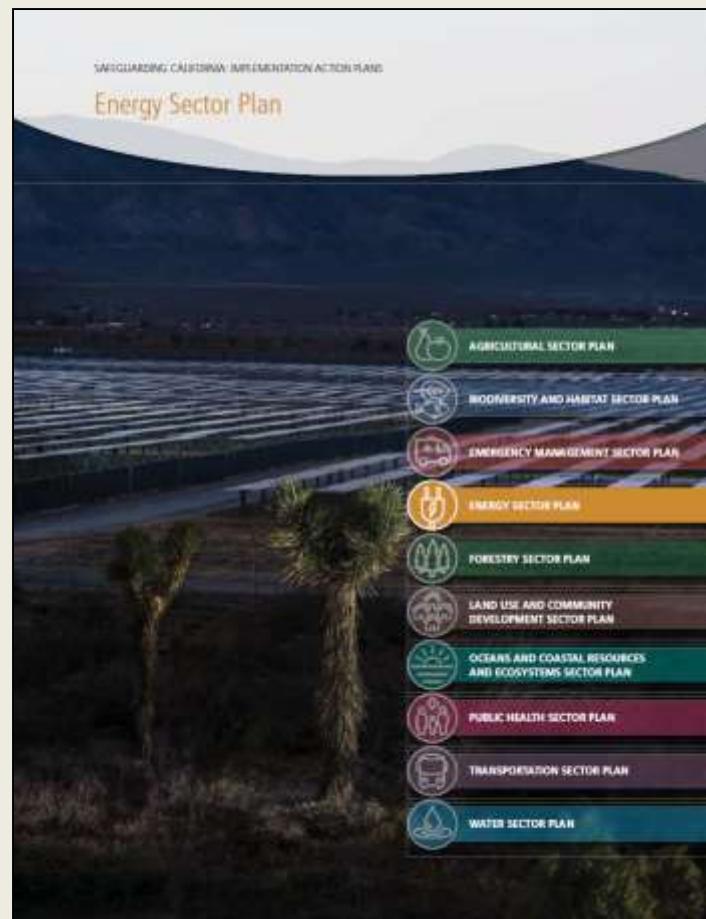
- CEC has been supporting regional climate change science since the early 2000s to complement federal efforts.
- The CEC led the preparation of climate assessments that have been very influential in policy circles in California (e.g., passage of AB32, adaptation work).
- The State is now preparing California's Fourth Climate Assessment



CEC and Energy Adaptation (cont.)

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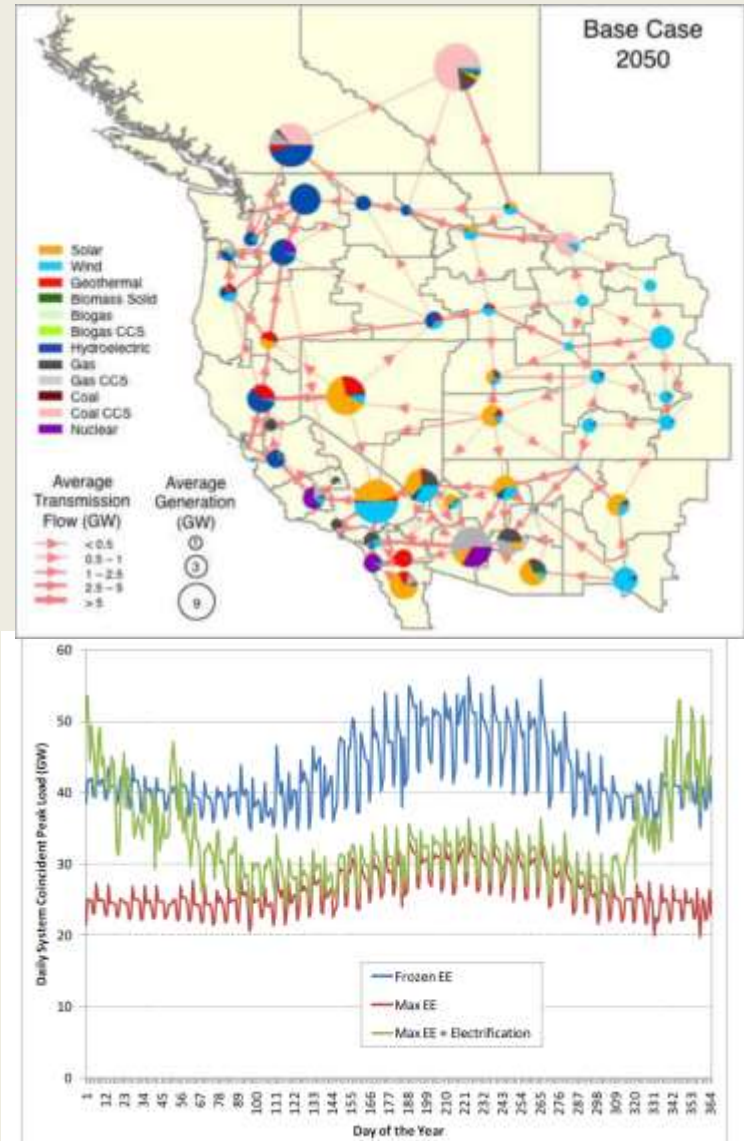
- CEC and CPUC are working very closely on adaptation for the energy sector.
- Formation of Climate Adaptation Working Group by the CEC and CPUC.
- Three adaptation Bills were signed into law by the Governor in late 2015.



Transformation of the Energy System

- The electricity system is changing very rapidly (e.g., 50% generation from renewables by 2030)
- This represents an opportunity to develop a more climate resilient system using:
 - Microgrids that protect important services/areas
 - Smart grid
 - Distributed generation
 - Other features
- On-going research project with LBNL, UC Berkeley, UC Irvine, and E3 to explore long-term climate scenarios with **deep GHG reductions that are less vulnerable to climate impacts.**

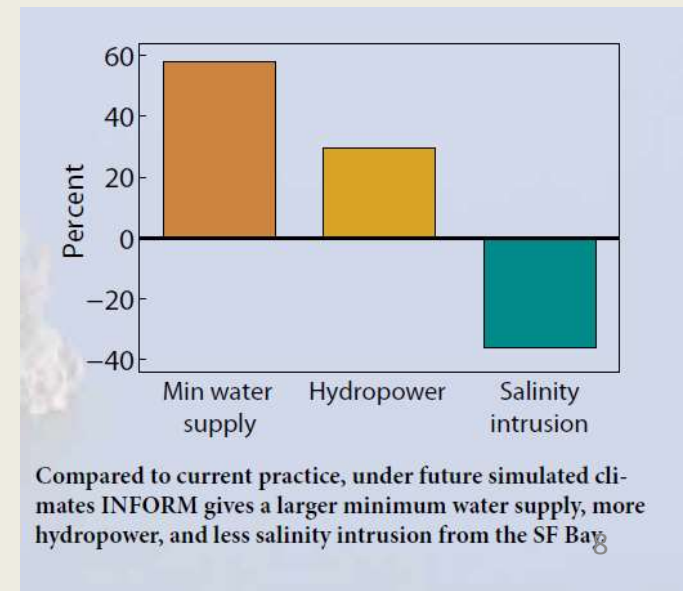
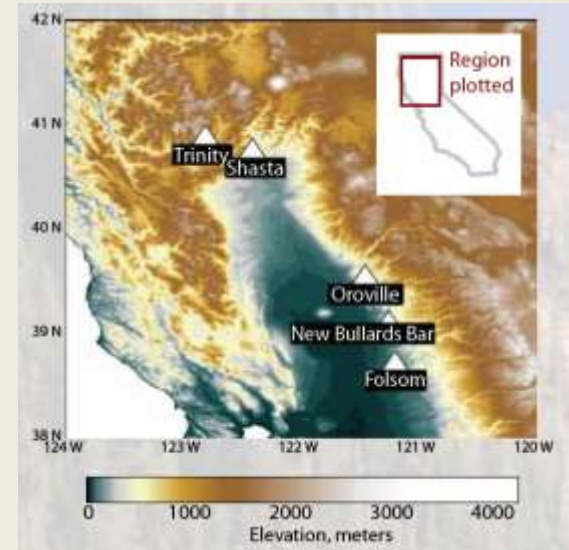
Source: Wei et al., 2012



Adaptation to Climate Variability Now
is a Good Starting Point to Adapt to
Climate Change and Potential
Increases in Climate Variability

Multipurpose Water Reservoirs

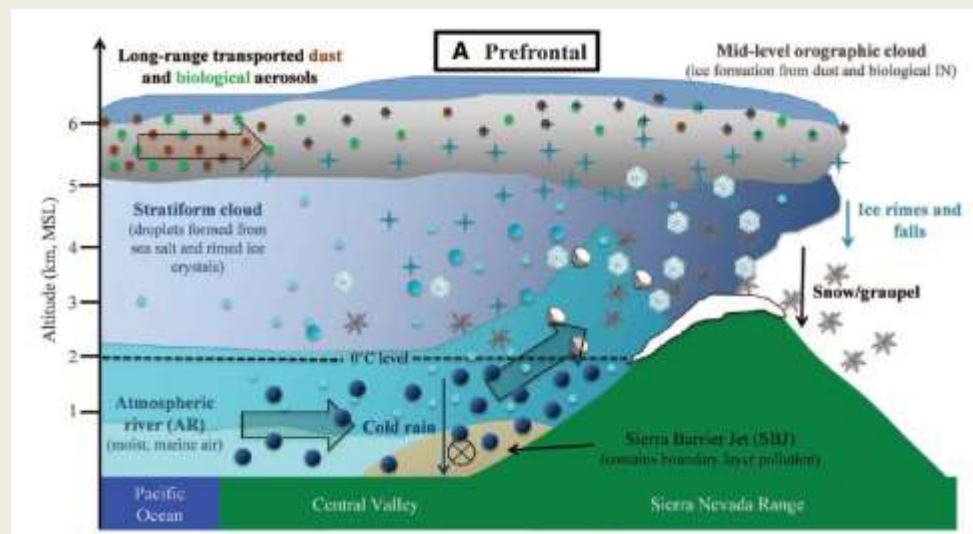
- INFORM, a project supported by NOAA and CEC, conclusively showed that the use of probabilistic forecasts and a modern decision system could significantly improve the management of water resources.
- INFORM was also shown to be an excellent climate adaptation tool
- The problem is the lack of resources to change the existing operating rules.



Aerosols Play a Significant Role in California's Climate

- CalWater I, a study funded by the CEC, conclusively demonstrated the importance of intercontinental transport of aerosols to precipitation in the Sierra Nevada*.
- Satellite data was used to track the transport of dust/bacteria, which are excellent ice nuclei.
- Models digesting satellite aerosol data could substantially improve forecasts.
- Regional climate models do not consider the impacts of aerosols in our climate.

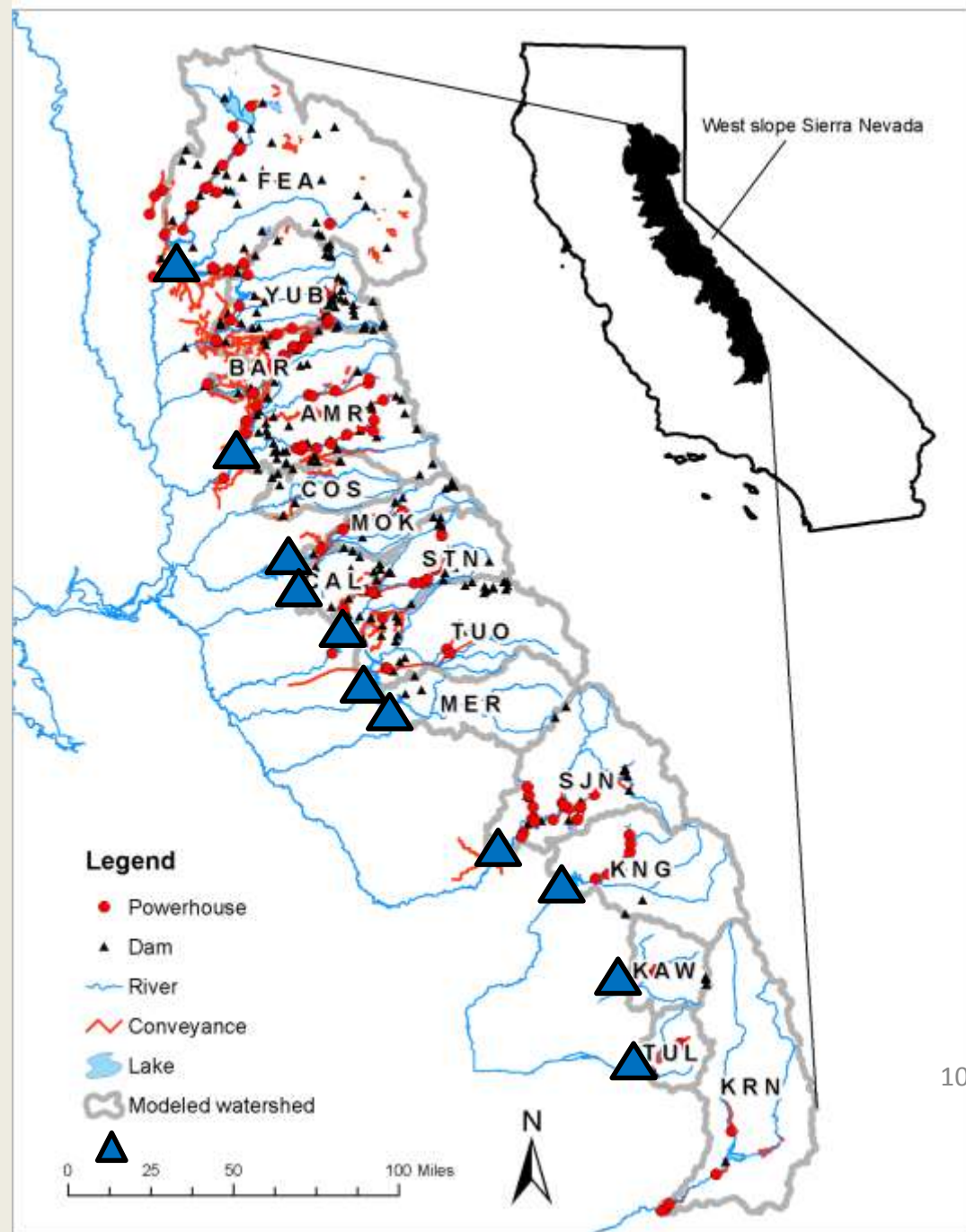
Creamean et al., Science 2013



*Aerosols of local origin mostly act as CCN

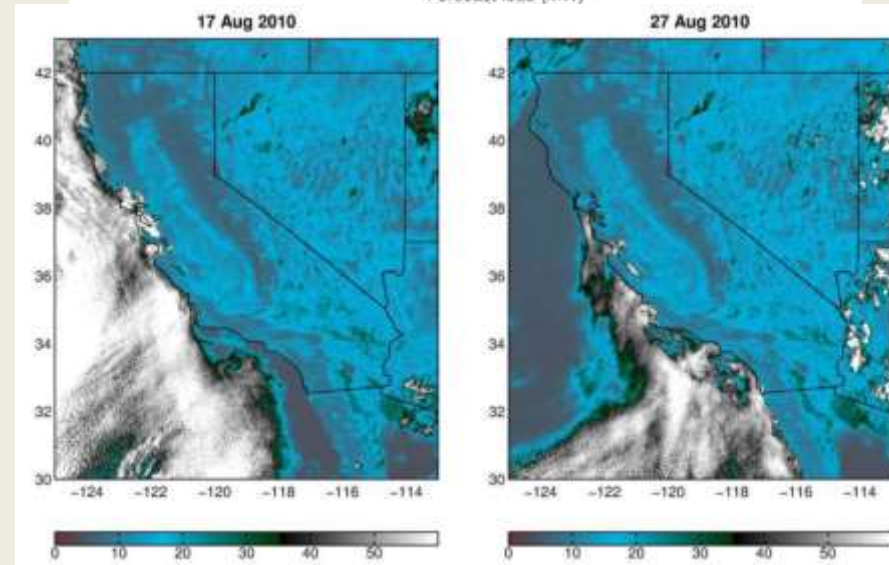
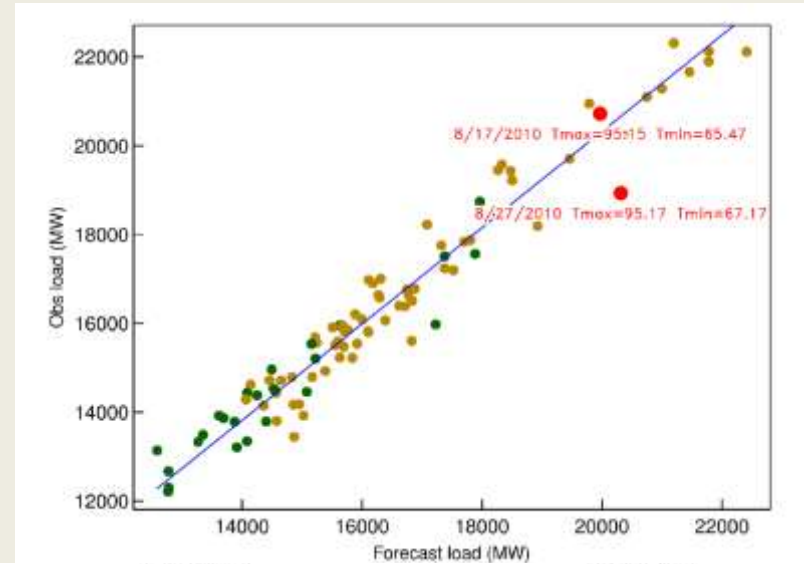
Hydropower

- **Potential Impacts of Climate Change:**
 - Overall reductions in generation
 - Less generation available in the summer. Shift to generation in the winter
- **Improved forecast will improve the management of high elevation hydropower units**
- **Use of satellite to better estimate the water content in the snowpack could substantially improve the management of water resources and hydropower generation in particular. On-going work with NASA/JPL**



Errors in Peak Load Forecasting and Clouds

- Some forecast errors of peak electricity demand are due to the presence of low clouds.
- GOES satellite readings can provide early morning observations about low clouds.



Thank you!

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