



CARBON FOOTPRINT

COUNTRY SPECIFIC ELECTRICITY GRID GREENHOUSE GAS EMISSION FACTORS

Last Updated: July 2020

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 – June 2020

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	0.928	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
Asia	China (PR)	0.555	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Hong Kong (China)	0.8100 or 0.7000	-	Hong Kong Electric Company (2019) or CLP Group (2019) These two companies supply different areas of HK so check which one you need.	2019	Combined generation and T&D factor
	India	0.708	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Indonesia	0.761	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Japan	0.506	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Korea (Republic)	0.500	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Thailand	Gen = 0.445 T&D = 0.052	-	Energy Policy and Planning Office (EPPO) Thai Government Ministry of Energy	2019	Generation Factor T&D = Consumption – Generation
Australasia	Australia	Gen = 0.7900 T&D = 0.0900	-	Australian Government	2018	Published in August 2019
	New Zealand	Gen = 0.0977 T&D = 0.0074	-	Ministry for the Environment https://www.mfe.govt.nz/node/18670/	2019 (based on 2016 data)	Emission factors published in 2019, based on 2018 national inventory which is based on 2016 data.

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	0.732	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Turkey	0.481	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	United Arab Emirates	0.4258	-	Dubai Electricity & Water Authority (sustainability report 2018)	2018	Generation factor only
North & Central America	Canada	0.13	-	UN Framework Convention on Climate Change	2020 (based on 2018 data)	Combined generation and distribution factor. Regional factors are available. See separate table below.
	Mexico	0.449	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	United States	0.45322	-	US Env Protection Agency (EPA) eGrid	2018	Combined generation and distribution factor. Regional factors are available. See separate table below.
South America	Argentina	0.313	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
	Brazil	0.074	-	Climate Transparency (2019 Report)	2018	Emissions intensity of the power sector
Europe	Austria	0.13286	-	Association of Issuing Bodies (AIB)	2019	Production mix factor
	Belgium	0.15313	0.18767	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Bulgaria	0.43737	0.43737	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Croatia	0.27315	0.51415	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Cyprus	0.67729	0.67556	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Czech Republic	0.54465	0.59511	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Denmark	0.15444	0.46521	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor

Grouping	Country	Production fuel mix factor (kgCO _{2e} per kWh)	Residual fuel mix factor (kgCO _{2e} per kWh)	Source	Year	Comments
	Estonia	0.72328	0.75771	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Finland	0.13622	0.31013	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	France	0.03895	0.04319	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Germany	0.37862	0.60937	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Greece	0.54901	0.57744	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Hungary	0.25298	0.28574	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Iceland	0.00011	0.39367	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Ireland	0.34804	0.49515	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Italy	0.33854	0.46589	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Latvia	0.30333	0.31524	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Lithuania	0.14913	0.35193	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Luxembourg	0.13939	0.44933	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Malta	0.37060	0.37835	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Netherlands	0.45207	0.55521	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Norway	0.01118	0.39627	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Poland	0.79107	0.81097	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Portugal	0.25255	0.25603	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Romania	0.31011	0.31068	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Russian Federation	0.325	-	Climate Transparency (2019 Report)	2019	Emissions intensity of the power sector
	Serbia	0.76253	0.76575	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Slovakia	0.15110	0.19859	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Slovenia	0.24385	0.36412	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Spain	0.22026	0.34269	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Sweden	0.01189	0.05022	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	Switzerland	0.01182	0.01853	Association of Issuing Bodies (AIB)	2019	Production & residual mix factor
	United Kingdom	Gen: 0.23314 T&D: 0.02005	0.34750	Production: UK Govt – Defra/BEIS	2020 (2019/20 Data)	Generation & transmission & distribution factors
				Residual: Association of Issuing Bodies (AIB)	2019	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. 2018 factors were published in February 2020. **Next set due to be published in 2022.**

State	Grid	Generation Factor (kgCO _{2e} per kWh)	T&D Factor (kgCO _{2e} per kWh)	Year
UNITED STATES		0.43222	0.0203	2018 (published 2020)
Alaska (AK)	ASCC & ASCC Misc. - Alaska Grid	0.41367	0.0223	2018 (published 2020)
Alabama (AL)	SERC - South	0.39385	0.0202	2018 (published 2020)
Arkansas (AR)	SERC - South	0.55299	0.0284	2018 (published 2020)
Arizona (AZ)	WECC - Southwest	0.44100	0.0223	2018 (published 2020)
California (CA)	WECC - California	0.19143	0.0097	2018 (published 2020)
Colorado (CO)	WECC - Rockies	0.62204	0.0314	2018 (published 2020)
Connecticut (CT)	NPCC - New England	0.23110	0.0119	2018 (published 2020)
Washington DC (DC)	RFC - East	0.19961	0.0102	2018 (published 2020)
Delaware (DE)	RFC - East	0.40841	0.0210	2018 (published 2020)
Florida (FL)	FRCC - All	0.42988	0.0221	2018 (published 2020)
Georgia (GA)	SERC - South	0.42268	0.0217	2018 (published 2020)
Hawaii (HI)	HICC - Misc. & Oahu	0.69163	0.0375	2018 (published 2020)
Iowa (IA)	MRO - East	0.48868	0.0251	2018 (published 2020)
Idaho (ID)	WECC - Rockies	0.07289	0.0037	2018 (published 2020)
Illinois (IL)	MRO - East	0.37128	0.0191	2018 (published 2020)
Indiana (IN)	RFC - West	0.79312	0.0407	2018 (published 2020)
Kansas (KS)	SPP - North	0.45205	0.0232	2018 (published 2020)
Kentucky (KY)	SERC - Tennessee Valley	0.83264	0.0427	2018 (published 2020)
Louisiana (LA)	SERC - South	0.38076	0.0195	2018 (published 2020)
Massachusetts (MA)	NPCC - New England	0.33287	0.0171	2018 (published 2020)
Maryland (MD)	RFC - East	0.38155	0.0196	2018 (published 2020)
Maine (ME)	NPCC - New England	0.12166	0.0062	2018 (published 2020)

State	Grid	Generation Factor (kgCO ₂ e per kWh)	T&D Factor (kgCO ₂ e per kWh)	Year
UNITED STATES		0.43222	0.0203	2018 (published 2020)
Michigan (MI)	RFC - Michigan	0.50610	0.0260	2018 (published 2020)
Minnesota (MN)	MRO - East	0.45500	0.0234	2018 (published 2020)
Missouri (MO)	SERC - South	0.77695	0.0399	2018 (published 2020)
Mississippi (MS)	SERC - South	0.41709	0.0214	2018 (published 2020)
Montana (MT)	WECC - Rockies	0.52886	0.0267	2018 (published 2020)
North Carolina (NC)	SERC - Virginia/Carolinas	0.36472	0.0187	2018 (published 2020)
North Dakota (ND)	MRO-West	0.68803	0.0353	2018 (published 2020)
Nebraska (NE)	MRO-West	0.64298	0.0330	2018 (published 2020)
New Hampshire (NH)	NPCC - New England	0.13872	0.0071	2018 (published 2020)
New Jersey (NJ)	RFC - East	0.22777	0.0117	2018 (published 2020)
New Mexico (NM)	WECC - Southwest	0.60800	0.0307	2018 (published 2020)
Nevada (NV)	WECC - Rockies	0.33866	0.0171	2018 (published 2020)
New York (NY)	NPCC - LI, NYC, & Upstate NY	0.18991	0.0097	2018 (published 2020)
Ohio (OH)	RFC - West	0.60321	0.0310	2018 (published 2020)
Oklahoma (OK)	SPP- South	0.40523	0.0208	2018 (published 2020)
Oregon (OR)	WECC - Northwest	0.14250	0.0072	2018 (published 2020)
Pennsylvania (PA)	RFC - West	0.35781	0.0184	2018 (published 2020)
Rhode Island (RI)	NPCC - New England	0.39407	0.0202	2018 (published 2020)
South Carolina (SC)	SERC - Virginia/Carolinas	0.28783	0.0148	2018 (published 2020)
South Dakota (SD)	MRO-West	0.23586	0.0121	2018 (published 2020)
Tennessee (TN)	SERC - Tennessee Valley	0.33945	0.0174	2018 (published 2020)
Texas (TX)	ERCOT - All	0.44618	0.0228	2018 (published 2020)
Utah (UT)	WECC - Rockies	0.72999	0.0368	2018 (published 2020)
Virginia (VA)	SERC - Virginia/Carolinas	0.33695	0.0173	2018 (published 2020)
Vermont (VT)	NPCC - New England	0.02608	0.0013	2018 (published 2020)
Washington (WA)	WECC - Northwest	0.09074	0.0046	2018 (published 2020)
Wisconsin (WI)	MRO - East	0.63333	0.0325	2018 (published 2020)
West Virginia (WV)	SERC - Virginia/Carolinas	0.88970	0.0457	2018 (published 2020)
Wyoming (WY)	WECC - Rockies	0.93610	0.0472	2018 (published 2020)

CANADA REGIONAL FACTORS (BY PROVINCE)

Province factors sourced from Canada's latest submission to the UN Framework Convention on Climate Change (2019).

State	Generation Factor (kgCO _{2e} per kWh)	T&D Factor (kgCO _{2e} per kWh)	Year
Canada	0.12	0.01	<i>2018 (published 2020)</i>
Alberta (AB)	0.63	0.05	2018 (published 2020)
British Columbia (BC)	0.0123	0.0005	2018 (published 2020)
Manitoba (MT)	0.0013	0.0001	2018 (published 2020)
New Brunswick (NB)	0.39	0.01	2018 (published 2020)
Newfoundland and Labrador (NL)	0.026	0.001	2018 (published 2020)
Nova Scotia (NS)	0.72	0.04	2018 (published 2020)
Northwest Territories (NT)	0.16	Negligible	2018 (published 2020)
Nunavut (NU)	0.84	0.05	2018 (published 2020)
Ontario (ON)	0.029	0.001	2018 (published 2020)
Prince Edward Island (PE)	0.004	Unknown use 'New Brunswick'	2018 (published 2020)
Quebec (QC)	0.0013	0.0004	2018 (published 2020)
Saskatchewan (SK)	0.68	0.03	2018 (published 2020)
Yukon Territory (YT)	0.069	0.010	2018 (published 2020)

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 August 2019 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	0.79	0.09	2017/18 (published in 2019)
Australian Capital Territory	0.81	0.09	2017/18 (published in 2019)
New South Wales	0.81	0.09	2017/18 (published in 2019)
Northern Territory	0.63	0.08	2017/18 (published in 2019)
Northern Territory – Darwin Katherine Interconnected System (DKIS)	0.55	Not available	2017/18 (published in 2019)
Queensland	0.81	0.12	2017/18 (published in 2019)
South Australia	0.44	0.10	2017/18 (published in 2019)
Tasmania	0.15	0.02	2017/18 (published in 2019)
Victoria	1.02	0.10	2017/18 (published in 2019)
Western Australia – North Western Interconnected System (NWIS)	0.59	Not available	2017/18 (published in 2019)
Western Australia – South West Interconnected System (SWIS)	0.69	0.04	2017/18 (published in 2019)

Sources of Emissions Factors:

- **AIB (2020). 2019 European Residual Mix Factors.** Version 1 (29 May 2020) <https://www.aib-net.org/facts/european-residual-mix>
- **Australian Government Dept of Environment & Energy Emissions Factors**
 - Table 5 and Table 44 for regional factors (Aug 2019 report) – <https://publications.industry.gov.au/publications/climate-change/system/files/resources/cf1/national-greenhouse-accounts-factors-august-2019.pdf>
- **Climate Transparency (2019)** – Country profiles from ‘G20 Brown to Green Report 2019’ (Nov 2019) - <https://www.climate-transparency.org/wp-content/uploads/2019/11/Brown-to-Green-Report-2019.pdf>
- **Defra/BEIS 2020 Emissions Factors** (June 2020) - <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>
- **Dubai Electricity & Water Authority (DEWA) (2018)** - page 81
https://www.dewa.gov.ae/~media/Files/Custom/Sustainability%20Reports/DEWA%20Sustainability%20Report%202018_EN.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>)
 - 2019 sustainability report, page 71 – “CO2e per electricity sold (kg/kWh)”
https://www.hkelectric.com/en/CorporateSocialResponsibility/CorporateSocialResponsibility_CDD/Documents/SR2019E.pdf
 - CLP Power Hong Kong
 - 2019 annual report, page 97 – https://www.clpgroup.com/en/Investors-Information-site/Documents/Financial%20Report%20PDF/e_2019Annual%20Report.pdf

- **New Zealand Government Ministry for the Environment**
 - <https://www.mfe.govt.nz/node/18670/>
 - 2016 factors (published Dec 2016) – https://www.mfe.govt.nz/sites/default/files/media/2016-voluntary-ghg-reporting-summary-tables-emissions_0.pdf
 - 2018 factors (published May 2019) – <https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/2019-emission-factors-summary.pdf>

- **Thai Government Ministry of Energy – Energy Policy and Planning Office (EPPO)**
 - <http://www.eppo.go.th/index.php/en/en-energystatistics/co2-statistic>
 - Table 9.1-15: CO2 Emission per kWh

- **United Nations Framework Convention on Climate Change**
 - <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019>
 - **Canada** – download ‘NIR’ (national inventory report) (Published: 15 Apr 2019). Page 60 onwards on ‘Part 3’ document.

- **United States EPA eGrid Database**
 - 2018 factors (Published: Jan 2020. Revised: Mar 2020)
 - <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid>
 - EFs converted from lbs/MWh to kg/kWh and calculated T&D factors