initiative for energy justice

JUNE 2026

BUILDING ENERGY JUSTICE INTO DISASTER RESILIENCE & RECOVERY

Learning from Communities on the Frontlines

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THE INITIATIVE FOR ENERGY JUSTICE

IEJ translates complex energy challenges into actionable resources and empowers U.S. communities and policymakers to create an equitable clean energy system.

ACKNOWLEDGEMENTS
The seeds for this publication were planted in conversations with members of the Energy Democracy Project's disaster cooperativism working group in 2025.

Thank you to many individuals who contributed their time and expertise to support its development, including:

Becky Selle, West Street Recovery

Bianca Sopoci-Belknap, Earth Care New Mexico and New Energy Economy

Catherine Hebson, Footprint Project

Crystal Huang, People Power Battery Collective

Dohee Kim, Local Clean Energy Alliance

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Pouya Najmaie, Cooperative Energy Futures

Selena Feliciano, Energy Democracy Project

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Cover Photo: Solar system installation workshop led by AMANESER PR in Caimito, San Juan, Puerto Rico.

EXECUTIVE SUMMARY

As global warming makes extreme weather events more frequent and severe, and as our grid infrastructure ages, communities are increasingly affected by climate disasters and prolonged electric outages. Access to resilient, reliable, renewable energy is a critical part of a community's ability to prepare for, respond to, and recover from these disasters. As the current federal administration rolls back support for clean energy and disaster relief, state, local, and community-led efforts to build resilient energy ecosystems are more important than ever. Crucially, disaster resilience and recovery must be just and equitable: these processes must prioritize, involve, and benefit low-income people, communities of color, tribal communities, and groups historically harmed by extractive energy systems.

This report offers a framework for an energy justice approach to disaster resilience and recovery. Mapping resilient community energy infrastructure across three scales – small and mobile infrastructure, place-based infrastructure, and institutional infrastructure – it aims to help community stakeholders identify entry points, assess what infrastructure is within reach, consider opportunities in different institutional contexts, and think about collaborations that can strengthen work across the ecosystem. Five case studies from California, Texas, North Carolina, and Puerto Rico show how communities are integrating resilient, renewable energy into local disaster preparation and recovery on the ground.

INTRODUCTION

As global warming makes extreme weather events more frequent and severe, and as our grid infrastructure ages, communities are increasingly affected by climate disasters and prolonged electric outages. Investments in disaster resilience and recovery have long struggled to meet the scale of need, leaving communities without vital resources to prepare and recover.[1]

Over the last several decades, with an increase in hurricanes, wildfires, floods, and severe storms due to climate change, communities face heightened risks. The number of billion-dollar disasters – extreme weather events generating over $1 billion in damage – has grown steeply over the past 45 years. In 2023, the U.S. reached a new record of 28 disasters that cost more than $1 billion each.[2] Since 1980, the total cost of these disasters has surpassed $3.1 trillion. While these figures reflect the increase in large-scale catastrophic events, they do not capture the true human costs – to people's lives and livelihoods, to health and wellbeing, and to the social fabric of communities.

Black, Indigenous, people of color, low-income, and other marginalized communities are often first and worst impacted in disaster contexts. These groups face disproportionate risks to their health, wellbeing, and economic stability, and are often forced to wait the longest before their electricity is restored. Furthermore, experiences of marginalized groups during and after disasters reveal longstanding inequities in the ways aid is distributed, particularly across lines of race and class,[3] as well as homeownership[4] and citizen status.[5] As a consequence, communities of color, low-income people, renters, and undocumented people have long been left behind in disaster recovery.

Compounding these challenges, the current political environment further threatens the ability of communities to prepare for and respond to these crises. Since taking office in 2025, the Trump administration has systematically targeted federal investments and offices that support climate mitigation, clean energy, and disaster resilience.

With the administration's rollback of the 2022 Inflation Reduction Act (IRA) – an unprecedented $368 billion investment designed to accelerate clean energy development, reduce carbon emissions, and mitigate climate change while creating millions of new jobs – crucial federal grants, tax credits, and programs have been stalled or terminated, just as this historic investment was getting off the ground. New directives to unleash fossil fuel production and pull back renewable energy investments, if actualized, are likely to accelerate the planetary warming that makes extreme weather more frequent and severe.

The administration's aggressive defunding and dismantling of federal agencies are also leaving states and localities without critical relief and recovery resources. Among them, cuts to NOAA have reduced meteorologists' ability to accurately predict extreme weather,[6] cuts to the U.S. Forest Service have hampered critical wildfire prevention efforts,[7] and cuts to FEMA have threatened crucial disaster resilience, relief, and recovery capacity.[8]

Alongside the loss of crucial federal resources, growing militarization threatens various dimensions of community resilience and disaster recovery. The administration's targeted attacks on immigrants and communities of color – including through an unprecedented expansion of ICE[9] and the deployment of the military to U.S. cities[10]– further threaten the ability and willingness of many individuals to seek out aid and services during and after disasters. The last several years have also seen increasing reports of militia activity in disaster zones from Texas[11] to California[12] to North Carolina,[13] as armed right-wing groups seek to expand their influence by providing emergency disaster aid.

In this climatic and political context, building disaster resilience at the state and local levels is more urgent than ever. Access to resilient, reliable, renewable energy is a critical part of a community's ability to prepare for, respond to, and recover from disaster. To this end, the energy justice movement has a crucial role to play in amplifying a vision for equitable disaster resilience and recovery, and a set of strategies for expanding access to these energy resources in frontline communities. Delivering the material benefits of clean, resilient power to people in times of extended outages and climate disasters may also help generate greater interest and involvement in the energy justice movement.

Access to resilient, reliable, renewable energy is a critical part of a community's ability to prepare for, respond to, and recover from disaster. To this end, the energy justice movement has a crucial role to play in amplifying a vision for equitable disaster resilience and recovery, and a set of strategies for expanding access to these energy resources in frontline communities.

This publication offers a framework for what an energy justice approach to disaster resilience and recovery can look like, highlighting ways that communities can meet emergency needs with renewable, community-owned energy systems. It also highlights the social infrastructure necessary to integrate resilient, renewable energy resources into communities and local places. Delivering immediate relief and working toward long-term change requires intentional relationship, coalition, and movement building. It also requires ongoing efforts to strengthen local capacities: from energy literacy to help individuals understand and address their energy needs, to technical assistance for community organizations seeking to acquire solar and storage, to education for local officials about ways to prioritize equity in decision-making.

In what follows, we discuss the inequities embedded in disaster response and recovery, and important movement-led work toward more equitable resilience and just recovery. We then build upon these frameworks to incorporate an explicit energy lens, mapping opportunities to shift from an inequitable, fossil fuel-dependent status quo, toward community-led resilience and recovery powered by renewable energy. We also highlight five cases of community efforts to integrate resilient, renewable energy into local disaster resilience and recovery. From Texas to North Carolina, Puerto Rico to California, these examples illustrate how communities are making this a reality in diverse social, geographic, and institutional contexts, with different levels of resources, and at different scales of intervention.

This publication offers a framework for what an energy justice approach to disaster resilience and recovery can look like, highlighting ways that communities can meet emergency needs with renewable, community-owned energy systems.

Footprint Project installs solar panels in the aftermath of Hurricane Helene.

FROM DISASTER CAPITALISM TO JUST RECOVERY

Disasters expose and exacerbate the social, economic, and racial inequities structured into our society. Communities of color and low-income communities are disproportionately impacted – among those most vulnerable to the harms of hurricanes, wildfires, and pandemics, and frequently less prioritized in recovery.[14] These vulnerabilities are also intersectional: factors like race, socio-economic status, age, and gender converge with factors like geography, health, disability, and legal status in ways that can further deepen vulnerability to disaster.

The disaster recovery process also perpetuates and deepens inequities as powerful actors exploit crises for profit – using disruption to pursue deregulation, privatization, land speculation, and redevelopment that disadvantages and harms marginalized communities. This process, referred to as ***disaster capitalism***, appears time and time again in places impacted by major disasters.[15]

Following Hurricane Katrina, while private contractors arrived in the city to rebuild, authorities took advantage of the state of emergency to push through privatization of New Orleans schools and public housing stock.[16] During the 2021 Texas winter storm that left a majority of the state in the dark for days, the governor-appointed Public Utility Commission allowed the wholesale cost of electricity to spike 7,400% above the average – costs that everyday Texans are still paying for years later.[17] In the aftermath of catastrophic wildfires that have destroyed neighborhoods and towns across California in recent years, land speculation has permanently displaced countless vulnerable residents from the communities they called home.[18] And after Puerto Rico's electric grid was destroyed during Hurricane Maria, authorities and corporations capitalized on the crisis to privatize the island's publicly-managed power system[19] – which some also analyze through a lens of coloniality[20] and disaster colonialism.[21]

A *just recovery* centers the needs and leadership of historically marginalized communities as they rebuild, while working to remedy longstanding injustices and inequities.

While corporate actors have often exploited disasters for gain, communities have long stepped up in times of disruption to support neighbors through mutual aid, collective care, and collective action.[22] These practices of social solidarity during times of emergency represent an alternative to disaster capitalism that has been referred to as ***disaster collectivism*** or ***disaster cooperativism***.[23] From sharing resources, to providing meals, to housing displaced neighbors, everyday people often step in to help each other when systems and institutions fail to meet their basic needs.

Alongside these everyday actions of solidarity and mutual aid during disaster are community-led efforts to build deeper structural change. In the wake of recent climate disasters, COVID-19 pandemic, and economic crises, grassroots organizers and movement support organizations have developed and advanced visions for a ***just recovery*** – one that centers the needs and leadership of historically marginalized communities as they rebuild, while working to remedy longstanding injustices and inequities.

MAPPING MOVEMENT FRAMEWORKS FOR JUST RECOVERY

The term *just recovery* is frequently attributed to organizers of color in the Gulf South involved in amplifying community needs and coordinating relief and recovery in the aftermath of Hurricane Harvey in 2017. Their calls for a #JustHarveyRecovery built on decades of experience building grassroots networks of solidarity and care in their communities and responding to fossil fuel and climate-linked disasters across the South, including the B.P. oil spill and Hurricane Katrina.[24]

Importantly, this vision of just recovery is not premised on returning to a pre-storm status quo characterized by deep and longstanding social, racial, and economic inequities. Rather, it recognizes and responds to ongoing disasters of structural oppression, rebuilding in a way that allows all communities to thrive.

The notion of just recovery has since spread widely through intersectional movements for environmental, climate, economic, and racial justice. Another Gulf is Possible offers a framework for moving from a climate disaster status quo to a just recovery.[25] In the status quo, emergency aid distributed by large NGOs and the federal government does not always reach the most vulnerable; large-scale disruption creates opportunities for wealthy and corporate actors to exploit vulnerable communities by acquiring cheap land and labor; and community members can face permanent displacement from their homes due to post-disaster gentrification, land speculation, and high rebuilding costs. Just recovery, on the other hand, builds networks of mutual aid to deliver relief in equitable ways, mobilizes resources to ensure that community members can return to their homes, and rebuilds communities in ways that remedy longstanding vulnerabilities and inequities.

The Climate Justice Alliance has built on this framework, developing rapid response infrastructure, deploying solidarity relief brigades to disaster-impacted communities, as well as articulating just recovery policy stances,[26] including:

1. A right to return for displaced migrants;
2. Land, soil, water restoration with community governance;
3. Fair housing recovery that remedies discriminatory inequities in housing assistance;
4. Investment in community hubs powered by renewable energy;
5. Resourcing mutual aid collectives;
6. Increasing funding for community-driven recovery over the long-term.

For Movement Generation, "A Just Recovery resists disaster capitalism at every step – from the disaster collectivism that models people-powered, heart-centered, socially just relief to the long-term organizing and actions that reclaim the right of peoples to define their economies and govern their communities." [27]

Many other community and movement organizations utilize just recovery frameworks and practices in their work. Communities for a Better Environment (CBE) applies this framework in its local organizing and campaigns to address the climate crisis.[28] In the wake of the 2025 Los Angeles fires, they mobilized quickly to distribute KN-95 masks, connect people to mutual aid networks, and provide capacity to local recovery hubs. The Miami Workers Center has coupled community-based disaster relief with just recovery policy advocacy at the local and state levels.[29]

For the Asian Pacific Environmental Network (APEN), "Our vision for just recovery is part of a necessary transition away from an extractive fossil fuel economy and toward a regenerative economy that centers local solutions that strengthen community resilience, improve air quality, and nurture collective models of local ownership and governance in working-class communities of color." [30] As part of this work, APEN has carried out research and resilience planning efforts focused on expanding networks of community resilience hubs powered by renewable energy across the state.

Countless other groups – from grassroots collectives to regional and national networks – are advancing on-the-ground efforts for just recovery.[31] Their frameworks and practices provide important foundations for building a resilient, renewable community energy ecosystem. In the sections that follow, we build on these foundations to more comprehensively map community energy infrastructure that can serve local needs in equitable ways before, during, and after disasters.

Footprint Project sets up solar panels at Big Ivy Community Center after Hurricane Helene.

RESILIENT COMMUNITY ENERGY INFRASTRUCTURE FOR DISASTER

Groups involved in local disaster relief and recovery recognize the importance of distributed renewable energy resources for meeting community needs. Among them are grassroots mutual aid collectives distributing mobile battery packs to neighbors, community organizations building local resilience hubs, and non-profits expanding access to rooftop solar and storage in low-income communities of color.

In a moment when federal funds for clean energy, community resilience, and disaster recovery are being massively rolled back, learning from community-based efforts is more important than ever.

In a moment when federal funds for clean energy, community resilience, and disaster recovery are being massively rolled back, learning from these community-based efforts is more important than ever. This publication aims to lift up their diverse ideas, lessons, and strategies for transforming a harmful energy status quo into a resilient community energy ecosystem.

THE ENERGY STATUS QUO

The benefits and burdens of our current energy system – characterized by heavy reliance on fossil fuels, corporate ownership, and profit-driven decision making – are not distributed equitably. While profits in the energy economy have accumulated for the fossil fuel industry, investor-owned utilities, and their shareholders, marginalized communities have experienced historic harms. Frontline communities living near toxic oil and gas facilities, low-income households struggling to pay skyrocketing utility bills, and tribal communities and communities of color that experience disproportionately high energy burdens and shutoff rates are among the most impacted.

When extreme weather hits and the grid goes down, these communities face additional challenges. As a result of structural inequality, many are left without the resources and support to adequately prepare for, cope with, or recover from these disruptions. Taking stock of disaster-related energy challenges reveals a status quo that is inequitable, health-harming, polluting, unreliable, and expensive.

- ***Inequitable***: Power outages and grid repairs are not distributed equally, and marginalized communities are often left behind. Grid infrastructure in underinvested and historically disadvantaged communities is, in many cases, older and less reliable,[32] and has less capacity to interconnect distributed energy resources.[33] All of this leaves residents more vulnerable to disruption. In many places, communities of color,[34] lower-income communities, and those with high social vulnerability[35] experience longer waits[36] than white and wealthier populations before their power is restored. Additionally, low-income households, renters, and communities of color have less access to resilient energy like solar and battery storage (whether due to cost, tenant status, or grid disparities that limit interconnection in historically disadvantaged communities).

- ***Polluting***: During disasters with extended power outages, people typically depend on loud, polluting gas and diesel generators to keep their lights, heating, and air-conditioning on. Fossil fuel generators emit harmful pollutants, such as carbon dioxide, nitrogen oxides, carbon monoxide, and particulate matter that has been linked to serious and chronic health conditions, including heart disease, respiratory disease, and cancers.[37] While they can provide crucial backup power in times of need, fossil fuel-powered generators worsen local air quality and perpetuate the carbon emissions that drive climate change.[38] With outages becoming more frequent, the scale of emissions can be significant. For example, in October 2019, over 970,000 electric customers in California were affected by public safety power shutoffs. The California Air Resources Board estimated that during this month, 125,000 used backup generators that released 9 tons of diesel particulate matter – equivalent to emissions from adding 29,000 heavy duty diesel trucks on the roads for an entire month.[39]

- ***Health-harming***: Power outages contribute to a significant portion of disaster-related morbidity and mortality. Lack of access to heating, cooling, or electricity to power medical devices[40] – along with improper use of portable generators and gas stoves to meet energy needs – pose significant risks to health and life. Of 91 deaths linked to Hurricane Ida, nearly 19% were attributed to power-outage related causes.[41] When the Texas grid went down during Winter Storm Uri, two-thirds of the 238 official deaths resulted from hypothermia, 10% from the exacerbation of underlying illness, and 8% from carbon monoxide poisoning.[42] At the same time, immediate disaster death tolls do not present the full picture, since disasters and outages can contribute to greater numbers of indirect deaths[43] or exacerbate health problems that lead to negative outcomes further down the line.[44]

- ***Unreliable***: Using gas and diesel generators during extended outages requires ongoing access to fossil fuel supply. Disasters regularly interrupt supply chains, destroy roads and transportation infrastructure, and prompt rushes on resources (e.g., long lines and low supply at gas stations).[45] When these resources are scarce, fossil fuel-dependent generators can become unreliable. Additionally, low-income, disabled, and elderly individuals, as well as rural residents living long distances from commercial centers, may lack the mobility to procure these supplies when needs arise.

- ***Expensive***: Energy is becoming increasingly unaffordable for everyday people, and the economic disruption that accompanies disasters can make access to back-up energy sources even more challenging. Gas and diesel generators are expensive to fuel and maintain, making them especially burdensome during extended outages of multiple days, weeks, or months.[46] In addition, fossil fuel prices are notoriously volatile, and can spike when extreme weather events like hurricanes shut down production, or when geopolitical unrest disrupts trade relations, supply chains, and shipping routes.[47]

Transforming this status quo is possible, and an energy justice approach works to meet community needs with energy resources that are equitable, clean, healthy, reliable and affordable.

RESILIENT ENERGY INFRASTRUCTURE ACROSS SCALES

Viable alternatives to this energy status quo exist, and communities are using them to support their needs during outages, extreme weather, and disasters. From solar battery sharing to mobile solar trailers to rooftop solar and storage – communities are using renewable energy resources to meet resilience, relief, and recovery needs.

Resilient community energy infrastructure is not merely physical, it is also social and political. Technologies are always embedded within specific places, social relationships, institutional arrangements, and power structures.

Importantly, resilient community energy infrastructure is not merely physical, it is also social and political. Technologies are always embedded within specific places, social relationships, institutional arrangements, and power structures. These social and political dynamics shape how technologies are deployed, adopted, and utilized, and the impact they are able to have. As a result, building community energy resilience is not solely a technical endeavor.

Equity must be at the center when building this infrastructure. An energy justice approach to community resilience should prioritize neighborhoods, communities, and places where histories of racial disinvestment, high social vulnerability, exposure to climate impacts, and a high risk of outages converge. Furthermore, centering the leadership of diverse, trusted community organizations is crucial for meeting the needs of historically marginalized groups, and supporting recovery that remedies longstanding social, racial, and economic inequities.

An energy justice approach to community resilience should prioritize neighborhoods, communities, and places where histories of racial disinvestment, high social vulnerability, exposure to climate impacts, and a high risk of outages converge.

The work of building a resilient community energy ecosystem happens at various scales, from dedicated residents organizing mutual aid out of a neighbor's garage, to city council chambers and statehouses where policies are debated and passed. It also requires efforts across near- and long-term timelines, ensuring immediate material support reaches people during an emergency, while also building power for structural and systemic change. Community members, advocates, practitioners, and policymakers all bring different strengths, different levels of resources, and different spheres of influence – and all have roles they can play.

To support efforts to build equitable energy resilience, we offer a framework for thinking about community infrastructure for disaster preparation and recovery at different scales. Building on movement-led just recovery frameworks, it takes a deeper dive into resilient, renewable energy resources specifically. While not exhaustive, it aims to provide a more comprehensive inventory of resilient energy infrastructure for disaster than we have seen compiled before.

We map community infrastructure across three scales: small and mobile infrastructure, place-based infrastructure, and institutional infrastructure. In organizing infrastructure by scale, we aim to help differently-positioned stakeholders identify entry points, assess what infrastructure is within reach, consider opportunities in different institutional contexts, and strategize what collaborations and coalitions can strengthen work across the ecosystem. Our hope is that this resource helps communities visualize the universe of possibilities available.

SMALL, MOBILE INFRASTRUCTURE

Small-scale, mobile energy resources are key tools for meeting basic needs like phone charging, refrigeration, and lighting during a crisis. Solar trailers (vehicles outfitted with solar panels and batteries) can be driven or towed to communities impacted by a disaster to deliver emergency energy, power emergency operations hubs, or set up community charging stations. Solar-powered fridges and water filtration systems can ensure access to safe food and clean water when the grid goes down. E-bikes, electric vehicles, and EV charging stations can help meet local transportation needs – supporting supply distribution, evacuations, and other logistics when disasters leave fuel in short supply. Mobile wind and hydro generators can supplement solar energy in diverse weather conditions. And battery lending libraries – where local residents can borrow rechargeable batteries to keep their devices charged at home – offer a lifeline for meeting the most essential energy needs when the grid is down.[48]

Portable technologies offer significant flexibility. They can be shared and circulated among neighbors, quickly deployed to disaster-impacted places, and moved to new locations as needs and conditions change.

These types of portable technologies offer significant flexibility. They can be shared and circulated among neighbors, quickly deployed to disaster-impacted places, and moved to new locations as needs and conditions change. This scale of infrastructure may be the most accessible starting point for small community groups, mutual aid collectives, and grassroots organizations seeking to acquire backup power for disasters. Communities have used various funding strategies to acquire small and mobile energy resources – including crowdfunding, soliciting in-kind or monetary donations, as well as philanthropic and public sector grants.

PLACE-BASED INFRASTRUCTURE

Place-based community energy infrastructure can help meet larger-scale needs in durable ways. Anchored in place and serving communities year round during disasters and blue skies, this type of infrastructure can take various forms. Resilience hubs are trusted community spaces like libraries, recreation centers, and community-based organizations where residents can access support and services.[49] Adding solar plus storage microgrids to these hubs is crucial for expanding access to safe gathering spaces with electricity, heating, and cooling during extreme weather.[50] When outfitted with distributed energy resources, resilience hubs become spaces where neighbors can seek relief

from extreme temperatures, keep medications refrigerated, or plug in medical devices. Community-owned microgrids can island from the grid to keep lights on during an outage, and they can also sell energy back to the grid during blue sky conditions – supporting the economic resiliency of local community groups year round.[51] As evidence from recent disasters has shown, they can also be especially useful in geographically isolated communities.[52]

Expanding household access to distributed energy resources like rooftop solar panels and home battery storage, particularly in low-income communities and communities of color, also supports community resilience. Greater access to backup power in historically marginalized communities positions neighbors to more effectively share resources and help each other out when the grid goes down. Virtual power plants (VPPs), meanwhile, can relieve overall stress on the grid during extreme conditions.[53] As networks of distributed energy resources (including solar and storage, smart thermostats, heat pumps, and EVs), VPPs can coordinate, aggregate, and optimize stored energy across thousands of users to reduce load during times of peak demand – and potentially mitigate outage risks.

Working to develop place-based infrastructure is a key scale for established community organizations, energy justice practitioners, and local governments to collaborate on building more permanent solutions in place. This requires larger sources of funding, such as philanthropic, municipal, and state grants; revenue from public or non-profit energy providers; as well as low-interest, community-accessible financing.

Place-based community energy infrastructure can help meet larger-scale needs in durable ways, serving communities year round during disasters and blue skies.

INSTITUTIONAL INFRASTRUCTURE

Building energy justice into disaster resilience requires institutional transformation over time and across our energy system. This includes policy, legislative, and regulatory efforts to support frontline community energy needs and a more resilient and flexible grid.

At the ground level, preparing for a more just disaster response requires new social infrastructures of collaboration between local governments with emergency response capacity and community organizations that closely understand the needs of marginalized communities. This includes coordination to inventory, acquire, and deploy rapid response resources and renewable back-up power – and ensure they reach the most vulnerable residents. Preparation also requires programmatic investments at the state, local, and utility levels. This includes weatherization, energy efficiency, and low-income bill assistance programs that build household energy security ahead of a disaster,[54] reduce stress on the grid,[55] and bolster the physical and economic resilience of households when extreme weather hits.[56]

State policies and legislation that enable and incentivize the adoption and expansion of DERs – from rooftop solar to community microgrids and virtual power plants – are critical for supporting community energy resilience. While momentum around DERs is growing in many states,[57] many policies still lack equity provisions, such as required enrollment targets for income-qualified households, renter-inclusive programs like community solar, as well as low-income grants and discount programs. Investments to modernize the aging power grid, build in greater grid flexibility,[58] and reduce the barriers of cumbersome interconnection queues[59] are needed as well. And after a disaster hits, state and federal funding incentives to rebuild housing, businesses and public buildings in more resilient ways, with distributed energy resources, are crucial for a just recovery.

Policy, legislative, and regulatory efforts that democratize energy ownership and decision-making are key to support frontline community energy needs.[60] Locally-controlled, democratically-managed, and publicly-owned energy institutions can include community choice aggregators (CCAs),[61] municipal utilities,[62] and community-owned solar cooperatives.[63] The structure of these organizations offers greater opportunity for community members to shape their local energy system when compared to investor-owned utilities. When held accountable to community needs, they can support resilience in key ways: procuring energy from renewable sources, keeping energy rates affordable, and channeling resources into local resilience hubs and community resilience programs.

Building energy justice into disaster resilience requires institutional transformation over time and across our energy system. This includes policy, legislative, and regulatory efforts to support frontline community energy needs and a more resilient and flexible grid.

Achieving these kinds of structural and institutional changes will require various long-term efforts – from ongoing policy advocacy, to public power campaigns, to ratepayer organizing to hold utilities accountable. This scale of intervention is an important space for coalitions of diverse stakeholders, from movement organizations to consumer advocacy groups to allied policymakers, to build power and momentum for systems change. Change at this scale will also require diverse funding over the long term, from philanthropic funding to support ground-game community organizing, to local and state funds for expanding energy efficiency and weatherization programs, to significant allocations of state, federal, and utility funding for grid modernization.

After a disaster hits, state and federal funding incentives to rebuild housing, businesses and public buildings in more resilient ways, with distributed energy resources, are crucial for a just recovery.

RESILIENT COMMUNITY ENERGY INFRASTRUCTURE

As climate change intensifies and federal disaster aid is rolled back, community-led efforts to prepare for and recover from extreme weather and extended outages are more crucial than ever. Building energy justice into this work happens across various scales, from neighborhood streets to policymaking arenas. This map of a resilient energy ecosystem offers an entry point for community members, advocates, and practitioners to assess what infrastructure is within reach, identify opportunities for different local and institutional contexts, and strategize their role in building energy justice into disaster resilience, relief, and recovery.

Small, mobile infrastructure

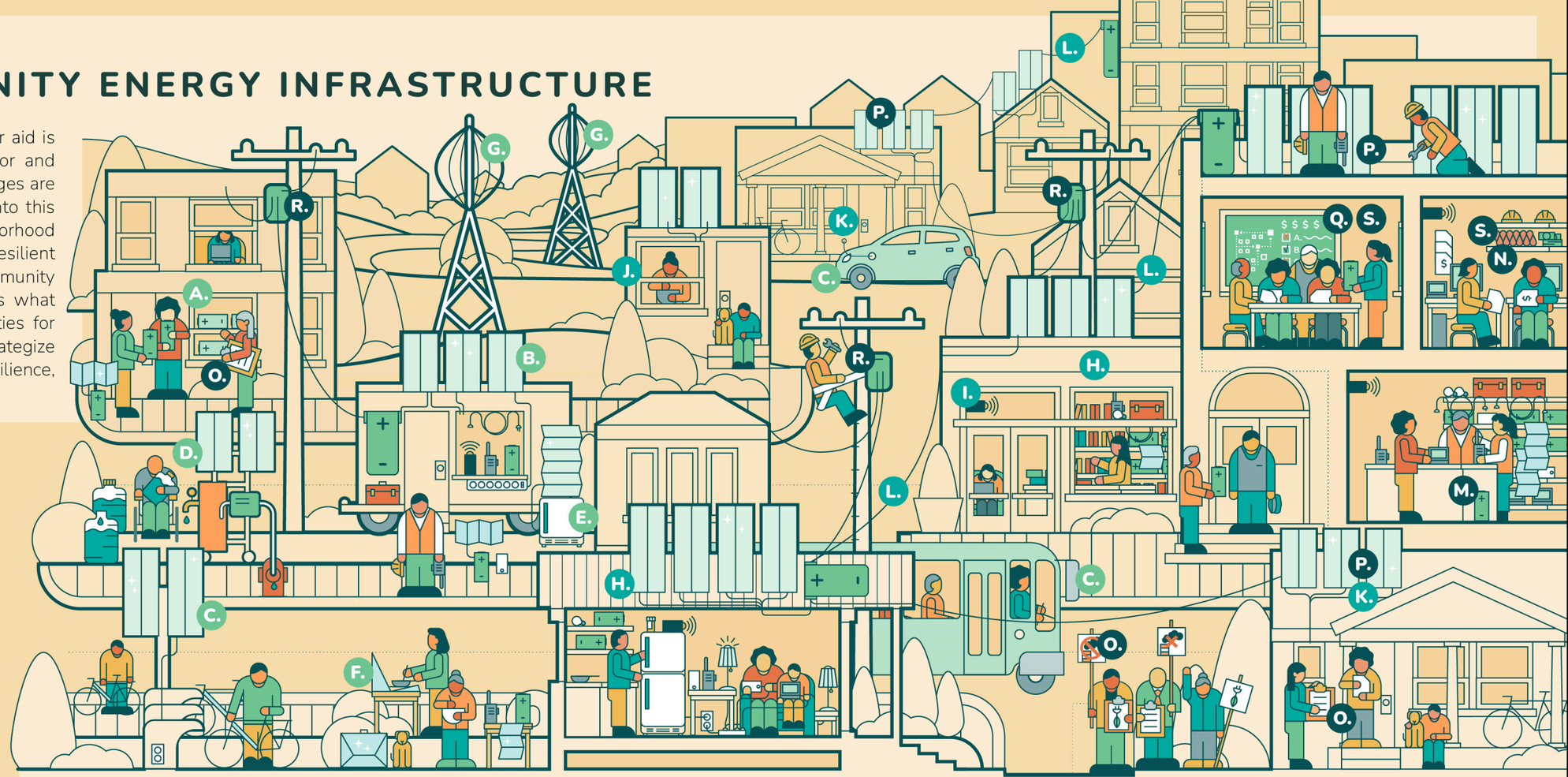
Small-scale, mobile energy infrastructure is crucial for meeting basic needs like phone charging, refrigeration, and lighting during a crisis. Portable technologies can be shared and circulated among neighbors, deployed to disaster-impacted places, and moved around as needs and conditions change. This scale represents an accessible starting point for mutual aid collectives, neighborhood groups, and grassroots organizations seeking backup power for disasters.

Place-based infrastructure

Place-based community energy infrastructure can help meet larger-scale needs in durable ways. Adding distributed energy to local buildings and trusted community spaces expands access to resources, electricity, and energy-intensive needs like heating and cooling during extreme weather. This scale is a key arena for established community organizations, energy justice practitioners, and local governments to build more permanent solutions in place.

Institutional infrastructure

Building energy justice into disaster resilience requires institutional transformation across our energy system. Policy, legislative, and regulatory efforts that democratize energy decision-making are key to support frontline community energy needs. This scale of intervention is an important space for coalitions of diverse stakeholders, from movement organizations to consumer advocacy groups to policymakers, to build collective power for systems-change.



SMALL & MOBILE INFRASTRUCTURE

- **A.** **Battery lending libraries** that provide neighbors with rechargeable backup power
- **B.** Mobile solar + storage units, like **solar trailers,** that can be quickly deployed for phone charging, lighting, medical devices & refrigeration
- **C.** **Electric vehicles & e-bikes** with charging stations to aid supply distribution, evacuations & other logistics
- **D.** Solar **water filtration systems or atmospheric water generators** that purify water & reduce need for bottled water shipments
- **E.** **Solar-powered fridges & freezers** to store food and medications
- **F.** **Solar ovens** to support hot meal preparation
- **G.** Mobile **wind & hydro units** to supplement solar generation in different weather conditions

PLACE-BASED INFRASTRUCTURE

- **H.** Community **resilience hubs** with solar + storage, where people can access electricity & resources during blackouts
- **I.** **Solar phone charging hubs & mesh networks** for communication when centralized systems go down
- **J.** Dignified, accessible **shelters powered by clean energy** where displaced people can meet basic needs during an emergency
- **K.** Equitable access to **distributed energy resources (DERs)** like rooftop solar + storage, virtual power plants, and EV-to-home charging technology, so neighbors can help each other when power goes out
- **L.** **Community microgrids** that generate energy savings for community organizations and provide backup power during disasters

INSTITUTIONAL INFRASTRUCTURE

- **M.** Coordination between local government and community organizations to **inventory, acquire, and deploy rapid response infrastructure** ahead of extreme weather
- **N.** **Weatherization, energy efficiency & bill assistance programs** for low-income households
- **O.** Organizing communities & ratepayers in **public power & utility reform campaigns** to hold utilities accountable
- **P.** **State policies & legislation** that enable DERs like community solar & community microgrids
- **Q.** Leveraging **locally-controlled energy institutions,** like community choice aggregators & municipal utilities, to fund community energy resilience
- **R.** **Grid modernization for climate resilience,** with equitable investments for marginalized & disinvested communities
- **S.** **State & federal funding incentives** to rebuild housing, businesses & public buildings with DERs after a disaster

CASE STUDIES

What can we learn from community-led efforts to build energy justice into disaster preparation, relief and recovery? Communities directly impacted by the failures of our current energy system illustrate important paths forward – drawing on lived expertise of energy insecurity, leveraging local community assets, and building power in strategic coalitions to advance equitable energy resilience.

The five case studies that follow highlight work happening in diverse places, across rural and urban geographies, within distinct institutional contexts, with differing levels of resources, and at different scales. Together, they offer important takeaways for expanding community energy resilience in just and equitable ways.

Supplies in Footprint Project's Solar Free Store in Western North Carolina.

CASE STUDY 01

People Power Battery Collective

A grassroots model for sharing backup energy among neighbors

San Francisco Bay Area, California

The People Power Battery Collective is a mutual aid network in the San Francisco Bay Area that supplies battery backup power to neighbors experiencing electric outages or shutoffs. It emerged as a project of People Power Solar Cooperative, which worked "to create a just and inclusive transition to renewable energy by enabling everyone to own and shape our energy future," through community-owned solar projects.

Origin

In September of 2020, as wildfires burned hundreds of thousands of acres across Northern California, blankets of thick wildfire smoke drifted into the Bay Area, turning the sky dark orange. Members of the People Power Solar Cooperative were already organizing to build democratically managed energy projects, and recognized that climate impacts on their doorsteps made this work ever more urgent. In response, members of the cooperative began organizing a battery sharing collective to deliver emergency power to neighbors affected by outages, public power safety shutoffs, and service disconnections. Their first call to organize brought together 60 people from various Bay Area communities interested in sharing energy resources.

Community Energy Needs

People Power Battery Collective supports Bay Area residents facing a variety of energy emergencies. Across the state, more frequent and catastrophic wildfires are leaving residents increasingly vulnerable to public safety power shut-offs and disaster-related outages. When utilities shut off electricity during high fire risk conditions, or when power lines go down during extreme events, the Battery Collective can deliver emergency power to neighbors with pressing power needs. The collective also has a role during blue sky conditions. In formerly redlined neighborhoods across East and West Oakland, South Berkeley and Richmond, historic disinvestment and aging grid infrastructure often lead to struggles with small-scale outages. According to Battery Collective co-founder Crystal Huang, "We end up using [the batteries] mostly for random brownouts. We were prepared for a neighborhood scale blackout... but poor infrastructure in redlined communities is also a thing." In addition, skyrocketing utility rates in California put low-income residents at risk of service disconnection when they can't afford to pay their bills. The collective's batteries have also been used to support members affected by utility shutoffs for non-payment.

CASE STUDY 01

The People Power Battery Collective

Over the course of many months, community members with different interests and skillsets came together to develop a system for sharing portable batteries. Individuals with backgrounds in community organizing stepped in to design processes for democratic decision making and communication, members with direct experience of energy insecurity shared their lived knowledge, and the technically-oriented in the group helped determine the wattage needed to support basic energy needs and set up the battery components. Volunteers in different neighborhoods hold onto the batteries until there is a need for backup power in the community. When network members experience an outage or shutoff, they reach out to the battery holders and who arrange for delivery. The batteries have capacity to charge phones and laptops, power a wifi modem, or keep food and medications refrigerated. When the emergency passes, the user recharges the battery with solar power or through an outlet, and returns the battery to the collective so that it can be shared with the next person in need.

Social Infrastructure

According to collective members, the most important element of the battery collective is the social relationships that make it possible. Rooted in mutual aid principles and solidarity across lines of race and class, the collective exists to help people share energy resources with each other, rather than waiting on institutions that are often slow to step in or fail to prioritize frontline community needs. As Crystal Huang explained, “Instead of relying on politicians to understand and authorize action, resources should flow directly to the communities already living the consequences of climate change. And the greatest resource we have is our collective power.”

The collective spreads the word through community events like a “Pancakes in the Park” party, where organizers cook community breakfasts on a solar-powered stove in a Pop-up Village. These public gatherings create an opportunity to meet new neighbors, build relationships, and help people learn about the taken-for-granted ways that energy shapes our lives. The battery collective aims to integrate joy into its events and organizing, creating spaces for people to have fun while strengthening community bonds and building new knowledge about energy.

Community members play the "How Much Energy?" game to learn about energy usage at one of People Power's Pop-Up Village events.

Interested in creating your own battery sharing collective? Check out People Power Battery Collective’s toolkit here.

CASE STUDY 01

Governance & Ownership

The battery collective is governed cooperatively, and the batteries belong to the collective rather than any individual organizers. The network members who attend meetings consistently are the primary decision makers of the collective, as they carry the knowledge and insights that come from carrying out the work. Collective decision-making, even when rooted in shared values and purpose, is not without its challenges. As Crystal Huang reflects, “It can be hard to get everyone to agree to something. Because misalignment happens all the time, especially if you have a diverse group of people.” For battery collective members, committing to an intentional practice of cooperative labor, extending grace toward each other, and taking rest when needed are all part of its approach to collective governance: “Listening to the cycle of nature is a key in our governance.”

Funding & Financing

People Power Battery Collective is a self-funded mutual aid project. Using a “pass the hat” approach, its members contributed small sums to collectively purchase parts for the batteries they steward. Its small scale and crowdfunded approach makes it a feasible model of replication in other communities with limited resources. Organizers also suggest a number of recommendations for other communities to procure batteries affordably, including seeking donations from local institutions or businesses, procuring batteries second hand through platforms like Craigslist or FreeCycle, or requesting retired batteries from medical settings, which typically discard batteries based on age, regardless of remaining function and capacity.

Battery Collective members transport one of their batteries.

CASE STUDY 01

Key Lessons

People Power Battery Collective offers key lessons for meeting emergency energy needs while building momentum for energy democracy.

- ***Community building.*** As People Power Battery Collective asserts, "Intentionally building community is the most critical part of building an emergency battery network, as it is the foundation that informs everything else: relationships, communication, norms, and an understanding of needs are all critical components." While the batteries themselves provide a focal point and tool to meet concrete material needs in emergencies, the relationships of solidarity, care, and collective problem solving built up around it play a key role in supporting communities when institutions fail.

- ***Battery sharing can meet community needs during various power emergencies, not only during extreme weather.*** While the battery collective was conceived during wildfire season with climate impacts in mind, in practice it supports community members experiencing diverse power emergencies. Whether someone needs to charge devices during a disaster, or to keep their fridge running after the utility disconnects their service for missing a utility bill payment, lending portable batteries within a community network offers a flexible, replicable approach to meeting small-scale energy needs.

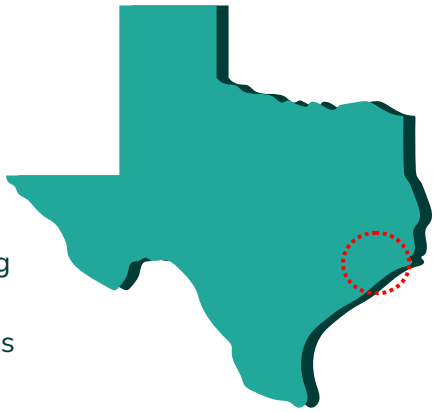
- ***Building energy literacy and new ways of relating to energy.*** Energy is often a taken-for-granted resource. In modern times, we meet countless basic needs with the flip of a switch, without having to think about where our electricity was sourced, how it was transmitted to our homes, as well as who makes decisions about how it is governed, who will profit, and who will be left behind. The People Power Battery Collective offers a way for people to build knowledge about the energy needed to meet daily needs. As Crystal Huang explains, "We cannot just think about energy as a bill we pay." With this in mind, the battery collective became "a gateway for people to understand their relationship with energy, so they can begin to grow the consciousness needed to reimagine a new energy system that will actually work for them." Small efforts to share energy resources locally can transform energy into a collective resource in real time, and plant the seed that a different energy system is possible.

CASE STUDY 02

West Street Recovery & Northeast Action Collective

Filling gaps in municipal resilience infrastructure with a network of solar-powered home-based hubs

Houston, Texas



West Street Recovery is a non-profit working in Northeast Houston to help communities prepare for and recover from disaster in just and equitable ways. Northeast Action Collective is a group of community members focused on improving environmental conditions and increasing quality of life in their Northeast Houston neighborhood. Together, they support disaster resilience with a network of "Hub Houses" that serve as emergency resource, evacuation, and distribution centers for neighbors during disasters or power outages. These local homes, outfitted with solar, battery storage, and backup generators, reflect a community effort to fill gaps in municipal resilience infrastructure.

Origin

In August of 2017, Hurricane Harvey made landfall on the Texas Coast. The most intense rainfall event in U.S. history, Harvey dumped over 51 inches of rain on Houston, produced catastrophic flooding, and took 68 lives. In the immediate aftermath, a group of community organizers came together to support rescues, distribute supplies, and assist flood survivors in Northeast Houston. Observing deep inequities in the recovery process, they formed West Street Recovery to carry out home repairs and build local flood resilience with low-income residents left behind by federal disaster aid. In 2018, Northeast Action Collective (NAC) came together as a way for impacted community members to work together for change and preparedness.

In February of 2021, Houston was hit by a different type of disaster with Winter Storm Uri. Snow, ice, and sub-freezing temperatures compromised Texas' poorly weatherized gas infrastructure, leading to a days-long blackout across a majority of the state. Over 246 lives were lost as residents froze in poorly insulated homes or succumbed to carbon monoxide poisoning in attempts to keep warm with gas stoves, cars, and generators. Winter Storm Uri prompted West Street Recovery and Northeast Action Collective to expand their work beyond flood resilience and recovery, to provide community members with resilient energy.

Community Energy Needs

West Street Recovery and the NAC work in six high-poverty, majority African American and Latinx zip codes in Northeast Houston that have faced historic and structural marginalization. Alongside intersecting social vulnerabilities, residents of Northeast Houston also face overlapping environmental and climatic risks, including hurricanes, high flood risk, extreme heat, and pollution

CASE STUDY 02

from nearby oil and gas facilities. Blackouts during the Houston summer can leave community members exposed to dangerously high temperatures and humidity, winter freezes create risks to surviving without heat, and outages can be life threatening for medically-vulnerable residents. At the same time, these neighborhoods are also home to organized and engaged community members involved in environmental justice activism, civic advocacy, and collective care.

Hub Houses

The Hub Houses are neighborhood homes outfitted with solar and storage capacity, backup generators, and emergency supplies available to neighbors during an emergency. Across northeast Houston, eight community members (hub captains) volunteer their homes and their time for the program, receiving training and supplies from West Street Recovery and Northeast Action Collective. The Hub Houses are outfitted with solar and battery systems that can power lighting, emergency medical equipment, mini-fridges, and small electronics, as well as a dual-fuel generator that can be used when a home's needs exceed the available solar and storage capacity (for example, to keep AC or heating units, refrigerators, and microwaves in use.)

Hub captains communicate with 12-15 other households within a mile of their home. With the support of 1-3 Hub assistants, the Hub captains help coordinate relief and response efforts in the neighborhood. For neighbors in need of heating, cooling, or backup power, the Hub Houses become gathering spaces to support basic needs. The Hub Houses are also outfitted with emergency supplies, including food, water, first aid, portable batteries, flashlights, fans, heating blankets, inflatable kayaks, life jackets, rope, and tarps.

NAC members and Hub House assistants, Fabian Jasso and Leola Cornett, sharing disaster preparation supplies in the community.

To learn more about what goes into a Hub House, check out West Street Recovery's preparedness resources here.

As more community members became involved, the Hub House network expanded beyond its eight anchor houses to include several "mini-hubs," which store and distribute supplies like fans, space heaters, and warming blankets. Mini-hubs allow the network to stage resources more widely across the community, and provide opportunities for more people to step into leadership roles. As NAC member Leola Cornett describes, "Anything you might need in the disaster, whether it's wintertime or summer, Ms. Doris's hub has it. And I have a mini-hub, but if I don't have it, I can always call Ms. Doris and see if she has it. And if not, another of the houses would have it. So if one hub don't have it, we could always find it in somebody's house close by."

CASE STUDY 02

Social Infrastructure

The Hub House network is embedded in – and made possible by – existing relationships among friends, family members, and neighbors in Northeast Houston. Structured around these social ties, Hub Houses are not open to the general public. As such, the model does not replace the need for municipal resilience hubs, but rather helps to fill critical gaps in the city's resilience infrastructure. Being able to gather and access emergency resources in the homes of trusted neighbors can offer a number of benefits, such as access to backup energy and emergency supplies within a shorter distance of home, a more comfortable alternative to public shelter sites, and access to kitchens for cooking meals. Importantly, West Street Recovery and Northeast Action Collective have an ethos and practice of deep community building. As they explain, "Disaster recovery is stressful, and prioritizing deep relationships over narrow efficiency makes our work more sustainable through inevitable future disasters." They continuously work to build new relationships and bring more neighbors into the fold.

Governance & Ownership

As a horizontally structured non-profit, West Street Recovery works with a consensus decision making model in its programs, and shares leadership with Northeast Action Collective members in the Hub House efforts. Supplies like fans, space heaters and heated blankets are either loaned out or donated to members with a long-term need. Developing a home-based hub model also required thoughtful consideration about ownership of solar panels and battery storage. While these may be owned by the person who has volunteered their home, West Street Recovery and the NAC aim to ensure the assets will continue to serve collective needs. In selecting hosts for the Hub House network, organizers carefully considered their community leadership and willingness to open their homes, rootedness and stability within the neighborhood, and accessibility in terms of location as well as language diversity.

Organizing supplies in Ms. Doris Brown's Hub House.

CASE STUDY 02

Funding & Financing

The Hub Houses are funded through a combination of grants and support from partner organizations like the Footprint Project and Solar United Neighbors, which helped with acquiring solar panels and battery storage. Before the massive rollback of federal climate and clean energy investments in 2025, the Hub House program was also slated to receive funding through a sub-grant of the Biden administration's Solar for All program, a $7 billion investment to bring solar energy access to low-income communities. Although the current administration is attempting to terminate Solar for All funding, inclusion of the Hub House program is both a testament to this model's potential to build equitable community energy resilience, and highlights an important pathway for funding similar work in the future under a different political climate.

Key Lessons

The work of West Street Recovery and Northeast Action Collective offers several lessons for building neighborhood-level resilience infrastructure:

- ***Know your neighbors.*** One of the most crucial elements of community-led disaster preparedness and response is strong relationships with neighbors: knowing who is most vulnerable, who to check on when the power goes out, and what people's most urgent needs are. As Leola Cornett explains, "I like to say there's a difference between knowing your neighbors and *knowing* your neighbors. I used to just wave and that was it. But now I know my neighbors. I know if there's a hurricane, who's going to stay and who's going to go." This relational knowledge, which public and private disaster aid organizations do not typically have, allows community-based organizations like West Street Recovery and Northeast Action Collective to effectively provide resources where they are most urgently needed.

- ***Start small and build from existing community assets.*** The Hub House model drew inspiration from community leaders in Northeast Houston who regularly opened their doors to neighbors during emergencies. West Street Recovery and the NAC worked to bolster and expand practices of solidarity by formalizing systems for communication, resourcing neighborhood hubs, and providing backup energy systems to ensure they can continue to operate when the grid goes down. This involved a learning curve around technical energy knowledge and an incremental process of adding solar and battery infrastructure to local homes. Reflecting on their pathway to outfitting eight Hub Houses with solar and storage, Becky Selle of West Street Recovery shares that one of her biggest pieces of advice for communities seeking to do something similar is "start small, and it will grow."

CASE STUDY 02

- ***Equitable rooftop solar and storage access can be a collective community resource.*** Significant disparities exist in rooftop solar access and adoption across income, race, and ethnicity.[64] Communities of color and low- income communities have historically had lower rates of solar adoption due to various structural barriers. Expanding access for households in historically marginalized communities can deliver broader resilience benefits. While rooftop solar and storage is often thought of as an individual resource, the Hub House model shows that when embedded in communities with strong relationships and networks of mutual aid, it can also become a collective resource. Additionally, expanding distributed energy resources like rooftop solar and storage can also play an important role relieving overall stress on the main grid during extreme weather.

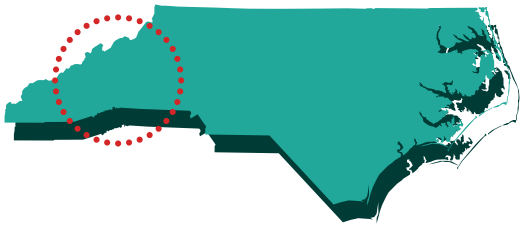
CASE STUDY 03

Footprint Project

Replacing fossil fuel-burning generators in disaster-impacted communities with mobile solar and storage solutions

Western North Carolina and other disaster-impacted communities

Footprint Project is a disaster response non-profit that partners with local communities to deliver mobile solar and storage solutions in the aftermath of disasters. Footprint deploys to disaster-impacted areas to support immediate relief, and through a locally-staffed hub in North Carolina, is supporting long-term energy recovery following Hurricane Helene.



Origin

Footprint Project was founded in 2018 by a tiny team working to meet community disaster needs with clean energy. Drawing on experience deploying renewable energy infrastructure in under-resourced communities in the global South, Footprint started with a self-built mobile solar trailer, which they offered to groups coordinating local disaster response after major storms at no cost. Over the last several years, Footprint has grown its staff and organizational reach, responding to more than 30 disasters in the United States and abroad, deploying over 300 kW of mobile solar, 4 MWh of mobile batteries, and powering over 250 local resilience hubs during power outages.

Community Energy Needs

In September 2024, Hurricane Helene left an enormous path of devastation across six states, from the Florida coast to the mountains of Appalachia. 5.5 million people lost power, and tens of thousands were in the dark for multiple weeks. The mountainous topography and steep terrain of Appalachia created extreme challenges for relief work. Storm damage, flooding, and landslides wiped out entire communities and left others physically isolated for weeks as mountain roads became impassable – preventing first responders, utility repair crews, and emergency supplies from reaching them. At the same time, everyday people from across the region mobilized to take care of one another, pooling and distributing resources, organizing search and rescue, and sheltering neighbors who lost their homes.

Before Helene hit, many residents of Western North Carolina and the greater Appalachia region were already struggling with energy insecurity and poverty. Remote mountain communities, sometimes served by a single transmission line, were affected by regular outages. Across both rural and urban areas, low-income residents were struggling with high utility bill costs. While the grid has since been restored, some of the region's most socio-economically vulnerable community members remain without secure housing and access to electricity today.

CASE STUDY 03

Mobile Solar Solutions & Place-based Programs

In the immediate aftermath of a disaster, Footprint Project delivers solar generators, portable solar-powered batteries, mobile solar trailers, and other cleaner infrastructure technologies (such as communications, water, and cooling appliances) to communities in need. During disasters, people typically rely on gas and diesel generators for backup power. In addition to being loud, polluting, and expensive to run, they produce more of the carbon emissions that are making extreme weather events more frequent and severe. Footprint works to break this negative feedback loop by providing communities with renewable energy alternatives.

In order to meet urgent needs in nimble ways, Footprint's "Beehive Microgrids," can be easily moved to serve places and people in need at any given time. A "Beehive" includes the following:

1. Power Bee: a solar trailer with battery, additional solar panels, and battery packs;
2. Cooler Bee: a solar trailer with powered coolers for storing food and medications;
3. Water Bee: a solar trailer with powered water filtration systems and/or atmospheric water generators to provide potable water;
4. Hive: a semi-permanent gathering/office space for people to coordinate relief efforts, store equipment (electric chainsaws, laptops, etc.), and repair Bees.

During blue-sky conditions, these resources can be used for other purposes, such as providing power at community events.

Footprint Project installs solar panels in Western North Carolina after Hurricane Helene.

To support long-term recovery in North Carolina, Footprint opened a permanent local office run by local staff members following Helene. As part of this recovery strategy, Footprint serves local residents with three place-based programs. The first is a solar, battery, and climate tech lending library, where residents can borrow small portable solar batteries or solar trailers to support shorter-term needs, and receive support with the installation and maintenance. This program primarily aims to support people struggling with energy poverty, living off gas generators, or without access to the grid. A second area of work outfits local groups and residents with solar nano-grids and helps develop larger microgrid hubs for longer term energy resilience. This includes an energy literacy component to educate users about how to align their energy usage with the system's capacity. A third initiative is the "Solar Free Store" where Footprint offers surplus donations of solar and electrical equipment to subsidize local resilience projects. Rather than letting these donations go to waste, Footprint has created a physical space where community members can gather materials for use in their own projects, free of charge.

CASE STUDY 03

Social Infrastructure

In order to ensure their energy resources reach the groups who will benefit most, Footprint Project taps into existing social infrastructure in the places it works, collaborating with groups like mutual aid collectives, food banks, church groups, and volunteer fire departments to distribute renewable energy resources. According to Footprint founding director Will Heegaard, they seek out local community organizations as well as small, informal collectives of organized residents, who, with their local knowledge and networks, "can do more with our equipment than the big aid groups all day long, every time."

Relationship and trust building is a central component of this work. Footprint's North Carolina office is run by local staff with roots and existing relationships in local communities. As Catherine Hebson, Footprint's recovery program manager for Appalachia explains, "It's really important to show up and take all the time in the install to really just talk with people. After a disaster, there is a lot of rushing. There is a lot of bureaucracy, there's a lot of chaos, people with different motives are doing different things, and it can just be very overwhelming...So I think it's good to slow down and just build a relationship with the person."

Governance & Ownership

Footprint Project is a small non-profit with national reach. Their small size allows them to move nimbly in times of disaster, while their partnership approach allows them to quickly lend resources to community-led relief efforts. In many cases, the solar and storage infrastructure that Footprint provides during a disaster remains in the community, allowing local groups to own and manage these assets to meet future needs.

Funding & Financing

Footprint Project relies on philanthropic funding as well as in-kind solar and battery donations from renewable energy companies to support its work. A helpful boost in recent years has been rapid advances in solar and storage technology, which has brought down the cost of batteries significantly. As new product models rapidly enter the market, many companies have been willing and eager to donate older versions of their equipment to Footprint's relief efforts – which may indicate a useful strategy for other community groups seeking to acquire portable solar and battery units as well. At the same time, Footprint recognizes that truly integrating renewable energy into disaster response at scale will require large commitments of federal and state funding. In the interim, partnering with local and state governments to build mobile solar and storage solutions into public disaster preparedness programs offers an additional route to secure funding and scale. In North Carolina, Footprint has worked with local and state government agencies, which have announced a $5 million investment to fund permanent and mobile "beehive" microgrids for North Carolina.

CASE STUDY 03

Key Lessons

Footprint's work in North Carolina highlights several key insights for using resilient, renewable energy in immediate relief and long-term recovery.

- ***Solar and battery systems are a viable and beneficial alternative to gas and diesel generators in disaster relief.*** Portable solar and storage technologies offer important advantages over gas and diesel generators. Mobile solar units provide critical backup energy that is quiet, non-polluting, more affordable, easier to maintain, and generated renewably onsite. When disasters lead to fuel shortages and impassable roads, solar can be a more reliable option. These tangible benefits of renewable backup power during an emergency may plant seeds for integrating clean energy into longer term rebuilding and recovery efforts. Additionally, mobile solar and storage systems offer a key pathway to transforming the disaster aid industry's carbon-intensive approach into a more sustainable alternative.

- ***Mobile solutions offer a flexible model for meeting needs in different places as conditions change.*** Mobile solar and storage solutions are nimble technologies that can be shared and circulated within communities, quickly deployed to disaster-impacted places, and moved around as needs and conditions change. They can be staged in a community ahead of a disaster, and they may also be shared among networks of communities across a region. Here, building intentional networks for disaster solidarity across places can build proactive resilience, so that when one community is impacted, others can step in with support. Mobile solutions can also be used to offset grid utility costs when skies are blue, with the use of a simple manual transfer switch.

- ***Energy recovery is a long-term process that isn't simply resolved when the grid comes back online.*** Low-income and marginalized people are disproportionately impacted by disasters. Even when the debris is cleared and the lights are back on, the lack of adequate social safety net for the most vulnerable deepens pre-existing inequalities and hinders people's ability to recover. For many, regaining some degree of economic, housing, and energy security can be a years-long process, and residents of rural, remote, and unincorporated areas may face unique geographic and institutional challenges in this regard. Energy recovery is more than just repairing downed power lines. It requires long-term efforts to expand access to affordable electricity and distributed renewable energy resources - and ensure they reach the populations most often left behind.

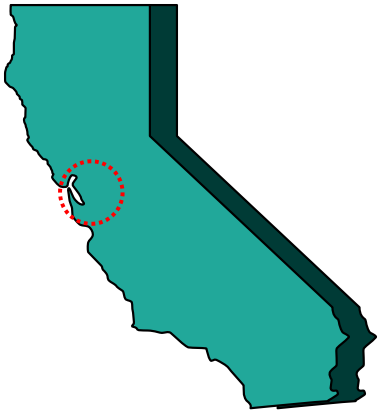
Community members gather in Footprint Project's Solar Free Store in Western North Carolina.

CASE STUDY 04

Local Clean Energy Alliance

Funding solar + storage for community resilience hubs through a community choice aggregator (CCA)

Alameda & San Joaquin counties, California



Local Clean Energy Alliance (LCEA) promotes the development of community-based renewable energy systems in frontline, low-income communities and communities of color in California's East Bay Area and San Joaquin county. LCEA has been instrumental in advocating for investments in solar and storage infrastructure, using revenue from a local community choice aggregator (CCA) to outfit community-led resilience hubs with solar and battery back-up power.

Origin

The Ava Resilience Hub Initiative emerged from LCEA's long history of intersectional organizing and advocacy to create a community choice aggregator in the East Bay. First established in 2017 as East Bay Community Energy (EBCE), the CCA is today known as Ava Community Energy and serves ratepayers across Alameda and San Joaquin counties. In California (and several other states[65]), community choice aggregation allows cities and counties to establish not-for-profit public agencies, known as community choice aggregators (CCAs), to provide electricity to residents. Instead of purchasing electricity from corporate investor-owned utilities, CCAs buy electricity in bulk from market energy suppliers. Governed by boards of local elected officials and community representatives, CCAs can offer more local control over the energy system, allowing them to prioritize renewable energy sources, maintain affordable rates, and promote a green economy through good local energy jobs. When LCEA began to explore how to strengthen local energy resilience with solar and battery systems, advocacy with their local CCA presented an innovative opportunity to reinvest local energy revenues into community-led resilience hubs.

Community Energy Needs

Alameda and San Joaquin counties are home to diverse communities, including many low-income people, communities of color, immigrant populations, and environmental justice (EJ) communities. In cities such as Oakland, San Leandro, and Hayward as well as Stockton, Tracy, and Lathrop, histories of racialized disinvestment have produced intersecting social inequities, energy insecurity, and environmental injustice. In recent years, California's skyrocketing utility costs mean that residents are impacted by increasingly high energy burdens. At the same time, Alameda and San Joaquin counties are home to rich cultural and language diversity, organized communities, diverse community assets, and legacies of community resilience and resistance.

CASE STUDY 04

A Resilience Hub Incentive Program

As not-for-profit public agencies, CCAs can offer an innovative structure for reinvesting local energy revenue into community-driven resilience hubs. Unlike investor-owned utilities, CCAs do not generate profits for shareholders, meaning excess revenue from electricity sales is directed back into community programs. Approved by the Ava board in November 2025, the nascent Ava Resilience Hub Initiative is now poised to channel $3.74 million in Ava revenue into an incentive program that will help community resilience hubs purchase battery storage capacity for solar systems. This can help ease grid stress, expand critical resilience services, meet energy demand, and provide avenues for greater affordability. Ava Community Energy is also exploring the potential for community resilience hubs to connect with their Virtual Power Plant (VPP) program, with the benefit of an ongoing financial incentive or a meaningful way to save on utility costs. With the launch of the Ava Resilience Hub Initiative, interested organizations receive free technical assistance (TA) to assess their readiness for solar and storage, complete an energy audit, prepare financial documents, explore additional funding opportunities, and receive site designs.

Social Infrastructure

Central to the incentive program is a dedicated process of community-led engagement and outreach. When Ava initially proposed a program to place solar panels and batteries on local fire and police stations, LCEA knew that for residents, these sites often feel inaccessible or unsafe. Instead, community members often frequent and seek support in trusted spaces embedded in community culture. To ensure the program centered equity and accessibility, LCEA led a months-long engagement process in partnership with Emerald Cities Collaborative that included a listening tour with 32 community organizations and over 170 community members. Gathering community definitions of resilience and their energy needs, LCEA successfully pushed Ava to prioritize *community-driven* resilience hubs: trusted community spaces that provide information, services, and resources to cultivate a strong community before, during, and after emergencies. These include recreation centers, places of worship, childcare centers, libraries, food banks, and other accessible spaces with an ethos of collective community care.

LCEA's Resilience Hub Learning Tour at Oakland Chinatown's Lincoln Square Park & Recreational Center in 2025.

CASE STUDY 04

Governance & Ownership

The solar and storage incentive program is formally administered by Ava Community Energy, with program design and implementation shaped significantly by advocacy from LCEA and community-based allies. Ava Community Energy is governed by a board of local elected officials from the participating counties and municipalities. Board members make decisions about rates, annual budgets, electricity purchasing, and funding allocation to programs like the Ava Resilience Hub Initiative. A Community Advisory Committee advises the board on community input, while monthly public meetings provide a forum for community members to make their voices heard.

While CCAs represent a more democratic structure for community members to shape their local energy system than investor-owned utilities, persistent advocacy from community stakeholders is necessary to ensure accountability. As LCEA notes, local elections can shift board makeup, and not all elected officials may represent the interests, or understand the needs, of community members. LCEA and Emerald Cities Collaborative were awarded a grant to lead the program's community outreach and engagement. In this case, having trusted community organizations leading outreach was key for centering equity and the needs of low-income residents and communities of color in the program design.

Funding & Financing

In allocating a significant portion of its revenue to the Ava Resilience Hub Initiative, Ava has created a multi-year funding pool to benefit community-based organizations within its service area. The inaugural investment includes an upfront incentive of $1,220/kWh for a solar-powered battery, and in the future may include an additional incentive for enrollment in Ava's Virtual Power Plant program. Together, these incentives can cover up to 60% or more of solar battery storage costs for community resilience hubs over a five-year period. At a time when federal funding has been rolled back and Net Energy Metering (NEM) 3.0 has gutted rooftop solar in the state of California, locally-controlled institutions like CCAs offer a promising vehicle for channeling revenues into community-based resilience projects.

Still, filling the remaining gap in upfront financing for solar and storage systems remains a challenge, especially for small, community-based organizations and those that do not already have solar panels in place. Technical assistance to prepare financial documents and identify additional funding sources is one important resource built into the program design, but more grant funding opportunities to help grassroots participants cover the upfront capital costs, operations and programmatic needs, as well as training and staffing are needed.

Jessica Guadalupe Tovar speaks at a Resilience Hub Listening Session organized with Little Manila Rising in Stockton.

CASE STUDY 04

Key Lessons

LCEA's work offers several key lessons for leveraging local institutions to fund community-driven resilience hubs.

- ***Leveraging local energy institutions & holding them accountable.*** As this incentive program shows, a community choice aggregator can be a promising vehicle for funding community energy resilience, but ongoing education and advocacy with elected officials is crucial. Initially, Ava's understanding of a resilience hub did not align with the needs of the community members, nor did it leverage the existing resilience resources built over years and decades by local grassroots groups. Ensuring that the communities most directly impacted by climate and environmental injustice will benefit requires persistent advocacy and active involvement from a coalition of community partners in the program design and implementation.

- ***Prioritizing diverse, trusted community institutions in resilience hub networks.*** According to LCEA, "The most important aspect is that these spaces and places are trusted by the community to be a source for information, support, and resources day-to-day and during times of crisis." Community-driven resilience hubs do not only provide emergency services during extreme events, they also operate day in and day out, supporting community needs year round. In Alameda and San Joaquin counties, this often means they offer culturally-welcoming and language-inclusive environments, community development resources, immigration and legal services, as well as workforce development and other life-affirming programs and services. Funding solar and storage for these community organizations multiplies impact by building on existing social infrastructure developed by frontline communities. Including intentionally diverse sites, from faith-based institutions to public-facing facilities to community-based organizations, helps ensure the resilience hub network serves diverse populations.

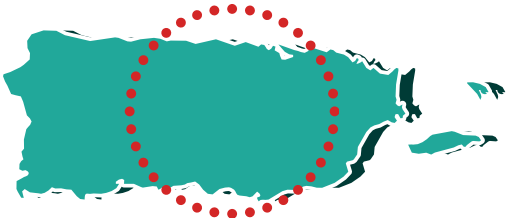
- ***Energy literacy for community members.*** For grassroots organizations, education around energy usage, energy efficiency, and technical energy requirements for solar and storage systems is key for equitable access. LCEA has observed that even with technical assistance providers (TA) involved, TA sometimes remains confusing for grassroots groups, and additional translation is often needed. LCEA finds that using a popular education approach to energy literacy with easily digestible language, translating technical energy concepts into the concrete activities they enable, and providing multilingual resources are all helpful for bridging this gap. A trusted community entity that can play a translational role between community groups and technical assistance providers is key to broadening access, inclusion, and equity.

CASE STUDY 05

La Alianza para el Manejo Sostenible de los Recursos (AMANESER Puerto Rico)

Creating prosperous, safe, sustainable, solar-powered communities in the era of climate change

Puerto Rico



La Alianza para el Manejo Sostenible de los Recursos / The Alliance for the Sustainable Management of Resources (AMANESER, or 'awakening' in English) is a grassroots organization building energy security with low- and middle-income vulnerable communities in Puerto Rico. On the hurricane-prone island, where residents are impacted by an unreliable electric grid, AMANESER collaborates with households to acquire affordable, storm-resilient solar systems that residents can move off of their roofs for protection ahead of extreme weather. AMANESER's model is designed to provide short-term energy security while a long-term transformation toward a resilient, sustainable grid takes place.

Origin

AMANESER grew from a long history of organizing in Puerto Rico's environmental justice movement. After more than four decades of work addressing toxic pollution, resource extraction, and worker exploitation that accompanied industrial sector growth on the island, its founders began to identify new pressing needs as the climate crisis intensified. In early 2015, longtime environmentalists juan e. rosario and Rafo Rosario initiated a series of meetings with community leaders and residents in Jayuya, Puerto Rico, about the climate disaster risks their communities faced. Although community members found the conversations relevant, no specific actions emerged. The following year, concerned that they were soon due for a major hurricane, juan and Rafo offered additional workshops focused on solar energy systems and disaster preparation. At the end of 2016, "AMANESER 2025" was incorporated as a local NGO dedicated to working with communities to address climate change and promote sustainability in Puerto Rico.

Community Energy Needs

Nine months after AMANESER was established, three major hurricanes passed by Puerto Rico in a span of just two weeks, exposing longstanding vulnerabilities in Puerto Rico's energy system. On September 6, 2017, Hurricane Irma lashed the north coast, leaving 20% of Puerto Rico without power. Four days after that, Hurricane Jose passed close by, but deviated to the north just in time to spare the island. A week later, Hurricane Maria made landfall. A Category 4 storm, Maria brought down the electric grid, destroyed 80% of the transmission infrastructure, and left nearly 3.7 million residents without power. It led to the longest blackout in U.S. history, and more than 4,000 estimated deaths.

CASE STUDY 05

On the slopes of Puerto Rico's tallest mountain, the community of Veguita Zama in Jayuya – where AMANESER had started working months before – endured one of the longest power outages following Maria. Left behind in restoration efforts, its residents were without power for nearly a year. Communities like Veguita Zama faced significant energy challenges before Maria hit, and these challenges have continued since. Puerto Rico's energy system runs predominantly on imported fossil fuels, which results in high residential energy bills. Before Maria, Puerto Rico's public utility, The Puerto Rico Electric Power Authority, was grappling with high debt, in financial crisis, and struggling to maintain poorly functioning grid infrastructure, making outages a regular occurrence.

As recovery began, activists, advocates and local energy experts called for rebuilding the energy system with distributed and renewable energy resources. Instead, authorities prioritized rebuilding the traditional grid, reproducing many of its existing vulnerabilities to hurricanes. Governing authorities also used Maria as an opportunity to privatize the island's publicly managed power system, and under the corporate management of LUMA Energy and Genera PR, grid reliability has seen little improvement. Puerto Rico's island context points to several key energy needs: locally-generated renewable energy that does not need fuel to be shipped in, distributed technologies that are resilient to frequent hurricanes, and affordable energy for the island's large low-income population.

For AMANESER, Puerto Rico's status as a colonized territory also highlights the importance of energy independence and sovereignty. For AMANESER, "We are not trying to build an energy system. We are trying to build a nation. We need to create systems with the people, not for the people. We need self-reliant communities, and we know that energy is paramount to build that nation and to live. Life is dependent on energy, so it has to be at the center."

A Simple, Affordable Rooftop Solar System

AMANESER's model uses an extremely simple behind-the-meter rooftop solar system, designed so that community members can remove the solar panels themselves before a hurricane in order to protect them. The model uses 2 kW rooftop solar systems that can meet the essential needs of an average community home during daytime hours. It also includes a 5-6 kWh lead acid battery that can be used to power an essential load at night or during a storm. The systems do not cover the home's entire energy consumption, and they do not export power back to the grid. This helps keep costs affordable, while allowing households maximize solar energy use alongside the grid, encouraging changes in energy consumption patterns, and allowing communities to self-manage the systems. Household members receive training in the maintenance and installation of solar energy systems, and the model has been endorsed by the engineering faculty at the University of Puerto Rico, Mayagüez.

Solar system installation workshop led by AMANESER in Barrio Candelero, Humacao.

CASE STUDY 05

Three elements help make the systems affordable to low- and middle-income communities in Puerto Rico. First, AMANESER helps members purchase system components in bulk or at a discount with its network of suppliers. Second, the program relies on collective, mutual support labor. Members put sweat equity into the installation, and commit to helping neighbors with their solar systems and other resilience needs. Third, AMANESER provides workforce training for licensed electricians in the community, who in exchange provide installation and certification services to participating households at a discounted rate. AMANESER has worked with more than 90 households across 13 municipalities in Puerto Rico, supporting them in acquiring flexible solar systems for their homes. The model aims to safeguard vulnerable populations from market fluctuations, hurricanes, and the consequences of electricity privatization on the island. AMANESER has also supported holistic disaster resilience with communal systems for refrigeration, water filtration, battery-powered communication, and food sovereignty through community gardens.

Social Infrastructure

AMANESER's model relies on relationships of mutual support between members. In the weeks and months following Hurricane Maria, many communities mobilized in self-led recovery. As AMANESER's Yiamar Rivera-Matos explained, these collective efforts are rooted in local cultures of *ayuda mutua y esfuerzo propio* (mutual and self-help efforts), where neighbors in small, rural, or self-built communities across the island pitch in to build community infrastructure. Yet, AMANESER observes that maintaining strong ties among members is a challenge. With electricity back on and basic needs restored, keeping active communal engagement and preventing retreat to an individualist mindset can prove difficult. The aging population in many small villages also makes relying on local labor difficult. In response, AMANESER is exploring new ways to bolster the social fabric around its energy security projects, with community building and workforce training for local youth.

Governance & Ownership

AMANESER operates as a network of member households across Puerto Rico. Participating households are committed to making their communities sustainable and resilient. As part of their commitment, they pay a nominal annual membership fee of $12 to be part of AMANESER, receiving support and training to use the flexible solar systems. Participating households receive about half of the cost of the system from AMANESER and contribute the remaining half themselves. They own the systems on their homes, while committing to support other members and energy security efforts in the community.

Community meeting following an installation in Los Almendros, Bayamón.

CASE STUDY 05

Funding & Financing

In line with its value for community self-sufficiency, AMANESER aims to offer a solar system that households can afford to purchase themselves, with little outside help and without federal subsidies. With its combination of strategies to keep costs low, the total system and installation costs are around $3,000. AMANESER helps supplement these costs with its relatively small budget, sustained by donations. To ensure greater access, AMANESER sees a need for creative community financing tools that make purchasing systems possible for more low-income families, such as low-interest loans from local cooperatives.

Key Lessons

AMANESER's work offers several key insights about delivering resilient and flexible solar system access in local communities:

- ***Creative models for affordability***. AMANESER's work illustrates creative cost-saving strategies that help make solar accessible to low- and middle-income families in Puerto Rico. Using small solar systems intended to meet the most essential electric needs helps keep material costs down. Their off-grid system avoids the need for additional permitting and engineering costs associated with interconnection. And through a combination of collective purchasing, sweat equity, and workforce training, AMANESER has been able to keep the system and labor costs affordable, expanding access to families previously unable to acquire solar technology.

- ***Simple and flexible technology can offer unique benefits in "last mile" contexts.*** For "last mile" communities in Puerto Rico that are located far from population centers and may be connected to the grid with just a single transmission line, solar infrastructure that is easy to use and maintain strengthens local energy security. With simple, moveable systems, households can protect their assets during storms to prevent the need for costly repairs. With training for local residents and electricians, maintenance skills reside within the community, which is helpful at times when extreme weather prevents outside help and services from arriving quickly.

- ***Local energy justice is linked to global energy justice.*** Global supply chains have long linked local energy consumption to the wellbeing of communities and ecosystems across the world. In the renewable energy transition, critical minerals such as lithium, cobalt, and nickel are important components of high-performance lithium-ion batteries. To meet growing demand, critical mineral mining has rapidly expanded in places like Chile, the Democratic Republic of the Congo, and the western U.S. – generating new threats to the land rights, health, and environment of Indigenous and other local communities. AMANESER seeks to deliver energy security to its members while reducing the impact on raw material-producing communities. According to juan e. rosario, in solidarity with affected communities across the region, AMANESER aims to avoid lithium batteries "unless we are sure that no lithium in those batteries comes from South America, from the Jujuy and the Atacama." Building justice into the renewable energy transition requires thinking and acting beyond the local – ensuring free, prior, and informed consent, and respecting sovereignty of communities of the global majority.

CONCLUSION

Energy is a vital resource and capacity that enables communities to do the work of preparing for, responding to, and recovering from disaster. It powers everything from the physical rebuilding of homes and infrastructure, to the work of community care that keeps neighbors safely housed, fed, and able to contribute to local recovery.

As climate disasters become more frequent and severe, and as the current administration rolls back renewable energy investments, state, local, and community efforts to build energy justice into disaster preparation and response are more urgent than ever.

Achieving resilient community energy ecosystems requires work across multiple scales, from grassroots mutual aid organizing to policy and regulatory change. A diverse array of renewable energy infrastructure can support this work. Small and mobile infrastructure, from battery lending libraries to solar trailers, offer flexible solutions that can be shared and circulated to meet small-scale, essential needs. Place-based infrastructure, like community-driven resilience hubs and community microgrids, can help meet larger-scale needs in more durable and rooted ways. And institutional infrastructure, like equity-focused policymaking and mechanisms for democratic accountability in energy decision-making, support important longer-term systems change.

Building this infrastructure requires more than simply procuring and plugging in renewable technologies. Resilient community energy ecosystems are built on – and shaped by – social relationships, institutional landscapes, and political power dynamics. As a result, organizing, advocacy, and coalition building are all crucial elements to making this work a reality. Furthermore, centering the needs, voices, and leadership of communities disproportionately impacted by climate change, disasters, and historical disinvestment is critical to ensure these efforts are equitable and just.

Building this infrastructure requires more than simply procuring and plugging in renewable technologies. Resilient community energy ecosystems are built on – and shaped by – social relationships, institutional landscapes, and political power dynamics. As a result, organizing, advocacy, and coalition building are all crucial elements to making this work a reality.

Communities across the country have been doing this work, and many have developed innovative models for building energy justice into disaster resilience and response. They demonstrate that pathways forward are not only possible, but already exist. Learning from these efforts is vital for further growing, scaling, and resourcing this work.

At a time when communities are facing heightened climatic and political threats, expanding equitable access to resilient, renewable, affordable, and community-owned energy will be critical for weathering the coming storms.

ADDITIONAL RESOURCES

Just Recovery Principles & Policy Platforms

- Climate Justice Alliance Just Recovery Policy Stances & Priorities
- Climate Justice Alliance Our Power Puerto Rico: Moving Toward a Just Recovery
- 85 California-based justice & equity organizations Recommendations for a Just COVID-19 Response & Recovery to Support Resilient Communities
- Resilience Force & New Florida Majority A People's Framework for Disaster Response: Rewriting the Rules of Recovery after Climate Disasters
- Movement Generation Core Principles of Just Recovery

Disaster Preparation, Rapid Response & Mutual Aid

- Climate Justice Alliance Rapid Response Timeline & Recommendations
- #JustHarveyRecovery Gulf South Regional Resources & Support Mobilization
- West Street Recovery's Disaster Preparedness and Recovery Resources
- NAACP's Power in the Storm: A People's Guide to Building a Resilient and Community Led Disaster Response
- Partnership for New Americans and Just Solutions: Know Your Rights During Disasters: FEMA and Immigration Enforcement
- Grist Disaster 101: Your guide to extreme weather preparation, relief and recovery

Mobile Solar & Storage Solutions

- Footprint Project open-source assessment forms, designs, and spec sheets for mobile solar & storage technologies
- People Power Solar Cooperative Emergency Battery Network Toolkit: How to Share Energy Resources with Your Community in Times of Need

Community Resilience Hubs

- Asian Pacific Environmental Network, SEIU, BlueGreen Alliance Resilience Before Disaster: The Need to Build Equitable Community-Driven Social Infrastructure
- PSE Healthy Energy, Asian Pacific Environmental Network, Communities for a Better Environment Building Community Resilience Across California: A Statewide Analysis of Climate Vulnerability and Resilience Hub Potential
- PSE Healthy Energy Candidate Resilience Hub Mapping Tool
- Urban Sustainability Directors Network Guide to Developing Resilience Hubs
- Urban Sustainability Director's Network Powering Community Resilience: A Framework for Optimizing Resilience Hub Power Systems
- Urban Sustainability Directors Network Creating a Hub and Spoke Model
- NorCal Resilience Network Resilience Hubs Site Assessment

Distributed Energy Resources (DERs)

- Solar United Neighbors' factsheet: Distributed Power Plants: A better grid, now!
- RMI Microgrids for Resilient Communities Cohort program & resources
- Community-led microgrid model in Chelsea, MA
- Solar United Neighbors' guide to Plug-in Solar
- Solar and Storage 101 Solar+Storage 101: An Introductory Guide to Resilient Power Systems

Advocacy for Institutional & Policy Change

- Climate and Community Institute, The 2023 People Power for Public Power Summit: The State of the Movement
- Clean Energy States Alliance, Working with CBOs to Advance Solar for LMI and Disadvantaged Communities
- Institute for Local Self-Reliance, Public Power Handbook

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