COMBINED
HEAT AND POWER
ALLIANCE

Submitted Electronically – April 21, 2023

Combined Heat and Power Alliance
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RE: Department of Energy's (DOE) Request for Information (RFI) on the Puerto Rico Energy Resilience Fund (PR-ERF)

The Combined Heat and Power Alliance (CHP Alliance) commends DOE for prioritizing energy resilience in Puerto Rico in response to Hurricane Maria in 2018, praises President Biden for allocating funds for the PR-ERF in the FY23 Consolidated Appropriations Act in the wake of Hurricane Fiona in 2022 and appreciates the Grid Deployment Office (GDO) for providing the opportunity to submit comments on the RFI regarding how to allocate the $1 billion managed through the PR-ERF. In particular, the CHP Alliance provides recommendations for the second round of investments focused on community resilience, urging GDO that combined heat and power (CHP) should be included in the scope of eligible technological solutions.

Agustín F. Carbó, Director of the Puerto Rico Grid Modernization and Recovery Team, stated: "For far too long, Puerto Ricans have endured an unreliable and expensive electric system with frequent blackouts due to catastrophic weather events and aging infrastructure. This historic investment [PR-ERF] will be transformative for many Puerto Rican families, keeping the lights on through power outages, providing peace of mind during hurricane season, and saving them more money and reducing high electric bills with these clean energy solutions."[1]

[1] "Department of Energy Announces $1 Billion to Improve Energy Resilience for Puerto Rico's Most Vulnerable Households & Communities," Department of Energy, February 20, 2023. https://www.energy.gov/gdo/articles/department-energy-announces-1-billion-improve-energy-resilience-puerto-ricos-most.

CHP has a proven track record of providing all the benefits Carbó outlines in his statement: keeping systems operational during outages, reducing energy costs, enhancing grid reliability, enabling use of clean energy, and reducing emissions. Therefore, we strongly encourage GDO to consider CHP as a key solution to grid resilience and should be eligible for future competitive solicitations within the PR-ERF.

About CHP

The CHP Alliance is a diverse coalition with more than 70 members including equipment manufacturers and distributors, engineers, utilities, labor, contractors, non-profit organizations, and educational institutions.[2] Our members come together with the common purpose to educate all Americans about CHP and waste heat to power (WHP), and how CHP and WHP can make America's manufacturers and other businesses more competitive, provide system resilience, reduce energy costs, enhance grid reliability, and reduce emissions.

CHP is an established and highly efficient technology that can reduce emissions using traditional fuels and can reduce emissions even further using renewable and low-carbon fuels, such as renewable natural gas (RNG), renewable propane, and clean hydrogen. Properly designed systems typically operate with an overall efficiency of 65 to 85 percent, with some systems approaching 90 percent.[3] No other technologies using traditional fuels can reach these levels of efficiency. This is compared to an average efficiency of 39 percent for fossil-fueled power plants in the U.S., and an efficiency of 50 percent when electricity generation is combined with an on-site boiler for thermal energy needs.[4] CHP systems achieve these high efficiencies by recovering the waste heat byproduct of electricity generation as useful thermal energy for heating and cooling.[5]

[2] "Who We Are," Combined Heat and Power Alliance, Accessed April 2023. https://chpalliance.org/who-we-are/.
[3] "Combined Heat and Power (CHP) Technical Potential in the United States," U.S. Department of Energy, March 2016, p. 3, https://www.energy.gov/eere/amo/articles/new-release-us-doe-analysis-combined-heat-and-power-chp-technical-potential; "CHP Benefits," U.S. Environmental Protection Agency Combined Heat and Power Partnership, last accessed April 2023, https://www.epa.gov/chp/chpbenefits.
[4] "Combined Heat and Power and a Changing Climate: Reducing Emissions and Improving Resilience," Combined Heat and Power Alliance, January 2021, p. 10, https://chpalliance.org/resources/publications/chp-and-a-changing-climate-reducing-emissions-and-improving-resilience/.
[5] "Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems," U.S. Environmental Protection Agency, Combined Heat and Power Partnership, February 2015, p. 3, https://www.epa.gov/sites/production/files/201507/documents/fuel_and_carbon_dioxide_emissions_savings_calculation_methodology_for_combined_heat_and_power_syste ms.pdf.

Because they operate so efficiently, CHP systems combust less fuel to provide the same energy services. This efficient generation of energy reduces all types of emissions, including greenhouse gases such as carbon, criteria pollutants, and hazardous air pollutants.

CHP systems utilizing clean fuel sources can be a long-term path to decarbonizing critical operations where dispatchable onsite power is needed for both resilience and reliability. CHP has long used digester and biogas as clean fuel sources,[6] and systems deployed today can operate on increasing percentages of RNG as availability increases. Additionally, CHP manufacturers are testing and operating CHP systems on high percentage hydrogen fuels, up to 100% clean hydrogen. The CHP Alliance published a roadmap to convert all existing and new CHP systems to 100% clean hydrogen by 2030 or sooner, highlighting that existing systems can convert to 100% clean hydrogen at reasonable cost and with minimal downtime because these conversions can occur during scheduled overhauls.[7]

CHP is unparalleled in its ability to provide continuous power, both electric and thermal, to critical infrastructure and limit the impact of outages by localizing power generation close to critical services. CHP can not only provide the benefit of essential energy services during catastrophic weather events and emergencies, but also create cost savings, distribution capacity, power quality benefits, and environmental benefits for entire communities.[8] During some climate events, as was the case with Hurricane Maria, grid outages could last for days or weeks or months on end. On-site battery storage cannot feasibly provide power for that duration as the technology currently stands and would be compounded by a likely lack of production by wind and solar leading up to and during the climate event. CHP, however, is proven to keep the lights on during such events, supporting critical infrastructure including hospitals, healthcare providers, nursing homes, colleges and universities, and other facilities that serve as

[6] DOE's CHP Installation Database lists 608 CHP systems with a total of 538 megawatt operating on digester gas and landfill gas utilizing reciprocating engines, gas turbines, microturbines and fuels cells. "CHP Installations," U.S. Department of Energy, last modified October 31, 2021, https://doe.icfwebservices.com/chpdb/.
[7] Clean Hydrogen and Combined Heat and Power: A Roadmap for Industrial and Commercial Decarbonization," CHP Alliance, March 2022. https://chpalliance.org/wp-content/uploads/2019/08/CHP-Hydrogen-Roadmap-2.pdf.
[8] "CHP and the Clean Energy Future: How CHP Fits into a Modern Electric Grid and a Green Gas System," Combined Heat and Power Alliance, November 2021, p. 23. https://chpalliance.org/wpcontent/uploads/2019/08/CHP_Clean-Energy-Future-1.pdf.

emergency shelters and places of sanctuary for the residents of Puerto Rico. Additionally, microgrids are becoming more prevalent in community resilience planning with multiple stakeholders, serving as a key enabler of electrification and decarbonization especially for low-income communities. In the U.S. over 200 microgrids use CHP, equivalent to 35 percent of all the nation's microgrids. Moreover, CHP serves as a critical backbone to over 67 percent of those microgrids that operate continuously.[9]

CHP in Puerto Rico

What are other technologies and business models that DOE should consider for future competitive solicitations in this Fund (e.g., community solar, other distributed energy technologies, grid-scale storage, smart grid technologies, microgrids, etc.)? Are there any examples or use cases in Puerto Rico or comparable jurisdictions?

As stated in the introduction, the CHP Alliance strongly urges DOE to consider CHP technologies for future competitive solicitations in the PR-ERF, for CHP is already utilized by critical facilities on the island today and there is potential to increase CHP deployment. To date, there are over two dozen CHP systems installed across the island, totaling over 1,030 megawatts (MW) of resilient energy capacity. Many of these systems are located at critical infrastructure facilities that provide sanctuary to Puerto Rican residents during emergency situations, such as healthcare systems. For example:

> The Hospital de la Concepción in San Germán, PR installed a 2.4 MW CHP system that runs on liquefied propane gas (LPG) and provides upwards of 80% total efficiency and saves the hotel nearly $1 million annually. However, the most essential value of the CHP system is its resiliency.
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> Construction of the CHP system began in the summer of 2017, and because hurricane season was approaching, a decision was made to install and make the generators operational, without finishing the building and the rest of the system. On September 6, 2017, Hurricane Irma hit and was followed by Hurricane Maria 14 days later, which devastated the entire territory and its electric infrastructure.

[9] "Microgrid Installations," U.S. Department of Energy, data current as of December 31, 2022, https://doe.icfwebservices.com/microgrid.

Hospital de la Concepción's CHP based microgrid was able to island and provide power, hot water, and cooling during the storm and for nearly five months afterwards despite the power grid being out of service.

Due to the devastation, ambulances could not reach trauma centers in San Juan, so Hospital de la Concepción was soon accepting patients from other regional hospitals that were forced to close or minimize operations due to the lack of power and water. The surgical suites and trauma centers ran at full capacity and even 3 neurosurgeries were conducted during that time.

For seven days after Maria, the hospital's cafeteria provided hot meals to the community. Also, because the hospital was powered and secure, hospital personnel were able to reach remote communities nearby to deliver hot food cooked in the cafeteria, water, and health services. The hospital's microgrid remained islanded from the grid until February 2018. Construction on the site was completed in August 2018, but the CHP project had already proven its worth.[10]

Another critical infrastructure sector that uses CHP today for its resiliency benefits is the propane gas (LPG) industry, which supplies energy to facilities across the island. For example:

In 2018 Empire Gas, Puerto Rico's largest LPG wholesaler, installed a microgrid at its ProCaribe LPG Terminal that includes a 1.4 MW CHP system to ensure that they could remain operational, strengthen their fuel supply chain, and serve their customers without any interruptions during extreme weather events. The CHP system serves as the backbone of the microgrid and enables solar and battery storage use.[11]

In September 2022, Hurricane Fiona caused excessive flooding and widespread power outages that lasted for weeks after the hurricane hit the island and

[10] "Project Profile: Hospital de la Concepción," U.S. Department of Energy Southeast CHP Technical Assistance Partnerships, issued January 2022, https://drive.google.com/file/d/1Yz3ip6eex1BVpQoyQl7BYOz3pxf8L-YB/view.
[11] POWER Magazine. "Building Puerto Rican Resiliency with LPG-Fueled Engines." March 1, 2019, https://www.powermag.com/building-puerto-rican-resiliency-with-lpg-fueled-engines/

affected the already weakened power grid. The CHP microgrid system at ProCaribe continued to operate as normal and was able to offer propane fuel deliveries to its customers throughout the island without any disruptions. Several other CHP systems on the island are fueled by propane, and the terminal remaining operational meant that there were no supply chain interruptions or delays concerning propane delivery, further enhancing the resiliency of other CHP system end users.

These are just two of many case studies that highlight where CHP's resiliency capabilities saved lives and provided necessary electricity, heating, and cooling for communities throughout Puerto Rico when they needed it most.

Technical Assistance

How can DOE and the National Laboratories provide recipients with technical assistance to support the execution of deploying energy resilience solutions (e.g., innovative finance tools, benefit cost analyses, public engagement, risk assessments, etc.)?

For nearly two decades, DOE has supported a regional network of technical assistance providers, known as the CHP Technical Assistance Partnerships program (CHP TAPs).[12] The CHP TAPs play a critical role in transforming the market for CHP, waste heat to power, and district energy technologies throughout the United States. The CHP TAPs offer fact-based, non-biased engineering support to manufacturing, commercial, institutional, and other critical facilities, conduct stakeholder engagement to educate the public on the benefits of installing CHP systems, and provide various technical services such as site screenings, economic impact analyses and risk assessments. To meet the evolving needs in the commercial and industrial sectors, this year DOE is initiating a broader TAP program with the goal of providing similar services for a wider range of technologies that include not only CHP but also renewable energy and storage through a new Onsite Energy TAP Program—technologies that will be critical to increasing energy resilience in Puerto Rico.

[12] "CHP Technical Assistance Partnerships (CHP TAPS)," U.S. Department of Energy Better Buildings, last accessed April 2023, https://betterbuildingssolutioncenter.energy.gov/chp/chp-taps.

The CHP Alliance encourages critical infrastructure facilities and other stakeholders to engage the Southeast CHP TAP, who's territory covers Puerto Rico. The regional TAP program is located at the North Carolina State University and the primary contact there is Isaac Panzarella, Director: ipanzarella@ncsu.edu.[13]

Conclusion

The CHP Alliance appreciates the opportunity to submit recommendations to GDO regarding program design and implementation of the Puerto Rico Energy Resilience Fund and looks forward to working closely with GDO staff and other affiliated agencies—Federal Energy Management Agency and the Department of Housing and Urban Development—to promote CHP as a resiliency solution for the island.

Respectfully,

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[13] "Southeast CHP Technical Assistance Partnership," U.S. Department of Energy Better Buildings, last accessed April 2023, https://betterbuildingssolutioncenter.energy.gov/chp/southeast-chp-technical-assistance-partnership.