Building a Sustainable Microgrid

How renewable-centric microgrids can make cities and counties more resilient

The Need for Energy Resiliency

Communities across California are under enormous pressure to adapt to reliability challenges within the state's power grid. As society continues to become more dependent on uninterrupted electricity supply, the frequency of outages is rising rapidly. That's because:

- Weather events are becoming increasingly severe. Wildfires, in particular, have begun setting records year after year, with no end in sight. Communities spared a direct hit may lose power when transmission lines are damaged.
- Since 2017, California communities have faced thousands of outage days due to Public Safety Power Shutoffs (PSPS). While utilities have reduced some outages through grid upgrades, PSPS events continue to affect tens of thousands of residents annually.

It's imperative for city and county managers across the state to ensure that critical operations are not impacted by grid outages. Their communities need a resilient power source, and their approach to filling that need will determine the project's long-term success.

Sometimes city or county leaders focus in on a discrete fix, such as implementing a single backup generator. However, a problem as significant as energy resiliency requires a broad solution that reflects the goals and values of the community. In many cases, that means building a sustainable microgrid that provides local, renewable power generation.

TOTAL BLACKOUTS
50,015
Oct. 2017–Dec. 2019

CUSTOMERS IMPACTED
51,192,509
Oct. 2017–Dec. 2019

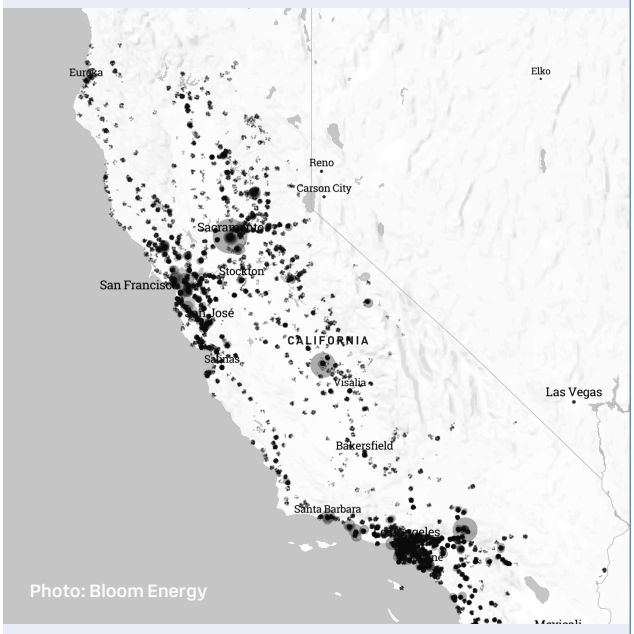


Photo: Bloom Energy

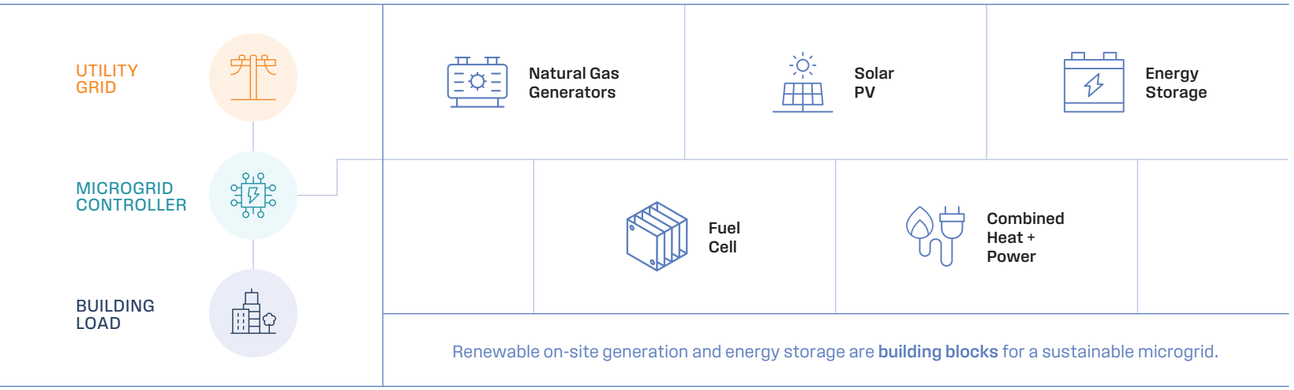
Overall, **blackout events** in California **increased 23%** from 2018 to 2019, and the number of utility customers impacted by outages **jumped 50%**.

What is a sustainable microgrid?

A microgrid is the technical solution to the problem of energy resiliency. It is a group of interconnected energy loads and distributed energy resources that acts as a single controllable entity with respect to the local utility grid.

Microgrids vary widely in size. Their distinguishing characteristic is their ability to "island" during power outages. When the utility grid is operational, a microgrid can run in parallel. When the external grid goes down, the microgrid can isolate from it and continue to provide power.

What makes a sustainable microgrid unique is the prominence of renewable energy generation. By incorporating renewables and energy storage, a microgrid can regularly generate and store enough energy to significantly reduce demand for power from the utility. This can make the microgrid economically viable beyond its role as a backup power source - generating energy cost savings.



Unique Benefits of Sustainable Microgrids

STRATEGY & PLANNING

A sustainable microgrid provides financial benefits all year long, not just during outages.

- Solar PV systems enable a city or county to generate clean and cost-effective electricity, reducing the amount of power purchased from the utility.
- Battery energy storage can take advantage of peak shaving and energy arbitrage opportunities to further reduce electric bills.
- Combined heat and power (CHP) systems improve efficiency by providing heat and energy, further reducing utility costs.
- Smart energy management can optimize loads and generate revenues from utility programs.

RAPID TRANSITION TO BACKUP POWER

The point of common coupling (PCC) in a sustainable microgrid can cut over to the backup power solution in milliseconds.

REDUCED CARBON EMISSIONS

Many California communities have prioritized sustainability goals in recent years. Relying on renewable energy in the event of a power outage avoids the pollution associated with backup diesel generators. This saves the local government from challenges complying with air quality regulations. It also saves them the difficulty of trying to site a diesel generator, which can be problematic even for generators that won't run frequently.

LONGER-DURATION RESILIENCY

Reduced dependency on diesel or natural gas generators supports longer-duration backup power. With renewables, generation does not stop when the finite amount of fuel stored onsite is exhausted. This is crucial because the average duration of a PSPS event is nearly two full days, and some of these outages last longer.

OPTERRA's Comprehensive Approach

1 Assessment

A sustainable microgrid could include a range of different technologies. The first step is to assess the community's energy resiliency needs, desired future state, and current actual state.

OPTERRA works with cities and counties to identify the facilities and loads that are most crucial to keep operational, setting priorities and considering:

- **Size:** How much load does the community need to protect from prospective power outages? Are phones and IT systems most important? Does every area of the building need to be operational, or just a cooling center or space for people to congregate?
- **Duration:** Does the city or county need backup for a few minutes, hours or days?
- **Speed:** How fast do these loads need to transition?
- Sustainability: What sustainability targets is the community pursuing, and how can resiliency technologies help it get there?
- **Financials:** What are the project's economic requirements – what are these objectives worth?

2 Cost Modeling

OPTERRA also helps plan project financials, including grants and incentives, to minimize the cost of renewable energy and storage technologies. As an example of what's possible, one California water district is receiving $7 million in incentives under California's Self-Generation Incentive Program (SGIP).

OPTERRA will also help the city or county optimize cost-saving and revenue-generation opportunities throughout the microgrid.

3 Planning

OPTERRA assists the city or county with design of the sustainable microgrid and operations planning. Based on the community's goals and current state, we come up with a portfolio of technology options that leads to the optimal solution for each site. Considerations include:

- Which generation technologies will best meet the community's needs?
- Does battery energy storage make sense in this location?
- Should legacy solutions, like an existing generator, be incorporated into the microgrid?
- Are upgrades to the electrical infrastructure, such as transformers or switch gear, necessary?
- Does the city or county need a new panel and wiring to segment critical loads?

4 Implementation, Maintenance, and Operations

Once a sustainable microgrid is in place, OPTERRA can provide routine service and preventative testing.

- Preventative testing: If the entity has not recently experienced an outage, OPTERRA will run a test to ensure everything is functioning properly.
- Post-outage follow-up: After an outage, OPTERRA will provide a review of system performance, reporting on how systems performed and highlighting lessons learned, to support continuous improvement.

Utilizing these services on a quarterly or annual basis gives community leaders confidence that they're ready for an outage, and knowledge of how much runtime to expect should an outage occur.

Recent Projects

Solano County has been severely impacted by wildfires in recent years. As part of a broader energy program, the county is installing microgrids utilizing solar PV and battery energy storage at four key locations. The project's goals include:

- Maintain critical operations during power outages and PSPS events
- Reduce utility expenses and exposure to rising utility rates
- Transition to more energy-efficient lighting and HVAC, implement water conservation measures, and install EV charging stations
- Increase community engagement through an online, real-time public dashboard
- Leverage workforce development activities to provide real-world experience for students in engineering and other fields

Santa Barbara USD has six microgrids at campuses across the district, generating a total of 2.5 MW of solar power, with 1.9 MW / 3.8MWh of battery storage. In a power outage, each microgrid "islands," separating from the external utility grid and prioritizing loads identified as critical.

- Initially, all loads across campus are powered by solar generation and stored energy
- When batteries get low, only critical loads are powered, to extend their life
- If solar is generating enough power to recharge batteries, additional loads are added
- When the external power outage ends, the microgrid ties back to the grid

The City of Milpitas is implementing a smart city infrastructure modernization program including 10 different measures to improve citywide services, conserve and generate clean energy, and reduce operation and maintenance expenses. Microgrids at two community centers are key components of the program.

- The microgrids include 200 kW of solar paired with battery energy storage to provide an initial source of backup power during grid outages and to reduce peak demand costs
- The battery system is supported by a natural gas generator, which provides a second source of backup power for longer outages
- The microgrids will allow Milpitas to open community centers as a resource or charging center during Public Safety Power Shutoff events or other power outages

Ask your OPTERRA representative for a **free evaluation** of your community's path forward with a sustainable microgrid.

OPTERRA ENERGY SERVICES

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