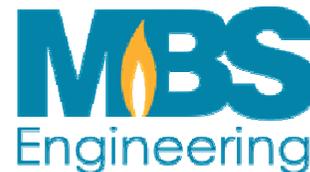


CO2 Output Comparison: Grid Gas Turbines vs. On-Site with Combined Heat and Power



While California utilities are currently using natural gas to generate about half the state's electric power, much of the 'waste heat' (thermal energy that remains after combustion of the gas powers an electric generator) cannot be utilized by the end industrial user, because it cannot be transported. This collection and utilization of 'waste heat' is called 'cogeneration' or 'combined heat and power' (CHP).

If, however one undertook not generate and then transport the power as electricity, but to use existing natural gas delivery infrastructure to deliver the fuel to the end-user, where the gas can be combusted to power a generator, the 'waste heat' can be used in a variety of ways: as thermal energy or for temperature control, even for drying or CO2 provision for plants. This takes the efficiency of a gas turbine from about 30% to about 90%.

To wit, rather than the 'hub' transforming gas fuel to electricity, and wasting thermal power, the 'spokes' generate power at the industrial location.

Needless to say, this solution reduces electricity costs by about 45%, and reduces CO2 emissions by about 66%, as a function of the power produced - provided thermal energy can be put to use.

Finally, on-site gas turbines may be the only way some industries get approval for their operations: the ailing electrical grid and concomitant power companies are often turning industrial operations down.

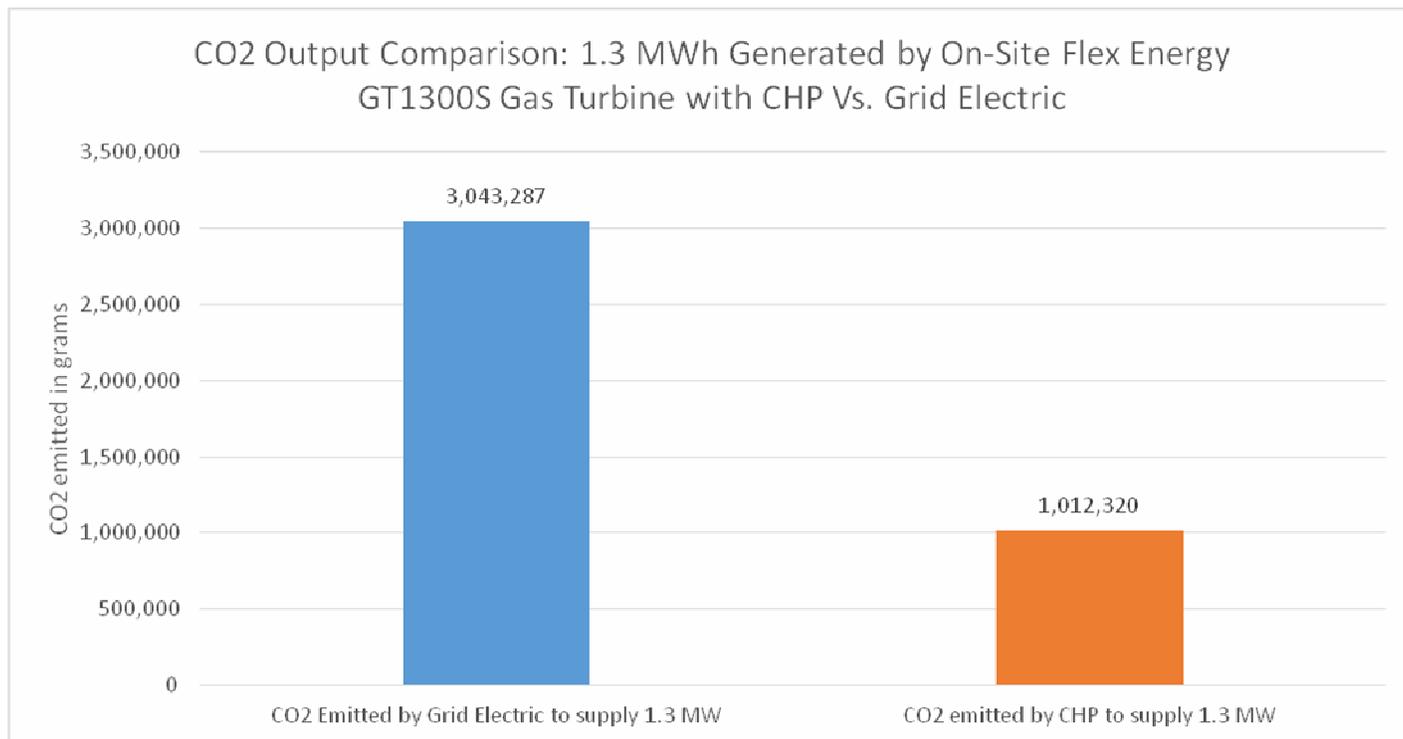


Figure 1: CO2 Output Comparison: 1.3 MWh Generated by On-Site Flex Energy GT1300S Gas Turbine with CHP Vs. Grid Electric.

703 g of CO2 are generated per kWh, for grid electric power in California, and while 50% of grid electricity is generated with natural gas, only coal (.2%) the only other greenhouse gas emitter.^{1 2}

To utilize 1.3 MW of power, at 30% efficiency, you'd have to generate 4.329 MW, using grid electric. However, to utilize 1.3 MW of power, at 90% efficiency, you'd have to generate 1.44 MW.

¹Source: [https://www.arb.ca.gov/cc/inventory/doc/docs1/1a1ai_importedelectricityspecified_pacificnorthwest_pacificorp\(pnw\)_electricity_generation_mostlyfromcoal_co2_2014.htm](https://www.arb.ca.gov/cc/inventory/doc/docs1/1a1ai_importedelectricityspecified_pacificnorthwest_pacificorp(pnw)_electricity_generation_mostlyfromcoal_co2_2014.htm)

² Source: https://www.energy.ca.gov/almanac/electricity_data/total_system_power.html