



Combined Heat and Power

Combined heat and power (CHP) systems, also referred to as *cogeneration*, generate on-site electricity and useful thermal energy in a single integrated system. As a result, well-designed CHP systems consume less fuel than would be required to obtain electricity and thermal energy separately. Since less fuel is consumed, CHP systems offer greenhouse gas (GHG) reduction benefits over the conventional method of obtaining heat from a boiler and power from the electric grid. Furthermore, since much of the energy of a CHP system is consumed on-site as a form of distributed generation (DG), less energy is lost through transmission, adding to the energy savings.

CHP can also provide opportunities to use renewable fuels. For example, wastewater treatment facilities are ideal for developing CHP systems as they use the waste heat on-site to warm the digesters and export excess renewable electricity to the grid.¹ Other potential bioenergy sites that could use CHP include dairies, food processing plants, and forestry camps. However, the feasibility of developing CHP at such sites depends on a large and constant need for waste heat throughout the year.

Two state policies set the goals for CHP development in California. One is Assembly Bill 32 (AB 32, Núñez, Chapter 488, Statutes of 2006), the Global Warming Solutions Act. Under this act, the California Air Resources Board (ARB) prepared an *AB 32 Scoping Plan*² that includes a reduction goal of 6.7 million metric tons (MMT) of carbon dioxide (CO₂) from CHP resources. In May 2014 the ARB published the *First Update to the Climate Change Scoping Plan*³, which reiterated the goals outlined in the original *Scoping Plan*. Also, Governor Brown's 2010 *Clean Energy Jobs Plan* calls for 6,500 megawatts (MW) of new CHP capacity by 2030.

California's goals align with those of the nation as President Obama issued an executive order calling for 40 gigawatts of new CHP by 2020.⁴

These policy goals have a significant effect on electric system planners and operators. Sites that use CHP electricity on-site reduce the need for grid electricity, thereby affecting the retail electric sales forecast and the amount of renewable generation needed to meet California's [Renewables Portfolio Standard](#) (RPS) requirements. For more information about the RPS, see http://www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf.

1 O'Neill, Garry, John Nuffer. 2011. *2011 Bioenergy Action Plan*. California Energy Commission, Efficiency and Renewables Division. Publication Number: CEC-300-2011-001-CMF.

2 http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

3 http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.

4 <http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency>.



CHP Market Potential

A 2011 report by ICF International, Inc., studied the long-term potential for CHP in California and the degree to which CHP can reduce potential GHG emissions over the two decades leading up to 2030. The report examines three possible scenarios using existing state policies in a Base Case and two additional cases (Medium and High) to show the market effects of additional CHP policy actions and incentives, including, but not limited to, an extension of the Self-Generation Incentive Program⁵ (the program is discussed further on page 4); reduction of standby and demand charges; and changes to export pricing. The additional cases were designed to prompt discussion and provide perspective as to what degree of development may occur if certain policy actions are taken. A summary of the results are provided in **Table 1**.⁶

Table 1: ICF Study of Combined Heat and Power Potential: 2030 Cumulative New Market Penetration by Scenario (MW)

Scenarios	On-Site	Export	Avoided Air Conditioning	Total
Base Case	1,513	213	160	1,886
Medium Case	1,782	1,661	186	3,629
High Case	3,289	2,458	361	6,108

Source: ICF International, Inc.

A subset of this information was a 2009 Energy Commission report that focused on wastewater treatment facilities.⁷ This study concluded that there could be as much as 450 MW of market potential for CHP at wastewater treatment facilities in California “by adding biodegradable waste from California dairies, food processing plants, and restaurants’ oil and grease to the sludge in the anaerobic digesters.”

Support for CHP

Wastewater treatment facilities in the Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), or San Diego Gas & Electric Company (SDG&E) service territories qualify for a standard contract for eligible CHP facilities up to 3 MW. The program was created by Assembly Bill 1969 (Yee, Chapter 731, Statutes of 2006) to encourage development of renewable energy at wastewater treatment facilities.

⁵ <http://www.cpuc.ca.gov/General.aspx?id=5935>.

⁶ <http://www.energy.ca.gov/2012publications/CEC-200-2012-002/CEC-200-2012-002-REV.pdf>.

⁷ <http://www.energy.ca.gov/2009publications/CEC-200-2009-014/CEC-200-2009-014-SD.PDF>.



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CHP facilities up to 20 MW in size can also secure a revenue stream through the Waste Heat Recovery and Carbon Emissions Reduction Act, also known as Assembly Bill 1613 (Blakeslee, Chapter 713, Statutes of 2007).⁸ This legislation created a feed-in tariff for certified CHP facilities that meet efficiency and performance requirements. The Energy Commission certifies AB 1613 facilities, while the rates are set by the California Public Utilities Commission (CPUC).⁹ Certified AB 1613 facilities must submit performance information to the Energy Commission annually to maintain eligibility for the feed-in tariff.¹⁰ As of September 2016, seven facilities are certified as eligible under AB 1613. See **Table 2** for a list of currently certified facilities.

Table 2: AB 1613 Certified Facilities

Facility Name	Thermal Application	System Size (MW)
Sonoma County	Space conditioning	1.4
Chevron McKittrick	Crude oil extraction	10.3
Pixley Cogen	Ethanol distillation	12
Houweling Tomatoes	Greenhouse conditioning	13
Elk Grove Milling	Cooking	1
Technicast	Metal heating	1.4
SunSelect Produce	Greenhouse conditioning	6.2
Total Certified Capacity		45.3

Source: Energy Commission staff

The Qualifying Facilities Settlement Agreement established a new vehicle for contracting with CHP facilities greater than 5 MW in the investor-owned utility service territories. The Qualifying Facilities Settlement Agreement set capacity targets for each utility to contract with eligible CHP facilities through competitive solicitations, as well as GHG emissions reduction targets. The CPUC typically provides semiannual reports on utility progress toward meeting the targets of the settlement agreement each April and October. The most recently published reports are available at <http://www.cpuc.ca.gov/General.aspx?id=5432>.

In Decision 15-06-028, the CPUC—citing the likelihood that other preferred resources will provide greater GHG reduction potential in the future—reduced the utilities’ GHG reduction

⁸ <http://www.energy.ca.gov/wasteheat/>.

⁹ <http://www.cpuc.ca.gov/PUC/energy/CHP/feed-in+tariff.htm>.

¹⁰ Annual performance data are submitted in April.



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targets. The decision describes the new targets as being still robust enough to achieve other CHP policy objectives beyond GHG emission reductions.

The settlement targets and progress to date are shown in **Table 3** and **Table 4**. The revised GHG targets and the utilities' progress toward both their procurement and GHG reduction targets are based on the CPUC's July 2016 semiannual report and are subject to change as more data are made available. According to the report, both PG&E and SCE have met their capacity procurement targets. PG&E has also met its GHG reduction target.

Table 3: Tracking QF Settlement MW Targets (MW)

Utility	CHP Capacity Procured by IOUs to Date	IOU 2015 CHP Targets	Remaining Capacity to Procure
PG&E	1,497	1,387	0
SCE	1,455	1,402	0
SDG&E*	134	211	77
Total	3,086	3,000	77

*SDG&E has until 2018 to reach its target.

Source: CPUC

Table 4: Tracking QF Settlement GHG Targets (in MMTCO₂e)

Utility	Initial GHG Target (D.10-12-035)	Revised GHG Target (D.15-06-028)	Utility Progress Toward GHG Target	Remaining Reductions
PG&E	2.17	1.22	1.52	0
SCE	2.15	1.22	0.78	0.44
SDG&E	0.5	0.28	0.02	0.26
Total	4.8	2.72	2.32	0.70

Source: CPUC

Additional incentives are provided to small, clean, and efficient CHP units through the Self-Generation Incentive Program (SGIP). The SGIP provides rebates for eligible distributed energy systems installed on the customer's side of the utility meter. Eligible technologies include wind turbines, waste heat to power technologies, pressure reduction turbines,¹¹ internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems. In June 2016, the CPUC issued Decision 16-06-055, which adopted several program modifications, including a more stringent GHG emissions threshold. Moreover, beginning in 2017, natural gas

¹¹ *Pressure reduction turbines* can control the pressure in pressurized systems using a rotatable barrier device, which generates electricity from the resulting pressure drop.



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technologies must be fueled by a mixture of at least 10 percent biogas to retain program eligibility. This requirement becomes more stringent each year, up to 100 percent biogas in 2020.

In October 2015, the CPUC issued decision D.15-10-049 which approved, with modification, Southern California Gas Company's (SoCalGas) application A.14-08-007 to establish a Distributed Energy Resources Services (DERS) Tariff. The DERS Tariff allows SoCalGas to design, install, own, operate, and maintain advanced energy systems, including many forms of CHP, on or adjacent to the customer's premises. It is designed to help overcome barriers for potential customers that might lack the internal capital and experience necessary to develop and operate such facilities. The DERS Tariff could help develop the largely untapped market potential of CHP facilities with 20 MW or less in nameplate capacity.

The Energy Commission also conducts research through its Research and Development Division that seeks to develop and help bring to market CHP technologies that provide increased environmental benefits, greater system reliability, and lower system cost for communities and utilities across the state.¹²

Despite these programs, CHP growth in California has been slow in recent years. Currently, the Energy Commission is examining scenarios in which California's CHP capacity may decline in the near future if large facilities relying on power purchase agreements struggle to secure new contracts. These are important factors in developing reliable demand forecasts, in assessing local reliability concerns that arise from the potential closure of critical facilities, and in assessing progress toward and supporting California's ambitious CHP policy goals. Staff will continue to engage industry, commercial businesses, institutions, and communities, exploring opportunities to meet their thermal needs efficiently and affordably while improving the resiliency and reliability of California's electricity system.

Additional References:

For information about the CPUC QF Settlement Agreement, Terms Sheet, semiannual reports, and GHG reductions please visit <http://www.cpuc.ca.gov/General.aspx?id=5432>.

For additional CHP-related information and events at the Energy Commission, please visit the Commission's CHP website at <http://www.energy.ca.gov/chp>

For information regarding the technical potential of CHP both nationally and on a state-by-state basis, a report published by the United States Department of Energy is available at: <http://energy.gov/sites/prod/files/2016/04/f30/CHP%20Technical%20Potential%20Study%203-31-2016%20Final.pdf>

¹² <http://www.energy.ca.gov/research/renewable/chp.html>.



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Next Update:

September 2017 with updates provided annually.