

Cap-and-Trade Program

Energy-Based Allocation Methodology

This document contains a description of the methodology used in calculating the energy-based allocation.

The energy-based allocation methodology is described in Section 95891(c) of the Cap-and-Trade Regulation. Three inputs are used in the energy-based allocation equation:

1. S_{Consumed} – Historical baseline annual arithmetic mean of steam consumed at the industrial facility for any industrial process excluding producing electricity;
2. F_{Consumed} – Historical baseline annual arithmetic mean of fuel consumed at the industrial facility. This value shall include any energy from fuel combusted in an onsite electricity generation or cogeneration unit. This value shall exclude energy used to generate the steam and accounted for in the “ S_{Consumed} ” term; and
3. e_{Sold} – Historical baseline annual arithmetic mean amount of electricity sold.

S_{Consumed}

To calculate S_{Consumed} , historical data on boilers and steam generators is used. This value only includes steam produced from boilers that have a rated capacity of 15 MMBTU/hr or greater and steam purchases. This value does not include emergency boilers, backup boilers, and other equipment excluded from mandatory greenhouse gas emissions reporting.¹ S_{Consumed} can be determined by either direct measurement using a flow meter calibrated to 5% accuracy, or by using the boiler efficiency method. Because most facilities do not have these high accuracy steam flow meters, we will use the boiler efficiency method as the default method. If your facility does have these high accuracy steam flow meters, please contact David Allgood at 916-445-8238 or dallgood@arb.ca.gov, and I will give you another spreadsheet to complete. The boiler efficiency method uses steam estimates and boiler fuel consumption to calculate steam production. The American Society of Mechanical Engineers (ASME) Performance Test Code 4 (PTC-4) – Indirect Method: Stack Loss Method² is used to estimate boiler efficiency. To use this method, excess dry oxygen and temperature of the stack must be reported from the most recent source test. Additionally, fuel to the boilers must be reported, either individually or aggregated. The efficiencies of the boilers are averaged using either an arithmetic mean or weighted mean. The weighting factor for each boiler is the ratio of the unit-level fuel meter and the sum of all unit-level fuel meters.

F_{Consumed}

To calculate F_{Consumed} , historical data on fuel use of the facility is used. This value includes fuel consumed by cogeneration units; process heater; dryers; heating, ventilation, and cooling units; bio-derived fuels; and other direct fire units. This value does not include transportation fuels, such as those used for mining or forklifts, or fuel

¹ See 95101(f) of the Mandatory Reporting Regulation.

² See ASME PTC-4 -- Indirect Method: Stack Loss Method attached to this document.

used from equipment excluded under greenhouse gas reporting. Further, this value does not include fuel used in units that are covered under S_{Consumed} .

All fuel reporting can *either* be reported in units of energy (MMBTU) *or* units of volume with corresponding higher heating value. The higher heating value of fuel burned can be reported as an annual average or using the default value derived from 40 CFR 98 Table C-1, reprinted at the end of this document.

e_{Sold}

To calculate e_{Sold} , historical data on electricity sold by the facility will be used. This value shall include any electricity that is provided for off-site use. These data are already provided through mandatory reporting and do not need to be re-reported.

Data years

Please report all data for the years 2008 through 2010. Data should be reported for all years even if the facility had abnormal operation in any year. A facility may report additional data years if it had previously reported those data to the California Climate Action Registry.³ The final calculation of each of the terms will use an arithmetic average of the annual data reported for the facility's baseline years.

Facility Types

For simplicity in calculation of the above terms, ARB has generalized facilities into three different types. If a facility uses over 80 percent of its fuel to power boilers, the facility can estimate that all fuel use is for the purpose of steam generation, S_{Consumed} . If a facility uses over 80 percent of its fuel to power direct fire units, the facility can estimate that all fuel use is for the purpose of direct fire application, F_{Consumed} . If a facility applies less than 80 percent of its fuel use to either direct fire units or boilers, both F_{Consumed} and S_{Consumed} must be calculated. To disaggregate fuel consumption between steam and direct fire application, unit-level fuel meters are used to calculate the percentage of fuel to each unit type. The ratio is the amount of fuel to a unit type divided by the total amount of fuel measured by the unit-level fuel meters. This ratio is then multiplied by the fuel use as measured by a revenue-quality fuel meter to determine fuel to each unit type. This process guarantees that the total amount of fuel used in calculating F_{Consumed} and S_{Consumed} is equal to the fuel measured by the revenue-quality meter.

³ The California Climate Action Registry was a voluntary greenhouse gas registry with the mandate to protect and promote early actions by organizations to reduce GHG emissions. See <http://www.caclimateregistry.org> for more information.

40 CFR 98 Table C-1Table C-1 to Subpart C—Default CO₂ Emission Factors and High Heat Values for Various Types of Fuel

Fuel type	Default high heat value	Default CO ₂ emission factor
Coal and coke	mmBtu/short ton	kg CO ₂ /mmBtu
Anthracite	25.09	103.54
Bituminous	24.93	93.40
Subbituminous	17.25	97.02
Lignite	14.21	96.36
Coke	24.80	102.04
Mixed (Commercial sector)	21.39	95.26
Mixed (Industrial coking)	26.28	93.65
Mixed (Industrial sector)	22.35	93.91
Mixed (Electric Power sector)	19.73	94.38
Natural gas	mmBtu/scf	kg CO ₂ /mmBtu
(Weighted U.S. Average)	1.028×10^{-3}	53.02
Petroleum products	mmBtu/gallon	kg CO ₂ /mmBtu
Distillate Fuel Oil No. 1	0.139	73.25
Distillate Fuel Oil No. 2	0.138	73.96
Distillate Fuel Oil No. 4	0.146	75.04
Residual Fuel Oil No. 5	0.140	72.93
Residual Fuel Oil No. 6	0.150	75.10
Used Oil	0.135	74.00
Kerosene	0.135	75.20
Liquefied petroleum gases (LPG)	0.092	62.98
Propane	0.091	61.46
Propylene	0.091	65.95
Ethane	0.069	62.64
Ethanol	0.084	68.44
Ethylene	0.100	67.43
Isobutane	0.097	64.91
Isobutylene	0.103	67.74
Butane	0.101	65.15
Butylene	0.103	67.73
Naphtha (<401 deg F)	0.125	68.02
Natural Gasoline	0.110	66.83
Other Oil (>401 deg F)	0.139	76.22

Fuel type	Default high heat value	Default CO₂ emission factor
Pentanes Plus	0.110	70.02
Petrochemical Feedstocks	0.129	70.97
Petroleum Coke	0.143	102.41
Special Naphtha	0.125	72.34
Unfinished Oils	0.139	74.49
Heavy Gas Oils	0.148	74.92
Lubricants	0.144	74.27
Motor Gasoline	0.125	70.22
Aviation Gasoline	0.120	69.25
Kerosene-Type Jet Fuel	0.135	72.22
Asphalt and Road Oil	0.158	75.36
Crude Oil	0.138	74.49
Other fuels-solid	mmBtu/short ton	kg CO ₂ /mmBtu
Municipal Solid Waste	9.95 ¹	90.7
Tires	26.87	85.97
Plastics	38.00	75.00
Petroleum Coke	30.00	102.41
Other fuels—gaseous	mmBtu/scf	kg CO ₂ /mmBtu
Blast Furnace Gas	0.092 × 10 ⁻³	274.32
Coke Oven Gas	0.599 × 10 ⁻³	46.85
Propane Gas	2.516 × 10 ⁻³	61.46
Fuel Gas ²	1.388 × 10 ⁻³	59.00
Biomass fuels—solid	mmBtu/short ton	kg CO ₂ /mmBtu
Wood and Wood Residuals	15.38	93.80
Agricultural Byproducts	8.25	118.17
Peat	8.00	111.84
Solid Byproducts	25.83	105.51
Biomass fuels—gaseous	mmBtu/scf	kg CO ₂ /mmBtu
Biogas (Captured methane)	0.841 × 10 ⁻³	52.07
Biomass Fuels—Liquid	mmBtu/gallon	kg CO ₂ /mmBtu
Ethanol	0.084	68.44
Biodiesel	0.128	73.84
Biodiesel (100%)	0.128	73.84
Rendered Animal Fat	0.125	71.06
Vegetable Oil	0.120	81.55

¹Use of this default HHV is allowed only for: (a) Units that combust MSW, do not generate steam, and are allowed to use Tier 1; (b) units that derive no more than 10 percent of their annual heat input from MSW and/or tires; and (c) small batch incinerators that combust no more than 1,000 tons of MSW per year.

²Reporters subject to subpart X of this part that are complying with §98.243(d) or subpart Y of this part may only use the default HHV and the default CO₂ emission factor for fuel gas combustion under the conditions prescribed in §98.243(d)(2)(i) and (d)(2)(ii) and §98.252(a)(1) and (a)(2), respectively. Otherwise, reporters subject to subpart X or subpart Y shall use either Tier 3 (Equation C-5) or Tier 4.

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