Electricity Demand Changes and Grid Infrastructure Vulnerabilities in LA County by 2060: Policy Brief

August 2018

In the California Energy Commission–funded project "Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat," researchers at University of California, Los Angeles, and Arizona State University projected energy demand increases and grid vulnerabilities by 2060, given scenarios of increased temperatures in a changing climate, population growth, and urban development. These projections reveal distinct challenges that energy providers and grid operators will need to cope with. This policy brief outlines the problems and potential solutions. These ideas and recommendations are focused on Los Angeles County and California, and are not exhaustive.

The problem: Rising temperatures

Human emissions of carbon dioxide and other greenhouse gases, so called because they trap heat in the atmosphere, are causing temperatures to rise across the globe, and California is no exception. Rising temperatures create impacts on natural and human systems in myriad ways. For one, hotter temperatures and heat waves are a public health issue, requiring air conditioning or other methods to keep people cool and healthy. Increased energy use can stress electricity grid systems, as can rising temperatures, by decreasing the safe operating capacity of grid hardware.

Solutions. Rising temperatures can be addressed by 1) slowing or ideally stopping human emissions of greenhouse gases, an approach often called *mitigation,* and 2) *adaptation* measures to help people and infrastructure cope with heat. Many adaptation solutions also help with mitigation.

Mitigation solutions. California is not insulated from the effects of greenhouse gases emitted in the rest of the world, and greenhouse gas emissions cuts are needed on a global scale. But as the world's fifth largest economy, California's actions on climate change make a substantial contribution, both in terms of absolute emissions reductions and by serving as a model other states and countries can emulate. The energy sector can cut greenhouse gas emissions by:

- Generating electricity with **renewable energy sources,** such as solar and wind, instead of natural gas, coal, and other fossil fuels.

- Encouraging **energy conservation,** such as with incentives for end users to make buildings more energy-efficient and choose energy-saving appliances.

Adaptation solutions. The following solutions can help to improve cooling of grid components and of buildings:

- **Improved equipment cooling systems** would help generation plants and substations continue to operate safely in higher ambient temperatures, preventing reductions in their capacities and equipment failures that lead to outages.

- **Increased building shading** would reduce the heat absorbed by buildings, reducing cooling needs.

- **Higher standards for building shell thermal efficiency** would prevent escape of cooled air in buildings, increasing the efficiency of cooling measures.

The problem: Increased peak electricity demand
The project's researchers found that peak electricity demand in Los Angeles County may increase significantly by 2060, thanks to both hotter temperatures and population growth. Much of this extra demand comes from an increase in buildings that have central air conditioning installed, as well as increased air conditioning use. This increase will occur despite efficiency gains in air conditioning, building envelopes, and possibly urban density.

Solutions: Population-driven increases in peak demand can be mitigated by lowering per capita energy use. Some strategies to reduce grid-delivered energy use at peak times include the following:

- **Investing in distributed energy.** Distributed energy resources, particularly rooftop solar, can supplement generation during times of peak demand. While it will be necessary to increase generation to meet increased demand, traditional large-scale generator plants cannot meet that demand because of limitations in the delivery system capacity. Distributed energy systems produce energy on-site, avoiding the need for transmission over power lines or through substations. Solar installations have an important advantage over natural gas plants in that they do not emit greenhouse gases and therefore do not contribute to the problem of rising temperatures. The researchers estimate that the following increases in distributed energy resources would help to offset projected demand increases:
    - 200–900 megawatts (MW) in Santa Clarita
    - up to 200 MW in the Lancaster–Palmdale area
    - up to 700 MW in the Southern California Edison–served areas between the western San Fernando Valley and Pomona
    - 60 MW in the Calabasas–Malibu area

- **Improving the efficiency of air conditioners.** When a building's air conditioning unit is in use, it accounts for 60% to 70% of the building's energy demand. Potential policies aimed toward this objective include the following:
    - Providing incentives for residents and developers to install more efficient units when installing new or upgrading existing air conditioners.
    - Developing a new 'peak performance rating' for air conditioners that assesses their performance up to 122°F, instead of 95°F as most are rated now. This could provide incentives for air conditioning manufacturers to engineer models with more efficient performance at higher ambient temperatures.

- **Policies that encourage more efficient, common-wall multifamily buildings** versus single family detached homes. Because individual units in multifamily buildings are

smaller, and shared walls reduce exposure to extreme heat, per capita peak energy demand in multifamily housing is about half that of single-family detached units.

- **Smarter site selection for new residential developments**. The researchers' findings suggest that new development would be best concentrated in cooler areas, rather than more heat-vulnerable areas such as northern Los Angeles County.

- **Use more appropriate metrics in long-term planning processes.** Using projected maximum temperatures, instead of 90th percentile historical values, would remove error associated with divergence from historical climate and enable recalculation of safety margins.

Recommendations for utilities

As electricity providers, utilities have a particular role to play in mitigating and adapting to energy demand increases and grid vulnerability. The research team offers the following suggestions:

- Utilities should recognize that their vulnerability to heat waves is a function of both increasing demand and decreasing supply capacity. In light of this, utilities should prioritize investments in areas of coincidence of the two—that is, where demand is expected to significantly increase and supply significantly decrease, raising concerns about the capacity of the infrastructure to manage extreme events.

- Where the researchers have identified "hotspots," utilities have a number of adaptation strategies available to them on both the demand and supply sides. On the demand side, load curtailment such as rooftop solar or incentives for demand reductions should be considered. On the supply side, hardware upgrades and redundancy should be considered, to name a few.

- While understanding the demand and supply effects associated with extreme events is necessary, utilities should also understand social vulnerability to power outages. Knowing where the most vulnerable populations are, relative to where demand/supply vulnerabilities are expected, is crucial for protecting people and communities.