

**Analysis of PG&E's
Long Term Procurement Plan**

***Projected Greenhouse Gas Emissions Resulting From
PG&E's Electricity and Natural Gas Procurement Plan,
With a Comparison to Sonoma County's
Greenhouse Gas Emission Reduction Target***

Prepared by

David Erickson, Technical Director

Climate Protection Campaign

www.climateprotectioncampaign.org

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Introduction

Since 1990, Sonoma County GHG emissions have increased steadily. This increase is due to the growing population’s use of electricity, natural gas, and transportation fuels. Sonoma County’s electricity and natural gas is supplied almost exclusively by Pacific Gas and Electric Company (PG&E), the incumbent utility¹. PG&E’s procurement practices and efficiency programs largely set the emissions intensity² of the residential, commercial and industrial energy sectors of Sonoma County.

Figure 1

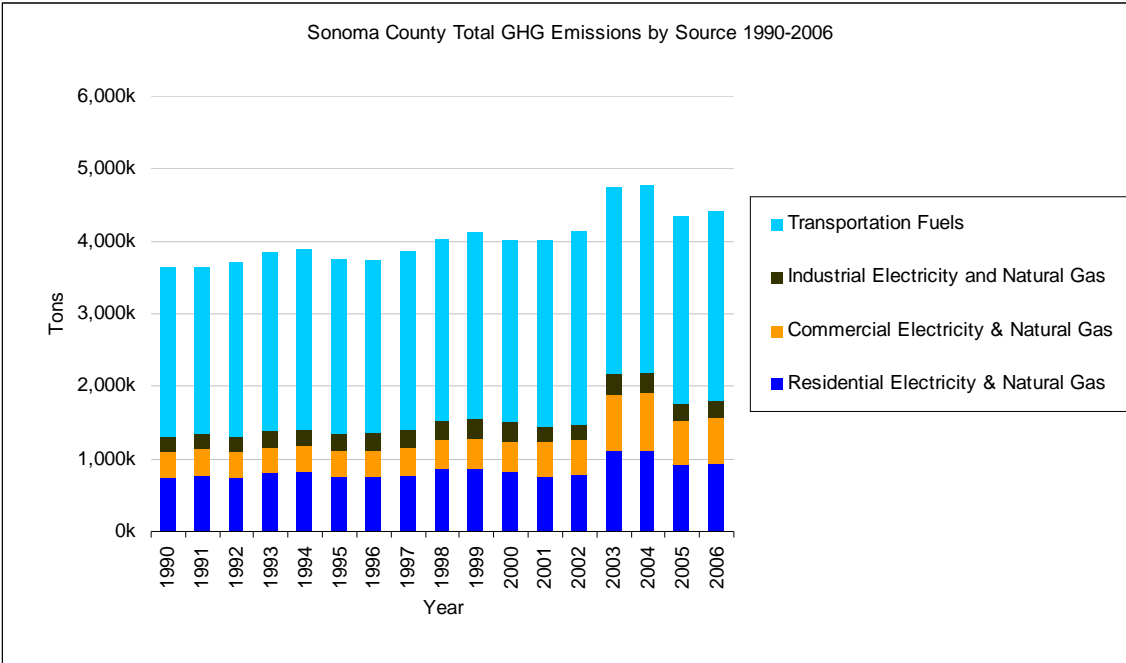


Figure 2 below shows the projected trend for total emissions from all major sectors (transportation, electricity and natural gas) out to 2015 if “business as usual” practices in energy use and transportation continue. This report analyzes the contribution of electricity and natural gas use to this emissions trend. In particular, this report focuses on the GHG consequences of PG&E’s plans for electricity procurement over the next decade. The data for this analysis comes from the Long Term Procurement Plan (LTPP) that all of the Investor Owned Utilities (IOU) are required to file with the California Public Utilities Commission³. We compare Sonoma County’s reduction target in the electricity and natural gas sectors to emissions projections from the LTPP. At this point in time, PG&E has no plan for reducing GHG emissions from the natural gas sector, other than its public

¹ Except where noted, all GHG emissions numbers are given in short tons of CO2 equivalent (eCO2).

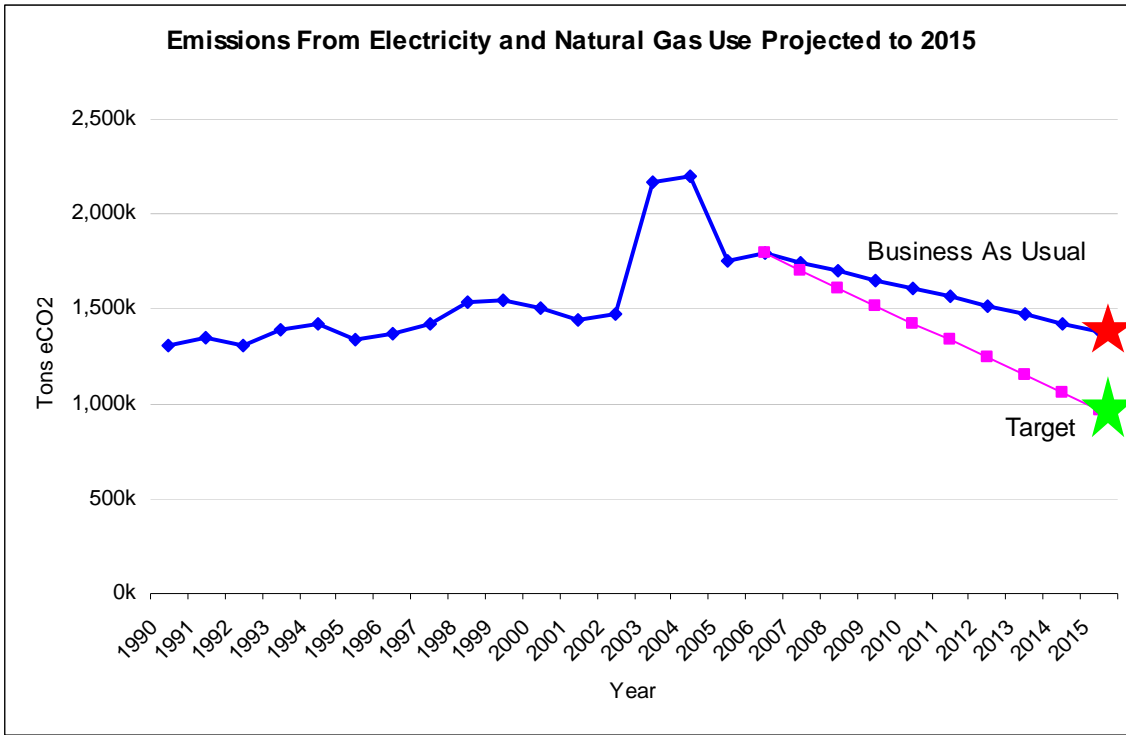
² Emissions intensity is defined as the mass of GHG emissions per unit of energy consumed. For electricity, the emissions intensity is usually expressed as “pounds of carbon dioxide per kilowatt (megawatt) hour.” For natural gas the intensity is “pounds of carbon dioxide per therm.”

³ Pacific Gas and Electric Company 2006 Long Term Procurement Plan, filed with the California Public Utilities Commission, March 2007.

http://www.cpuc.ca.gov/PUC/hottopics/1Energy/resourceadquacy/_0616ltpps.htm

goods charge financed programs for rebates on certain efficiency upgrades for homes and businesses.

Figure 2



Projected Electricity and Natural Gas Use

Data on per capita energy use and growth for PG&E’s service territory, along with population projections from the California Department of Finance were used to estimate the total annual electricity and natural gas consumption for 2015.

Sonoma County population for 2015 is estimated at 524,176. Annual electricity use is estimated at 3,221 GWh and natural gas is estimated at 129 million therms⁴.

Electrical energy and natural gas usage is anticipated to increase at about the same and half the rate of population, respectively.

Projected Baseline GHG Emissions

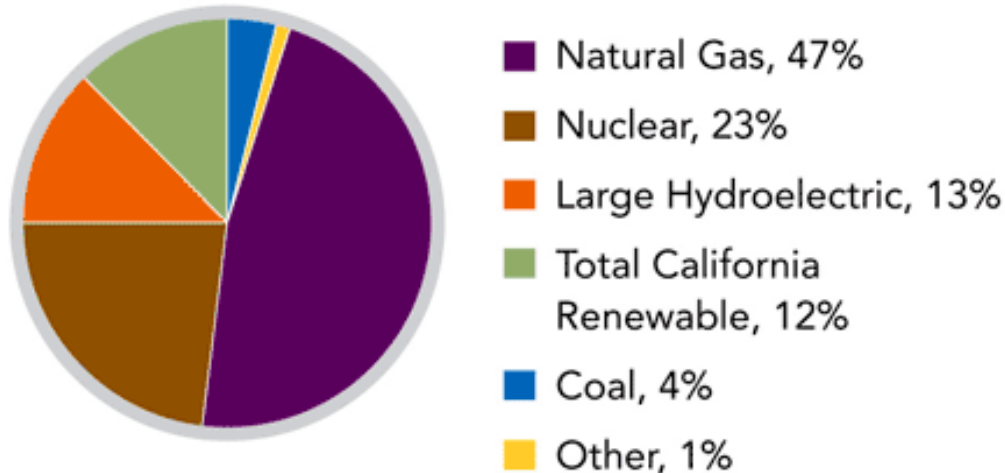
Baseline emissions for Sonoma County are estimated by multiplying estimated baseline energy usage by appropriate unit GHG emission factors. The latter, for PG&E, is based

⁴ Estimates provided by Resource Performance Partners. For full description of methodology and data used to make these estimates, please refer to Appendix A of *Resource Efficiency for Sonoma County* (prepared for the Community Climate Action Plan and available online), Ned Orrett, President, Resource Performance Partners

on the “Electric Power Mix,” or the mix of generation types that generate the electricity delivered to customers. See Figure 3.

Figure 3

PG&E’s 2007 Electric Power Mix Delivered to Retail Customers*



* Due to a dry winter and the resulting reduction in the availability of hydroelectric generation, PG&E increased its power market purchases in 2007. Because California regulators require us to automatically assume that a certain portion of these market purchases are coal-fired generation, this chart shows an increase in that area. However, PG&E’s direct purchases of coal have not increased, and remain at 1.6 percent.

As indicated in the note in Figure 3, the emissions factor for PG&E electricity is highly dependent on the availability of hydroelectric power. For 2005, the last year a reported figure for PG&E’s emissions intensity is available⁵, there was more hydroelectric power available than in 2007. We use the 2005 figure to indicate the level of “current emissions.” Table 1 shows the emissions factors for 1990⁶ and 2005⁷.

⁵ At the time this document was written, PG&E had not yet released its 2006 CCAR report. The factor for 2006 is 0.456 lb eCO₂/kWh.

⁶ The California Climate Action Registry: Development of Methodologies for Calculating Greenhouse Gas Emissions from Electricity Generation. Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, August 2002

⁷ Annual Emissions Report, 2005, Pacific Gas and Electric Company, on file at California Climate Action Registry (www.climateregistry.org)

Table 1

<i>PG&E Emission Factor</i>	
<i>Year</i>	<i>lb CO2/kWh</i>
1990	0.566
2005	0.489

For natural gas, the emission factor is determined by the chemistry of combustion. Burning natural gas creates carbon dioxide, nitrous oxide and methane, as a result of the oxidation reaction occurring in air. Atmospheric air includes a significant amount of nitrogen. There are additional factors that come into play, which are the heat value of the natural gas, the combustion efficiency and transport pipeline leakage. Although the EPA recommends 11.7 lb CO2 per therm⁸, the IPCC recommends, 13.01 lb CO2 per therm⁹. We use 12.3 lb eCO2/therm as recommended by ICLEI¹⁰.

Table 2

<i>Natural Gas Emission Factor</i>		
EPA (Supplier)	11.7	lb CO2/therm
End User	12.3	lb eCO2/therm
IPCC (National)	13.0	lb eCO2/therm

Projected Emissions Estimates based on LTPP

Table 3 shows the range of emissions intensities presented in PG&E's LTPP. Scenario 1, with the best (lowest) carbon efficiency, is described as: "...customers are more likely to exercise CCA and DA (direct access) options."¹¹ This means that as more customers exit PG&E service to go to a CCA, the more likely PG&E will be to reduce its emissions.

Another highly variable element of PG&E's projected carbon emission level is the availability of hydroelectric power. There is a note in the text as follows:

"As indicated in the tables below, the Increased Reliability and Preferred Resources Plan (IR & PR) has slightly lower CO2 emissions than the other two alternative plans (Basic & IR) at the end of the planning horizon. *However, long-term changes in load and resources which are represented in the scenarios increase emission volumes by 15% to 25%, depending on the scenario and plan. Additional swings in hydro availability can further contribute to increased volatility in CO2 emissions in a given year.* For example, a 5,000 GWh reduction in hydro from a normal to a dry hydro scenario would increase CO2 emissions by another 13% to 15%." (Emphasis added).

⁸ EPA publication AP-42, Fifth Edition, Volume 1, External Combustion Sources, Section 1.4, Table 1.4-2

⁹ 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. II, Chapter 2, Table 2.5, lists the default emissions factor for natural gas combustion as 56,100 kg per terajoule.

¹⁰ ICLEI, www.iclei.org

¹¹ PG&E 2006 LTPP, Volume 1, Section IV A – 1(d)

Table 3

**TABLE VOL. 1, VIB-12
PACIFIC GAS AND ELECTRIC COMPANY
CARBON EFFICIENCY IN LB/ MWh OF LOAD PLUS AVOIDED LOAD IN 2016**

Plans	Scenarios			
	1	2	3	4
Basic Procurement	342	409	381	385
Increased Reliability	342	409	381	385
Increased Reliability and Preferred Resources	311	352	349	365

Baseline energy usage in 2015, net of efficiency efforts committed through 2008, is estimated at 3,221 GWh and 129 MMTh. Baseline emissions expected in 2015 are found by multiplying these values by the appropriate coefficients provided in Table 1, Table 2, and Table 3 above.

For electricity, the range of possible emissions levels is shown in tons of eCO₂:

Table 4

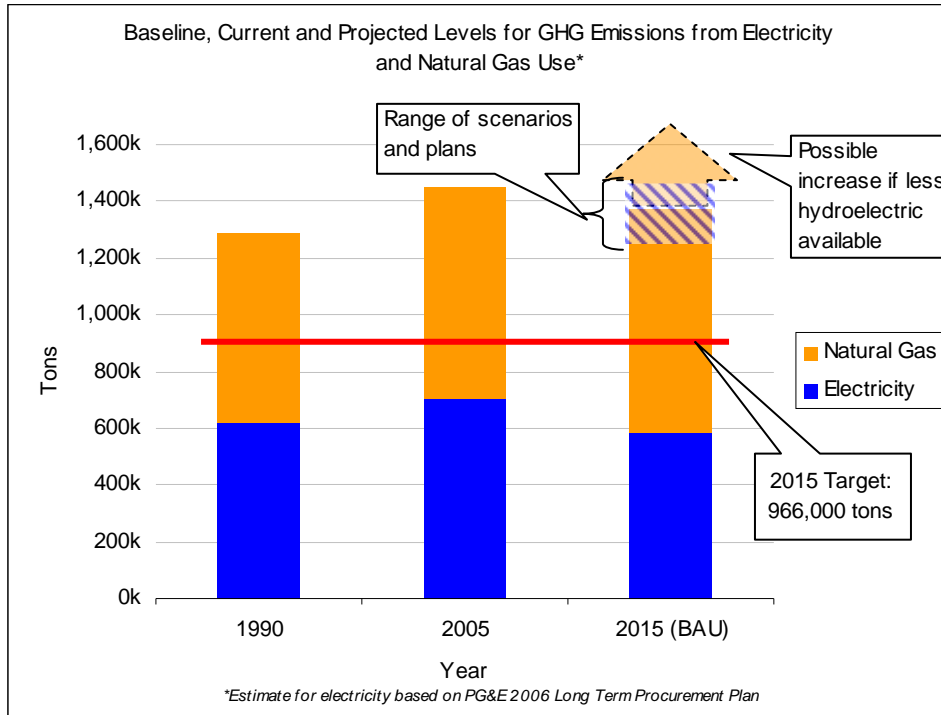
Plans/Scenarios (tons eCO ₂)	PG&E Scenario 1	PG&E Scenario 2	PG&E Scenario 3	PG&E Scenario 4
<i>Basic & IR</i>	552,273	660,467	615,252	621,711
<i>IR & PR</i>	502,213	568,421	563,577	589,414

Each of these emissions levels corresponds to an emissions intensity in Table 3. The average of all these levels, assuming that they are all equally likely, is approximately 584,000 tons. For natural gas, the estimated emissions level is approximately 790,000 tons.

The resulting baseline value for 2015 is approximately 1,377,000 tons eCO₂. This exceeds the nominal target of 966,000 tons (25% less than the 1990 total) by approximately 400,000 tons, or 40 percent. This relationship is shown in Figure 4 below.

The range of values from all scenarios and plans is indicated by the cross-hatched area, along with the magnitude of increase due to hydro unavailability.

Figure 4



See the appendix for more information regarding the effect of the changing availability of large hydroelectric on the overall emissions intensity of PG&E's generation mix.

Conclusion

We computed estimates of emissions due to electricity and natural gas use in Sonoma County for 2015, based on electric load and natural gas use forecasts for Sonoma County, along with information from the PG&E 2006 Long Term Procurement Plan (LTPP). The estimated emissions levels significantly exceed the Sonoma County target of 25 percent below 1990 levels. The estimated levels exceed the target in all cases of the various plans and scenarios presented in the LTPP.

Appendix

The following table illustrates the relationship between large hydro and nuclear availability and total emissions. This data is taken from PG&E's California Climate Action Registry GHG reports for 2004-2006. "Zero Emission" total consists of nuclear and large hydroelectric generation. It does not include renewables (wind, solar, etc.). Output from nuclear plants is relatively constant, unless there is maintenance activity.

Year	Zero Emission (MWh)	Total Fossil (MWh)	Total Generation (MWh)	Emissions (Metric Tons)	Reported Intensity (lbs CO2/MWh)
2004	15,210,301	37,057,597	72,981,005	18,743,479	566.2
2005	17,721,047	34,498,295	77,503,461	17,196,414	489.2
2006	30,780,541	32,365,455	79,211,982	16,480,577	455.8

PG&E GHG Emissions Reports 2004-2006

The following tables are from the California Climate Action Registry. Nuclear and Large Hydroelectric are reported as Zero Emission Generation.

2004

POWER/UTILITY GENERATION/PURCHASES INFORMATION	Amount	Unit	CO ₂	Unit
Owned Generation Total (Net)	26,096,035	MWh	590,671	metric tons
Fossil Generation (Net)	911,590	MWh	590,671	metric tons
Biogenic Generation (Net)	0.00	MWh	0.00	metric tons
Geothermal Generation (Net)	0.00	MWh	0.00	metric tons
Other Renewable Generation (Net)	9,974,144	MWh	0.00	metric tons
Zero Emission Generation (Net)	15,210,301	MWh	0.00	metric tons
Steam Generation (Net)	0.00	MWh	0.00	metric tons
Purchased Generation Total (Net)	46,884,970	MWh	18,152,809	metric tons
Purchased Fossil Generation (Net)	36,146,007	MWh	18,152,809	metric tons
Purchased Biogenic Generation (Net)	3,268,621	MWh	0.00	metric tons
Purchased Geothermal Generation (Net)	1,732,857	MWh	0.00	metric tons
Purchased Other Renewable Generation (Net)	5,737,485	MWh	0.00	metric tons
Purchased Zero Emission Generation (Net)	0.00	MWh	0.00	metric tons
Purchased Cogeneration (Net)	0.00	MWh	0.00	metric tons
Purchased Wholesale Power (Net)	0.00	MWh	0.00	metric tons
TOTAL FOSSIL GENERATION/PURCHASES	37,057,597	MWh	18,743,479	metric tons
TOTAL FROM BIOGENIC/GEOTHERMAL SOURCES	5,001,478	MWh	0.00	metric tons
TOTAL OTHER GENERATION/PURCHASES	30,921,930	MWh	0.00	metric tons
TOTAL FROM ALL GENERATION SOURCES	72,981,005	MWh	18,743,479	metric tons

2005

POWER/UTILITY GENERATION/PURCHASES INFORMATION	Amount	Unit	CO ₂	Unit
Owned Generation Total (Net)	30,237,867	MWh	668,221	metric tons
Fossil Generation (Net)	1,055,517	MWh	668,221	metric tons
Biogenic Generation (Net)	0.00	MWh	0.00	metric tons
Geothermal Generation (Net)	0.00	MWh	0.00	metric tons
Other Renewable Generation (Net)	11,461,302	MWh	0.00	metric tons
Zero Emission Generation (Net)	17,721,047	MWh	0.00	metric tons
Steam Generation (Net)	0.00	MWh	0.00	metric tons
Purchased Generation Total (Net)	47,265,594	MWh	16,528,193	metric tons
Purchased Fossil Generation (Net)	33,442,778	MWh	16,528,193	metric tons
Purchased Biogenic Generation (Net)	3,286,885	MWh	0.00	metric tons
Purchased Geothermal Generation (Net)	1,680,710	MWh	0.00	metric tons
Purchased Other Renewable Generation (Net)	8,855,221	MWh	0.00	metric tons
Purchased Zero Emission Generation (Net)	0.00	MWh	0.00	metric tons
Purchased Cogeneration (Net)	0.00	MWh	0.00	metric tons
Purchased Wholesale Power (Net)	0.00	MWh	0.00	metric tons
TOTAL FOSSIL GENERATION/PURCHASES	34,498,295	MWh	17,196,414	metric tons
TOTAL FROM BIOGENIC/GEOTHERMAL SOURCES	4,967,595	MWh	0.00	metric tons
TOTAL OTHER GENERATION/PURCHASES	38,037,571	MWh	0.00	metric tons
TOTAL FROM ALL GENERATION SOURCES	77,503,461	MWh	17,196,414	metric tons

2006

GENERATION & PURCHASED POWER INF	Amount Unit	CO ₂	Unit
Owned Generation Total (Net)	32,841,725.49 MWh	421,993.00 metric tons	
Fossil Generation (Net)	623,991 MWh	421,993 metric tons	
Biogenic Generation (Net)	0 MWh	0.00 metric tons	
Geothermal Generation (Net)	0 MWh	0.00 metric tons	
Other Renewable Generation (Net)	1,437,193 MWh	0.00 metric tons	
Zero Emission Generation (Net)	30,780,541 MWh	0.00 metric tons	
Cogeneration (Net)	0.00 MWh	0.00 metric tons	
Purchased Generation Total (Net)	46,370,256.90 MWh	15,955,179.00 metric tons	
Purchased Fossil Generation (Net)	31,741,464 MWh	15,635,374 metric tons	
Purchased Biogenic Generation (Net)	3,072,092 MWh	0.00 metric tons	
Purchased Geothermal Generation (Net)	1,790,870 MWh	0.00 metric tons	
Purchased Other Renewable Generation	4,250,897 MWh	0.00 metric tons	
Purchased Zero Emission Generation (Ne	4,865,696.20 MWh	0.00 metric tons	
Purchased Cogeneration (Net)	649,237.90 MWh	319,804.95 metric tons	
Purchased Wholesale Power (Net)	0.00 MWh	0.00 metric tons	
TOTAL FOSSIL GENERATION/PURCHAS	32,365,455.20 MWh	16,057,367.05 metric tons	
TOTAL FROM BIOGENIC/GEOTHERMAL	4,862,962.00 MWh	0.00 metric tons	
TOTAL OTHER GENERATION/PURCHAS	41,983,565.19 MWh	319,804.95 metric tons	
TOTAL FROM ALL GENERATION SOURCE:	79,211,982.39 MWh	16,377,172.00 metric tons	
TOTAL FROM RETAIL SALES	0.00 MWh	0.00 metric tons	