

*For the first session of a new webinar series:*

## **Advanced Energy 101 for LPCs**

*co-hosted by*

**Tennessee Advanced Energy Business Council &  
Seven States Power Corporation**

# **Combined Heat and Power Opportunity in TVA Region & DOE Resources**

**21 October 2020**

**Isaac Panzarella, Director,  
DOE Southeast CHP TAP;**  
NC Clean Energy Technology Center  
NC State University



**CHP Technical Assistance Partnerships**

# DOE CHP Technical Assistance Partnerships (CHP TAPs)

- **End User Engagement**

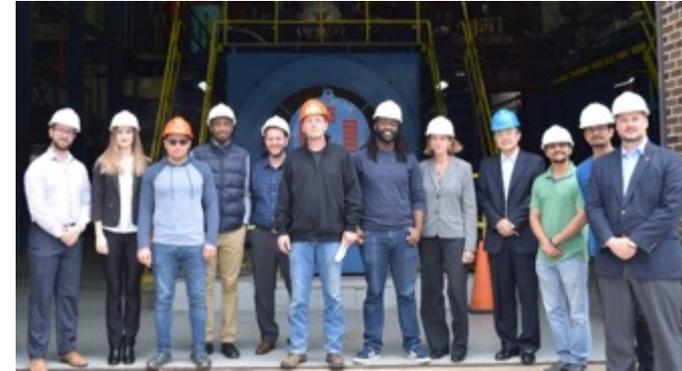
Partner with strategic End Users to advance technical solutions using CHP as a cost effective and resilient way to ensure American competitiveness, utilize local fuels, and enhance energy security. CHP TAPs offer fact-based, non-biased engineering support to manufacturing, commercial, institutional and federal facilities and campuses.

- **Stakeholder Engagement**

Engage with strategic Stakeholders, including regulators, utilities, and policy makers, to identify and reduce the barriers to using CHP to advance regional efficiency, promote energy independence, and enhance the nation's resilient grid. CHP TAPs provide fact-based, non-biased education to advance sound CHP programs and policies.

- **Technical Services**

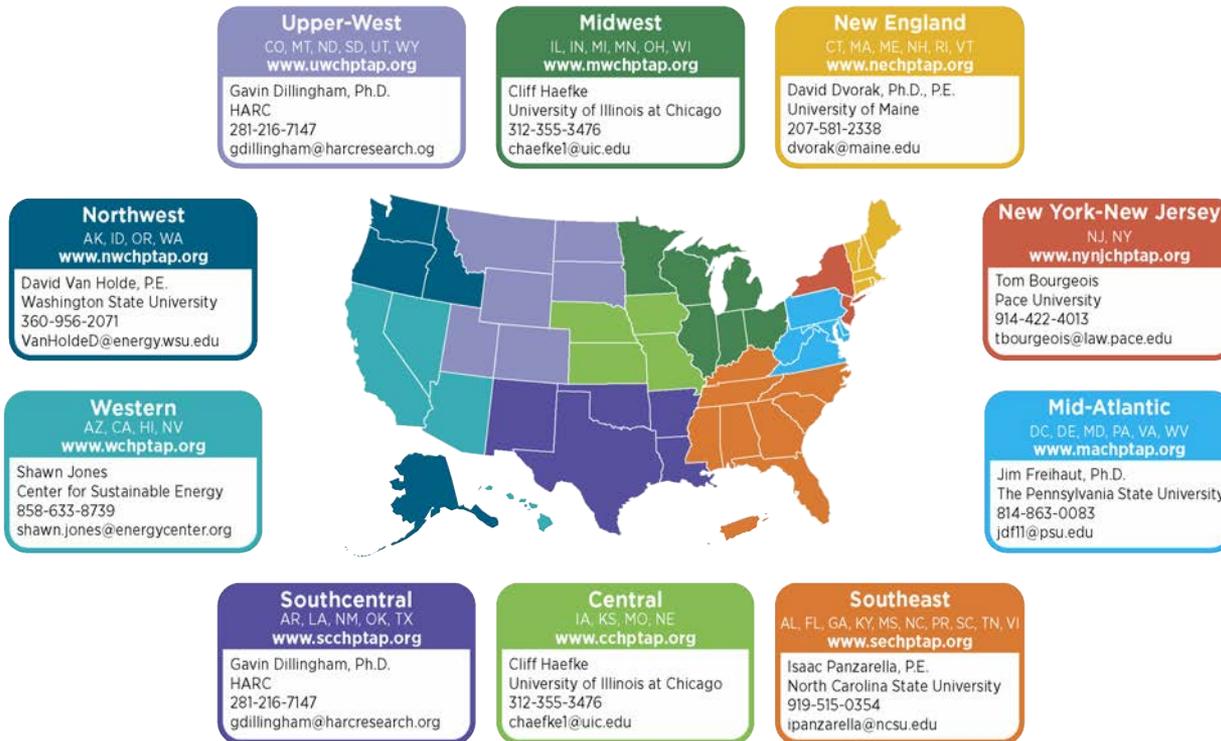
As leading experts in CHP (as well as microgrids, waste heat to power, and district energy) the CHP TAPs work with sites to screen for CHP opportunities as well as provide advanced services to maximize the economic impact and reduce the risk of CHP from initial CHP screening to installation.



National Manufacturing Day 2019 at the University of Illinois at Chicago

[www.energy.gov/chp](http://www.energy.gov/chp)

# DOE CHP Technical Assistance Partnerships (CHP TAPs)



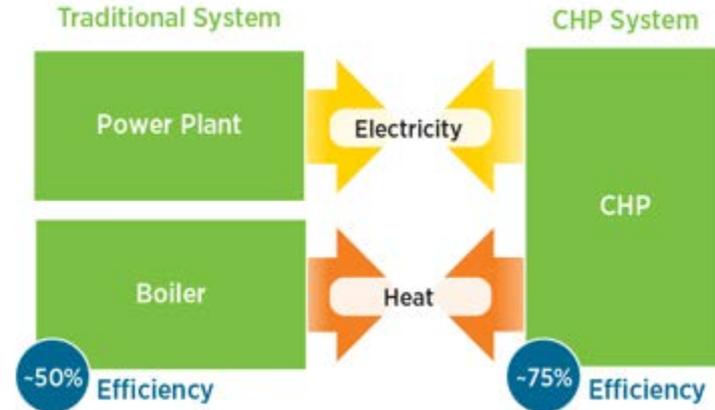
DOE CHP Deployment  
Program Contacts  
[www.energy.gov/CHPTAP](http://www.energy.gov/CHPTAP)

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# CHP: A Key Part of Our Energy Future

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification



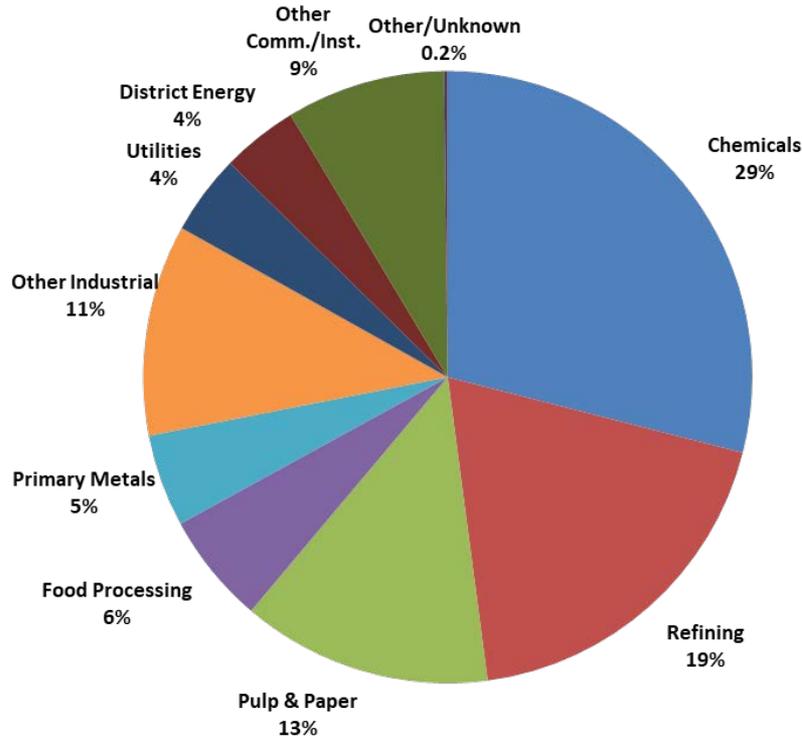
CHP provides efficient, clean, reliable, affordable energy – today and for the future.

Source: [www.energy.gov/chp](http://www.energy.gov/chp)



# CHP Today in the United States

## Existing CHP Capacity



Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2019)

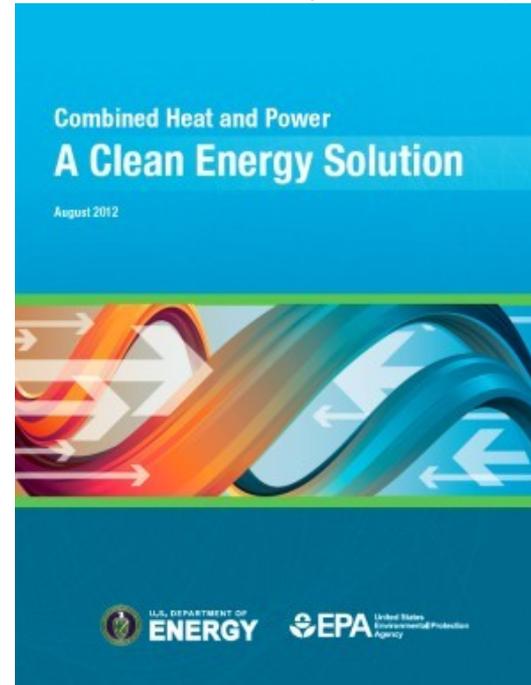
- **80.7 GW** of installed CHP at more than 4,600 industrial and commercial facilities
- 7% of U.S. Electric Generating Capacity; 13% of Industrial
- Avoids more than **1.7 quadrillion Btus** of fuel consumption annually
- Avoids **232 million metric tons of CO<sub>2</sub>** compared to separate production



# Emerging National Drivers for CHP

- Benefits of CHP recognized by policymakers
  - State Portfolio Standards (RPS, EEPS), Tax Incentives, Grants, standby rates, etc.
- Favorable outlook for natural gas supply and price in North America
- Opportunities created by environmental drivers
- Utilities finding economic value
- Energy resiliency and critical infrastructure
- Interest in hybrid CHP systems

*DOE / EPA CHP Report (8/2012)*



[http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp\\_clean\\_energy\\_solution.pdf](http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf)

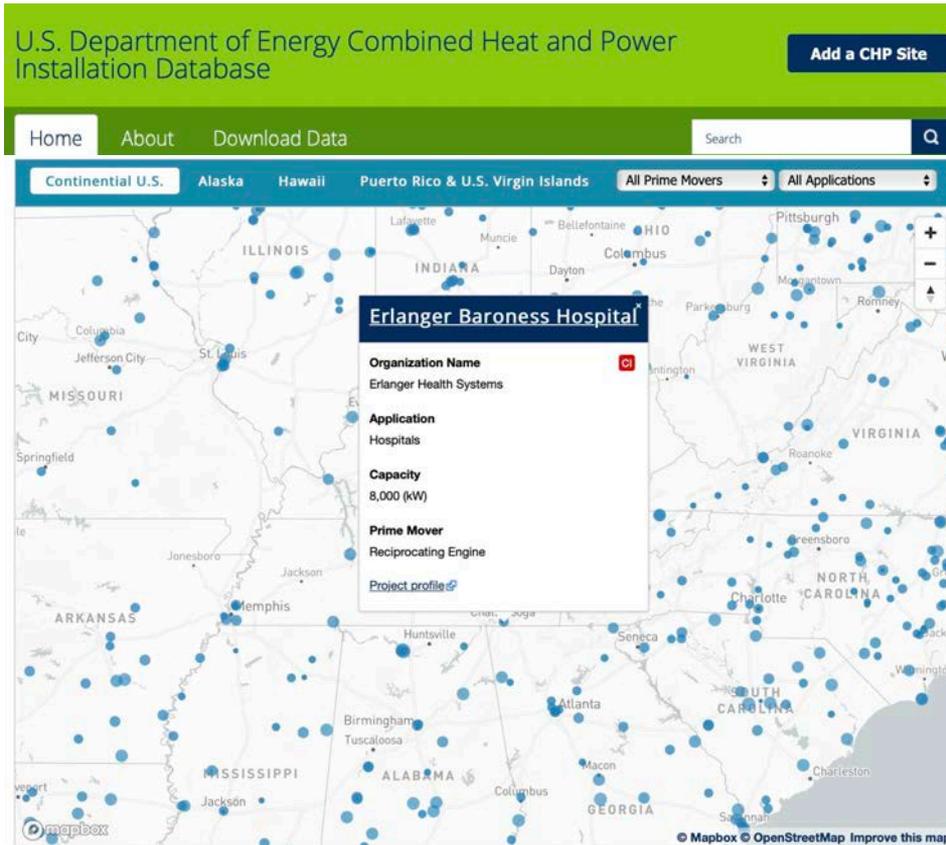


# What Are the Benefits of CHP?

- CHP is more efficient than separate generation of electricity and heating/cooling
- Higher efficiency translates to lower operating costs (but requires capital investment)
- Higher efficiency reduces emissions of pollutants
- CHP can also increase energy efficiency, resiliency and enhance power quality
- On-site electric generation can reduce grid congestion and avoid distribution costs.



# DOE CHP Database



# CHP Installations in Tennessee

U.S. Department of Energy Combined Heat and Power Installation Database

Add a CHP Site

Home About Download Data

Search



## Combined Heat and Power Installations in Tennessee

Go to state-level data

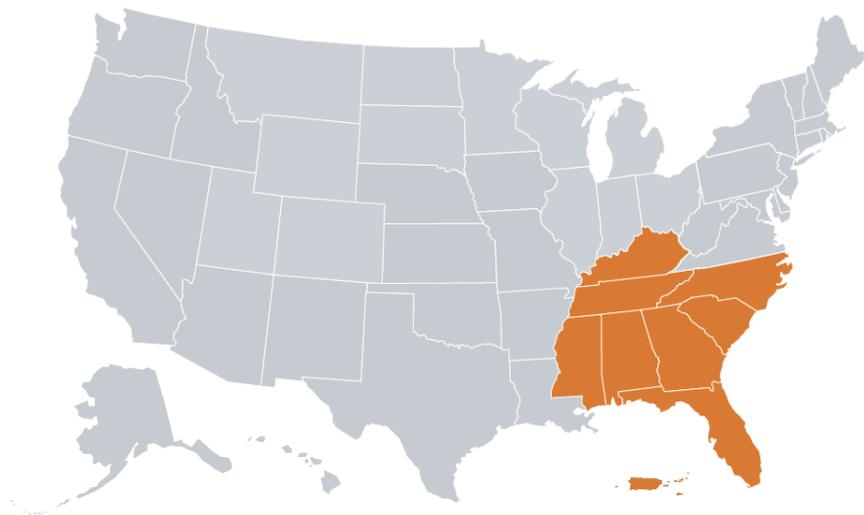
Search:

City	Organization Name	Facility Name	Application	SIC4	NAICS	Op Year	Latest Install Year	Capacity (KW)	Prime Mover	Fuel Class-Primary Fuel	Last Verified
Dickson	Daltile	Daltile Manufacturing Plant	Stone / Clay / Glass	3253	32712	2019	2019	1,000	MT	NG - Natural Gas	2020
Chattanooga	Erlanger Health Systems	<a href="#">Erlanger Baroness Hospital</a>	Hospitals	8062	62211	2018	2018	8,000	ERENG	NG - Natural Gas	2019
Johnsonville	Tennessee Valley Authority - Johnsonville	The Chemours Company	Chemicals	2816	325131	2018	2018	87,000	B/ST	COAL - Coal	2019
Loudon	Tate & Lyle	Tate & Lyle - Loudon	Food Processing	2046	311221	2017	2017	50,000	CT	NG - Natural Gas	2020
Nashville	Vanderbilt University	<a href="#">Vanderbilt University</a>	Colleges / Universities	8221	61131	2002	2017	18,700	B/ST	NG - Natural Gas	2018
Lebanon	City of Lebanon	Lebanon Waste-to-Energy Plant	Solid Waste Facilities	4953	562219	2016	2016	400	ORC	WASTE - Municipal Solid Waste	2017
Murfreesboro	General Mills / TVA	<a href="#">Yoplait</a>	Food Processing	2023	311511	2015	2015	1,600	ERENG	RENEWABLE - Digester Gas	2017
Murfreesboro	Alvin C. York VA Medical Center	<a href="#">Alvin C. York VA Medical Center</a>	Hospitals	8062	62211	2010	2014	3,555	B/ST	RENEWABLE - Landfill Gas	2017

<https://doe.icfwebservices.com/chpdb/>



# Southeast Regional CHP Technical Onsite Potential



State	Industrial (MW)	Commercial (MW)	Total (MW)
Alabama	1,634	1,143	2,777
Florida	1,281	5,688	6,969
Georgia	2,739	2,371	5,110
Kentucky	1,809	911	2,720
Mississippi	1,141	691	1,832
North Carolina	2,421	1,931	4,352
South Carolina	1,812	1,251	3,063
Tennessee	2,551	1,632	4,183
<b>Total</b>	<b>15,388</b>	<b>15,618</b>	<b>31,006</b>



# Multiple Pathways for Utility Involvement in CHP

## Utility-Owned CHP for Grid Generation

- Build, own, and operate CHP at customer sites as part of resource planning



## CHP as a Distribution System Resource

- Encourage customers to install CHP as non-wires alternative to enhance grid stability, alleviate grid congestion, or defer investments



## CHP in Utility Energy Efficiency Portfolio

- Encourage customers to install CHP to gain low-cost energy savings



# TVA's Power Supply Flexibility Program

The screenshot shows the homepage of the American Public Power Association website. At the top left is the logo for the American Public Power Association, with the tagline "80 Years of Powering Strong Communities". To the right of the logo are navigation links for "Log In", "Join", "Shop", "Subscribe", "Jobs", and "Contact", along with social media icons for Facebook, Twitter, LinkedIn, YouTube, and Instagram. Below the logo is a navigation menu with categories: "ASSOCIATION", "PUBLIC POWER", "ISSUES & POLICY", "EDUCATION & EVENTS", and "NEWS". There are also buttons for "TOPICS" and "MEMBERS".

The main article is titled "TVA's flexibility program enables local utilities to embrace distributed energy" and is dated August 19, 2020, by Peter Maloney. The article text is as follows:

In June, the Tennessee Valley Authority began allowing local power companies the flexibility to generate up to 5% of their average electric needs from distributed resources.

That equates to about 800 megawatts of new distributed generation, or 2,000 MW if all the generation is solar power, TVA said.

The program, approved by TVA's board in February, allows any of the 141 local power companies that have entered into 20-year Long-Term Partnership Agreements with TVA to reduce the amount of energy they buy, potentially cutting their overall energy costs. TVA serves 154 local power companies.

TVA anticipates that much of the generation that will be built under the program will be solar power because the cost of the technology has fallen rapidly in recent years.

Since the June 22, 2020, launch, 47 local power companies have signed on to the program, citing a desire to provide customers with more renewable energy, a chance to lower costs for customers, and the economic development benefits of being able to offer renewable energy.

On the right side of the article, there is a promotional graphic for "SPIDA BUILD A BETTER GRID" software, which includes the text "INTRODUCING THE NEW INDUSTRY STANDARD FOR SAG AND TENSION SOFTWARE" and a "LEARN MORE" button.

Below the graphic is a section titled "UPCOMING EVENTS".

<https://www.publicpower.org/periodical/article/tvas-flexibility-program-enables-local-utilities-embrace-distributed-energy>

# TVA's Power Supply Flexibility Program

- A new program that allows local power companies (LPC) with long term agreements with TVA to develop their own flexible load-side distributed energy generation. Several key features are:
  - Eligible resources include solar PV, combined heat and power (CHP) and natural gas generators.
  - Each LPC may develop an aggregate capacity of energy resources of up to 5% of their “energy”, where energy is the average hourly capacity usage, initially based on fiscal years 2015-2019, or one megawatt, whichever is greater.
  - Solar PV is allowed a technology factor of 0.4 due to its lower capacity factor.
  - LPCs are credited for energy produced at TVA's wholesale power rate
- A total of approximately 800 MW could be developed if all 154 LPCs across the Valley participate and develop their maximum allowable capacity with resources other than solar. Approximately 2,000 MW could be developed if all 154 LPCs across the Valley participate and deploy only solar to develop their maximum allowable capacity
- Information available at TVA's Environmental Review Process webpage  
<https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews/Flexibility-Proposal>



# TVA's Power Supply Flexibility Program Principles

1. Energy resource sites must be documented, metered, operated, and connected in a manner consistent with applicable TVA standards
2. Valley Partner energy resources will either displace demand and energy usage that TVA would have otherwise charged to the Valley Partner under the prevailing wholesale power rate structure; or, Valley Partner energy resources will be treated in accordance with an economically equivalent wholesale crediting mechanism
3. Each Valley Partner may deploy energy resources in an aggregated capacity amount not to exceed the greater of (1) 5% of that Valley Partner's energy, where energy is the average hourly capacity usage, initially over TVA fiscal years 2015 through 2019, or (2) one megawatt of aggregated capacity
4. All Valley Partner energy resource facilities must be distribution scale and located within the service territory of the Valley Partner. Exceptions to the location requirement, due to circumstances such as restrictive siting, may be approved by the CEO after notice to the Finance, Rates, and Portfolio Committee.
5. Valley Partner energy resource output must be provided or distributed only to the Valley Partner's end-use customers
6. A Valley Partner's energy resource implementation must be consistent with TVA's Integrated Resource Plan to ensure that TVA's system carbon position is improved

*from TVA Board Presentation on February 13, 2020, available at  
<https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews/Flexibility-Proposal>*



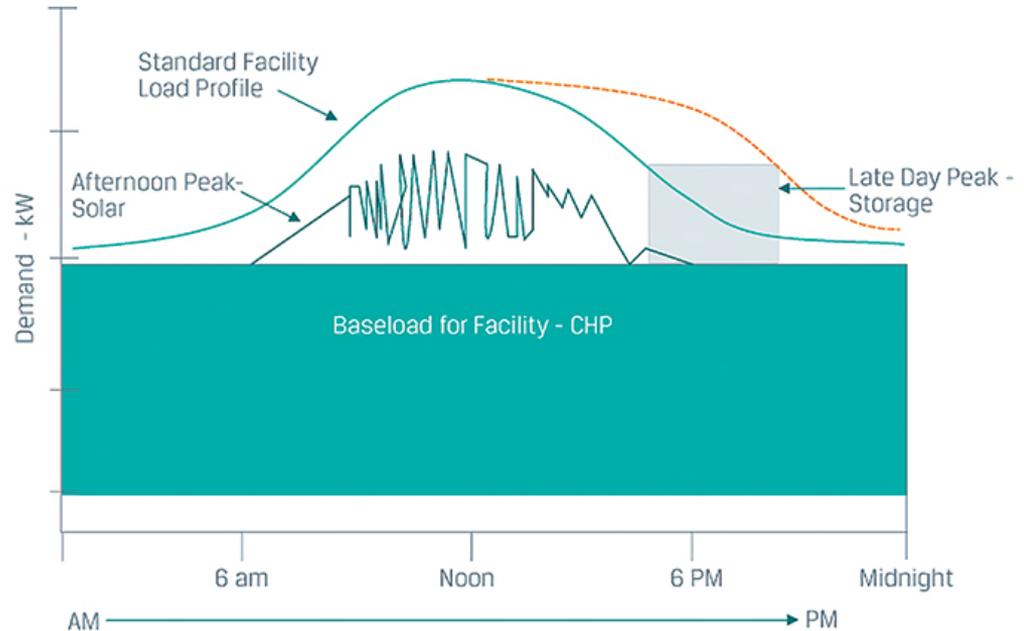
# CHP Increases Resilience

- For end users:
  - Provides continuous supply of electricity and thermal energy for critical loads
  - Can be configured to automatically switch to “island mode” during a utility outage, and to “black start” without grid power
  - Ability to withstand long, multiday outages
- For utilities:
  - Enhances grid stability and relieves grid congestion
  - Enables microgrid deployment for balancing renewable power and providing a diverse generation mix
- For communities:
  - Keeps critical facilities like hospitals and emergency services operating and responsive to community needs



# Growth of Hybrid DER Systems

- Hybrid DER approaches offer the opportunity for technologies to complement one another
- Hybrid systems combine characteristics of individual technologies
  - CHP – provides baseload energy
  - Solar – variable renewable generation can now be “firmed”
  - Storage – adding flexibility
- Allows CHP to be a key part of the move toward a distributed/renewable grid



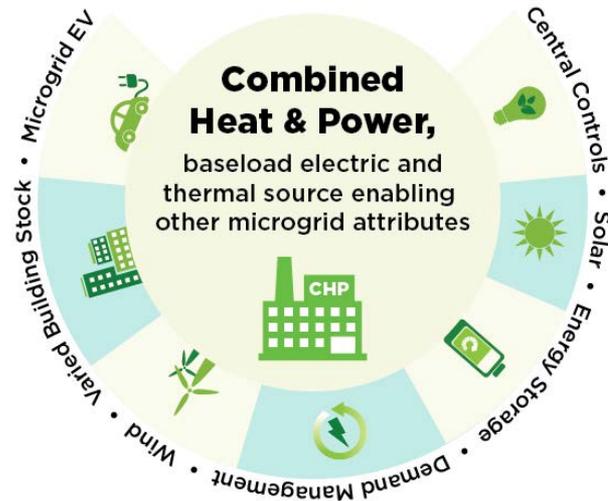
# CHP and Microgrids

A microgrid is a **group of interconnected loads and distributed energy resources** within clearly defined electrical boundaries that acts as a **single controllable entity** with respect to the grid.

A microgrid can **connect and disconnect** from the larger utility grid to enable it to operate in both **grid-connected** or **island-mode**.

Source: U.S. Department of Energy Microgrid Exchange Group

- With a CHP system providing reliable baseload electric and thermal energy, microgrids can add renewables and storage
- Increased focus on resilience for critical infrastructure
  - Universities, Hospitals, Military bases, Communities



# DOE Packaged CHP eCatalog

- A national web-based searchable catalog (*eCatalog*) of DOE-recognized packaged CHP systems and suppliers with the goal to reduce risks for end-users and vendors through partnerships with:
  - *CHP Packagers and Solution Providers* that assemble, install, commission and service packaged CHP systems
  - *CHP Engagement* partners that provide CHP market deployment programs at the state, local and utility level
- Pre-engineered and tested packaged CHP systems that meet DOE performance requirements
- End-users and design engineers search for applicable CHP system characteristics, and get connected to packagers, installers and CHP engagement programs
- Allows users to compare technology options on a common basis

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



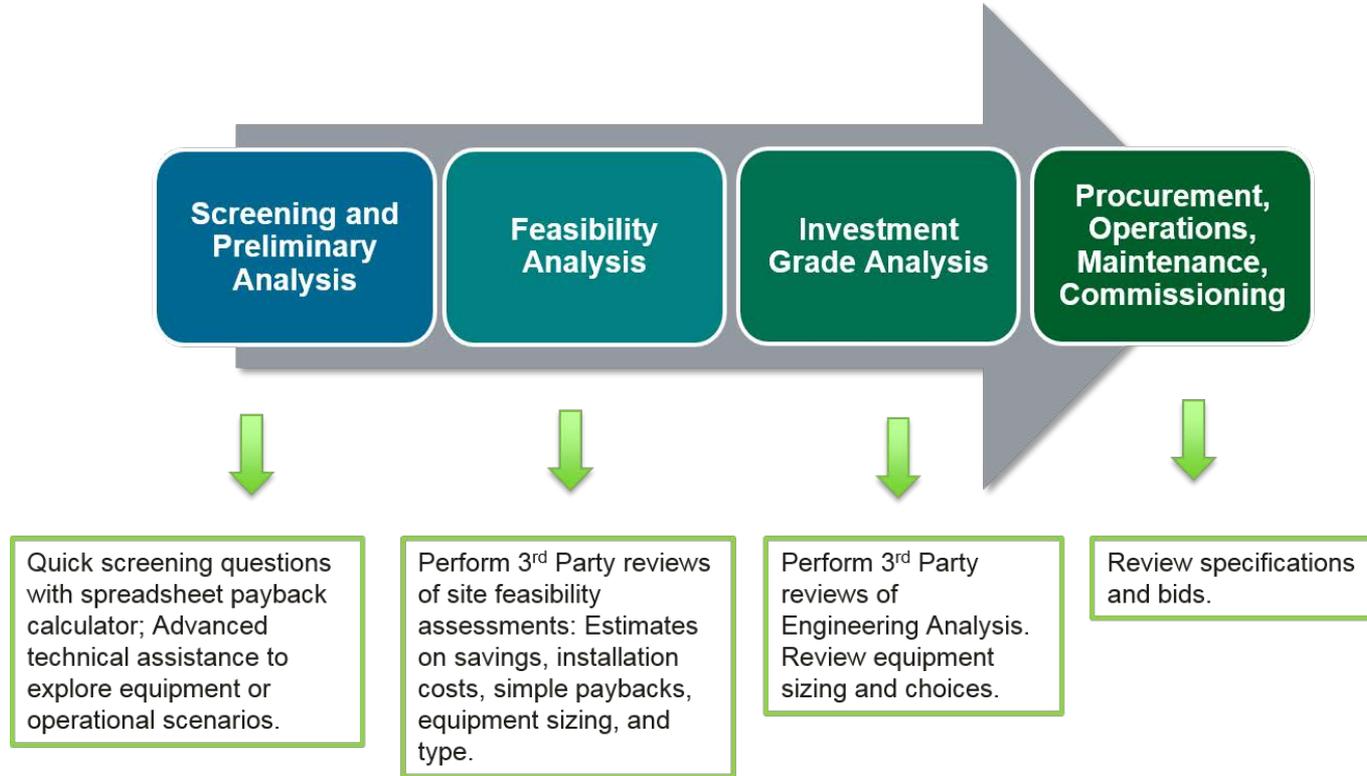
# DOE Packaged CHP eCatalog status as of October 2020

- 34 recognized Packagers
- 22 recognized Solution Providers
- 260 Package Offerings
  - ✓ 177 recip engine
  - ✓ 82 microturbine
  - ✓ 1 gas turbine
  - ✓ 232 natural gas
  - ✓ 27 digester gas
  - ✓ 57 grid parallel only
  - ✓ 189 grid islandable/auto transfer
  - ✓ 24 kW to 7.5 MW
  - ✓ Multiple suppliers and packages in every zip code
- 10 Customer Engagement Partners

The screenshot displays the DOE Packaged CHP eCatalog interface. The top navigation bar includes the U.S. Department of Energy logo and the title 'COMBINED HEAT & POWER eCATALOG RECOGNIZED PACKAGED CHP SYSTEMS'. A search bar is set to 'SEARCH eCATALOG'. The main content area is titled 'FOCUS YOUR RESULTS' and shows 'DISPLAYING: 260 Packages ordered by Relevance'. On the left, a sidebar contains filters for 'PRIMARY SITE LOCATION' (20001, Washington, DC), 'SUPPLIER PRIORITY', 'CUSTOMER ENGAGEMENT PARTNER', 'POWER OUTPUT (kW)' (3000 kW), and 'OUTDOOR INSTALLATION' (Required). The main area displays a grid of product cards, each with an image, name, and key specifications. The first row includes: 1. 'AGENTOR 412 NG' by ZG, 438 kW, Hot Water Only, Natural Gas fuel, 1x Reciprocating engine, Black Start, Auto grid connection. 2. 'TECOPOWER CM-60' by Tecogen, 59 kW, Hot Water Only, Natural Gas fuel, 1x Reciprocating engine, Parallel Only grid connection. 3. 'CPT-GE-JMS616-F01-CHILLER' by CPT, 2,637 kW, Steam, Hot & Chilled Water, Natural Gas fuel, 1x Reciprocating engine, Black Start, Auto grid connection. The second row includes: 1. '333SM DUAL MODE' by FLEXENERGY, 330 kW, Hot Water Only, Natural Gas fuel, 1x Microturbine, Other grid connection. 2. 'XRGI 25N' by Lochimmar, 24 kW, Hot Water Only, Natural Gas fuel, 1x Reciprocating engine, Parallel Only grid connection. 3. 'AEGIS POWERTHERM 75' by AEGIS, 73 kW, Hot Water Only, Natural Gas fuel, 1x Reciprocating engine, Parallel Only grid connection. Each card indicates a 'FULL MATCH (100%)'.

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

# CHP TAP Role: Technical Assistance



# DOE CHP TAP Screening Analysis

High level assessment to determine if site shows potential for a CHP project

## Quantitative Analysis

- Energy Consumption & Costs
- Estimated Energy Savings & Payback
- CHP System Sizing

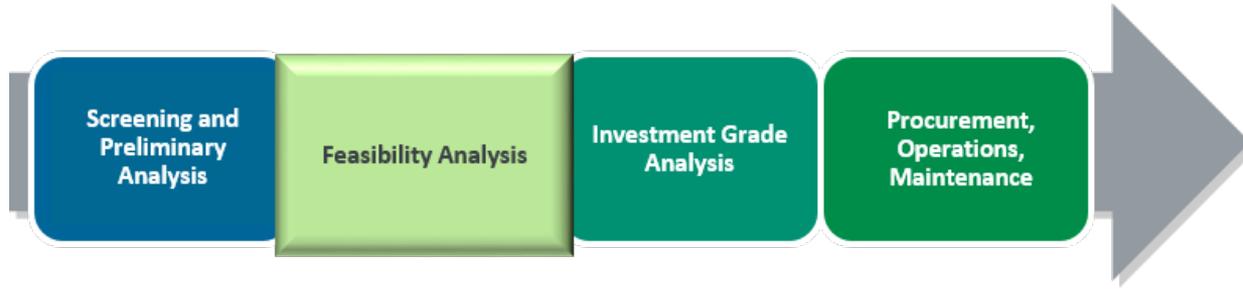
## Qualitative Analysis

- Understanding project drivers
- Understanding site peculiarities

Annual Energy Consumption	Base Case	CHP Case
Purchased Electricity, kWh	88,250,160	5,534,150
Generated Electricity, kWh	0	82,716,010
On-site Thermal, MMBtu	426,000	18,872
CHP Thermal, MMBtu	0	407,128
Boiler Fuel, MMBtu	532,500	23,590
CHP Fuel, MMBtu	0	969,845
Total Fuel, MMBtu	532,500	993,435
<b>Annual Operating Costs</b>		
Purchased Electricity, \$	\$7,060,013	\$1,104,460
Standby Power, \$	\$0	\$0
On-site Thermal Fuel, \$	\$3,195,000	\$141,539
CHP Fuel, \$	\$0	\$5,819,071
Incremental O&M, \$	\$0	\$744,444
Total Operating Costs, \$	\$10,255,013	\$7,809,514
<b>Simple Payback</b>		
Annual Operating Savings, \$		\$2,445,499
Total Installed Costs, \$/kW		\$1,400
Total Installed Costs, \$/k		\$12,990,000
Simple Payback, Years		5.3
<b>Operating Costs to Generate</b>		
Fuel Costs, \$/kWh		\$0.070
Thermal Credit, \$/kWh		(\$0.037)
Incremental O&M, \$/kWh		\$0.009
Total Operating Costs to Generate, \$/kWh		\$0.042



# A Feasibility Analysis Typically Involves



- Electrical load profiling
- Thermal load profiling
- Unit sizing
- Thermal use determination (what to do with the heat)
- Installation cost estimations
- Financial calculations (simple payback, ROI, etc.)
- Cost/savings information compared to what your facility would pay if the CHP system were not installed



# Next Steps

## Contact the Southeast CHP TAP for assistance if:

- Your utility is looking at CHP as a flexible generation resource
- Interested in having a qualification screening performed to determine if there is an opportunity for CHP at your industrial or commercial site
- If you already have an existing CHP plant and are interested in expanding
- Need an unbiased 3rd Party Review of a proposal





*A program sponsored by*



# Thank You!...

# Questions?

**Isaac Panzarella**

NC Clean Energy Technology Center

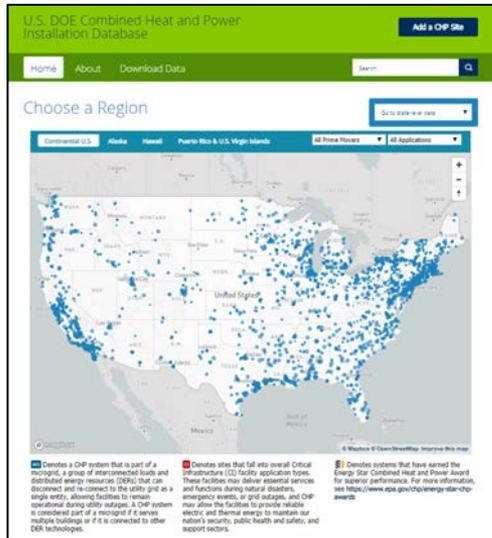
NC State University

[ipanzar@ncsu.edu](mailto:ipanzar@ncsu.edu)

(919) 515-0354

# CHP Databases

## DOE CHP Installation Database (List of all known U.S. CHP systems)



[energy.gov/chp-installs](https://energy.gov/chp-installs)

## EPA dCHPP (CHP Policies and Incentives Database)



[www.epa.gov/chpdchpp-chp-policies-and-incentives-database](https://www.epa.gov/chpdchpp-chp-policies-and-incentives-database)



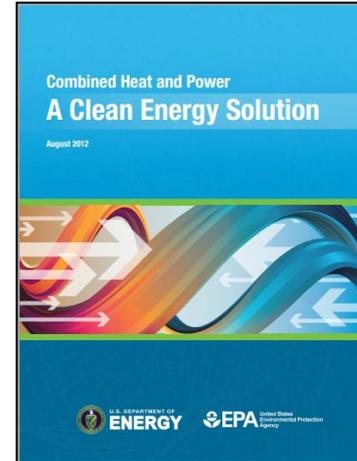
# CHP Resources

## CHP Issue Brief Series



<https://betterbuildingsolutioncenter.energy.gov/chp/resources-publications>

## Good Primer Report



<https://www.energy.gov/eeer/amo/downloads/chp-clean-energy-solution-august-2012>



# CHP Resources

## DOE CHP Technologies Fact Sheet Series

The collage shows several pages from the DOE CHP Technologies Fact Sheet Series. Key elements include:

- Table 4. Gas Turbine Emission Characteristics:** A table with columns for pollutant (CO, NOx, SOx, etc.) and units.
- Table 2. Gas Turbine Performance Characteristics:** A table with columns for parameter (Efficiency, Capacity, etc.) and values.
- Technology Description:** A text block explaining the technology and its applications.
- Gas Turbines:** A section with a photograph of a gas turbine and descriptive text.
- Table 1. Summary of Gas Turbine Attributes:** A table with columns for attribute (Efficiency, Capacity, etc.) and values.
- Applications:** A section describing where CHP technology is used.

## State of CHP Pages

The collage displays various State of CHP Pages, including:

- New York CHP by Technology:** A bar chart showing CHP capacity by technology (e.g., Gas Turbine, Internal Combustion Engine, etc.).
- New York CHP Capacity (MW) by Fuel:** A pie chart showing the distribution of CHP capacity by fuel source (e.g., Natural Gas, Coal, etc.).
- New York CHP:** A bar chart showing CHP capacity by technology.
- New York CHP Capacity:** A bar chart showing CHP capacity by technology.
- The State of CHP: New York:** A page featuring a map of New York with CHP installations marked as blue dots, and text describing the state's CHP resources.
- New York Existing CHP:** A table with columns for number, MW, and capacity (MW).

[www.energy.gov/chp-technologies](http://www.energy.gov/chp-technologies)

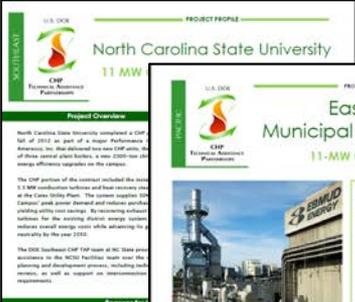
<https://www.energy.gov/eeer/amo/state-chp-all-50-states-fact-sheet-series>



CHP Technical Assistance Partnerships

# CHP Project Resources

## DOE Project Profile Database



**PROJECT PROFILE**  
North Carolina State University  
11 MW

**Project Overview**  
North Carolina State University completed a CHP test at 2012 as part of a larger Performance Analysis, Inc. that delivered two new CHP units, one of those served other facilities, a new 1000-ton chiller energy efficiency upgrade on the system.

The CHP portion of the contract included the installation of 11 MW combustion engines and heat recovery units at the Cores Utility Plant. The system supplies 100,000 kilowatt hours per year based on existing workload shifting with site savings. By recovering exhaust heat from the existing district energy system, reduced overall energy costs while allowing for a monthly fee per year (2012).

The DOE Southeast CHP Test at NC State provides assistance to the WCU Facilities team over the planning and development process, including technical review, as well as support on interconnection requirements.

**Reasons for Success**  
Implementing a CHP system into WCU's current energy infrastructure provides the following benefits:  
- Achieve higher efficiency for combustion and power generation, a 15% increase compared to separate diesel generation and boiler systems.  
- Fuel savings/CHP system efficiency.  
- Reduced operating costs for air treatment units of approximately 6.6% for the campus.  
- Acting as a primary energy source for the new Building Central for campus buildings.  
- Enabling for expansion during grid power out.



**PROJECT PROFILE**  
East Bay Municipal Utility District  
11-MW CHP System

**Quick Facts**  
LOCATION: Oakland, California  
OWNER: M&E, Inc. (contracted utility)  
TOTAL PROJECT COST: \$11 million (total)  
Annual energy improvement:  
FUELS: PROX: 4 MW (Site: Fuel Gas Recovery)  
CHP Fuel: Fuel Gas  
FUEL: Propane gas  
FUELS: PROX: 4 MW (Site: Fuel Gas Recovery)  
CHP Fuel: Fuel Gas  
FUELS: PROX: 4 MW (Site: Fuel Gas Recovery)  
CHP Fuel: Fuel Gas  
FUELS: PROX: 4 MW (Site: Fuel Gas Recovery)  
CHP Fuel: Fuel Gas

**Site Description**  
The East Bay Municipal Utility District (EBMUD) is a publicly-owned utility that provides water services to customers in the San Francisco Bay Area. An energy storage system (ESS) consists of 100 MW (total) and power system 3.5 million customers, and its combined treatment system includes 400,000 customers in an 80 square mile (212 km²) area.

**Reasons for Success**  
For many years, EBMUD has been generating electrical power using coal-fired power plants from its 1,100 MW coal-fired power plant. In 2011, the utility added a modern 4.8 MW fuel cell to its fuel cell system in San Diego. EBMUD's project utilized power from a gas-fired cogeneration plant and other technologies to generate power. In 2011, EBMUD became the first customer to receive a CHP system in the San Francisco Bay Area. The addition of the 4.8 MW gas turbine system to the existing set of other measures that the fuel cell can be used as the primary electricity generation source, supplemented by one or more of the other systems that is additional gas-fired system. The overall system currently provides an average of 11 MW of renewable electricity, with a total capacity of 11 MW.

[energy.gov/chp-projects](http://energy.gov/chp-projects)

## DOE Policy/Program Profiles



**POLICY PROFILE**  
Alternative Portfolio Standard

**Program Description**  
Massachusetts' Alternative Energy Portfolio Standards Initiative for creating alternative energy systems and other alternative energy systems contribute to growth by increasing energy efficiency and reducing greenhouse gas emissions. The program requires that all new electricity generation capacity in the state be certified as clean energy technology. Although the AEP includes clean technologies, CHP is required that at least 4.7% of Massachusetts' total power produced by AEP-eligible technologies.

Year	AEP Minimum	Net State of MA	AEP/CAP Rate
2009	1.0%	1.0%	1.0%
2010	1.5%	1.5%	1.5%
2011	2.0%	2.0%	2.0%
2012	2.5%	2.5%	2.5%
2013	3.0%	3.0%	3.0%
2014	3.5%	3.5%	3.5%
2015	4.0%	4.0%	4.0%
2016	4.5%	4.5%	4.5%
2017	5.0%	5.0%	5.0%
2018	5.5%	5.5%	5.5%
2019	6.0%	6.0%	6.0%
2020	6.5%	6.5%	6.5%

**Summary of AEP**  
The AEP required CHP capacity has far exceeded required CHP capacity operating in 2018 with an average of 11 MW.



**POLICY PROFILE**  
CHP Roadmap for Michigan

**Program Description**  
A project team completed an extensive two-year study to develop a roadmap for Michigan to meet its Department of Energy and Environment's (DEE) goal to increase the state's energy efficiency and reduce greenhouse gas emissions. The study identified an opportunity for CHP to play a more significant role in the state's energy mix. The **CHP Roadmap for Michigan** report outlined how various projects, if applied or integrated together, could help to determine how CHP deployment of AEP resources under various scenarios, and environmental considerations based on projections of demand, fuel availability, and other factors. The report also provides a detailed analysis of the availability of alternative energy resources, including wind, solar, and other factors, to help inform the state's energy policy and the development of a comprehensive energy strategy. The report also provides a detailed analysis of the availability of alternative energy resources, including wind, solar, and other factors, to help inform the state's energy policy and the development of a comprehensive energy strategy.

**Program Development**  
Reason for Project: CHP is a proven technology with environmental, economic, and grid benefits, but Michigan has not fully leveraged its potential as a power source. The program is designed to help Michigan CHP-related study and other efforts, providing insight to support state-level policy analysis and recommendations.

**Reason for Project:** CHP is a proven technology with environmental, economic, and grid benefits, but Michigan has not fully leveraged its potential as a power source. The program is designed to help Michigan CHP-related study and other efforts, providing insight to support state-level policy analysis and recommendations.

**Timeline:** January 2010 - February 2010

**Scope of Funding:** \$1.5 million

**Key Findings:** Michigan has the potential to generate 100 MW of CHP capacity. The CHP Roadmap for Michigan identifies the state's potential for CHP and provides a detailed analysis of the availability of alternative energy resources, including wind, solar, and other factors, to help inform the state's energy policy and the development of a comprehensive energy strategy.

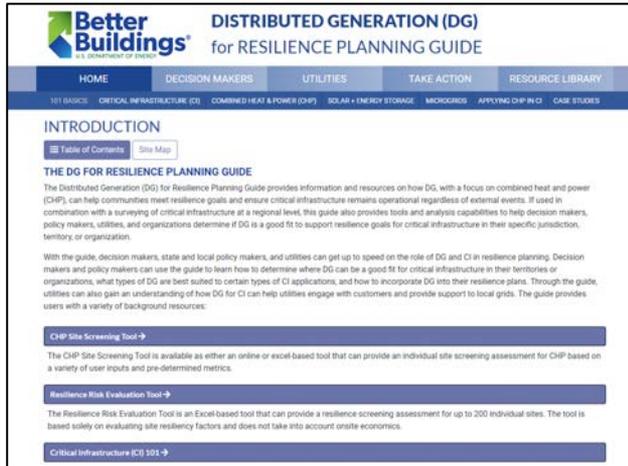
**Stakeholders and Partners:** M&E's extensive energy policy and program development is facilitated through partnerships, administrative and funds, and providing expertise, technical support, and stakeholder collaboration. For this project, M&E engaged with over 100 stakeholders, including 12 elected building participants. The CHP Roadmap for Michigan identified between 100 MW and 1,000 MW of potential CHP capacity. The program is designed to help Michigan CHP-related study and other efforts, providing insight to support state-level policy analysis and recommendations.

[energy.gov/chtpat](http://energy.gov/chtpat)



# CHP in Resilience Resources

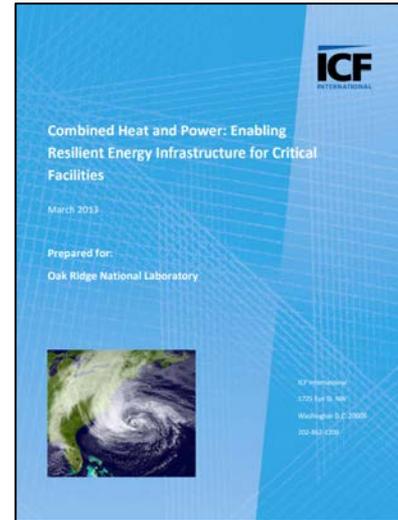
## DG for Resilience Planning Guide



The screenshot shows the homepage of the "Better Buildings U.S. DEPARTMENT OF ENERGY" website for the "DISTRIBUTED GENERATION (DG) for RESILIENCE PLANNING GUIDE". The navigation bar includes "HOME", "DECISION MAKERS", "UTILITIES", "TAKE ACTION", and "RESOURCE LIBRARY". Below the navigation bar, there are tabs for "101 BASICS", "CRITICAL INFRASTRUCTURE (CI)", "COMBINED HEAT & POWER (CHP)", "SOLAR & ENERGY STORAGE", "MICROGRIDS", "APPLYING CHP IN CI", and "CASE STUDIES". The main content area is titled "INTRODUCTION" and includes a "Table of Contents" and "Site Map" button. The text describes the guide's purpose: "The Distributed Generation (DG) for Resilience Planning Guide provides information and resources on how DG, with a focus on combined heat and power (CHP), can help communities meet resilience goals and ensure critical infrastructure remains operational regardless of external events. If used in combination with a surveying of critical infrastructure at a regional level, this guide also provides tools and analysis capabilities to help decision makers, policy makers, utilities, and organizations determine if DG is a good fit to support resilience goals for critical infrastructure in their specific jurisdiction, territory, or organization." Below the text, there are three highlighted links: "CHP Site Screening Tool", "Resilience Risk Evaluation Tool", and "Critical Infrastructure (CI) 101".

<https://dg.resilienceguide.lbl.gov/>

## CHP: Enabling Resilient Infrastructure for Critical Facilities



The cover of the report features the ICF logo in the top right corner. The title "Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities" is prominently displayed in the center. Below the title, it states "March 2013" and "Prepared for: Oak Ridge National Laboratory". At the bottom left, there is a small image of a hurricane. On the right side, the authors are listed: "ICF International", "1721 East 6th Ave", "Washington, D.C. 20008", and "202 462-1226".

[https://www.energy.gov/sites/prod/files/2013/11/f4/chp\\_critical\\_facilities.pdf](https://www.energy.gov/sites/prod/files/2013/11/f4/chp_critical_facilities.pdf)

