Carbon Footprint Methodology Energy

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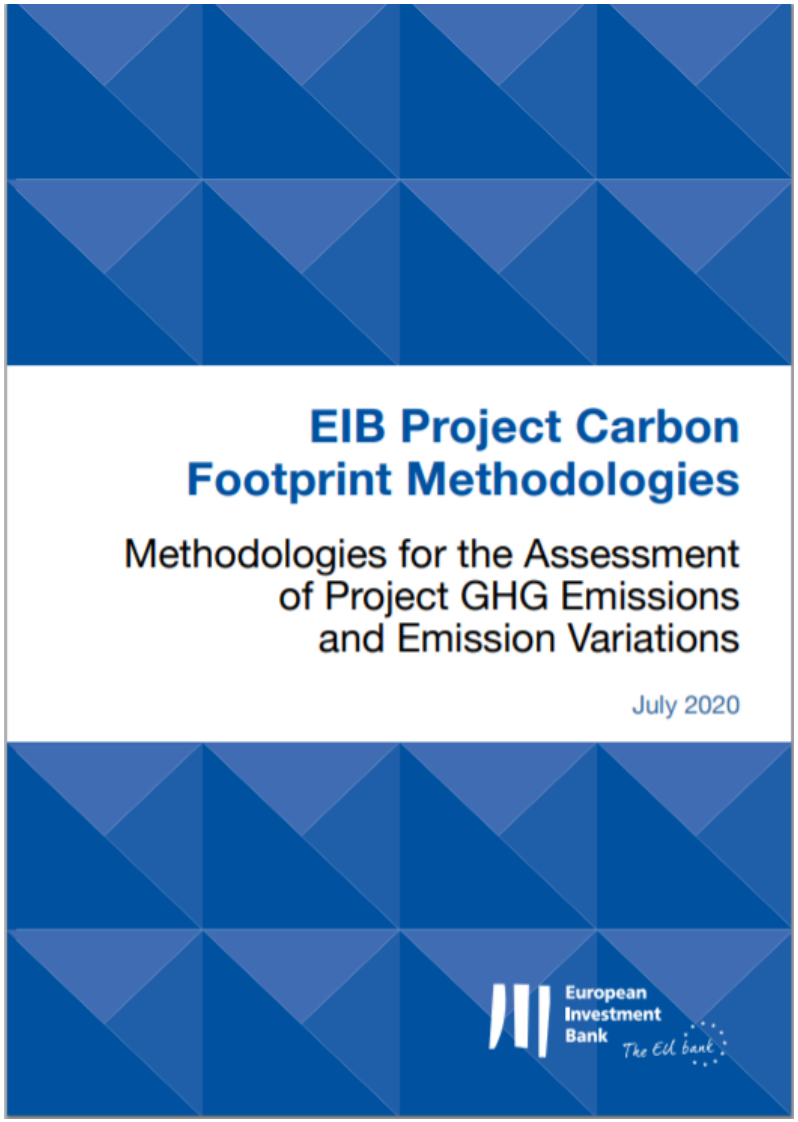
What does the manual say?



In general, depending on the scale of the project GHG assessment WILL NOT be required	• Telecommunications services • Drinking water supply networks • Rainwater and wastewater collection networks • Small scale industrial waste water treatment and municipal waste water treatment • Property developments • Mechanical/biological waste treatment plants • R&D activities • Pharmaceuticals and biotechnology
In general GHG assessment WILL be required	• Municipal solid waste landfills • Municipal waste incineration plants • Large waste water treatment plants • Manufacturing Industry • Chemicals and refining • Mining and basic metals • Pulp and paper • Rolling stock, ship, transport fleet purchases • Road and Rail infrastructure • Power transmission lines • Renewable sources of energy • Fuel production, processing, storage and transportation • Cement and lime production • Glass production • Heat and power generating plants • District heating networks • Natural gas liquefaction and re-gasification facilities • Gas transmission infrastructure

Thermal power and heat generation

ANNEX 1: DEFAULT EMISSIONS CALCULATION METHODOLOGIES

Method #	Sector & GHG	Calculation Input Data Requirements (i) (ii) etc.	Calculation Method
1A	**Stationary fossil fuel combustion** **CO_2e**	(i) Annual fuel use in energy units (e.g. TJ), volume or mass units (ii) Default emission factor (see table A1.1)	CO_2e (t) = Fuel energy use * Emissions Factor
1B	**Stationary fossil fuel combustion** **N_2O**	(i) Annual fuel energy input (derive from data above) (ii) Default emission factor (see table A1.1)	N_2O (t) = Fuel energy input * emission factor
1C	**Stationary biomass fuel combustion[9]** **CH_4 and N_2O**	(i) Fuel energy input (derive from data above) (ii) Default emission factors (CH_4 and N_2O expressed as CO_2e):	CH_4 (t) = Fuel energy input * emission factor N_2O (t) = Fuel energy input * emission factor Conversion factors to convert to CO_2e see table A1.9
1D	**Cogeneration Combined Heat and Power (CHP)** **CO_2e**	Direct emissions from fuel combustion to follow methodology 1A and 1C, as applicable, above.	
1E	**Purchased electricity** **CO_2e**	(i) Energy Purchased for use in project activities (ii) Country specific emissions factor (see table A1.3) for electricity consumption or	CO_2 (t) = Energy use * Country Specific Emissions Factor for Electricity Consumption

	t CO_2e/TJ
Energy/Manufacturing	
- Gaseous	0.0545
- Liquid	0.243
- Solid	1.9
- Municipal waste	1.9
- Unknown	1.37
Commercial/Residential	
- Gaseous	9.46
- Liquid	0.439
- Solid	0.1665
- Municipal waste	9.46
- Unknown	3.33

(iii) In line with international and EU common practice, CO_2 releases from the combustion of biomass is accounted for as 0 (see footnote 4 earlier in the text).

(iv) Emissions associated to the production for agricultural biomass fuel and processing of agricultural and forest biomass are including where significant:

- Fertilisers for purpose grown energy crops (N_2O); Fuel oil consumed to run machinery at farm level; chipping; drying, torrefaction and peletising of solid biomass (CO_2), and long-distance transportation (CO_2); factors on a case by case basis

Absolute emissions

- Energy generation projects
- *CO2e (t) = Fuel energy use * fuel emissions factor*
- Default fuel emissions factors in Annex A.1.1

Method #	Sector & GHG	Calculation Input Data Requirements (i) (ii) etc.	Calculation Method
		in special cases, such as electricity for pumped storage, the appropriate combination of marginal plants.	
1F	**Renewable energy** **CO_2e**	(i) Zero or minor absolute emissions except for hydropower with large reservoir storage capacity (see hydro reservoir emissions table A1.8). (ii) Renewable energy is assumed to displace (at least in part) fossil fuels (see electricity generation baseline assumptions Annex 2).	CO_2 (t) = Energy generated * Country Specific Emissions Factor for Electricity Combined Margin
1G	**Stationary combustion of waste type fuels** **CO_2e**	(i) Annual fuel use (ii) Default emission factor (see table A1.1) (iii) Zero or minor absolute emissions for organic portion of waste fuels.	CO_2 (t) = Fuel use * Fuel Emissions Factor

Default CO2e fuel emissions factors (A.1.1)

GASEOUS FOSSIL FUELS

Fuel Name	Amount of fuel	Units	kg CO_2	kg CH_4	kg N_2O	kg CO_2e	kg CO_2e incl. unox. carbon
Natural gas	1	Cubic metre (m^3)	1.9	0.0	0.0	1.9	1.9
Natural gas	1	TJ	56,100	1.0	0.1	56,15	55,874
Refinery gas	1	metric tonne (t)	2,851	0.0	0.0	2,851	2,837
Refinery gas	1	TJ	57,600	1.0	0.1	57,65	57,367
Liquefied Petroleum Gases	1	litres (l)	1.6	0.0	0.0	1.6	1.6
Liquefied Petroleum Gases	1	TJ	63,100	1.0	0.1	63,15	62,839
Blast furnace gas	1	metric tonne (t)	642	0.0	0.0	642	639
Blast furnace gas	1	TJ	260,000	1.0	0.1	260,05	258,754
Coke oven gas	1	metric tonne (t)	1,718	0.0	0.0	1,718	1,709
Coke oven gas	1	TJ	44,400	1.0	0.1	44,45	44,232
Oxygen steel furnace gas	1	metric tonne (t)	1,284	0.0	0.0	1,284	1,278

LIQUID FOSSIL FUELS

Fuel Name	Amount of fuel	Units	kg CO_2	kg CH_4	kg N_2O	kg CO_2	kg CO_2e incl. unox. carbon
Gas/Diesel oil	1	litres (l)	2.7	0.0	0.0	2.7	2.7
Gas/Diesel oil	1	TJ	74,100	3.0	0.6	74,343	73,600
Crude oil	1	litres (l)	2.5	0.0	0.0	2.5	2.5
Crude oil	1	TJ	73,300	3.0	0.6	73,543	72,808
Refinery feedstocks	1	metric tonne (t)	3,152	0.1	0.0	3,155	3,123
Refinery feedstocks	1	TJ	73,300	3.0	0.6	73,543	72,808
Motor gasoline	1	litres (l)	2.3	0.0	0.0	2.3	2.3
Motor gasoline	1	TJ	69,300	3.0	0.6	69,543	68,848
Aviation/jet gasoline	1	litres (l)	2.2	0.0	0.0	2.2	2.2
Aviation/jet gasoline	1	TJ	700,000	3.0	0.6	700,24	693,241
Aviation/jet gasoline	1	metric tonne (t)	3,101	0.1	0.0	3,104	3,073
Jet kerosene	1	TJ	71,500	3.0	0.6	71,743	71,026
Naphtha	1	litres (l)	2.5	0.0	0.0	2.5	2.5
Naphtha	1	TJ	73,300	3.0	0.6	73,543	72,808
Shale oil	1	litres (l)	2.8	0.0	0.0	2.8	2.8
Shale oil	1	TJ	73,300	3.0	0.6	73,543	72,808
Residual fuel oil / HFO	1	litres (l)	2.9	0.0	0.0	2.9	2.9
Residual fuel oil / HFO	1	TJ	77,400	3.0	0.6	77,643	76,867
Other kerosene	1	litres (l)	2.5	0.0	0.0	2.5	2.5
Other kerosene	1	TJ	71,900	3.0	0.6	72,143	71,422

SOLID FOSSIL FUELS

Fuel Name	Amou nt of fuel	Units	kg CO_2	kg CH_4	kg N_2O	kg CO_2	kg CO_2e incl. unox. carbon
Anthracite	1	metric tonne (t)	2,625	0.0	0.0	2,625	2,573
Anthracite	1	TJ	98,300	1.0	1.5	98,726	96,751
Bitumen	1	metric tonne (t)	3,244	0.1	0.0	3,247	3,182
Bitumen	1	TJ	80,700	3.0	0.6	80,943	79,324
Lignite	1	metric tonne (t)	1,202	0.0	0.0	1,202	1,178
Lignite	1	TJ	101,000	1.0	1.5	101,42	99,397
Other bituminous coal	1	metric tonne (t)	2,441	0.0	0.0	2,441	2,392
Other bituminous coal	1	TJ	94,600	1.0	1.5	95,026	93,125
Sub bituminous coal	1	metric tonne (t)	1,816	0.0	0.0	1,816	1,780
Sub bituminous coal	1	TJ	9,6100	1.0	1.5	10,036	9,835
Brown coal briquettes	1	metric tonne (t)	2,018	0.0	0.0	2,018	1,978
Brown coal briquettes	1	TJ	97,500	1.0	1.5	97,926	95,967
Peat	1	metric tonne (t)	1,034	0.1	0.0	1,037	1,016
Peat	1	TJ	106,000	10	1.4	106,65	104,518
Municipal waste (Non biomass fraction)	1	metric tonne (t)	917	0.3	0.0	925	907
Coking coal	1	metric tonne (t)	2,668	0.0	0.0	2,668	2,615
Coking coal	1	TJ	94,600	1.0	1.5	95,026	93,125
Petroleum coke	1	metric tonne (t)	3,169	0.1	0.0	3,172	3,109
Petroleum coke	1	TJ	97,500	3.0	0.6	97,743	95,788
Coke oven coke	1	metric tonne (t)	3,017	0.0	0.0	3,017	2,957
Coke oven coke	1	TJ	107,000	1.0	1.5	107,42	105,277

SOLID WASTE FUELS

Source: Factors are for non-biomass fractions. IPCC 2006 Stationary Combustion

Fuel Name	Amount of fuel	Units	kg CO_2
Municipal Solid Waste (non biomass fraction)	1	TJ	91,700
Municipal Solid Waste (non biomass fraction)	1	metric tonne	917
Industrial Wastes	1	TJ	143,000
Waste oils	1	TJ	73,300

Baseline for power generation projects

- For grid-connected electricity generating projects, a weighted average of **operating margin** and **build margin** should be used to define the baseline emissions of the project – the **Combined Margin (CM)**

- CM is different depending on whether the generation is intermittent (e.g. wind, solar, run-of-river hydro…) or firm/controllable (e.g. reservoir hydro, biomass combustion…

Emission Factors in gCO_2/kWh (The impact of non-CO_2 GHGs is negligible. For calculation purposes, the factors below can be considered as CO_2e.)					
Country / Territory / Island	Combined Margin Intermittent Electricity Generation	Combined Margin Firm Electricity Generation/ Electricity Consumption	Electricity Consumption/ Network Losses HV Grid +2%	Electricity Consumption/ Network Losses MV Grid +4%	Electricity Consumption/ Network Losses LV Grid +7%
Afghanistan	300	206	210	214	220
Albania	16	43	44	45	46
Algeria	498	429	438	446	459
American Samoa (U.S.)	699	544	555	566	582
Andorra	16	43	44	45	46
Angola	613	426	434	443	455
Anguilla (U.K.)	680	493	503	513	528
Antigua and Barbuda	693	527	538	548	564
Argentina	497	350	357	364	375
Armenia	339	247	252	256	264
Aruba	664	450	459	468	482
Australia	646	412	420	428	440
Austria	173	134	136	139	143

Consumed electricity

1E	**Purchased electricity** CO_2e	(i) (ii)	Energy Purchased for use in project activities Country specific emissions factor (see table A1.3) for electricity consumption or	CO_2 (t) = Energy use * Country Specific Emissions Factor for Electricity Consumption

- Emissions from electricity which is consumed as part of the project, or as part of the baseline, should be calculated based on the country emissions factor, including grid losses of the connecting grid:
  - Country grid factor: 0% (e.g. transmission grid projects)
  - HV: 2% (e.g. transmission-connected power generation and distribution grid projects)
  - MV: 4% (e.g. industrial demand)
  - LV: 7% (e.g. final consumer demand, distribution-connected RES)

Emission Factors in g CO_2/kWh
(The impact of non-CO_2 GHGs is negligible. For calculation purposes, the factors below can be considered as CO_2e.)

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American Samoa (U.S.)	699	544	555	566	582
Andorra	16	43	44	45	46
Angola	613	426	434	443	455

Electricity, gas and DH networks

Method #	Sector & GHG	Calculation Input Data Requirements (i) (ii) etc.	Calculation Method
4	**Electricity, Gas and Heat Transmission & Distribution** **CO_2 and SF_6**	Scope 1 direct emissions and scope 2 electricity consumption and fugitive losses from equipment and the network, over an average year. (i) Distribution losses for the part of the network (energy) affected the project (ii) Electricity consumption based on grid factor for country (table A1.3) (iii) Total quantity of SF_6 in switchgear and circuit breakers (iv) Switchgear and circuit breakers: SF6 leakage rate: total life cycle: 0.4%, only operation phase: 0.13% (v) Fugitive emissions (see methodology 2) If GHG emissions are only quantifiable for the whole network, then a pro-rata proportion must be calculated for the extension/rehabilitation only. All network losses associated with incremental supply are attributed to network extensions (see Annex 2). If the secondary effects of the project on GHG emissions are significant (e.g. fuel switching), these effects are included as emissions outside the project boundary for the assessment of baseline and relative emissions.	GHG emissions for electricity transmission and distribution losses = Energy loss * Country specific emissions factor for electricity consumption. Assume High Voltage losses of 2%, Medium Voltage losses of 4% and Low Voltage losses of 7% (non-cumulative). For electricity, the baseline without the project is to meet market demand assuming increased network losses. In such cases, Baseline losses are assumed to be equal to: Current % of network losses x (1 + % demand growth). SF_6 (CO_2 t/y) = SF_6 project inventory(t) * SF_6 leakage rate * SF_6/CO_2 emissions factor Conversion factors to convert to CO_2e see table A1.9.

- **In networks it's mostly about the losses**
- Absolute emissions only if in project scope
- Relative emissions consider system impact (e.g. losses outside project scope, RES connection, fuel switching…)
- I.e. With project vs Without project

Baseline for District Heating projects

ENERGY NETWORK PROJECTS	INCLUSION: scope 3 emissions from outside the boundary defined by the physical limits of the project are included in the relative emissions calculation where they are considered significant. For example, a district heating network project typically has a boundary that includes the losses of the heat network and any sources of heat generation under the control of the operator. If the project results in fuel switching (individual heating to district heating) or results in a change of the operational regime of a heat plant outside the control of the project operator, significant GHG emissions from these sources are included.

- For new **district heat generation or network** projects (or extensions), the baseline is typically individual heating based on average local fuel mix.
- For **heat generation** projects, use economic alternative as a baseline
  - Does the heat generation plant replace an existing plant before the end of its life? - > use the existing plant as a baseline
  - Otherwise, industrial gas steam or hot water (as applicable) boiler
- Factor in DH network losses under “with project” emissions, even if network is outside the project boundary.

Project examples

- **Wind farm**
- **Biomass CHP**

Project example 1

New Wind Farm in Germany

Absolute Emissions: zero

EIB baseline approach :

- Grid connected intermittent RE replaces in part existing fossil fuel capacity + in part forecast incremental build
- This is represented by a country-specific “Combined Margin“ emissions factor for intermittent generation

Project example 1: wind farm in Germany

- Expected electricity generation = 300 MW * 25% load factor = 660 GWh pa
- The CM emissions factors for intermittent generation in Germany is 596 t CO_2e/GWh

Emission Factors in gCO_2/kWh (The impact of non-CO_2 GHGs is negligible. For calculation purposes, the factors below can be considered as CO_2e.)					
Country / Territory / Island	Combined Margin Intermittent Electricity Generation	Combined Margin Firm Electricity Generation/ Electricity Consumption	Electricity Consumption/ Network Losses HV Grid +2%	Electricity Consumption/ Network Losses MV Grid +4%	Electricity Consumption/ Network Losses LV Grid +7%
Georgia	278	195	199	202	208
Germany	596	366	373	380	391
Ghana					

Absolute emissions (with project): 0 kt CO_2e pa

Baseline emissions (without project):

660 * 596 /1000 = 393.4 kt CO_2e pa

Relative emissions: 0 - 393.4 = -393.4 kt CO_2e pa

Project example 2: Biomass CHP in Poland

New biomass-fired CHP next to an existing CHP using biomass co-firing with coal; co-firing is supposed to stop as the support period expired

Both plants are connected to the DH network, but the connection capacity was not increased to allow the additional heat from new CHP unit to be sold

- Capacity: 25.7 MWe, 7.26 MWth,
- Power production: 204,751 MWh/a
- Amount of biomass fired: 208,158 t/a

Absolute emissions:

- Biomass is from sustainable sources, assumed to have zero emissions at point of combustion

Absolute emissions from combustion: zero

- Average distance covered by a truck supplying biomass: 50 km
- Average truck load: 25 t
- Total distance covered by trucks: 416,316 km
- Emission factor: 0.94 $kgCO_2/km$

Absolute emissions from transporting biomass: 0.391 $ktCO_2/a$

Project example 2: Biomass CHP in Poland

Baseline and Relative emissions

Heat

- new plant offsets heat generation from existing plant, no incremental heat produced
- Conservatively assume heat production displaced is from biomass in existing plant

Baseline emissions from heat production: identical to new plant, i.e. **zero**

- Power production: 204,7 GWh/a
- Emission factor for **firm** electricity generation in Poland: 568 tCO2e/GWh

Philippines	543	489	499	508	523
Poland	765	568	579	591	608
Portugal					

Baseline emissions electricity generation 204.7 * 568 /1000 = 162.2 kt CO_2/a

Relative emissions = Absolute emissions – Baseline emissions

Relative emissions: 0.4 - 162.2 = -161.8 ktCO2

Questions?