Methodology for the calculation of the Greenhouse (GHG) inventory of Red Eléctrica de España, SAU

(Simplified version)

RED ELÉCTRICA DE ESPAÑA

"METHODOLOGY FOR THE CALCULATION OF THE GREENHOUSE GAS EMISSIONS (GHG) INVENTORY OF RED ELÉCTRICA DE ESPAÑA, SAU & RED ELÉCTRICA INFRAESTRUCTURAS DE TELECOMUNICACIÓN, S.A.U."

1. Scope of the inventory

Organisational boundaries

The inventory only applies to the activities that take place in Spain. The calculation of Red Eléctrica de España SAU & Red Eléctrica Infraestructuras de Telecomunicación, SAU (REE) emissions is performed under operational control criteria.

Until the year 2018, the inventory included the emissions from Red Eléctrica de España, SAU. Since 2018, emissions associated with the activity of telecommunications have been also included.

Operational scope

Emissions associated with REE's activities and facilities are quantified, taking into consideration the following scopes:

Scope 1: Direct GHG (Greenhouse Gas) emissions

Emissions resulting from the Company's controlled or owned sources:

- Fugitive Emissions: SF_6 gas leaks in electricity substations and refrigerant gases leaks from air conditioning systems.
- Mobile Combustion: emissions derived from fuel consumption of the fleet.
- Stationary combustion: derived from the combustion of fuels used in diesel generating sets. No other stationary combustion source exists in the Company.

Scope 2: Indirect GHG emissions associated with electricity consumption

- Electricity consumption.
- Electricity losses in the transmission grid.

Scope 3: Other indirect GHG emissions

Scope 3 emissions are a consequence of the company's activities, but occur in sources not owned or controlled by it.

Applicable and relevant categories defined in GHG Protocol Corporate Value Chain (Scope3) Standard, are calculated.

- Supply chain: Purchase of goods and services.
- Capital goods.
- Life cycle of fuel and energy consumed: emissions due to energy production (not included in scope 1 and 2).
- Upstream transportation and distribution.
- Waste management.
- Business travel by plane, train and car (taxi, private and rented vehicles).
- Employees commuting to the work place.
- Leased assets (downstream).

2. Methodology and data to be used to calculate emissions

2.1 Direct emissions: SCOPE 1.

2.1.1 Fugitive emissions of SF_6 at electricity substations

SF_6 gas is a dielectric gas that is used in electrical substations. It is mainly found in the switchgears and Gas Insulated Substations (GIS).

- Method of calculation

SF_6 gas emissions are calculated using the following formula:

Total SF_6 leaks = Leaks from equipment in service + Leaks associated with the end of life of equipment

a. Leaks from equipment in service: the amount of gas leaking from operational equipment is regarded as equivalent to the amount used to fill the equipment in question minus the gas recovered. This information is recorded in accordance with the instructions set out in REE's internal procedures. (The amount of gas recorded includes leaks inherent to the equipment itself, leaks resulting from the breakdown or ageing of this equipment and leaks associated with accidents: emissions during operation and maintenance emissions, as defined in the

Voluntary Agreement between MAGRAMA, AFBEL, UNESA, REE and the waste and SF_6 gas managers signed in 2015).

b. Leaks associated with the end of the SF_6 equipment's operational life are calculated by applying the figure shown in the voluntary agreement for the equipment in question: this is calculated by applying the emission rate shown in the Voluntary Agreement (0.4%) mentioned in the previous paragraph.

CO_2 emissions: in order to convert SF_6 emissions to CO_2, the GWP for 100 years is used, as published in the fourth IPCC report (2007) of 22800.

2.1.2 Fugitive emissions of refrigerant gas from air conditioning systems.

Air conditioning equipment is fitted at both buildings and substations.

- Method of calculation

  a. Equipment in service leaks: calculations are based on the amount of gas used to refill each equipment each year (refilled gas = leaked gas).

  b. Retired equipment leaks: considering the difference between the rated load of the equipment and the gas recovered from this one at the end of its useful life.

The GWP figures for 100 years are used, as published in the fourth IPCC report (2007) (Regulation 517/2014), as indicated in the document issued by the Spanish Climate Change Office (OECC).

2.1.3 Emissions resulting from the consumption of fuel by fleet vehicles

When calculating these emissions, the following vehicles are considered:

a. Fleet vehicles: those that are owned by REE. These vehicles are used by technicians in different areas to perform their work.

b. Shared leasing vehicles used by technicians in different areas to perform their work.

c. Manager´s vehicles: emissions derived from fuel consumption by vehicles, owned by REE or leasing cars, used by managers to perform their work (excluding private use).

- Method of calculation

Emissions are calculated using the following formula:

Total liters of fuel consumed (by type) ∗emission factor (according to the type of fuel used).

Emission factors: as published by the Spanish Climate Change Office OECC at the Ministry of Agriculture, Fisheries, Food and Environment (MAPAMA). Annex 1 includes emission factor used for the emissions calculation from the consumption of fuel by fleet vehicles, according to each type of fuel.

2.1.4 Emissions resulting from the consumption of fuel used in diesel generating sets

Diesel Generating sets are in most of REE substations and some buildings (working premises) in order to ensure the supply in the event of electricity failure. In general (with some exceptions), the number of operating hours registered, corresponds to the time where they have been on in order to perform maintenance checks to ensure that they are in working conditions.

- Method of calculation

Calculations are based on the number of hours they have been in operation and the power of each generator (apparent power).

Apparent power (KVA) ∗power factor (0.8) = active power (kw)

Active power (kw) ∗ hours of operation (h) = energy generated (kwh)

Assumptions made: We assume a power factor of cosϕ=0.8. We assume that the generating sets are operating at maximum power (which means that we are taking account of the worst possible scenario as regards emissions, since generators normally operate well below maximum power).

Emission factor used: 0.28 $kgCO_2$/kwh (Source: DEFRA)

2.2 Indirect emissions. SCOPE 2

2.2.1 Emissions associated with electricity consumption

These are the emissions associated with the consumption of electricity at the different facilities. Emissions due to the loss of energy in the electricity transmission grid are not included.

- Method of calculation

These emissions are calculated by multiplying the consumption of electricity by the emission factor applicable to each case (market-based methodology):

- Energy mix factor that corresponds to each specific electricity distribution company: contract information is used if available (It will be always the case of the green energy). On the contrary, when contract information is not available, the relevant emission factors must be those determined by the Spanish Climate Change Office OECC attached in Annex 1.
- Emission factor (peninsular, Balearic or Canary electric mix): calculated by REE in accordance with the methodology defined by REE.

2.2.2 Emissions associated with electricity losses in the transmission grid

The transmission of electricity involves some loss of electricity in the grid, which means that in order to satisfy customer final demand it is necessary to increase the amount of electricity generated. There are several reasons and factors that contribute to these losses, being the Joule Effect the most significant. (The Joule Effect refers to the phenomenon by which, when a conductor carries electrical current, some of the kinetic energy from the electrons is transformed into heat due to their collision with the atoms of the conductor material along which they are travelling, thus raising the temperature of this material).

The amount lost is directly related to the location of generation points and its associated consumption points, the amount of energy required, the energy mix, international exchanges and the shape of the demand curve.

- Method of calculation

Losses in the transmission grid ∗ average emission factor for electricity in the year in which the inventory is calculated.

Losses from the transmission network: Based on the figures published in the daily electricity balance sheet for 31st December of the year for which the calculation is to be made (Losses are considered also for Balearic and Canary islands systems). Transmission losses information comes from the information collected in the Measurement System (SIMEL) - an intelligent system managed by REE that receives, directly or through the secondary concentrators, real time data from every meter installed in Spain (more than 27 million).

http://www.ree.es/es/actividades/balance-diario

Emission factor: the figure calculated by REE is used, as in section 2.2.1 (specific factor for each system).

2.3 Indirect emissions. SCOPE 3.

2.3.1 Emissions associated with the supply chain: purchase of goods and services

These include emissions that are associated with the life cycle of goods and services acquired by REE.

- Method of calculation

The annual expenditure is broken down for each group of items purchased by REE - groups already included in scopes 1 and 2 or in other categories of scope 3, are excluded from this calculation to avoid double counting-

The emissions are obtained by multiplying the expenditure of each group of items by the emission factor that best fits their denomination.

Emission factors: those from the Comprehensive Environmental Data Archive (CEDA) 4.0 database that provides emissions per dollar of production for more than 400 sectors of the US economy are used. The CEDA database is used by the US

Environmental Protection Agency (U.S. EPA), the Department of Commerce (DOC) and the European Commission for policy support.

2.3.2 Emissions associated with capital goods

These include emissions that are associated with the capital goods acquired by REE. Capital goods are final products that have a prolonged useful life and are treated as fixed assets, as property or an equipment.

- Method of calculation

The emissions of the assets acquired in the year are estimated by multiplying the area of the facilities acquired by the base values, or relevant benchmarks. The emissions of the goods acquired are only considered in the year of acquisition, without apportioning over time.

Some groups of items (mentioned in category 1) are included in this category because they correspond to the concept of capital good. In this case, the emissions are calculated using the corresponding CEDA factors, as explained in the previous section.

Emission factors: USEPA (1995) Heavy Construction Operations Benchmark and Comprehensive Environmental Data Archive (CEDA) 4.0

2.3.3 Emissions associated to life cycle of fuel and energy consumed

These include emissions due to energy and fuel production, consumed by REE and that have not been included in scope1 and scope2:

- Emissions associated with the extraction, production and transport of fuels consumed by REE
- Emissions associated with the extraction, production and transport of fuel consumed in the generation of electricity, steam, heat or refrigeration used by REE

- Method of calculation

- Fuels consumed by REE: To obtain associated emissions, fuel consumption is multiplied by an emission factor that results from combining the emission factors of DEFRA and the factors of Emission used by REE (MAPAMA).
- Fuels consumed in the generation of electricity: only emissions associated with non-renewable energy consumption are considered. Emission factor: Well-to-tank (WTT) for Spain, DEFRA (upstream).

Emission factors: MAPAMA and DEFRA.

2.3.4 Upstream transportation and distribution.

This category includes emissions associated with the transport and distribution of products acquired by REE in vehicles not owned by REE. Two types of transport are considered:

- External transport of products and materials between the supplier and REE facilities;
- Internal transport of materials between REE facilities
  - Method of calculation
- External transport: The annual expenditure is broken down for the groups of items that refer to this type of service. The emission factor CEDA 4.0 for this type of articles is applied. ($KgCO_2$/Euro)
- Internal transport: Emissions are calculated from the litres of diesel consumed by the company that carried out the logistics service for REE. The logistics company monitors the kilometres travelled and litres of fuel used by each individual vehicle. Emissions are calculated using the same methodology used for scope 1 emissions (REE vehicles. Emission factors from MAPAMA).

2.3.5 Emissions associated to waste management.

This category includes emissions associated with the treatment of waste generated by REE's operations taking into account their final treatment: landfill disposal, recycling, incineration, composting, etc.

- Method of calculation

Detailed information on the amount of waste (kg) is collected by type of waste and treatment method.

Emission factors: DEFRA (for each type of waste and final treatment method).

2.3.6 Emissions associated with business travel

These include emissions associated with business travel by plane, train (high-speed and long-distance) and car (private vehicles, shared leasing, rented vehicles, manager's vehicles and taxis).

- Method of calculation

2.3.6.1. Trips by plane

The travel agency provides the trip data, ticket type and number of routes.

The emissions of each route are calculated by multiplying the total distance (distance of the route x number of routes) x emission factor of the ICAO (International Civil Aviation Organization).

2.3.6.2. Trips by train

The travel agency provides the trip data: type of train (high speed or long distance), distance of the route and number of routes ticket type and number of routes.

The emissions of each route are calculated by multiplying the total distance (distance of the route x number of routes) x emission factor.

Emission factor: Published by Renfe. AVE: Renfe Sustainability (2011); Long distance: Renfe, Environmental Report (2007).

2.3.6.3. Trips by car

- Private vehicle: calculations are based on the number of kilometres travelled.
- Rental vehicle: calculations are based on the number of kilometres travelled, provided by car rental suppliers.

  Emission factor: DEFRA 2017
- Taxis: Emissions are calculated by the company hired to carry out this service, with its own methodology.

2.3.7 Emissions from employees commuting to the workplace

Emissions associated with the employees commuting from their homes to the workplace.

Necessary data (kilometres travelled by employees according to each transport method employed) are obtained from a survey to all employees. Once the calculation is made for the employees responding to the survey, the results are extrapolated for the entire workforce.

Emission factors:

- Train: SACE tool (from Andalusian Autonomous Community) and Renfe
- Motorbike: SACE
- Bus: SACE
- Car: DEFRA.

2.3.8 Emissions from leased assets (downstream)

This category includes the emissions associated with the operation of assets owned by REE and leased to third parties, whose impact has not already been considered in the scope 1 and 2 inventory.

- Method of calculation

Electricity consumption primary data is taken into account, if they are available. If not, electricity consumption is estimated from leased area data (using benchmark information: CIBSE (2000).

Emission factor: the same as in scope 2. (If thermal energy is consumed: MAPAMA)

3. Calculation procedure

The Sustainability Department receives information from the different units, compiles it and makes the relevant calculations for the GHG inventory.

Once these calculations have been completed, an internal validation session is carried out, during which the figures are reviewed and the inventory is closed prior to its validation by an external independent body.

4. Uncertainty

All the processes relating to the different sources of emissions fall within the scope of REE's quality and environmental systems. These systems are respectively certified under standards ISO 9001:2000 and ISO 14001:2004.

Implementation of these quality systems minimises any uncertainty in the information used to calculate the GHG inventory.

To minimise any uncertainty associated with emission factors, official sources are used whenever it is possible.

Of all the sources considered in the inventory, only scope 3 emissions are considered to lie higher levels of uncertainty due to the fact that primary data are not always used for the calculation.

5. Recalculation of the historical series

In the case of significant variations that are important to consider in the historical series, the emissions will be recalculated, mainly those of the base year (2015).

These variations can be caused by the increase in the scope of the inventory, incorporation of assets or modification in the calculation methodology.

It is considered there is a significant variation if there is a value higher than 2% in the total amount of emissions and/or an increase of 10% in the affected category.

Nevertheless, even there are not changes which may affect significantly, it is possible to recalculate the emissions in the historical series if it is necessary to its evolution analysis to check its accomplishment or the redefinition of the reduction objectives.

Annex 1. Emission factors (ACTUALIZAR)

a. Emission factors used, proposed by the Spanish Climate Change Office OECC. (Version published in April 2018):

Emission factors according to the type of fuel used (2018):

Petrol (kg CO2/l)	2,180
Diesel (kg CO2/l)	2,520

Energy mix factor that corresponds to each specific electricity distribution Company (2017):

Endesa Energía, S.A.	0,39
Gas Natural Comercializadora, S.A.	0,35
Iberdrola Clientes, S.A.U.	0,28
EDP Comercializadora, S.A.U	0,26
FennieEnergia, S.A	0
Viesgo Energía	0,32

b. Emission factors for diesel generating sets:
DEFRA (Department for Environment Food & Rural Affairs. UK Government) 2017: 0,28 kg CO_2/kWh