ASPEN TECH POLICY HUB
POLICY

Solar Microgrids for Backup Power at Community Resilience Centers

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Executive Summary

Marin County, California, is a high-risk area for natural disasters and wildfires, which can cause extended power outages. Power outages have dramatically increased over the last 5 years. These outages can significantly impact community members' livelihood, health, and safety and produce a disproportionate impact on low-income neighborhoods, people of color, and other vulnerable individuals.[1] Compounding the problems are Public Safety Power Shutoffs or preventative "de-energization" events that began in 2019 to help reduce wildfires and can last for a week or longer. Unfortunately, the traditional solution, diesel generators, are often inadequate for long-duration power outages and may not be the most reliable or cost-effective solution.

To mitigate the far-reaching challenge of power outages, Marin County needs additional designated Community Resilience Centers (CRCs) with battery storage and solar energy (solar microgrids) that provide long-lasting and

reliable backup electricity during power outages. In particular, Marin County should:

1. Identify additional locations for CRCs and widely publish this information so that community members know exactly where they can receive services during a power outage or natural disaster;
2. Implement a solar microgrid pilot project in a county-operated CRC;
3. Incorporate a recommendation, strategy, or section prioritizing solar microgrids in the county's next updated A) Multi-Jurisdiction Local Hazard Mitigation Plan and B) Countywide Plan; and
4. Convene a roundtable with experts on solar microgrids to work on implementing a pilot project and location selection.

Background

Extended power outages cause a significant health and safety risk for the entire community, especially for underserved or economically disadvantaged populations. According to the Urban Sustainability Directors Network, "[d]ue to a history of marginalization and disinvestment, people of color, immigrants, refugees, and lower-income populations experience increased exposure and sensitivity to climate hazards and a reduced capacity to adapt." These community members typically cannot afford backup energy systems at their residences, live in multi-family housing which prohibits these systems, or lack access to these options due to inadequate electrical grid capacity in their neighborhoods.

Marin County has implemented diesel generators at several facilities to prepare them for extended power outages. However, most solar microgrid projects have yet to proceed due to technical challenges, human resources, or a lack of funding. Marin County should nonetheless continue the progress of sustained community energy resilience. By prioritizing solar microgrid projects at designated CRCs, Marin County will be well-equipped to protect its citizens during future emergencies and long-duration power outages.

This section reviews the challenges of relying on diesel generators alone during blackouts and the potential for solar microgrids to solve these problems.

Risk Factors for Long-Duration Power Outages

Public Safety Power Shutoffs require utilities to turn off electricity when there are gusty winds and dry conditions to prevent wildfires. A new report shows other fault lines that could unleash earthquakes as strong as a magnitude 7.8 and cause a tsunami. The catastrophic effects of a natural disaster would significantly worsen if the backup diesel generators at essential community facilities failed or ran out of fuel — a real possibility during an extreme natural disaster.

The final factors leading to more electricity blackouts are the increasing demand for electricity driven by rising temperatures, less rainfall, and the electrification of vehicles, homes, and buildings. These factors add additional pressure to the state's already stressed electrical grid. As a result, in the summer of 2022, as many as 3.75 million homes were at risk of losing power, and statewide blackouts came very close to occurring in September 2022 due to record heat waves.

Challenges of Diesel Generators

Frequent power outages have increased the adoption of backup diesel generators in California. However, backup generators are only a short-term solution due to their limited on-site fuel storage capacity and need for refueling. Generators at critical facilities such as hospitals typically have just 48 to 96 hours of diesel fuel on-site, which is insufficient during a sustained power outage or natural disaster, especially if there were fuel shortages due to damaged roads or other higher-priority uses for fuel. Generators also face reliability issues since they are infrequently operated and can sit idle for long periods. For example, when Hurricane Maria struck Puerto Rico, there was an "epidemic of broken generators." Likewise, when Hurricane Sandy hit New

York, thousands were evacuated from critical hospitals where generators malfunctioned or overheated.

Generators are also significant emitters of greenhouse gas (GHG) emissions. During the Public Safety Power Shutoffs in October 2019, California customers had about 43 hours of power outages. Due to these outages, an estimated 125,000 backup generators provided backup electricity. The generators emitted about 9 tons of diesel particulate matter (diesel PM), equivalent to emissions from about 29,000 heavy-duty diesel trucks driving on California roads for 1 month. Lastly, generators require storing diesel fuel on-site, which carries additional fire risk and the risk of explosions.

Alternatives to Diesel: Backup Batteries and Solar Technology

Solar-based microgrids (or solar+storage) are becoming more common solutions to provide energy resilience and backup electricity, especially as diesel generators have proven to lack sufficiency in a longer-term power outage. California has seen this trend and has gone so far as to require all new commercial buildings to install solar and battery storage systems. The systems are becoming even more attractive as battery and solar costs decrease and financial savings increase.

Solar microgrids can operate independently of the primary electrical grid (islanding) to provide backup power to a facility during a power outage. Solar microgrids also benefit from the fact that they can maintain backup power indefinitely if designed with sufficiently large solar systems to replenish the batteries with power generated from the sun daily. Moreover, solar microgrids are not only utilized during a power outage but can be used daily to store excess solar energy generated during daylight hours and to use that power during the highest cost times of grid electricity, reducing electricity costs (peak load management).

There are now many different grants and financing mechanisms for solar microgrids, and the Inflation Reduction Act (IRA) passage provides even more

momentum, support, and funding, including $60 billion for environmental justice and $30 billion for clean energy and energy storage. There may be more funding and partnership opportunities that Marin County will be able to explore as a result of this historic legislation that can support Marin County's transition to solar microgrids. The attached operational plan provides more details on project funding and recommendations for paths to follow.

Recommendations

As described in more detail below, Marin County should:

1. Identify additional locations for CRCs and widely publish this information so that community members know exactly where they can receive services during a power outage or natural disaster;
2. Implement a solar microgrid pilot project in a county-operated CRC;
3. Incorporate a recommendation, strategy, or section prioritizing solar microgrids in the county's next updated A) Multi-Jurisdiction Local Hazard Mitigation Plan and B) Countywide Plan; and
4. Convene a roundtable with experts on solar microgrids to work on implementing a pilot project and location selection.

The recommendations below align with Marin County's commitment to environmental justice as outlined in the Countywide Plan and the county's commitment to prioritize battery storage as outlined in the Marin County Unincorporated Area Climate Action Plan 2030. The Climate Action Plan 2030 includes the following strategies:

- Strategy RE-C1(4): "Renewable Energy Generation and Storage[:]... Encourage installation of battery storage in conjunction with renewable energy generation projects through engagement campaigns and partner agency incentives."
- Strategy RE-C4: "Innovative Technologies[:] Investigate and pursue innovative technologies such as micro-grids, battery storage, and

demand-response programs that will improve the electric grid's resiliency and help to balance demand and renewable energy production in cooperation with local and regional partners such as MCE and PG&E, as feasible."

- Strategy RE-C5: "Community Resilience Hubs[:] The County of Marin will work with the City of San Rafael to develop [2] community resilience hubs at the Albert J. Boro Community Center/Pickleweed Park and the County Health and Wellness Campus."

I. Identify additional locations for CRCs and widely publish this information so that community members know exactly where they can receive services during a power outage or natural disaster.

CRCs, also known as Resilience Hubs, are central locations where community members can access essential services and backup electricity. CRCs are necessary community resources during disasters to provide a range of services, including healthcare, housing, cooling, phone charging, and food and water distribution. CRCs can take all different forms, including libraries, schools, healthcare facilities, community centers, civic centers, shelters, food banks, nursing homes, and emergency services providers. In the Resilience Before Disaster Report, resilience hubs are defined as:

> Physical spaces that provide resources and capacity to promote social cohesion and everyday resilience (e.g., economic, health, environmental), as well as disaster preparedness, response, and recovery (e.g., wildfires, heat waves, and power outages.

Marin County has implemented CRCs in natural disasters and power outages in the past. For example, in October 2019, in partnership with the Red Cross, Marin Center sheltered more than 600 evacuees from the Kincade Fire in Sonoma County. In addition, it provided services to local community members as nearly all 121,581 (99%) electrical customers in Marin County lost power for

several days. A 500-kilowatt portable diesel generator powered the facility during this power outage,[4] and it made it clear that additional energy resilience solutions and additional CRCs are needed.

Marin County should select new locations to designate as CRCs in the county and widely publish a list of all CRC locations. To date, the only published information on designated CRCs easily accessible in the county relates to homeless shelters and offices of healthcare and emergency preparedness agencies. A comprehensive list of CRC locations across the county is unavailable. Community members would likely face a significant challenge with finding the appropriate CRC location to access essential services, especially in an emergency when communication channels may be disrupted.

The attached operational plan shares detailed site selection criteria and checklists to assist in site prioritization and qualification of CRCs.

II. Implement a solar microgrid pilot project in a county-operated CRC.

Marin County should identify a county-operated facility that would be used as a CRC and determine the most suitable funding mechanism to pay for an initial solar microgrid pilot project at the selected CRC. Providing community members with essential services during power outages is of the utmost importance and is a crucial environmental justice issue. Diesel generators at CRCs pose a significant risk for the county, as diesel generators can fail more often. Such failures could be due to malfunctioning switches, overheating, lack of adequate fuel supplies, or other common ailments that affect an engine that sits idly for the vast majority of the time.[5] Diesel generators fail to ensure the dependable backup power that CRCs require and, second, are a short-term solution with a high cost to environmental impact and human health.

Marin County should implement a solar microgrid pilot project in a county-operated CRC to reduce the multiple risks posed by diesel generators — the high probability of a backup power failure and the threats to human and environmental health. Solar microgrids offer many benefits:

- Longer-lasting and more reliable energy resiliency during power outages.
- Cost savings by reducing electricity usage during the most expensive times for electricity.
- Less complicated operations and maintenance needs compared to diesel generators.
- Improved safety because no fuel storage is required.
- No GHG emissions or noise pollution.
- Support for the electrical grid, as batteries can be charged during the day when there is excess electricity supply, and that battery power can be discharged when the grid needs additional power.

Given the dramatic increase in support for community resilience projects across the United States, numerous grant programs are available at the federal, state, and utility levels. Marin County could have the costs of a solar microgrid system fully funded by one of these programs. For example, the California Strategic Growth Council's $100 million CRC Grant Program opens for applications in early 2023. Additional financing mechanisms for solar microgrids and community energy resilience funding are covered in the operational plan.

Preparing for long-duration power outages and natural disasters is a crucial role of the government today and ensuring that the most at-risk community members will be taken care of is essential. Implementing a pilot solar microgrid project will allow Marin County to gain experience deploying solar microgrids and would serve as an essential step in expanding sustainable backup power to more facilities across the county.

III. Incorporate a recommendation, strategy, or section prioritizing solar microgrids in the county's next updated A) Multi-Jurisdiction Local Hazard Mitigation Plan and B) Countywide Plan.

A) Marin County Multi-Jurisdiction Local Hazard Mitigation Plan

Marin County's Hazard Mitigation Plan is due to be updated in 2023. This updated plan should mention community energy resilience projects or backup energy systems for CRCs. Community energy resilience projects and backup energy storage for CRCs are crucial for hazard mitigation and disaster response planning. Therefore, Marin County should include a section or specific recommendations, strategies, and plans for backup battery storage and solar energy at CRCs in the updated Hazard Mitigation Plan.

B) Marin Countywide Plan

The Marin Countywide Plan, which is in the process of being updated, discusses the importance of environmental justice in numerous areas and includes an entire section dedicated to environmental justice (Section 4.10). Community energy resilience is also a crucial component of environmental justice, yet the current version of the Countywide Plan does not address CRCs or backup energy storage for community centers. Marin County should include either a section or specific recommendations, strategies, and plans for backup battery storage and solar renewable energy at CRCs in the updated Countywide Plan.

IV. Convene a roundtable with experts on solar microgrids to work on implementing a pilot project and location selection.

Marin County stakeholders involved in community resilience should participate in a roundtable event facilitated by Aspen Tech Policy Hub fellows to convene leading community resilience, battery storage, and renewable energy experts. The roundtable would review the latest case studies, work

through the technical challenges in previous projects, better understand the different options to fund battery storage, and discuss potential locations to implement backup batteries and solar microgrids. The roundtable's goal would be for Marin County to consider how it can take advantage of the above-noted cost reductions in backup battery and solar technology and implement a pilot project to install a solar microgrid at a CRC.

Given the various departments and working groups within Marin County that either are or would be involved with CRCs and deploying a solar microgrid pilot, the roundtable should include all possible stakeholders. Invited stakeholders should include, but not be limited to, the Microgrid Ad Hoc Working Group, Department of Public Works (DPW), Community Development Agency (CDA), Health and Human Services (HHS), Office of Emergency Services (OES), Facility Planning and Development Division (FPD), the Sustainability Team, and others. The roundtable would align the various stakeholders and address their questions and concerns directly with insights from experts who specialize in solar microgrids and related areas. In addition, the roundtable discussion would help support and inform the various county plans that are in the process of being updated.

This roundtable would:

- Provide background on the need for CRCs, the real risk of long-term power outages, and why backup batteries and renewable energy are much more effective than diesel generators;
- Review the primary criteria and requirements for site selection and how to determine and prioritize the best locations to deploy backup battery solutions;
- Provide an overview of the different funding and financing options for backup batteries, the economic payback period, and the pros and cons of each option; and
- Review 2 to 3 successful examples and case studies of projects that went well, the stakeholders involved, funding sources used, and outcomes.

A sample roundtable agenda can be found here.

Timeline

Installing a solar microgrid can typically take 6 to 12 months for construction and permiting or about 18 to 24 months from the start of the project. Major County public works projects such as this tend to have longer timelines than this and it is likely to take even longer for a public agency that needs to separately design, bid, then build the projects. Based on the following timeline, Marin County would be able to complete an initial pilot solar microgrid project as early as the mid to late 2024. Therefore, we recommend convening the roundtable in Q4 of 2023, choosing a path forward and pilot location by January 2024. This timeline would provide the appropriate schedule to complete the project and apply for grant funding.

Conclusion

Marin County should select additional Community Resilience Centers and deploy solar microgrids at designated CRCs to prepare the community for a future of extreme weather, potential natural disasters, and other threats. The county should use the attached operational plan, a roundtable of experts, and available private and public programs to fund and deploy battery storage and solar microgrids at CRCs. After implementing an initial pilot project, Marin County should better understand the resources required to deploy solar microgrids and the funding opportunities available. Marin County should then expand this initiative and set targets for incorporating CRCs and solar microgrids into their long-term planning. Following successful implementation, Marin County should share the learnings and resources with other city leaders in Marin County and eventually with other cities and counties in California. By implementing these recommendations, Marin County can showcase its leadership by supporting vulnerable communities,

providing all citizens with fundamental human rights and access to community services, and addressing environmental justice by implementing energy resilience solutions for all.

Endnotes

1 Marriele Mango et al., "Resilient Solar And Battery Storage For Cooling Centers: Mitigating the Impacts of Extreme Heat on Vulnerable Populations," *Resilient Power Project*, accessed on October 24, 2022, www.cleanegroup.org/wp-content/uploads/Resilient-Solar-and-Battery-Storage-for-Cooling-Centers.pdf.

2 "Marin County Multi-Jurisdictional Local Hazard Mitigation Plan 2018," *County of Marin*, accessed on September 19, 2022, https://www.marinsheriff.org/assets/videos/Marin-County-Multi-Jurisdictional-Local-Hazard-Mitigation-Plan-2018.pdf

3 Marin County Sheriff's Office of Emergency Services, *Marin County Operational Area Emergency Recovery Plan*, 2012-118, Marin County: Marin County Board of Supervisors, 2012, accessed on September 19, 2022, https://www.marinsheriff.org/assets/downloads/OES/Marin-ERP-Final-BOS-Approved-11.13.2012.pdf.

4 "Innovative Solutions for a Resilient and Equitable Energy." Webinar from CAL-CCA, May 2021, https://cal-cca.org/wp-content/uploads/2021/05/CalCCA-Webinar-10-MCE-Energy-Resilience.pdf.

5 Seth Mullendore and Lewis Milford, "Solar+Storage 101: An Introductory Guide to Resilient Power Systems," *Clean Energy Group*, accessed on September 19, 2022, https://www.cleanegroup.org/wp-content/uploads/Energy-Storage-101.pdf.