Combined Heat and Power: Progress and Potential

September 24, 2009

Key Messages

- Combined heat and power (CHP) is important to our electric supply portfolio and customers.
- PG&E supports efficient CHP that contributes to statewide GHG emission reductions.
- PG&E sees CHP as an opportunity to reduce GHG emissions in PG&E's electric supply portfolio and strives to balance these efforts with its other procurement objectives as a utility.

Combined heat and power (CHP) is important to our electric supply portfolio and customers

- PG&E currently has 77 PPAs with QFs that own or operate CHP facilities
- More than 260 customers operate CHP in PG&E's service area
- PG&E's CHP resources represent a diverse range of sizes & applications
  - Less than 1 MW to more than 200 MW
  - Hospitals, schools, enhanced oil recovery, etc.

PG&E sees clear opportunities for GHG emissions reductions from efficient CHP

1.) **Energy efficiency**

- On-site efficiency gains will reduce fuel use

2.) **Lower-carbon fuel inputs**

- Switching from high carbon fuel (e.g., coal) to lower carbon fuel (e.g., biomass)

3.) **Bottoming cycle facilities**

- With no additional fuel, GHG emissions are always reduced with bottoming cycle CHP

4.) **Market opportunities for all CHP**

- Self-generation
- Small CHP
- Large CHP

Regardless of type or size, good matching of electrical output and thermal output is a precondition for reducing GHG emissions

PG&E supports efficient CHP that ensures statewide GHG emission reductions

1.) Energy efficiency

- Since the early 1990's, PG&E has been a leader in energy efficiency
- PG&E has requested more than $180 million for energy efficiency program funding for industrial customers

2.) Lower-carbon/ renewable fuel inputs

Mt. Poso: bridging agreement approved by CPUC to support conversion to 100% biomass in 2011

- 44 MW capacity facility
- Enhanced oil recovery application

Pacific Gas and Electric Company

PG&E supports efficient CHP that ensures statewide GHG emission reductions (cont.)

3.) Bottoming cycle facilities

- PG&E supports AB 1613 FiT eligibility for any bottoming cycle CHP under 20 MW with no significant supplemental firing

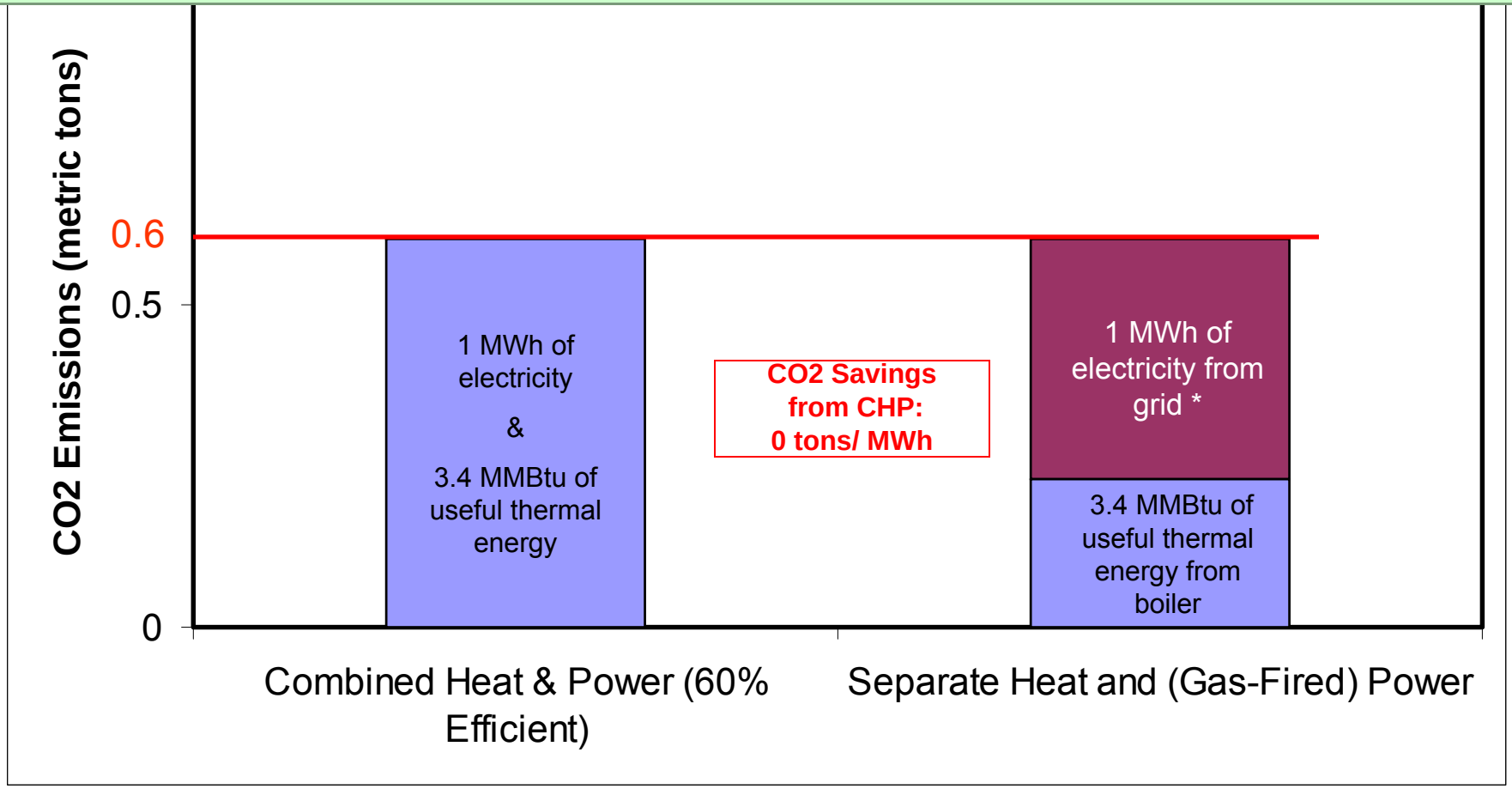
4.) Market- based opportunities for all CHP

- **Self-generation:** PG&E supports SB 412 which expands Self-Generation Incentive Program (SGIP) eligibility to all self-generation technologies supporting state's goal of reducing GHG emissions, including eligible CHP
- **Small CHP < 20 MW:** PG&E is helping to draft the AB1613 standard offer contract (CPUC) & working with staff to define efficiency standards for AB 1613 (CEC)
- **Large CHP > 20 MW:** Opportunity for existing QFs to provide competitive bids for:
  - Long term RFOs
  - Intermediate term RFOs
  - Bilateral contracts

To achieve GHG reductions, CHP must be more efficient than an appropriate Separate Heat and Power (SHP) double benchmark

Assumptions: Total CHP efficiency: 60% ■ Boiler efficiency: 80% ■ Power-to-Heat : 1:1

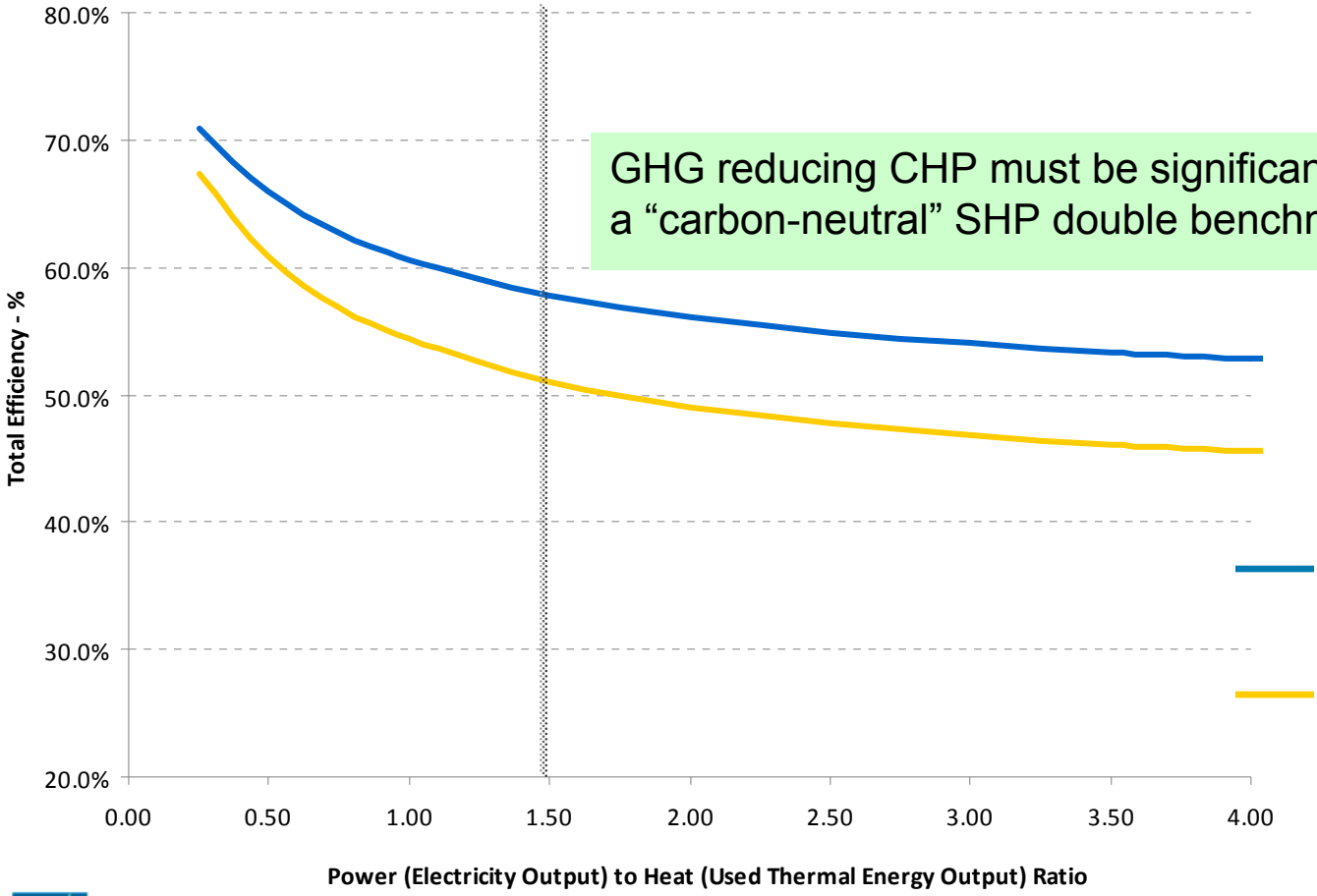
Electricity portfolio marginal efficiency: 48.7% (Heat rate 7,000 Btu/ kWh)



*Equivalent to 3.4 MMBtu of thermal energy

To achieve GHG reductions, CHP must be more efficient than an appropriate (SHP) double benchmark (cont.)

Carbon neutral SHP double benchmark as a function of power-to-heat ratio



GHG reducing CHP must be significantly above a "carbon-neutral" SHP double benchmark

Assumptions:

- Heat rate: 7,000 Btu/kWh; Boiler efficiency: 80%
- Heat rate: 8,300 Btu/kWh; Boiler efficiency: 80%

CHP procurement opportunities must be balanced against other utility goals to ensure a reliable supply at reasonable costs

PG&E Goals

- Reasonable prices for customers
- System reliability
- Environmental stewardship
- Support our customers

CHP Opportunities

- Energy efficiency
- Lower-carbon/ renewable fuels
- Bottoming cycle
- Well-designed commercial process that will attract bids that provide GHG reductions

PG&E's Electric Supply Portfolio Goal: A reliable supply at reasonable cost that supports statewide GHG emissions reductions