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Utility Ownership of Combined Heat and Power

Issue Brief

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Foreword

Combined Heat and Power as a Utility-Owned Resource

Some utilities are exploring how investing in combined heat and power (CHP) systems can bring value to customers, communities, and the wider grid in the context of changing utility business models. Accordingly, policymakers and state regulators may find it advantageous to understand the range of considerations associated with CHP as a utility-owned resource. From a utility perspective, while every investment involves some amount of risk, CHP systems can achieve a levelized cost of electricity (LCOE) lower than that of a central power plant, can be brought online in a shorter time frame, and provide additional benefits to utilities, their customers, and the local electric grid. The traditional utility business model of owning large central power plants is changing with increased penetration of distributed energy resources (DERs) and as renewable energy generation may present a risk of over supply during peak periods. In this context, state decision makers may benefit from exploring the business model underlying utility-owned CHP, the opportunities and other considerations associated with utility-owned CHP, and recent state activities related to utility-owned CHP.

Utility Combined Heat and Power Ownership Model

In general, "utility ownership of CHP" refers to a CHP system that is owned by a utility and physically located at a customer site. The CHP system may also be operated and maintained by the utility, but this is not necessary to the business model. Utility ownership of CHP systems can be a good fit for states and utilities operating within traditional vertically integrated regulatory structures, where utilities can own generation assets.[1] Once a utility-owned CHP facility is operational, the customer typically continues to buy electricity from the utility, as before, but also agrees to take the thermal energy generated by the CHP system under a long-term steam purchase agreement. Under the utility ownership model of CHP, revenue earned by the utility from steam sales can be applied to the cost of fuel needed to operate the CHP system, resulting in a lower cost of electricity for all utility customers. The host facility is not a customer choosing to leave the utility to generate its own power. Rather, the power is exported to the grid, and the host becomes a new thermal energy customer. This long-term steam agreement can be a strong driver for the CHP host because it can lock in reliable steam supply at a price lower than the cost of self-generating steam. An outline for the utility-owned CHP business model is highlighted in Figure 1.

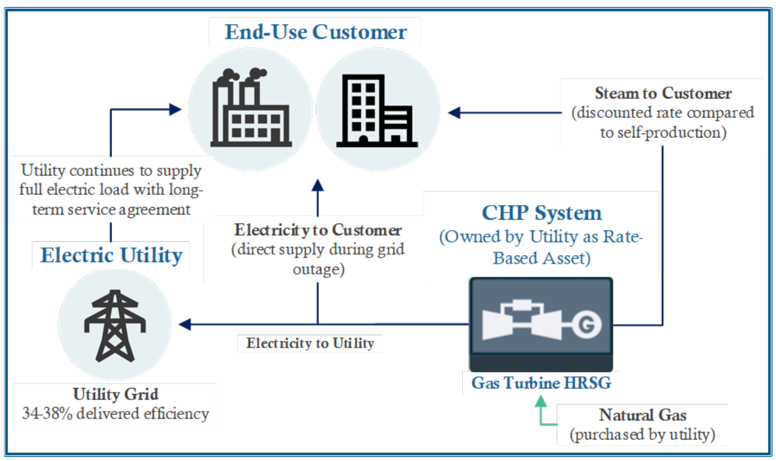

Figure 1. Business model framework for utility-owned CHP

1 In some states with deregulated markets, utilities are encouraged to serve customers with DERs, not through direct ownership but through competitive resource solicitations with third parties. This approach could be another pathway for utility involvement in CHP while ensuring system needs are met in the least-cost way. Utilities may also be permitted to own CHP as a distribution asset, where it can be demonstrated to be valuable.

From a technical and financial perspective, the CHP system is located on the "utility side of the meter," and power generated goes directly to the utility distribution system to be sold to retail customers. The customer hosting the CHP system takes power from its existing grid connections and is billed for the electricity as before. With a CHP system, the customer may also be able to operate in island mode in case of a grid outage.

A Cost-Effective Resource

CHP can be a more cost-effective resource for utilities than traditional forms of power generation. In some cases, utility-owned CHP presents a favorable LCOE, a common metric for comparing the cost of different generating resources. A resource's LCOE represents the total cost of building and operating the plant over its expected lifetime, in today's dollars, divided by the total kilowatt-hours generated. Key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, project life, and an assumed utilization rate (or capacity factor). Because of the high capacity factor and fuel efficiency of most CHP projects, well-sited and properly designed systems can be more cost-effective than other available baseload resource options.

To fully value CHP's overall cost-effectiveness, utilities apply the revenues from steam sales back to the cost of fuel for generating electricity, resulting in a lower cost of electricity for all utility customers. Figure 2 compares CHP's LCOE with that of a natural gas combined-cycle (CC) generator and shows how crediting the steam sales revenue to the cost of fuel results in CHP as the least-cost generating option.

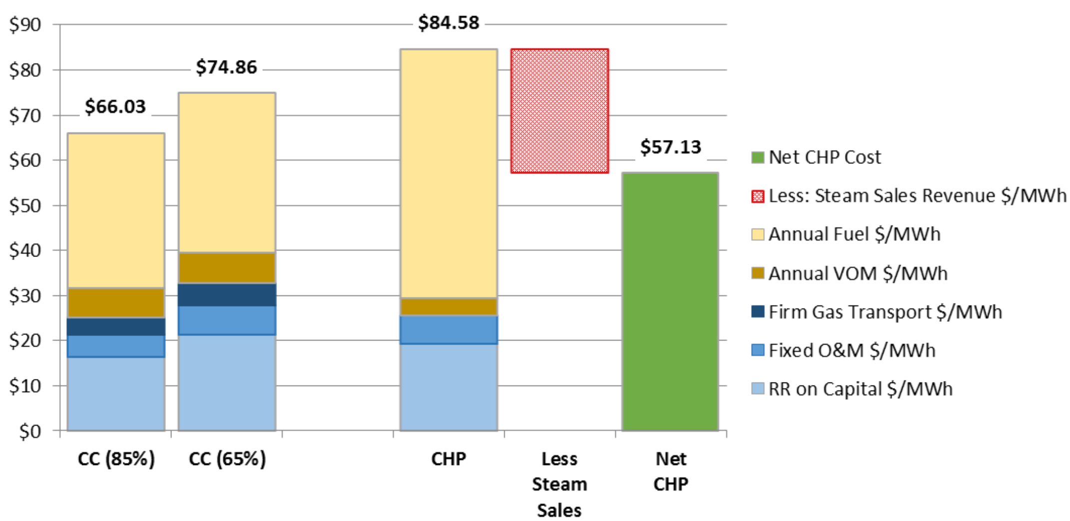

Figure 2. Business model framework for utility-owned CHP[2]

[2] Example illustrating a lower LCOE ($ per MWh) for CHP compared to CC power plants. CC numbers are based on a 2018 Dominion Integrated Resource Plan for 596 MW 2x1 CC, $1,233/kW CAPEX, $24/kW-year fixed O&M, $4.25/MWh variable O&M, $27.77/kW-year firm gas transportation, 6.6 MMBtu/MWh design (HHV) heat rate, 35-year plant life, and 6.25% levelized fixed charge rate. CHP is based on a 20 MW class gas turbine, $1,750/kW CAPEX, $34.50/kW-year fixed O&M, $2.50/MWh variable O&M, $0.60/Dth LDC fuel charge, 10.1 CT (HHV) heat rate, 74.3% overall efficiency (HHV), 5.2 fuel charged to power (HHV) heat rate using 83% alternative boiler efficiency, 35-year plant life, and 6.25% levelized fixed charge rate. Capacity factors are 85% and 65% for CC and 95% for CHP. Source: Sterling Energy Group, LLC.

The figure shows the LCOE of three different generating resources:

1) $66.03/MWh for a 1,000 MW CC gas turbine operating at an 85% capacity factor

2) $74.86/MWh for a 1,000 MW CC gas turbine operating at a 65% capacity factor

3) $57.13/MWh for a 20 MW CHP system operating at a 95% capacity factor (includes steam sales revenue)

CC plants were used for this comparison because they are currently the lowest-cost resource option utilities are considering for baseload power in much of the United States.[3] Capacity factor has a significant impact on LCOE. Actual costs of all resources vary significantly, depending on where they are geographically located. Well-designed CHP projects typically have high annual capacity factors because they are operated to serve the thermal needs of industrial or campus-type host sites, which often operate 24 hours a day, 365 days a year. The U.S. Energy Information Administration (EIA) estimates that in 2019, the national average capacity factor for natural gas CC power plants was 56.8%.[4]

Other Benefits of Utility-Owned Combined Heat and Power

Solutions to Deployment Challenges

Many of the barriers to customer-owned, behind-the-meter CHP deployment, such as standby charges and challenges associated with the interconnection process, can be avoided through utility-owned CHP. When CHP systems are customer-owned, utilities face the prospect of losing load and revenue. As many of the utility costs are fixed, other customers ultimately pay for the lost revenue in the form of rate increases. The lost revenue may be partially recovered via standby charges, but from the customer perspective, these charges can represent a significant economic impediment to installing behind-the-meter CHP, even where CHP would otherwise be an ideal fit. An additional barrier to customer-owned CHP installations is the interconnection process associated with grid-connected CHP systems; the interconnection process can be complicated, cumbersome, and costly.

With utility-owned CHP, the customer host incurs no standby charges because the utility owns and controls the CHP generation directly. Additionally, the utility handles both sides of electric and gas interconnections, reducing customer challenges experienced during the interconnection process.

Utility Benefits

Utility ownership of CHP benefits a variety of stakeholders. In addition to lower LCOEs and higher capacity factors, CHP installations are smaller than central station plants and take less time to permit and install. Utility ownership of CHP enables projects to proceed in areas where electricity rates have not traditionally been conducive to CHP. Further, strategically sited CHP installations can relieve system congestion and provide grid services that may defer the need for future infrastructure investments in support of least-cost planning. Overall, CHP systems can provide significant resilience, risk, and economic benefits to customers, helping them stay competitive in their industries. By collaborating with customers on ownership of CHP projects, utilities may retain large energy users they would otherwise lose to self-generation.

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3 Lazard, *Levelized Cost of Energy Analysis: Version 13.0*, New York: Lazard, 2019.

4 U.S. Department of Energy, Energy Information Administration, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a

Customer Benefits

For customers with CHP on site, systems can be configured to operate in island mode during a grid outage, providing long-term power and thermal stability for continuous operation. Having CHP on site can also offer access to lower-cost steam. Retiring aging thermal equipment decreases energy costs, which creates opportunities for businesses to become more competitive or for campuses to expand. On the financial side, the utility provides the upfront capital investment, and long-term contracts provide price certainty against future volatility.

Grid Benefits

Utility-owned CHP benefits all users of the electric grid. The utility's revenue from thermal sales is credited back to fuel costs, which lowers the amount of money the utility must recover from its rate base, resulting in cost savings for all customers. Additionally, sites with CHP systems capable of maintaining power during widespread outages can serve as places of refuge for surrounding communities. With CHP as a cornerstone of microgrid systems, utility-owned CHP may open the door to increased community resilience through expansion of microgrids. Finally, CHP systems generate power and heat efficiently, and they typically generate fewer emissions than separate heat and utility-purchased power. As some utilities are starting to set increasingly stringent carbon reduction goals, savings from utility-owned CHP may count toward these targets.

Benefits to Local and Regional Communities

Utility partnerships enabling CHP investments at customer sites can boost economic development by increasing the local tax base and creating construction jobs. CHP systems can also bring increased manufacturing competitiveness, which supports keeping and growing local jobs. For example, the Chesapeake Utilities' Eight Flags Energy CHP project has played an important economic development role for the communities of Fernandina Beach, Amelia Island, and Nassau County, Florida. Not only has the collaboration resulted in a lower-cost, more resilient local electric supply, it has also provided an additional $800,000 to the local tax base and added 100 jobs during construction of the facility. Increased operational efficiencies and new steam and gas supply enabled by the CHP system also contributed to a nearby $135 million expansion at the Rayonier Advanced Materials mill, which

Customer-Owned Utilities and CHP

Customer-owned utilities, such as municipal electric utilities and electric cooperatives, may find ways to capture the local economic benefits of CHP through innovative arrangements. The 36 MW CHP system located at the Georgia Pacific Wauna Mill near Clatskanie, Oregon, is an example of a CHP project owned through a unique agreement between two customer-owned utilities. The Wauna Mill produces approximately 1,200 tons of finished paper products per day, employing about 1,100 people at its 1,200-acre site.

Photo source: Georgia Pacific.

For more information on the Wauna Mill CHP Project, visit www.clatskaniepud.com/about/energy-resources

In 1993, the Eugene Water and Electric Board (EWEB) and the Clatskanie County People's Utility District formed an intergovernmental agency to construct, own, and operate the CHP system at the Wauna Mill. Revenue bonds issued by the agency were paid off through sale of electrical output to the Bonneville Power Administration for the first 20 years of operation. Since April 2016, all the project's electrical output has been purchased by EWEB.

is expected to add 50 more full-time jobs at the manufacturing site, representing the largest local industrial development expansion seen in recent times.[5]

Additional Considerations

Alongside its benefits, utility ownership of CHP systems presents additional issues that may merit consideration before moving forward with installation, as discussed below.

Ownership Approval: Uncertainty about how state regulators would view a utility's proposal to own CHP could lead some utilities not to pursue utility-owned CHP projects. The utility-ownership model can complement traditional utility regulation, where it can follow existing procedures for inclusion in the rate base just like any other asset, provided the utility demonstrates that the project is a prudent investment, given the specific circumstances. By contrast, utilities operating in states with deregulated markets are typically prohibited from owning generation and can engage only in the delivery or distribution of electricity to customers. In such states, regulatory approval for CHP ownership is less certain and might require special consideration. Some deregulated states have explored allowing utility ownership when the assets act as a distribution resource to improve grid reliability. For example, as part of the Modernizing the Energy Delivery System for Increased Sustainability (MEDSIS) Initiative in 2017, regulatory staff in the District of Columbia found ownership of distributed energy resources could be allowed as long as the electricity generated was not sold but was instead used by the utility to support reliable operation of the distribution system.[6]

Market Solutions: In deregulated markets, there are concerns about utilities having an unfair advantage over competitors. Competition is expected to result in lower costs for customers, but investor-owned utilities have inherent advantages that could crowd out independent developers. One way to alleviate this concern is to acknowledge when the market has not delivered CHP, even when CHP is a cost-effective solution. For example, in New York, regulators aim largely to prevent utility ownership of DERs, unless the competitive market fails to deliver optimal solutions.[7] Other ways to address this concern include limiting the size or purpose of utility-owned generation or allowing the market to develop and the utility to own CHP within certain guidelines.[8]

Policy Patchworks: In any market structure, there is not usually a sole state policy regulating CHP, which makes it difficult to clearly assess rules governing utility ownership. Instead, several individual regulations can impact CHP projects, either directly or indirectly. The landscape for utility regulation is changing rapidly, with states undertaking assessments of what, if any, grid modernization or related efforts they should be making. States that want to encourage consideration of CHP could clarify their willingness to consider utility-owned, customer-sited CHP as a component of the rate base to provide certainty to utilities.

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5 *Better Buildings: The CHP Solution for Growth, Economics, and Business Continuity*, U.S. Department of Energy, May 16, 2017, slides 11-12, https://betterbuildingssolutioncenter.energy.gov/sites/default/files/The_CHP_Solution_for_Growth%2C_Economics%2C_and_Business_Continuity.pdf

6 "Therefore, there is no need for Commission action regarding Pepco's ownership of DER facilities so long as the electricity generated by such facilities is not sold but is instead used by Pepco to support the reliable operation of the distribution system," from Modernizing the Energy Delivery System for Increased Sustainability Staff Report, Public Service Commission of the District of Columbia, Formal Case No. 1130, 2017, p. 64, http://www.dcpsc.org/getmedia/6048d517-1d9d4094-b0f4-384f19a11587/MEDSISStaffReport.aspx.

7 *Deployment of Distributed Generation for Grid Support and Distribution System Infrastructure: A Summary Analysis of DG Benefits and Case Studies. Final Report*, New York State Energy Research and Development Authority (NYSERDA), 2011, p. 27, http://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Electric-Power-Transmission-and-Distribution-Reports

8 Ibid., p. 4.

Host Dependability: Another risk factor for utilities is fear of the customer-host changing operations and energy needs or going out of business. A utility may be reluctant to invest in a CHP system at a particular manufacturing plant, for example, if the industry is facing a downturn or there is some concern that the plant may cease operations. This factor can be addressed in the steam purchase agreements. For example, the agreements could include a provision that the customer must take steam for a certain time period or face a termination payment. In the case of the customer-host closing its doors, the utility can operate the system as a peaking resource until a new customer for the thermal energy is found. This solution is not ideal, as the thermal resource is wasted, but does limit the risk.

State Activity Related to Utility Ownership of Combined Heat and Power

Several states have taken a variety of approaches to explore utility ownership of CHP as a supply-side generation resource. These approaches are summarized in Table 1.

Table 1. State Policy Action Related to Utility Ownership of CHP

State	Year	Action
Indiana	2020	The Indiana Utility Regulatory Commission approved a petition from Duke Energy Indiana to own and operate a CHP system at Purdue University and recover costs from the facility.
Michigan	2019	The Michigan Public Service Commission approved a 34 MW CHP plant at Ford Motor Company's Research & Engineering Center. DTE Energy owns and operates the CHP system.
Virginia	2018	Senate Bill 966 directs Dominion Energy to consider the deployment of 200 MW of CHP or waste heat to power (WHP) by 2024 in its next integrated resource plan, either as a demand-side energy efficiency measure or a supply-side generation alternative.[9]
Louisiana	2017	The Louisiana Public Service Commission sought public comment on "identifying ways in which utilities could potentially finance CHP projects and include those projects in their rate bases."[10]
South Carolina	2017	Duke Energy received regulatory approval from the South Carolina Public Service Commission for cost recovery from the 15 MW CHP thermal energy power purchase agreement (PPA) with Clemson University.
Alabama	2015	The Alabama Public Service Commission approved a request from Alabama Power to secure up to 500 MW of renewable energy and CHP by constructing facilities themselves, entering into PPAs with customers, or using a combination of both.[11]
California	2015	The California Public Utilities Commission (CPUC) granted Southern California Gas Company (SoCalGas) permission to establish the Distributed Energy Resources (DERS) Tariff. The DERS Tariff will enable SoCalGas to construct, own, and operate behind-the-meter, customer-sited CHP facilities.[12]

9 Virginia SB 966 of 2018, https://lis.virginia.gov/cgi-bin/legp604.exe?181+ful+CHAP0296+pdf

10 "In re: Rulemaking to study the possible development of financial incentives for the promotion of energy efficiency by jurisdictional electric and natural gas utilities. Second corrected Notice of Scheduling of Technical Conference and Initial Request for Comments," Louisiana Public Service Commission, February 24, 2017.

11 Alabama Public Service Commission, Docket No. 32382, June 25, 2015, www.pscpublicaccess.alabama.gov/pscpublicaccess/ViewFile.aspx?Id=e014291c-4450-4f3e-bb28-47e2e1ca1021

State	Year	Action
Minnesota	2015	Minnesota's CHP Action Plan includes a clear objective to "explore and clarify whether and how CHP could qualify as an eligible supply-side resource as defined under electric utility infrastructure improvement statutory language."[13]
Pennsylvania	2015	In its 2015 Climate Change Action Plan, policy makers in Pennsylvania suggest evaluating the "ability of utilities to participate in CHP operation, either in ownership or service packages," as one approach to increasing installed capacity of CHP in the state.[14]
Florida	2014	The Florida Public Service Commission approved Florida Public Utilities' request to recover costs for the purchase of power from a 21 MW utility-owned CHP facility in Fernandina Beach, Florida.[15]

While these actions offer some direction on feasibility of utility ownership from a regulatory perspective, in most states, it is not always clear how regulators view utility ownership of CHP.

Utility Experience with Combined Heat and Power Ownership

While utilities have traditionally viewed CHP as a customer-owned asset, this perception is changing. Experience to date has been limited, but some utilities have successfully pursued ownership stakes in CHP projects and received regulatory approvals to recover costs. Utilities can have varying levels of involvement in utility-owned CHP. Some utilities retain full ownership of the CHP equipment and the energy it produces, while others have only partial ownership or a small stake in the CHP project. The type of utility company involved is also an important consideration; most existing projects were developed by municipal utilities, electric cooperatives, or unregulated subsidiaries of utility companies, which operate in a different regulatory environment from investor-owned utilities.

To improve understanding of existing utility-owned CHP, national-level data from DOE's CHP Installation Database was evaluated to determine how many utilities already own or partially own CHP projects, as well as to locate states where regulators have experience evaluating these projects.[16] The DOE CHP Installation Database tracks known CHP installations of all sizes and technology types across the country and is updated annually. There are currently about 81 GW of existing CHP generation capacity at over 4,600 facilities in the United States.[17] Utilities own less than 5% of the total capacity and less than 4% of total installations. Figure 3 shows existing utility-owned CHP installations by state.

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12 Other rules in California encourage electric utilities to acquire CHP as a resource, but they may not exemplify the utility ownership model. For example, the CPUC requires the state's investor-owned electric utilities to meet CHP procurement targets established by the qualifying facility and CHP program settlement agreement.

13 Minnesota Department of Commerce, Final CHP Action Plan, St. Paul, MN: Minnesota Department of Commerce, 2015, http://mn.gov/commerce-stat/pdfs/CHP%20pdfs/final-unabridged-chp-action-plan-2015.pdf

14 Pennsylvania Department of Environmental Protection, 2015 Climate Change Action Plan Update, August 2016, www.elibrary.dep.state.pa.us/dsweb/Get/Document-114163/FINAL%202015%20Climate%20Change%20Action%20Plan%20Update.pdf

15 Florida Public Service Commission, Docket No. 140 185-EQ – Petition for approval of negotiated power purchase contract with Eight Flags Energy, LLC, by Florida Public Utilities Company, December 14, 2014.

16 U.S. DOE CHP Installation Database, accessed 2020, https://doe.icfwebservices.com/chpdb/

17 Ibid.

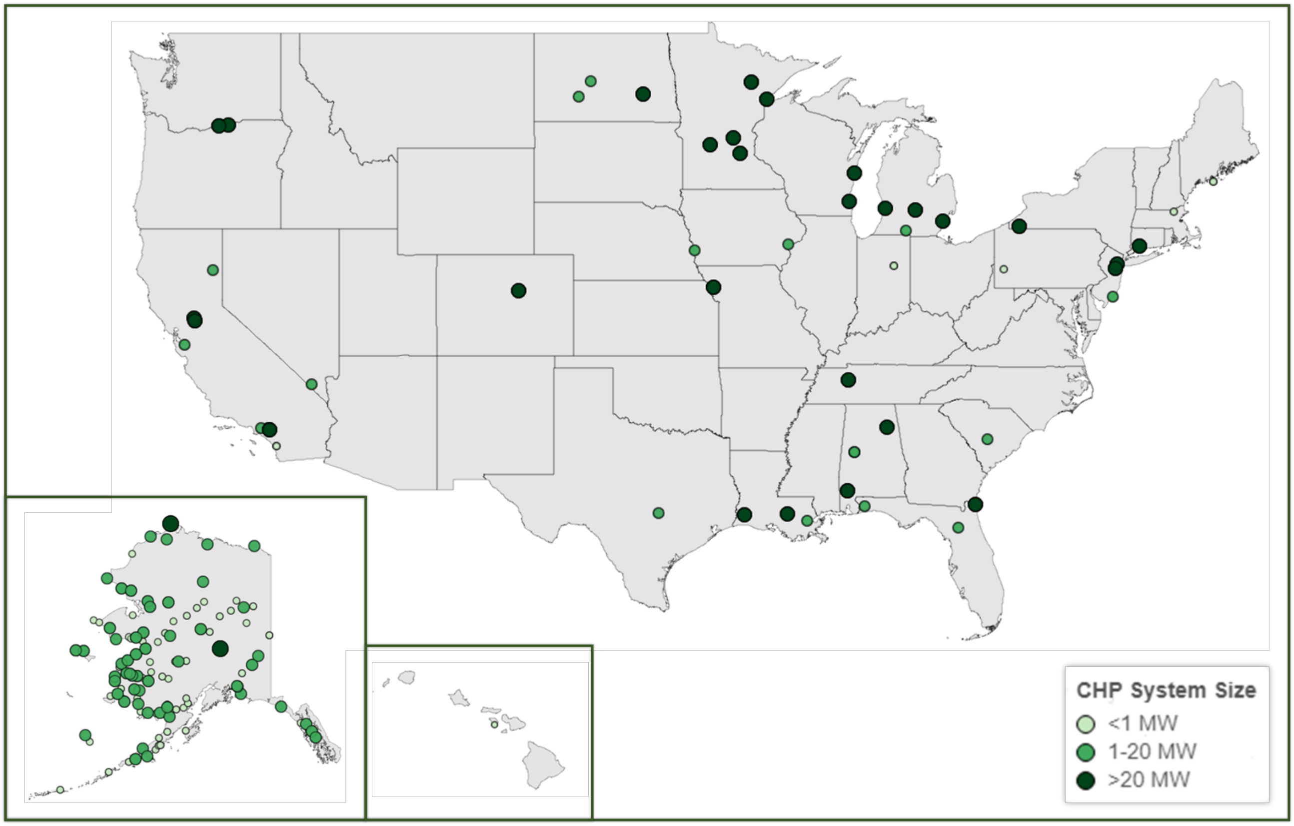

Figure 3. Existing utility-owned CHP installations in the United States. *Source: U.S. DOE CHP Installation Database*

For the continental United States, 51 CHP facilities are identified as utility-owned, comprising 3,437 MW of capacity. Beyond the continental United States, there is one site in Hawaii, and Alaska contains the most utility-owned systems, with 119 installations providing 260 MW of capacity.[18] Many cities and communities in Alaska are not served by central station power plants or natural gas pipelines and instead meet their local power needs with diesel-fueled electric generators. Some of these generators are configured as CHP systems to recover heat for nearby buildings. These cities and communities are classified as electric utilities.[19]

Prior to 2005, Public Utility Regulatory Policies Act (PURPA)[20] legislation required that utilities purchase excess electricity from efficient CHP plants, so many industrial facilities installed large CHP systems based on their thermal requirements and sold excess electricity to the utility. As a result, several utilities chose to support these projects, in some cases through ownership of the generation assets. The Energy Policy Act of 2005 exempted utilities from the must-purchase obligation as long as a qualifying facility had access to power markets, which led to a reduction in large CHP plants and associated utility involvement. Newer industry trends include increased DER penetration, efforts to improve efficiency and reduce grid emissions, and a movement away from centralized power generation. These shifts have led some utilities to explore new utility ownership arrangements for CHP installations.

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[18] Alaska has the greatest number of sites, but Louisiana has the highest installed capacity with over 880 MW. Louisiana's capacity is primarily due to Entergy's involvement in CHP installations at two large chemical plants: PPG Industries' Lake Charles complex and Calpine's Carville Energy Center. See U.S. DOE CHP Installation Database for more on installed capacity by state: doe.icfwebservices.com/chpdb/

[19] ICF analysis of data from U.S. DOE CHP Installation Database, available at: https://doe.icfwebservices.com/chpdb/

[20] PURPA was enacted in 1978 as part of the National Energy Act, aimed at promoting energy conservation and domestic energy use in response to the 1973 energy crisis.

Recent Explorations of Utility-Owned Combined Heat and Power

This section describes four recent publicly available examples of utility-owned CHP.

Table 2. Examples of Utility-Owned CHP Projects

	Amelia Island, FL	Dearborn, MI	Clemson, SC	West Lafayette, IN
Utility	Florida Public Utilities	DTE	Duke Energy	Duke Energy
Year	2016	2019	2019	2022
Size	21 MW	34 MW	15 MW	16 MW
Host Type	Industrial	Research Campus	Campus/University	Campus/University
Host Name	Rayonier Advanced Materials	Ford Motor Company	Clemson University	Purdue University
Term of Agreement	20 years	30 years	35 years	35 years
Main Drivers	Baseload power, community resilience, and reliability	Grid congestion, campus reliability, and resilience	Campus energy, system reliability, and resilience	Campus energy, system reliability, and resilience
Regulatory Oversight	Cost recovery for thermal PPA approved	Request for cost recovery approved	Cost recovery for thermal PPA approved	Certificate of Public Convenience and Necessity (CPCN) granted; request for cost recovery approved

Eight Flags Energy CHP Plant

Figure 4. The Eight Flags Energy Plant, Florida Public Utilities. *Source: Cottle Communications*

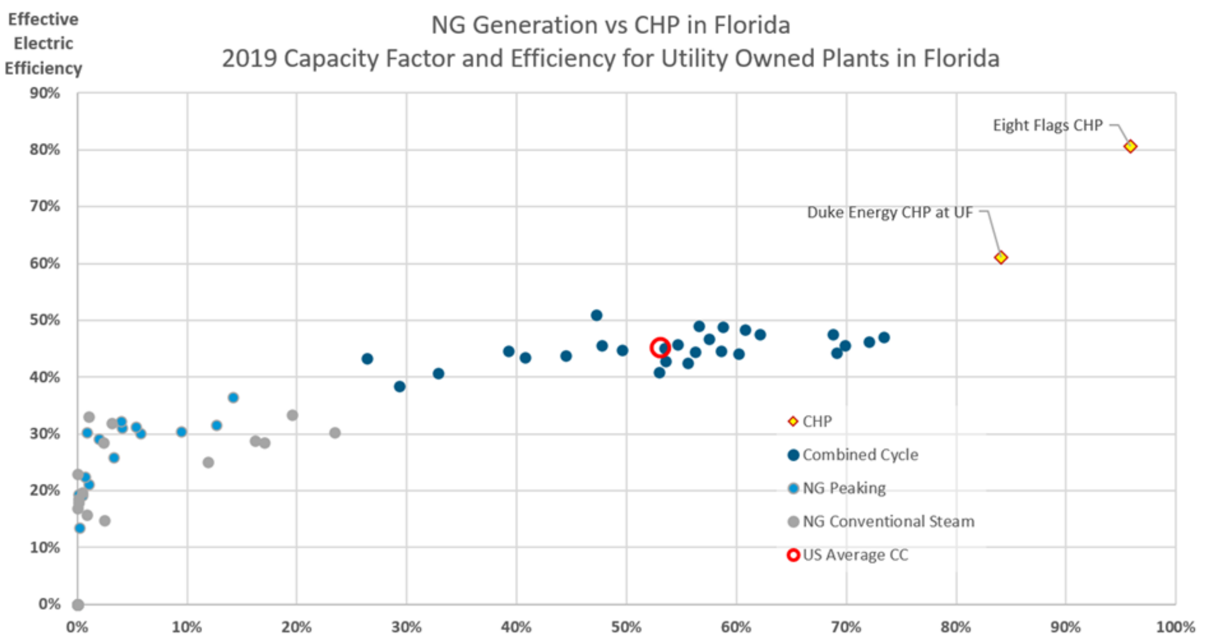
Chesapeake Utilities Corporation built, owns, and operates the Eight Flags Energy CHP Plant on Amelia Island in Nassau County, Florida. The 21 MW natural gas CHP system is hosted by Rayonier Advanced Materials, an industrial facility that purchases steam and hot water for cellulose production. Eight Flags Energy is its own business entity, owned entirely by Chesapeake Utilities. Florida Public Utilities (FPU), a smaller investor-owned subsidiary of Chesapeake, purchases all the electricity from the CHP unit for distribution to its retail customers, meeting approximately 50% of the average demand of the island's 16,000 customers.[21] The primary drivers for this project were reliability and resilience. The system is designed to survive a Category 4 storm surge and has the ability to support essential services such as the island's hospital, fire department, police department, and water treatment systems.[22] The project has been operating since July 2016 with efficiency of over 77% higher heating value (HHV).

[21] Chesapeake Utilities Corporation. "Chesapeake Utilities Corporation to Celebrate Commencement of First Combined Heat and Power Plant Operation," Chesapeake Utilities Corporation, Dover, Delaware, September 1, 2016, www.chpk.com/news-2016/chesapeake-utilities-corporation-to-celebrate-commencement-of-first-combined-heat-and-power-plant-operation/

[22] "Combined Heat and Power (CHP) Technical Potential in the United States," U.S. Department of Energy, Washington, DC, 2016, www.energy.gov/sites/prod/files/2016/04/f30/CHP%20Technical%20Potential%20Study%203-31-2016%20Final.pdf

CHP Asset Utilization

The chart below illustrates two key variables related to asset utilization: effective electric efficiency and capacity factor. The results shown are based on 2019 operating data from utility-owned plants in Florida, including Duke Energy's CHP Plant at the University of Florida and the Eight Flags CHP Plant. Natural-gas-fired CHP can achieve higher utilization of its capacity and effective electric efficiency than large, central station natural-gas-fired generating plants, making CHP competitive.



Notes:

- All combined cycle data based on reports DOE EIA-960 and EIA-923 for 2019. All data and efficiency calculations based on HHV.
- Duke Energy owned 45 MW CHP at UF capacity factor based on EIA-960 and EIA-923, and verified by 2018 operating data. The LM6000 driven plant installed in 1992, still utilizes steam injection for N0x control which impacts overall efficiency
- Capacity factor and efficiency for Eight Flags CHP based on actual operating data provided for calendar year 2019. Unit was also uprated during Feb 2019 outage to 21.5 MW net.
- Effective electric efficiency accounts for grid losses and includes a credit for the displaced thermal fuel for CHP.
- Per EPA eGRID 2020 (2018 data), total grid losses for central station plants in FL is 4.88%, US average is 4.87%. Losses associated with CHP of 2.44% due to proximity of generation to point of consumption.

Compiled by: Sterling Energy Group, LLC

Higher effective electric efficiency does not necessarily translate to lower costs. A key to the economics is the value of steam. If the CHP system owner does not capture the value of steam (by giving it away rather than selling it, for example), the plant will show significantly less favorable economics.

Eight Flags operates as a qualifying facility under PURPA. The Florida Public Service Commission approved FPU's request for cost recovery of the negotiated PPA with Eight Flags Energy for a 20-year term. In its analysis, Commission staff found the facility was capable of serving a significant portion of FPU's baseload needs on Amelia Island and would reduce the potential impact of severe weather on critical services. The arrangement is expected to save approximately $28 million for FPU's electric customers over the life of the term.

Ford Research and Engineering Center

DTE Energy (DTE) built, owns, and operates the 34 MW CHP plant at Ford Motor Company's Research and Engineering Center in Dearborn. The CHP system is part of a larger state-of-the-art energy infrastructure project at the facility. The Center is incorporating solar photovoltaics (PV), distribution systems, thermal energy storage, advanced chilled and hot water systems, and a geothermal system designed to increase the efficiency of the chilled and hot water facilities. The CHP system provides steam for the campus and produces electricity to be sold on the power grid.[23]

Figure 5. The Ford Engineering and Research Center in Dearborn, Michigan.
Source: Ford Motor Company

DTE constructed the CHP system for $62.3 million under a fixed price agreement with Ford Motor Company. Services under the agreements commenced following completion of construction in December 2019. The plant is expected to provide a number of tangible benefits to DTE and its customer base, including avoiding a ~$5 million substation upgrade, freeing up nearby substation capacity.

If Ford had opted to pursue behind-the-meter CHP instead of partnering with DTE on an in-front-of-the-meter solution, DTE estimates its customers would have had to pay more than $102 million to make up for the utility's lost margins that would have been incurred if Ford was not retained as a customer and to cover the cost of system upgrades that would have been needed to continue serving the site.

Clemson University

In 2015, Duke Energy began evaluating interest in CHP from customers with continuous steam needs[24] and found substantial receptivity. The utility included CHP in its most recent integrated resource plan and identified Clemson University as a potential steam host. Clemson University was interested in the project as a means of addressing reliability and sustainability concerns. The project came at a time when the campus was upgrading and replacing sections of its aging electrical infrastructure as part of a strategy to improve system reliability. Only one transmission line connects the campus to the grid, making the university vulnerable to prolonged outages. Clemson had been considering investing in a second transmission line to address that risk, but leadership became convinced that on-site CHP would provide the required reliability at a lower cost to the university.

Figure 6. The Duke Energy CHP system at Clemson University in South Carolina.
Source: Duke Energy

[23] "DTE Energy to Power Ford Motor Company Research and Engineering Center with Advanced Technologies / Achieving 50 Percent Energy Efficiency," DTE Energy (via Cision PR Newswire), October 24, 2017, https://www.prnewswire.com/news-releases/dte-energy-to-power-ford-motor-company-research-and-engineering-center-with-advanced-technologies--achieving-50-percent-energy-efficiency-300542452.html

[24] *South Carolina 2016 Integrated Resource Plan (Biennial Report)*, Duke Energy Carolinas, September 1, 2016, www.energy.sc.gov/files/view/DEC%20IRP%202016%20Corrected%2010-2016%20Clean%20Copy.pdf

Duke Energy Carolinas constructed the 15 MW natural gas CHP facility to provide electric service to Duke's system customers and thermal energy to Clemson University.[25] The facility began operation in 2019, and Duke Energy has received regulatory approval for cost recovery from the thermal energy PPA with Clemson.[26] While Duke Energy did not need a Certificate of Public Convenience and Necessity (CPCN) from the South Carolina Commission to build the plant because it is smaller than 75 megawatts, the utility did ask the Commission to approve the 35-year contract to sell steam to Clemson and credit the revenue back to fuel costs for all Duke Energy customers.

In the event of a major grid outage, the CHP facility is capable of islanding to supply power to the university. In addition, the CHP system provides the university with steam at a lower cost and with fewer emissions than the campus' existing gas boilers could produce.

Purdue University

Purdue University and Duke Energy have partnered on construction of a new 16 MW natural gas CHP facility. The Purdue CHP plant will be located on the southern edge of the Purdue campus, adjacent to the university's existing Wade Utility Plant, which provides steam to the West Lafayette campus. Under the partnership arrangement, Duke Energy will build, operate, and own the CHP plant, and Purdue will lease land to the utility for a 35 year term, purchase 100% of the steam produced by the new CHP plant for 35 years, and construct the needed infrastructure to connect the new plant to the existing Wade Utility Plant.

Figure 7. The Wade Utility Plant, neighbor to the planned Purdue CHP plant site.
Source: Purdue University

The Indiana Utility Regulatory Commission granted Duke Energy a CPCN for the CHP system on March 31, 2020. In its order, the Commission stated: "Based on the evidence presented, we find the addition of the Purdue CHP Facility is a reasonable step toward the diversification of Duke Energy Indiana's electric generating portfolio with cleaner-burning electricity produced from natural gas. In addition, by owning and maintaining the proposed facility, Petitioner will be able to gain insight and experience on reliably and safely operating resources of this type and size in conjunction with its large customers."[27]

[25] J. Downey, "Duke Energy plans combined heat-and-power project at Clemson University," *Charlotte Business Journal*, March 2017, www.bizjournals.com/charlotte/news/2017/03/09/duke-energy-plans-combined-heat-and-power-project.html

[26] K. Koenig and Z. Kuznar, "Utility CHP ownership – a new partnership," *District Energy*, first quarter, International District Energy Association, 2018.

[27] Indiana Utility Regulatory Commission, Cause No. 45276, Order of the Commission dated March 31, 2020, p. 19.

In addition to offering affordable steam for purchase, the new Purdue CHP plant will lend the university more flexibility in its facilities operations, reducing costs and deferring capital expenses associated with O&M of its other plants. Further, in the event of a major grid outage, the system will be able to provide electricity to the campus. The plant is expected to be operational in April 2022.[28]

Conclusions

As utilities explore how owning CHP systems can bring value within their changing business models, utility-owned CHP presents considerations that are important for state decisionmakers to evaluate. While regulatory pathways exist and recent case studies may provide a helpful roadmap, some regions still experience uncertainty around the rules, regulations, and limitations associated with utility-owned CHP. Policy makers and state regulators can continue to play an important role by further defining and clarifying rules for utility ownership and by issuing guidance on the treatment of CHP in future resource planning efforts.

[28] Indiana Utility Regulatory Commission, Cause No. 45276, Order of the Commission dated March 31, 2020, p. 9.

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