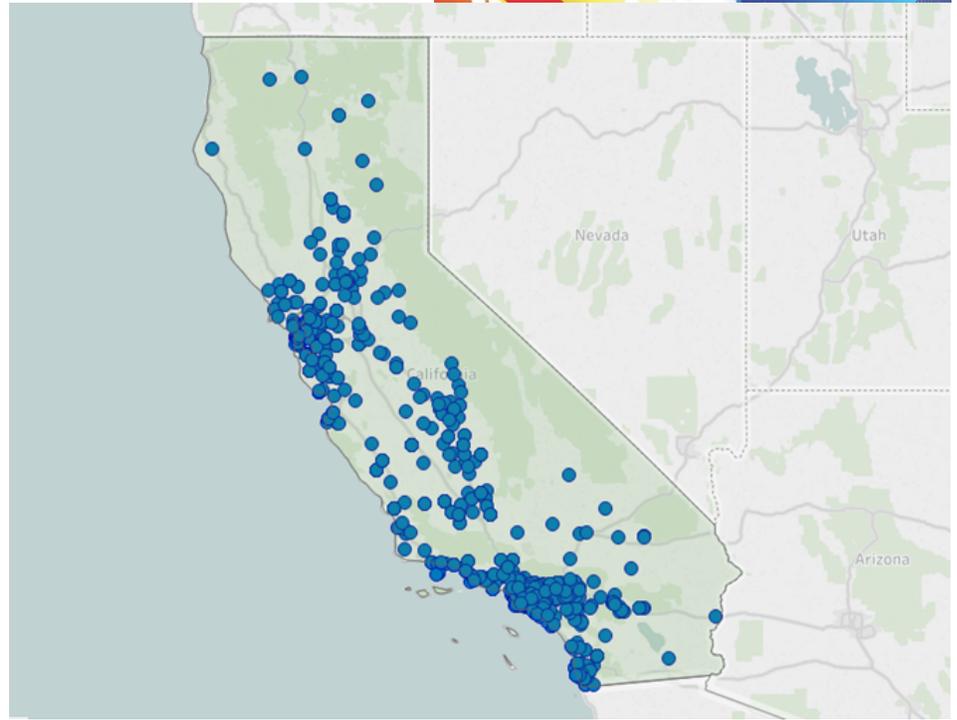


The State of CHP: California



Combined heat and power (CHP) – also referred to as cogeneration – is an efficient and clean approach to generating on-site electric power and useful thermal energy from a single fuel source. The information in this document provides a general overview of the state of CHP in California, with data on current installations, technical potential, and economics for CHP.



Map of current CHP installations in California. Illustration from ICF.

California: Installed CHP

U.S. DOE Combined Heat and Power Installation Database

The DOE CHP Installation Database is a data collection effort sponsored by the U.S. Department of Energy. The database contains a comprehensive listing of combined heat and power installations throughout the country, including those in California, and can be accessed by visiting energy.gov/chp-installs.

CHP Project Profiles

The Western CHP TAP has compiled information on certain illustrative CHP projects in California. You can access these by visiting the Department of Energy’s CHP Project Profiles Database at energy.gov/chp-projects.

Western CHP Technical Assistance Partnership

For assistance with questions about specific CHP opportunities in California, please consult with the Western CHP TAP by visiting wchptap.org or contacting the CHP TAP director.

California Existing CHP

| Sector | Sites | Capacity (MW) |
|--------------------------|--------------|---------------|
| Industrial | 182 | 3,672 |
| Commercial/Institutional | 676 | 2,139 |
| Other | 356 | 3,141 |
| Total | 1,214 | 8,952 |

Western CHP TAP Director

Shawn Jones

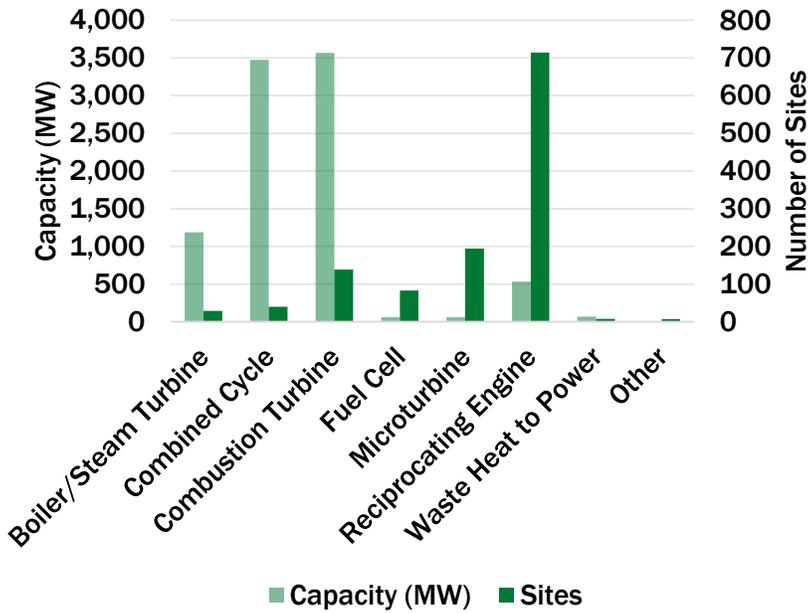
- Center for Sustainable Energy
- shawn.jones@energycenter.org
- 858-633-8739

WESTERN

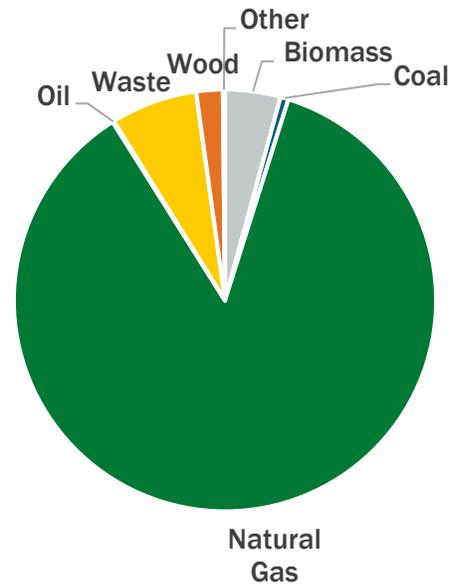


CHP
TECHNICAL ASSISTANCE
PARTNERSHIPS

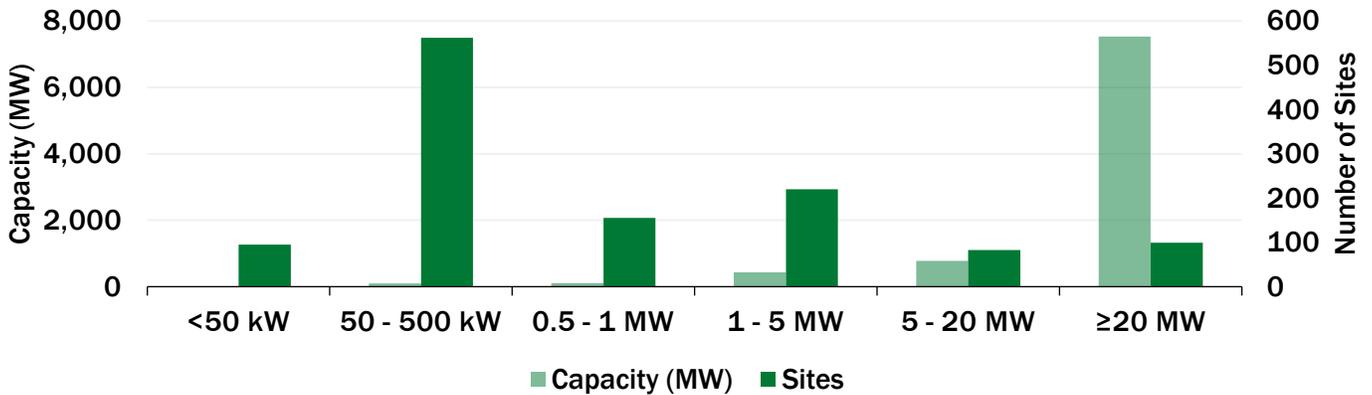
California CHP by Technology



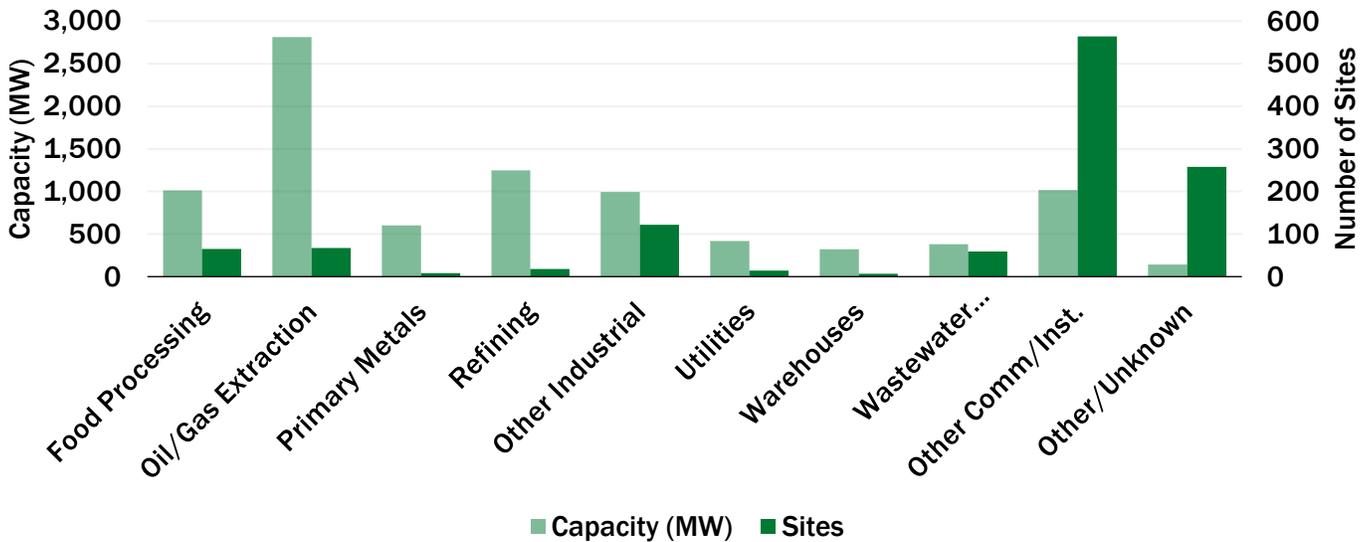
California CHP Capacity (MW) by Fuel



California CHP by Size Range



California CHP by Application



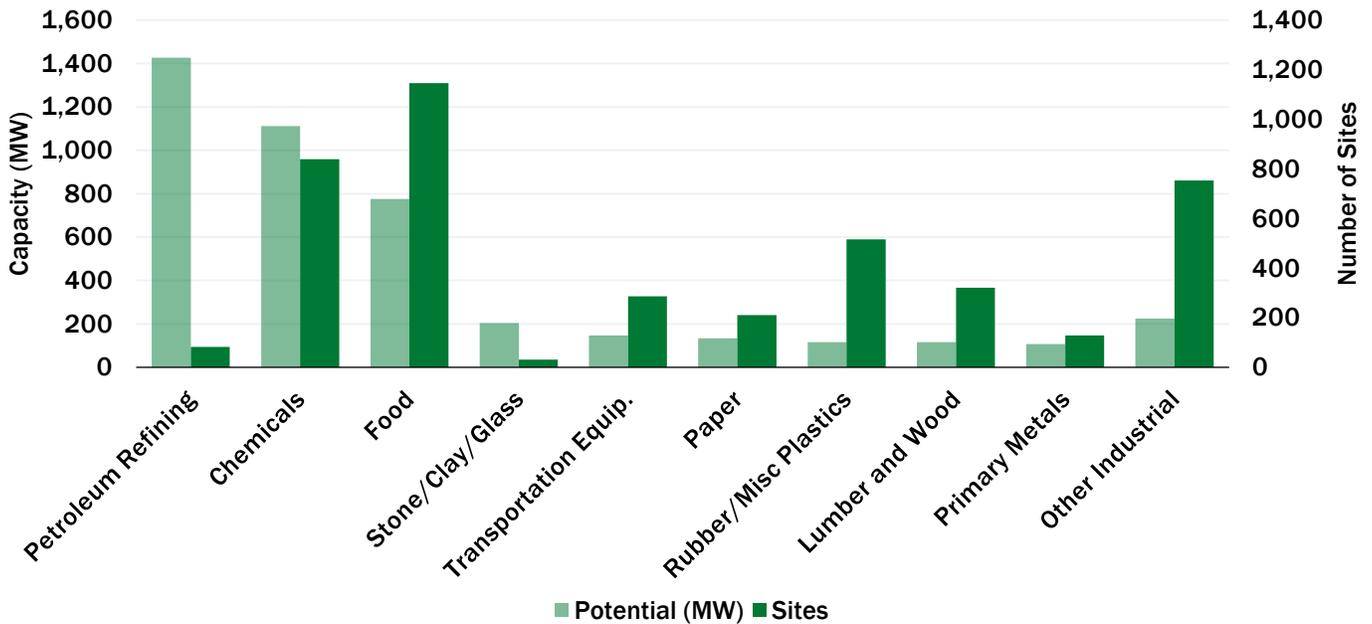
California: Technical Potential for New CHP Installations

The “Combined Heat and Power (CHP) Technical Potential in the United States” market analysis report provides data on the technical potential in industrial facilities and commercial buildings for “topping cycle” CHP, waste heat to power (WHP) CHP, and district energy CHP in the U.S. This report can be accessed at energy.gov/chp-potential.

California CHP Technical Potential

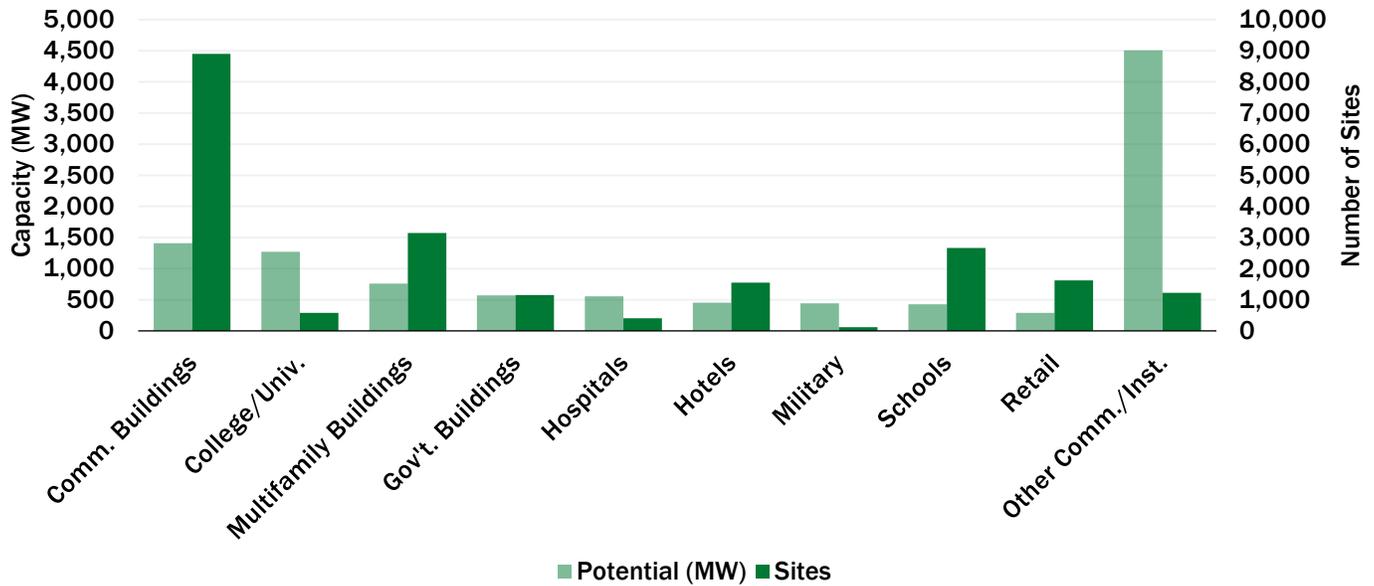
| Sector | Potential Sites | Potential MW |
|--------------------------|-----------------|---------------|
| Industrial | 4,315 | 4,362 |
| Commercial/Institutional | 24,646 | 7,179 |
| Total | 28,961 | 11,542 |

California Technical Potential (MW) for Industrial CHP Applications



| Application | 50-500 kW | | 0.5 - 1 MW | | 1 - 5 MW | | 5 - 20 MW | | >20 MW | | Total | |
|-----------------------|--------------|------------|------------|------------|------------|--------------|-----------|------------|-----------|--------------|--------------|--------------|
| | Sites | MW | Sites | MW | Sites | MW | Sites | MW | Sites | MW | Total Sites | Total MW |
| Petroleum Refining | 3 | 1 | 10 | 8 | 42 | 102 | 6 | 48 | 21 | 1,268 | 82 | 1,427 |
| Chemicals | 492 | 94 | 123 | 91 | 181 | 430 | 39 | 331 | 5 | 165 | 840 | 1,111 |
| Food | 852 | 155 | 131 | 97 | 132 | 263 | 30 | 240 | 1 | 21 | 1,146 | 776 |
| Stone/Clay/Glass | 2 | 0.5 | 1 | 1 | 13 | 48 | 14 | 122 | 1 | 33 | 31 | 204 |
| Transportation Equip. | 242 | 35 | 21 | 14 | 18 | 45 | 6 | 53 | 0 | 0 | 287 | 147 |
| Other Industrial | 1,602 | 267 | 178 | 127 | 145 | 267 | 4 | 35 | 0 | 0 | 1,929 | 697 |
| Total | 3,193 | 553 | 464 | 338 | 531 | 1,155 | 99 | 831 | 28 | 1,486 | 4,315 | 4,362 |

California Technical Potential (MW) for Commercial/Institutional CHP Applications



| Application | 50-500 kW | | 0.5 - 1 MW | | 1 - 5 MW | | 5 - 20 MW | | >20 MW | | Total | |
|-----------------------|---------------|--------------|--------------|--------------|--------------|--------------|------------|--------------|-----------|------------|---------------|--------------|
| | Sites | MW | Sites | MW | Sites | MW | Sites | MW | Sites | MW | Total Sites | Total MW |
| Commercial Buildings | 6,430 | 322 | 1,979 | 792 | 495 | 297 | 0 | 0 | 0 | 0 | 8,904 | 1,410 |
| College/Univ. | 336 | 55 | 33 | 20 | 141 | 423 | 63 | 538 | 8 | 236 | 581 | 1,273 |
| Multifamily Buildings | 2,130 | 160 | 825 | 413 | 185 | 185 | 0 | 0 | 0 | 0 | 3,140 | 757 |
| Government Buildings | 948 | 131 | 85 | 58 | 97 | 189 | 19 | 148 | 2 | 45 | 1,151 | 571 |
| Hospitals | 114 | 32 | 93 | 67 | 192 | 390 | 9 | 66 | 0 | 0 | 408 | 555 |
| Other Comm./Inst. | 9,856 | 1,356 | 349 | 222 | 199 | 399 | 58 | 448 | 4 | 418 | 10,469 | 2,842 |
| Total | 19,814 | 2,055 | 3,364 | 1,571 | 1,309 | 1,883 | 149 | 1,201 | 14 | 699 | 24,653 | 7,409 |

Department of Energy CHP Accelerators

Packaged CHP Accelerator

Standardized packaged CHP systems can reduce risk for both CHP users and suppliers by reducing design errors, limiting uncertainty about performance, shortening project development time, and reducing overall costs. Accelerator partners will validate the installation, performance, and economic and resiliency benefits of packaged CHP systems, evaluate the integration of new technologies and packaged CHP, and identify R&D challenges. For more information, visit <https://betterbuildingsinitiative.energy.gov/accelerators/packaged-chp>

CHP for Resiliency Accelerator

The U.S. DOE collaborated with cities, states, utilities, and other stakeholders who are actively pursuing CHP as a consideration in resiliency planning for critical infrastructure in their jurisdictions. This included defining resiliency, identifying critical infrastructure, and assessing CHP opportunities. This process was documented in the DG for Resilience Planning Guide and the CHP for Resilience Screening Tool. For more information, visit <https://betterbuildingsinitiative.energy.gov/accelerators/combined-heat-and-power-resiliency>

California: CHP Economics

The most important indicators for CHP economics are electricity and gas prices. For most potential CHP installations, natural gas and electricity rates for host facilities will fall within the range of average commercial and industrial prices. Lower energy prices may be possible for large CHP applications.

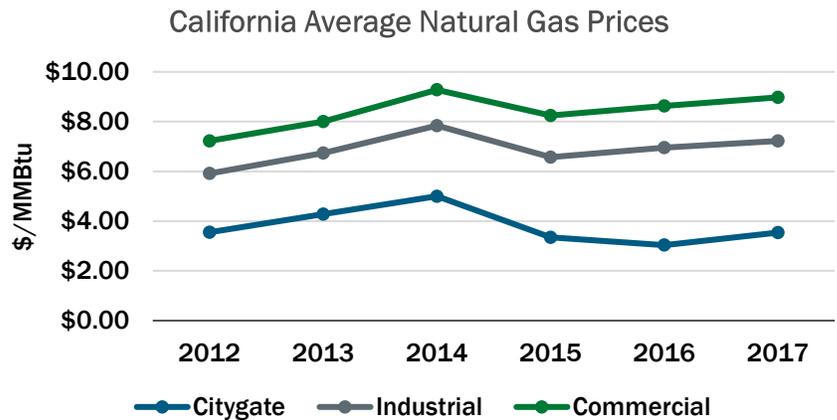
California Natural Gas Prices

The EIA industrial natural gas price is a full tariff rate, and most large consumers are purchasing gas commodities from marketers at a lower rate.

California Average Gas Prices (\$/MMBtu) - 2017

| Sector | CA Price | U.S. Price |
|------------|----------|------------|
| Citygate* | 3.54 | 4.26 |
| Industrial | 7.23 | 4.20 |
| Commercial | 8.98 | 8.08 |

*Citygate is a point or measuring station at which a distributing gas utility receives gas from a NG pipeline company or transmission system.

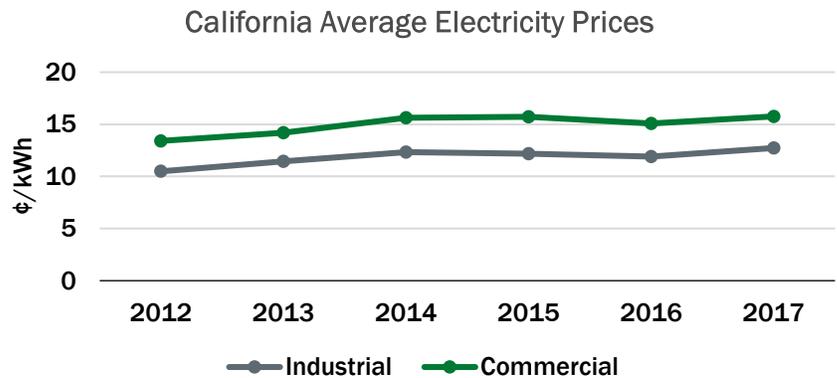


California Electricity Prices

Electricity rates can vary greatly by utility and facility size range. The rates below from EIA represent general averages; individual facility rates may vary.

California Average Electricity Prices (¢/kWh) - 2017

| Sector | CA Price | U.S. Price |
|------------|----------|------------|
| Industrial | 12.73 | 6.88 |
| Commercial | 15.76 | 10.66 |



California Average Delivered Electricity Prices by Utility

| Utility | Industrial Price (¢/kWh) | Commercial Price (¢/kWh) | Average Price (¢/kWh) |
|-------------------------------|--------------------------|--------------------------|-----------------------|
| San Diego Gas & Electric | 17.28 | 21.22 | 19.25 |
| Pacific Gas & Electric | 17.31 | 20.50 | 18.90 |
| LA Dept. of Water & Power | 14.30 | 15.48 | 14.89 |
| Pacific Power | 13.49 | 14.97 | 14.23 |
| Imperial Irrigation District | 14.81 | 12.31 | 13.56 |
| Turlock Irrigation District | 12.53 | 13.47 | 13.00 |
| Southern California Edison | 10.97 | 14.21 | 12.59 |
| Sacramento Municipal District | 10.57 | 13.75 | 12.16 |
| Modesto Irrigation District | 10.08 | 14.02 | 12.05 |

