The power shutoffs begun yesterday by Pacific Gas & Electric across swaths of Northern California, cutting electricity for hundreds of thousands of Californians, are many things: a serious risk for vulnerable and immobilized populations; an economic hit for local businesses; a tremendous inconvenience for everyone; both an outrage and industry best practice, according to Governor Newsom. They are controversial, painful, and the result of inadequate maintenance and planning mixed with increasingly dangerous conditions.

They are also, of course, a sign of our collective future in a changing climate. High wind potential, dry conditions, and warm temperatures led PG&E to cut power in order to prevent distribution lines from causing wildfires. PG&E has determined these precautionary measures are necessary following the catastrophic 2017 and 2018 wildfire seasons, including last year's Camp Fire, which was sparked by PG&E's equipment. Not only do these massive wildfires threaten lives, homes, and entire communities, they also effectively undo our state's progress in reducing greenhouse gas emissions.

As long as we have aboveground electrical lines in vegetated areas (likely very long), and as long as we periodically experience windy, dry, and warm weather conditions (likely forever), some level of planned shutoffs may be necessary to limit fire risk at key times of year. This could be the case even if PG&E and other electric utilities can rapidly upgrade their most vulnerable equipment and ramp up vegetation management.

If planned shutoffs are an unavoidable reality, California leaders should attempt to maximize our communities' energy resilience and advance state climate goals as they minimize fire risks. Distributed generation and rooftop solar, local microgrids, and large-scale battery storage (including electric vehicles) can enhance the ability to maintain power for essential uses during system outages, helping communities support vulnerable residents and emergency services. At the same time, expanding adoption of these technologies can integrate more renewable energy into the grid while displacing inefficient diesel and gas backup generators, with the potential to reduce the need for new large-scale distribution infrastructure in high-risk areas.

California's utilities, legislature, local governments, and energy regulators will have to coordinate investment and infrastructure planning processes to maximize benefit and minimize pain. An integrated planning process could begin to address increasingly intertwined questions, such as:

- Planning outages: What data and technologies do utilities need to model complex and evolving risks, identify high-risk areas and infrastructure in advance, limit the scope of precautionary shutoffs, and communicate with affected communities?
- Protecting vulnerable residents: How can local governments locate residents who rely on constant power supplies—like those with life-sustaining medical equipment—and what resources do they need to provide them secure energy access?
- Investing in distributed generation: How can utilities, energy regulators, and local governments work together to accelerate deployment of rooftop and community solar installations that can operate off-grid, prioritizing communities that are most likely to experience planned shutoffs?
- Increasing access to battery storage: What mandates or incentives are needed to drive down the cost of large-scale battery storage enough for communities to afford investments that support vulnerable residents and key infrastructure?
- Proving the viability of microgrids: What research or pilot projects can the state support to develop microgrids that can combine with distributed generation to maintain baseline local power supplies during a shutdown, and what rules are needed to manage safety and use priority?
- Boosting efficiency: How should utilities and state leaders prioritize energy efficiency investments to minimize the need for new infrastructure and facilitate safety efforts?

Increasing coordination and cooperation—among California's utilities; state agencies like the Public Utilities Commission, Energy Commission, Office of Emergency Services, and CAL FIRE; local governments; and technology leaders developing new risk mapping and advanced energy solutions—could help minimize the tension between the priorities of community safety, fire prevention, emission reduction, and energy reliability. As California enters a new world of electrical grid management, ensuring our resources are invested in ways that advance all these priorities will be essential.