

Packaged CHP Accelerator Topical Webinar – Microgrid Database

March 25, 2021

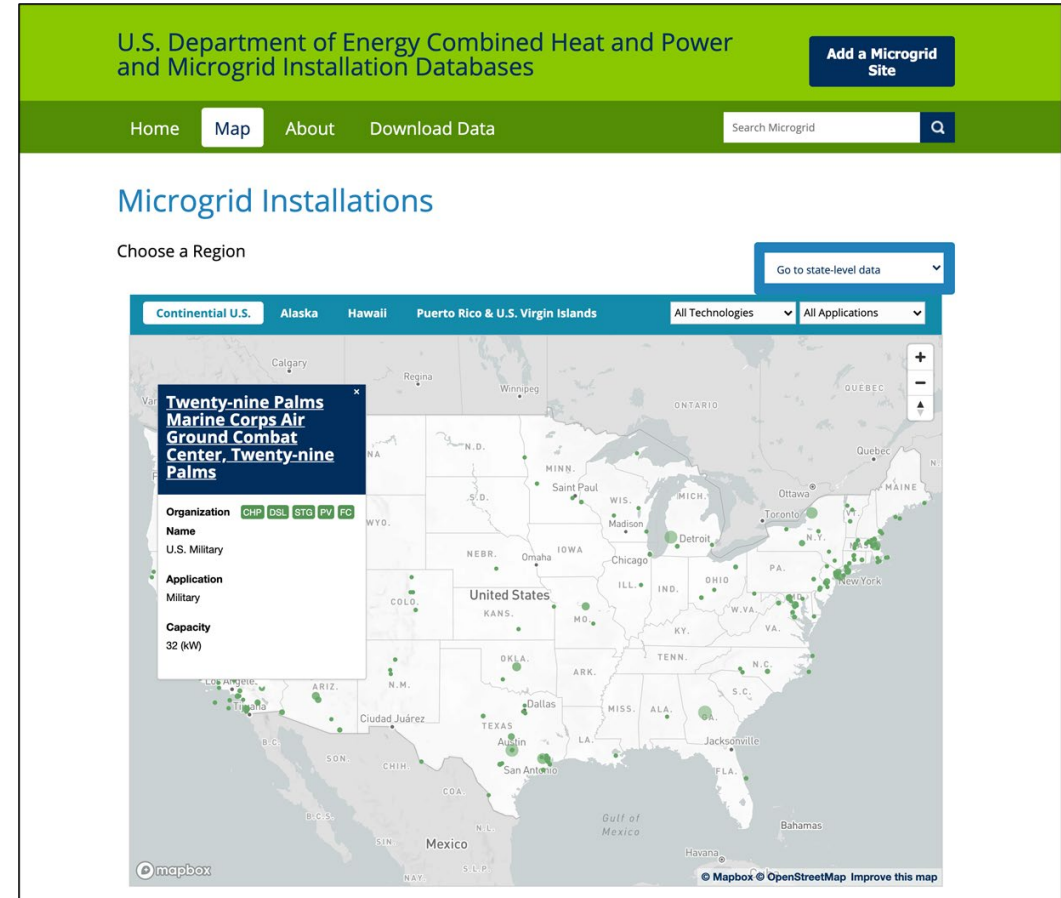
Agenda

- Introduction – Bruce Hedman
- Microgrid Database and website background – Josh Freeman, ICF
- Microgrid statistics and trends – David Jones, ICF
- Website demo – Trent Blomberg, ICF
- Packaged CHP Accelerator Update – Bruce Hedman

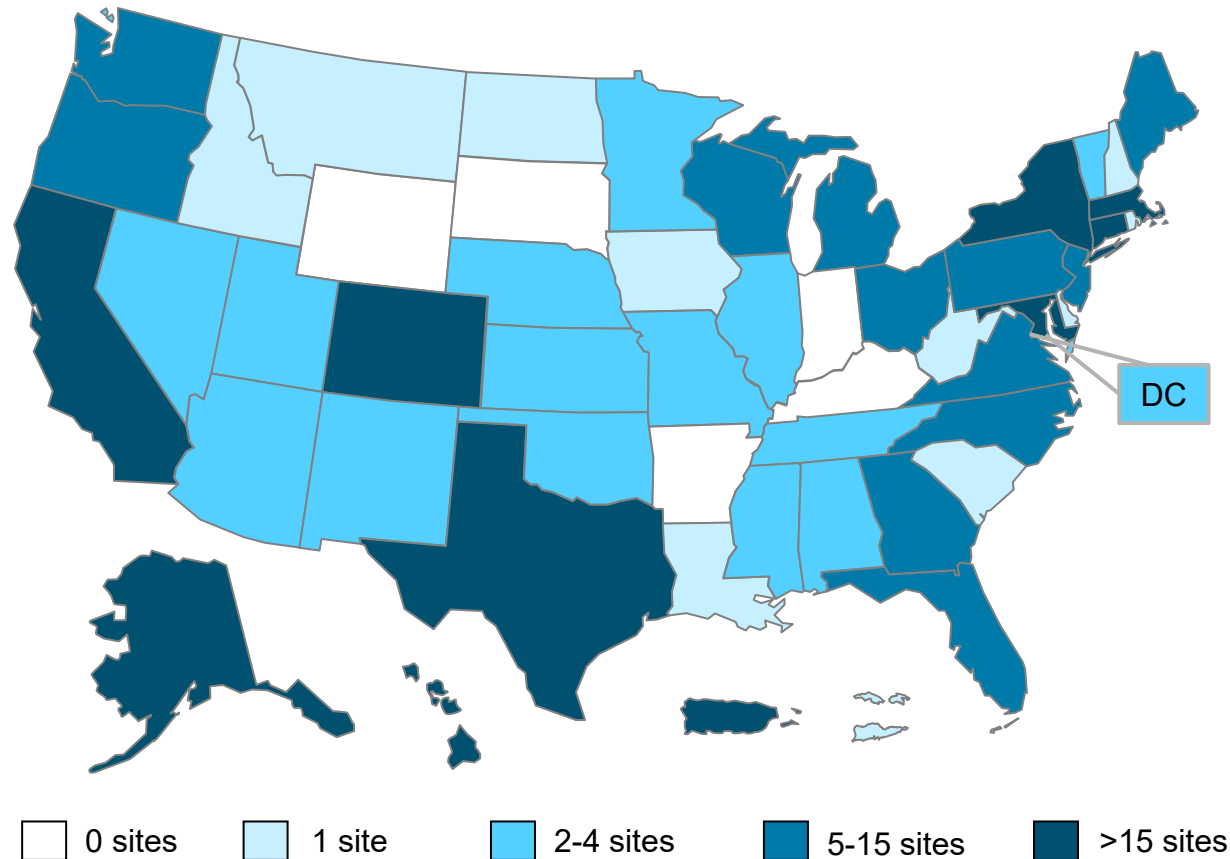
Microgrid Installation Database

Microgrid Database

- Created to gain insights into the microgrid market and the roles of CHP and other technologies in microgrid development
- Tracks information for operational systems, including:
 - Project owner
 - Generation and storage capacity (kW)
 - Technologies (CHP, Solar, Storage, Wind, Hydro, Non-CHP Combustion, Fuel Cell, Advanced Controls)
 - Location (City, State)
 - Date of system installation
- Database maintained for U.S. Department of Energy and hosted online along with CHP Installation Database
- Website is live for review
 - <https://doe.icfwebservices.com/index>
- Full launch this spring



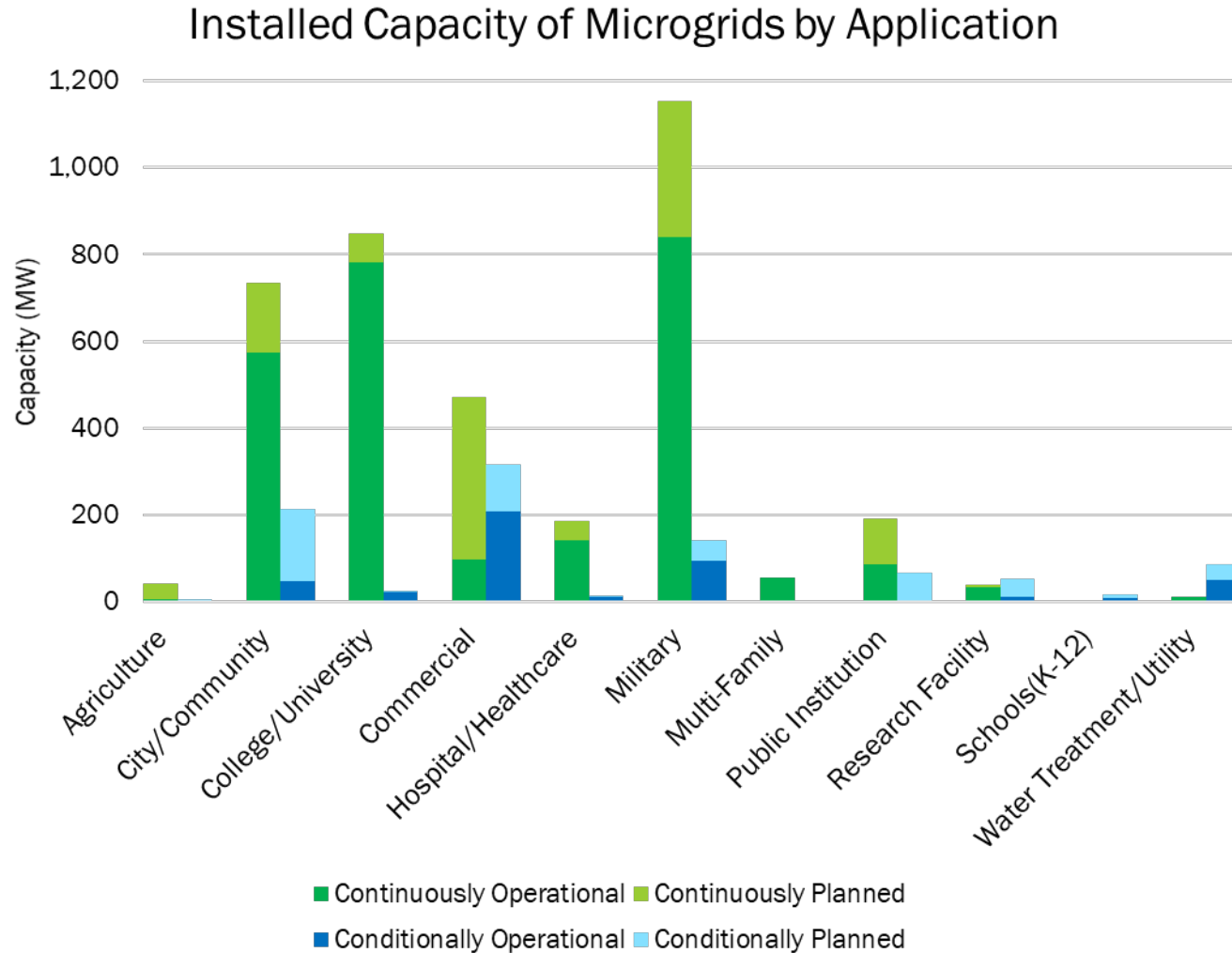
U.S. Microgrid Installation Database



- A microgrid is a network of DERs and loads that can disconnect and re-connect to the larger utility grid as a single entity or functions as an isolated grid.
- Multi-technology or multi-building for this database
- **709** *operating and planned* microgrid systems in the U.S.
- **461** operating microgrids with **3.1 GW** total capacity
- **248** planned or announced microgrids with more than **1.6 GW** of additional capacity

Source: Microgrid Database (U.S. installations as of February 18, 2021)

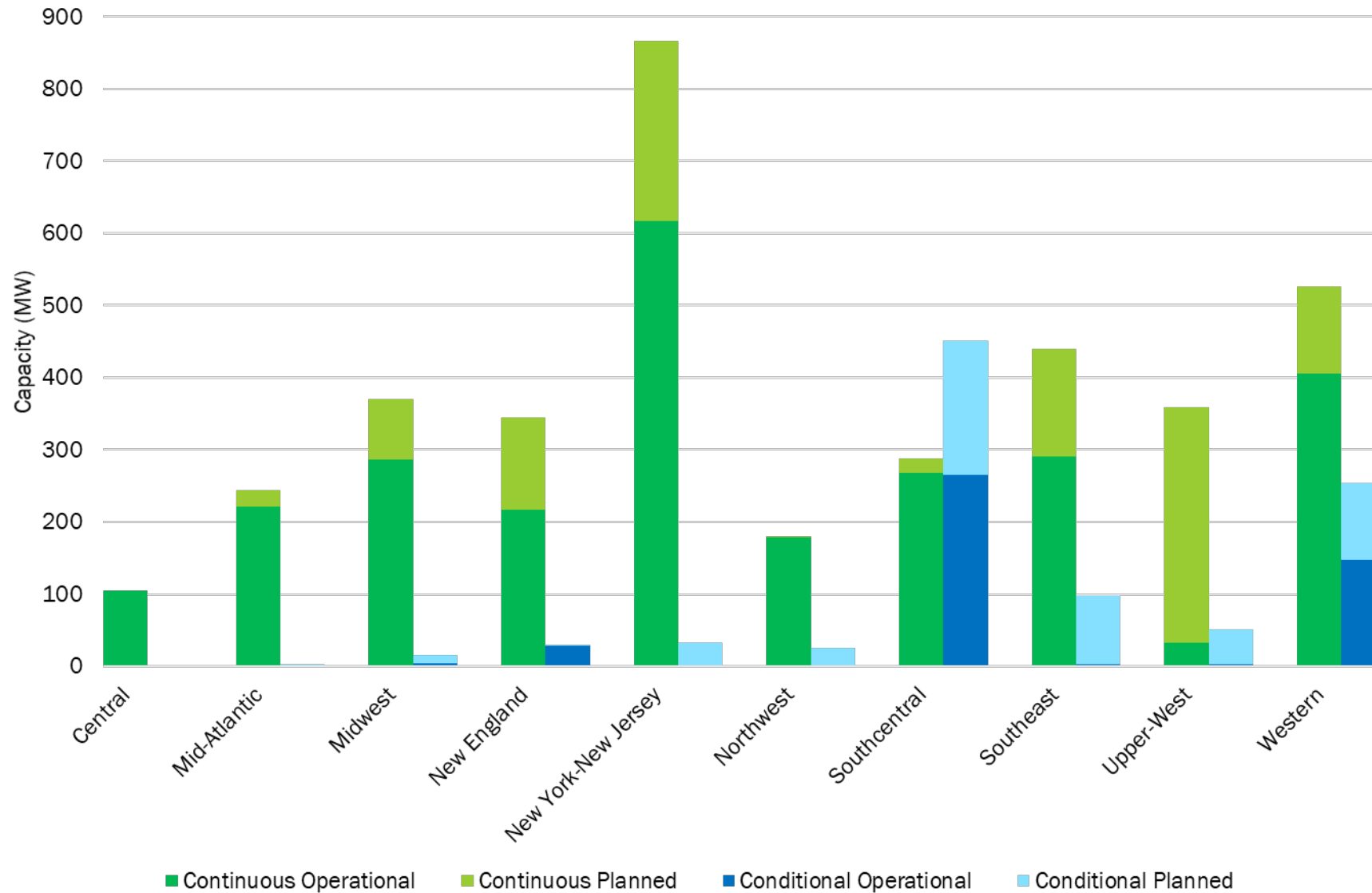
U.S. Microgrid Installation Database



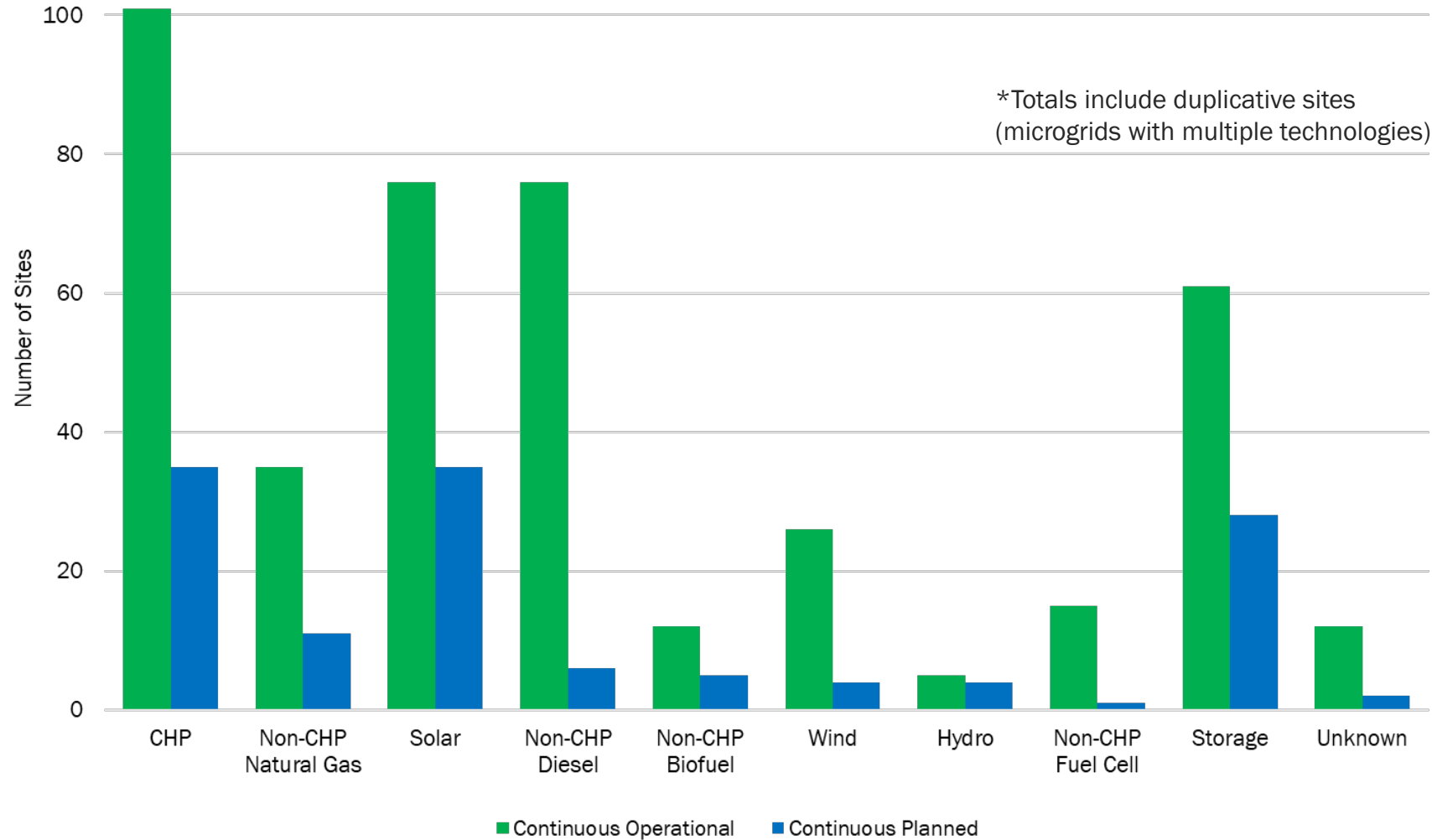
Source: Microgrid Database (U.S. installations as of February 18, 2021)

- Identified two types of microgrids based on operational characteristics
- Continuous Microgrid:** Operates continuously, supplying power to the host site on a regular basis, both in grid-connected and island mode.
Examples:
 - CHP + other DERs
 - Non-CHP NG/biogas/fuel cell + other DERs
- Conditional Microgrid:** Operates conditionally with power supply to the site based on the availability of renewable resources or market signals such as demand response or real-time pricing. ***Still must be able to provide continuous power during an outage.***
Examples:
 - Solar + storage microgrid
 - Grid-connected, economically dispatched standby generators

Installed and Planned Microgrid Capacity by CHP TAP Region

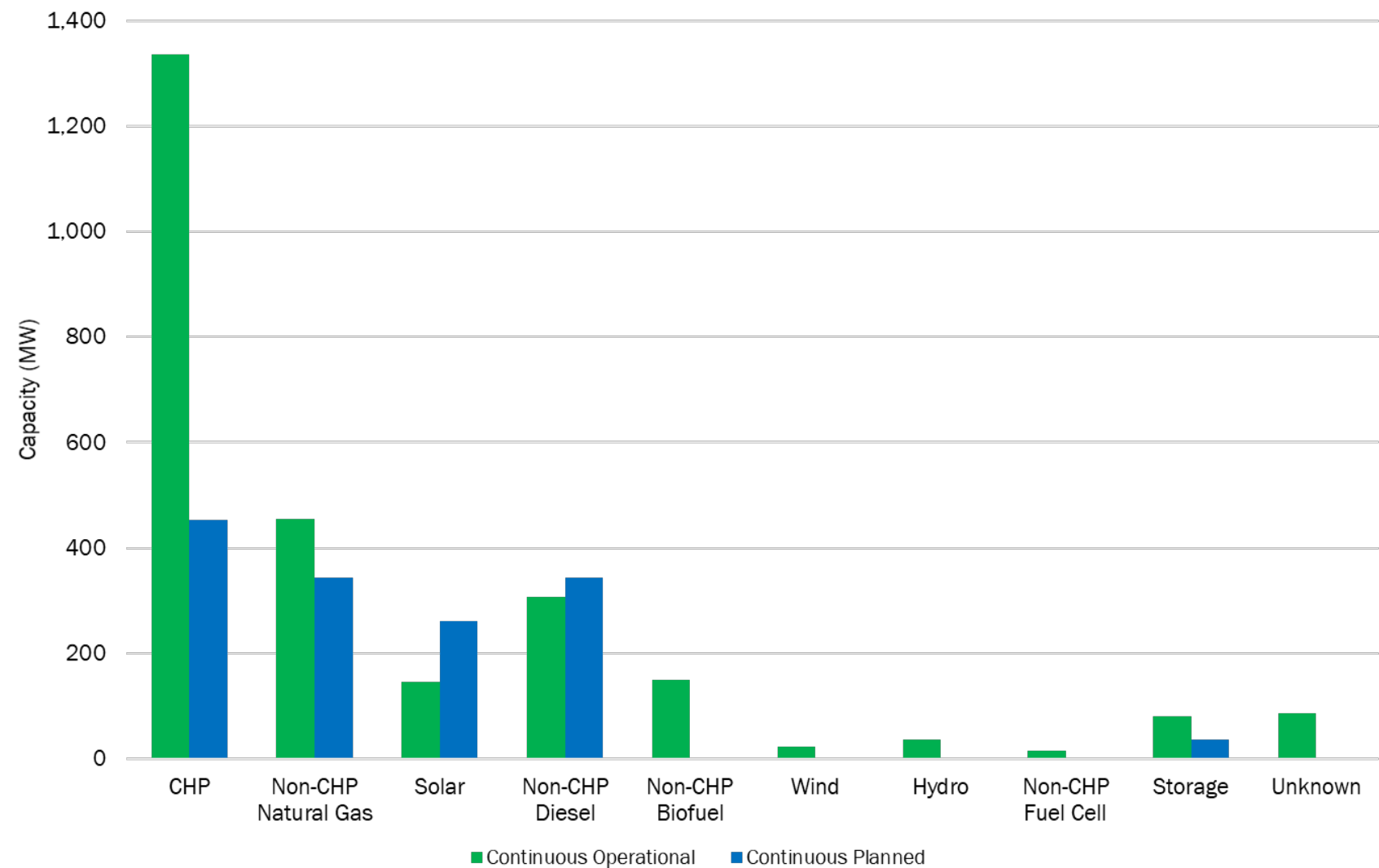


Planned and Operational *Continuous* Microgrid Sites by Technology



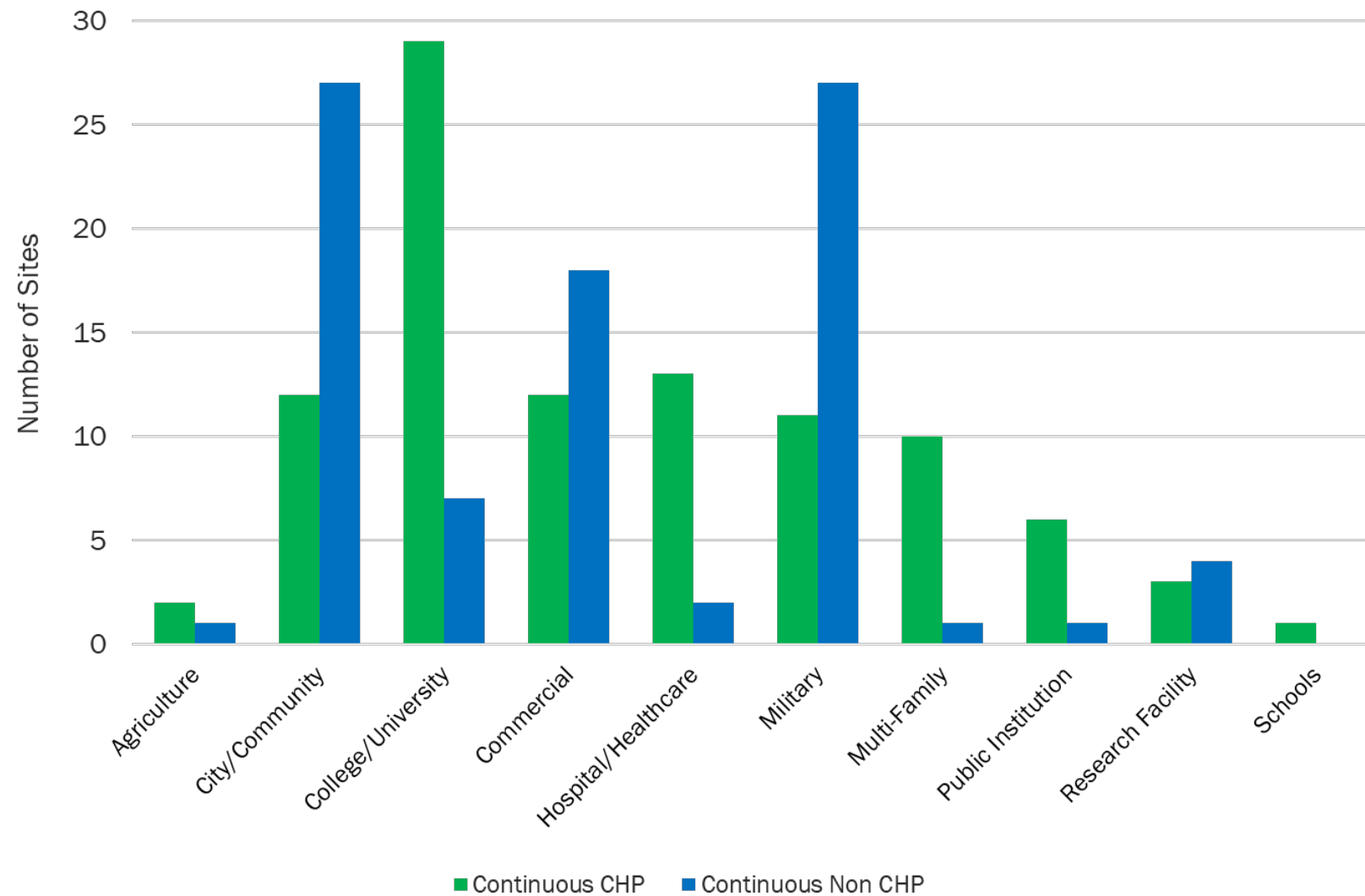
Source: Microgrid Database (U.S. installations as of February 18, 2021)

Planned and Operational *Continuous* Microgrid Capacity by Technology



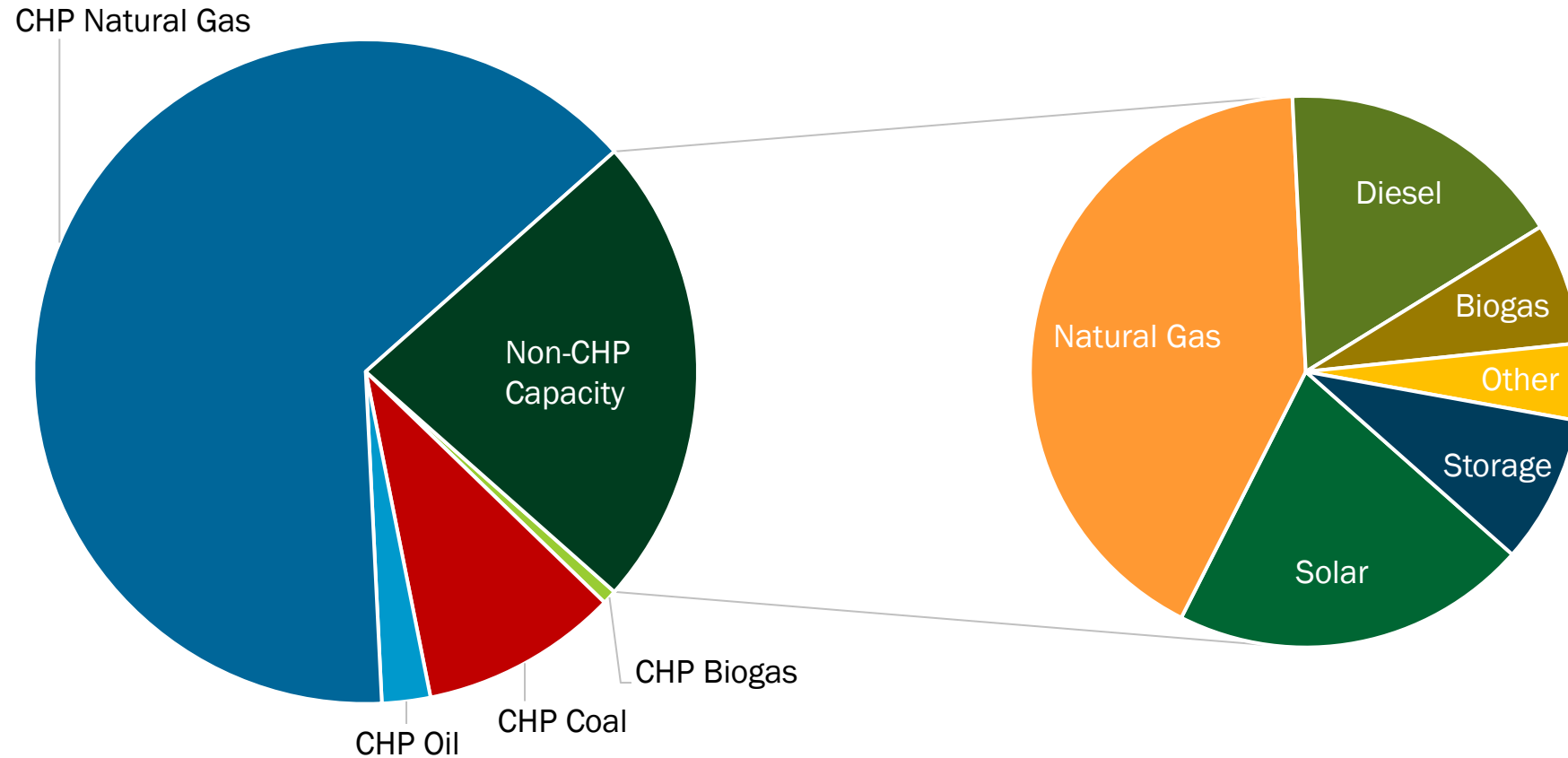
Source: Microgrid Database (U.S. installations as of February 18, 2021)

Operational *Continuous* CHP and Non-CHP Microgrid Sites by Primary Application



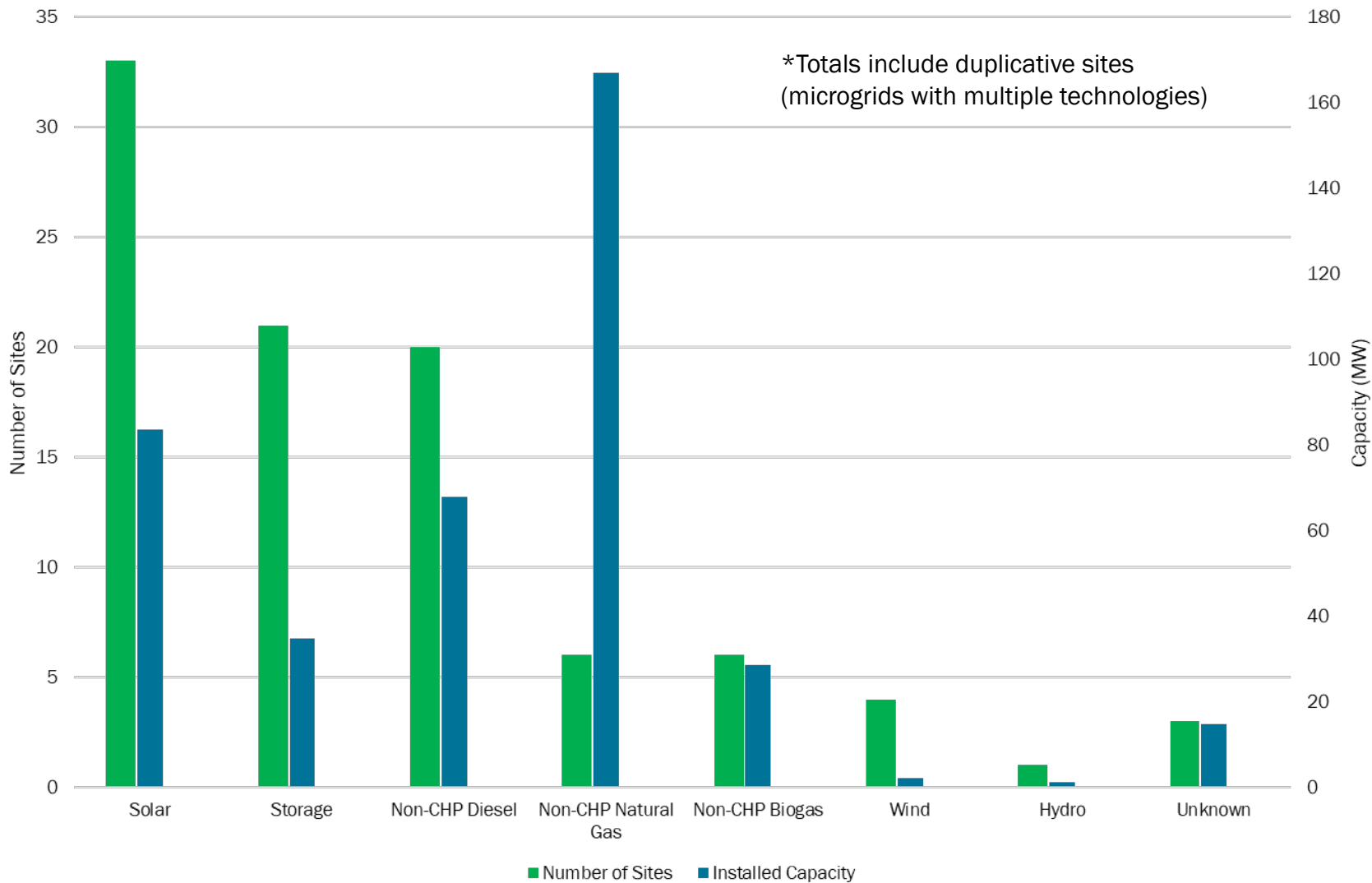
Source: Microgrid Database (U.S. installations as of February 18, 2021)

CHP Microgrid Capacity by CHP Fuel Types and Other Technology



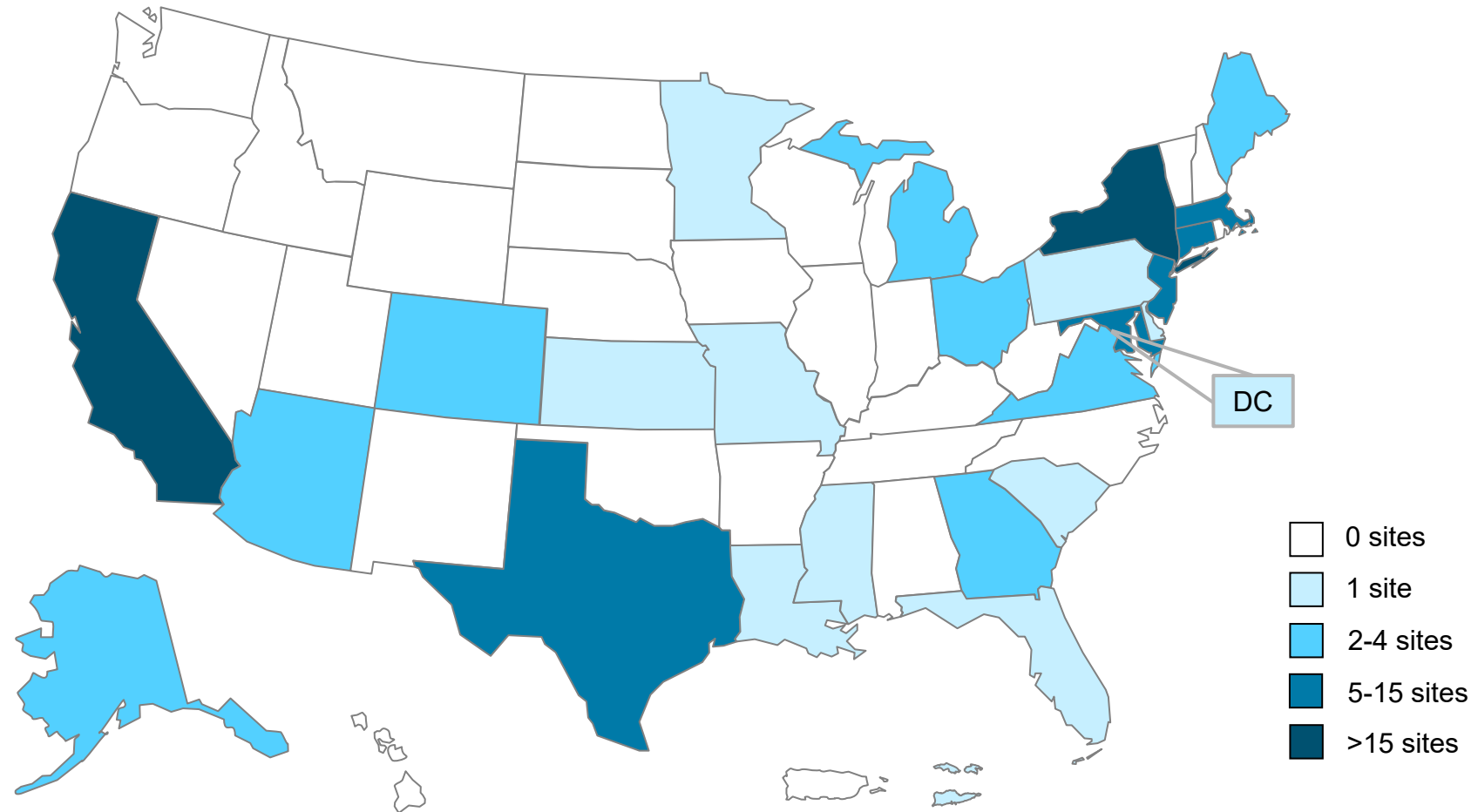
Source: Microgrid Database (U.S. installations as of February 18, 2021)

Technologies Used with CHP in Microgrids



Source: Microgrid Database (U.S. installations as of February 18, 2021)

Planned and Operational CHP Microgrid Sites by State



Source: Microgrid Database (U.S. installations as of February 18, 2021)

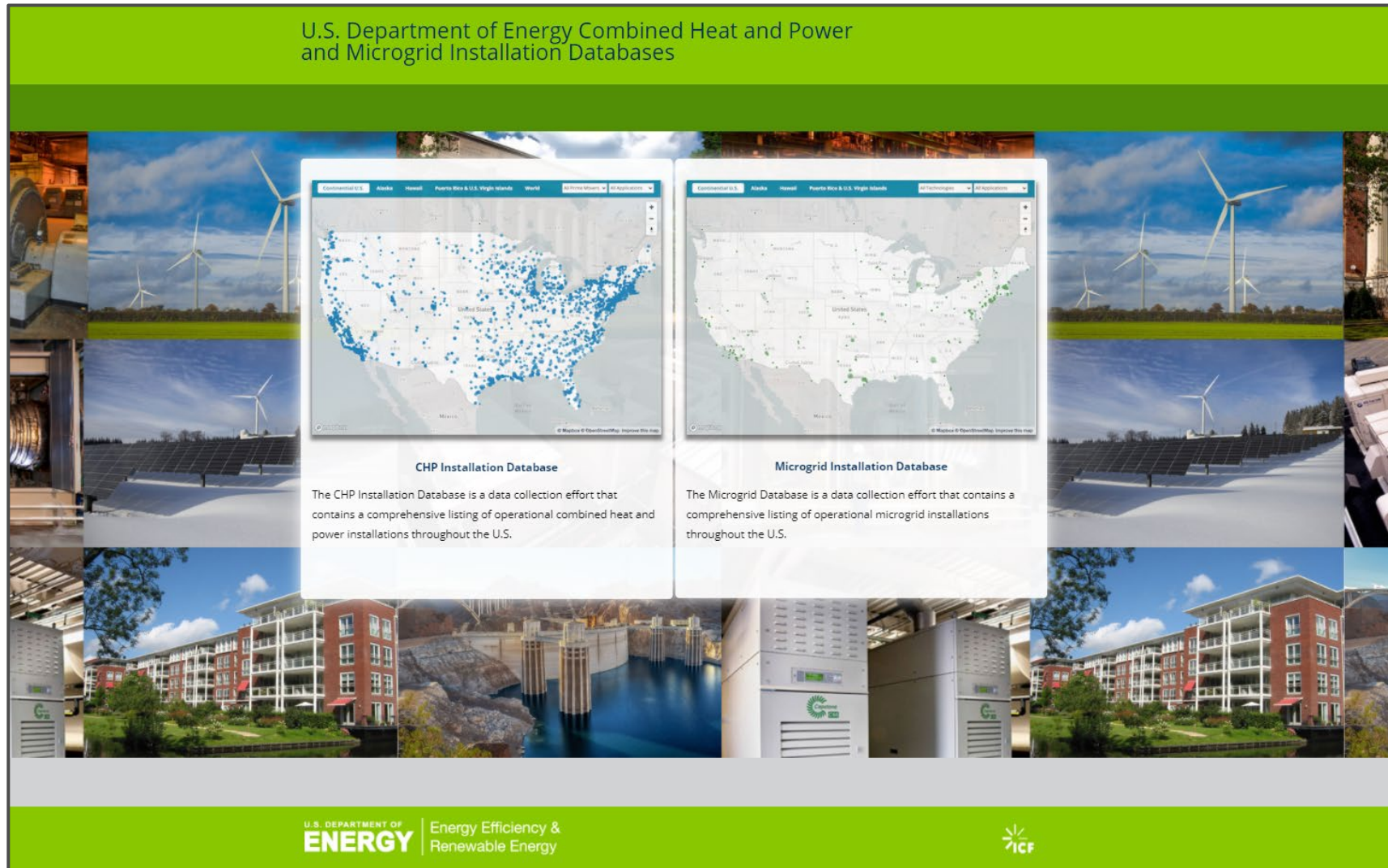
Packaged CHP System Trends

- Preliminary assessment of packaged CHP systems used in microgrids
- Most common installed system types:
 - Reciprocating engines
 - Microturbines
- Most common market sectors for packaged CHP systems:
 - Commercial buildings
 - Hospitals
- Half of all packaged CHP microgrids do not incorporate a secondary form of electricity generation
 - Most common technologies used with packaged CHP: solar PV and storage
- Packaged CHP system microgrids are focused in the Western, Mid-Atlantic, and NY-NJ TAP regions

Source: Microgrid Database (U.S. installations as of February 18, 2021)

Microgrid Database Website Demo

U.S. Department of Energy Combined Heat and Power
and Microgrid Installation Databases



CHP Installation Database

The CHP Installation Database is a data collection effort that contains a comprehensive listing of operational combined heat and power installations throughout the U.S.

Microgrid Installation Database

The Microgrid Database is a data collection effort that contains a comprehensive listing of operational microgrid installations throughout the U.S.

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

icf

Schedule and Next Steps

- Full Launch
 - Updated Microgrid Fact Sheet now available online <https://www.energy.gov/eere/amo/articles/combined-heat-and-power-technology-fact-sheet-series-microgrids>
 - Microgrid Issue Brief to be posted soon
 - Press release announcing database and website later this spring
- How Accelerator Partners can help
 - Now
 - Review the Microgrid Database contents and use as a resource (similar to the CHP Installation Database)
 - Provide corrections or updates to ICF (Joshua.freeman@icf.com)
 - Later this spring
 - Share the DOE press release with your partners
 - Reference the database, website, and updated fact sheet in newsletters

Packaged CHP Accelerator Update


Topical Webinar Series - 2021

- February 18 - REopt Lite Screening Tool
- March 25 - Microgrid Database
- April 29 - CHP and Hydrogen
- May 20 - Market Sector Deep Dive: Healthcare
- June 17 - RNG 2.0



Market Sector Fact Sheets

- Brief summaries of key CHP market sectors
<https://betterbuildingssolutioncenter.energy.gov/accelerators/packaged-chp/market-sector-fact-sheets>
- Actionable information on CHP benefits, addressable loads, site requirements, typical systems and brief project profiles
- Account reps, end users, and design community
- On deck:
 - Greenhouses
 - Wastewater treatment facilities
 - Correctional facilities




Combined Heat and Power Fact Sheet Series

CHP MARKET SECTOR: HOSPITALS

CHP at Hospitals

Hospitals and healthcare systems are at the front line of responding to natural disasters, reducing mortality rates, and assisting with public health crises. It is imperative that these facilities, along with the patient health and critical life support systems they house, operate nonstop. Yet economic development continues to grow in regions that face extreme weather events—events whose intensity, duration, and geographic reach are on the rise. The trend affects even areas of the country not historically associated with severe weather. Furthermore, most communities are struggling with weak or outdated infrastructure. In the face of these natural hazards, healthcare organizations must improve the resilience of their facilities, including power delivery systems. One approach is the installation of combined heat and power (CHP) systems. Well suited to meet both resilience requirements and energy demands, CHP can provide electricity, hot water, and space heating and cooling during both normal operations and major outage events.



Doctors Community Hospital in Lanham, Maryland, installed two 600 kW reciprocating engines to provide 80% of the hospital's electrical load and 90% of the hospital's thermal load. Photo courtesy of Doctors Community Hospital

Characteristics of Energy Use in Hospitals

A hospital is one of the most energy-intensive commercial building types, using more than three times the energy per square foot compared to a typical office building. Hospitals require continuous power for their operations and have significant thermal demands for heating, hot water, steam for sterilization, cooling, dehumidification, and laundry services. These coincident thermal and electric loads make CHP a good fit to provide year-round critical power and thermal energy. Figure 1 (next page) shows average monthly hospital electric and gas loads, modeled using DOE Commercial Reference Buildings for two different weather regions.¹ Electric and gas loads are relatively consistent for facilities in both warm and cold climates, with some fluctuation due to space heating in winter and space cooling in summer. CHP can meet baseload thermal demand year-round and can provide cooling in warmer months, which could significantly decrease electricity costs and generate resilient space cooling on site.

HOSPITAL CHP QUICK FACTS

- ▶ Hospitals have **24.7 energy loads** and significant thermal requirements (hot water, space heating/cooling).
- ▶ CHP's **reliability** independent of the electric grid makes it a good match for hospital needs as **critical infrastructure** in the event of disasters.
- ▶ **Over a quarter** of all existing CHP systems at hospitals were installed after 2012.
- ▶ Hospitals spend an average of **\$3.16 per square foot** on energy costs each year. CHP can help reduce these costs and free up resources for patient care.
- ▶ The current average CHP installation size at a U.S. hospital is **~3.3 MW**.


Packaged CHP Systems eCatalog

Packaged CHP systems are standardized, prefabricated CHP systems built off site prior to installation, allowing customers to reduce installation time and cost. The Packaged CHP eCatalog from DOE provides tools for users to learn about, select, and compare packaged CHP systems and solutions that have been reviewed and recognized by DOE. The eCatalog is the product of a voluntary public-private partnership designed to validate packaged CHP technologies for growing commercial, institutional, multifamily, government, and light manufacturing markets. Visit the DOE CHP eCatalog at <https://chp.ecatalog.lbl.gov/>.

¹ Environmental Protection Agency, "CHP for Hospitals: Superior Energy for Superior Patient Care." Accessed 2020. <https://www.epa.gov/chp/chp-hospitals-superior-energy-superior-patient-care>.

² Data obtained from DOE Commercial Reference Buildings, modeled in EnergyPlus. <https://www.energy.gov/eere/buildings/commercial-reference-buildings>.

Learn more at <https://betterbuildingssolutioncenter.energy.gov>



Based on DOE Commercial Reference Buildings data, daily electric and gas loads are shown in Figure 3. This graph uses Pacific region weather data to illustrate daily and seasonal energy demand and consistent coincident demand (monthly and annual energy use characteristics indicate that CHP install hospitals with long operating hours.

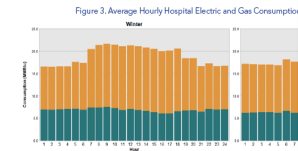
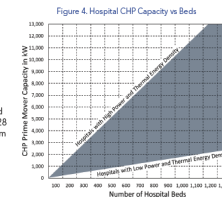


Figure 4 compares the CHP system capacities installed at 120 hospitals in the Database⁴ as a function of the number of licensed beds and shows based on patient services provided. CHP system sizes range from 2 kW/represents local hospitals without teaching or research facilities that the density needs. Regional medical centers are on the higher end, as they have high simultaneous electric and thermal energy needs driven by high-power-density equipment, extensive operating facilities, and an urgent need for air conditioning and research refrigeration during power outages.

Current Hospital CHP Installations

According to the U.S. Department of Energy CHP Installation Database, there are 745 MW of installed electric CHP capacity at 229 hospitals across 35 states and territories. Massachusetts, Texas, and California have the most CHP capacity at hospitals, each with more than 100 MW. CHP projects in the hospital sector range from small engines supplying local clinics to large combustion turbines providing heat and power to medical campuses housing thousands of patients. The most common CHP technology used in hospitals is reciprocating engines, with installations at 128 sites. Other sites use combustion turbines (48), boiler/steam turbines (19), microturbines (18), and other prime mover technologies (16). Over 83% of hospital CHP systems use natural gas, while the remainder use waste heat or other fuels, such as biomass, biogas, and oil.⁵



⁴ U.S. Department of Energy CHP Installation Database. Accessed 2020. <https://doe.icfweb.com/chp/bv/>.

⁵ "U.S. installations as of July 31, 2020." U.S. Department of Energy CHP Installation Database. Accessed 2020. <https://doe.icfweb.com/chp/bv/>.

Learn more at <https://betterbuildingssolutioncenter.energy.gov>



CHP Trade Ally Network Page for eCatalog

- Objective
 - Provide eCatalog users resources for next steps (CHP assessment and full engineering services)
 - Get providers engaged with and using the eCatalog
- Utilize CHP Engagement Partners' trade ally lists
 - Rely on companies you currently work with
 - We will have disclaimer that you will review
- Google survey to CHP Engagement Partners
 - Survey sent to individual company/organization (emails next week)
 - One completed survey for each CEP

Trade Allies

Consulting Engineers

Consulting Engineers, listed below, generally provide professionally licensed CHP engineering services such as technical modeling and analysis, equipment selection for design basis, plans and specification development, final design, documentation, and investment grade financial analysis.

Accurate Solutions, BLACK & VEATCH, BOND, Brown and Caldwell, BURNS MEDONNELL, BURNS ENGINEERING, carollo, CDM Smith, CIA, CMTA, Commonwealth, CONCORD ENGINEERING, ICDS, Jacobs, VANDERWEIL, WALDRON

CHP Consultants

CHP Consultants, listed below, may offer feasibility assessment/analysis, system design, preliminary equipment selection, initial project financial analysis, request for proposal development, sustainability analysis, regulatory analysis, 3rd party reviews and project owner representation.

ANTARES Group Incorporated, BRIDGESTONE ASSOCIATES LIMITED, Chinook, Global Energy Alternatives, D-TEC, DSM, EME GROUP, Global Imperium Group, Energy Integration Inc., SW LLC

Startup and/or Commissioning Services

The Startup and/or Commissioning Service Companies, listed below, perform startup and commissioning services for any CHP system.

Bluewater, Chinook, CONCORD ENGINEERING, THERMO SYSTEMS, WALDRON

Service and Maintenance Organizations

The Service and Maintenance Organizations, listed below, provide service and maintenance on any CHP system including routine scheduled maintenance, minor and major overhauls, and unintended outage response.

ALL SYSTEMS COGENERATION, Bluewater, VIBRA

CHP Trade Allies – Google Questionnaire

- Does your organization maintain a list of CHP trade allies?
- If so, what types of trade allies are included?
 - Consulting engineers
 - CHP consultants (screenings, audits, assessments)
 - Service and maintenance
 - Start-up/Commissioning
- Are there specific criteria or requirements to be on the list? If so, please describe
- Can we contact your trade allies for inclusion in the eCatalog?

CHP Trade Allies

Briefly provide information on your network of combined heat and power trade allies.

* Required

Name *

Your answer

Company / Organization *

Your answer

Email Address *

Your answer

Does your company/organization maintain a list of CHP trade allies? *

☐ Yes

☐ No

If so, what types of trade allies are included in the list?

☐ Consulting Engineers

☐ CHP Consultants (provide screenings, energy audits, and facility assessments)

☐ Service & Maintenance Companies

☐ Start-Up/Commissioning Agents

☐ Other:

Do you have specific criteria or an outlined process for organizations to be listed as a trade ally? *

☐ Yes

☐ No

If so, please briefly outline that criteria or process for trade allies.

Your answer

CHP Engagement Partners – Next Steps

- Enroll as a Customer Engagement Partner in the eCatalog
 - Company and CHP program description
 - Service area (zip code)
 - Logo
- Complete Engagement Partner Roadmaps
 - Accelerator deliverable item
 - Develop with Accelerator team support
 - Trent Blomberg and Rick Tidball
 - CHP program objectives, priorities, and plans

Customer Engagement Partners

CHP Engagement Partners (utilities, federal agencies, states, and municipalities) commit to promote Packaged CHP Systems (via the eCatalog) to their customers, constituents, or members and to validate the performance and the benefits of packaged CHP. Customer Engagement Programs can range from education and outreach on the benefits and applicability of CHP, to technical assistance in evaluating and implementing CHP, to incentives or other financial support depending on the objectives and resources of individual Customer Engagement Partners.

FILTER BY STATE: All

4 RECOGNIZED STATE-LEVEL CUSTOMER ENGAGEMENT PARTNERS

Maryland Energy Administration, Missouri Division of Energy, NJ Clean Energy Program, NYSEDA

7 RECOGNIZED UTILITY-LEVEL CUSTOMER ENGAGEMENT PARTNERS

AEP Ohio, BGE SMARTENERGY savers, ConEd, Con Edison, DTE, DTE Energy, Peoples Natural Gas, Texas Gas Service

Customer Engagement Partners
PROMOTE YOUR CHP PROGRAMS THROUGH THE eCatalog

NOTE: To complete the eCatalog registration process

Enrollment Requirements
Customer Engagement Partners with market engagement programs will be identified on the Packaged CHP System

UTILITY-LEVEL CUSTOMER ENGAGEMENT PARTNER
Back to all Customer Engagement Partners

BGE SMARTENERGY savers PROGRAM

Customer Engagement Partner	Baltimore Gas & Electric
Contact	Brendan Cassidy
Address	110 W. Fayette Street Baltimore, MD 21201
Phone	+14102901202
Email	brendan.cassidy@icf.com
Website	https://www.bgesmartenergy.com/business/chp

Program Description

Baltimore Gas & Electric (BGE) is Maryland's largest gas and electric utility, delivering power to more than 1.2 million electric customers and more than 655,000 natural gas customers in central Maryland. The Combined Heat and Power (CHP) program is offered as part of the utilities' EnPOWER Maryland energy efficiency programs and is an additional component of the BGE Smart Energy Savers Program®.

The CHP program is intended to provide customer incentives that will make it more economically viable for Commercial and Industrial customers to employ CHP to reduce their energy (kWh) consumption and demand (kW) usage. Eligible CHP systems must be sized to meet all or a portion of the customer's on-site load, not to exceed 100% of most recent historical annual consumption or peak demand. Incentives are not available for CHP systems that serve off-site customers, exports to the grid, or are not located on the customer's property.

Incentives under the program are calculated by the system capacity and three payments are comprised of a Design Incentive, Commissioning Incentive, and a Production Incentive.

Tiered Incentives: Less than or equal to 50kW - \$2,000 per kW; Between 51kW and 200kW - \$1,600 per kW; Between 201kW and 1MW - \$1,200 per kW; Greater than 1MW - \$800 per kW.

1) Design Incentive: 10% of total incentive at project approval, subsequent to signed commitment letter and acceptance of minimum requirements document.

2) Commissioning Incentive: 30% of total incentive after installation is complete, subsequent to commissioning of the CHP system and BGE inspection.

3) Production Incentive: 60% of total incentive after receiving 12 contiguous months of actual kWh generation data received within 24 months of project installation, subsequent to review of metering data. Payment will be prorated, based on actual kWh generation and will be capped at 60% of total incentive. For example, if the actual kWh generation is 80% of estimated, the Production Incentive will be decreased by 20%.

Project Caps: The maximum incentive any one CHP project could receive is \$2.5 million. A limit of one project per customer site every 3 years applies.

BGE seeks to assist those customers who are interested in CHP and be able to make more informed decisions about possible participation in the CHP Program. A dedicated CHP outreach specialist is available to assist applicants through the entire process.

More information is available here: <https://www.bgesmartenergy.com/business/chp>

Technical Assistance

Technical Assistance

DOE Team

Anne Hampson, Program Manager, Technology Partnerships,
US DOE Advanced Manufacturing Office

Anne.hampson@ee.doe.gov

Packaged CHP Accelerator Coordinator	eCatalog Coordinator	Packaged CHP Accelerator Support
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Entropy Research	Exergy Partners	ICF
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<https://betterbuildingssolutioncenter.energy.gov/accelerators/packaged-chp>

<https://chp.ecatalog.lbl.gov/>