



**CARBON FOOTPRINT**

**COUNTRY SPECIFIC ELECTRICITY GRID GREENHOUSE GAS EMISSION FACTORS**

**Last Updated: March 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 <sub>2e</sub> per kWh)	Residual fuel mix factor (kgCO <sub>2e</sub> 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) <b>These two companies supply different areas of HK so check which one you need.</b>	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 <a href="https://www.mfe.govt.nz/node/18670/">https://www.mfe.govt.nz/node/18670/</a>	2018	Emission factors published in 2020, based on 2018 national inventory.

Grouping	Country	Production fuel mix factor (kgCO <sub>2</sub> e per kWh)	Residual fuel mix factor (kgCO <sub>2</sub> 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. <b>Regional factors are available. See separate table below.</b>
	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. <b>Regional factors are available. See separate table below.</b>
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 <sub>2</sub> e per kWh)	Residual fuel mix factor (kgCO <sub>2</sub> 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> 2020 factors, published January 2022. **Next set due to be published in 2023.**

State	Grid	Generation Factor (kgCO <sub>2</sub> e per kWh)	T&D Factor (kgCO <sub>2</sub> e per kWh)	Year
<b>UNITED STATES</b>		0.37313	0.0198	2020 (published 2022)
<b>Alaska (AK)</b>	ASCC & ASCC Misc. - Alaska Grid	0.43823	0.0241	2020 (published 2022)
<b>Alabama (AL)</b>	SERC - South	0.32707	0.0173	2020 (published 2022)
<b>Arkansas (AR)</b>	SERC - South	0.43150	0.0229	2020 (published 2022)
<b>Arizona (AZ)</b>	WECC - Southwest	0.33429	0.0177	2020 (published 2022)
<b>California (CA)</b>	WECC- California	0.20553	0.0109	2020 (published 2022)
<b>Colorado (CO)</b>	WECC - Rockies	0.55304	0.0293	2020 (published 2022)
<b>Connecticut (CT)</b>	NPCC - New England	0.24030	0.0127	2020 (published 2022)
<b>Washington DC (DC)</b>	RFC - East	0.36338	0.0193	2020 (published 2022)
<b>Delaware (DE)</b>	RFC - East	0.34248	0.0182	2020 (published 2022)
<b>Florida (FL)</b>	FRCC - All	0.38200	0.0202	2020 (published 2022)
<b>Georgia (GA)</b>	SERC - South	0.32818	0.0174	2020 (published 2022)
<b>Hawaii (HI)</b>	HICC - Misc. & Oahu	0.69241	0.0388	2020 (published 2022)
<b>Iowa (IA)</b>	MRO - East	0.27905	0.0148	2020 (published 2022)
<b>Idaho (ID)</b>	WECC - Rockies	0.09679	0.0051	2020 (published 2022)
<b>Illinois (IL)</b>	MRO- East	0.25240	0.0134	2020 (published 2022)
<b>Indiana (IN)</b>	RFC - West	0.70282	0.0372	2020 (published 2022)
<b>Kansas (KS)</b>	SPP- North	0.36478	0.0193	2020 (published 2022)
<b>Kentucky (KY)</b>	SERC - Tennessee Valley	0.76425	0.0405	2020 (published 2022)
<b>Louisiana (LA)</b>	SERC - South	0.34552	0.0183	2020 (published 2022)
<b>Massachusetts (MA)</b>	NPCC - New England	0.39912	0.0212	2020 (published 2022)
<b>Maryland (MD)</b>	RFC - East	0.29271	0.0155	2020 (published 2022)
<b>Maine (ME)</b>	NPCC - New England	0.10350	0.0055	2020 (published 2022)
<b>Michigan (MI)</b>	RFC - Michigan	0.42548	0.0226	2020 (published 2022)
<b>Minnesota (MN)</b>	MRO - East	0.34943	0.0185	2020 (published 2022)

State	Grid	Generation Factor (kgCO <sub>2e</sub> per kWh)	T&D Factor (kgCO <sub>2e</sub> per kWh)	Year
<b>UNITED STATES</b>		0.37313	0.0198	2020 (published 2022)
<b>Missouri (MO)</b>	SERC - South	0.73410	0.0389	2020 (published 2022)
<b>Mississippi (MS)</b>	SERC - South	0.40557	0.0215	2020 (published 2022)
<b>Montana (MT)</b>	WECC - Rockies	0.41397	0.0219	2020 (published 2022)
<b>North Carolina (NC)</b>	SERC - Virginia/Carolinas	0.29413	0.0156	2020 (published 2022)
<b>North Dakota (ND)</b>	MRO-West	0.62965	0.0334	2020 (published 2022)
<b>Nebraska (NE)</b>	MRO-West	0.54461	0.0289	2020 (published 2022)
<b>New Hampshire (NH)</b>	NPCC - New England	0.11244	0.0060	2020 (published 2022)
<b>New Jersey (NJ)</b>	RFC - East	0.22330	0.0118	2020 (published 2022)
<b>New Mexico (NM)</b>	WECC - Southwest	0.57147	0.0303	2020 (published 2022)
<b>Nevada (NV)</b>	WECC - Rockies	0.32505	0.0172	2020 (published 2022)
<b>New York (NY)</b>	NPCC - LI, NYC, & Upstate NY	0.18901	0.0100	2020 (published 2022)
<b>Ohio (OH)</b>	RFC - West	0.56848	0.0301	2020 (published 2022)
<b>Oklahoma (OK)</b>	SPP- South	0.32144	0.0170	2020 (published 2022)
<b>Oregon (OR)</b>	WECC - Northwest	0.15495	0.0082	2020 (published 2022)
<b>Pennsylvania (PA)</b>	RFC - West	0.31639	0.0168	2020 (published 2022)
<b>Rhode Island (RI)</b>	NPCC - New England	0.37537	0.0199	2020 (published 2022)
<b>South Carolina (SC)</b>	SERC - Virginia/Carolinas	0.23308	0.0124	2020 (published 2022)
<b>South Dakota (SD)</b>	MRO-West	0.15449	0.0082	2020 (published 2022)
<b>Tennessee (TN)</b>	SERC - Tennessee Valley	0.25919	0.0137	2020 (published 2022)
<b>Texas (TX)</b>	ERCOT - All	0.38896	0.0202	2020 (published 2022)
<b>Utah (UT)</b>	WECC - Rockies	0.71022	0.0376	2020 (published 2022)
<b>Virginia (VA)</b>	SERC - Virginia/Carolinas	0.29250	0.0155	2020 (published 2022)
<b>Vermont (VT)</b>	NPCC - New England	0.01375	0.0007	2020 (published 2022)
<b>Washington (WA)</b>	WECC - Northwest	0.09674	0.0051	2020 (published 2022)
<b>Wisconsin (WI)</b>	MRO - East	0.54069	0.0287	2020 (published 2022)
<b>West Virginia (WV)</b>	SERC - Virginia/Carolinas	0.87304	0.0463	2020 (published 2022)
<b>Wyoming (WY)</b>	WECC - Rockies	0.90270	0.0478	2020 (published 2022)

## 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 <sub>2e</sub> per kWh)	T&D Factor (kgCO <sub>2e</sub> per kWh)	Year
<b>Canada</b>	<b>0.12</b>	<b>Negligible</b>	2019 (published 2021)
<b>Alberta (AB)</b>	0.62	0.05	2019 (published 2021)
<b>British Columbia (BC)</b>	0.0186	0.0011	2019 (published 2021)
<b>Manitoba (MT)</b>	0.0012	0.0001	2019 (published 2021)
<b>New Brunswick (NB)</b>	0.26	0.01	2019 (published 2021)
<b>Newfoundland and Labrador (NL)</b>	0.028	0.001	2019 (published 2021)
<b>Nova Scotia (NS)</b>	0.76	0.05	2019 (published 2021)
<b>Northwest Territories (NT)</b>	0.20	Negligible	2019 (published 2021)
<b>Nunavut (NU)</b>	0.85	0.05	2019 (published 2021)
<b>Ontario (ON)</b>	0.030	Negligible	2019 (published 2021)
<b>Prince Edward Island (PE)</b>	0.002	Negligible	2019 (published 2021)
<b>Quebec (QC)</b>	0.0012	0.0003	2019 (published 2021)
<b>Saskatchewan (SK)</b>	0.66	0.05	2019 (published 2021)
<b>Yukon Territory (YT)</b>	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 <sub>2e</sub> per kWh)	T&D Factor (kgCO <sub>2e</sub> per kWh)	Year
<b>AUSTRALIA</b>	0.76	0.08	2019 (published in 2021)
<b>Australian Capital Territory</b>	0.79	0.08	2019 (published in 2021)
<b>New South Wales</b>	0.79	0.08	2019 (published in 2021)
<b>Northern Territory</b>	0.57	0.05	2019 (published in 2021)
<b>Northern Territory – Darwin Katherine Interconnected System (DKIS)</b>	0.54	Not available	2019 (published in 2021)
<b>Queensland</b>	0.80	0.12	2019 (published in 2021)
<b>South Australia</b>	0.35	0.07	2019 (published in 2021)
<b>Tasmania</b>	0.16	0.02	2019 (published in 2021)
<b>Victoria</b>	0.96	0.10	2019 (published in 2021)
<b>Western Australia – North Western Interconnected System (NWIS)</b>	0.58	Not available	2019 (published in 2021)
<b>Western Australia – South West Interconnected System (SWIS)</b>	0.68	0.02	2019 (published in 2021)

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## 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 Reports/DEWA Sustainability Report 2020.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](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](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](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](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**
  - 2020 factors (Published: Feb 2022)
    - <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid>
    - EFs converted from lbs/MWh to kg/kWh and calculated T&D factors