



California Energy Commission

**ADAPTATION...**  
**to Climate Change...**  
**and to Climate Variability**

Energy Aware Planning Guide Workshop

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## What is “Climate Change”?

**According to the Intergovernmental Panel on Climate Change (IPCC):**

***Climate change*** refers to a statistically significant variation in either the mean state of the *climate* or in its *variability*, persisting for an extended period (typically decades or longer).



## What is “Adaptation”?

**According to the California Adaptation Strategy (CAS) it involves:**

Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which minimizes harm or takes advantage of beneficial opportunities.

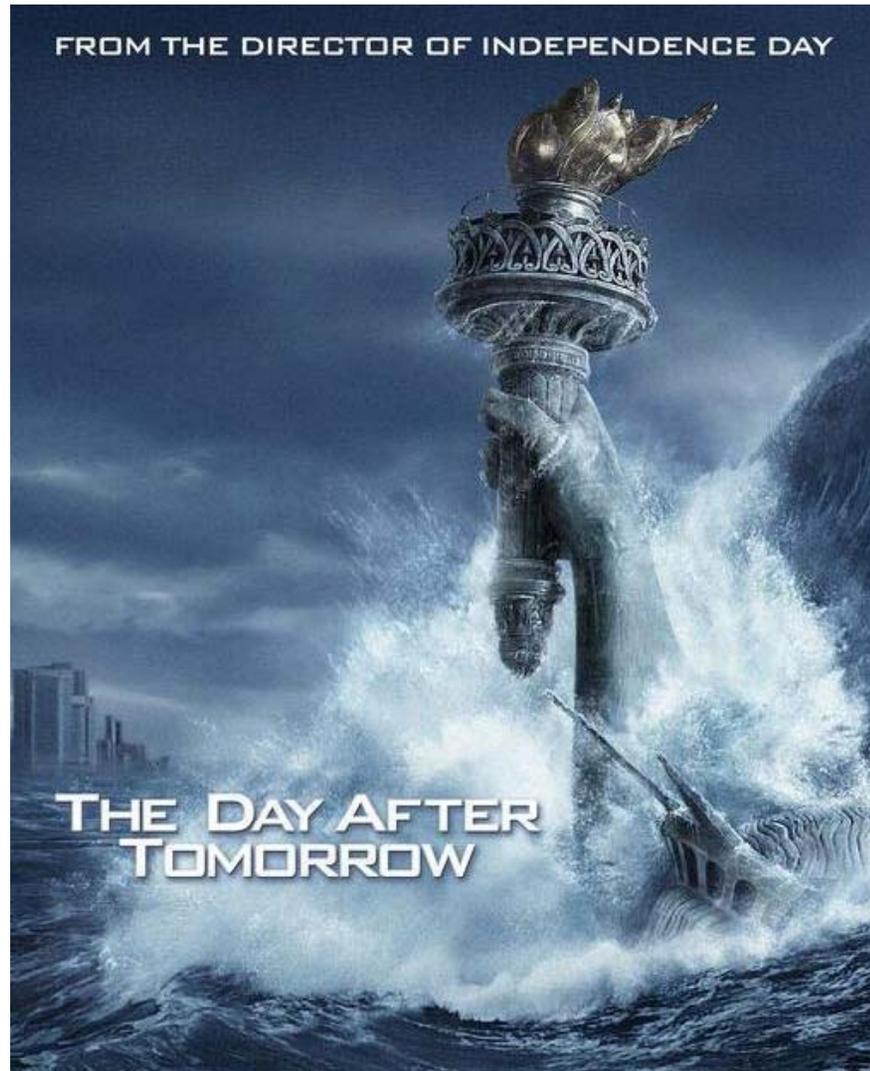


## Why Adaptation?

- Climate change impacts are ***already*** occurring
- Future climate impacts projected to be worse
- Next 10 estimates that \$2.5 trillion at risk from extreme weather events, sea level rise, and wildfires
- Opportunity to reduce risks and build resistance
- Governor's Executive Order S-13-08



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**So, should  
NYC  
be planning  
to “adapt”  
to this?**



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CA adapt to this? (Lake Oroville, 3/12/09)





### Adapt to Floods, More Rain Instead of Snow



Photo by:  
Dale  
Kolke



# California Has Species at Risk



Sea Otters

Photo by: Ed Bowlby



Pika

Photo by: Hugh Rose



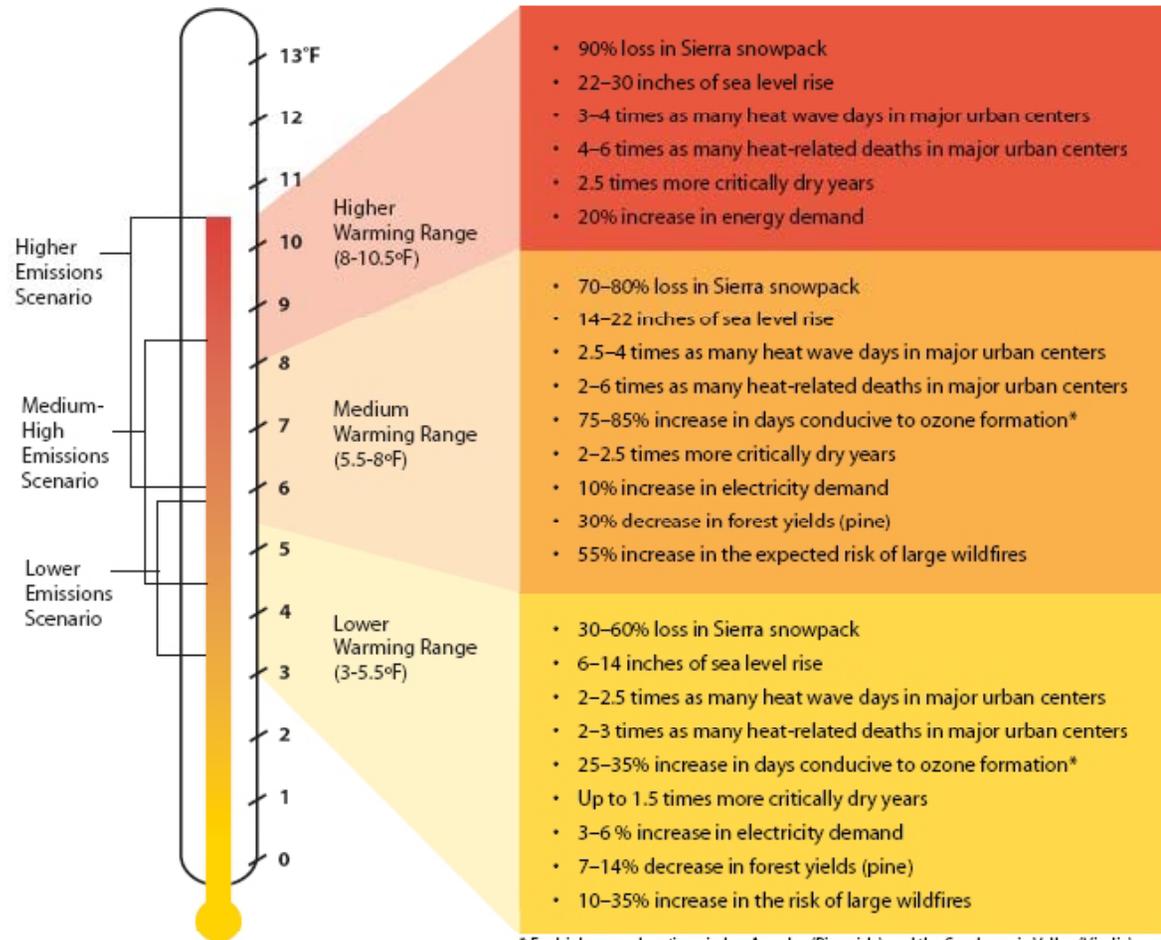
# Research Essential for Adaptation

- The Energy Commission was directed to assess climate change back in 1988 (Assembly Bill 4420 - Sher)
- Since creation of the PIER research program, CEC has produced many reports on the topic of climate change ([www.climatechange.ca.gov/publications/energycommission.html](http://www.climatechange.ca.gov/publications/energycommission.html))
- PIER climate research areas:
  - Regional climate monitoring, analysis, and modeling
  - GHG Inventory Methods
  - Options to reduce GHG emissions & economics
  - Impacts and adaptation studies



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## Summary of Projected Global Warming Impact, 2070–2099 (as compared with 1961–1990)

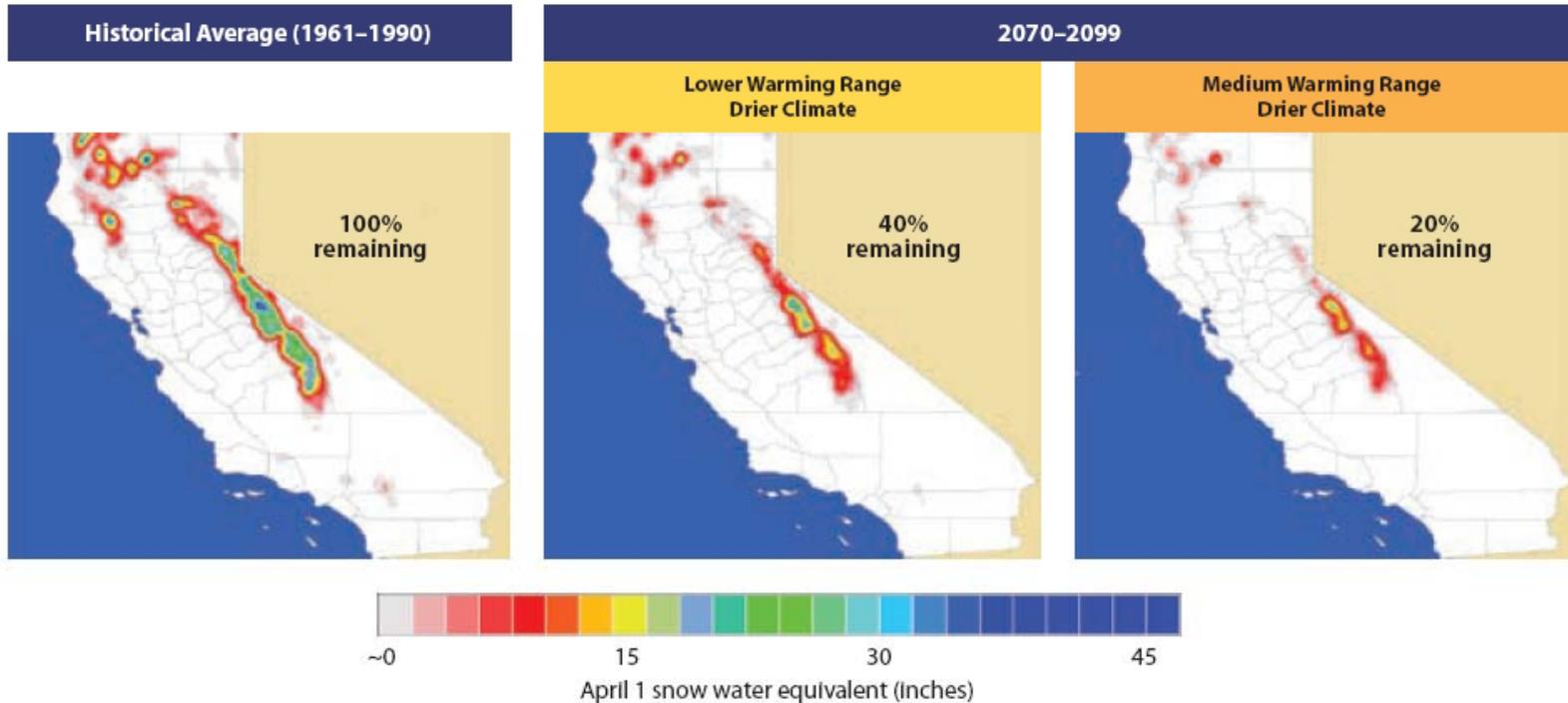


\* For high ozone locations in Los Angeles (Riverside) and the San Joaquin Valley (Visalia)



# PIER Research on Snowpack

## Decreasing California Snowpack





# California Energy Commission

## THE IMPACTS OF SEA-LEVEL RISE ON THE CALIFORNIA COAST

A Paper From:  
**California Climate Change Center**

Prepared By:  
**Matthew Heberger, Heather Cooley,  
Pablo Herrera, Peter H. Gleick, and Eli  
Moore of the Pacific Institute**

### DISCLAIMER

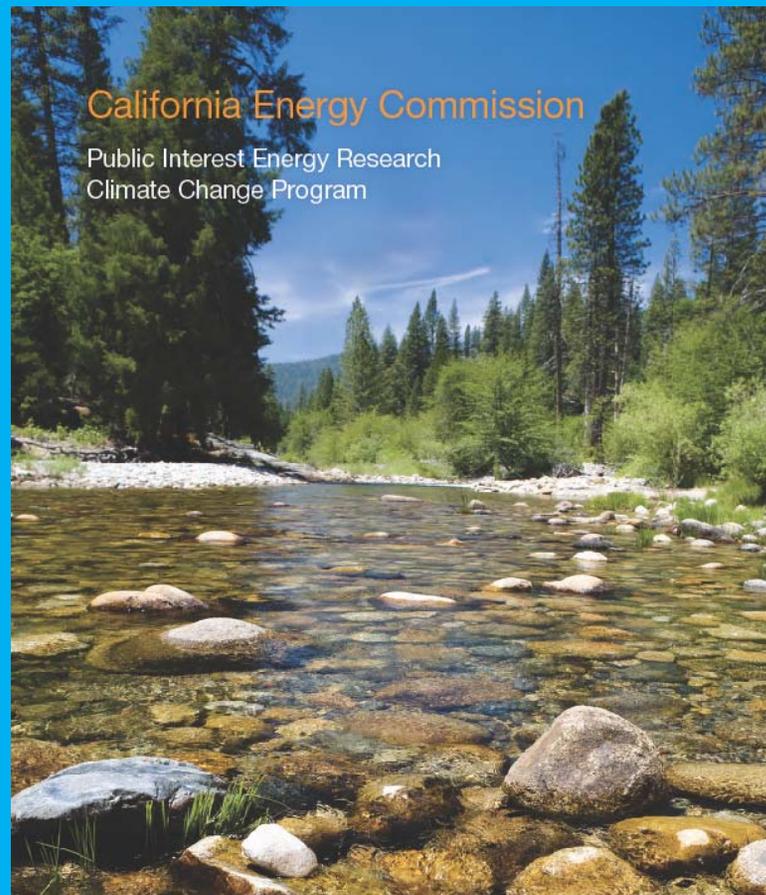
This paper was prepared as the result of work funded by the California Energy Commission, the California Environmental Protection Agency, Metropolitan Transportation Commission, California Department of Transportation, and the California Ocean Protection Council (collectively "the funding agencies"). It does not necessarily represent the views of the funding agencies, their respective officers, agents and employees, or the State of California. The funding agencies, the State of California, and their respective officers, employees, agents, contractors, and subcontractors make no warrant, express or implied, and assume no responsibility or liability for the results of any actions taken or other information developed based on this paper, nor does any party represent that the uses of this information will not infringe upon privately owned rights. This paper is being made available for informational purposes only and has not been approved or disapproved by the funding agencies, nor have the funding agencies passed upon the accuracy, currency, completeness, or adequacy of the information in this paper. Users of this paper agree by their use to hold blameless each of the funding agencies for any liability associated with its use in any form. This work shall not be used to assess actual coastal hazards, insurance requirements or property values, and specifically shall not be used in lieu of Flood Insurance Studies and Flood Insurance Rate Maps issued by the Federal Emergency Management Agency (FEMA).



Arnold Schwarzenegger, Governor

FINAL PAPER

May 2009  
CEC-500-2009-024-F



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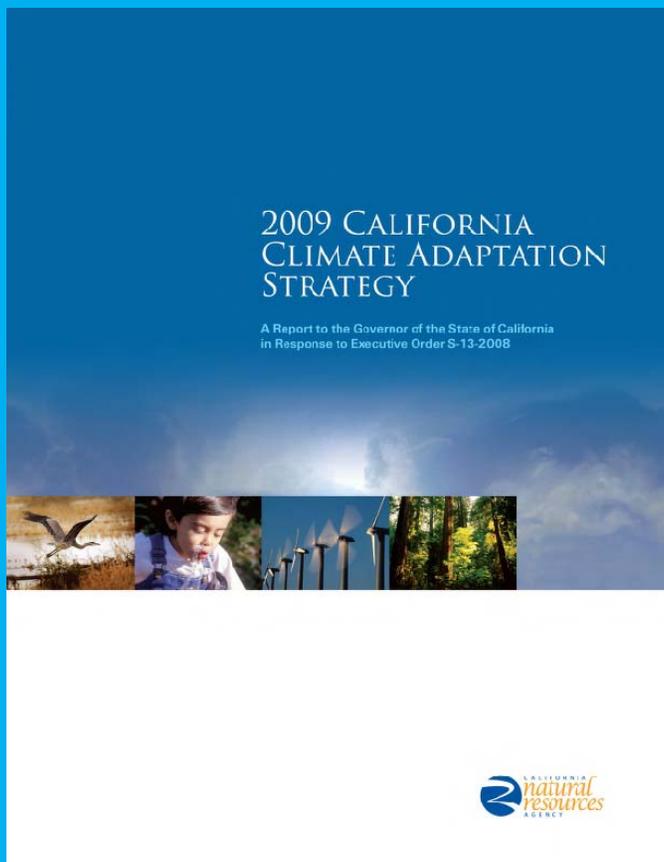
Public Interest Energy Research  
Climate Change Program



California Climate Change Center  
[www.climatechange.ca.gov/research](http://www.climatechange.ca.gov/research)



# CLIMATE ADAPTATION STRATEGY (CAS)



## Some Anticipated Changes

- Temperature:
  - ↑ **2 - 5 °F by 2050**
  - ↑ **4 - 9 °F by 2100**
- Precipitation:
  - ↓ **12 - 35% by 2050**
- Sea Level:
  - ↑ **12-18 inches by 2050**
  - ↑ **21-55 inches by 2100**



## 2009 CA Climate Adaptation Strategy

- Led by California Natural Resources Agency
- PIER Climate Change Research provides the foundation for impact assessment
- Has a state agency focus
- Coordinated with GHG reductions, AB 32 Scoping Plan
- Developed seven Climate Adaptation Working Groups: Public health, Biodiversity & Habitat, Ocean & Coastal Resources, Water Management, Agriculture, Forestry, Transportation & Energy Infrastructure
- It is just the beginning of the strategy conversation



## Strategy Development

- Energy Commission Staff published: *Potential Impacts of Climate Change on California's Energy Infrastructure and Identification of Adaptation Measures*
  - CEC-150-2009-001, January 2009
- Draft 2009 California Climate Adaptation Strategy report released August, 2009
  - Public workshops in Northern and Southern CA
  - 45-day public comment period
- Final report released December 2, 2009



## Overall Recommendations

1. Establish Climate Adaptation Advisory Panel
2. Adapt water management & use for climate change
3. State agencies should avoid significant new development in high risk areas
4. State agencies will develop adaptation plans
5. Follow the CA Environmental Quality Act
  - consider potential impacts of locating significant state projects in areas susceptible to climate change hazards
6. Assess California's vulnerability to climate change
  - develop climate hazard mitigation plan, including identification of most vulnerable communities



## Overall Recommendations, con't

7. Identify most vulnerable habitats
8. Provide guidance to local communities on assessing ways to maintain & improve public health given a changing climate
9. Offer guidance & tools for local adaptation planning
10. Identify wildfire areas most vulnerable
11. Increase renewable energy supply & efficiency
12. Make research and monitoring more accessible



## ENERGY AWARE PLANNING GUIDE SECTION IIIB ADAPTATION PLANNING

Scientists are in agreement that the climate is changing at an alarming rate. Some current projections show global average temperature increases of between 3° F and 10° F over the next 90 years, with warming expected to be even higher in the United States.<sup>1</sup> Climate change will have profound consequences for California, and impacts are already being felt across the state. During the last century, the average spring snowpack in the Sierra Nevada mountains has decreased by 10 percent (a loss of 1.5 million acre-feet) and sea levels have risen seven inches along California's coast, increasing erosion and pressure on the state's infrastructure, water supply, and natural resources. Southern California cities have experienced their lowest recorded annual precipitation twice in the past 10 years.<sup>2</sup>

The California Natural Resources Agency has recently completed a draft of the *2009 California Climate Adaptation Strategy*, which lays out a state-level plan for combating the effects of climate change. However, much of the burden of mitigating climate change impacts will be up to municipalities.

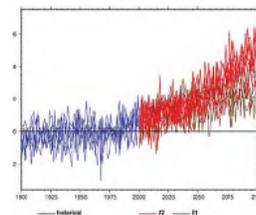
Scientists have identified a number of climate change impacts that have significant implications for local governments, including:

- » *Increased temperatures* that can damage infrastructure and reduce water levels in inland waterways;
- » *Volatile precipitation* that can damage infrastructure and impact soil condition;

### What is Adaptation Planning?

In spite of our best efforts to avoid the effects of climate change, some climate change impacts are occurring now and will increase in intensity in the future. Government agencies need to plan for how they will adapt to these impacts.

- » *Rising sea levels* that can impact coastal communities, bays, estuaries and deltas;
- » *Extreme weather events*, which may impact infrastructure and operations; and
- » *Public health impacts*.



Annual Temperature Projections for the Sacramento Area. Source: California Energy Commission, 2009.

# Adaptation Planning is discussed in the Energy Aware Planning Guide



# Planning Leads to Recommendations

- Increase Energy Efficiency in Vulnerable Areas
  - Meet the Energy Efficiency Goals in AB32 Scoping Plan
  - Facilitate Access to Local, Decentralized Renewable Resources
- Assess environmental impacts from climate change in siting and re-licensing of new facilities
  - Assess Power Plants Vulnerable to Climate Impacts, and Recommend Reasonable Adaptation Measures
  - Encourage Expansion of Renewable Energy Resources
  - Assess the Impacts of Climate Change on Energy Infrastructure
  - Identify the Most Vulnerable Communities



# Potential Impacts on Energy Infrastructure

- Energy infrastructure will be impacted by higher temperatures and more intense storm events
- Higher average temperatures and higher summer peaks will affect energy production, distribution, and demand. Increased demand for energy to cool ourselves is likely to far outpace reductions in winter demand to heat ourselves.
- Higher temperatures, together with a drying climate and less snowpack, will decrease hydropower, especially high-elevation systems.
- Transmission of electricity is less efficient during hotter periods, leading to additional electricity losses especially during peak demand times. This would increase the risk of power outages.



## State Adaptation Next Steps

- Climate Adaptation Advisory Panel appointed
  - Develop recommendations by July 2010
- Google Earth CalAdapt Tool...coming soon!  
(<http://www.climatechange.ca.gov/visualization/index.html>)
- PIER is developing state vulnerability assessments
- In 2010, merge adaptation and mitigation efforts in the Climate Action Team



# Thank You!

## Web pages for more information

- **CEC Climate Change Reports:**  
[www.climatechange.ca.gov/publications/energycommission.html](http://www.climatechange.ca.gov/publications/energycommission.html)
- **California Climate Change Web Portal:**  
[www.climatechange.ca.gov/index.php](http://www.climatechange.ca.gov/index.php)
- **2009 California Climate Adaptation Strategy (CAS):**  
[www.climatechange.ca.gov/adaptation/index.html](http://www.climatechange.ca.gov/adaptation/index.html)
- **US EPA**  
<http://www.epa.gov/statelocalclimate/>