UCLA Institute of the Environment & Sustainability
California Center for Sustainable Communities

California Energy Commission
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Electricity Infrastructure Vulnerabilities due to Long-Term Growth and Extreme Heat from Climate Change in Los Angeles County

In partnership with Arizona State University, the California Center for Sustainable Communities at UCLA is investigating potential risks to the electricity grid posed by expected future population growth and rising temperatures. This assessment quantified infrastructure vulnerabilities that could potentially lead to unmet demand, and unplanned system outages.

The work will aid in long-term adaptation plans and policies by allowing California's government and public utilities to identify locations where investments in infrastructure projects can best meet stakeholder objectives.

CCSC **PROJECT GOALS:**

- **Identify** how much electricity grid infrastructure capacity could be reduced due to extreme heat events from climate change.
- **Assess** how peak demand and decreased infrastructure capacity will reduce safe energy supply.
- **Understand** which areas are most at risk and should be prioritized in policy and adaptation options.

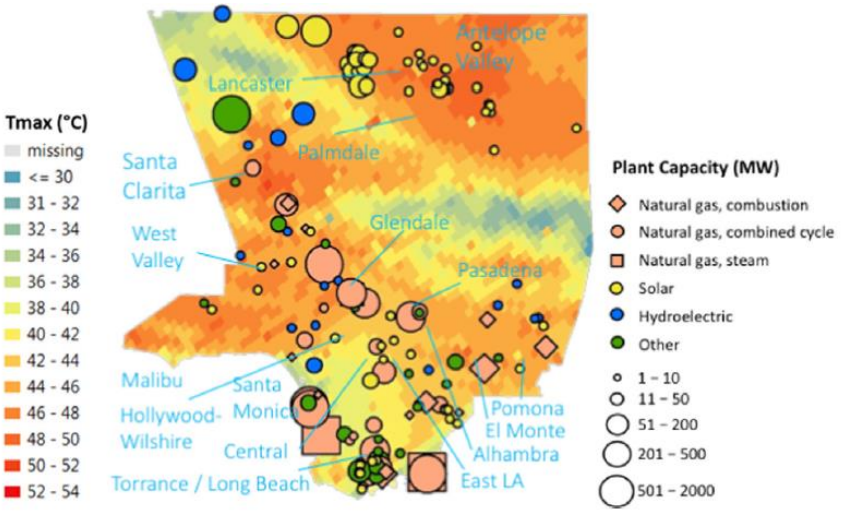

Fig. 1. Map of power plants and historical hottest day air temperatures.

GEOGRAPHIC FOCUS:

Our work is focused on communities within Los Angeles County, California (LAC) that are likely to both experience significant population growth and increased exposure to high heat. These communities, specifically include: Santa Clarita and Antelope Valley areas, El Monte, Pomona, Lancaster, and Palmdale.

METHODOLOGY:

- Downsized climate change scenarios from the IPCC (RCP 4.5 and RCP 8.5) were used to estimate the severity and future of extreme heat events.
- Because capacity loss in any component of electrical infrastructure can constrain the system, the magnitudes of capacity loss in all component classes were assessed.
- Substation (localized electrical component) analysis was used to geographically determine where adaptation measures should be implemented.

CCSC PRELIMINARY FINDINGS:

- Due to rising air temperatures, the overall vulnerability of infrastructure is a 2-20% loss of capacity by 2060.
- The only region whose infrastructure is not at risk of experiencing air temperatures above 104 °F, and thus is relatively stable, was West Santa Monica.
- High efficiency measures such as more efficient appliances and housing structures would reduce total energy consumption and allow most substations to reliably operate even during the worst heat wave conditions.
- However, substations in Santa Clarita are expected to face a high risk of component failures in all scenarios. Also, the Palmdale and Lancaster areas are vulnerable to power outages even with significant energy efficiency improvements.

NEXT STEPS:

- In order to keep substations operating reliably, it is necessary to reduce and shift peak load. This can be achieved either by adding substation capacity, installing distributed energy resources, or implementing some form of demand side management.
- Going forward, a better understanding of these infrastructure vulnerabilities in the face of climate change will enable stake holders to evaluate policy and investment options more effectively.
- Our approach can be used to consider vulnerabilities to other forms of climate and technological change and similar studies can be developed for other regions.

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