Combined Heat and Power Overview

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Nicor Gas | Energy Efficiency Program

Background

- Nicor Gas Energy Efficiency Program helps customers save energy and money
- Nicor Gas promotes energy-efficient technology, not a specific brand
- More information about this technology incentive at end

Agenda

- Overview of CHP technology
- The best customers for CHP
- Available technology types
- Right-sizing to meet energy demands

Presenter

Ben Campbell
Principal Research Engineer

UIC ENERGY RESOURCES CENTER

About the speaker

Ben Campbell is a principal research engineer at the Energy Resources Center (ERC)--an interdisciplinary public service, research, and special projects organization that works to advance energy sustainability and improve the environment, based out of the College of Engineering at the University of Illinois Chicago. Ben has 10 years' experience in energy efficiency and distributed power generation with a focus on combined heat and power and solar photovoltaics.

Combined Heat and Power (CHP) Overview

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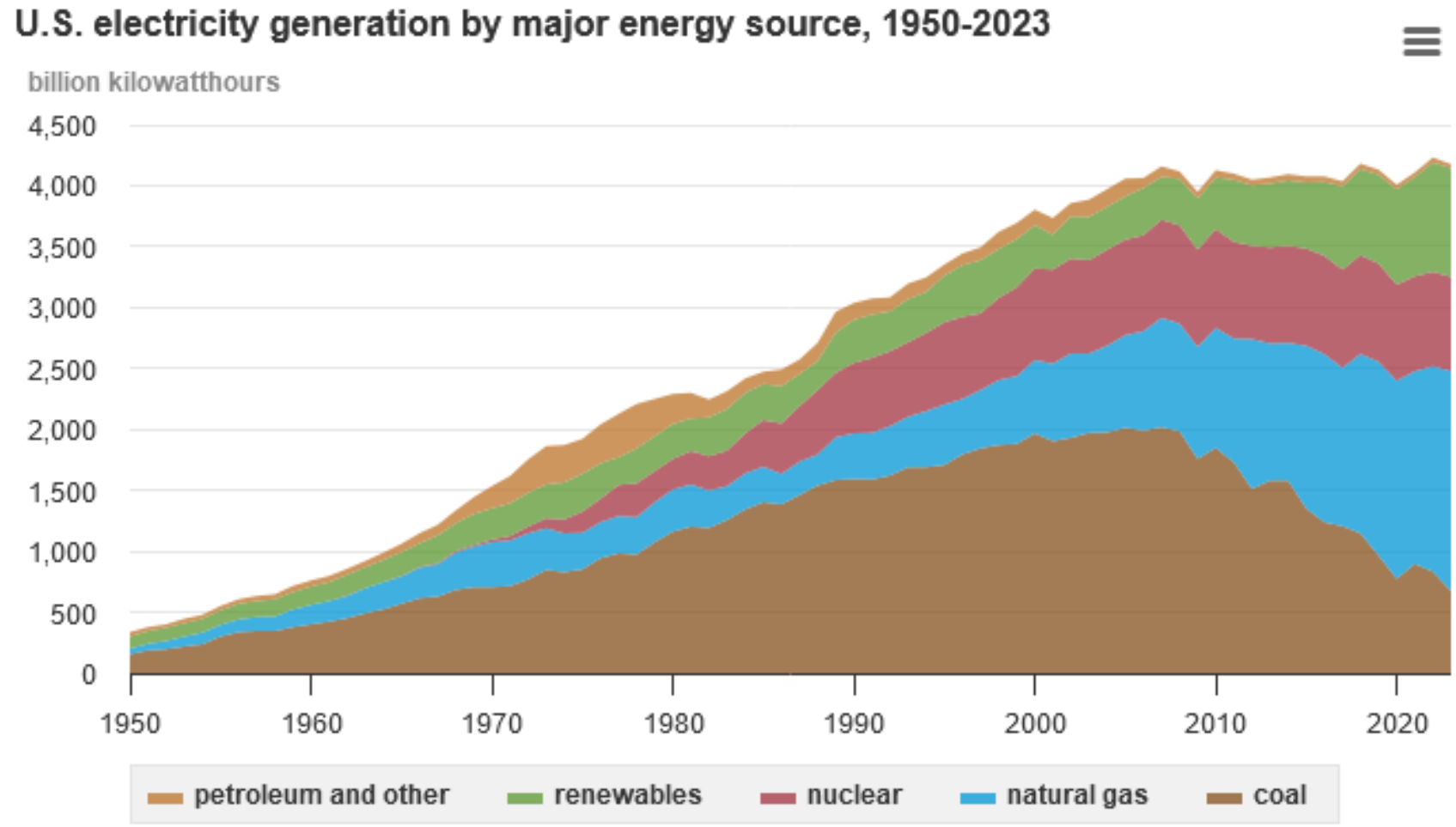
Nicor Gas | Energy Efficiency Program

U.S. Electricity Generation by Major Energy Source (1950-2023)



Source: US DOE Energy Information Administration https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php

North American Electric Reliability Corporation 2025 Summer Reliability Assessment

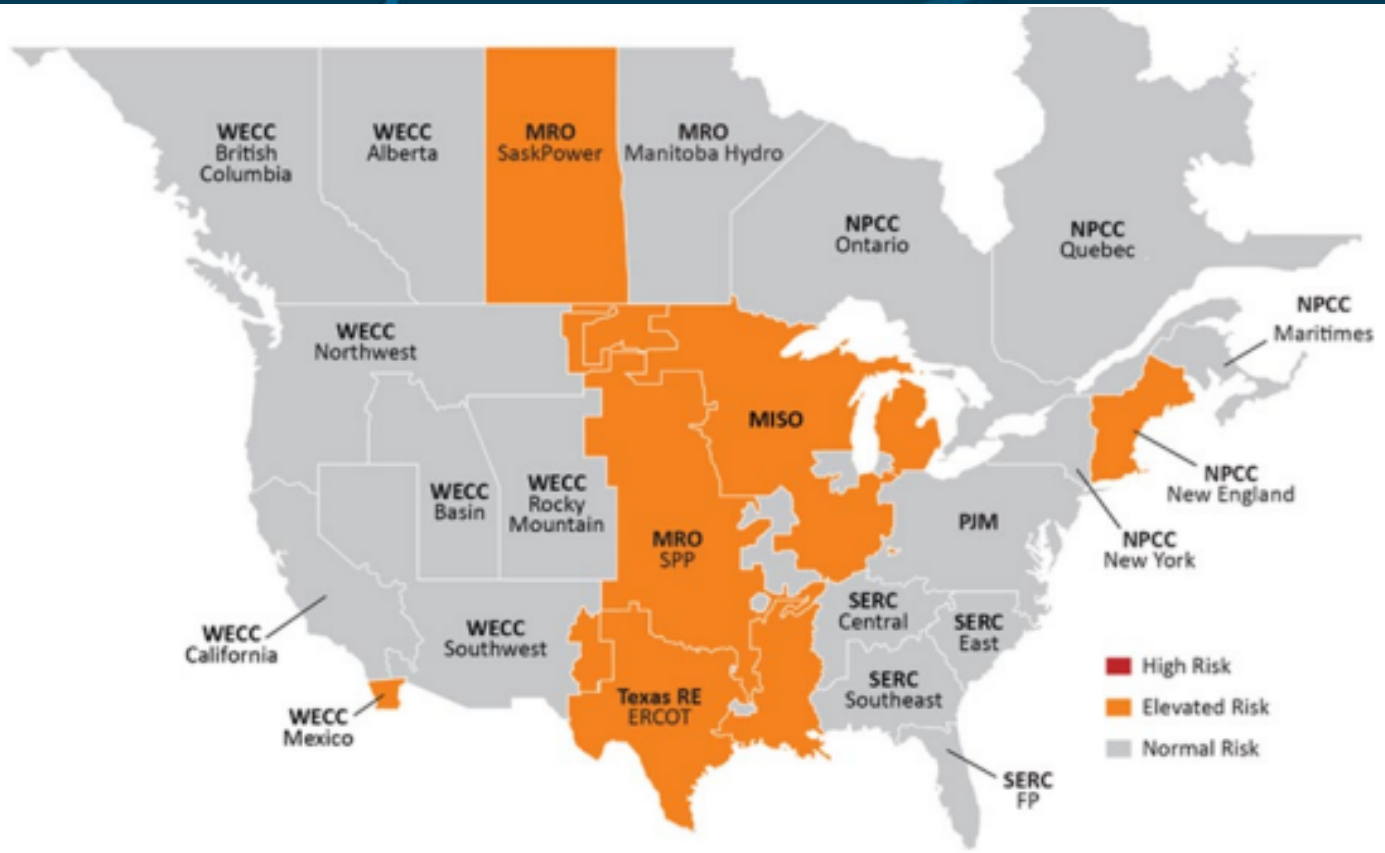
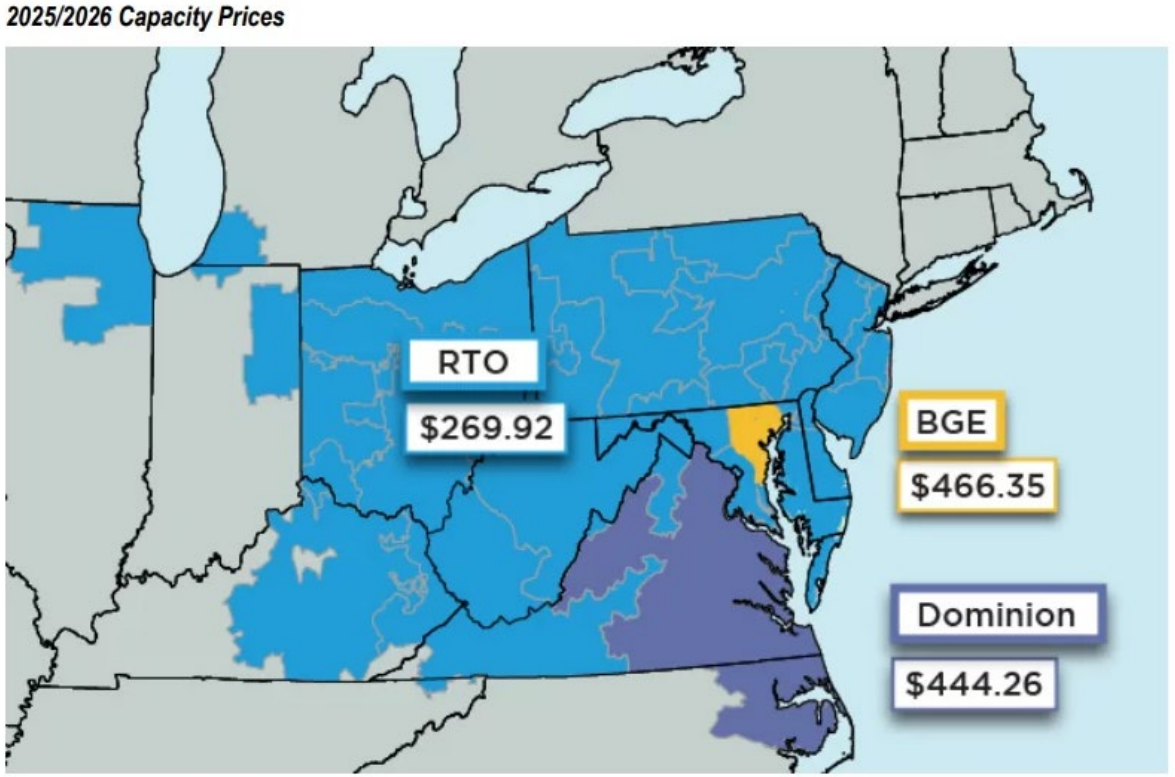


Figure 1: Summer Reliability Risk Area Summary

Seasonal Risk Assessment Summary	
High	Potential for insufficient operating reserves in normal peak conditions
Elevated	Potential for insufficient operating reserves in above-normal conditions
Normal	Sufficient operating reserves expected

Source: 2025 Summer Reliability Assessment

PJM Capacity Auction Prices Surge Over Nine-Fold, Signal Urgent Need for New Power Generation



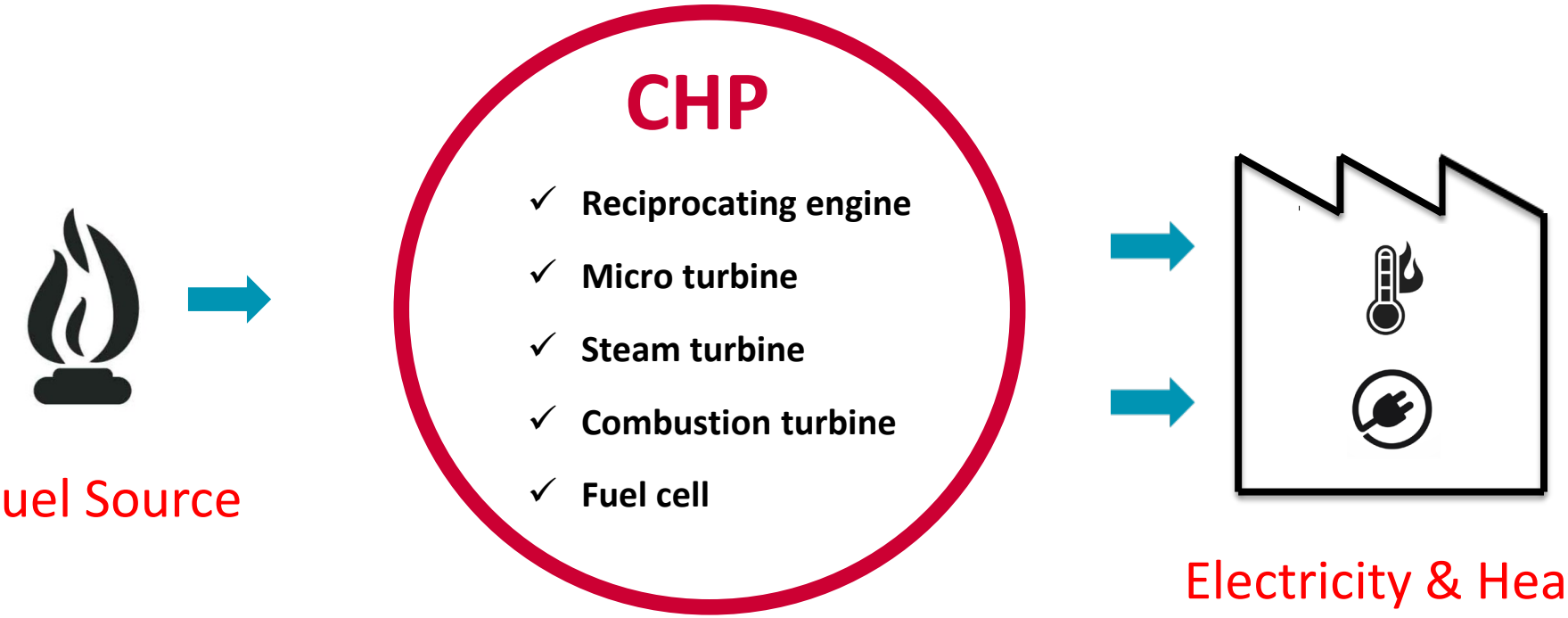
In the latest auction, covering the 12-month period from June 2025 through May 2026, prices for most of PJM jumped about 833 percent, from $28.92 per Megawatt-day in last year's auction to a record $269.92 per MW-day. The prices were even higher in two eastern sections of PJM: The Baltimore Gas and Electric zone in Maryland ($466.35 per MW-day) and in the Dominion zone in Virginia and North Carolina ($444.26 per MW-day).

https://www.powermag.com/pjm-capacity-auction-prices-surge-over-nine-fold-signal-urgent-need-for-new-power-generation/

CHP is a Demand Reduction Technology

- Customers can mitigate the impacts of market pressures on increasing demand rates by evaluating demand reduction technologies
- Combined Heat and Power (CHP) can operate as a distributed baseload energy generation asset to reduce peak demand
- CHP is an opportunity to efficiently use natural gas by generating electricity locally, and capturing heat from the CHP system for hot water/steam/chilled water needs

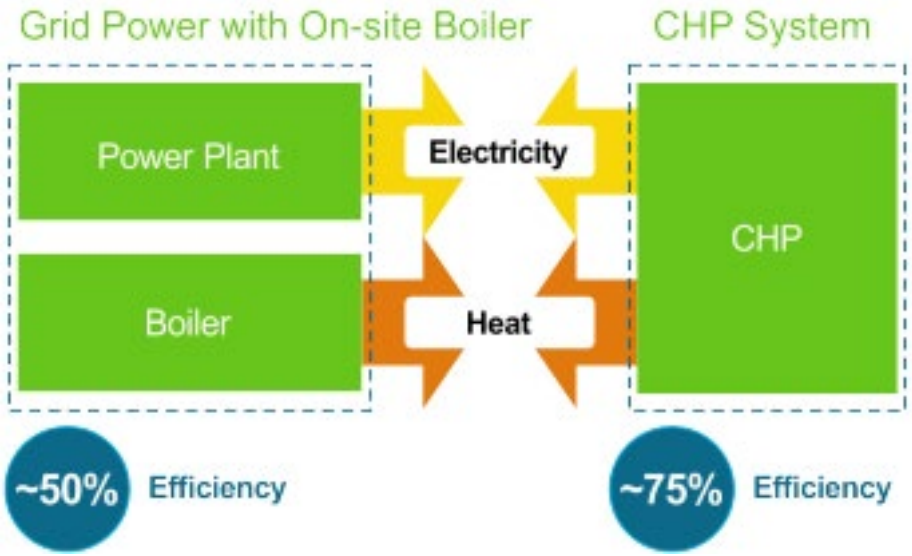
Basic Principle of CHP



Natural gas fueled generators to reduce electricity purchases and offset boiler thermal load

What is Combined Heat and Power (CHP)

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building/facility
- Provides
  - Electricity- at least a portion of the electrical load and
  - Heat or thermal energy used for:
    - » Space heating/cooling
    - » Process heating/cooling
    - » Dehumidification



Source: U.S. DOE Better Buildings Solution Center

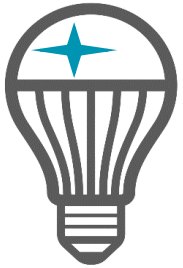
CHP provides efficient, clean, reliable, affordable energy – today and for the future.

What are the Benefits of CHP?

More efficient

Lower operating cost

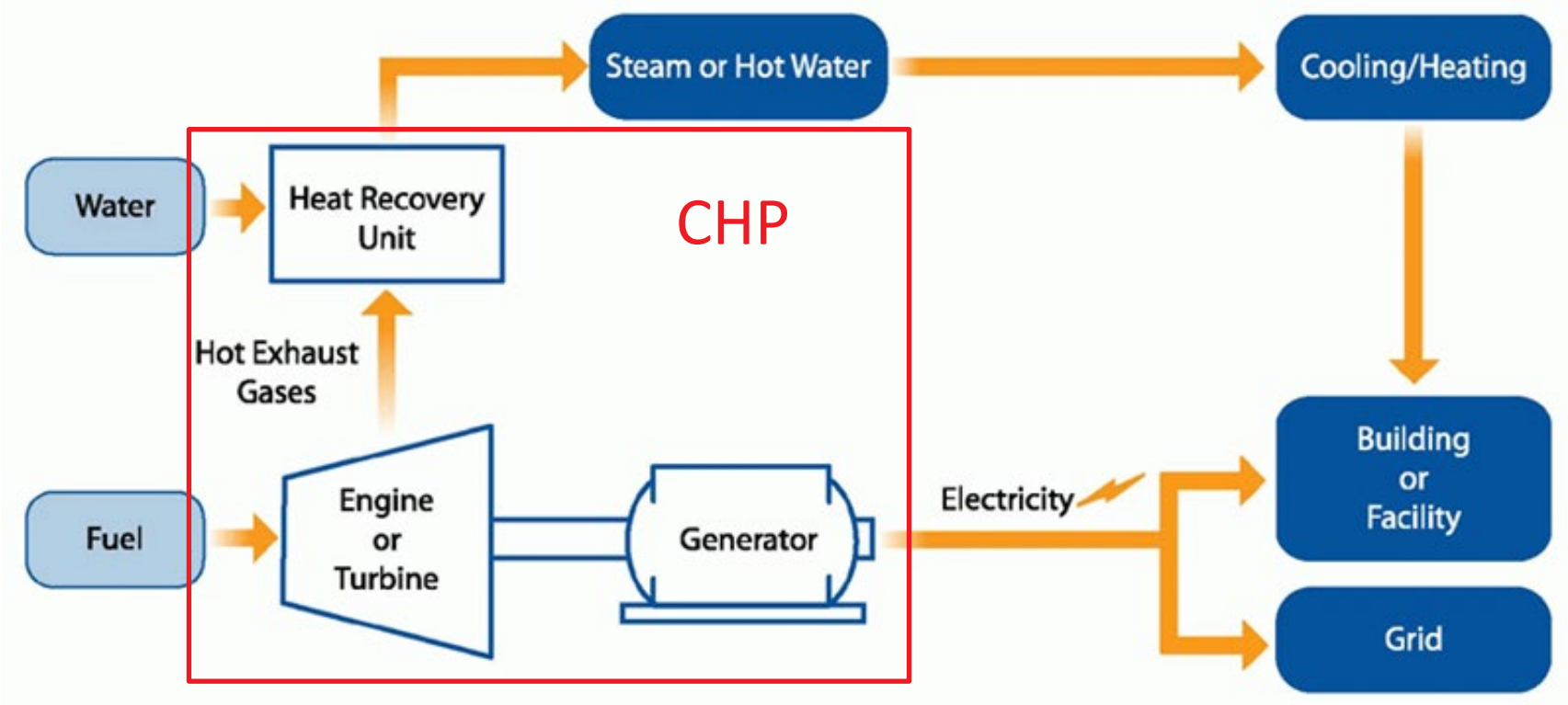
Reduces grid congestion and avoids distribution costs



Increased energy reliability

Reduces emissions of all pollutants

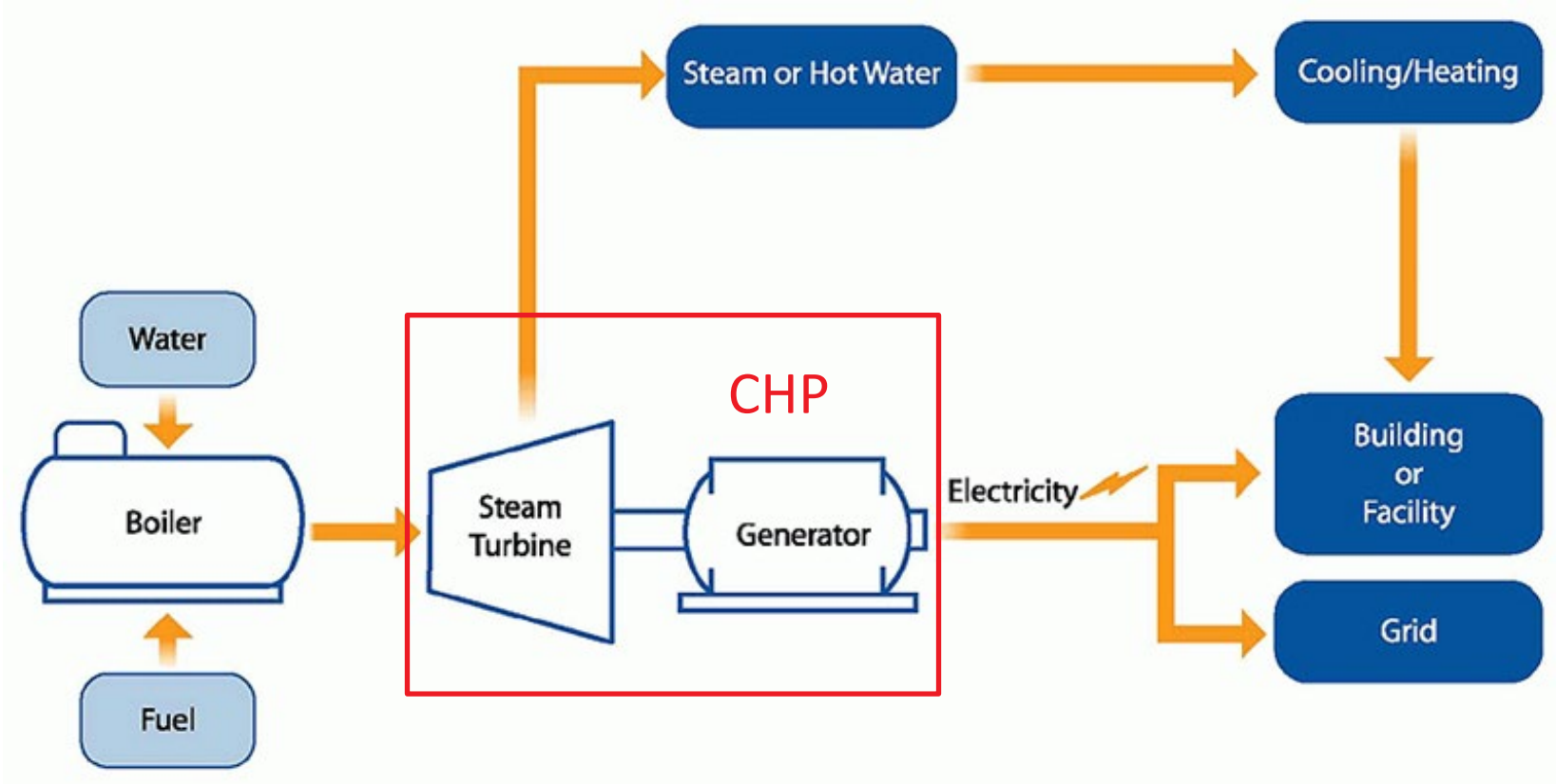
Combustion Turbine or Reciprocating Engine with Heat Recovery



Source: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Overview_of_CHP_Technologies.pdf

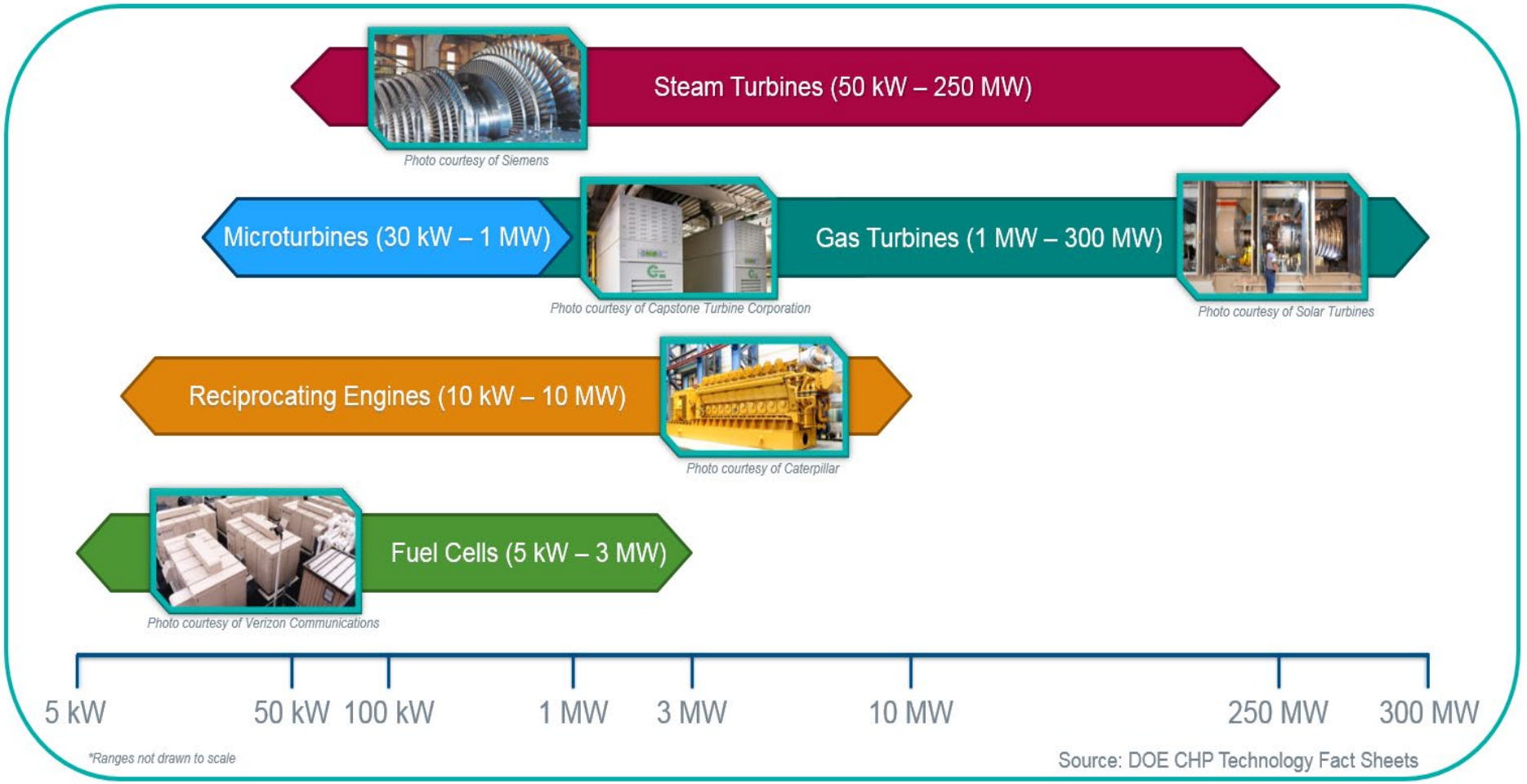
Boiler with Steam Turbine and Power (CHP)

Replace a steam pressure reducing station with
a steam turbine generator



Source: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Overview_of_CHP_Technologies.pdf

Which CHP Technology Fits my Site Energy Demand?



Example Reciprocating Engine Costs

Cost Element	CHP Reciprocating Engine (Stoichiometry and Gross Power)							
	Rich Burn			Lean Burn				
	35 kW	100 kW	250 kW	500 kW	1 MW	2 MW	3 MW	4.5 MW
CHP Equipment Cost ($/kW)	$2,250	$1,900	$1,700	$1,500	$1,300	$1,150	$1,050	$900
Installation Cost ($/kW)	$2,000	$1,800	$1,750	$1,650	$1,500	$1,400	$1,300	$1,100
Total Installed Cost ($/kW)	$4,250	$3,700	$3,450	$3,150	$2,800	$2,550	$2,350	$2,000
Non-Fuel O&M (¢/kWh)	3.0	2.5	2.2	2.0	1.7	1.5	1.4	1.3
Total Installed Cost for SCR ($/kW)	NA	NA	NA	$375	$300	$230	$180	$130
O&M Costs for SCR (¢/kWh)	NA	NA	NA	0.25	0.25	0.25	0.25	0.25

Notes: Costs are compiled from multiple sources and reported in 2020 US$. Equipment costs are based on hot water thermal recovery.

Additional cost resources at the end of the slide deck!

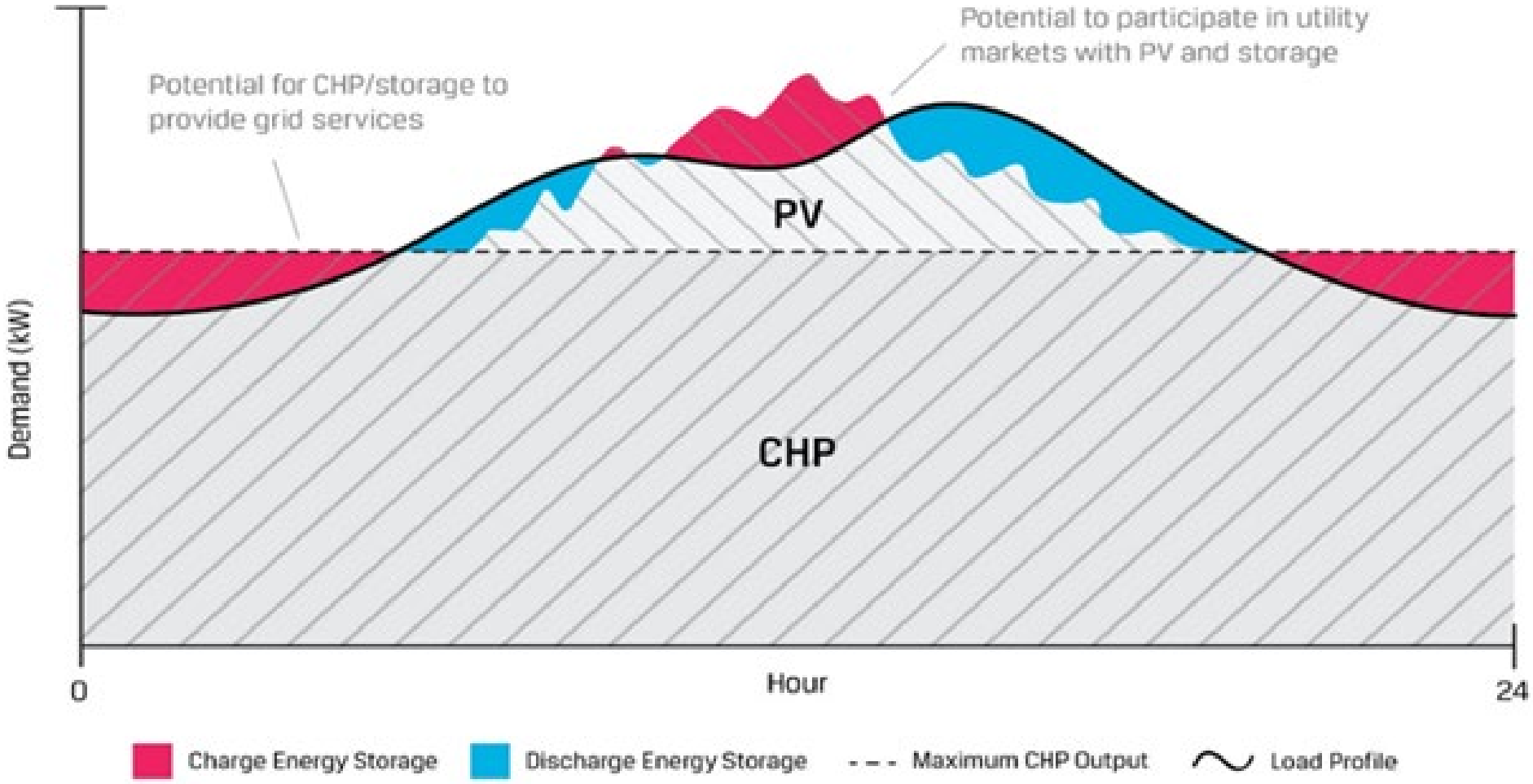
Source: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/CHP_Reciprocating_Engines.pdf

Absorption Chillers

- Can produce chilled water with excess hot water, steam, or direct exhaust gas
- Can be paired with a CHP system to provide consistent electricity and coincidental cooling
- Ideal for process cooling loads and high electricity costs
- Size ranges from 5 – 3,000 refrigeration tons
- Can produce chilled water at temperatures for refrigeration (40°F) and cold storage (<40°F)

A 300-ton absorption chiller located at a data and research center at Syracuse University, New York. The chiller uses exhaust from twelve 65-kW microturbines and can cool water to 45°F. Photo courtesy of New York-New Jersey Onsite Energy Technical Assistance Partnership (TAP).

Enabling Renewable Energy Technologies: Hybrid CHP Systems



Source: ICF

Ideal Customer for CHP

1. Necessary conditions

- High electric usage
- Coincidental major heat load
- High hours of operation

2. Equipment replacement

- Older back-up generator
- Replacing chillers
- Replacing boilers

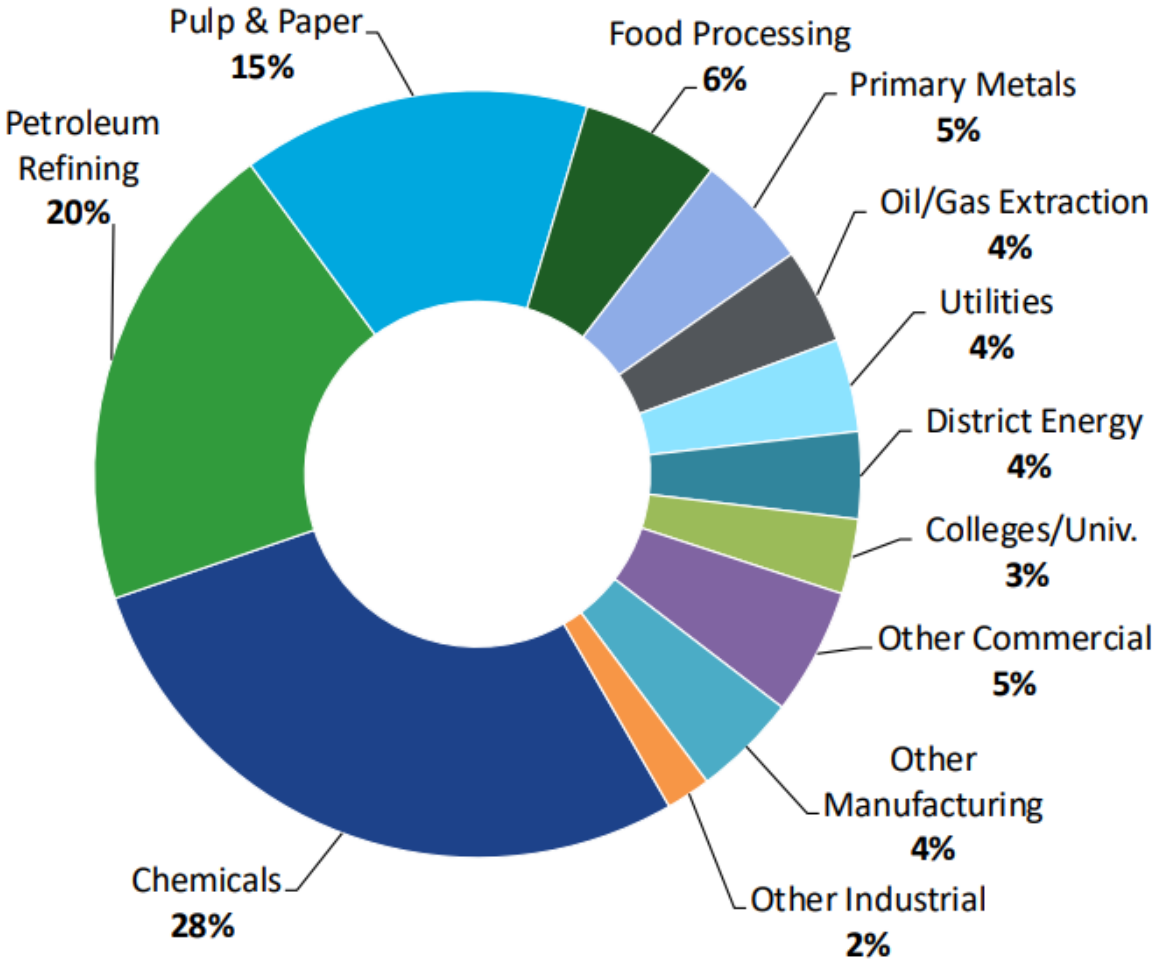
3. Customer motivation

- Utility cost
- Power reliability
- Waste heat or biofuel untapped resource
- Sustainability & environmental
- Plans to expand facility

4. Other factors

- EE measures already implemented
- Centralized HVAC

CHP Industry Snapshot

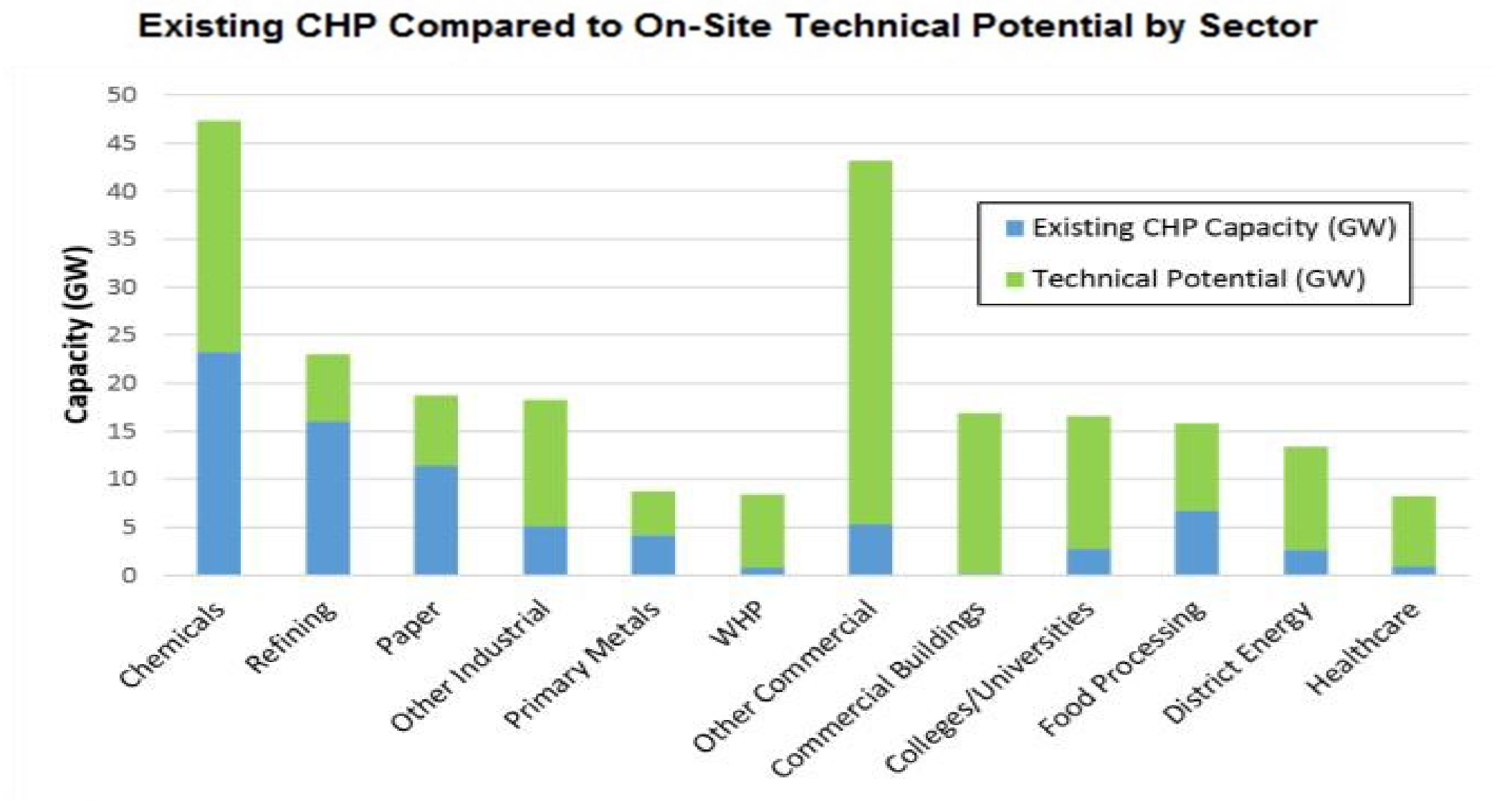


As of 2024:

- 80 GW of installed CHP at more than 4,000 sites
- ~7% of U.S. electric generating capacity
- Avoids 1.2 quadrillion Btus of fuel consumption annually
- Avoids 200 million tons of CO2 compared to separate production

Source: CHP-Summit-2024-Welcome-Address.pdf

CHP Technical Potential by Market Sector

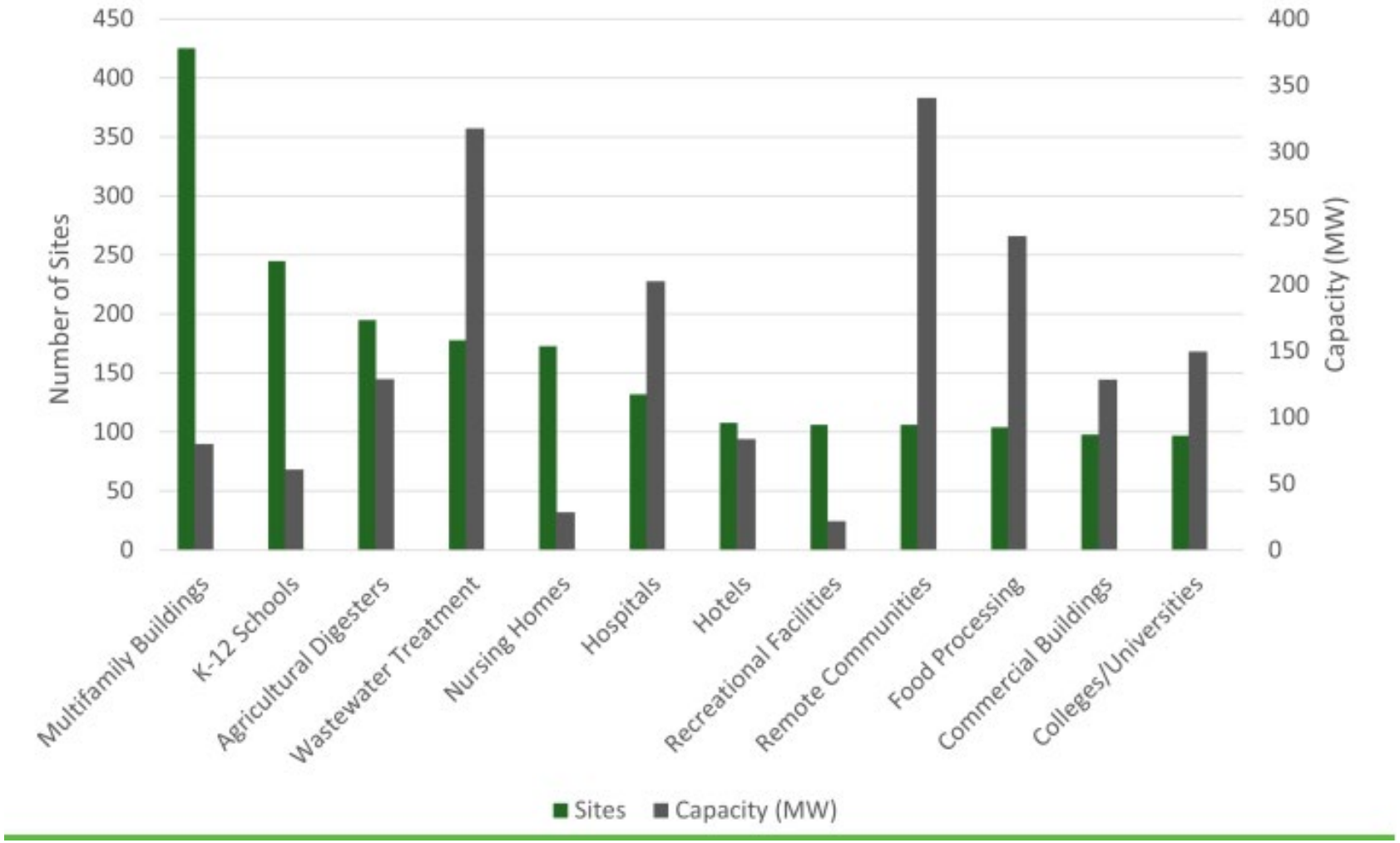


U.S. Dept. of Energy, "Combined Heat and Power (CHP) Technical Potential in the United States", March 2016.

CHP Reciprocating Engine System Installations

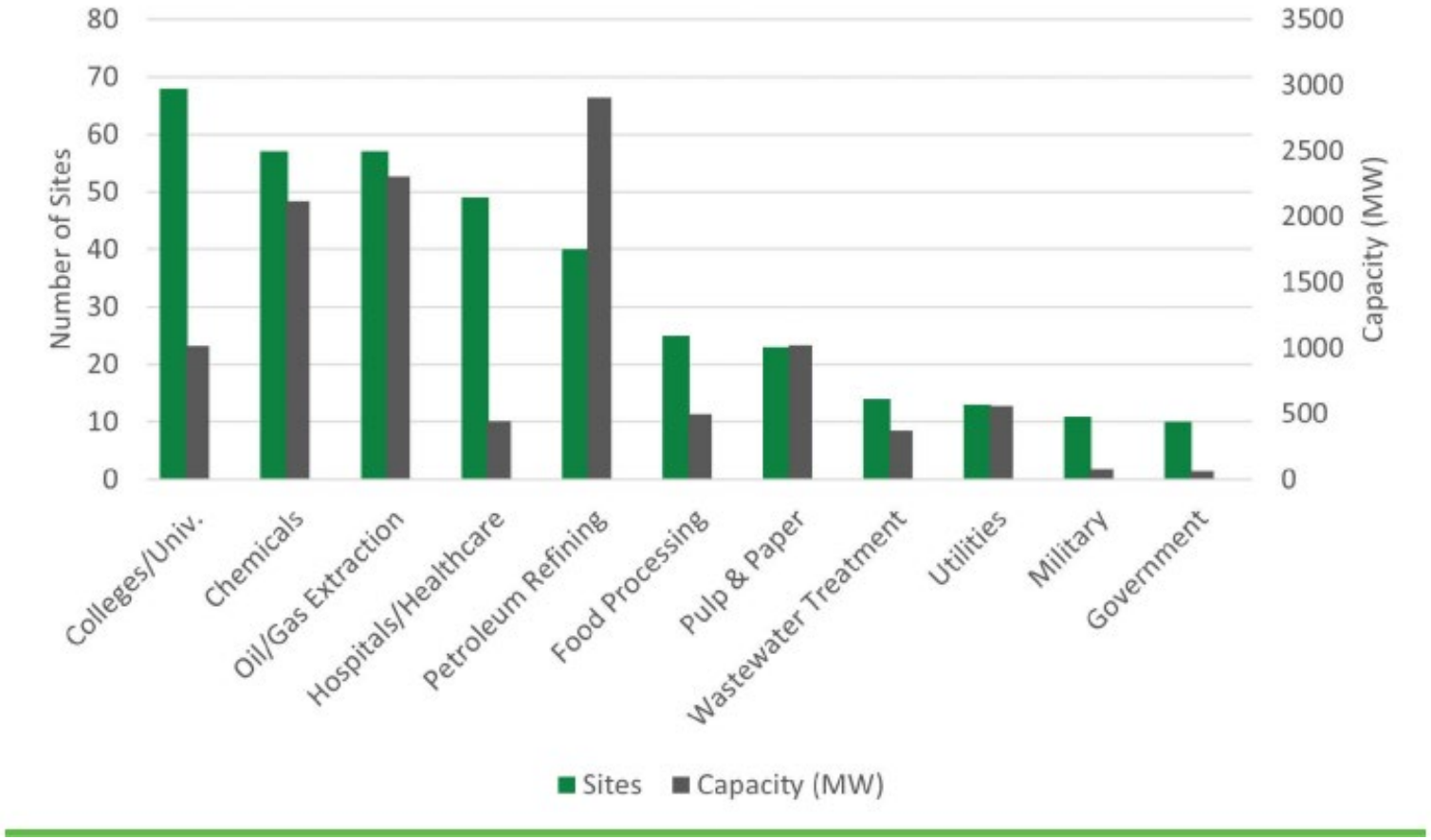
Ideal for:

- Electric load following and fluctuating demand
- Hot water production
- Low pressure steam
- Fast start-up
- Fuel flexibility



Source: U.S. DOE Better Buildings CHP Fact Sheets

CHP Combustion Turbine System Installations



Ideal for:

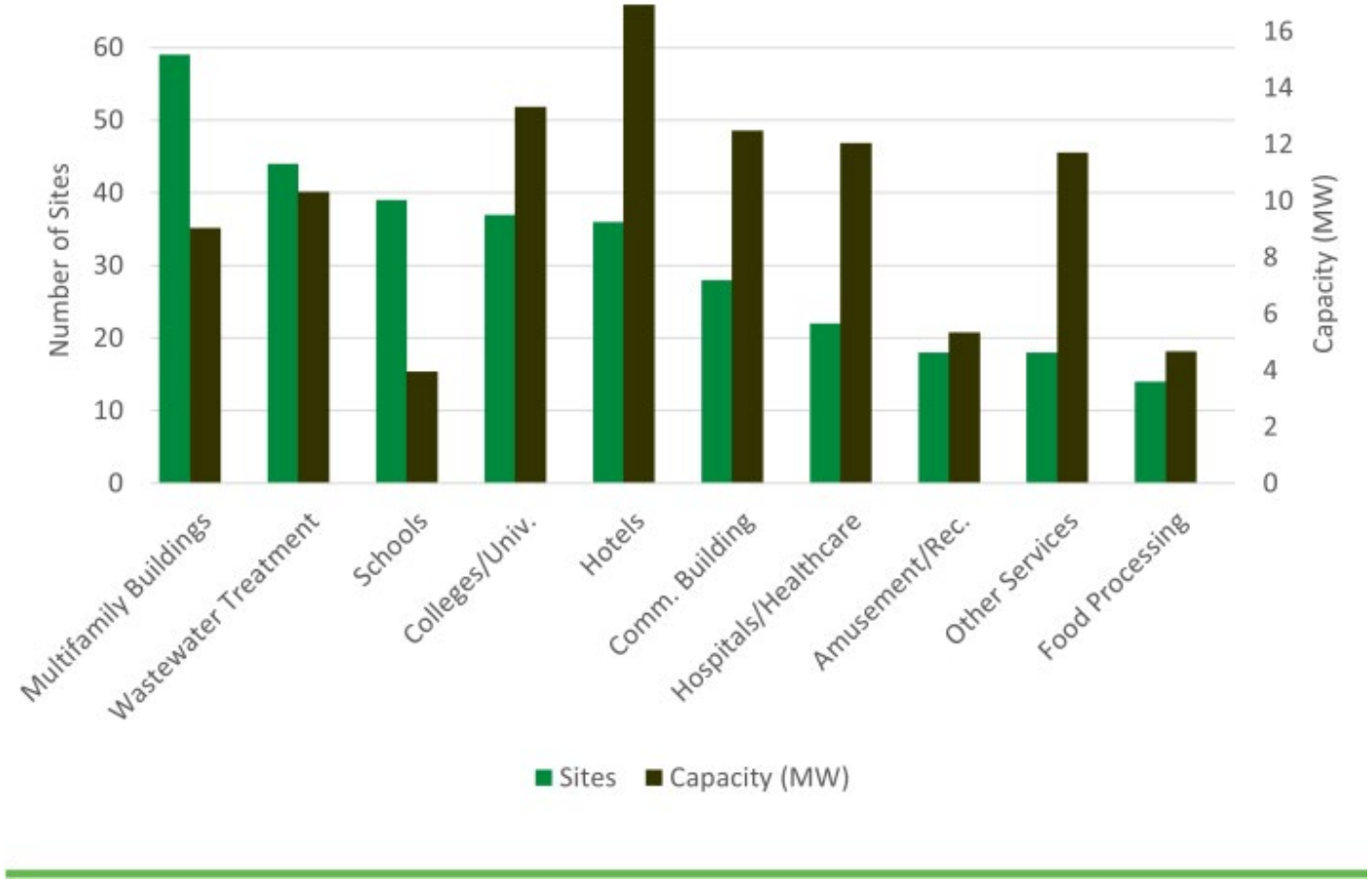
- High thermal loads
- Baseload power
- Steam
- District thermal systems

Source: U.S. DOE Better Buildings CHP Fact Sheets

CHP Microturbine System Installations

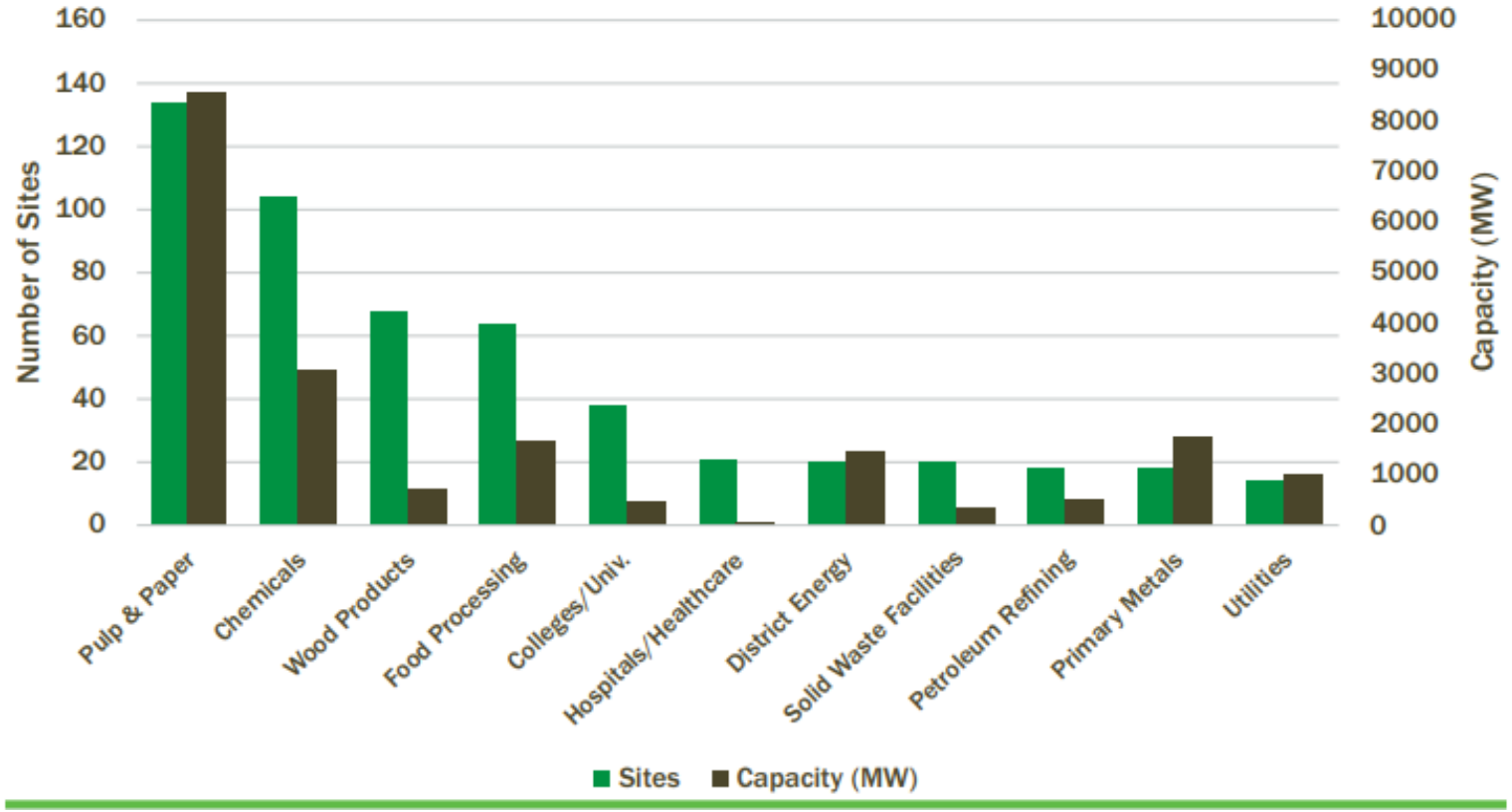
Ideal for:

- Hot water production
- Space constraints
- Modular systems
- Part load flexibility
- Low maintenance



Source: U.S. DOE Better Buildings CHP Fact Sheets

CHP Steam Turbine System Installations



Ideal for:

- Pressure Reducing Valve/Let Down Station replacement
- High pressure steam availability
- Waste heat availability

Source: U.S. DOE Better Buildings CHP Fact Sheets

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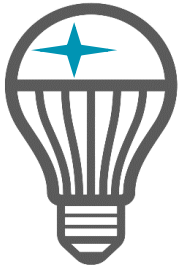

Increased energy reliability

Reduces emissions of all pollutants

CHP feasibility study and incentives

Nicor Gas CHP Feasibility Study Program

- No cost CHP Feasibility Study for eligible Nicor Gas customers
- $1/therm incentive, capped at $500,000, for installed systems after a one-year verification by the Nicor Gas Energy Efficiency Program to determine eligible therm savings
- ComEd offers an additional $0.18/claimable kWh generated
- Sites should complete an Opportunity Assessment or Facility Assessment prior to considering onsite generation - No charge

To learn more
visit **nicorgas.com/custom**

Questions?

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Additional Resources

CHP Technology Fact Sheets

CHP Installation Database

CHP eCatalog of Technologies

CHP Solution Providers