



CARBON FOOTPRINT

COUNTRY SPECIFIC ELECTRICITY GRID GREENHOUSE GAS EMISSION FACTORS

Last Updated: January 2022

Key terms

- **Dual reporting** – Reporting both location-based and market-based emissions.
- **Generation** – This is the emissions factor for the fuels burned to provide you with the energy that you have directly used. This will be part of your “Scope 2” emissions, although you have directly used the energy, the emissions occurred at a power station, where the fuel was burned.
- **Location-based reporting** – Calculating your emissions based on where your site is, using the fuel mixes from power stations local to you.
- **Market-based reporting** – Calculating your emissions based on the consumer choices you have made, e.g. using a green or renewable tariff, so that you only purchase the energy from renewable sources.
- **Production mix** – These are emissions factors based on the mix of fuels used by power stations in the area. Use these for location-based reporting.
- **Residual mix** – These are emissions factors based on the mix of fuels used by power stations in the area where the energy from certain fuels that has been sold to specific consumers has been taken out. For example, people using green or renewable energy tariffs have bought energy that comes from only renewable sources. Therefore, these values can be used for market-based reporting when you have not bought energy from a specific mix of fuels.
- **Scope 1** – Emissions that occurred from burning fuel in assets under your control, e.g. on your sites or in your vehicles.
- **Scope 2** – Emissions that occurred out of your control but as a result of energy you have directly consumed.
- **Scope 3** – Emissions that occurred in your supply chain.
- **Transmission & distribution** – This is the emissions factor for the energy generated to move the energy you used around the grid to get to your site. This will be part of your “Scope 3” emissions, as the energy associated with these emissions was neither consumed nor generated on your site, but is used as a result of energy consumed on your site.

COUNTRY SPECIFIC ELECTRICITY FACTORS – January 2022

The following grid electricity emissions factors are used in our online calculators. Countries and territories are ordered alphabetically and grouped by geographic area.

Grouping	Country	Production fuel mix factor (kgCO _{2e} per kWh)	Residual fuel mix factor (kgCO _{2e} per kWh)	Source	Year	Comments
Africa	South Africa	0.9006	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
Asia	China (PR)	0.5374	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Hong Kong (China)	0.7100 or 0.6500	-	Hong Kong Electric Company (2020) or CLP Group (2020) These two companies supply different areas of HK so check which one you need.	2020	Combined generation and T&D factor
	India	0.7082	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Indonesia	0.7177	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Japan	0.4658	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Korea (Republic)	0.4156	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Singapore	0.4080	-	Singapore Energy Market Authority (EMA)	2020	Electricity Grid Emissions Factors
	Thailand	Gen = 0.4420 T&D = 0.0390	-	Energy Policy and Planning Office (EPPO) Thai Government Ministry of Energy	2020	Generation Factor T&D = Consumption – Generation
Australasia	Australia	Gen = 0.7600 T&D = 0.0800	-	Australian Government	2019	Published in August 2021
	New Zealand	Gen = 0.1014 T&D = 0.0087	-	Ministry for the Environment https://www.mfe.govt.nz/node/18670/	2018	Emission factors published in 2020, based on 2018 national inventory.

Grouping	Country	Production fuel mix factor (kgCO ₂ e per kWh)	Residual fuel mix factor (kgCO ₂ e per kWh)	Source	Year	Comments
Middle East	Saudi Arabia	0.5059	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Turkey	0.3750	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	United Arab Emirates	Gen = 0.4041 T&D = 0.01379	-	Dubai Electricity & Water Authority (sustainability report 2020)	2020	Generation factor only
North & Central America	Canada	0.12	-	UN Framework Convention on Climate Change	2021 (based on 2019 data)	Combined generation and distribution factor. Regional factors are available. See separate table below.
	Mexico	0.4314	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	United States	0.42394	-	US Env Protection Agency (EPA) eGrid	2019	Combined generation and distribution factor. Regional factors are available. See separate table below.
South America	Argentina	0.3070	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Brazil	0.0617	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
Europe	Austria	0.11118	-	Association of Issuing Bodies (AIB) 2021	2020	Production mix factor
	Belgium	0.16189	0.20478	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Bulgaria	0.37212	0.37212	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Croatia	0.22696	0.4688	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Cyprus	0.6429	0.642	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Czech Republic	0.49549	0.53244	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Denmark	0.14252	0.42767	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Estonia	0.59869	0.54689	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor

Grouping	Country	Production fuel mix factor (kgCO ₂ e per kWh)	Residual fuel mix factor (kgCO ₂ e per kWh)	Source	Year	Comments
	Finland	0.09532	0.26818	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	France	0.05128	0.05852	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Germany	0.33866	0.58883	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Greece	0.41001	0.4904	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Hungary	0.24375	0.27411	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Iceland	0.00013	0.40193	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Ireland	0.33599	0.44647	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Italy	0.32384	0.45857	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Latvia	0.21567	0.42152	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Lithuania	0.25356	0.34019	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Luxembourg	0.10136	-	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Malta	0.39062	0.39092	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Netherlands	0.37434	0.45172	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Norway	0.00762	0.40194	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Poland	0.75962	0.79868	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Portugal	0.20155	0.37538	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Romania	0.26184	0.26516	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Russian Federation	0.3102	-	Climate Transparency (2021 Report)	2020	Emissions intensity of the power sector
	Serbia	0.77669	0.81076	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Slovakia	0.15548	0.21823	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Slovenia	0.22405	0.3452	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Spain	0.17103	0.28653	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Sweden	0.00567	0.02314	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	Switzerland	0.01152	0.03034	Association of Issuing Bodies (AIB) 2021	2020	Production & residual mix factor
	United Kingdom	Gen: 0.21233 T&D: 0.01879	0.316	Production: UK Govt – Defra/BEIS (2021) Residual: Association of Issuing Bodies (AIB) 2021	2021 (2019/20 Data) 2020	Generation & transmission & distribution factors Residual mix factor

UNITED STATES REGIONAL FACTORS (BY STATE)

Regional factors are sourced directly from the United States Environmental Protection Agency's (EPA) eGrid database.

<https://www.epa.gov/egrid> 2019 factors, published February 2021. **Next set due to be published in 2022.**

State	Grid	Generation Factor (kgCO ₂ e per kWh)	T&D Factor (kgCO ₂ e per kWh)	Year
UNITED STATES		0.40334	0.0206	2019 (published 2021)
Alaska (AK)	ASCC & ASCC Misc. - Alaska Grid	0.44222	0.0239	2019 (published 2021)
Alabama (AL)	SERC - South	0.35633	0.0182	2019 (published 2021)
Arkansas (AR)	SERC - South	0.51163	0.0261	2019 (published 2021)
Arizona (AZ)	WECC - Southwest	0.39613	0.0202	2019 (published 2021)
California (CA)	WECC- California	0.17562	0.0090	2019 (published 2021)
Colorado (CO)	WECC - Rockies	0.60376	0.0308	2019 (published 2021)
Connecticut (CT)	NPCC - New England	0.21655	0.0110	2019 (published 2021)
Washington DC (DC)	RFC - East	0.36183	0.0185	2019 (published 2021)
Delaware (DE)	RFC - East	0.32272	0.0165	2019 (published 2021)
Florida (FL)	FRCC - All	0.39793	0.0203	2019 (published 2021)
Georgia (GA)	SERC - South	0.39959	0.0204	2019 (published 2021)
Hawaii (HI)	HICC - Misc. & Oahu	0.70884	0.0390	2019 (published 2021)
Iowa (IA)	MRO - East	0.39075	0.0199	2019 (published 2021)
Idaho (ID)	WECC - Rockies	0.09588	0.0049	2019 (published 2021)
Illinois (IL)	MRO- East	0.32921	0.0168	2019 (published 2021)
Indiana (IN)	RFC - West	0.74126	0.0378	2019 (published 2021)
Kansas (KS)	SPP- North	0.40535	0.0207	2019 (published 2021)
Kentucky (KY)	SERC - Tennessee Valley	0.80768	0.0412	2019 (published 2021)
Louisiana (LA)	SERC - South	0.37481	0.0191	2019 (published 2021)
Massachusetts (MA)	NPCC - New England	0.35406	0.0181	2019 (published 2021)
Maryland (MD)	RFC - East	0.33507	0.0171	2019 (published 2021)
Maine (ME)	NPCC - New England	0.09687	0.0049	2019 (published 2021)
Michigan (MI)	RFC - Michigan	0.45968	0.0234	2019 (published 2021)
Minnesota (MN)	MRO - East	0.39958	0.0204	2019 (published 2021)

State	Grid	Generation Factor (kgCO _{2e} per kWh)	T&D Factor (kgCO _{2e} per kWh)	Year
UNITED STATES		0.40334	0.0206	2019 (published 2021)
Missouri (MO)	SERC - South	0.72521	0.0370	2019 (published 2021)
Mississippi (MS)	SERC - South	0.37982	0.0194	2019 (published 2021)
Montana (MT)	WECC - Rockies	0.57276	0.0292	2019 (published 2021)
North Carolina (NC)	SERC - Virginia/Carolinas	0.35359	0.0180	2019 (published 2021)
North Dakota (ND)	MRO-West	0.65657	0.0335	2019 (published 2021)
Nebraska (NE)	MRO-West	0.57408	0.0293	2019 (published 2021)
New Hampshire (NH)	NPCC - New England	0.11623	0.0059	2019 (published 2021)
New Jersey (NJ)	RFC - East	0.24729	0.0126	2019 (published 2021)
New Mexico (NM)	WECC - Southwest	0.60186	0.0307	2019 (published 2021)
Nevada (NV)	WECC - Rockies	0.33535	0.0171	2019 (published 2021)
New York (NY)	NPCC - LI, NYC, & Upstate NY	0.17157	0.0088	2019 (published 2021)
Ohio (OH)	RFC - West	0.56357	0.0287	2019 (published 2021)
Oklahoma (OK)	SPP- South	0.33305	0.0170	2019 (published 2021)
Oregon (OR)	WECC - Northwest	0.18059	0.0092	2019 (published 2021)
Pennsylvania (PA)	RFC - West	0.34417	0.0176	2019 (published 2021)
Rhode Island (RI)	NPCC - New England	0.38659	0.0197	2019 (published 2021)
South Carolina (SC)	SERC - Virginia/Carolinas	0.24421	0.0125	2019 (published 2021)
South Dakota (SD)	MRO-West	0.22322	0.0114	2019 (published 2021)
Tennessee (TN)	SERC - Tennessee Valley	0.3195	0.0163	2019 (published 2021)
Texas (TX)	ERCOT - All	0.41432	0.0211	2019 (published 2021)
Utah (UT)	WECC - Rockies	0.72657	0.0371	2019 (published 2021)
Virginia (VA)	SERC - Virginia/Carolinas	0.28842	0.0147	2019 (published 2021)
Vermont (VT)	NPCC - New England	0.02325	0.0012	2019 (published 2021)
Washington (WA)	WECC - Northwest	0.13567	0.0069	2019 (published 2021)
Wisconsin (WI)	MRO - East	0.55927	0.0285	2019 (published 2021)
West Virginia (WV)	SERC - Virginia/Carolinas	0.88235	0.0450	2019 (published 2021)
Wyoming (WY)	WECC - Rockies	0.93848	0.0479	2019 (published 2021)

CANADA REGIONAL FACTORS (BY PROVINCE)

Province factors sourced from Canada's latest submission to the UN Framework Convention on Climate Change (2021).

State	Generation Factor (kgCO _{2e} per kWh)	T&D Factor (kgCO _{2e} per kWh)	Year
Canada	0.12	Negligible	2019 (published 2021)
Alberta (AB)	0.62	0.05	2019 (published 2021)
British Columbia (BC)	0.0186	0.0011	2019 (published 2021)
Manitoba (MT)	0.0012	0.0001	2019 (published 2021)
New Brunswick (NB)	0.26	0.01	2019 (published 2021)
Newfoundland and Labrador (NL)	0.028	0.001	2019 (published 2021)
Nova Scotia (NS)	0.76	0.05	2019 (published 2021)
Northwest Territories (NT)	0.20	Negligible	2019 (published 2021)
Nunavut (NU)	0.85	0.05	2019 (published 2021)
Ontario (ON)	0.030	Negligible	2019 (published 2021)
Prince Edward Island (PE)	0.002	Negligible	2019 (published 2021)
Quebec (QC)	0.0012	0.0003	2019 (published 2021)
Saskatchewan (SK)	0.66	0.05	2019 (published 2021)
Yukon Territory (YT)	0.101	0.010	2019 (published 2021)

AUSTRALIA REGIONAL FACTORS (BY STATE)

State specific factors are sourced from publicly available emissions factors published by the Australian Government to support annual GHG measurements.

This was updated using the report published in October 2020 report. If the electricity is not sourced from a listed grid, Northern Territory emissions factor may be used.

State	Generation Factor (kgCO _{2e} per kWh)	T&D Factor (kgCO _{2e} per kWh)	Year
AUSTRALIA	0.76	0.08	2019 (published in 2021)
Australian Capital Territory	0.79	0.08	2019 (published in 2021)
New South Wales	0.79	0.08	2019 (published in 2021)
Northern Territory	0.57	0.05	2019 (published in 2021)
Northern Territory – Darwin Katherine Interconnected System (DKIS)	0.54	Not available	2019 (published in 2021)
Queensland	0.80	0.12	2019 (published in 2021)
South Australia	0.35	0.07	2019 (published in 2021)
Tasmania	0.16	0.02	2019 (published in 2021)
Victoria	0.96	0.10	2019 (published in 2021)
Western Australia – North Western Interconnected System (NWIS)	0.58	Not available	2019 (published in 2021)
Western Australia – South West Interconnected System (SWIS)	0.68	0.02	2019 (published in 2021)

Sources of Emissions Factors:

- **AIB (2021). 2020 European Residual Mix** - Results of the calculation of Residual Mixes for the calendar year 2020 (Version 1.0, 2021-05-31)
<https://www.aib-net.org/facts/european-residual-mix>
- **Australian Government Dept of Environment & Energy Emissions Factors**
 - Table 5 and Table 46 for regional factors (August 2021 report) [National Greenhouse Accounts Factors – August 2021 \(industry.gov.au\)](https://www.industry.gov.au/publications/national-greenhouse-gas-emissions-factors-august-2021)
- **Climate Transparency (2021)** – Country profiles from ‘G20 Brown to Green Report 2020’ (Oct 2021) - [The Climate Transparency Report 2021 | Climate Transparency \(climate-transparency.org\)](https://www.climate-transparency.org/publications/g20-brown-to-green-report-2020)
- **Defra/BEIS 2021 Emissions Factors** (June 2021) - <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021>
- **Dubai Electricity & Water Authority (DEWA) (2020)** - [https://www.dewa.gov.ae/~media/Files/Customer/Sustainability Reports/DEWA Sustainability Report 2020.ashx](https://www.dewa.gov.ae/~media/Files/Customer/Sustainability%20Reports/DEWA%20Sustainability%20Report%202020.ashx)
- **Hong Kong**
 - Power generation is managed by two major companies: Hong Kong Electric Company (supplies HK Island and Lamma Island) and CLP Power Hong Kong Ltd (supplies Kowloon, New Territories and outlying islands except Lamma Island).
https://en.wikipedia.org/wiki/Electricity_sector_in_Hong_Kong
 - HK Electric (<https://www.hkelectric.com/en/corporate-social-responsibility/sustainability-reports>)
 - 2020 sustainability report, page 75 – “CO2e per electricity sold (kg/kWh)”
 - https://www.hkelectric.com/en/CorporateSocialResponsibility/CorporateSocialResponsibility_CDD/Documents/SR2020E.pdf
 - CLP Power Hong Kong
 - 2020 annual report, page 100 – https://www.clpgroup.com/content/dam/clp-group/channels/sustainability/document/sustainability-report/2020/CLP_Sustainability_Report_2020_en.pdf

- **New Zealand Government Ministry for the Environment**
 - <https://www.mfe.govt.nz/node/18670/>
 - 2018 factors (published Dec 2020) – <https://environment.govt.nz/assets/Publications/Files/Measuring-Emissions-Factors-Summary-2020-final.pdf>
- **Singapore - Energy Market Authority (EMA)**
 - https://www.ema.gov.sg/statistic.aspx?sta_sid=20140729MPY03nTHx2a1
 - PDF available for download at the above URL
- **Thai Government Ministry of Energy – Energy Policy and Planning Office (EPPO)**
 - [CO2 Statistic \(eppo.go.th\)](https://www.epppo.go.th)
 - Table 9.1-15: CO2 Emission per kWh
- **United Nations Framework Convention on Climate Change (UNFCCC)**
 - <https://unfccc.int/ghg-inventories-annex-i-parties/2021>
 - **Canada** – download ‘NIR’ (national inventory report) (Published: 15 Apr 2021). Page 60 onwards on ‘Part 3’ document.
- **United States EPA eGrid Database**
 - 2019 factors (Published: Feb 2021)
 - <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid>
 - EFs converted from lbs/MWh to kg/kWh and calculated T&D factors