

# **ESTIMATING RISK TO CALIFORNIA ENERGY INFRASTRUCTURE FROM PROJECTED CLIMATE CHANGE**

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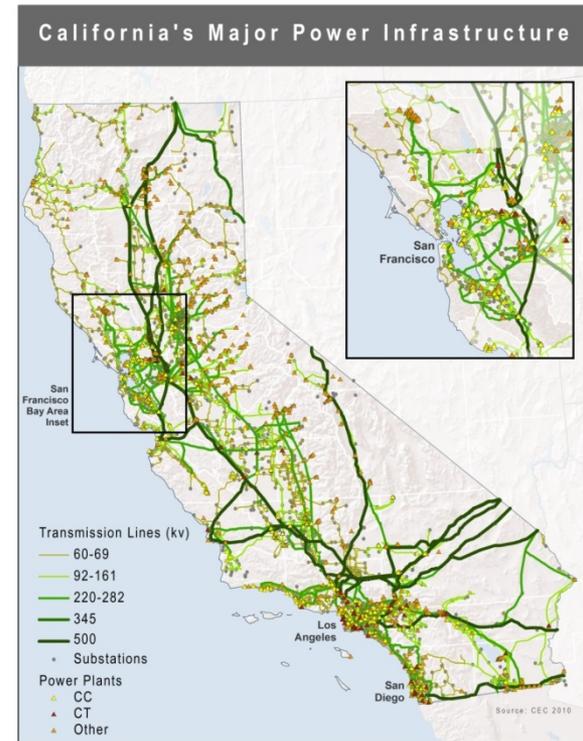
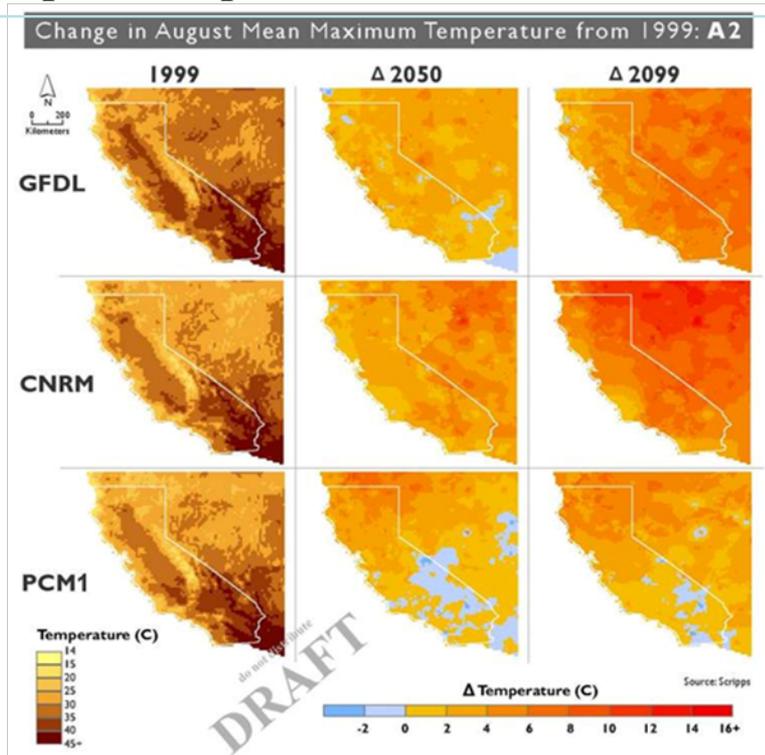
# Overview of Research Tasks

- Assess the vulnerability of ...
  - *electricity infrastructure* to **warming temperatures.**
  - *electricity infrastructure* to **wildfires.**
  - *electricity, natural gas, and other energy infrastructure* to **sea level rise**

# Case Study: Risk to CA Energy Infrastructure

## BACKGROUND:

- California Energy Commission funded study to estimate power demand and explore physical risk to CA energy supply system.
- Technical advisory committee, including power sector stakeholders, provide feedback on data sources and methods.
- Estimated risk for A2 and B1 scenarios for three time periods up to 2100



## BASIC METHOD:

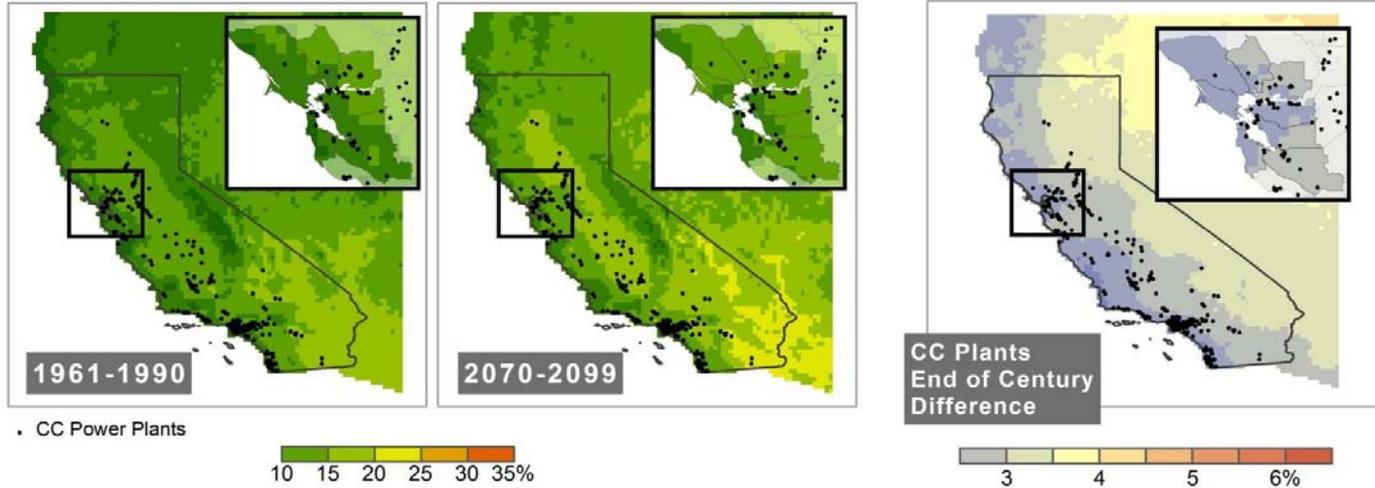
- Coupled downscaled AOGCM projections to electrical system thermal equations to estimate changes to system capacity and demand from increased ambient temperature.
- Overlaid sea-level rise estimates and wildfire projections with known location of CA energy infrastructure.

# End-of-Century Impact Mapping

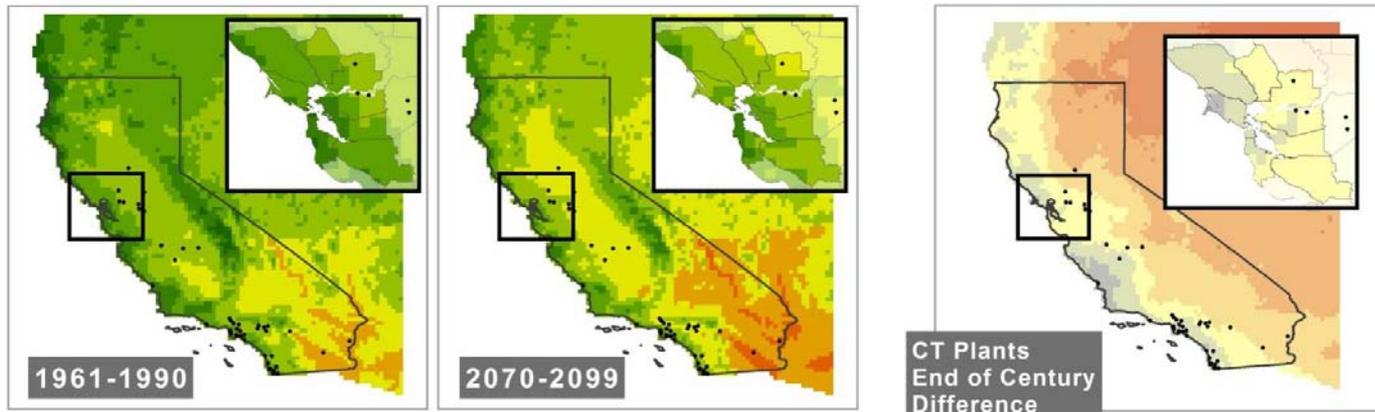
A2 Scenario, Three AOGCMs  
Average Peak Capacity Loss in August

Source: Scripps; CEC; LBNL

## CC Power Plants



## CT Power Plants



● — Absolute Capacity Reductions — ● ● — Incremental Reduction — ●

# Electricity Demand and Supply: Results Summary

## • Need for More Generation on Hottest Days

### • Decreased Gas Plant Generation Efficiency

- Current Nameplate 44.1 GW
- Need 3.5 additional GW (8%)

### • Peak Period Demand (90% tile)

- 21% higher cooling demand
- Need 12.1 additional GW (27%)

### • Substation Loss

- 2.7% higher losses
- Need 1.6 GW (3.6%)

### • Total Required Generation Capacity:

- Current capacity 44.1 GW
- Need 17.2 additional GW (39%)

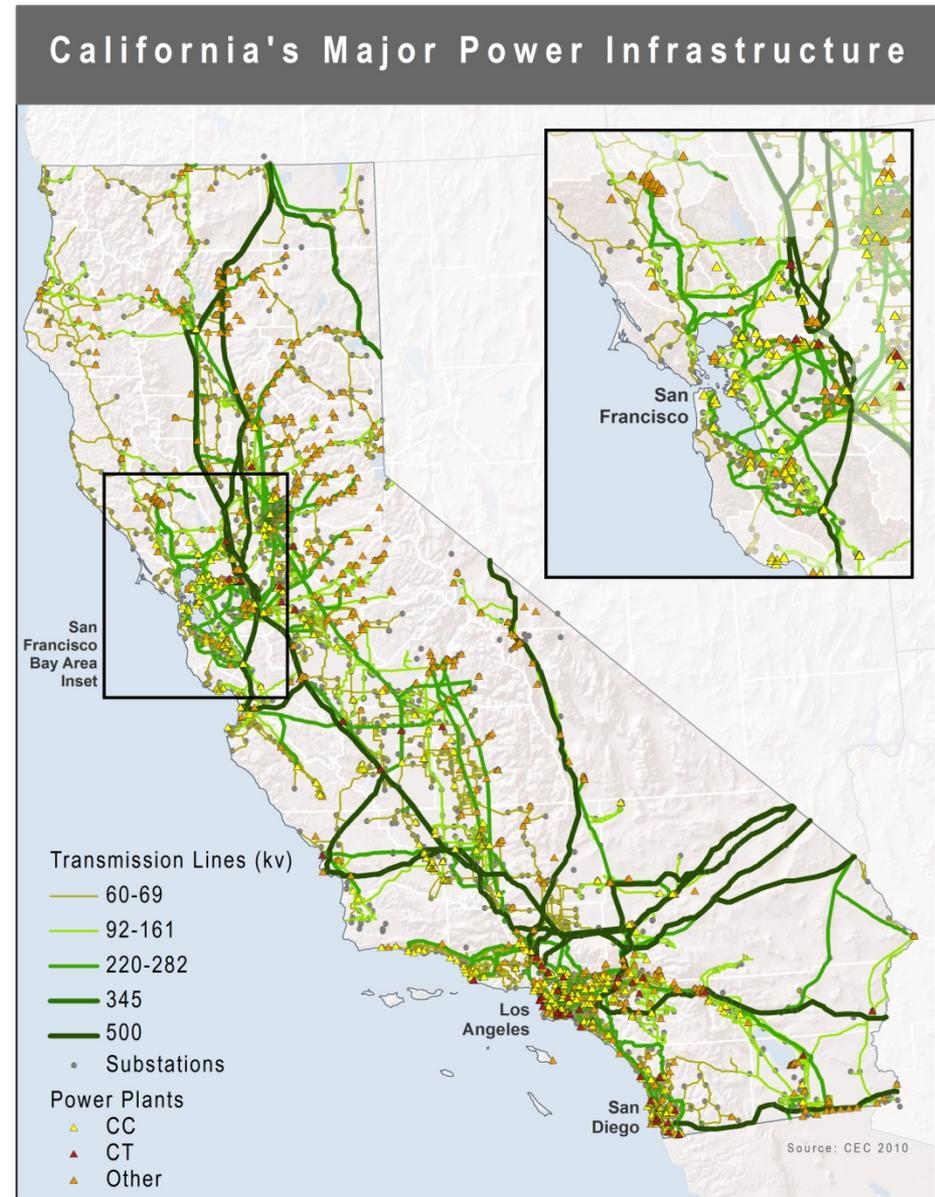
## • Need for More Transmission Capacity

### • Transmission lines

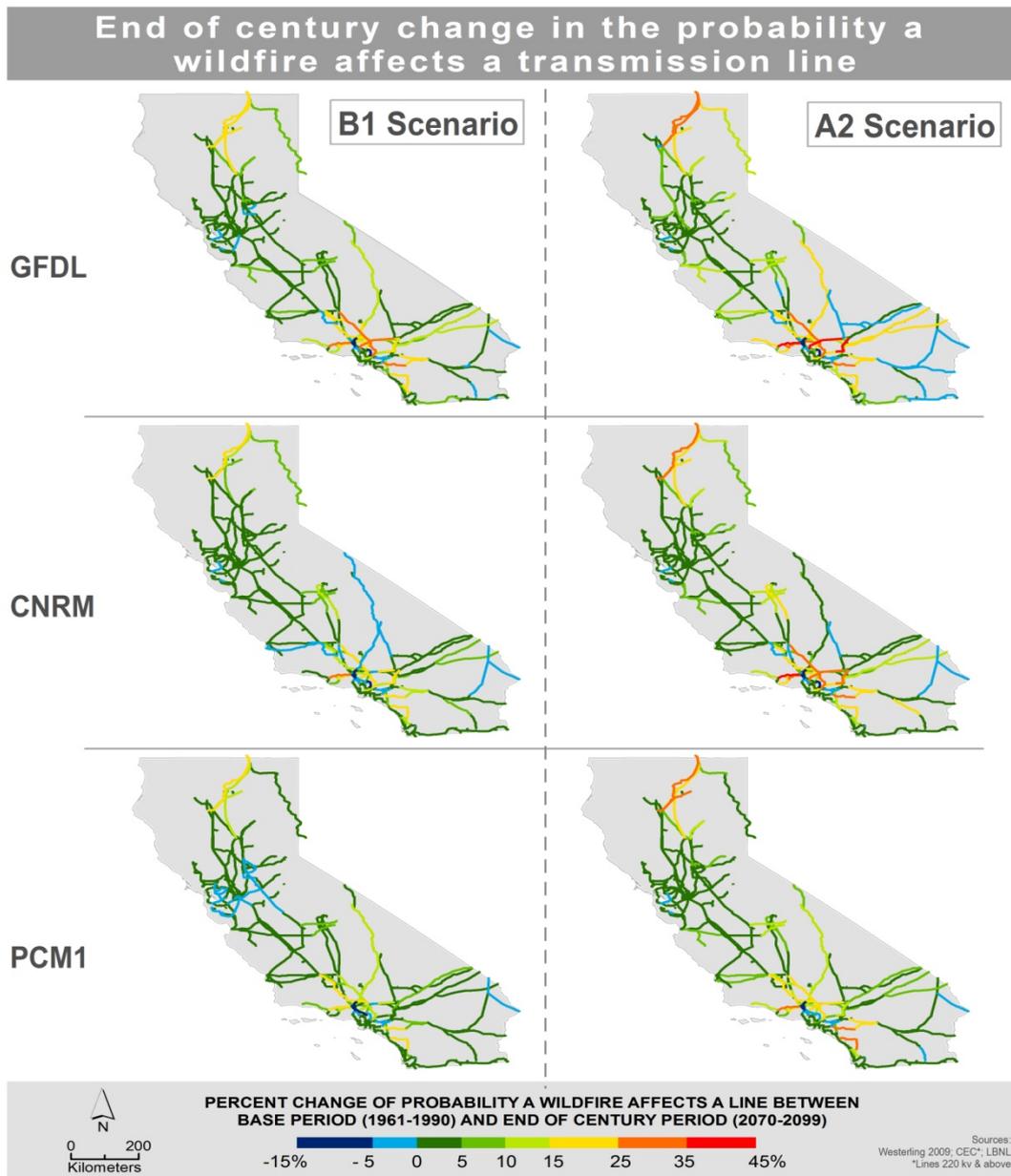
- 7% - 8% loss of peak period capacity
- 21% higher peak load
- Need up to 31% additional transmission capacity

## • End of Century and Mid Century Impacts

- Focused on End of Century
- Mid Century under 2100 impact
- Growing Population

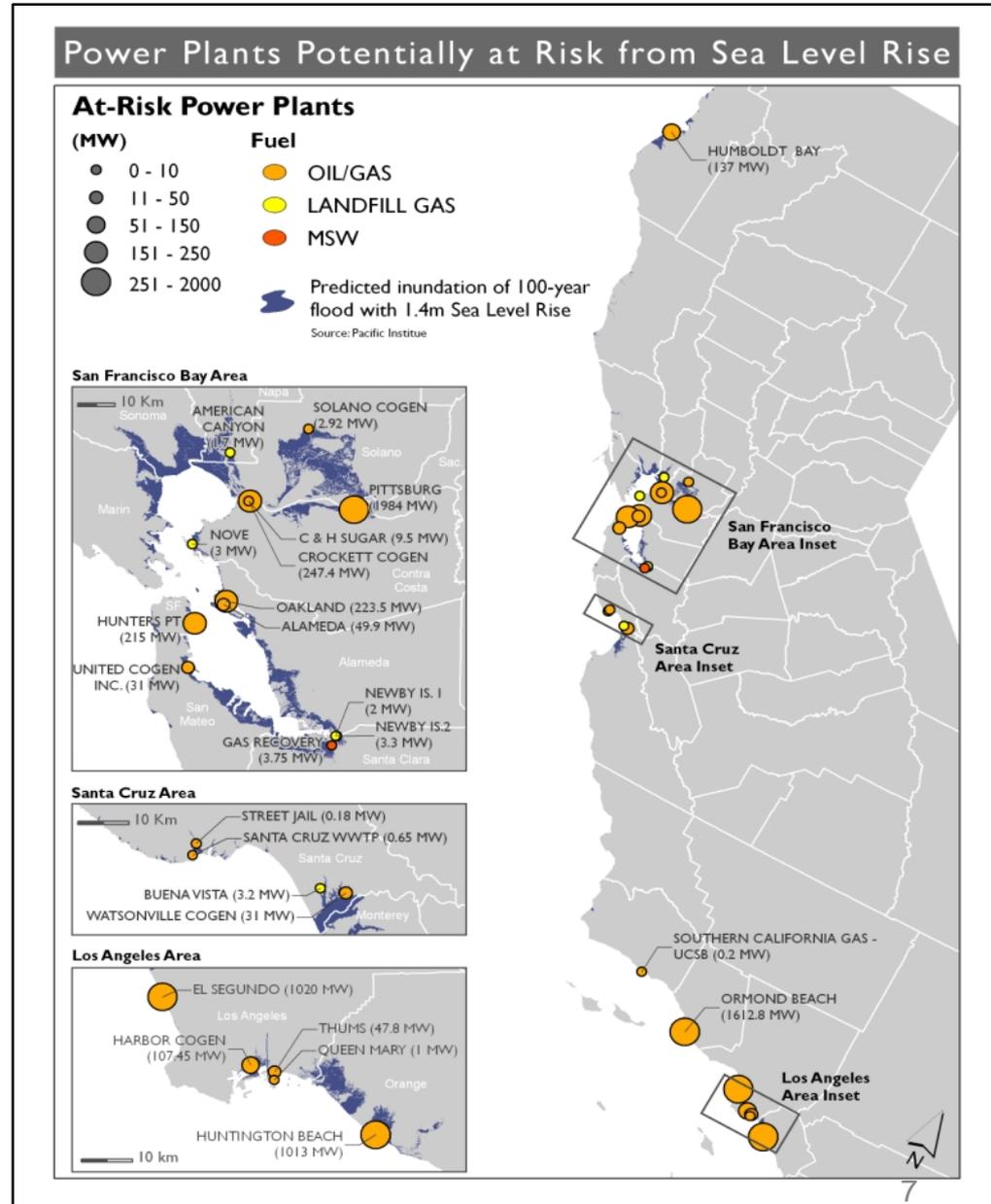


# Projected fire risk to transmission lines for the A2 scenario



# Sea Level Rise Impact Mapping & Comparisons

- Projected sea level rise – 1.4 meters
- 25 power plants and about 90 substations are vulnerable to sea level rise
- Humboldt Bay and Antioch Site visits indicated that coarse vertical resolution of CA topography may have over- or under-stated impacts in power plant locations.

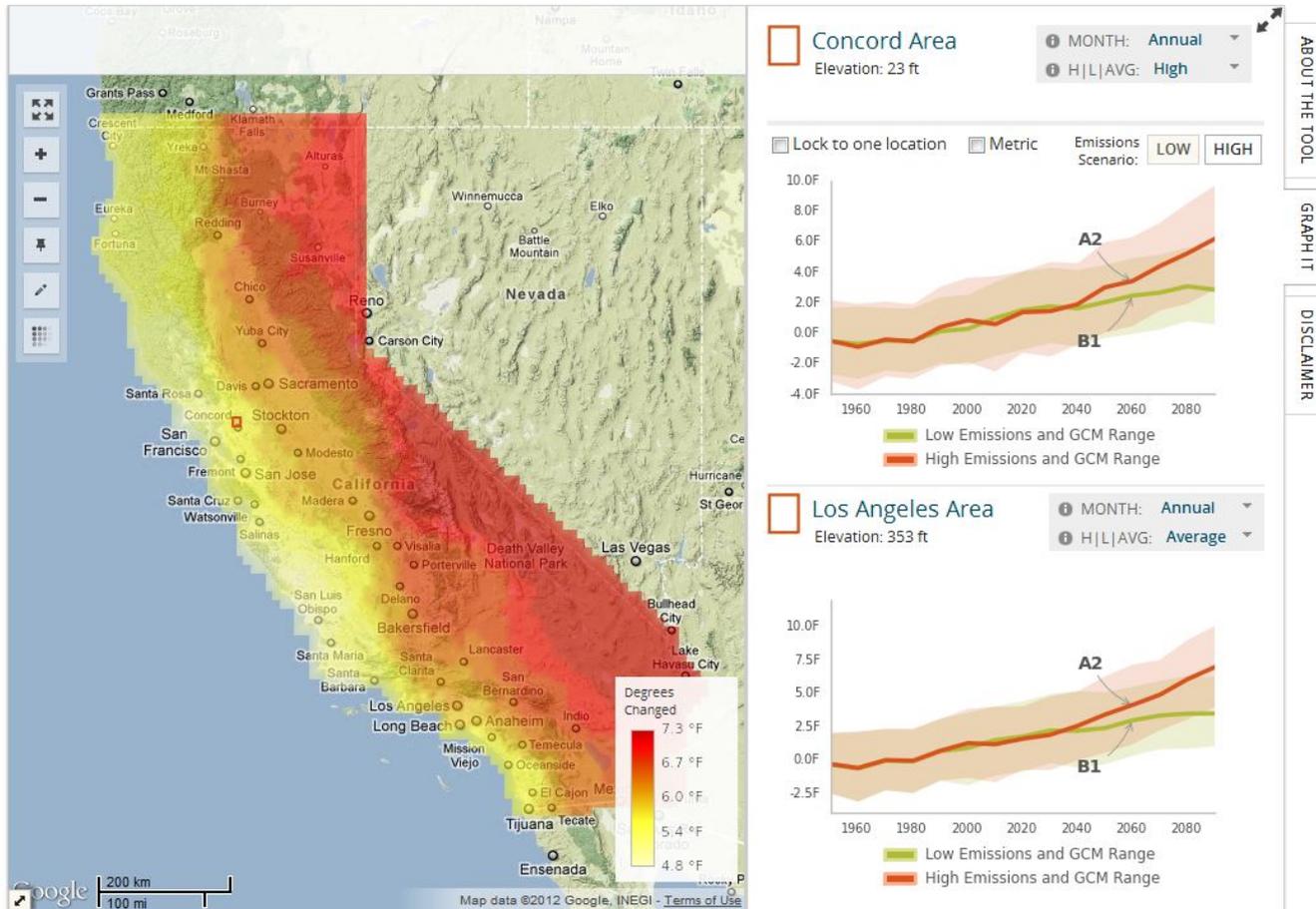


# Lessons Learned

- Temperature impact on demand is higher than on supply infrastructure
  - Impacts work together combined impact is substantial—38% more generation needed
  - Impact on hydropower depends on water supply conditions
- Impact of wildfires potentially high.
  - Up to 40% increased fire risk along key transmission corridors.
- More data and research are needed to evaluate:
  - Wildfire and sea level rise.
  - Temperature impacts on electricity transmission and distribution
  - Changes to electricity infrastructure design
  - All time periods
- Electric Utility Planning Issues

# New Data from Cal-Adapt Site

TEMPERATURE: DEGREES OF CHANGE MAP



# Acknowledgements for CA Research

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- Jayant Sathaye, Larry Dale, Peter Larsen, and Gary Fitts (LBNL)
- Kevin Koy and Sarah Lewis (Geospatial Innovation Facility at UC-Berkeley)
- Andre Lucena (Federal University of Rio de Janeiro)

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- Guido Franco (PIER Program at California Energy Commission)