

Greenhouse Gas Emission Factors: Guidance for PG&E Customers November 2015

This document is intended to help Pacific Gas and Electric Company (PG&E) customers understand the different greenhouse gas (GHG) emission factors they may use to estimate GHG emissions. GHG estimates are often used for climate action planning purposes and voluntary GHG emissions tracking or reporting.

PG&E's most recent electricity GHG emissions factor is for calendar year 2013. It can be found [here](#). Due to the multiple sources of power used in the course of a year and the rigorous process PG&E follows to have its emissions independently verified by a third party, the emission factor for delivered electricity lags by over a year.

Please note: The information in this document is not to be used for mandatory GHG reporting, financial analysis, or regulatory compliance, and does not necessarily reflect the approaches taken by PG&E for its own regulatory compliance purposes.

What is a GHG emission factor?

A GHG emission factor¹ is a measure of the pounds of carbon dioxide (CO₂) emitted per megawatt-hour of electricity or per therm of natural gas.

- **Electricity** generated from fossil fuels such as natural gas or coal emit CO₂, while other sources of electricity such as hydropower, wind, solar, and nuclear power are considered to be carbon-free. The electricity that PG&E delivers to customers comes from a mix of these generation sources. PG&E's emission factor for delivered electricity incorporates the annual energy and associated emissions from each generation source for the given year. Variance in PG&E's mix of electricity sources largely account for changes in PG&E's GHG emission factor from year to year.
- The **natural gas** emission factor represents the amount of GHGs emitted per therm of natural gas combusted. This emission factor does not vary because the composition of PG&E's natural gas does not change significantly over time.

Electricity Emission Factors

If you are estimating the GHG emissions generated by a business, city, county, or related entity over the course of a year, and if 100% of your electricity was purchased from PG&E, you can use the average emission factor for all the PG&E electricity delivered during that specific year.

¹ An emission factor is also known as an emission rate or emission coefficient.

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Historic emissions: Historic average emissions factors take into account all of the sources of electricity that PG&E delivered to customers during a specific year in the past. As a founding member of the California Climate Action Registry (CCAR), PG&E has emission factors that have been third-party verified starting in the year 2003. For factors prior to 2003, please see FAQ #2.

Current/Future emissions: Because of the multiple sources of power used in the course of a year and the rigorous process PG&E follows to have its emissions independently verified by a third party, the emission factor for delivered electricity lags by a year. To estimate GHG emissions in a recent or future year for which an emission factor is not yet available, we recommend using an average of the five most-recent coefficients available. Another resource is the emissions factor forecast for PG&E's electricity in the [CPUC GHG Calculator](#). The calculator is a publicly-available document that provides emission factor forecasts from 2014-2020 as shown below. Please note that the CPUC published the calculator in 2010 prior to the drought, so the forecasts do not take into consideration the impact of the drought on hydroelectric power.

Avoided emissions: When you implement an energy efficiency project or install a renewable generation project (e.g., a solar photovoltaic system), you are reducing your use of electricity from the utility, and therefore are avoiding the associated GHG emissions. Determining the emissions avoided from these projects can be complicated, depending on the season and time of day the electricity was saved.

For simplicity, you can use the relevant annual emission factor to estimate the GHGs avoided from these projects. See FAQ #5 for more information.

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PG&E Emissions Factor Summary

Emission Type	Emission Factor			Source
	Year	Lbs CO ₂ /MWh	Metric tons CO ₂ /MWh	
Historical Emissions	2003	620	0.281	PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR) ² (2003-2008) or The Climate Registry (TCR) (2009-2013)
	2004	566	0.257	
	2005	489	0.222	
	2006	456	0.207	
	2007	636	0.288	
	2008	641	0.291	
	2009	575	0.261	
	2010	445	0.202	
	2011	393	0.178	
	2012	445	0.202	
	2013	427	0.194	
2009-2013 Average	2009-2013	457	0.2074	Average of the last five years of historical emissions
CPUC Future Emissions (estimated in 2010 prior to the drought)	2014	412	0.187	CPUC GHG Calculator, which provides an independent forecast of PG&E's emission factors as part of a model on how the electricity sector would reduce emissions under AB 32 ³
	2015	391	0.177	
	2016	370	0.168	
	2017	349	0.158	
	2018	328	0.149	
	2019	307	0.139	
	2020	290	0.131	

Natural Gas Emission Factors

Historic, Current, and/or Future: The combustion of natural gas (in your stove, a furnace, or a natural gas power plant) releases CO₂. The emission factor for natural gas represents the amount of GHGs emitted per therm of natural gas combusted. Since the composition of PG&E natural gas does not change significantly over time, this factor does not change from year to year.

Emission Type	Year	Emission Factor		Source
		Lbs CO ₂ /therm	Metric ton CO ₂ /therm	
Historic, Current, or Future	All years	11.7	0.00531	U.S. Energy Information Administration ⁴

² The 2003-2008 factors are in the Power/Utility Protocol (PUP) spreadsheet of PG&E's [CCAR reports](#). The 2009-2013 factors are in the Additional Optional Information tab of the Electric Power Sector (EPS) Report spreadsheet of PG&E's [TCR reports](#).

³ E3, [GHG Calculator version 3c](#), worksheet tab "CO₂ Allocations," cells AH35 - AH44.

⁴ U.S. Energy Information Administration, [Voluntary Reporting of Greenhouse Gases Program](#).

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UPDATES: The emissions factors will be updated annually, so please check with your PG&E account manager or the PG&E website at www.pge.com/environment for the most recent version.

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1. Q: Why do the emission factors for PG&E electricity vary from year to year?
A: PG&E’s electricity emission factors vary primarily because the amount of available hydroelectricity varies from year to year. During drought years, less hydroelectricity is available and other power sources (usually natural gas generation) are used instead.

Emission factors also change, but less significantly, based on variables such as change in demand due to weather (hot summers mean more air conditioning demand). Increased demand on a short-term basis is generally met by fossil fuel generation, which raises the average emission factor. PG&E works to mitigate demand by following California’s “loading order,” which involves reducing electricity demand by increasing energy efficiency and demand response, and meeting new long-term generation needs first with renewable and distributed generation resources, and second with clean fossil-fueled generation. The loading order was adopted in the 2003 Energy Action Plan prepared by the California energy agencies⁵.

⁵ [Implementing California’s Loading Order for Electricity Resources.](#)

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Over time, PG&E's emission factor is also decreasing as we make steady progress toward California's target of 33% renewables by the end of 2020.

2. Q: Does PG&E have emission factors from years prior to 2003?

A: PG&E was among the earliest companies to voluntarily quantify and report its GHG emissions using rigorous, publicly-vetted GHG reporting standards. As a charter member of the California Climate Action Registry which later grew into The Climate Registry, PG&E has voluntarily registered and publicly reported its third-party verified GHG inventory every year since 2003. Prior to 2003, there were no commonly-accepted guidelines to report the GHG emission factors from a utility. If you would like to calculate emissions prior to 2003, you can use the 1990 emission factor in FAQ #3 below.

3. Q: What emission factor should I use to calculate the emissions from electricity use in 1990?

A: You can use the factor from a study published by Lawrence Berkeley National Laboratory, which cites an emission factor of 0.070 kg C/kWh for PG&E in 1990.⁶ This figure translates to approximately 572 lbs CO₂/MWh or 0.259 metric tons CO₂/MWh.⁷

4. Q: Why do you use an average emission factor to estimate avoided emissions and not a marginal⁸ or project-specific emission factor?

A: For the purposes of climate action planning or voluntary tracking and reporting, using an average emission factor simplifies the emissions calculation process. While some large entities may be required to estimate the amount of GHGs avoided by using emission factors specific to the hours of the day, the days of the year, or the seasons in which the energy use was avoided, the use of an average emission factor is appropriate for most customers.

5. Q: What emission factor should I use if I want to estimate the emissions avoided through participation in PG&E's demand response programs⁹?

A: For the purposes of climate action planning or voluntary tracking or reporting, an average emission factor is appropriate. If you are participating in a third-party Demand Response program, you may reach out to your program manager for further guidance. Using the average factor is a simplification and may not

⁶ LBNL-49945, Marnay *et al*, [Estimating the CO₂ emissions factors for the California Electric Power Sector](#), August 2002.

⁷ Assuming 1 kg CO₂ = 0.27 kg C and 2.2046 lbs/kg.

⁸ A marginal emission factor represents the emissions from electricity generated "at the margin", i.e., electricity generated in response to an additional unit of electricity demand. In California, this factor is typically that of a natural gas power plant, because this type of plant is most frequently deployed when electricity demand increases in the state. The California Air Resources Board (ARB) uses a marginal emission factor for California of 944 lbs CO₂e/MWh. See: ARB, [Mandatory Reporting Requirement Final Regulation](#), Section 95111(b)(1).

⁹ [PG&E's demand response programs](#) offer incentives to customers that volunteer and participate by temporarily reducing their electricity use when demand could outpace supply.

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reflect the approach taken by large entities for regulatory compliance purposes.

6. Q: If I am a direct access electricity customer, what emission factor should I use?
A: If you are a direct access customer, you should contact your direct access electricity provider for the appropriate emission factor. If the emission factor is unavailable, The Climate Registry's Local Government Operations Protocol and the World Resources Institute's GHG Protocol recommend using the EPA [Emissions & Generation Resource Integrated Database \(eGRID\)](#) annual output emission factors for the WECC California (CAMX) sub-region.
7. Q: Can PG&E customers use the U.S. EPA carbon calculator to calculate the emissions from PG&E electricity?
A: PG&E does not recommend that customers use this calculator. The EPA calculator uses an average emission factor for electricity generated nationwide. PG&E's emission factor is independently verified and based on the PG&E-specific mix of electricity delivered to PG&E customers. Because of PG&E's higher use of lower- and zero-emission generation sources, PG&E's emission factor is more than 60 percent cleaner than the national average.¹⁰ Using the EPA carbon calculator would dramatically overstate PG&E customers' emissions and any emissions savings associated with energy efficiency projects.
8. Q: What is the difference between the emission factors used in the U.S. EPA's Portfolio Manager benchmarking tool and PG&E's emission factors?
A: The EPA tool uses emission factors from the EPA [Emissions & Generation Resource Integrated Database \(eGRID\)](#), which are derived from utility data for each of the 26 sub-regions of the U.S. power grid. Users are not able to enter a PG&E-specific emission factor into the tool. Instead, based on the zip code of each building entered, Portfolio Manager identifies the appropriate sub-region and emission factor, and provides a graphic comparison of the sub-region's emission factor and electric generation fuel mix to the national factor. PG&E customers are in the WECC¹¹ California (CAMX) sub-region. Because eGRID's WECC California emission factor has consistently been higher than PG&E's historic emission factors, customers should understand that this tool overestimates emissions from buildings that use PG&E electricity.
- The tool also gives users the choice of selecting a specific power generation facility, which is not generally appropriate for the purposes of climate action planning or voluntary tracking and reporting, since the electricity delivered by PG&E to customers comes from a variety of sources.
9. Q: Does PG&E have emission factors for smaller geographic areas like cities or counties within its service territory?

¹⁰ PG&E website: <http://www.pge.com/myhome/environment/pge/cleanenergy/index.shtml>.

¹¹ The Western Energy Coordinating Council (WECC) is a regional organization that promotes reliable electric service by establishing operating criteria and facilitating electric system support between utilities.

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A: No, PG&E's emission factor is based on the electricity delivered to all of its customers. Because electricity enters PG&E's electrical transmission and distribution system from multiple sources and gets distributed throughout the system to customers, it is not possible to calculate emission factors for specific geographic areas.

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10. Q: Why are PG&E's emission factors in CO₂ (carbon dioxide) and not CO₂e (i.e. CO₂ equivalent)?¹²

A: The electricity emission factors reported via CCAR and TCR are in pounds of CO₂ and not CO₂e because their methodology for calculating emission factors only includes CO₂ and not methane (CH₄) or nitrous oxide (N₂O) from electricity generation. CCAR and TCR do not include CH₄ or N₂O because these emissions are considered to be *de minimis*.

However, PG&E customers can still estimate the CH₄ and N₂O emissions associated with their electricity use by using the California-specific emission factors provided by The Climate Registry's [Local Government Operations Protocol](#)¹³. For natural gas, customers can use the relevant default emission factors for natural gas provided by the same protocol¹⁴.

11. Q: Why don't PG&E's emission factors include the emissions associated with the delivery of electricity or natural gas?

A: The emissions associated with the delivery of electricity or natural gas are not included in PG&E's emission factors for delivered electricity or natural gas because those emissions are reported separately by PG&E in its own GHG inventory. Standard voluntary reporting practice is to report such emissions, like the emissions associated with transmission and distribution line losses, natural gas compressor stations, and vehicles used to service electricity and natural gas delivery systems, separately from the emissions attributed to the generation or use of the energy itself.

12. Q: Who can I contact at PG&E to ask questions about emission factors?

A: Email ghgdatarequests@pge.com and a PG&E employee will get back to you shortly.

¹² CO₂e or CO₂ equivalent is a measure used to compare the emissions from various GHGs based upon their global warming potential (GWP). The CO₂e for a gas is derived by multiplying the amount of the gas by the GWP of the gas.

¹³ Version 1.1, May 2010. Page 209, Table G.7: California Grid Average Electricity Emission Factors (1990-2007).

¹⁴ Page 205, Table G.3: Default Methane and Nitrous Oxide Emission Factors by Fuel Type and Sector.