

PRINCIPLES FOR CALCULATING AVOIDED CO₂ EMISSIONS WITHIN THE EDF Group

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1 - Presentation

The company's Carbon Footprint (GHG emissions inventory) and the Carbon Footprint of kWh (emission factor or specific emissions) are determined rigorously using standardized approaches.

Calculations of "avoided emissions" are more complex, as they depend on the baseline against which comparisons are made and on a number of parameters. There is no single recognised external reference method, and the existing methods are generally complex and sometimes questionable.

The objective of this report is to define very simple principles for calculating the emissions avoided **by an activity, action or project** of the EDF Group. In the interests of consistency and exemplarity, **all the entities of the Group are required to comply with these principles**, except where justified and approved by the Impact Division. This note is validated by an external auditor as part of the annual verification process of the calculation of avoided emissions by projects funded by Green Bonds, and is updated regularly.

2 - The principles for calculating avoided emissions within the EDF Group

The **basic principles** are as follows:

2.1 The calculation of emissions avoided by an "action" is intended to compare two situations:

- Emissions without the considered action: **the reference situation**,
- Emissions with the considered action: **the situation assessed**.

2.2 The action may avoid emissions **within the EDF Group or from third parties**¹

2.3. **Lifecycle** emissions are considered (LCA approach).

2.4. The calculation of the avoided emissions of the electrical system shall be based on **the average emission factor of the kWh of the grid in question, LCA approach**². The last known value for this network will usually be adopted.

2.5 Avoided emissions are calculated **annually**.

2.6 Significant emissions associated with the **implementation of the action** (equipment, works, etc.) are taken into account and are distributed over the lifetime of the action³.

2.7 In case of doubt, the approach leading to the least amount of avoided emissions shall be adopted.

2.8 Relevant emission factors from recognised external sources are proposed and used by default (see Appendix 1 for the list of emission factors valid on the validation date of this note, updated annually by the Impact Division and the R&D).

¹ Some consider that 'avoided' emissions are limited to emission reductions outside the enterprise, where reductions within the enterprise are often referred to as 'reduced' emissions; however, this distinction is difficult to apply in the electrical sector: Thus, a new EDF wind farm in France will have an impact on the emissions of other EDF assets or the assets of other producers, without it being easy to distinguish the two

² Any "marginal" reasoning will therefore be avoided (see Appendix 2)

³ It should be noted that the VAC emission factor of kWh produced by a given production line already includes the emissions associated with the construction of the structure. In the event that, for a given project, it is possible to justify an LCA emission factor different from the default one, it would be acceptable to take this into account

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In cases that would justify a different or more complex approach, a calculation proposal is submitted to the Impact Directorate for validation.

A few examples of possible exceptions to the basic principles are set out in Appendix 2

3 - Validation of avoided emissions calculations used in external communication

Group business units frequently use avoided emissions calculations to highlight the CO₂ benefits of their low-carbon projects and solutions. To this end, the avoided emissions data are presented in various external communication media (e.g. press releases, marketing materials, external reports, etc.). To ensure proper application of the design basis and consistency of these disclosures, entities submit their avoided emissions calculations to the Impact Directorate for validation prior to publication.

4 - Illustrative examples

4.1 Energy saving on a tertiary building in the UK

- Baseline: annual consumption of 10 MWh,
- Situation assessed: implementation of insulation work with a 20 % electricity saving,
- Digital application:
 - Input data:
 - Average UK ACV emission factor: 212 g eq CO₂/ kWh,
 - Work-related emissions: considered negligible.
 - Calculation:

$$\begin{aligned} \text{Annual avoided emissions} &= \text{annual economy} \times \text{average FE} \\ &= 2 \times 212 = 0.424 \text{ Tons eqCO}_2 \end{aligned}$$

4.2 Installation of a wind farm in France

- Baseline: the electricity is produced by the country's existing means of production.
- Situation assessed: a new wind farm has been installed and is in operation.
- Digital application:
 - Input data:
 - Average emission factor ACV France: 50 g eq CO₂/ kWh,
 - Annual production (actual or expected): 30 GWh,
 - Wind kilowatt hours emission factor in LCA (including equipment and works): 11 g eq CO₂ / kWh (default).
 - Calculation:

$$\begin{aligned} \text{Annual avoided emissions} &= \text{annual production} \times (\text{mean FE} - \text{wind FE}) \\ &= 30 \times (50-11) = 170 \text{ tons eqCO}_2 \end{aligned}$$

Note: for the sake of simplicity, this calculation does not take into account the emissions related to the energy production necessary to compensate for intermittency.

ANNEX 1: Average electric kWh emission factors, including VAC, by industry and region

Sources: EDF R&D calculations based on the following source data:

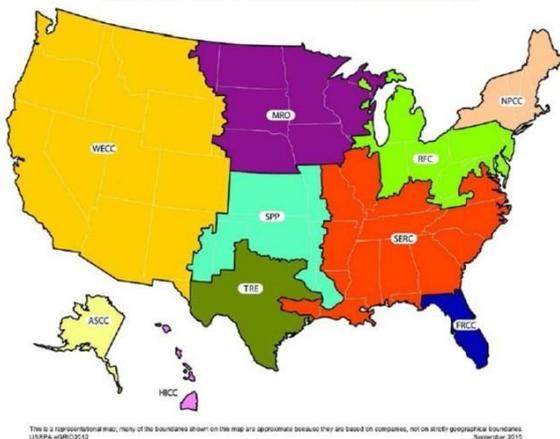
- Kwh emission factors by production line, including VAC: IPCC 2014 global median values AR5 Chapter 7, page 539, and Annex III, p 1335; except fuel: SRREN 2011 (most recent values available) and except PV: IEA PVPS Task 12 2023 m@j data
- Production mix Country:
 - All countries Europe and other countries: IEA 2024 (website section "Country profile / Electricity generation by source / chart data"); specific mention 2023 if 2024 not available
 - US networks: EPA eGRID 2023 (eGRID with 2023 Data Revision 2 Released: 6/12/2025)
 - Networks/Provinces Canada: Statistics Canada 2024
 - Islands: Ademe Carbon/Imprint@ Base - latest V23.9 update, 16/12/2025

The following data is to be used by default. Data from other countries or production lines may be added as required. If more precise or appropriate values are available and auditable, they can be used (justification to be provided to the Impact on Demand Directorate).

Kwh emission factor by production line, including VAC	FE g eqCO2/kWh average
Nuclear	12
Coal	1040
Fuel	840
Gas ⁵	490
Hydraulic	24
Wind ⁶	11
Solar PV	36
CSP Solar	27
Biomass (dedicated crops and waste) ⁷	230
Biomass (wood from forests)	148
Geothermy	38

Regions	FE g eqCO2/kWh average
COUNTRY	
France continues.	50
UK	212
Belgium	148
Italy	292
China	665 ⁽²⁰²³⁾
Switzerland	31
Germany	374
Poland	670
Greece	331
Chile	256
Brazil	101
Mexico	460
	497
Israel	
ISLANDS	
Guyana ⁴	353
Martinique	848
Guadeloupe	700
Mayotte	784
Meeting	779
St Barthélemy	855
St Pierre and Miq	945
Corsica	594
US/Canada networks	
WECC	333
TRE	384
SPP	407
MRO	408
SERC	423
NPCC	278
FRCC	435
RFC	430
Quebec	30
Ontario	70

Figure B-2. eGRID NERC Region Representational Map



⁴ Excluding fugitive emissions from Petit Saut

⁵ IPCC AR5 median data Annex III Table A.III.2 for CCGT, the combined cycle being considered as the most significantly representative gas technology in thermal gas production

⁶ According to the IPCC report, onshore wind is at 11 g and offshore wind at 12 g CO2 eq/kWh: it is therefore proposed to keep the same default value for both streams, and to take into account a more precise value for a given project if it is possible to justify it

⁷ The values for biomass are the default values given in the IPCC report; an R&D study establishing specific values for each type of biomass is planned

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ANNEX 2: A few examples of possible exceptions to the basic principles

The operation of the electrical systems is complex and the results obtained are erroneous if two essential aspects are omitted:

- Energy policies and the market are leading to coordinated development of upstream and downstream technologies over time: it is therefore wrong to consider the impact on emissions of a change in production on the assumption that consumption is fixed and vice versa;
- A change in consumption or production on an electrical system can never be considered as isolated, as many other changes occur simultaneously and have countervailing effects; the impact of one variation cannot therefore be considered in isolation from the others.

As a result, any calculation of the 'marginal' type, which seeks to assess the impact on emissions of a change in production or consumption 'all other things being equal', should be avoided in the context of electrical systems.

It may be added that:

- the electricity systems are not controlled in such a way as to optimize emissions, but rather costs, and this optimization of costs is itself disturbed by various regulatory and technical constraints (priority of renewables, availability, etc.);
- the assumptions about the means of production that will develop tomorrow are inherently uncertain. Studies show that assumptions made in the past have proved to be inaccurate, as have calculations that account for them.

The basic principles adopted for the EDF Group in the present procedural note avoid these pitfalls by taking as a reference the last known average emission factor of the kWh of the grid in question and therefore constitutes the most satisfactory approach in most situations.⁸

However, it is conceivable **to allow for a certain number of exceptions (after validation by the Impact Division)**, notably concerning the choice of the reference situation. A few examples are presented in the table below.

The spirit of the basic principles will be respected, namely: conservative approach, preferably in terms of ACV, transparency about the reference adopted, and rigor.

⁸ It would be possible to take account of exports imported on the network in question, but on the basis of the net hourly balances to avoid the intransit electricity distorting the calculations; in France, the impact would be limited, as there are few times of the year when France is a net importer

	Specific nature of the action considered	Envisaged calculation reference	Examples
1	Specific time interval	Average hourly content, rather than annual content, of the network in question, if available. The deviation from the basic principles would be relatively small.	Variation in efficiency of a hydraulic turbine driven mainly at the tip
2	Impact of storage on avoided emissions	There are many storage modes and they are used in many different ways. If the basic principles are maintained, a production installation with storage avoids less CO2 than a plant without storage, since this is compared to the average content, and it is necessary to deduct the emissions associated with the production of the storage mode and the losses in efficiency. A hourly interval calculation may however result in a different result, which may be taken into account if justified. But it usually requires careful analysis.	Wind or photovoltaic installation with battery storage
3	Consideration of impacts outside the electrical system, and/or multiple impacts	Estimate the actual impacts against a relevant baseline that will be specified, including VCA where possible; where appropriate, multiple impacts may be accumulated, specifying the method of calculation: ENR, energy efficiency etc.	Emissions avoided by a heat network, or by cogeneration; replacing a fuel boiler with a gas or heat pump boiler
4	Calculation of emissions avoided over time and/or too far in the future for the last known average FE in the network to be a relevant reference	2 options offered: <ul style="list-style-type: none"> - use as a reference the prospective average content for the year in question or an average content trajectory, determined according to sources or assumptions to be specified (<i>e.g.: TEN scenario</i>) - other relevant and conservative reference, preferably in LCA. The reference to which the comparison is made will be explicitly specified (<i>example: comparison with CCGT emissions</i>) - the expected production for the year in question, or the production trajectory, will then be compared with this reference 	Impact on emissions of a new generation plant that will be connected to the grid in 5 or 10 years; or cumulative impact over the lifetime of a plant; or renovation of a generating station
5	Significant change in output such that the average content of the network in question can be significantly varied, or it is impossible to determine a reference	Compare yourself with as relevant a reference as possible. The reference to which the comparison is made will be explicitly specified (<i>example: average European content outside France</i>)	Emissions avoided due to the existence of French nuclear power plants
6	Significant and very sporadic change in production	The impact depends on the period considered (level of demand), the magnitude of the variation in production considered in relation to the volume of production, carbon or non-carbon, mobilizable in replacement, other concomitant variations, etc. ; reference will therefore be made to the basic principles, which avoid any uncertain assessment. Furthermore, the CO2 impact of an exceptional and very ad hoc variation in production or consumption has only a very small impact on the CO2 balances which are meaningful only in the long term. If, however, the conditions are such that, at the specific moment of the punctual variation in production, the probability is high: <ul style="list-style-type: none"> - that the measure cannot be offset by other variations of comparable magnitude, - a certain type of production asset modulates as a result of the action, it could then be considered to use emissions of this type of asset as a benchmark, if a particular issue warrants it. The reference to which the comparison is made shall be explicitly specified, and the fact that the result is valid only under the specific conditions considered (<i>e.g.: comparison with CCGT emissions</i>)	One day reduction of a nuclear unit outage

7	Building a manufacturing asset in a country where electricity consumption is growing rapidly	In this case, the comparison to the average mix makes little sense, as a new production asset will not replace existing assets but will add to emissions from the electricity system. There are two options: - Refer to an asset that could have been built instead of the project (and that emits more) - Assess the emissions generated by other, usually non-electric, energies that the project avoids. In both cases, the reference used should be explicitly specified.	Construction of a photovoltaic park in India
8	Variation in downstream consumption	Variations in consumption are almost never isolated and limited in time. Therefore, it is normally the basic principles that apply.	Reduction of electric heating