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Decarbonising Distribution

A report on the carbon footprints and mitigation strategies of Distribution System Operators

Eurelectric report

November 2024

Eurelectric represents the interests of the electricity industry in Europe. Our work covers all major issues affecting our sector. Our members represent the electricity industry in over 30 European countries.

We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

We stand for

The vision of the European power sector is to enable and sustain:

- A vibrant competitive European economy, reliably powered by clean, carbon-neutral energy
- A smart, energy efficient and truly sustainable society for all citizens of Europe

We are committed to lead a cost-effective energy transition by:

investing in clean power generation and transition-enabling solutions, to reduce emissions and actively pursue efforts to become carbon-neutral well before mid-century, taking into account different starting points and commercial availability of key transition technologies;

transforming the energy system to make it more responsive, resilient and efficient. This includes increased use of renewable energy, digitalisation, demand side response and reinforcement of grids so they can function as platforms and enablers for customers, cities and communities;

accelerating the energy transition in other economic sectors by offering competitive electricity as a transformation tool for transport, heating and industry;

embedding sustainability in all parts of our value chain and take measures to support the transformation of existing assets towards a zero carbon society;

innovating to discover the cutting-edge business models and develop the breakthrough technologies that are indispensable to allow our industry to lead this transition.

Dépôt légal: D/2024/12.105/38

WG Sustainable Network Technology
DT Sustainable Grid Report

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Executive Summary

Distribution system operators (DSOs) play a crucial role in the global transition by facilitating electrification, thereby enabling homes, industries and transport to reduce their greenhouse gas (GHG) emissions. DSOs also contribute by actively committing to environmental targets and reducing their own greenhouse gas emissions. Moreover, the recent update to the Corporate Sustainability Reporting Directive (CSRD) has mandated new transparency standards on company reporting, particularly concerning carbon footprints.

This report analyses various DSO carbon footprints, highlighting their main emission sources from direct and indirect emissions. While the relative impact of emission sources may vary between DSOs across Europe, generally the indirect emissions in scopes 2 and 3 constitute the largest share of the emissions, mainly linked to grid components and electrical losses. The report showed that for the average DSO, the relative scope 1 emissions are 4%, scope 2 are 43% and scope 3 are 54%. The data represents DSOs which connect to 106 million customers, which translates to 40% of the customers in the EU.

DSOs are committed to reducing their direct emissions inter alia through sustainable development plans and innovative solutions, such as the decarbonisation of their vehicle fleet needed to operate or reducing gas leakage in certain grid components. In addition, they are committed to reducing their indirect emissions through the reducing network losses, procuring sustainable components and recycling waste. To illustrate the different ways to reduce scopes 1 through 3 emissions, DSOs have shared their best practices through 8 case studies.

Policy recommendations

1. Any sustainability initiative should encompass a life cycle approach involving the entire value chain, minimising the demand for raw materials and with this contribute to a circular economy vision.
2. Sustainability initiatives should promote the optimal use of existing assets, not incentivising premature decommissioning.
3. Regulation should incentivise sustainable asset acquisition where feasible, prioritising long-term environmental and social benefits alongside cost efficiency for the customer.
4. The climate targets set for 2030, 2040 and 2050 should remain a priority, while focusing on using the most sustainable materials and chemicals when viable.
5. For reporting emissions for electricity losses and electricity consumption under the GHG Protocol, DSOs should have the possibility to opt for the most appropriate methodology.

For more details on each recommendation, please see the last section of the report.

1. Background and introduction

The EU has set off on a journey to reduce emissions by 55% compared to 1990 levels by 2030 and thereafter reach net zero emissions before 2050[1]. This legally binding commitment has been translated into many specific targets for actors involved in power generation and load. To mention a few - in 2030, renewable production must constitute 42.5% of the energy mix[2], from 2025 there must be a charging point every 60 km on highways[3] and the industry will have higher incentives to decarbonise due to the cost of carbon emissions[4].

Reaching the net zero goal requires a holistic approach to sustainable development. Sustainability encompasses the responsible management of natural resources, social equity and economic growth to ensure that current and future generations can meet their needs. It integrates environmental and social responsibility as well as economic viability into business practices, aiming for a balanced and enduring approach.

This report focuses on one of these aspects - climate mitigation. It analyses DSOs' corporate emissions and mitigation of their climate impact. It does this by delving into GHG emissions, scope by scope and by exemplifying mitigation strategies via case studies.

Inherent in their business model and purpose, DSOs have two key roles to play in the decarbonisation and electrification of society: i. by connecting customers with clean electricity; and ii. by responsibly reducing its emissions. The report will cover both aspects and mainly focus on the second.

1.1 The role of DSOs in the energy transition

The expected increase in electricity demand will be nothing like we have seen in the last years. During the last 30 years, demand has risen by 500 terawatt-hours (TWh) in the EU. Over the next 30 years, this increase is instead expected to be four times higher – adding 2,000 TWh of demand.

Figure 1 EU-27 Electricity demand. Source: Eurelectric Grids for speed (2024)

[1] The European Climate Law https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32021R1119
[2] The Renewable Energy Directive https://eur-lex.europa.eu/eli/dir/2023/2413/oj
[3] The Alternative Fuels Infrastructure Regulation https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1804
[4] The Emissions Trading System https://eur-lex.europa.eu/eli/dir/2023/959/oj

This enormous increase is the result of industrial, transport and building decarbonisation. By 2050, electric vehicles (EVs) and heat pumps will each reach about 250 million units—a twenty-fold increase from today. Public EV chargers will soar to over 7 million, nearly sixty times more than today and distribution-connected renewables will expand seven-fold to around 2,300 GW.

When connecting all the new capacity, DSOs play a key role in enabling electrified industry, transport and decarbonised production to be connected to the grid. 70 percent of the new renewable generation and electricity storage is expected to be connected at the distribution level[5]. In 2022, in Europe, the DSOs connected 19 percent more new customers compared to 2019[6].

To accommodate more customers and distribute an increased amount of decarbonised power, DSOs must invest adequately in expanding capacity. Eurelectric's *Grids for Speed* report estimates investments of €67 billion annually to be necessary, nearly double the current level of €36 billion. The primary strategy involves reinforcing and renewing the grid to meet both demand and generation needs. In addition, innovation and digitalisation allow for optimised network planning and operations, utilising distributed energy resources (DERs) and digital technologies to regulate power flows, manage voltage and leverage the flexibility of DERs.

Reducing DSOs own carbon footprint is another vital aspect of the DSOs' role in the energy transition. This involves mapping the direct and indirect impacts of their operations and introducing measures to reduce these to achieve carbon neutrality by 2050 or earlier.

1.2 The CSRD mandates sustainability reporting

The CSRD[7] entered into force on 5 January 2023 and modernises the framework for corporate sustainability reporting within the EU. The Directive expands the reporting obligations to include a broader range of large companies, listed small and medium enterprises (SMEs) and non-EU companies with significant EU market activities.

DSOs must report their emissions and detail how these targets align with their GHG inventory boundaries. From 2025, companies with more than 500 employees and a turnover that exceeds €40 million or a balance sheet that exceeds €20 million are required to report their carbon footprint of 2024. This obligation will extend to companies with more than 250 employees in 2025 and by 2026, certain SMEs will also be required to report, although they can opt to declare unpreparedness for reporting until 2028.

This entails that many DSOs must disclose their climate-related data, including the implementation of energy efficiency measures and integration of renewable energy, aligning with the European Sustainability Reporting Standards (ESRS). The Directive's goal is to enhance transparency for investors and stakeholders, enabling them to assess the environmental and social impacts of DSOs, as well as the associated financial risks and opportunities arising from sustainability challenges.

The CSRD emphasises the importance of accurate GHG emissions reporting, requiring companies to set and disclose GHG emission reduction targets. Under Commission

[5] *Eurelectric, "Grids for Speed" (2024)* https://powersummit2024.eurelectric.org/grids-for-speed/
[6] *Eurelectric, "Power Barometer"(2023)* https://powerbarometer.eurelectric.org/power-barometer-2023/
[7] *CSRD Directive:* https://eur-lex.europa.eu/eli/dir/2022/2464/oj

Delegated Regulation (EU) 2023/2772[8], these targets must be presented in absolute terms, either as tonnes of CO_2 equivalent or as a percentage reduction from a base year. In addition, the DSOs should, where relevant, report their emissions as intensity values. This means that the emissions are presented in relation to a unit of physical activity or economic output. For DSOs, three examples include: gCO_2e per euro invested in CapEx, gCO_2e per distributed kWh and gCO_2e per meter cable. For instance, at the distribution level, the absolute value of emissions might increase during consecutive years to meet the increasing connections request due to electrification. The intensity value would still decrease if the DSO has made efforts to decarbonise.

Additionally, targets must be science-based, compatible with limiting global warming to 1.5°C and periodically updated. Companies are required to disclose their base year, baseline values and methodologies used to determine their targets, including external validation where applicable. They must also describe the decarbonisation strategies and quantitative contributions of various measures, such as energy efficiency improvements and renewable energy adoption.

Finally, the European Financial Reporting Advisory Group (EFRAG) plays a pivotal role in creating the ESRS, which provide a framework for sustainability reporting across different sectors. While the initial set of standards applies broadly, EFRAG is working on developing more detailed, sector-specific standards that will address the unique needs of various industries, including DSOs. Currently, EFRAG offers Q&A documents[9] to clarify the application of ESRS, though specific guidance for DSOs is still pending. These sector-specific standards will eventually offer more precise reporting guidelines tailored to DSOs' operational characteristics, ensuring that their sustainability impacts are effectively communicated and managed. Until then, DSOs must adhere to the general ESRS and use best estimates and reasonable efforts to report information about their upstream and downstream value chains.

1.3 Carbon footprint: understanding the scopes

A carbon footprint, according to the International Panel on Climate Change (IPCC), is a "measure of the exclusive total amount of emissions of carbon dioxide (CO_2) that is directly and indirectly caused by an activity or is accumulated over the lifecycle stages of a product"[10].

This measure is expressed as the weight of CO_2 emissions produced in tonnes. Furthermore, the concept of a carbon footprint extends to include the total sum of GHG emissions associated directly and indirectly with an event, organisation or product, which is expressed in units of mass of CO_2 equivalent (CO_2e). The CO_2e metric accounts for the varying global warming potentials (GWP) of different GHGs, providing a comprehensive assessment of their collective impact on climate change.

The GHG Protocol is the main standard for understanding, managing and measuring the carbon footprint of organisations[11]. This assessment includes defining the scope and system boundaries of the emissions being measured. In specific projects, it can involve the

[8] *ESRS Regulation 2023/2772 Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards (europa.eu)*
[9] *EFRAG, "ESRS Implementation Q&A Platform" (2024) https://www.efrag.org/Assets/Download?assetUrl=/sites/webpublishing/SiteAssets/Explanations+January+-+May+2024+%28final+version%29.pdf*
[10] *Wiedmann, T. and Minx, J. C., "A definition of carbon footprint" (2008) in C. Pertsova (ed.), Ecological Economics Research Trends, Nova Science Publishers, Hauppauge NY, chapter 1, pp. 1–11. URL: https://www.novapublishers.com/catalog/product info.php?products id=5999*
[11] *Greenhouse Gas Protocol, "About us". https://ghgprotocol.org/about-us*

calculation of both absolute and relative GHG emissions avoidance. Data and parameters used in this assessment often include default values to standardise calculations and ensure comparability. Additionally, GHG methodology incorporates appendices on monitoring, reporting and verification of performance, which serve both disbursement and knowledge-sharing purposes. Such methodologies help organisations accurately track their emissions and identify opportunities for reduction. Commonly, companies measure their emissions and report them using the default value for each material or activity.

GHG emissions are categorised into three distinct scopes to facilitate comprehensive reporting and management. Scope 1 emissions refer to direct emissions from sources that are owned or controlled by the organisation, such as company vehicles or on-site fuel combustion. Scope 2 emissions cover indirect emissions from the generation of purchased energy, including electricity, heat or steam. Scope 3 emissions encompass all other indirect emissions that occur in the value chain of the reporting company, including both upstream and downstream activities. Upstream activities refer to the emissions generated from sources related to the production and supply chain before a company's operations, such as raw material extraction, supplier transportation and energy use. Downstream activities cover emissions that occur after a company's operations, including product use, disposal and distribution by third parties. The figure below visualises the concept of scopes.

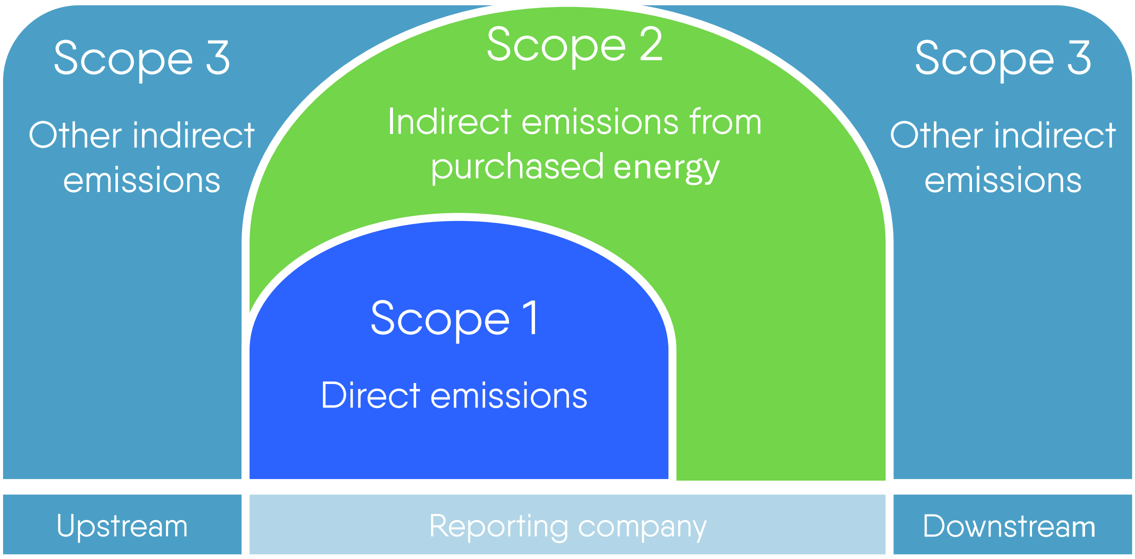


Figure 2 Visualisation of the scopes as defined in the Greenhouse Gas Protocol

2. GHG emissions in power distribution networks

This section presents a detailed analysis of the various operational scopes of DSOs and their environmental footprints. To ensure a comprehensive and representative overview, we established a drafting team with representatives from 8 European DSOs, each contributing valuable insights based on their experiences and practices. This collaborative approach draws on discussions and information from DSO members within Eurelectric. The objective is to outline the framework for understanding how DSOs' activities impact their climate-related footprint.

The DSOs participating with data connect to 106 million customers in the EU, which translates to 40% of the connected customers in the EU[12]. There were 8 DSOs participating with data, which are based in 10 EU countries and with data sets ranging from 2021-2023. The emissions reported are exclusively for electricity distribution, excluding for instance gas distribution or electricity supply. The report also provides 8 case studies of practical mitigation strategies.

By aggregating the carbon footprints, a typical DSO carbon footprint was retrieved, in the figure below. **Scope 1 accounts for 4%, while scope 2 accounts for 43% and Scope 3 for 54%**. The largest variation between companies is the ratio between the indirect emissions in Scope 2 and 3. These differences depend largely on the country electricity mix and the categories accounted for in Scope 3.

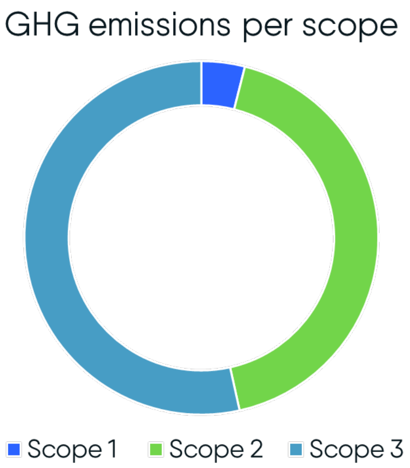
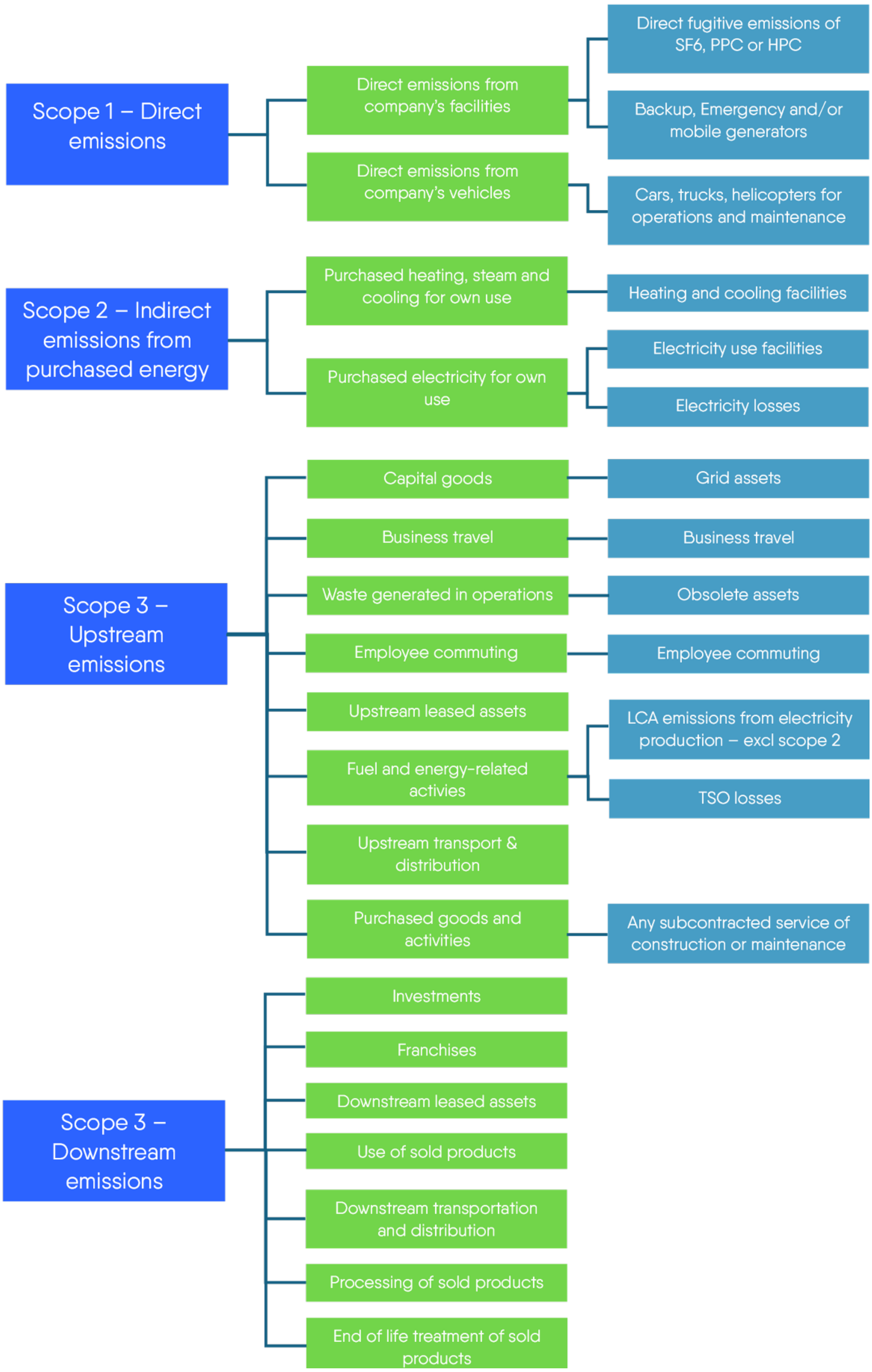


Figure 3 A carbon footprint of a typical DSO in the EU. The aggregated data comes from 8 different DSOs active in 13 countries in the EU.

[12] *EU DSO Entity, DSOs united in diversity (2024)* https://eudsoentity.eu/publications/download/119

The subcategories are designed for all types of businesses, meaning that not all categories will be relevant for DSOs. The table below showcases the GHG Protocol scopes (in blue), its subcategories (in light green) and providing the most relevant emissions for DSOs (in turquoise).



2.1 Direct emissions - Scope 1

Definition in the GHG Protocol[13]: "Scope 1 emissions are direct emissions from owned or controlled sources".

Relative GHG emissions

The relative impact is slightly less than 4% of total GHG emissions. For the first scope, the measurement of data is the most accurate, due to direct emissions being easier to estimate. The vehicle fleet usually comprises the largest category, followed by sulphur hexafluoride (SF6) gas leakage from switchgear.

Main sources:

- Direct emissions from company's facilities: For DSOs, this category is composed of two types of emissions; direct fugitive emissions of SF6, PPC or HPC and emissions from emergency generators.

  Direct fugitive emissions mainly comes from SF6 gas which is used in switchgear. The gas is used for its technical advantages such as high chemical stability and non-flammable properties, high reliability and long lifetime of the equipment as well as compactness, which allows for saving space and materials, with low to no maintenance or replacement needed.

  When the SF6 leaks, it has a climate impact with a GWP of 24,300[14] over a 100-year period. This means that releasing 1kg of SF6 is equivalent to releasing 24,300 kg of CO2 in the atmosphere, according to GHG protocol assessment. The actual leaks are low and usually constitute below 1% of the DSOs total GHG emissions.

  Even if SF6 leakage can vary from one year to another but is typically a fraction of the designed leakage rate standard. For modern switchgear below 0,5 % and below 3% for grids comprising decades old switchgear, as per the international IEC standards: IEC 60694-1996: 3% per year, IEC 62271-1 version 2003: 1% per year, IEC 62271-1 version 2017: 0.5% per year[15].

  The second type of direct emissions are from power generators. DSOs in the EU do not generate electricity for consumer, but have smaller backup systems in place to ensure a stable electricity supply in case of a network failure. Everything from fixed sources, mobile generators used during planned/unplanned power cuts, emergency generators in the network/administrative buildings. These are often run on fossil fuels.

- Direct emissions from company's vehicles: combustion of fuel from fleet vehicles used in the business. This includes any cars used for field work powered with gasoline or diesel. Adding to this, helicopters are used for overhead line and vegetation management, to cut surrounding vegetation or to control that the distance between vegetation and lines is long enough.

[13] *Greenhouse Gas Protocol FAQ https://ghgprotocol.org/sites/default/files/2022-12/FAQ.pdf*
[14] *IPCC AR6 Chapter 7 Supplementary Material https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-7/*
[15] *Eurelectric (2024) https://www.eurelectric.org/publications/eurelectric-response-to-technical-assumptions-for-the-eu-reference-scenario-2025/*

The figure below illustrates the share of emissions for a typical DSO.

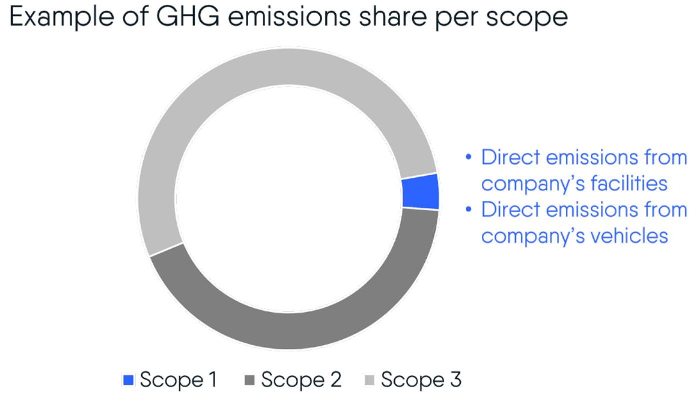


Figure 4 Typical scope 1 emissions of DSOs in the EU. The aggregated data comes from 8 different DSOs active in 13 countries in the EU.

Mitigation strategies

Greening the vehicle fleet

Tackling the emissions from different combustion engines is typically done through electrification of the transport fleet or changing fuels from fossil- to bio-based ones. In addition, the helicopters used for overhead line maintenance or control can be replaced by drones for simple tasks.

Alternative to SF6: optimising investment for regulatory compliance and net zero targets

By careful consideration of available materials, technology and environmental impact, DSOs can optimise investment in alternative switchgear which do not use SF6. Alternative technologies are being developed, trialled and technically assessed using fluorinated gas (F-gas) mixtures with lower GWP and natural origin gas (air/vacuum) based technologies with GWP<1.

The F-Gas Regulation 2024/573[16] is driving a phase out of SF6 switchgear, aiming to avoid the use of SF6 switchgear and resultant leakages related to production of SF6 gas emissions over the lifecycle of the switchgear and any emissions related to recovery of SF6 at end of life. In cases where SF6-free switchgear is not available or plausible to install, leakage rates will continue to decline to follow the IEC standards.

In addition to optimising new investments, measures can be taken to reduce the leakage rates of the existing fleet of switchgears. This can be done by introducing more accurate and digitalised monitoring as well as improving the sealing of components.

[16] https://eur-lex.europa.eu/eli/reg/2024/573/oj

Case study: SF6 Gas Management

ESB Networks, Ireland

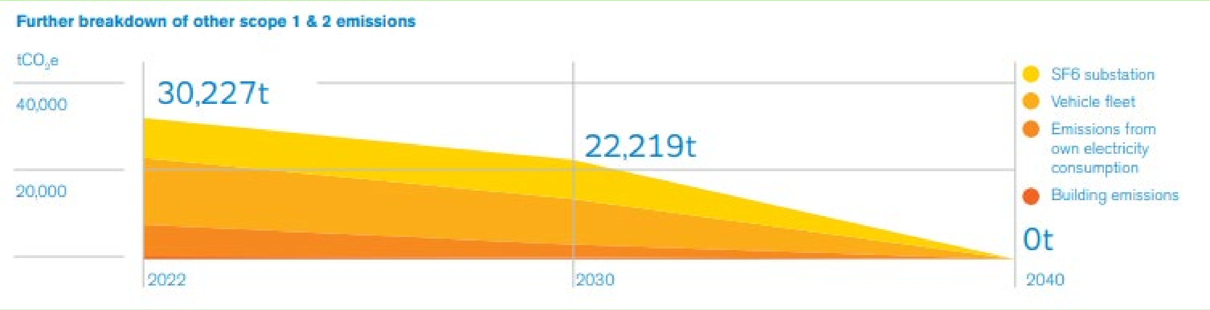
Targeted Scope: 1
Subcategory: Direct emissions from company's facilities
Status: Under deployment

ESB has lowered SF6 gas use and emissions over the last 15 years. In the last five years, we focused on key elements across the entire SF6 gas lifecycle to unlock improvements in sustainability; from initial filling, gas stocks, through to maintenance decisions and processes and finally disposal at end of life.

In advance of further regulatory commitments, ESB introduced measures including:

- SF6 gas application developed to track usage and increase awareness
- "Degas and repair" policy introduced to reprioritise outages to minimise environmental impact
- New processes mapped out and documented in new procedures;
    - Ensuring filtering can be performed locally to minimise waste SF6 gas
    - Use of "blocked" stock to control use
    - Briefing of ESB staff and contractors on ESB procedures to embed processes
    - Regular senior management co-ordination of leak repairs, driving culture shift
- New geographic information system (GIS) specifications include SF6 gas monitoring to proactively identify leaks.
- Recovery of SF6 gas from GIS at end of life. 8,800kg of SF6 gas was recycled in new GIS switchgear, preventing potential disposal/destruction and saving over 213,000 tCO2eq.

These significant efforts have driven ESB SF6 gas emissions figures to the lowest level of 0.04%, in line with our Net Zero 2040 roadmap to reduce our carbon footprint.



Case study: Fleet electrification

Enedis, France

Targeted Scope: 1	
Subcategory: Direct emissions from company's vehicles	
Status: Under deployment	

Enedis, a key public service operator and wholly owned subsidiary of EDF, with an independent governance, manages France's largest electricity distribution network, covering 95% of the country and serving 38 million customers.

Enedis is progressively electrifying its fleet to reach 100% of its 12,000 light vehicles by 2030 (excluding emergency response vehicles). This ambition is part of the EV100 initiative, dedicated to the energy transition of corporate fleets worldwide.

In 2023, the electrification rate was 31% over the whole fleet. With 6300 electric vehicles, Enedis operates the second largest electric fleet in France.

2.2 Indirect emissions from energy - Scope 2

Definition in the GHG Protocol: "Scope 2 emissions are indirect emissions from the generation of purchased energy".

The GHG Protocol includes dual reporting, allowing for two types of emissions calculations. Location-based emissions are calculated by multiplying the kilowatt-hours consumed by the grid's emission factor at the location of use. Market-based emissions, on the other hand, account for contractual instruments such as renewable energy purchases.

Relative GHG emissions

The relative impact of this scope varies significantly from one DSO to another. However, the main source is the same for all DSOs: the electricity losses representing more than 99% of Scope 2. The reason for the difference between companies comes from multiple factors, starting with a difference in carbon intensity of the losses which vary depending on how the electricity was produced. Also, the level of losses can vary depending on the region, natural temperature and technological efficiencies of grid assets.

Main sources:

- Purchased electricity for own use: Is composed of three sources of emissions for DSOs: technical, non-technical losses, and electricity for use in buildings.

    - **For technical losses**, the carbon footprint of electricity losses refers to the CO_2e emissions associated with the energy lost as heat during the transmission of electricity through power lines. These losses, known as technical losses, occur due to the electrical resistance of the lines.

      Additionally, **non-technical losses**, such as electricity theft or metering inaccuracies, also contribute to Scope 2 emissions by causing discrepancies between supplied and billed energy. The amount of non-technical losses varies largely depending on country. The GHG Protocol on the Scope 2 guidance mentions in an endnote that "companies are not required to account for line losses due to unauthorized connections or energy theft, which make up a significant percentage of T&D [transmission and distribution] losses in many jurisdictions"[17]. Thus, the extent in which DSOs accounting for non-technical losses varies. Some exclude it from their carbon footprint because the electricity is de-facto being utilised. Some include them and use them as a target to reduce fraud and as an extra incentive to look for a greener mix. However, there are no correct answers on this point which is more linked to the culture and targets of the operator concerned. An additional challenge is that it is difficult to estimate precisely the share of technical and non-technical losses.

      The electricity use in any facilities or properties, such as office buildings and control rooms, will fall under this category. The emissions of the electricity mix used will form the basis of the footprint from this category.

- Purchased heating, system and cooling for own use: This accounts for a smaller share of emissions in Scope 2. This consumption derives from heat and cooling consumption in both office buildings and network facilities owned by the DSO.

[17] *GHG Protocol, Scope 2 Guidance, page 97.* *https://ghgprotocol.org/sites/default/files/2023-03/Scope%202%20Guidance.pdf*

The figure below illustrates a typical scope 2 share, showing the large variation between DSOs

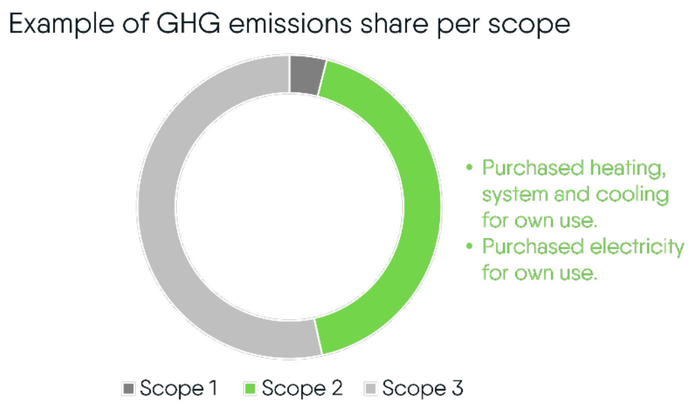


Figure 5 Scope 2-emissions of a typical DSO in the EU. The aggregated data comes from 8 different DSOs active in 13 countries in the EU.

Mitigation strategies

Minimising technical losses

Minimising technical losses is crucial for improving energy efficiency and reducing the carbon footprint of the electrical system. This can be done through economic optimisation methods, such as choosing cable types that minimise the sum of investment and losses over its lifespan.

Another way to reduce losses is by increasing voltage levels. This can be done by increasing the voltage levels on existing assets up to the physical limit. For example, In Ireland, the line losses were reduced by 75 % by increasing voltage from 10 kV to 20 kV. It also allowed for two to four times more capacity. When new lines are built, a strategy can be to increase capacity in those lines.

Ensuring a clean electricity mix

Moreover, the only losses reported in the Scope 2 emissions are the ones produced by fossil sources. This is because the emissions caused by the losses depend on how the electricity was produced. Therefore, opting for a clean electricity mix is a lever to reduce the proportion of the technical losses and the emissions from electricity use in facilities. A prerequisite to ensure the clean electricity is not curtailed, is to ensure enough grid capacity is available.

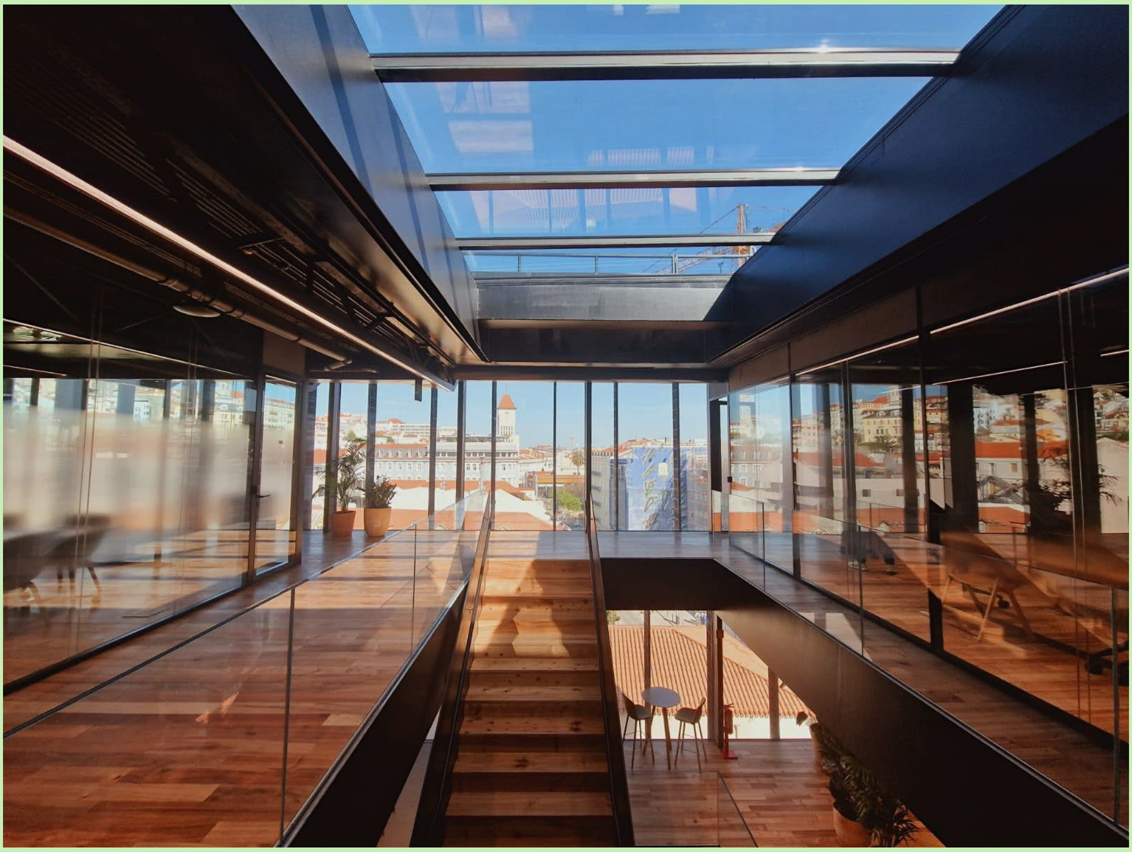
Case study: Renewable energy for buildings

E-REDES, Portugal

Targeted Scope: 2
Subcategory: Purchased electricity for own use
Status: Under deployment

Over the last few years, E-REDES has been actively installing renewable energy production units, specifically designed for its own consumption, in its administrative buildings. The installation of these renewable energy systems is still ongoing and is part of a set of carbon reduction measures in office buildings.

Since the review of the methodology to calculate emissions of this project in 2020, E-REDES has avoided an average of approximately 49 tCO_2eq per year. By focusing on self-consumption, E-REDES not only reduces its carbon footprint, but also improves energy resilience and cost-effectiveness. This project is in line with broader sustainability goals, contributing to the reduction of GHG emissions and promoting the use of clean energy in business operations.



2.3 All indirect emissions - Scope 3

Moving to the second part of indirect emissions, named Scope 3. **As defined in the GHG Protocol: all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions".**

Scope 3-emissions can be divided into upstream and downstream emissions. Upstream emissions are those emitted during the production and delivery of goods and services that a company purchases and uses in its operations. For a DSO, most emissions fall under this category. Downstream emissions are the emissions occurring as a result of the use of the company's products and services by end-users, as well as during the end-of-life treatment of those products. For DSOs, these emissions are not common as the product is to distribute electricity, but the companies are not responsible for the electricity as a product itself.

Relative GHG emissions

As with Scope 2, the emissions differ tremendously between companies depending on the assets and services included in the carbon footprint perimeter. Indeed, since there is no explicit list of what emissions to include, the main sources of emissions are included by every company.
In addition, the methodologies for calculating emissions in Scope 3 vary and entail that it is challenging to make company-to-company comparisons. DSOs in particular are asset-heavy companies and 30% of today's grid is more than 40 years old[18]. For older assets, the details about the material content and carbon footprint are not always available. In that case, the monetary value is roughly translated to a carbon footprint. Apart from assets, any emissions from provided services are complex to quantify.

Main sources

For DSOs, the significant emissions in Scope 3 arise from upstream emissions.

- Capital goods: It includes emissions generated from the manufacturing, transportation and installation of network infrastructure components such as transformers, cables and meters.

- Purchased goods and services: Any subcontracted service, for example construction, maintenance and more.

- Waste generated in operations: For a DSO, downstream emissions encompass those associated with the product distribution, use and end-of-life such as disposal, recycling or repurposing of electrical equipment and infrastructure, considered in the waste category, once they reach the end of their lifecycle.

- Business travel and employee commuting: All emissions arising from work trips and travel to and from work. Some DSOs also include the emissions of employees working from home.

- Fuel and energy-related activities: Certain DSOs include the transmission system operator (TSO) losses under this category. Moreover, the carbon footprint corresponding to the electricity losses are accounted for in Scope 2, but the life cycle emissions from that electricity mix can be included in this category.

[18] https://powersummit2024.eurelectric.org/grids-for-speed/

For DSOs, the downstream emissions are not usually relevant due to the intricacies of the business model. The product that DSOs deliver is not electricity *per se*, but rather the distribution of electricity. To name a particular example, a downstream emission would occur if a DSO leased equipment, such as a mobile generator, to another DSO. The emissions generated during the lease period would be classified as downstream emissions for the leasing DSOs.

The figure below shows the Scope 3 emissions of a typical DSO, illustrating the large variations between DSOs.

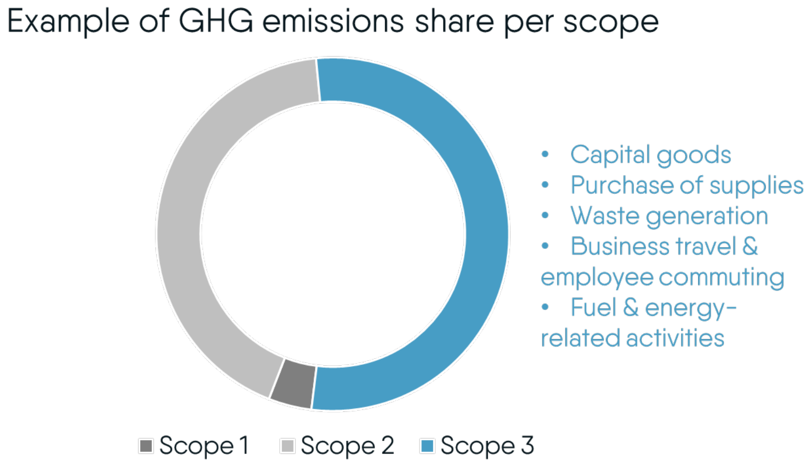


Figure 6 Scope 3-emissions of a typical DSO in the EU. The aggregated data comes from 8 different DSOs active in 13 countries in the EU.

Mitigation strategies

Buying sustainable assets when expanding

DSOs identify environmental criteria in their calls for tender. By working closely with their suppliers, asking them to provide lifecycle analyses (LCAs) for their main procurements. Measuring precisely the product's emissions will support the choice towards more environmentally friendly materials. In general, forming strategic partnerships with suppliers to co-develop low-emission products or enhance supply chain transparency can foster innovation. Not only for Scope 3, selecting transformers with optimal losses and using high-efficiency conductors can also minimise energy wastage and therefore benefit other scopes.

Proactive planning reduces emissions in the long run

Anticipatory grid investments which consider future energy demands and technological advancements can mitigate future environmental impacts and operational costs, improving grid sustainability. Adopting a long-term perspective through anticipatory investment allows DSOs to integrate renewable energy sources (RES) more. For example, investing in a larger cables in an area with increasing load is more economical and sustainable in the long-term. It will also be better value for the customer than using multiple cables which would have a higher level of embedded carbon.

Moreover, combining an anticipatory approach with buying sustainable assets enhances the benefits. For instance, procuring a more sustainable asset, perhaps even with a higher cost, could be more cost-effective in the long run, instead of buying new assets when sustainability or efficiency criteria could become more stringent. Furthermore, it reduces the raw material consumption of the sector and all linked environmental, sustainability and governance (ESG) risks.

Optimising the use of existing grid infrastructure
Investing in smart grid technologies that optimise the management of the grid and facilitate the integration of RES into the grid can significantly reduce emissions. Grid-enhancing technologies (GETs) help to increase the capacity of the grid with a lower environmental impact. For instance, using dynamic line rating (DLR) improves the utilisation of the grid using real-time data such as temperature and sag of the power line resulting in a better utilisation within its limit. This decreases the environmental footprint by decreasing the need to opt for new overhead lines, allowing a faster deployment of renewable power and a facilitation of the electrification of heat and transport.

End-of-life management and grid mining
Implementing a take-back scheme for old equipment ensures that materials are recycled rather than landfilled. By partnering with recycling firms, DSOs can ensure that valuable materials like copper and aluminium from cables are recovered and reused, reducing the need for new raw materials and associated emissions. Moreover, in transformers it is possible to recover materials like copper windings and steel cores and to reuse oil after purification. Finally, in substations and switchgear, in addition to metals and material, the SF6 gas can be recycled.

Additionally, the re-use of older switchgear and equipment is critical for a circular economy. It enables utilities to procure obsolete components or entire switchgear which may no longer be manufactured. Effective asset management not only reduces outage times for customers but also provides significant environmental benefits by reusing existing materials. This approach delays the need to source new raw materials for manufacturing new switchgear, ensuring that resources are utilised efficiently and sustainably.

Innovation and circularity supporting the development of new solutions
Supporting innovation to develop new technologies that enhance grid efficiency and capacity (in building, operation and maintenance) and reduce emissions can lead to breakthroughs in how electricity is distributed and consumed. Embracing a circular economy approach in grid design means that new components are created with their end-of-life recovery in mind, leading to a more sustainable lifecycle.

Greening personnel business travels, home-to-work travel and teleworking conditions
As with all sectors, personnel's travel habits have an impact on Scope 3 emissions. Implementing green travel policies, such as promoting the use of public transport, carpooling or EVs for business travel can further reduce the carbon footprint.

Case study: Sustainable Infrastructure, development of primary cabins

Enel, Italy

Targeted Scope: 3
Subcategory: Purchased goods and activities
Status: Under deployment

The Sustainable Infrastructure project was launched in 2022, with a particular focus on the construction of primary cabins, where the "Sustainable Site Reference Model" tool was adopted to standardise the adoption of sustainable initiatives. Integrated into digitalised systems, it allows monitoring the number and type of solutions implemented in all active or opening construction sites and measuring their impacts along the following four lines: decarbonisation, social, environmental and circularity.

The decarbonisation of infrastructure is in fact a collective challenge that requires collaboration to address direct and indirect emissions. This means designing and building a more efficient infrastructure, accelerating efforts to reduce technical losses and increasingly involving the supply chain to reduce indirect emissions also from acquired materials and components, which represent around 60% of GHGs in the Enel Grids perimeter.

In 2022, an agreement was signed with Holcim in Spain to promote the use of low-carbon concrete. In the construction of the primary cabin in Zumajo, in Andalusia, around 2,000 m3 of low-carbon concrete were used to create the foundations, perimeter wall and driveways, produced by Holcim plants in the area, which made it possible to avoid the emission of 260 tonnes of CO2, equal to 10% of the emissions associated with the entire project.

Case study: Low-carbon aluminium in cables

E.ON Energidistribution, Sweden

Targeted Scope: 3
Subcategory: Capital goods
Status: Under deployment/deployed

Over 90% of the GHG emissions from E.ON's grid business in Sweden comes from procured components and services. Cables are a significant source of emissions as they consist mainly of aluminium, copper and plastic - all of which are very energy-intensive materials to produce. Aluminium, which can constitute up to 70% of the cable's weight, also represents the largest part of the cable's carbon footprint.

Addressing cables and aluminium is therefore an important measure to mitigate E.ON's climate impact. As a priority action, new climate requirements have been implemented in an ongoing tender for the new framework agreement on cables. A key requirement is that at least half of the cables purchased must contain aluminium with a maximum GWP value of five kilograms per kilogram of aluminium produced, giving up to a 40% reduction in carbon footprint compared to a conventional cable alternative. With the new requirements, E.ON hopes to reduce procurement related emissions in the Swedish DSO business by up to approximately 10%.

Case study: Low-carbon worksites
Enedis, France

Targeted Scope: 3
Subcategory: Purchased goods and activities
Status: Under deployment

The highest source of emission in the carbon footprint of Enedis relates to the purchase of services for the maintenance or development of its network. Reducing the impact from the underground network worksites is therefore a key lever towards decarbonation.

An in-depth analysis of the carbon footprint has shown that one of the most effective decarbonation lever is to reuse soil on site. This limits the need for truck transport and the purchase of new backfill. At the end of 2023, Enedis decided to generalise this approach, where possible, to a minimum number of worksites in each region of France.

At the end Q3 2024, 870 worksites had been carried out by reusing at least 50% of the soil on-site, resulting in an average reduction of 60% of the emissions per site[1]. This was made possible through a common effort with the contractors as well as the communities.

In addition to lowering emissions, these practices reduce noise pollution, which effectively improves the acceptability of worksites in urban environments. Finally, it also helps preserve natural resources by reducing the consumption of materials (aggregates and sand) and landfill deposits.

[1]*Excluding emissions from equipment (cables, transformers…)*

Case study: Refurbishment of Power Transformers

Rheinische NETZGesellschaft, Germany

Targeted Scope: 3
Subcategory: Waste generated in operations
Status: Under deployment

Rheinische NETZGesellschaft (RNG), the DSO for the Cologne region and a subsidiary of RheinEnergie, is addressing its new company-wide sustainability targets and challenges caused by supply chain disruptions. To meet these challenges, RNG is exploring the refurbishment of its fleet of approximately 100 high- and medium-voltage (HV and MV) transformers as an alternative to purchasing new equipment. While a pilot project six years earlier found refurbishment economically unfeasible, recent shifts—such as heightened sustainability goals, increased costs and environmental impact of new materials and limited availability of essential resources like transformer steel—have spurred renewed interest in extending the service life of existing transformers.

The study focuses on determining whether refurbishing transformers, through retrofitting, recycling and upcycling, can meet modern performance and regulatory standards. This includes reusing metallic components like oil tanks and radiators, upgrading the power capacity of transformers and ensuring compliance with stricter Eco-Design Regulation. Additional objectives include recycling valuable materials, such as insulation oil and copper conductors and updating technical systems like fans and monitoring equipment. A cost-benefit analysis (CBA) will evaluate the financial and technical viability of refurbishment versus purchasing new equipment, with potential implications for RNG's asset strategy and life-cycle costs.

Case study: Developing a cable with 70% lower climate impact

Ellevio, Sweden

Targeted Scope: 3
Subcategory: Capital goods
Status: Deployed

Ellevio's largest emissions come from Scope 3, particularly in the supply chain. Materials like cables and conductors, especially aluminium, contribute significantly to emissions, with aluminium alone accounting for 60-70%.

In 2022, Ellevio collaborated with cable supplier NKT to develop a "green cable" with 70% lower climate impact compared to conventional cables. The aluminium used in these cables is low-carbon and sourced from Norway, while the insulation and sheathing are made from renewable materials. The cables are delivered on wooden reels as part of an efficient return system from NKT's factory in Falun, Sweden.

NKT has since expanded production of these "green cables" for different voltage levels and Ellevio is incorporating them into various projects. Verifiable emission data, especially via the Environmental Product Declaration (EPD)-system, is key to ensuring these reductions. Other Swedish cable producers are now also offering environmentally improved options, supporting Ellevio's transition to net-zero emissions.

2.4 Beyond scopes: avoidance of emissions

Avoided emissions refer to emissions reduction beyond a company's value chain, i.e., emission reductions that are not already included within the company's own carbon footprint. Through their crucial role in the maintenance and development of the electrical grid, as well as the connection of low-carbon assets, it is recognised that DSOs actions lead to avoided emissions on a wider level. However, accurately measuring these contributions in terms of CO2e is difficult, as there is currently no consensus or internationally recognised methodology to quantify avoided emissions. Therefore, the inclusion of avoided emissions may be generalised in the future but is not quite mature yet.

3. Policy recommendations

To ensure that sustainability initiatives are comprehensive and effective, Eurelectric sees five actionable policy recommendations to further enable DSOs to mitigate their climate impact.

1. **Any sustainability initiative should encompass a lifecycle approach involving the entire value chain, minimising the demand for raw materials and with this, contribute to a circular economy vision. – Scope 1, 2 and 3**

When crafting sustainability initiatives, it is recommended to adopt a comprehensive lifecycle approach that encompasses the entire value chain, from raw materials through to disposal.

In the case of transformers, the Ecodesign Regulation on transformers (2019/1783), should maintain the already ambitious efficiency requirements (Tier 2) and avoid increasing material usage and costs. As transformers are generally more than 99% efficient, further improvements will lead to undesirable increases in both size and weight. For instance, a 5% increase in efficiency would roughly lead to a 50% increase in costs due to the material increase[19]. While efficiency gains are important, it risks increasing the overall environmental footprint due to the additional raw materials used. In addition, a holistic approach to improving system efficiency should consider more than just transformers. Our understanding is that moving beyond the current efficiency requirements would not be justified given the already high levels of efficiency and the disproportionate costs of further improvements.

When advancing sustainability initiatives, the EU Commission should ensure that such measures do not exacerbate the strain on raw materials essential for manufacturing network assets. Since 2020, the scarcity of raw materials has driven a price surge in transformers of 60-80 %. In addition to prices, the lead times are currently on average 115-130 weeks - a rise from the pre-pandemic levels of 30-60 weeks.[20]

Moreover, grid asset manufacturers should be incentivised to use comparable LCAs to the greatest extent possible. Harmonising and using independently verified LCAs would further enhance transparency and comparability across industries, facilitating informed decision-making and sustainable practices. These measures collectively underscore a holistic approach to sustainability, aligning with the evolving regulatory landscape and fostering a more resilient and environmentally conscious economy. For example, the French electrical industry has the Pep ecopassport® which certifies the LCA of each product in a database. As long as the specificities of the different countries are kept within a coherent framework, such an example could be implemented at the European level. This would be particularly important in the process of moving away from SF6-insulated switchgear, providing DSOs with a fair and equal comparison of the different SF6-free alternatives available.

[19] *Eurelectric, "Review of Ecodesign of small, medium and large Power Transformers Eurelectric Reaction to Phase 1 Report" (2023) https://www.eurelectric.org/wp-content/uploads/2024/06/review-of-ecodesign-of-small-medium-and-large-power-transformers-copy.pdf*

[20] *Wood Mackenzie POWER TRANSFORMERS: SUPPLY SHORTAGE AND HIGH LEAD TIMES Market Dynamics and Supply Chain Update (2024)*

2. **Sustainability initiatives should promote the optimal use of existing assets, not incentivise premature decommissioning – Scope 1, 2 and 3**

To effectively promote sustainability, the EU Commission should focus on maximising the use of existing assets throughout their full lifespan. Effective end-of-life management should be prioritised by reusing assets and components whenever feasible, thereby minimising waste and promoting circular economy principles.

National regulatory frameworks should be designed to incentivise the optimal utilisation of assets while minimising premature replacement of functional infrastructure. At the same time, balancing the critical need for targeted expansion and replacement in the many areas where infrastructure is no longer reliable or sufficient to meet future demands.

In the case of switchgear, the existing components should remain in use for as long as their technical lifetime allows for, as the F-gas Regulation (2024/573) currently acknowledges. This nuanced approach ensures the pragmatic use of critical resources, aligning with broader sustainability goals without disproportionately burdening DSOs.

3. **Regulation should incentivise sustainable asset acquisition where feasible, prioritising long-term environmental and social benefits alongside cost efficiency for the customer – Scope 3**

Eurelectric welcomes that the Net-Zero Industry Act (2024/1735) has introduced non-price criteria which can be set in public procurement procedures and will introduce environmental conditions. The upcoming implementing act mandated by Article 25(5) should acknowledge that this field is under development and that the legislation will be mandatory for the DSOs in scope. This can be done by drafting flexible technical specifications or contract performance clauses which allow for further development.

In addition to improving procurement procedures, the National regulatory authorities (NRAs) should also acknowledge the cost in the tariffs. The NRAs should implement policies that incentivise the acquisition and development of sustainable assets, aligning with political goals, rather than focusing on the most cost-efficient options. This approach ensures that sustainability is integrated into procurement practices, supporting broader climate and environmental goals and reducing supply chain risks.

For instance, on climate adaptation, Italy's regulation[21] includes incentives which provide bonus points for incorporating sustainability into asset acquisition if it contributes to the resilience of grid operators. This model demonstrates how slight financial rewards can encourage the adoption of sustainable practices while maintaining reasonable costs.

[21] *ARERA Delibera 472/2024*

4. The climate targets for 2030, 2040 and 2050 should remain a priority, while focusing on using the most sustainable materials and chemicals when viable – Scope 1, 2 and 3

The EU Commission and the European Chemicals Agency should ensure that new legislative initiatives promote the use of the most sustainable materials and chemicals whenever they are available and viable. Legislation should focus on fostering the development of innovative, sustainable technologies.

For example, while addressing the use of per- and polyfluoroalkyl substances (PFAS), it is crucial to recognise their essential applications and avoid outright prohibitions that could disrupt critical functions unless substitutes can meet the same requirements. This approach encourages the advancement of sustainable technologies and the careful integration of environmentally preferable materials, balancing the need for innovation with practical usability in essential applications.

When the F-gas Regulation is revised, it will be key to include the electricity sector to assess any developments in the field. For SF6-free switchgear, some alternatives instead contain an air-solution containing PFAS. As the PFAS restriction under the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation (1907/2006) is being developed, it is important to avoid any overlaps between the F-gas and PFAS Acts and provide clear guidelines in the case of a prioritisation having to be made by companies.

5. When reporting emissions for electricity losses and electricity consumption under the GHG protocol, DSOs should have the possibility to opt for the best-suiting methodology – Scope 2

When reporting scope 2 emissions, the electricity losses can be reported based on location or market of the electricity mix. For different DSOs across varying European contexts, it remains important to allow for a choice. Failure to do so would undermine individual efforts to source renewable electricity and carbon reduction initiatives in jurisdictions with higher emissions grid mixes. This becomes increasingly important as reporting will become an obligatory tool under the CSRD. By allowing for both methods, it supports the private investments needed to boost renewable energy production and reach the EU objectives.

Eurelectric pursues in all its activities the application of the following sustainable development values:

Economic Development

- Growth, added-value, efficiency

Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability

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