



redeia

El valor de lo esencial

Methodology for the calculation of GHG Inventory

Sustainability Department

2022

Index

1	Scope of the inventory	4
1.1	Organizational boundaries	4
1.2	Operational scope.....	4
2	Direct emissions: SCOPE 1	5
2.1	Stationary combustion	5
2.1.1	Emissions resulting from the consumption of fuel in diesel generating sets	5
2.1.2	Emissions from heating fuel consumption.....	5
2.2	Mobile combustion.....	6
2.3	Fugitive emissions of SF6 at electricity substations	6
2.4	Fugitive emissions of refrigerant gas from air conditioning systems.....	7
3	Indirect emissions: SCOPE 2.....	8
3.1	Electricity consumption	8
3.2	Electricity losses in the transmission grid.....	9
4	Indirect emissions: SCOPE 3.....	10
4.1	Supply chain: purchase of goods and services	10
4.2	Capital goods.....	10
4.3	Life cycle of fuel and energy consumed	11
4.4	Upstream transportation and distribution.....	11
4.4.1.1	External transport of products and materials.....	11
4.4.1.2	Internal transport of materials between Redeia facilities.	12
4.5	Waste management.....	12
4.6	Business travel	12
4.7	Employees commuting to the workplace	13
4.8	Leased assets.....	13
4.9	Downstream transportation and distribution	13
4.10	Processing of sold products	13
4.11	Use of sold products	14
4.12	End of life treatment of sold products	14
4.13	Downstream leased assets	14
4.14	Franchises.....	14
4.15	Investments.....	14
5	Calculation procedure.....	14

5.1 Recalculation of the historical series 14

6 Uncertainty 15

1 Scope of the inventory

1.1 Organizational boundaries

Redeia carbon inventory is performed under operational control criteria. The inventory applies to the activities that take place in Red Eléctrica Corporación, S.A. and the following companies linked to the group's businesses:

- Red Eléctrica: Red Eléctrica de España, S.A.U., Red Eléctrica Infraestructuras en Canarias S.A.U.
- Redinter: Red Eléctrica Internacional, S.A.U., Red Eléctrica Andina S.A., Red Eléctrica del 2 Sur S.A., Red Eléctrica del Norte S.A. y Red Eléctrica Chile SpA.
- Reintel: Red Eléctrica Sistemas de Telecomunicaciones, S.A.U.
- Elewit: Red Eléctrica y de Telecomunicaciones, Innovación y Tecnología, S.A.
- Hispasat: Hispasat S.A.

Transmisora Eléctrica del Norte S.A (TEN), Argo Energía Empreendimentos e participações S.A. (ARGO) and Hisdesat Servicios estratégicos, S.A, as well as the holdings of the Hispasat subgroup and other significant shareholdings of Elewit are investees societies and considered as investments. Therefore, the emissions corresponding to these companies are included in scope 3.

1.2 Operational scope

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

Scope 1: Direct GHG emissions

- Emissions resulting from the Company's controlled or owned sources:
- Fugitive Emissions: SF6 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 and heating.

Scope 2: GHG indirect emissions from electricity consumption.

- Electricity consumption
- Electricity losses in the transmission grid.

Scope 3: Other indirect GHG emissions

- 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 workplace.
- Leased assets.
- Investments.

2 Direct emissions: SCOPE 1

2.1 Stationary combustion

2.1.1 Emissions resulting from the consumption of fuel in diesel generating sets

Diesel Generating sets are in most of Redeia substations and some buildings 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.

Organizational boundary

Applies to all companies.

Method of calculation

a) Fuel consumption available:

$$\text{Emissions (tCO}_2\text{e)} = \text{Total fuel consumption} * \text{emission factor}$$

Emission factors: OECC¹ and DEFRA².

b) If fuel consumption information is not available, calculations are based on the number of hours they have been in operation and the power of each generator (apparent power).

$$\text{Emissions (tCO}_2\text{e)} = \text{Energy generated (kWh)} * \text{emission factor (kgCO}_2\text{e/kWh)}$$

Assumptions: We assume a power factor of $\cos\phi=0.8$. 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).

- *Apparent power (KVA) * power factor (0.8) = active power (kw)*
- *Active power (kw) * hours of operation (h) = energy generated (kwh)*

Emission factors: DEFRA.

2.1.2 Emissions from heating fuel consumption

Organizational boundary

Applies to Hispasat (Spain).

Method of calculation

Emissions from heating fuel consumption are calculated using the following formula:

¹ OECC: Spanish Climate Change Office, for its acronym in Spanish.

² DEFRA: Department for Environment, Food and Rural Affairs in UK.

$$\text{Emissions (tCO}_2\text{e)} = \text{total fuel consumed (by type, l)} * \text{emission factor (tCO}_2\text{e/l)}$$

Emission factors: OECC. In this case the units are Liters as the consumption is diesel, if the consumption was gas it would be necessary to adjust the emissions.

2.2 Mobile combustion

When calculating these emissions, the following vehicles are considered:

- Fleet vehicles: those that are owned by Redeia. These vehicles are used by technicians in different areas to perform their work.
- Shared leasing vehicles used by technicians in different areas to perform their work.
- Manager’s vehicles: emissions derived from fuel consumption by vehicles, owned by Redeia or leasing cars, used by managers to perform their work (excluding private use).

Organizational boundary

Applies to all companies.

Method of calculation

a) Fuel consumption available:

$$\text{Emissions (tCO}_2\text{e)} = \text{total liters of fuel consumed (by type)} * \text{emission factor (by type of fuel)}.$$

Emission factors: For calculations in Spain the emission factors published by OECC. For calculations in other countries the emission factors published by DEFRA.

b) If this information is not available, the following formula can be used:

$$\text{Emissions (tCO}_2\text{e)} = \text{km travelled (by car type and fuel type)} * \text{emission factor (by km)}$$

Emission factors: DEFRA.

2.3 Fugitive emissions of SF6 at electricity substations

SF6 gas is a dielectric gas that is used in electrical substations. It is mainly found in the switchgears and Gas Insulated Substations (GIS). Emissions correspond to gas leaks in use and end of life, and do not consider possible emissions associated with the filling of new equipment (this is carried out by the manufacturers, who are responsible for their installation).

Organizational boundary

Applies to Red Eléctrica & Redinter.

Method of calculation

SF6 gas emissions are calculated using the following formula:

1. $\text{Emissions (tCO}_2\text{e)} = \text{SF6 Leaks} * \text{GWP SF6}$
2. $\text{SF6 Leaks} = \text{Leaks from equipment in service} + \text{End of life leaks}$

- 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 Red Elctrica’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).
- Leaks associated with the end of the SF6 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 Agreement³ (0.4%) mentioned in the previous paragraph.

CO2e emissions: to convert SF6 emissions to CO2e, the GWP for 100 years is used, as published in the fifth IPCC⁴ report (2014) of 23,500.

2.4 Fugitive emissions of refrigerant gas from air conditioning systems

Air conditioning equipment is fitted at both buildings, substations, and telecommunication booths.

Emissions correspond to refrigerant leakage during the use of the equipment and at its end of life. Possible emissions associated with the installation of the equipment (installer's responsibility) are not considered.

Organizational boundary

Applies to all companies.

Method of calculation

These are calculated according to the following formula:

$$Emissions (tCO_2e) = Total\ gas\ (by\ type)\ leaks * GWP_{gas}\ (by\ type)$$

$$Total\ gas\ leaks = Equipment\ in\ service\ leaks + Retired\ equipment\ leaks$$

Leakage recharges: this is the gas that is released during the lifetime of the equipment.

- If recharge data is available, it is calculated by adding up the recharges that have occurred in the equipment, each year, by gas type. If gas recoveries occur, the total recharge is the difference between recharge and recovery.
- If recharge data is not available, it is calculated by applying corresponding emission rates depending on the type of gas and the nominal load of each piece of equipment. An average value will be taken from the range proposed by the IPCC for residential and commercial A/C equipment, including heat pumps with nominal load between 0.5 and 100 kg (the indicated annual leakage rate is between 1 and 5%, so we will consider a rate of 3%). Note: if the equipment does not correspond to this description, the leakage emission rate according to IPCC values shall be applied.

GWP: 100-year GWP figures published in the IPCC fifth report (2014) are used, as indicated in the document issued by the OECC.

³ Voluntary Agreement signed in May 2015, between the Ministry of Agriculture, Food and Environment (Spain), manufacturers and suppliers of electrical equipment using SF6, electricity transmission and distribution companies and waste managers of this gas and equipment containing it, for a more environmentally friendly integrated management of the use of SF6 in the electricity industry.

⁴ IPCC: Intergovernmental Panel on Climate Change.

Calculated end-of-life leakage:

- These correspond to leaks that have occurred over the lifetime of the equipment but have not resulted in recharges. They are calculated when the equipment is removed and correspond to the difference between the nominal load of the equipment and the gas recovered from it. They are calculated in this way when documentation is available to prove the correct management of the gas at the end of its useful life.
- If there is no documentation proving the correct management of the gas contained in the equipment at the time of its removal (provided by the maintainer or authorised manager), the equivalent of the full load of the equipment is considered as leakage, since without the necessary documentation it cannot be proved that the gas has not been released into the atmosphere. This should not happen as the equipment and the gas containing it must be properly managed.

GWP: 100-year GWP figures published in the IPCC fifth report (2014) are used, as stated in the document issued by the OECC.

3 Indirect emissions: SCOPE 2

3.1 Electricity consumption

Emissions associated with electricity consumption in the different facilities.

Organizational boundary

- Electricity consumption in buildings/offices and consumption of electric vehicles.
Applies to all companies (although for the moment only electric vehicles are available at companies in Spain).
- Electricity consumption in substations:
 - Substations' own (auxiliary) consumption: these are accounted for in losses. They can be identified in some cases, but as losses are also included in scope 2, it is not considered necessary to report them separately. See point 3.2
 - Electricity supplied by a distribution company. Applies only to some substations (LATAM) where there is an electricity supply contract for certain services (lighting).

Applies to Red Eléctrica & Redinter.

Method of calculation

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

Emission factors: If available, case-specific information should preferably be used.

- Supplier-specific emission factor (factor for the green energy supply or GdO⁵, average of the supplier or residual, as applicable).
- Emission factor associated with the electricity mix of each country (and if possible, of each system) to the generation of electricity in each country.
 - Emission factor peninsular, Balearic or Canary electric mix: calculated by Redeia according to its own public methodology. For the Spanish peninsular and Canary Islands systems, the weighted emission factor referring to net generation is used. In the case of the Balearic system, the weighted emission factor referring to net

⁵ GdO: guarantee of origin, for its acronym in Spanish.

generation in the Balearic Islands is combined with the weighted emission factor referring to peninsular generation, considering the proportion of demand that has been covered by the peninsular-Balearic Islands link.

- Emission factor in Perú: If possible, average factors for SEIN⁶ published by OSIN-ERGMIN⁷ will be used or calculated from generation structure information published by COES⁸. If not available, the emission factor published by the IEA⁹ is used.
- Emission factor in Brazil: If available, the factor published by the Brazilian administration is used. If not available, the emission factor published by the IEA is used.
- Emission factor in Chile: If available, the factor published by the Chilean administration is used. If not available, the emission factor published by the IEA is used.

3.2 Electricity losses in the transmission grid

The transmission of electricity involves some loss of electricity in the grid, which means that 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 Effect¹⁰ the most significant.

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.

Organizational boundary

Applies to Red Eléctrica & Redinter.

Method of calculation

These are calculated according to the following formula:

Emissions (tCO₂e)

= *losses in the transmission grid*

* *average emission factor for electricity in the year in which the inventory is calculated*

Losses in the transmission grid:

- Losses in the transmission grid in Spain: Those published in the daily electricity balance for 31 December of the year to be calculated are taken (the losses of the peninsular, Balearic and Canary Islands electricity system are considered). These data are those collected by SIMEL, an intelligent system that receives, directly or through the secondary concentrators of other electricity companies.

⁶ SEIN: National Interconnected Electricity System, for its acronym in Spanish.

⁷ OSINERGMIN: Energy and Mining Investment Supervisory Agency in Peru.

⁸ COES: Economic Operation Committee of the System.

⁹ IEA: Intergovernmental Panel on Climate Change.

¹⁰ The Joule effect is the phenomenon whereby, when an electric current circulates in a conductor, part of the kinetic energy of the electrons is transformed into heat due to the collisions they suffer with the atoms of the conductive material through which they circulate, raising its temperature.

- In the case of Peru: Information included in the monthly report: "Informe de Operación Comercial" (Commercial Operation Report) submitted to MINEM (Ministry of Energy and Mines).
- In the case of Chile: The information contained in the report prepared by maintenance personnel will be used.
- If the information for the last months of the year is not available at the time of the GHG inventory, the unavailable months will be completed with the information for the corresponding months of the previous year.

Emission factor: as described in in section 3.1 (specific factor for each system).

4 Indirect emissions: SCOPE 3

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

The Scope 3 greenhouse gas inventory is carried out following the GHG protocol of the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), "GHG Protocol Corporate Value Chain (Scope 3) Standard", which categorises Scope 3 emissions into 15 sub-categories, 8 of which are applicable to Redeia: category 9, category 10, category 11, category 12, category 13, and category 14.

4.1 Supply chain: purchase of goods and services

This category includes emissions that are associated with the life cycle of goods and services acquired by Redeia.

Organizational boundary

Applies to all companies.

Method of calculation

- The annual expenditure is broken down for each group of items purchased by Redeia - 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 GLOBAL 6.0) 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.

- For the most relevant suppliers, Redeia carries out specific data collection work to improve the calculation described above. In case that suppliers provide quality information regarding the life cycle of the products purchased or emissions information verified by a third party, it will be used instead of applying the CEDA emission factors on the annual expenditure.

4.2 Capital goods

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

Organizational boundary

Applies to all companies.

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 or using the direct information available from suppliers, which is incorporated following the same criteria as in the case of emissions of products and service, as explained in the previous section.

Emission factors: USEPA (1995) Heavy Construction Operations Benchmark and Comprehensive Environmental Data Archive (CEDA GLOBAL 6.0).

4.3 Life cycle of fuel and energy consumed

This category includes emissions due to energy and fuel production, consumed by Redeia and that have not been included in scope 1 and scope 2:

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

Organizational boundary

Applies to all companies.

Method of calculation

- Fuels consumed: 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 proposed by OECC
- Fuels consumed in the generation of electricity: only emissions associated with non-renewable energy consumption are considered. Emission factor: Well-to-tank (WTT), DEFRA (upstream).

Emission factors: OECC and DEFRA.

4.4 Upstream transportation and distribution

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

4.4.1.1 External transport of products and materials.

Organizational boundary

Applies to all companies.

Method of calculation

The annual expenditure is broken down for the groups of items that refer to this type of service.

Emission factor: CEDA GLOBAL 6.0.

4.4.1.2 Internal transport of materials between Redeia facilities.

Organizational boundary

Applies to Red Eléctrica.

Method of calculation

Emissions are calculated from the litres of diesel consumed by the company that carried out the logistics service. 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 (Company vehicles).

Emission factors: OECC.

4.5 Waste management

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

Organizational boundary

Applies to all companies.

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).

4.6 Business travel

This category includes 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).

Organizational boundary

Applies to all companies.

Method of calculation

- 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).

- 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).

- Trips by car

- Private vehicle: calculations are based on the number of kilometres travelled.
Emission factors: DEFRA.
- Rental vehicle: calculations are based on the number of kilometres travelled, provided by car rental suppliers.
Emission factors: DEFRA.
- Taxis: Emissions are calculated by the company hired to carry out this service (with its own methodology) or using internal registers (km travelled by taxi).
Emission factors: DEFRA or emission factors specific to the contracted taxi fleet.

4.7 Employees commuting to the workplace

Organizational boundary

Applies to all companies.

Method of calculation

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.

4.8 Leased assets

- Downstream: this category includes the emissions associated with the operation of assets owned by Redeia and leased to third parties, whose impact has not already been considered in the scope 1 and 2 inventory.
- Upstream: this category includes the emissions associated with the operation of assets leased by Redeia, whose impact has not already been considered in the scope 1 and 2 inventory.

Organizational boundary

Applies to all companies.

Method of calculation

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

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

4.9 Downstream transportation and distribution

Not applicable. Redeia does not sell physical products. Emissions associated to energy transmission (service) are already included in Scope 2.

4.10 Processing of sold products

Not applicable. Redeia does not process physical products. Emissions associated to energy transmission (service) are already included in Scope 2.

4.11 Use of sold products

Not applicable. Redeia does not sell physical products. Emissions associated to energy transmission (service) are already included in Scope 2.

4.12 End of life treatment of sold products

Not applicable. Redeia does not sell physical products.

4.13 Downstream leased assets

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

As the facilities are owned by Redeia, the company compiles the data for the calculation and emissions are calculated with the same methodology as scope 1 and 2 emissions (direct information).

4.14 Franchises

Not applicable. Redeia does not have any franchises

4.15 Investments

Emissions from companies where Redeia has financial control but not operational control (investees companies).

Method of calculation

The result of the annual participation for each company (in economic terms) is considered. This information is included in the Annual Accounts Report.

The corresponding **emission factors** are applied to the economic data: CEDA factors are used. For the companies whose activity is electricity transmission, the average emission factor will be used-this average factor is calculated considering Scope 1&2 emissions/EBITDA.

5 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.

5.1 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.

6 Uncertainty

All the processes relating to the different sources of emissions fall within the scope of Redia'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 since primary data are not always used for the calculation.

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