Carbon Footprint in Chemical Industry – Fuels and Gases

PEP Review 2025-06

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Glossary

¢/kWh	Cents per kilowatt-hour
¢/lb	Cents per pound
¢/Mgal	Cents per thousand gallons
¢/Mlb	Cents per thousand pounds
¢/t-h	Cents per ton hour
°C	Degree Celsius
ARU	Amine regeneration unit
ATR	Autothermal reforming
bhp	Brake horsepower
BTL	Biomass-to-liquids
Btu	British thermal units
BTX	Benzene, toluene and xylene
C3MR	Propane precooled mixed refrigerant
CaL	Calcium looping
CCS	Carbon capture and storage
CD	Continuous deglycerolization
CDM	Clean Development Mechanism
CFCs	Chlorofluorocarbons
CO_2e	Carbon dioxide equivalent
CO_2e/GJ	Carbon dioxide equivalent per gigajoule
CO_2e/MWh	Carbon dioxide equivalent per megawatt-hour
CPOX	Catalytic partial oxidation
DME	Dimethyl ether
DMR	Dual mixed refrigeration
EIA	Energy Information Administration
EPC	Engineering, procurement and construction
EU-ETS	EU European Trading Scheme
EVA	Ethylene-acetate
FCC	Fluid catalytic cracking
FCCU	Fluid catalytic cracking unit
FT	Fischer-Tropsch
ft	Feet
ft dia	Feet diameter
g	Gram(s)
G&A	General and administrative
gal	Gallon
GHG	Greenhouse gas
GJ/ton	Gigajoules per ton
GTL	Gas-to-liquids
GWP	Global warming potential
h	Hour
HFC	Hydrofluorocarbon
IEA	International Energy Agency
IH2	Integrated Hydropyrolysis and Hydroconversion
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
kg/cm^2	Kilograms per square centimeter
kg/h	Kilograms per hour
lb	Pounds
lb/h	Pounds per hour
lb/y	Pounds per year
MEA	Monoethanolamine
mgal	Thousand gallons
Misc.	Miscellaneous
mlb	Thousand pounds

MMBtu/h	Million British thermal units per hour
MMt	Million metric tons
MMt/y	Million metric tons per year
Mol wt	Molecular weight
MTBE	Methyl t-butyl ether
MTG	Methanol-to-Gasoline
MWh	Megawatt-hour
MWh/ton	Megawatt-hour per ton
Negl.	Negligible
NGL	Natural gas liquid
PBR	Photobioreactor
PEP	Process Economics Program
PFCs	Perfluorinated compounds
POX	Partial oxidation
PSA	Pressure swing adsorption
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
RVP	Reid Vapor Pressure
SAF	Sustainable aviation fuel
SMR	Steam methane reforming
sq ft	Square feet
SS	Stainless steel
Syngas	Synthetic gas
t	Metric tons
TAC	Thermal Advanced Chemical
t-h	Ton-hour
TIGAS	Topsoe Improved Gasoline Synthesis
t/y	Metric tons per year
TFC	Total fixed capital
USGC	United States Gulf Coast
VA	Vinyl acetate
VCC	Veba Combi Cracking
VR	Vacuum residue
wt%	Weight percent

Abstract

There has been a growing urgency to curb greenhouse gas (GHG) emissions. While viable solutions to reduce GHG emissions are being explored, the chemical industry has been a primary focus of many international environmental organizations. Numerous opportunities exist for emissions reductions in the chemical industry. Quantifying the carbon emissions for chemical processes is necessary to understand potential reductions. However, carbon emissions estimates for many chemical processes have not been established.

To help determine potential emissions reductions, the Process Economics Program has prepared an estimate of the carbon footprint of the processes for the production of fuels and gases. This review presents carbon dioxide emissions factors for 204 processes. Estimates have been broken down into Scope 1 (direct emissions) and Scope 2 (indirect emissions). Direct emissions occur at the plant site, while indirect emissions arise from remotely located electrical generators. GHG emissions factors calculations are presented on a US Gulf Coast basis.

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