



# Building Community Resilience

*How Local Leaders are Advancing Resilience Hubs and Bolstering Critical Infrastructure*

January 2025

THE WAREHOUSE  
FOR TEENS BY TEENS



Alliance for a Sustainable Future  
A joint effort by:



THE UNITED STATES  
CONFERENCE OF MAYORS



CENTER FOR CLIMATE  
AND ENERGY SOLUTIONS

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## Acknowledgement

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# Letter from the Chair



Severe weather events in the United States continue to be fueled by the climate crisis. In the past five years alone (2019–23), over 100 climate related events have resulted in staggering environmental and economic losses - causing over \$615 billion in damage. 2024 has proven no different—major disasters have caused billions of dollars of damage and hundreds of lives lost. Back-to-back hurricanes impacted millions across the Southeast United States, resulting in dangerous winds, catastrophic flooding and extended power outages. Other parts of the United States continue to suffer from droughts, wildfires, and even bomb cyclones.

The City of Asheville, once described as a safe refuge from climate hazards, is now on the long road to recovery after widespread damage caused by Hurricane Helene. And yet, although we are all affected by the climate change crisis, these impacts are not felt equally. Vulnerable populations, mainly our underserved communities, are disproportionately affected by the hazards of climate change. They are the least prepared and the most at risk.

Failure to address the climate crisis will only worsen impacts, and with no certainty on future federal commitments, cities must continue to take the lead on progress at the local level. To meet their climate mitigation and resilience goals, cities have begun to develop new strategies aimed at building community-level resilience. These strategies include building resilience hubs, establishing microgrids at critical infrastructure facilities, and securing local energy independence. These initiatives provide communities with on-going benefits, increased adaptive capacity, and improved preparedness for increasingly frequent and severe natural disasters.

The Alliance for a Sustainable Future, a partnership between The U.S. Conference of Mayors (USCM) and the Center for Climate and Energy Solutions (C2ES), has collected city-oriented case studies to highlight partnerships that advance climate solutions. One of the goals of the Alliance is to inform mayors, local officials, and business leaders of innovative new strategies that could present an opportunity for their own communities to reach their climate goals.

From the Vicars Resilience Hub in Atlanta to Fremont’s Fire Station microgrids, the case studies in this document highlight how cities and business leaders are leading the way to build and support more resilient spaces in our communities.

We hope you are inspired by this report and strive to increase your community’s resiliency.

Sincerely,

A handwritten signature in black ink, appearing to read 'Erin Mendenhall'.

Erin Mendenhall  
Mayor of Salt Lake City  
Chair, Alliance for a Sustainable Future



## Introduction: Understanding Climate Resilience & Resilient Spaces

Climate change and extreme weather events are creating stress on communities, homes, and local economies across the country. In 2023, 28 climate disasters cost communities over a billion dollars each, and extreme weather events drove a record 2.4 million people from their homes.<sup>1,2</sup> Improving local climate resilience—a community’s ability to prepare for threats and hazards, adapt to changing conditions, and withstand and recover rapidly from adverse conditions and disruptions from climate threats—with community resilience hubs, for instance, is crucial for communities’ ability to thrive.<sup>3</sup>

“Resilience hubs”—characterized by the Urban Sustainability Directors Network (USDN) as community-serving facilities enhanced to support residents and coordinate resource distribution and services before, during, and after a disruption—are an emerging strategy to improve local resilience.<sup>4</sup> Many of these facilities have benefits beyond bolstering community resilience. They can also improve quality of life and meet a variety of local goals by using a trusted physical space, such as a community center, recreation facility, church, or multifamily housing building, as well as the surrounding assets such as a vacant lot, community park, or local businesses.

While the strategy is often used to enhance the resilience of community-serving facilities in vulnerable and low-income communities, it can also be applied more broadly, to include critical infrastructure, like fire stations, public health buildings, and more.

Many resilience hubs house resilient energy systems that can ensure power continuity during grid outages and reduce energy costs year-round, potentially generating revenue through on-site power generation. Other features may include water systems, internet, community services and programming, amenities, and more.

Resilience hubs can go by many names and have become more common in recent years. The **Resilience Hub Finder**<sup>5</sup> managed by the U.S. Department of Homeland Security offers a real-time database of many of these facilities across the country. As the number of resilience hubs continues to increase, more resources are being made available for communities interested in building their own. Implementation resources are available to communities, including many from the USDN that provide planning and technical guidance for the variety of iterations (see <http://resilience-hub.org>)<sup>6</sup>. Additional federal funding and technical assistance resources are offered in the **Federal Resources** section.

1 <https://www.climate.gov/news-features/blogs/beyond-data/2023-historic-year-us-billion-dollar-weather-and-climate-disasters>

2 <https://web.archive.org/web/20250114140418/https://www.whitehouse.gov/wp-content/uploads/2024/07/Climate-Resilience-Game-Changers-Assessment.pdf>

3 [https://nca2023.globalchange.gov/downloads/NCA5\\_Ch1\\_Overview.pdf](https://nca2023.globalchange.gov/downloads/NCA5_Ch1_Overview.pdf)

4 [https://resilience-hub.org/wp-content/uploads/2019/10/USDN\\_ResilienceHubsGuidance-1.pdf](https://resilience-hub.org/wp-content/uploads/2019/10/USDN_ResilienceHubsGuidance-1.pdf)

5 <https://experience.arcgis.com/experience/7f7988a5b2df4543b9c6c73b2d8e18e1/>

6 Other Resources: <http://resilience-hub.org>; [https://resilience-hub.org/wp-content/uploads/2019/07/USDN\\_ResilienceHubTech\\_Final.pdf](https://resilience-hub.org/wp-content/uploads/2019/07/USDN_ResilienceHubTech_Final.pdf); [https://resilience-hub.org/wp-content/uploads/2019/07/USDN\\_ResilienceHub.pdf](https://resilience-hub.org/wp-content/uploads/2019/07/USDN_ResilienceHub.pdf)



The following case studies showcase the variety of resilience spaces and hubs that are emerging in communities around the country and the role of local governments. They feature the following:

- 1. The Vicars Community Center:** Equity Centered Community Resilience (Atlanta, GA)
- 2. The Warehouse:** Building Climate Resilience through Youth Empowerment and Well-being (Wilmington, DE)
- 3. Resilient Fire Stations:** Protecting and Preparing Critical Infrastructure Facilities with Microgrids (Fremont, CA)
- 4. Central Park Recreation Center:** Energy Resilience for Recreation Centers (Denver, CO)

To develop this document, USCM, C2ES, and AECOM drew on public information and interviews to understand the projects, their impacts on local resilience, how funding was secured, how funding decisions were made, and what lessons learned could be shared with other cities. While each case study offers unique lessons, there were also several key strategies that cut across these success stories including:

**Think broadly about how community resilience can be enhanced.** Solutions are not one-size fits all. Allocating funding, time, and capacity for a new, comprehensive resilience hub is not the only path to improve local preparedness. Even low-cost building retrofits and support for ongoing community programming can improve communities' ability to withstand and bounce back from a disaster.

**Engage with community and partners early.** Tailoring resilience solutions to the needs of a community is crucial for ensuring their relevance, impact, and sustainability. Each community faces unique challenges and has different assets, relationships, and existing programming from which to define and shape resilience hubs or resilience-focused spaces. Engage with community champions, potential partners, and other key stakeholders early to find meaningful ways to invest in resilience.

**Stack funding from diverse sources.** Organizations—from the government to private philanthropies to local businesses as well as nonprofits—can support investments in community resilience. These investments are not strictly monetary; they can range from offering in-kind services, donating buildings or other assets, or providing technical expertise.

**Understand regulatory and technical requirements.** Local regulatory requirements—such as permitting, zoning, and utility interconnection—have significant impacts on project timelines and viability. Similarly, technical requirements vary by building, system, and usage patterns. Engage partners and experts as necessary to understand these impacts.

**Learn from others.** The four case studies highlighted in this report are a tiny sample of the work communities across the globe are doing to build resilience. Other organizations have created case studies, toolkits, and general resources to help governments and other players find ways to enhance community resilience through resilience hubs and investments. See additional resources in the Federal Resources Table on **page 33** and throughout this report.



## **Case Study 1: The Vicars Community Center: Equity Centered Community Resilience Atlanta, GA Mayor Andre Dickens**

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### **OVERVIEW**

In partnership with the City of Atlanta, Community Church Atlanta (CCA), Groundswell, and Stryten Energy, the Vicars Community Center Resilience Hub paves a new pathway forward toward building community resilience. Launched in late 2024, the community-owned resilience hub offers residents a trusted location to gather in the aftermath of an emergency, such as during sustained power outages and after severe weather events. Owned by Community Church Atlanta, the community center’s solar installation and battery energy storage system allows it to generate up to three days of back-up power without additional sunlight.

As the fourth-highest-energy burdened city in the United States, the need for equitable solutions to the climate crisis in Atlanta is clear. Located near downtown in southwest Atlanta, the Vicars resilience hub promises to increase energy reliability and mitigate climate impacts for vulnerable communities, including people of color, low-income households, those experiencing homelessness, and the elderly.

Although any community can be threatened by the severe impacts of a rapidly changing climate, these groups are often most at risk and the least prepared to recover.

Led by Groundswell, a nonprofit focused on building community power through equitable solar projects and resilience centers, the Vicars resilience hub has been described as one of the first of its kind across the country. As one of the first community-owned projects in the nation to benefit from historic new clean energy tax credits from the Inflation Reduction Act (IRA), the Vicars resilience hub will serve as a blueprint for the City of Atlanta and others looking to build their own resilience hub projects.

### **DESIGN AND IMPLEMENTATION**

#### **LOCAL MARKET CONDITIONS AND DRIVERS**

The Breaking Barriers initiative, a collaboration between the City of Atlanta, Groundswell, Partnership for Southern Equity, and the U.S Department of Energy’s (DOE) National Renewable Energy Laboratory (NREL) initiated the project in 2019 to increase the energy reliability within the Atlanta University Center (AUC), specifically on the campus of four historically Black Colleges. Community organizers from Partnership for Southern Equity worked with Groundswell to host public outreach events, convene with community leaders, and work with city staff from the Mayor’s Office of Sustainability and Resilience to review feasibility studies to determine the most appropriate site to develop a microgrid storage project for the campus.



Through this process, project leaders recognized that AUC-adjacent communities represented the most energy-burdened neighborhoods in the city and sought to develop an additional resilience center that would serve the residential neighborhoods just west of the AUC campus.

Building off of the work of the Breaking Barriers initiative and previous community outreach, the Vicars community center was identified as a trusted central location for a potential hub site. The city's Clean Energy Advisory Board, which had allocated a set number of seats for residents from high-burdened energy neighborhoods, had recommended the Vicars community center as a potential site. The site is optimal because it is well known by the community and served a number of vulnerable populations facing worsening climate impacts, such as increased power outages, flooding, extreme heat, severe storms, and air pollution.

The CCA's strong role in community engagement was also crucial in the site selection. As a trusted faith-based institution, the CCA already had strong preexisting community networks that could support the goals of a resilience hub. For example, the community center serves as a meeting site for groups such as the Concerned Black Clergy of Metropolitan Atlanta, the Girl Scouts of the USA, and one of the city's Neighborhood Planning Units.

Once the site was selected, the City of Atlanta worked with project leaders to determine implementation strategies and goals. This included sharing municipal emergency management strategies, making connections between the city's Office of Emergency Preparedness, and aiding with the permitting process. For example, cooling centers were already active across the city, so project leaders learned about the city's emergency management strategies to inform their community response plans. Additionally, city staff played a key role in updating various municipal departments on the project's progress, helping prioritize it as the city sought solutions for climate resiliency, energy burden reduction, and improved emergency management.

## **EMERGENCY OPERATIONS: SOLAR ARRAY AND BATTERY STORAGE SYSTEM**

Equipped with a 34.1-kW DC solar installation connected to a 320-kWh lead-acid battery storage system, the resilience hub can provide backup power for at least three days, and potentially up to a week after a severe weather-related event has occurred. In the event of an extended power outage, the solar array will be able to charge the battery and keep the facility up and running for several weeks. In addition to providing a safe haven during extreme heat or cold weather events, the resilience hub provides reliable power for individuals who may depend on electric appliances to store food, medications, and charge communication devices. While not intended to serve as an overnight shelter, project leaders believe in an extreme situation they would be able to collect the necessary resources (e.g., beds and blankets) for overnight services to be accommodated.

Incorporating solar and battery storage components to the resilience hub served multiple functions. Primarily, it allows the facility to generate its own power without having to rely on the main grid, which may fail after a weather-related event. This independent energy system also supports local emergency management by allowing limited back-up power services to be prioritized for other critical infrastructure facilities, such as hospitals, fire stations, and shelters.

In addition to these benefits, the independent energy system also supports the community's broader public safety and sustainability goals. Facilities powered by renewable energy sources combined with storage capabilities reduces dependence on gas-generated back-up power. Additionally, a trusted faith-based institution adopting clean energy initiatives can serve as a strong inspiration for other community members to consider similar actions. Residents who see solar panels on their church may be more so inclined to consider solar improvements for their own households.

Groundswell project leaders led the outreach approach for identifying and connecting with technical partners. **Stryten Energy**, a Georgia-based energy storage solutions company, was responsible for the development, construction, and installation of the battery energy storage system, while **InterUrban Solar**, a Black-owned engineering firm, led the development and installment of the solar array. Project leaders from Stryten Energy noted that because the battery system and solar array are self-contained, very little utility coordination was needed for installation completion.

### **NON-EMERGENCY OPERATIONS: YEAR-ROUND RESILIENCE**

During times of non-emergency, the Vicars Community Center Resilience Hub will continue to serve the needs of the community. By purchasing food from the Atlanta Food Bank and using local volunteers, the community center provides a food pantry serving 300–400 families once a week, a 500 percent increase in the number of families served compared to four years ago. The goal of distributed meals is to address food insecurity by providing families with a week's worth of groceries. Church leaders noted that over 90 percent of the people receiving these meals are not official members of the Church, reflecting a strong tie to the community that extends beyond congregational membership.

In addition to the food pantry, the community center currently offers other services such as blood drives and health screenings, job fairs, social networking events, and child-centered services. During the COVID pandemic the community center was essential in providing residents with free masks, testing, vaccinations, and virtual ministry services. Project leaders are currently in the process of holding stakeholder engagement meetings with residents to inquire which programs and what types of resources the resilience hub should prioritize moving forward.

### **TIMELINE**

- **2019:** Breaking Barriers Initiative began, led by Groundswell and in collaboration with NREL, AUC, the City of Atlanta, and the Partnership for Southern Equity.
- **March 2019:** The Atlanta City Council unanimously passed Resolution No. 17-R3510, adopting Clean Energy Atlanta, the city's 2035 clean energy goal.
- **August 2022:** Passage of the Inflation Reduction Act, allowing projects in service starting in 2023 to be eligible for direct pay.
- **January 2023:** Groundswell approaches Community Church Atlanta as a potential resilience hub site location.
- **February 2023:** Letter of Intent and Site Access Agreement signed with Groundswell by Community Church of God (CCG).
- **March 2023:** Project planning begins. Other stakeholders, including Stryten Energy and InterUrban Solar, join as project partners.
- **November 2023:** Facility Development Agreement signed between CCG and Groundswell.
- **April 2024:** Ground-breaking ceremony held.
- **May 2024:** Construction began.
- **July 2024:** Ribbon cutting of Vicars Community Center Resilience Hub with EPA and City of Atlanta.
- **December 2024:** Final inspection and utility (GA Power) approval for Permission to Operate (PTO).

## KEY PARTNERS AND STAKEHOLDERS

The successful planning and implementation of the Vicars resilience hub resulted from extensive collaboration among local, community, private, and nonprofit partners. A short description of key partners and their roles are listed below:

**City of Atlanta:** The Mayor’s Office of Sustainability and Resilience has been actively involved in the Vicars resilience hub since its inception. Staff were crucial in advocating for the project at the city level by providing guidance on municipal emergency management plans, supporting project partners through the permitting process, and prioritizing the project as a critical tool for advancing climate resilience and energy reliability.

**Community Church Atlanta (CCA):** Led by Senior Pastor Kevin Earley, CCA owns the community center where the resilience hub is sited. Located near downtown Atlanta, the church will be responsible for day-to-day operations of the resilience hub, as well as program implementation and emergency coordination with the city.

**Groundswell:** Nonprofit who led the design and implementation of the project. Groundswell builds community power through equitable community solar projects, clean energy programs that reduce energy burdens, and pioneering research initiatives that help light the way to clean energy futures for all.

**Stryten Energy:** A Georgia-based energy storage company that designed, constructed, and installed the battery storage system.

### OTHER:

- General Motors
- SunCatch Energy
- Georgia Power
- Wells Fargo
- InterUrban Solar One LLC

Please note the list above does not reflect an exhaustive account of the full range of stakeholders and key partners involved in the project’s planning and implementation.

## RELEVANT POLICIES AND PROGRAMS

**Clean Energy Atlanta:** City of Atlanta’s plan to achieve 100 percent clean energy by 2035. The plan identifies pathways that can make clean energy more available and more affordable. The call to form the city’s Clean Energy Advisory Board, originated from this plan.

**Inflation Reduction Act:** Federal policy passed in August 2022 which invested nearly \$370 billion in new funding to support climate mitigation and resiliency efforts. Through a new financial tool called direct pay, the law also gives cities and other traditionally non-taxpaying entities the opportunity to take advantage of these tax credits for the first time.

**Community Resilience Hub at the City of Refuge, Baltimore, MD:** Groundswell also built a resilience center located in the [City of Refuge in Baltimore Maryland](https://groundswell.org/city-of-refuge-baltimore-main-campus/)<sup>7</sup> which served as one of the inspirations for the Vicars Community Center Resilience Hub. Like the Vicars community center, this resilience hub also plans to be community owned and benefit from the IRA’s direct pay provision.

## COST AND FINANCING

### DIRECT PAY AND LEVERAGING CLEAN ENERGY TAX CREDITS

With investments of nearly \$370 billion dollars in new clean energy tax credits, the Inflation Reduction Act (IRA) provided the largest climate investment in U.S. history. Historic new grant opportunities representing billions of dollars in new programs will help push communities closer to reaching their environmental and sustainability goals.

<sup>7</sup> <https://groundswell.org/city-of-refuge-baltimore-main-campus/>

The IRA's historic direct pay provision also allows cities and nonprofits to take advantage of the clean energy tax incentives that were previously only available to traditional taxpaying entities.

Project costs for the Vicars Community Center Resilience Hub totaled **\$444,997**. The project funding is a mix between federal clean energy tax credits and private funds which covered the construction costs in full, with no debt incurred by the church. Additionally, with the solar array and battery energy storage system in place, the facility is expecting to save between **\$6,000–\$7,000 per year** on electricity costs. The saved costs are expected to go toward the expansion of new and existing programs to support the resilience hub.

Community ownership plays an essential role in Groundswell's approach toward resilience hubs, and as such the Vicars Community Church was advised to apply for the IRA's direct pay provision. The project qualifies for the solar investment tax credit and a low-income bonus tax credit, covering roughly **40 percent of total project costs**. As owner of the project, the Community Church will receive a direct payment in the form of a refund from its fiscal year 2025 tax returns. The remaining project costs are being covered by private grants through Wells Fargo and General Motors, with additional financial contributions made by Stryten Energy. Groundswell, alongside Wells Fargo, were instrumental in developing the financial model that supported leveraging direct pay, and both plan to provide on-going guidance to Church leaders as they navigate the application process.

## OUTCOMES AND NEXT STEPS

The Vicars Community Center Resilience Hub became fully operational in December 2024. Moving forward, project leaders are considering several future adaptations to enhance the goals of the resilience hub including:

**Workforce Development and Environmental Stewardship:** Project leaders envision future programming of the resilience hub to include workforce development programming, such as training for the installation and repair of solar panels and battery energy storage systems. Additionally, the Vicars resilience hub is located only a mile from the West Atlanta Watershed Alliance and PatchWork City Farms. The hope is that future opportunities could include environmental education for youth, and that undeveloped land next to the community center could be utilized as an urban agricultural farm to support food security goals.

**Sense of Community:** Dangerous climate risks are often heightened for vulnerable and disconnected populations such as elderly, those who live alone, and individuals with disabilities. Project leaders are planning to facilitate opportunities for neighbors to meet each other prior to climate-related emergencies so residents can know to check in on people or help them reach resources when they may not be able to do it on their own.

**Emergency Management Coordination:** This includes plans to solidify resilient lines of communication with municipal emergency management officials so the resilience hub can serve as not only a place of refuge, but also as a coordination center where residents can receive updates about weather conditions, aid distribution, and response timelines.

Overall, the city envisions the Vicars Community Center Resilience Hub will be one location of many in a larger resilience hub network located throughout the greater Atlanta area. This network would include both municipal buildings as well as community-owned facilities. Through its planning work for upcoming federal grant opportunities, the city has already started asset mapping of its municipal buildings with a focus on siting future resilience hubs, potentially including libraries, schools, and fire stations.

## LESSONS LEARNED AND STRATEGIES FOR REPLICATION

Although each resilience hub project will differ according to community needs, project partners offered several insights for both public and private entities considering a similar approach.

**Climate Resilience and Public Safety Perspective:** As the impacts of climate change continue to become more frequent and severe, more communities are looking toward resilience hubs to address these challenges. At the same time, we know political challenges may create barriers in supporting and implementing these types of strategies. Project leaders emphasized that reframing the conversation to include public safety, alongside climate concerns, has been key to building local support and collaboration. Regardless of cause, power outages represent dangerous health risks and serious public safety hazards, especially for vulnerable communities. By emphasizing that resilience hubs are not just a tool to solve the climate change crisis, but also about clean energy generation, reducing energy burdens, and making our communities safer, project leaders can help attract more diverse funding, broaden community engagement, and strengthen local support.

**Engage Partners to Meet Project Needs:** The successful implementation of the Vicars Community Center Resilience Hub has largely been attributed to the diverse range of partners involved. For example, with no certified public accountant on staff, church leaders were able to rely on Groundswell to provide financial planning and guidance. Other partners, such as Stryten Energy and InterUrban Solar, were crucial in proving the technical expertise needed for managing and installing solar-battery energy systems. City staff involvement was key in project visibility and prioritization.

**Value Alignment:** The City of Atlanta emphasized that Groundswell's successful track record and extensive background with working with other local governments was key in securing credibility and a sense of trust. Groundswell's service-focused values deeply resonated with the values of Vicars Community Church. This alignment of values between Groundswell and church leaders helped to streamline collaboration and ensure that the project served its long-term best interests. Once the project goals were clearly defined, it became easier to address the challenges that arose along the way. The shared values between all parties further reinforced a unified approach to solving issues and achieving success.

**Leveraging Available Funding:** This project relied on a significant amount of nonprofit guidance and private funding. Acknowledging this pathway is one of many that communities may consider in implementing resilience hub initiatives, project leaders strongly emphasized communities take advantage of new and existing federal grant opportunities and tax incentives. Without direct pay, church leaders stated the project would likely have been too cost prohibitive to proceed. Project leaders advised that barriers may arise for community-based entities responsible for covering the predevelopment costs, and partners should plan accordingly.

## ADDITIONAL RESOURCES

- **Vicars Community Center Resilience Hub | Community Church<sup>8</sup>**
- **Vicars Community Center at Community Church Atlanta | Groundswell<sup>9</sup>**
- **The Mayor's Office of Sustainability and Resilience | Atlanta, GA<sup>10</sup>**
- **Stryten Energy Is Advancing Georgia's Clean Energy Industry with Innovative Battery Technologies<sup>11</sup>**
- **Direct Pay | Clean Energy | The White House<sup>12</sup>**

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8 <https://ccogatl.org/hub/>

9 <https://groundswell.org/project/vicars-community-center-atlanta/>

10 <https://www.atlantaga.gov/government/mayor-s-office/executive-offices/office-of-sustainability-and-resilience>

11 <https://www.stryten.com/stryten-energy-is-advancing-georgias-clean-energy-industry-with-innovative-battery-technologies/>

12 <https://webcf.waybackmachine.org/web/20250101161638/https://www.whitehouse.gov/cleanenergy/directpay/>



**Case Study 2:**  
**The Warehouse:**  
**Building Climate**  
**Resilience through Youth**  
**Empowerment and**  
**Well-being**  
**Wilmington, DE**  
**Mayor John Carney**  
**Former Mayor Michael Purzycki**

## OVERVIEW

The City of Wilmington, Delaware—particularly the low-income Riverside neighborhood—historically has lacked supervised after-school programming for teenagers in the existing community centers. At the same time, the community has seen significant teen violence. Available after-school programs are catered toward elementary-school children, leaving teenagers without structured opportunities to promote career readiness, academic achievement, and personal growth in a safe environment. The WRK Group, an alliance of three organizations—The Warehouse, Kingswood Community Center (KCC) and REACH Riverside—envisioned a transformative initiative that would not only address these challenges, but also foster community resilience and sustainable practices among local youth.

The Warehouse was established to integrate recreational, education, arts, career, and health services with hands-on learning opportunities for local youth with innovative green technologies, including an agricultural pod (“Ag Pod”) for year-round food production, a vehicle-to-grid (V2G) electric bus, and a solar and battery storage system. Supported by various partners, including Delmarva Power and the Delaware Department of Natural Resources and Environmental Control (DNREC), The Warehouse initiative aims to enhance food security and empower teens through education and workforce training. Since its official opening in August 2021, The Warehouse has transformed into a hub for over a third of Wilmington's teen population, providing essential services and resources.

## DESIGN AND IMPLEMENTATION

### PROCESS AND APPROACH

The WRK Group took a multi-faceted approach to implement The Warehouse initiative, including widespread community engagement, partnerships with local organizations, and the incorporation of innovative technologies. The process began by identifying key community needs and socializing the project idea among stakeholders, including the Mayor's office, the WRK Group, Delmarva Power, and other organizations serving the community. Central to the ethos of The Warehouse, the initiative also ensured local teens were key stakeholders in the planning and marketing process, giving the teens a strong sense of ownership over the creation and operations of their center.

The WRK Group originally intended to utilize 10,000-square-feet of a 100,000-square-foot existing warehouse for the new teen center, however, the WRK Group determined the effort, cost, and time associated with restoring the 100-year-old warehouse was insurmountable. Additionally, interest in the new teen center was skyrocketing and the project team no longer thought 10,000-square-feet would be sufficient. A broader facility search identified a vacant facility previously occupied by a charter school and owned by Capital One. In March 2018, the WRK Group, the mayor, and a representative from the Longwood Foundation, met with Capital One to present the plans for The Warehouse. In October 2018, Capital One granted the building to The WRK Group and the deal was closed on December 26, 2018.

The deployment of green technology at The Warehouse was comprised of three Energize the Warehouse initiatives:

- In 2021, The Warehouse installed the Ag Pod, a 40-foot shipping container outfitted with vertical racks for growing crops without soil. The Ag Pod, donated by Delmarva Power, has LED grow lights that operate 16 hours per day, a 50-gallon water distribution and pumping system, a seedling area to sprout seeds, and a dedicated electric service and meter. Through a partnership with the non-profit Planting to Feed, The Warehouse harvests and distributes produce such as kale, collard greens, lettuce and beets to the community. The data collected on harvests and hours spent in the Ag Pod is shared with the Electric Power Research Institute (EPRI), which supports Delmarva Power with research and analysis of the hydroponic system.
- The Warehouse installed 66 solar panels on the northwest area of the facility's roof to offset the energy consumption of the hydroponic system, as well as a battery storage system in the main electrical room. In the event of a power outage, the battery storage can provide backup power for 72 hours to the Main Distribution Frame room and classrooms on the 2nd floor of The Warehouse.
- In 2021, The Warehouse acquired a 56-passenger electric bus with vehicle-to-grid capabilities to be used for transport of teens to and from the facility.

The Warehouse was designed with state-of-the-art facility and services, including but not limited to the following:

- Gymnasium
- Dance studio
- Digital technology labs
- Theater
- Art studio
- Demonstration kitchen for culinary arts
- Rise innovation center
- Mental health counseling and mentoring

The Warehouse also offers safe transportation for teens after school to and from neighborhood bus stops and other Wilmington community centers.

## TIMELINE

**2017:** The WRK Group conceptualizes The Warehouse project and identifies the former charter school location as the potential project location. The WRK Group approaches Mayor Purzycki with the idea.

**2018:** Design phase and community input begin.

**March 2018:** Mayor Purzycki, Logan Herring, and There du Pont (President and CEO of the Longwood Foundation) met with Capital One to discuss the status of the former charter school building.

**October 2018:** Capital One alerts the WRK Group that the former charter school building will be granted to The Warehouse initiative if closed by the end of the year.

**December 2018:** Capital One deal closes granting the building to the WRK Group.

**2019:** Renovations commence on the previously failed charter school building (built in 2000), donated by Capital One.



**March 2020:** Renovations are completed; COVID pandemic prompts adaptive responses to community crises.

**August 2021:** The Warehouse officially opens to the public.

**September 2021:** Hurricane Ida flooding prompts fundraising, community outreach, and state agency coordination.

## DRIVERS

The driving force for the creation of The Warehouse was the noticeable lack of teen-oriented after-school programming; there was a clear need in Wilmington for a teen community center. The Warehouse was envisioned as a safe, engaging space where teens could gather, learn, and grow outside of school hours, providing them with constructive alternatives to unsupervised time. By offering mentorship, skill-building programs, and recreational activities, The Warehouse aims to address the gap in youth services and support positive youth development in Wilmington.

After reading an EPRI study that highlighted hydroponic systems contribute significant loads to electric systems, The Warehouse team decided to utilize solar panels and energy storage to power and offset the energy consumed by the Ag Pod. While efficient for growing plants with minimal soil and water in urban environments, hydroponic systems require a reliable energy supply to power lights, pumps, and climate control systems.

These systems consume a considerable amount of energy, which could lead to high electric bills without a supplemental source like solar panels. This dual need for dependable and affordable power underscored the importance of sustainable energy sources, like solar or wind, along with robust storage solutions to support continuous operation. As a result, energy generation and storage became essential components to ensure both the economic and operational viability of the Ag Pod.

## FUNDING

Project costs for The Warehouse renovations total \$4 million to date, including architecture, design, furniture, and continuing improvements costs. Fundraising began in 2019 for the Wilmington community revitalization effort, including The Warehouse initiative, and was sourced from a combination of public and private contributions. The majority of funding comes from the public sector, foundations, and corporations. Notably, a \$50 million grant from the U.S. Department of Housing and Urban Development and over \$40 million from the state of Delaware played critical roles in financing the overall community revitalization efforts of the WRK Group. Future fundraising efforts will focus more on the federal level. See **Table 1** below for a breakdown of the contributions to The Warehouse project. The remaining funding was sourced by The WRK Group.

**Table 1: Funding Sources for The Warehouse**

Funding Source	Amount	Funding Allocation
DNREC Environmental Mitigation Trust Fund	\$552,568	V2G bus
DNREC Green Energy Fund	\$138,825	
DNREC Community Environmental Project Fund	\$25,000	Ag Pod
Delmarva Power & Light	\$60,500	
CMI Solar	\$31,298	Rooftop solar panels
EPRI	\$6,638	Ag Pod
<b>Total</b>	<b>\$814,829</b>	

## RELEVANT POLICIES AND PROGRAMS

- **DNREC Environmental Mitigation Trust Fund:** A 2017 agreement between the federal government and the Volkswagen Corporation created an Environmental Mitigation Trust. The purpose of the trust is to fund projects that mitigate air quality impacts from high-emitting diesel vehicles and engines. The state of Delaware received approximately \$9.6 million of the Environmental Mitigation Trust to distribute to eligible projects throughout the state.
- **DNREC Green Energy Fund:** The Green Energy Fund, established in 1999, provides grants to customers of Delmarva Power to offset the installed cost of renewable energy technologies, including solar, geothermal, and wind.
- **DNREC Community Environmental Project Fund:** A 2004 law established the Community Environmental Project Fund (71 Del. Laws, c.203). The law authorized DNREC to withhold 25 percent of funds collected as penalties for violations of environmental regulations to fund grants. These grants support the restoration of the environment in communities that were damaged by environmental pollution.

## KEY PARTNERS AND STAKEHOLDERS

- **Teens:** The local Wilmington teens actively participate in marketing and outreach, program development, and the operations of The Warehouse. The teens also contributed to the design of The Warehouse facility.
- **WRK Group:** The WRK Group, which includes The Warehouse, REACH Riverside, and Kingswood Community Center, played a foundational role in bringing The Warehouse project to life in Wilmington, Delaware. As a collective, the WRK Group's mission is to revitalize and empower the Riverside community by providing resources for youth, education, and community development. For The Warehouse specifically, the WRK Group helped

secure funding, develop partnerships, and establish programming tailored to the needs of local teens. The WRK Group continues to provide management and administration services to The Warehouse, helping to keep operating costs down, while overseeing daily operations.

- **Delmarva Power:** Delmarva Power is a unit of Exelon Corporation and a provider of electric and natural gas services to customers in Delaware and Maryland. Delmarva Power provided funding and technical support for the renewable energy technologies deployed at The Warehouse. Delmarva Power helped to energize and operate the Ag Pod, the V2G electric bus, and the solar and battery storage system.
- **Delaware Department of Natural Resources and Environmental Control:** DNREC provided funding for the renewable energy technologies through grant programs, including the Community Environmental Project Fund, the Environmental Mitigation Trust Fund, and the Green Energy Fund.
- **The University of Delaware:** The University of Delaware provided technical support in deploying the V2G bus at the Warehouse.
- **EPRI:** EPRI worked with the WRK Group and Delmarva Power to conduct research on the Ag Pod to evaluate how the hydroponic system operations impact the energy consumption at The Warehouse.
- **Planting to Feed:** Planting to Feed is an ongoing partner of The Warehouse to provide food assistance to the community. Planting to Feed supports the Ag Pod and the community refrigerators; produce grown from the Ag Pods fill the community refrigerators along with shelf stable food items.
- **Local Organizations:** Local Wilmington organizations collaborate on the educational programs and workforce training offered at the Warehouse.

- » STRIVE: How You Lead Matters
- » EastSide Charter School
- » Social Contract, LLC

Please note this list may not capture the full scope of relevant stakeholder and partners involved in The Warehouse project.

## OUTCOMES AND CITY BENEFITS

Since its official opening in August 2021, The Warehouse has transformed into a hub for over one-third of Wilmington's teen population, providing essential services and resources and serving 50 to 75 teens on a daily basis. Additionally, The Warehouse successfully engages 200 teens annually in workforce training programs, fostering skills in entrepreneurship, employment, and sustainability through a 12-week experience including a 4-week work experience with employers around the city.

The produce grown in the Ag Pod is distributed to community food pantries, refrigerators, and local grocery stores. In 2024, the Warehouse harvested and distributed over 1,000 pounds of produce to the community.

The solar panel system has proven to play a vital role in supporting The Warehouse operations by generating clean, renewable energy and offsetting the increased energy consumption due to the addition of the Ag Pod. The energy produced by the solar panels covers the energy consumed by the Ag Pod systems, with excess energy stored in the battery storage system and serving as a backup power source for the MDF room and 2nd floor classrooms, ensuring continued operation of The Warehouse during power outages. With the solar array and battery energy storage system in place, the facility saves approximately \$750 per month (6,500 kWh) on electricity costs.

Notably, The WRK Group unintentionally created a reliable framework for community support during emergencies, as demonstrated during the COVID pandemic and Hurricane Ida.

The Warehouse renovations were completed in March 2020, at the start of the COVID pandemic. Since The WRK Group was already familiar with the needs of the community through its operations at Kingswood Community Center, they immediately jumped into action to raise funds to distribute cash payments, laptops, and meals directly to families. They also opened the Center to offer COVID testing, employment information, and other community support services, underscoring how adding services to existing facilities produces successful resilience hubs.

These proactive services allowed The WRK Group to develop a muscle for community crisis response, which was further strengthened in response to the flooding that Hurricane Ida inflicted on the 11th Street Bridge community that borders The Warehouse and Kingswood Community Center. After Hurricane Ida brought six feet of flooding to the community, The WRK Group immediately started helping families and businesses clean up the damage, while also fundraising to provide cash payments to community members affected by the flooding. Additionally, The Warehouse opened its gymnasium to over twenty state agencies so the community could access information and assistance during the flood recovery.

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**Emergency preparedness was never anticipated to be a function of The Warehouse, but the hub has successfully adapted to the circumstances.**

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The WRK Group's success in emergency response during COVID and Hurricane Ida was largely due to its preexisting role as a trusted resource in the community. As a cornerstone of community support, they had already established deep connections with local organizations, businesses, and residents, which has allowed them to swiftly mobilize both people and resources in times of crisis. Their ability to tap into these networks meant they could bring together the right partners and resources efficiently.

This foundation of trust also made it easier to distribute aid, as community members were already accustomed to turning to The Kingswood Community Center and Reach Riverside for support—The Warehouse became another part of a trusted-resource network in Wilmington. The pivot to emergency response, while unexpected, was seamless because of the strong, collaborative infrastructure that had been built long before the 2020 and 2021 disasters struck.

## LESSONS LEARNED AND STRATEGIES FOR REPLICATION

**Community Engagement:** Building trust and actively involving community members in project development enhances program success.

- Teen engagement in the design process created a sense of ownership over the new facility, which drove outreach and marketing efforts. In addition to an Instagram campaign and tables at school club fairs, the teens organized a Teen Night event to introduce The Warehouse to its target audience. With just three days of advertising, the organizers welcomed a crowd of 400–500 teens on Teen Night.
- Identifying and selecting a central location at the intersection of the four Wilmington school districts paved the way for The Warehouse to partner with the school districts to locate new bus stops within a few blocks of the hub to ensure easy and safe access for school-aged teens.

### **Inter-Organizational Collaboration:**

Leveraging partnerships can optimize resource utilization and expand program reach.

**Adaptive Responses:** Flexibility in operations, as demonstrated during the COVID and Hurricane Ida crises, is crucial for community resilience.

- The need for a location to organize emergency response efforts for unexpected crises drove the rethinking of the space as a resilience center. The resilience center concept transformed the space into a multifunctional resource, ready to adapt to various emergencies while fostering a sense of preparedness and support within the community.

**Sustainability Focus:** Integrating renewable energy technologies can provide long-term benefits and reduce operational costs.

**Tailored Technological Solutions:** Just because a technology is available, does not mean it is fit for purpose. The electric bus is not used as often as planned because of its size and restrictive driver training requirements; The Warehouse is evaluating electric passenger van options for future investment.

## ADDITIONAL RESOURCES

- **The Warehouse: For Teens, By Teens**<sup>13</sup>
- **The WRK Group**<sup>14</sup>
- **EPRI Indoor Agriculture**<sup>15</sup>
- **DNREC Green Energy Fund**<sup>16</sup>
- **DNREC Community Environmental Project Fund**<sup>17</sup>
- **DNREC Environmental Mitigation Trust Fund**<sup>18</sup>

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<sup>13</sup> <https://teenwarehouse.org/>

<sup>14</sup> <https://wrkgroup.org/>

<sup>15</sup> <https://www.epri.com/indoor-ag>

<sup>16</sup> <https://dnrec.delaware.gov/climate-coastal-energy/renewable/assistance/>

<sup>17</sup> <https://dnrec.delaware.gov/environmental-justice/cepf/>

<sup>18</sup> <https://dnrec.delaware.gov/air/mobile-sources/vw-mitigation-plan/>



### **Case Study 3:**

## **Resilient Fire Stations: Protecting and Preparing Critical Infrastructure Facilities with Microgrids**

### **Fremont, CA**

**Mayor Raj Salwan**  
**Former Mayor Lily Mei**

#### **OVERVIEW**

To increase community resilience during times of power outages and save on energy costs, the City of Fremont, California, in collaboration with Gridscape Solutions and the California Energy Commission (CEC), has installed solar-powered emergency microgrid systems at three fire stations in the city. Equipped with solar photovoltaic carports and large battery energy storage systems, each fire station is able to generate its own backup power in the event of a power outage emergency.

Today, extreme weather events are the leading cause of electrical power outages across the nation, making it crucial that critical infrastructure facilities—such as fire stations, hospitals, and emergency operation centers—are resilient enough to be able to meet the public health and safety needs of their communities.

The combination of solar-powered energy systems with battery storage (microgrids) allows the stations to be able to “island off” from the grid during peak times or during a sustained power outage. The systems can operate with or independently from the electrical grid. As extreme weather events have become more severe and **public safety power shutoffs**<sup>19</sup> have become more common—for instance, in the case of heightened wildfire risk—city leaders have emphasized the importance of having these technologies in place for emergency management planning.

Financed through a 10-year power purchase agreement (PPA), the city is able to buy the energy generated by the system at half the cost than if bought directly from the public utility. Over the course of ten years, the city is expected to save a minimum of \$215,000 on utility costs alone under the PPA. To date, the project has delivered a wide range of environmental, economic, and public safety benefits including increased infrastructure resiliency, reduced carbon emissions, increased energy cost savings, support for local innovation and entrepreneurship, and reduced demand on the grid during peak times.

<sup>19</sup> <https://www.pge.com/en/outages-and-safety/safety/community-wildfire-safety-program/public-safety-power-shutoffs.html>

## **DESIGN AND IMPLEMENTATION**

### **LOCAL MARKET CONDITIONS AND DRIVERS**

Through the city's [Climate Action Plan](#)<sup>20</sup>, it has committed to a series of local greenhouse gas (GHG) emission reduction and climate adaptation measures to be undertaken through 2030. Like many cities across the nation, Fremont faces severe climate hazards, including drought, wildfires, sea level rise, and extreme heat. As severe storms become more frequent and intense, storm surge and rising tides are expected to bring flood impacts to the city's most low-lying regions. Many areas of the city are at high risk of severe wildfires, and projected climate changes could exacerbate these risks, leading to larger, faster-spreading fires. Finally, the location of the city over the Hayward Fault makes the city highly vulnerable to earthquakes.

Fremont's Climate Action Plan outlines GHG emission reduction initiatives and adaptation strategies and explicitly calls for the city to implement climate-smart initiatives that protect critical infrastructure facilities. As one of the most developed and technological manufacturing hubs in the nation, Fremont's partnership with Gridscape also supports its goals to grow the local economy and foster green business growth. The project benefits vulnerable communities indirectly by assuring that during an emergency, these fire stations can act as the hub of operations and be considered a local resource for the entire community.

### **DEMONSTRATION PERIOD (2016–18)**

In 2015, Gridscape Solutions, a Fremont based clean technology firm, received a grant from the CEC to demonstrate how low-carbon microgrids can enhance the resilience of communities and offer savings on energy costs.

Fremont has eleven fire stations throughout the city. The three fire stations selected for this project (Fire Stations #6, #7, and #11) were selected based on solar availability, anticipated energy cost savings, the size of the facility (at least 10,000-square-feet), the populations served, and energy usage.

Once the sites were selected, the CEC grant required that each of the three fire stations undergo a one-year "demonstration period," where all design, construction, and system testing would be conducted. During this initial one-year period for each of the fire stations, Gridscape would have full access to the three sites, and the city would receive the renewable energy that was generated from these systems at no cost. The terms of the PPA (explained further below) did not start until after the initial demonstration period for each of the systems was concluded. The one-year period allowed Gridscape to demonstrate the systems' capabilities to the CEC, as required by the grant.

### **TEN-YEAR POWER PURCHASE AGREEMENT (2018–28)**

After the demonstration period ended, the City of Fremont transitioned to a standard PPA agreement with Gridscape, which runs from 2018 to 2028 and includes the option of up to ten years in renewal provisions. A PPA is a contract between a solar energy provider and a municipality for the purchase of electricity from a renewable energy system. The provider pays for the installation and maintenance of the energy system, and the city agrees to buy the energy produced at a fixed rate for the duration of the PPA. This agreement is allowed under California Code 4217.10-4217.18, which permits public facilities to single source energy projects if savings exceed costs. The city used a previous 20-year PPA from another solar project as a template for this agreement.

<sup>20</sup> <https://www.fremont.gov/climateactionplan>

Because the demonstration project received funding from CEC, Gridscape was able to offer a rate well below the market rate. The original electricity pricing for each of the fire stations averaged around 9 cents per kWh, with a 2.5 percent inflation escalation factor included in the 10-year PPA pricing terms. Even with a contracted annual 2.5 percent rate increase, the cost savings were still determined to be significant. The Fremont City Council considered directly purchasing microgrid systems but found that a PPA approach offered more benefits, including: (1) no upfront costs; (2) lower electricity costs; (3) no maintenance or installation responsibilities; and (4) fixed pricing over a long term. Most importantly, Gridscape would own, manage, and operate the systems, providing a 10-year warranty at no extra cost.

### PROJECT COMPONENTS AND SYSTEM OVERVIEW

Each fire station is equipped with a 37–43-kW solar canopy (i.e., carports), a 110-kWh battery energy storage system, a data visualization tool to collect and display information, and a microgrid controller system. Developed by Gridscape, the controller enables communication from the battery to the solar system, as well as from the grid to the station. The data visualization tool allows city staff to monitor generation and usage via the cloud-based visualization management software.

During the day, the solar panels generate energy to power the station, and any excess energy is then stored in the batteries. Once the batteries are full, the system can sell the excess solar energy back to the electrical grid. Alternatively, when there is high demand on the grid, the system is able to “island off” and rely on the energy stored in the batteries. If battery energy storage is depleted and solar generation is unavailable, the system then goes back to drawing from the main grid. Utilizing **net metering**<sup>21</sup>, the station is able to seamlessly transition from selling excess solar energy to the utility to drawing power from the grid.

In the event of a power outage of the main grid, the systems will “island off” immediately and use the energy stored in the batteries to power the stations with renewable energy. The battery storage systems have enough capacity to power the systems for up to 12–15 hours. In the event of a major power outage, solar generation (if available) will be able to recharge the battery and provide power for an extended length of time. Although not officially designated to serve as resiliency hubs, the fire stations would be able to coordinate with emergency management officials and distribute needed resources to residents in the event of an emergency.

### TIMELINE

- **April 2015:** California Energy Commission grant awarded to Gridscape.
- **December 2015:** Conversations between city and Gridscape begin.
- **September 2016:** City council approves project.
- **November 2016:** Power Purchase Agreement (PPA) signed between city and Gridscape.
- **April 2017:** Construction completed for microgrid on Fire Station #11.
- **September 2017:** Microgrid on Fire Station #11 goes into service.
- **December 2017:** Construction begins for microgrids on Fire Stations #6 and #7.
- **April 2018:** Construction completed for microgrids on Fire Stations #6 and #7.
- **September 2018:** Microgrid on Fire Station #6 goes into service.
- **January 2019:** Microgrid on Fire Station #7 goes into service.
- **2028:** PPA agreement ends, renewal options available.

<sup>21</sup> <https://seia.org/net-metering/>

## RELEVANT POLICIES AND PROGRAMS

- **California Government Code 4217.10-4217.18:** Allows public agencies to directly hire a company for energy services contracts without going through a standard request for proposal (RFP) process, as long as the savings of the project outweigh the costs to the public agency. This helps public agencies expedite implementation of energy conservation projects.
- **Carbon Neutrality Resolution:** In February 2019, the Fremont City Council adopted a Carbon Neutrality Resolution, setting a 55 percent GHG emission reduction target from 2005 levels by 2030 and a goal to achieve long-term carbon neutrality by 2045.
- **City of Fremont Updated Climate Action Plan:** On October 10, 2023, the Fremont City Council adopted Fremont's updated Climate Action Plan, titled *Climate Ready Fremont*<sup>22</sup>. The city's carbon neutrality goal forms the basis of the plan, setting Fremont on the pathway to a sustainable, vibrant, and healthy community that supports the environment.

## KEY PARTNERS AND STAKEHOLDERS

The fire station microgrid project was a result of a public-private partnership between the City of Fremont, Gridscape Solutions, and the California Energy Commission. Other relevant stakeholders included Sun Light & Power, Pacific Gas & Electric Company (PG&E), Delta Products, Microgrid Energy, and Ideal Power. A more detailed synopsis of key partners is available below:

- **City of Fremont:** Staff from the city's sustainability function was essential in raising awareness about the project, obtaining city council approval, and

connecting with various stakeholders. Once the demonstration period had been completed, the city entered into a 10-year PPA with Gridscape Solutions. Benefits from the project would help meet the city's Climate Action Plan and sustainability goals.

- **Gridscape Solutions:** Based in Fremont, Gridscape is a leading innovative energy solutions company specializing in developing and implementing standardized innovative products and solutions for microgrid and electric vehicle charging systems. Gridscape owns, manages, and operates all three fire station microgrids.
- **California Energy Commission:** CEC—the State's primary energy policy and planning agency responsible for ensuring energy facilities are located, constructed, operated, and decommissioned—awarded Gridscape the initial \$1.8 million grant for the project.

Please note this list may not capture the full scope of relevant stakeholders and partners involved in the fire station microgrid project.

## COSTS AND FINANCING

Total project cost was valued at **\$2,475,185**. The initial CEC grant, received by Gridscape directly, covered 75 percent of costs (\$1,817,925) to support project installation, and Gridscape used its own funds to cover the remaining 25 percent (\$657,260). This match funding covered by Gridscape for initial investments was made up by payments by the city through the PPA agreement. Although the City of Fremont had no upfront costs for this project, it is estimated that the city provided around \$80,000 in the form of staff time.

<sup>22</sup> <https://www.fremont.gov/home/showpublisheddocument/14218/638428261066300000>



Table 2: Funding Sources for The Warehouse

Funding Source	Amount
California Energy Commission Grant	\$1,817,925
Gridscape Solutions (matched funds)	\$657,260
<b>Project Total</b>	<b>\$2,475,185</b>

Source: City of Fremont, CA

## OUTCOMES AND CITY BENEFITS

The project was finished in four years, from the time Gridscape was awarded its initial grant from the CEC to when all three fire stations were operating their systems. The project has resulted in a wide range of economic and environmental benefits for Fremont and its residents. An initial analysis conducted by Gridscape and the city revealed the following:

- Saves on Utility Costs:** According to the city, in just the demonstration period alone, the city saved over \$30,000 in utility bills for the three stations combined, with a combined total of nearly \$250,000 in increased savings expected over the 10-year timeframe of the PPA.
- Reduces GHG Emissions:** The project has resulted in annual GHG emission reductions of approximately 80,000 pounds per year (36 metric tons of carbon dioxide per year).
- Reduces Demand on the Electricity Grid:** During high peak times, the system's ability to "island off" from the grid via its battery energy storage and solar generation helps manage demand on the main grid. This helps maintain grid stability, improve cost-effectiveness, and reduce the possibility of sustained power outages.
- Protects Critical Facilities from Power Outages:** As extreme weather events and public safety power shutoffs become more common, the fire stations have the necessary power to support their critical services. With this infrastructure technology in place, the city can also rely less on limited availability of diesel

generators powering other emergency facilities. As an additional benefit, there is a further reduction in GHG emissions as fewer diesel generators are utilized.

The battery storage systems have an estimated lifespan of 10–12 years, while the solar microgrid systems are expected to last around 20–25 years. Technological advances over the past decade are expected to extend the lifespan of future battery and microgrid systems, potentially reducing the frequency of replacement cycles. To date, Gridscape has not needed to replace any of the batteries or microgrid components. However, they do provide routine maintenance and repairs, as well as quarterly software updates. These updates typically include performance enhancements, operational fixes, capability upgrades, and improved power consumption load estimates.

Because the project was one of the first of its kind, its success has led other cities in the state to adopt similar initiatives. Cities such as Fontana, Stockton, Hayward, and Lancaster have since moved forward in implementing solar microgrid battery storage systems to power municipal facilities.

## NEXT STEPS

The terms of the PPA agreement will expire in 2028. The Fremont City Council will then have to decide whether to extend the contract or purchase the systems themselves from Gridscape. Additionally, the city council recently approved participation in the Critical Municipal Facilities Project, a major project to install additional microgrids on municipal facilities in multiple cities, including Fremont.

Gridscape will develop the microgrids for this project, which is a partnership with Ava Community Energy, Fremont's electricity provider. As part of the project, microgrids will be installed at critical facilities including fire stations and police stations, community centers, libraries, equipment and corporation yards, and water treatment facilities. The project will represent one of the largest deployments of microgrids under a single third-party financed PPA agreement.

## LESSONS LEARNED AND STRATEGIES FOR REPLICATION

### Planning for Utility Connections:

The interconnection process with PG&E was time consuming. Public agencies should be prepared for this in project planning timelines.

**Addressing Regulatory Challenges:** City leaders noted that a primary challenge associated with project implementation was navigating the regulatory environment with new technology. Gridscape's single inverter microgrid systems are designed differently than those currently approved by the California Public Utilities Commission (CPUC). One of the issues was making sure that the battery system did not pull directly from the grid during low-cost time and gain revenue from PG&E. While Gridscape engineered a software-based solution, the CPUC ruling had not accounted for non-hardware fixes to separate the grid and the battery. Thus, PG&E had to send in a letter of support to show that the software fix was appropriate.

**Preventing Delays:** Ensuring site inspections are conducted by technical experts is important so that issues do not arise during construction, which can lead to project delays.

**Evaluating Project Partners:** City staff emphasized the importance of thoroughly vetting potential project partners for public-private partnerships. This can include reviewing past project experiences, verifying funding sources, and analyzing their industry expertise. For example, the city felt comfortable relying on Gridscape because its funding award from the CEC demonstrated the company held the legitimate skills needed to successfully lead the project.

## ADDITIONAL RESOURCES

- **California Energy Commission Report: Solar Emergency Microgrids for Fremont Fire Stations - Demonstrating Energy Savings and Grid Resilience for Critical Facilities**<sup>23</sup>
- **Solar & Microgrid Projects | City of Fremont, CA Official Website**<sup>24</sup>
- **Microgrid Demonstration Project at City of Fremont Fire Stations | ICLEI Local Governments for Sustainability**<sup>25</sup>
- **Presentation: City of Fremont & Gridscape Solutions, LLC**<sup>26</sup>
- **Gridscape**<sup>27</sup>

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<sup>23</sup> <https://www.energy.ca.gov/publications/2019/solar-emergency-microgrids-fremont-fire-stations-demonstrating-energy-savings>

<sup>24</sup> <https://www.fremont.gov/about/sustainability/municipal-public-projects/solar-microgrid-projects>

<sup>25</sup> <https://s3-us-west-2.amazonaws.com/memberresource/ICLEI+Member+Case+Study+Fremont+CA+Microgrid.pdf>

<sup>26</sup> [https://www.bayren.org/sites/default/files/2021-11/fremont-fire-stations-microgrid-demonstration\\_1-31-18.pdf](https://www.bayren.org/sites/default/files/2021-11/fremont-fire-stations-microgrid-demonstration_1-31-18.pdf)

<sup>27</sup> <https://grid-scape.com/>



## Case Study 4: Central Park Recreation Center: Energy Resilience for Recreation Centers Denver, CO Mayor Mike Johnston

### OVERVIEW

Over the past three decades, Denver has confronted unprecedented climate-related environmental threats, including extreme heat, prolonged **urban drought**<sup>28</sup>, **air pollution**<sup>29</sup> from **wildfires**<sup>30</sup>, and water stress. Future projections for Colorado suggest a potential temperature increase of **2.5 °F to 5 °F**<sup>31</sup> by 2050. To alleviate the effects of climate change on the vulnerable population residing in Denver, the city's Office of Climate Action, Sustainability, and Resiliency (CASR) is investing in resiliency hubs strategically located in areas most vulnerable to wildfires, heat, and flooding.

As a first step, the city is installing long-duration battery energy storage and electrifying existing heating, ventilation, and air conditioning (HVAC) equipment to complement previously installed **solar panels and batteries at the Central Park Recreation Center**<sup>32</sup>.

This work will demonstrate how the center's solar and battery system can serve local communities during emergencies and power outages. During normal operations, the solar power generated at the site currently powers the recreation center with 100 percent renewable electricity, with the structures providing the added benefit of shade and cooling during the summer months. Excess energy generated goes into a donation program through the Denver public school system where it is used to offset energy costs for families with high energy burden.

Once the microgrid is completed in 2025, this energy could power the facility itself when necessary. The recreation center is positioned to meet the needs of the entire city and county of Denver, including vulnerable communities. City bus lines help ensure the center can be accessed via public transportation. The center's resources, including essential wellbeing amenities (e.g., showers and kitchen space), have previously been leveraged to receive migrants in an emergency. Together these attributes allow the center to serve as a city-wide facility that could receive people during emergency situations. This project is aimed at showing what is possible when pairing existing city resources with new microgrid technologies.

28 <https://www.drought.gov/states/colorado/county/denver>

29 <https://www.colorado.gov/airquality/addendum.aspx>

30 <https://data.coloradoan.com/fires/>

31 <https://cwcb.colorado.gov/focus-areas/hazards/climate>

32 <https://www.youtube.com/watch?v=XNgqQ09Ly5I>

## DESIGN AND IMPLEMENTATION

### LOCAL MARKET CONDITIONS AND DRIVERS

In Denver, current and future climate change challenges are impacting everyone, yet their adverse effects are disproportionately felt by more vulnerable populations, in particular individuals experiencing homelessness, internally displaced people due to climate disasters, seniors, people living in poverty, people with disabilities, and a growing population of climate refugees. These groups are more susceptible to climate risks, have reduced capacity to adapt, and are frequently the last to receive support in times of emergency.

To address these challenges, the City of Denver's Office of Climate Action, Sustainability, and Resiliency (CASR) is leveraging a growing toolkit of resources and solutions that demonstrate the value and process of developing local community resiliency hubs for climate adaptation. CASR is investing in resiliency hubs for several key reasons:

- 1. Community Support During Emergencies:** Resiliency hubs can provide essential services and resources during climate-related emergencies such as wildfires, heatwaves, and floods. These hubs can offer shelter, cooling or heating centers, and access to food, water, and medical supplies when traditional infrastructure fails.
- 2. Enhancing Social Cohesion:** Resiliency hubs can serve as community centers that foster social connections and collaboration, which are crucial for building strong, resilient communities.
- 3. Sustainable Infrastructure:** Integrating renewable energy sources—solar panels and batteries, for example—into resiliency hubs ensures that these centers can operate independently of the grid during power outages. This not only supports emergency response efforts but also contributes to the city's overall sustainability goals.

- 4. Climate Justice and Equity:** Climate impacts disproportionately affect low-income and marginalized communities. By establishing resiliency hubs in these areas, we can address these inequities, ensuring that all residents have access to the resources and support needed to adapt to a changing climate.

The emergence of new government grants and incentives is making the city's efforts to deploy resiliency hubs across the jurisdiction a more achievable goal.

### PROCESS AND APPROACH

In early 2023, as the City of Denver was installing a community solar garden in the parking lot of the **Central Park Recreation Center**, Colorado's Department of Local Affairs (DOLA) amended the purpose of the Energy and Mineral Impact Assistance Fund (EIAF) to include community resiliency. Through conversations with DOLA, CASR identified the opportunity to leverage these funds to pilot a resiliency hub and build resiliency into the center's design. In November 2023, the program awarded just over \$2 million to the city.

The Central Park Recreation Center was selected as the pilot site for several reasons, most notably for energy considerations. The Center's size would support a variety of services, and its location and Americans with Disability Act (ADA) compliance would allow for more inclusive community access. Importantly, the recently built facility's HVAC systems could support the renovations needed to achieve the new functionality.

These improvements include electrification of two out of three HVAC rooftop units. Reducing on-site natural gas combustion will cut the city's scope 1 GHG emissions by 200 metric tonnes carbon dioxide-equivalent per year. In addition, the battery component will provide important resiliency benefits. With the new technology, the center will have the capacity to operate most facilities as a microgrid<sup>33</sup>. The battery will allow the city to operate the facility when there is no power, "island off" the building during heatwaves to provide grid relief and export power from the battery when needed elsewhere on the local grid.

<sup>33</sup> The exception here are aquatic facilities (e.g., pools) at the center.

CASR is working with the Department of Parks and Recreation (DPR) and the Department of Transportation and Infrastructure (DOTI) to develop the resilience hub in two tracks: capital projects and community engagement and planning. The capital projects track includes inter-departmental planning and design, contracting, and installation of improvements such as battery storage and building electrification in 2025 and 2026. These departments will also coordinate in the community engagement and planning process track, which will aim to maximize community benefits and ensure alignment with community goals.

## RELEVANT POLICIES AND PROGRAMS

As the city drives toward its goal of 100 percent GHG emissions reduction by 2040, demand and consumption of electricity will increase dramatically, as will our residents' reliance on the local electric grid. However, the anticipated increase in demand combined with expectations of more severe heat and cold in the Denver area has the potential to decrease the reliability of the grid itself.

## COSTS AND FINANCING

The total project costs for the building electrification, energy storage capacity, and microgrid components are just over \$3 million, with construction making up most of the figure. This cost does not include the existing solar array, which was already installed and funded through a separate program.

These upfront costs are covered by a variety of funding sources:

- 1. Denver's Climate Protection Fund:** This special revenue fund staffs the Office of Climate Action and provides seed capital for the city to pursue projects separate from the city's typical construction and procurement process.
- 2. Colorado Department of Local Affairs (DOLA) EIAF Resilience Hub Grant:** The state's funding for this project was critical to getting the greenlight to pursue.
- 3. EECBG:** The city is tapping the Energy Efficiency and Conservation Block Grant (EECBG) from the Department of Energy for additional funding for this capital project.

Table 3: Central Park Recreation Center Resiliency Funding Sources. (source: City and County of Denver)

Source	Design	Construction	Total
DOLA - EIAF Resilience Hub Grant	\$330,796	\$1,675,825	\$2,006,621
Federal Energy Efficiency and Conservation Block Grant (EECBG)		\$655,720	\$655,720
CASR - Climate Capital Funds	\$165,398	\$516,630	\$682,028
<b>Total</b>	<b>\$496,194</b>	<b>\$2,848,175</b>	<b>\$3,344,369</b>

In addition to these funding sources, the city is leveraging the **IRA's Elective Pay tax credit to reduce the cost of certain components of the project**. The elective pay benefit will reduce costs of certain components like the battery by 30 percent, amounting to hundreds of thousands of dollars in capital cost savings. Because the microgrid is partially state- and federal-funded, under the elective pay system some portions of the tax credit will be discounted. The city took considerable time to ensure it followed the novel process correctly and found that applying for elective pay through the IRS was straightforward and easy to navigate.

Finally, these improvements will reduce the facility's demand and cut energy costs by approximately \$25,000 – 30,000 per year.

## KEY PARTNERS AND STAKEHOLDERS

Partners and stakeholders play a vital role in the collaborative project to develop the Central Park Recreation Center into a resilience hub and meet the needs of the Denver community.

The resilience hub follows a local government-led model that leverages multiple state agency programs.

- **CASR** provides **leadership, funding, and builds capacity** for the project by coordinating with key departments and managing the project build out.
  - » CASR coordinates and collaborates with DOTI and DPR on **community engagement** to leverage each agency's strength and meet the community's needs. CASR engages the communities that do not always have a voice in these types of projects by reaching out to community-based organizations and developing partnerships to understand what voices and perspectives are missing.
- » The office is financing the project through city funds and grants from DOLA and U.S. Department of Energy.
- » CASR plans to continue investing in resilience hubs by supporting community-run resilience hubs following this pilot program.
- **The Department of Transportation and Infrastructure** provides **infrastructure support** to the project. DOTI is managing the design, construction, implementation, and oversight of the energy resilient infrastructure. DOTI will also engage stakeholders who are involved with construction.
- The **Department of Parks and Recreation** serves as a building operator and is responsible for activating the center to serve as a heating/cooling center, when needed. DPR is well positioned to engage constituents and people who access the parks and recreation.
- **Other agencies**, such as emergency management, human services, and safety departments will help to assess the utilization of the energy resources once they are available for use.
- **Xcel Energy** provided technical design support to the project team to determine the safest way to "island off" the facility from the grid during emergency operations.

## LESSONS LEARNED AND STRATEGIES FOR REPLICATION

**Focusing on Collaboration and Coordination:** CASR found that a resilience hub project—especially one focused around installing energy resilient infrastructure—requires collaboration and coordination with multiple stakeholders. Investing in a large battery and a new electrical system requires multiple departments to be "on board" and approve the project.

**Relying on Technical Expertise:** To gain the confidence and approval of decision makers and departments, technical expertise was needed. CASR noted the project benefited from a “knowledgeable champion,” or someone that can explain the technologies to less informed stakeholders.

Having a staff member with expertise on the battery component and who has existing relationships with other departments and agencies, allowed CASR to build trust with decision makers and move the project forward.

**Learning from Others:** CASR drew inspiration from successful implementation in other cities around the nation. These examples provided insight into how to improve energy resilience of existing facilities and what resources resilience hubs should provide a community:

- Tuolumne County in California recently opened the [Groveland Community Resilience Center](#)<sup>34</sup>, which provides energy resilience to the community from heating and cooling systems to a diesel power generator.
- As an endeavor to safeguard Minneapolis from power disruptions, Xcel Energy is opening [three resilience hubs](#)<sup>35</sup> in historically disadvantaged communities, which will provide crucial backup power during natural disasters.
- The City of Baltimore provides various forms of grant-funded assistance to support community resiliency hubs, comprising of high-quality emergency preparedness supplies, improvements to

their building's energy efficiency, and the provision of backup power capabilities that may include rooftop solar panels and battery storage if deemed feasible.

**Stacking Funding Sources:** Key to the success of this effort is the ability to stack funding sources and incentives to finance a project. For the first time, the city is able to utilize new tax credits (e.g., from the IRA) to reduce the costs of certain components of the project. The fund stacking allows the city to scale a program that will provide benefits to more residents and communities.

## ADDITIONAL RESOURCES

- [Denver Working to Build out Climate Resilient Hubs | Denver 9News \(KUSA\)](#)<sup>36</sup>
- [Resilience Hub Core Components | USDN](#)<sup>37</sup>
- [Energy and Mineral Impact Assistance Fund Program | Colorado DOLA](#)<sup>38</sup>
- [Energy Efficiency and Conservation Block Grant | Department of Energy](#)<sup>39</sup>
- [Climate Project Fund | City and County of Denver](#)<sup>40</sup>

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<sup>34</sup> <https://www.theguardian.com/us-news/2022/sep/23/california-extreme-heat-resilience-centers>

<sup>35</sup> <https://grist.org/beaton/minneapolis-is-getting-solar-resilience-hubs/>

<sup>36</sup> <https://www.youtube.com/watch?v=XNgqQ09Ly5I>

<sup>37</sup> <https://resilience-hub.org/core-components/>

<sup>38</sup> <https://dlg.colorado.gov/climate-resilience-challenge>

<sup>39</sup> <https://webcf.waybackmachine.org/web/20250117235530/https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program>

<sup>40</sup> <https://localinfrastructure.org/wp-content/uploads/2023/12/Climate-Protection-Fund-%E2%80%93-Denver-CO.pdf>

# Key Takeaways

With the frequency and severity of climate-related hazards continuing to increase, it is important for organizations at all levels to find ways to enable greater community resilience. The investments in resilience hubs, community programming, and energy infrastructure by local leaders across the country serve as helpful models for building community resilience at different scales. From full-blown hubs to investments that ensure critical infrastructure operates in emergencies and programming that strengthens the social fabric, these case studies demonstrate different tangible actions that others can replicate.

Key takeaways you should consider on your resilience journey:

**Think broadly about how community resilience can be enhanced.** Solutions are not one-size fits all. Allocating funding, time, and capacity for a new, comprehensive resilience hub is not the only path to improve local preparedness. Even low-cost building retrofits and support for ongoing community programming can improve communities' ability to withstand and bounce back from a disaster.

**Engage with community and partners early.** Tailoring resilience solutions to the needs of a community is crucial for ensuring their relevance, impact, and sustainability. Each community faces unique challenges and has different assets, relationships, and existing programming from which to define and shape resilience hubs or resilience-focused spaces. Engage with community champions, potential partners, and other key stakeholders early to find meaningful ways to invest in resilience.

**Stack funding from diverse sources.** Organizations—from the government to private philanthropies to local businesses as well as nonprofits—can support investments in community resilience. These investments are not strictly monetary; they can range from offering in-kind services, donating buildings or other assets, or providing technical expertise.

**Understand regulatory and technical requirements.** Local regulatory requirements—such as permitting, zoning, and utility interconnection—have significant impacts on project timelines and viability. Similarly, technical requirements vary by building, system, and usage patterns. Engage partners and experts as necessary to understand these impacts.

**Learn from others.** The four case studies highlighted in this report are a tiny sample of the work communities across the globe are doing to build resilience. Other organizations have created case studies, toolkits, and general resources to help governments and other players find ways to enhance community resilience through resilience hubs and investments. See additional resources in the Federal Resources Table on **page 33** and throughout this report.

Resilience hubs provide a unique opportunity to work at the nexus of community resilience, emergency management, climate change mitigation, and social equity while also providing opportunities for communities to become more self-determining, socially connected, and successful before, during, and after disasters. Shifting adaptive capacity to community-driven resilience hubs can cultivate community cornerstones, reduce stress on systems and infrastructure, and support relief agencies during a disaster and the recovery efforts.



# Federal Resources

Focus Area	Agency	Programs	Resource Type
Resilient Infrastructure	Federal Emergency Management Agency (FEMA)	<b>Hazard Mitigation Grant Program<sup>41</sup></b> <b>Building Resilient Infrastructure and Communities<sup>42</sup></b> <b>Pre-Disaster Mitigation Grant Program<sup>43</sup></b>	Grants
Energy	Department of Energy (DOE)	<b>Energy Futures Grant<sup>44</sup></b> <b>Renew America's Nonprofits Grant<sup>45</sup></b> <b>Energy Efficiency and Conservation Block Grant Program<sup>46</sup></b> <b>Communities Sparking Investment in Transformative Energy (C-SITE)<sup>47</sup></b>	Grants
	Housing and Urban Development (HUD)	<b>Green and Resilient Retrofit Program<sup>48</sup></b>	Grants
	Internal Revenue Service (IRS)	<b>Direct Pay Tax Credits<sup>49</sup></b>	Tax Credits
Community	Environmental Protection Agency (EPA)	<b>Community Change Grants Program<sup>50</sup></b> <b>Environmental Justice Government to Government Program<sup>51</sup></b>	Grants
Hub Locations	Department of Homeland Security (DHS)	<b>Resilience Hubs Finder<sup>52</sup></b>	Informational Tool
Community Risk and Resilience	U.S. Global Change Research Program (USGCRP), National Oceanic and Atmospheric Administration (NOAA)	<b>U.S. Climate Resilience Toolkit<sup>53</sup></b>	Informational Tool

<sup>41</sup> <https://www.fema.gov/grants/mitigation/learn/hazard-mitigation>

<sup>42</sup> <https://www.fema.gov/grants/mitigation/learn/building-resilient-infrastructure-communities>

<sup>43</sup> <https://www.fema.gov/grants/mitigation/learn/pre-disaster>

<sup>44</sup> <https://web.archive.org/web/20241225163535/https://www.energy.gov/scep/energy-future-grants>

<sup>45</sup> <https://www.energy.gov/scep/renew-americas-nonprofits-grant>

<sup>46</sup> <https://web.archive.org/web/20241003185855/https://www.energy.gov/scep/renew-americas-nonprofits-grant>

<sup>47</sup> <https://www.energy.gov/scep/about-funding-opportunity-communities-sparking-investments-transformative-energy-c-site>

<sup>48</sup> <https://www.hud.gov/grrp>

<sup>49</sup> <https://www.irs.gov/credits-deductions/elective-pay-and-transferability>

<sup>50</sup> <https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-community-change-grants-program>

<sup>51</sup> <https://www.epa.gov/environmentaljustice/environmental-justice-government-government-program>

<sup>52</sup> <https://experience.arcgis.com/experience/7f7988a5b2df4543b9c6c73b2d8e18e1/>

<sup>53</sup> <https://toolkit.climate.gov/>



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