CO₂ Impact
Methodology:

Saved and avoided emissions by Schneider Electric offers

Methodological Guide
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Time for climate impact disclosure

**Climate is increasingly embedded in companies’ strategies.** Economic actors are committing to reduce their carbon emissions and set « 2 and 1.5°C compatible » (or science-based) targets, striving to reduce risks and capture new opportunities associated with the energy and climate transition. Climate mitigation strategies make good business sense: energy efficiency, resource circularity and renewable energy enable recurring cost savings and to increase the resiliency of supply chains. CO₂ pricing has already been enforced in several geographies (through quotas or taxes), and the cost of resources shows important volatility, weighing on productivity. Companies also ambition to increase the resiliency of their assets by avoiding “stranded assets” risks, meaning the deterioration of asset value due to inequation with “2°C-compatible” markets and regulations. The climate transition is also an opportunity to innovate, outpace competitors and attract talents, and appears as one the mega-trends driving market evolution.

**Standardized definitions and quantification methodologies are essential to assess climate impact and build trust, on corporate, customers and investors side.**

Time has come to go one step further with transparent climate impact disclosure, focusing on key impact metrics depending on the activity of companies. For the capital goods and consumer durables sectors, a priority is to measure and reduce the CO₂ impact of offers during their lifetime, as solutions sold today will be used for years or even decades. Emissions from the use-phase of offers typically represent over 80% of the end-to-end CO₂ footprint of capital goods and consumer durables companies, and therefore the main lever of action to contribute to climate change mitigation. Many technologies bring energy efficiency and flexibility, enabling to cut CO₂ emissions from historical emissions. Climate impact disclosure therefore needs to account fully for induced, avoided and saved emissions over offers’ lifetime.

The need for an innovative CO₂ methodology

**To meet the challenge of the climate transition, it appears necessary to beef up the ability to quantify CO₂e impact of offers, looking both at induced and avoided or saved emissions.** Customers demand increased transparency, with environmental information available at a fingertip and the ability to distinguish offers with a positive impact on climate. Investors demand full overview of the impact of investee companies, to reduce risks and capture opportunities in their portfolio. Both needs should be answered in a consistent manner, with a CO₂e methodology that can be used both at a granular and aggregated level, to quantify the CO₂e impact of single offers and full lines of business, and that enables to quantify CO₂e savings or avoidance compared to a reference situation.

**No methodology standardised today meets the need to quantify the CO₂e impact of offers for customers and investors.** While traditional Life-Cycle Analysis (LCA) concentrates on quantifying end-to-end (cradle to grave) emissions, it gives no guidance on how to quantify CO₂e savings or avoidance compared to a reference situation. CO₂e Project Accounting methodology is granular and bottom-up, focussing on single identified large projects. It is therefore not applicable to a wide range of offers sold across a variety of end-user markets with different use-cases. Finally, Corporate CO₂e Accounting standards (scope 1, 2 and 3) cannot be applied at the offer level and provide no guidance on how to quantify CO₂e savings or avoidance compared to a reference situation. As a result, claims made by economical actors are often inconsistent and lack transparency, reinforcing the need for a shared methodology.
The objective of this guide is to share and promote an innovative CO₂e impact methodology, that enables to quantify saved and avoided emissions by offers in use. This methodology is inspired from existing CO₂e standards, with the ambition to leverage best practice from each.

This methodology ambitions to become a shared industry standard within the consumer durables and capital goods sectors. This methodology guide is an effort to share transparently on principles and calculation rules, so that all companies can disclose consistently the CO₂e impact of their offers.

The methodology is **pragmatic, robust and flexible** to allow fast adoption in the industry.

**Our promise: 120 MTCO₂ saved over 3 years**

Schneider Electric, global specialist in energy management and automation, is committed to help its customers become more efficient and reduce CO₂e emissions. With EcoStruxure, our IoT-enabled architecture, we help buildings, data centres, energy infrastructures and industries manage their energy and process in ways that are safe, reliable, efficient.

**CO₂e savings are delivered at every layer of 3-layer EcoStruxure™ architecture:**
- We eco-design our **Connected Products**, to improve their efficiency and deliver electricity savings.
- The **Edge Control** layer gives the capability to manage on-site operations, with day-to-day optimization of energy consumption through remote access and advanced automation.
- Our portfolio of **Apps, Analytics & Services** leverages IoT data and the expertise of our engineers to identify additional energy efficiency opportunities, increase the lifetime of assets, optimize maintenance services and boost demand flexibility and renewable electricity.

At Schneider Electric, sustainability is a top priority and is embedded in our strategy, shaping our value propositions and technologies.
Key guiding principles

The CO₂ Impact Methodology is a transversal framework, applicable for all offers across the capital goods and consumer durables sectors, and that covers products, software and services. The methodology follows 4 guiding principles:

1. **Rigorous and conservative**, the methodology has been developed with the support of an independent and expert consulting company (Carbone 4):
   - **Detailed calculation rules** per offer/technology, leveraging in each case the best available data (such as sales data, market data, or expert estimates)
   - **Forward-looking emission factors**, to account for the future decarbonization of the world (as technologies sold today will be used for decades).

2. **Conservative and realistic**, we applied a conservative approach to all methodology assumptions to avoid “green washing” in CO₂ claims. One of the most important principles of the methodology is the **distinction between brownfield sales** (enabling emissions savings compared to previous years – saved CO₂) and **greenfield sales** (enabling a limitation of emissions increase versus an alternative scenario – avoided CO₂).

3. **Transparent**, with a **recommended disclosure framework** applicable to all offers and all companies. The choice of reference situation and emission factors can lead to important variability of results between actors. It is therefore paramount to disclosure transparently calculation rules, to build trust and to enable further alignment between peers. This is why **Schneider Electric chose to publish the hereby full and detailed methodology** and to make it available for the market. **All calculation rules and data sources are disclosed transparently** for each offer.

4. **Compliant and verified**
   - The methodology is **aligned with Greenhouse Gas Protocol accounting and reporting principles**. Notably, results are expressed in tonnes of CO₂ equivalent (tCO₂e) and include scope 1, 2 and 3 emissions as defined by GHG Protocol Standard.
   - As an independent verifier, EY reviewed the methodology prepared by Schneider Electric with regards to its consistency, accuracy, understandability, neutrality, completeness and relevance. The methodology has been assessed in view of the requirements of ISO 14067 and ISO 14021.

5. **Pragmatic, flexible and widely applicable**
   - This methodology has been designed to be applicable across the capital goods and consumer durables sectors.
   - Key principles are transversal to all long-lasting equipment manufacturers, software and service providers (capital goods and consumer durables sectors)
   - Pragmatic and flexible calculation rules can easily be adapted to a wide variety of activities, leveraging existing financial and business reporting
Distinction between saved and avoided emissions

1. Definition of saved and avoided emissions

The distinction between saved and avoided emissions enables to distinguish brownfield sales that enable reduction of global CO₂e emissions compared to previous years (saved CO₂e), from greenfield sales that enable a limitation of the increase of global emissions versus an alternative situation (avoided CO₂e).

Brownfield sales correspond to the situation where the offer sold replaces or upgrades an existing system, and greenfield sales where the offer sold equips a new infrastructure.

A similar distinction exists in the finance and accounting communities, to distinguish “cost savings” that are calculated compared to the previous situation and impact the company’s P&L, from “avoided costs” that enable to avoid having to incur costs in the future. Cost avoidance will never be reflected in the budget or the financial statements, they will only be reflected in situations where the proposed action is not implemented. Cost avoidance is calculated compared to an alternative situation, such as a reduction of a proposed price from a vendor or the reduction for the need for additional headcount through process improvement ².

Following vocabulary defined in the finance sector, net CO₂e emissions in the case of brownfield sales are called “CO₂e savings”, they correspond to a reduction of CO₂e emitted in the atmosphere compared to previous years. In this case, the reference situation is defined as the initial situation, meaning the greenhouse gas emissions that were emitted to the atmosphere before the sale of offer.

Net CO₂e emissions in the case of greenfield projects are called “avoided CO₂e”. For a greenfield sale, the reference situation answers the following question: « What would the customer’s situation be if he was not implementing this offer? ». In other words, the reference situation reflects the most realistic market situation. The greenfield reference situation can vary depending on the offer, on the end-user segment and on the geography, and can typically be a competitor’s offer, a regulatory requirement or no alternative offer. Constructing highly performing new systems, to answer the needs of market growth, results in a limitation of the increase of global CO₂e emissions.

² Defining cost reduction and cost avoidance, CAPS Research, March 2006
“Avoided CO₂e” and “Saved CO₂e” are both net values, meaning they deduct emissions of the new offer installed.

The distinction between saved and avoided CO₂e is at the heart of the CO₂e Impact Methodology: the objective to divide by 2 global emissions by 2050 compared to 1990 refers to “CO₂e savings”, meaning a twofold division of total CO₂e emissions to the atmosphere. When taking into account the increase of emissions due to economic growth (and therefore greenfield sales), Schneider Electric estimates that the required sum of saved and avoided CO₂e to mitigate climate change is a threefold increase in efficiency.

In a nutshell: brownfield sales enable reduction of global CO₂ emissions compared to previous years (saved CO₂), greenfield sales enable a limitation of the increase of global emissions (avoided CO₂). This distinction is crucial to quantify impact on climate change, with robust reference scenarios and conservative results.
2. Choice of brownfield and greenfield reference situation

**Brownfield reference situation** is defined as the initial situation prior to the sale of the offer, meaning greenhouse gas emissions that were emitted in the atmosphere in the near past without the offer. This definition is applicable to all offers, end-user segments and geographies.

The choice of a **greenfield reference situation** needs to be decided on a case-by-case basis, depending on offers, end user segments and geographies. The choice of a greenfield reference situation should be made following the following principles inspired from UNFCCC Standards for the definition of CDM baseline:

**Step 1: List of alternative scenarios.** Identify all plausible alternative scenarios that provide the same output as the offer sold. These alternative scenarios should focus on common practice in the end-user sector and geography, and should consider:

1. Greenfield scenario 1: alternative offers on the market
2. Greenfield scenario 2: average market penetration of the offer, and other available technologies
3. Greenfield scenario 3: compulsory regulatory performance of new equipment or infrastructure, and reality of enforcement of these regulatory requirements
4. Greenfield scenario 4: impact of innovation on the environmental performance of the offer over the past years
5. Greenfield scenario 5: other offers that can provide the same output or service, without necessarily being the same technology or a direct competitor

**Step 2: Barrier analysis.** Establish a complete list of realistic and credible barriers that may prevent alternative scenarios to occur, such as investment barriers (insufficient financial returns, lack of capital availability) and technological barriers (skilled labor, lack of infrastructure, risk of technological failure, technology availability in geography).

**Step 3: Reference scenario selection.** Eliminate alternative scenarios which are prevented by identified barriers. If several alternative scenarios still exist, select the most plausible scenario, that reflects the market common practice. Several scenarios can be combined to design a mixed alternative scenario, with weighing of several alternative scenarios.

In all cases, the **greenfield reference scenario** used to calculate avoided CO₂e should be disclosed transparently for each offer.

The table below summarizes the distinction between saved and avoided CO₂e:

<table>
<thead>
<tr>
<th>What is the definition of BF/GF offer sales?</th>
<th>Brownfield (BF)</th>
<th>Greenfield (GF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the situation in which the product or service sold replaces or upgrades an existing system (retrofit projects).</td>
<td></td>
<td>Is the situation in which the product or service sold equips a new infrastructure to answer demand growth (new projects).</td>
</tr>
</tbody>
</table>

| How to define the reference situation? | Brownfield reference situation is defined as the solutions in place prior to the sale of the offer. For instance, the product or service used in the past to fulfil the same objective. | The Greenfield reference situation is defined as the most likely alternative to fulfil the same output or service of the offer. For instance, the alternative offer from competitors or an alternative technology. |

| Saved or avoided emissions | SAVED EMISSIONS correspond to the reduction of CO₂ emission compared to previous situation | AVOIDED EMISSIONS correspond to the reduction of CO₂ emission compared to the most likely alternative |

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3 UNFCCC, CDM Standard, Determining coverage of data and validity of standardized baselines, version 2, CDM-EB77-A05-STAN
Calculating CO₂e emissions

1. Top-down approach

This methodology has been designed to the applicable in a “top-down” manner, looking at the CO₂e impact of total sales over a year. Calculation rules have therefore been designed to be reflect accurately global market trends and average impact of technologies. Notably, brownfield and greenfield reference situations are assessed against market averages, rather than looking at specific contracts. For instance, in the building sector, the methodology will look at the global share of buildings being retrofitted, destroyed and newly built, to assess the share of Schneider Electric’s offers that will address brownfield and greenfield market.

This choice is motivated by 3 reasons:

- **Availability of data**: detailed contract by contract information is rarely consolidated at global level, considering the variety of Schneider’s customers (4 main markets are buildings, data centres, industries and energy infrastructure, representing 70% of global energy consumption), geographies (100 countries) and offers.

- **Reproducibility and consistency of results**: market averages can be consistently used by all companies within the same industry, at the condition that their own market exposure is in line with global trends (a niche actor would have to tailor calculation terms to reflect accurately his markets).

- **Accuracy of results**: global CO₂e impact is best estimated looking at global trends and markets. For instance, a sales team working on a specific new renewable capacity would not be able to assess whether this capacity will replace an existing capacity in the grid or whether it will answer a growth of electricity demand. Similarly, a sales team working on the commissioning of a new building will not know if a domino effect of moving companies and households will lead to the destruction of other building stock in the country. “Macro-effects” on climate are better assessed at the country or global level, rather than on a project-by-project basis.

This methodology can also be used in a more “bottom-up” manner, looking at specific sales per end-segment, country or line of business. As a general rule, the more “bottom-up” and the more granular the calculation, as more information will be available on the offer’s characteristics and the use case by the customers. In this case, offer or country-specific data will be used in the calculation instead of average market values, to reflect the specific situation.

To perform a CO₂e impact calculation on a single project for a single customer, CO₂e project accounting standards would be preferred.

2. Share of greenfield and brownfield sales

The split between greenfield sales and brownfield sales is assessed based on market data, either historical or prospective.

**Method 1: Based on historical market data**

Assessment of % brownfield and greenfield sales can be based on historical market growth in volume of the offer and on the average lifetime of the offer, using the formula below:

With:

- \(d\): expected lifetime of the offer
- \(x\%\): compound annual growth rate of market in volume over \(d\) past years

Calculation formula for % brownfield and % greenfield sales is:

- \(\%\) brownfield sales = \(1 / (1+x\%)^d\)
- \(\%\) greenfield sales = \(1 – \%\) brownfield sales
This method is relevant if the dynamics of markets that the offer is targeting is expected to follow historical trends.

Two examples are illustrated below, for growth rates of 1% and 5%, logically resulting in contrasted share of greenfield sales.

![Historical market growth (in volume)](image1)

**Method 2: Based on prospective (future) market data**

Assessment of % brownfield and greenfield sales can also be made using prospective market studies, based on future expected market trends.

This method is relevant if the market dynamics of the offer are expected to change over the next years, due to economic growth, energy and climate transition, digitalisation of the economy or any other reasons.

For instance, in the building sector, the methodology will look at the global share of buildings expected to be retrofitted, destroyed and newly built in the coming years, to estimate the share of Schneider Electric's products for brownfield and greenfield markets. This enables to quantify from a “macro” (top-down) point of view CO₂e savings against historical emissions and “avoided CO₂e” on the net increase of the global building stock.

Illustration of building sector prospective market study is available below:

![Illustrative](image2)

Another example is in the power sector, with the analysis of expected electricity capacity additions and retirements over the coming years. This enables to estimate the share of capacity additions that will enable to meet electricity demand growth versus that will replace decommissioned electricity capacity. Global data can be found in World Energy Investment Outlook published by the International Energy Agency, and country-specific data is often published by national governments.
For both methods, attention should be put to select the right underlying market data that drives the offer’s dynamics. For instance, for variable speed drives installed on electric motors, both speed drives and electric motors markets trends have to be considered to understand whether new speed drives are sold to equip new motors, existing motors with an obsolete speed drive or existing motors with no speed drive previously installed. Similarly, to assess the share of greenfield sales for renewable equipment technologies (such as inverters installed on solar or wind farms), it is necessary to look at market dynamics of total installed (fossil and non-fossil) electricity capacities of the country.

3. Four different calculation methods depending on available data

For each offer, a tailored methodology needs to be created and disclosed transparently. Four different calculation methods can be used to assess avoided and saved emissions of offers, depending on the available sales data:

1. Method 1: Based on the volume of offers sold during the year
2. Method 2: Based on industry-specific ratios in kgCO₂e/€ of sale
3. Method 3: Based on the ROI from energy savings enabled by the offer
4. Method 4: Based on the share of energy OPEX in the offers’ total lifecycle cost

For methods 2, 3 and 4, there might be a geographical bias affecting the average pricing of the products, and consequently their emission intensity; therefore, a particular attention should be given to the distribution of sales and their average price. A possible solution to overcome this potential issue is to consider the specific price of the product for every geography or to calculate an average price based on the distribution of sales.

Method n°1: Based on the volume of offers sold during the year

This methodology is applicable to homogeneous lines of business for which it is possible to count sales with a “physical unit”, such as a number of units, MW, kWh of energy, etc.

Examples: variable speed drives, transformers, green electricity contracts, energy performance contracting, etc.

In this case, terms of the calculation will typically be:

- Volume of offer sold during the year (unit/year)
- Annual energy consumption of the offer (kWh/year/unit)
• Energy consumption of brownfield and greenfield reference situation (or energy savings of the offer versus reference) (kWh/year/unit)
• Offer lifetime (years)
• % brownfield and greenfield sales (%)
• Energy emission factor (kgCO₂e/kWh)

Calculation formula for use-phase emissions will typically be:

\[
\text{Induced emissions} = \text{Volume offer sold (unit/yr)} \times \text{Energy consumption offer (kWh/yr/unit)} \times \frac{\text{EF energy over lifetime (kgCO₂e/kWh)}}{\text{Offer lifetime (yrs)}}
\]

\[
\text{Avoided emissions} = \text{Volume offer sold (unit/yr)} \times \text{Energy consumption greenfield reference (kWh/yr/unit)} \times \frac{\text{EF energy over lifetime (kgCO₂e/kWh)}}{\text{Offer lifetime (yrs)}} \times \% \text{ greenfield sales}
\]

\[
\text{Saved emissions} = \text{Volume offer sold (unit/yr)} \times \text{Energy consumption brownfield reference (kWh/yr/unit)} \times \frac{\text{EF energy over lifetime (kgCO₂e/kWh)}}{\text{Offer lifetime (yrs)}} \times \% \text{ brownfield sales}
\]

Finally, manufacturing, installation and end-of-life emissions of the offer need to be added to calculate total induced emissions over the offer lifecycle, and similarly subtracted from total avoided and saved emissions.

Method n°2: Based on industry-specific ratios in kgCO₂e/€ of sale

This methodology is applicable for lines of business for which typical ratios of saved and avoided emissions in kgCO₂e/€ of sales can be created. This is the case in industries, such as the renewable industry, where CO₂e savings per € of investment can be estimated, based on market studies.

Example: inverters and electrical distribution technologies for solar and wind farms, etc.

In this case, terms of the calculation will typically be:
• Offer revenue during the year (€/year)
• Induced emissions per € of sale (kgCO₂e/€/year)
• Saved emissions per € of sale (kgCO₂e/€/year)
• Avoided emissions per € of sale (kgCO₂e/€/year)
• Offer lifetime (years)
• % brownfield and greenfield sales (%)
• Energy emission factor (kgCO₂e/kWh)

Calculation formula for use-phase emissions will typically be:

\[
\text{Induced emissions} = \frac{\text{Offer revenues (€/yr)}}{\% \text{ greenfield sales}} \times \frac{\text{Induced emissions (kgCO₂e/€/yr)}}{\% \text{ brownfield sales}}
\]

\[
\text{Avoided emissions} = \frac{\text{Offer revenues (€/yr)}}{\% \text{ greenfield sales}} \times \frac{\text{Avoided emissions v/s greenfield reference (kgCO₂e/€/an)}}{\% \text{ brownfield sales}}
\]

\[
\text{Saved emissions} = \frac{\text{Offer revenues (€/yr)}}{\% \text{ brownfield sales}} \times \frac{\text{Saved emissions v/s brownfield reference (kgCO₂e/€/an)}}{\% \text{ greenfield sales}}
\]
Finally, manufacturing, installation and end-of-life emissions of the offer need to be added to calculate total induced emissions over the offer lifecycle, and similarly subtracted from total avoided and saved emissions.

**Method n°3: Based on the ROI from energy savings enabled by the offer**

This methodology is applicable for lines of business that enable energy savings in a system, and that have negligible or nil use-phase emissions.

Example: variable speed drives, building management system, etc.

In this case, terms of the calculation will typically be:

- Offer revenue during the year (€/year)
- ROI (return on investment) enabled by energy savings (years)
- Average energy price (€/kWh)
- Offer lifetime (years)
- % brownfield and greenfield sales (%)
- Energy emission factor (kgCO₂e/kWh)

Calculation formula will typically be:

\[
\text{Avoided emissions} = \frac{\text{Offer revenues (€/yr)} \times \text{Greenfield reference ROI on energy savings (yrs)}}{\text{Reference annual energy savings (in €)}}
\]

\[
\text{Saved emissions} = \frac{\text{Offer revenues (€/yr)} \times \text{Brownfield reference ROI on energy savings (yrs)}}{\text{Reference annual energy savings (in €)}}
\]

\[
\text{EF energy (kgCO₂e/kWh)} = \text{Offer lifetime (yrs)} \times \frac{\text{Energy price (€/kWh)}}{\% \text{ greenfield sales}}
\]

\[
\text{EF energy (kgCO₂e/kWh)} = \text{Offer lifetime (yrs)} \times \frac{\text{Energy price (€/kWh)}}{\% \text{ brownfield sales}}
\]

Finally, manufacturing, installation and end-of-life emissions of the offer need to be added to calculate total induced emissions over the offer lifecycle, and similarly subtracted from total avoided and saved emissions.

**Method n°4: Based on the share of energy OPEX in the offers’ total lifecycle cost**

This methodology is applicable for lines of business that generate significant use-phase emissions, while enabling use-phase emission savings compared to the reference situation.

Example: electric motors, datacentre cooling, etc.

In this case, terms of the calculation will typically be:

- Offer revenue during the year (€/year)
- % energy consumption cost and % CAPEX cost in offer total lifecycle costs
- % energy efficiency versus greenfield and brownfield reference
- Average energy price (€/kWh)
- % brownfield and greenfield sales (%)
- Energy emission factor (kgCO₂e/kWh)
Calculation formula for use-phase emissions will typically be:

\[
\text{Induced emissions} = \text{Offer revenues (€/yr) \times \% energy consumption in lifecycle cost (\%)} \times \frac{\text{EF energy (kgCO2e/kWh)}}{\text{Energy price (€/kWh)}}
\]

\[
\text{Saved emissions} = \text{Offer revenues (€/yr) \times \% energy consumption in lifecycle cost (\%)} \times \frac{\text{1}}{\left(1 - \frac{\text{EF energy (kgCO2e/kWh)}}{\text{Energy price (€/kWh)}}\right)} \times \frac{\% \text{brownfield sales}}{}
\]

Notes:
- Same formula for “Avoided emissions” than “Saved emissions”, replacing brownfield by greenfield
- “Saved emissions” formula is valid only for changes of equipment using the same source of energy (otherwise slightly more complex formula that accounts for the change of energy emission factor)

4. Emission sources

All relevant emission sources are considered, following ISO 14064 and GHG Protocol principles of relevance and accuracy. This methodology covers scope 1, 2 and 3 emissions.

Relevant emission sources have been identified using Life Cycle Assessment results available in Product Environmental Profiles (PEP). Across Schneider Electric offer portfolio (such as variable speed drives (VSD), process automation, electricity transformers, UPS, power metering infrastructure, etc) the most significant life cycle phase contributing to Global Warming Potential are “Usage” and “Manufacturing” phases, due to energy consumption during use phase and the raw material used in products. This assumption could be safely applied to a vast majority capital goods and consumer durables.

Our products’ PEP are publicly available in Schneider Electric Check a Product website or via the PEP EcoPassport association website.

For use-phase emissions (that corresponds to category 18 “use stage of the product” in ISO 14064 and GHG Protocol), emissions considered can typically include:

- direct and indirect emission from energy consumption of the offer during use-phase
- direct emission from fugitive or process emissions of offer during use-phase
- indirect emissions from the purchase of goods and services, travel, freight, etc. during use-phase of offer

Since saved and avoided emissions are net emissions calculated as the difference between offer’s induced emissions and reference’s induced emissions, only emission sources that will vary significantly between the offer and the reference situations need to be quantified.
Summary table below gives examples of emissions sources that are considered, depending on the type of offer.

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>Examples of offer where emission sources will be taken into account</th>
</tr>
</thead>
</table>
| Direct and indirect emission from energy consumption of the offer and reference situation during use-phase | • Variable Speed Drive  
• Building management system |
| Direct emission from fugitive or process emissions of offer and reference situation during use-phase | • Process automation for natural gas flaring in O&G  
• Low-GWP gas cooling equipment |
| Indirect emissions from the purchase of goods and services, travel, freight, etc. during use-phase of offer and reference situation | • Predictive analytics for maintenance optimisation  
• Retrofit-ready offer that enables longer lifetime |

Emission sources defined for each offer should be disclosed for transparency.

5. Boundaries: product, system, ecosystem

The boundaries of CO₂e emissions calculation is defined on a case-by-case basis, depending on the offer considered. Three different levels of boundaries can be defined:

**Product-level boundary**: The boundary can be set to the product itself, looking at the energy consumed and dissipated (joule effect) over the product’s lifetime.

Example: Transformers, UPS, etc.

**System-level boundary**: The boundary can be defined as the system in which the product is included, for instance a building or an industrial process.

Examples: Building Management Systems (BMS) that deliver energy efficiency in buildings, Variable Speed Drives (VSD) that deliver energy efficiency on electrical motors, Process Automation solutions in industrial facilities, etc.

**Ecosystem-level boundary**: The boundary can be defined as a larger ecosystem, for instance when the offer enables a superior quality of service and operation to a network, thanks to increased connectivity and managing capabilities.

Examples: Smart Grid EcoStruxure that enables renewable integration in the electricity grid and energy demand management.

In all cases, induced, saved and avoided emissions are considered on the same boundary for a given offer. The definition of boundaries should follow ISO 14064 principles of relevance and accuracy. **Boundaries defined for each offer should be disclosed for transparency.**
Accounting and reporting principles

1. Applicability

This methodology is applicable to companies selling long-lasting tangible assets (such as buildings, machinery, equipment, vehicles and tools), software and services that will be used either by other business to produce consumer goods or by final consumers. Said differently, this methodology is applicable to the capital goods and consumer durables sectors, covering both sales to businesses and final consumers. For instance, this methodology is applicable to manufacturers of automobiles, aircrafts and machinery, as well as to their supply chain of components manufacturers.

2. Temporality

Two methodologies are available to quantity emissions from the use of products and services over their lifetime: yearly accounting and cumulative accounting.

This methodology uses the yearly accounting methodology, meaning that the methodology considers induced, avoided and saved emissions of the offers sold within the year, cumulated over the expected offers lifetime.

The methodology takes into account 100% of lifetime emissions of offers sold within the year:

- 100% of lifetime CO₂e emissions are taken into account at the time when the sale is booked as revenues into financial statements, meaning that only the sales of the year are taken into account each year
- Net sales are considered each year (sales output minus refunds) to account for overpayments, product recalls, cancellations, etc.

This enables to align the scope and period of financial and CO₂e reporting, while ensuring of no double-accounting. The delay between the sale and the commissioning of offers at customer’s site (due to stock at customer’s sites, shipping time, installation time, billing time, etc.) does not impact results.

Cumulative accounting (not used in this methodology) considers induced, avoided and saved emissions of the offers sold in the past during the year of reporting. The implementation of this method is complex as it requires to have access to detailed sales and technical data of offers sold over the past decades, as well as defining tailored reference situations to account for each period. In addition, cumulative accounting does not meet the need from investors and customers to assess the CO₂e impact of offers currently sold by a company.

3. Greenhouse gases

Following the GHG Protocol Standard, results include emissions from the six main greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). All results are in tonnes CO₂ equivalent (tCO₂e).
4. Scopes 1, 2 and 3

Avoided and saved emissions are net emissions calculated over the full life-cycle of offers (similarly to a LCA calculation approach) and they include scope 1, 2 and 3 emissions.

The large majority of saved and avoided emissions correspond to scope 3 emissions, as defined by the ISO 14064 standard, as capital goods and consumer durables typically show most significant impacts during the manufacturing and the use phases.

5. Emission factors

The selection of GHG emission factors follows recommendations from ISO 14064: emission factors are derived from a recognized origin, appropriate and consistent.

As a general rule, emission factors from public databases are preferred, such as Ademe, GHG Protocol and IEA. Emission factors from private database can also be used when more relevant or accurate, such as EcoInvent.

Emission factors include all greenhouse gases under the GHG Protocol Standard and are in tonnes of CO₂ equivalent.

In all cases, the source and update frequency of emission factors should be disclosed transparently for each offer.

As a key guiding principle, this methodology is “forward-looking”, meaning that when relevant emission factors are adjusted to consider the future “decarbonisation” of the world. Indeed, offers sold today have life expectancies of several years or decades, and induced, avoided and saved emissions will evolve in time depending on the evolution of the environment.

This mainly applies to electricity emission factors, where significant reductions of CO₂e emissions are expected over the next decades. Using current electricity emission factors would lead to a systematic overestimation of induced, avoided and saved emissions. Electricity emission factors are chosen using the “location-based” approach (as defined by the GHG Protocol), meaning that average country electricity emissions factors are used. The “market-based” approach cannot be used in this methodology, as Schneider Electric has no visibility of energy suppliers chosen by its customers’ over the lifetime of sold offers.

In this version of the methodology, Schneider Electric uses the 2017 “Reference Technology Scenario” (RTS) by the International Energy Agency (IEA) ⁴ to discount electricity emission factors from expected future reduction of CO₂e emissions. The RTS takes into account today’s commitments by countries to limit GHG emissions, including the NDCs pledged under the Paris Agreement. By factoring in these commitments and recent trends, the RTS already represents a major shift from a historical “business as usual” approach and results in an average temperature increase of 2.7°C by 2100. Calculation is done for each offer, depending on the offer expected lifetime. For instance, in the RTS scenario, the average world electricity emission factor is reduced by 28% in 2035 compared to 2018.

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⁴ Energy Technology Perspectives 2017, International Energy Agency (IEA)
6. Data collection

Following ISO 14064 Standard, data used in the calculation can be primary data or secondary data. Sales data is typically primary data, from financial or business databases. Other data used in calculation will mostly be secondary data, from market studies, expert estimates or existing technical standards.

<table>
<thead>
<tr>
<th>Data type</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary data</td>
<td>Sales data</td>
</tr>
<tr>
<td></td>
<td>Sales database</td>
</tr>
<tr>
<td>Secondary data</td>
<td>Energy and material efficiency, brownfield/ greenfield split, offer use case scenario, lifetime, etc.</td>
</tr>
<tr>
<td></td>
<td>Market studies, expert estimates, technical standards</td>
</tr>
</tbody>
</table>

Primary data is preferred to secondary data. Among secondary data, the most consistent is chosen on a case by case basis, following the preferred order below:

1. Primary data
2. Technical standards
3. Public market studies (historical or prospective)
4. Private market studies (historical or prospective)
5. Expert estimates (internal)

In all cases, the source and update frequency of collected data should be disclosed transparently for each offer.

7. Uncertainties

This methodology follows the GHG Protocol principle for “accuracy”, meaning that results should give a faithful representation of the CO₂e impact of sold offers, reducing uncertainties as much as possible and enabling users to make decisions with reasonable assurance as to the integrity of the reported information.

With this methodology, uncertainties of results are similar to uncertainties of corporate scope 3 CO₂e accounting, and typically of the order of magnitude of +/-30%.

Uncertainty results from the combination of uncertainties of all terms of the calculation, as detailed in the table below:

<table>
<thead>
<tr>
<th>Calculation terms</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data</td>
<td>Very low, data typically comes from sales databases used for financial and business reporting</td>
</tr>
<tr>
<td>Energy and material efficiency, brownfield/ greenfield split, offer use case scenario</td>
<td>Medium, mostly world-average estimated based on experts estimates, technical standards, market studies</td>
</tr>
<tr>
<td>Lifetime</td>
<td>Low, from existing technical standards where possible. Conventional values from existing technical standards will further enable comparison of results between peers</td>
</tr>
<tr>
<td>Emission factors</td>
<td>Low, as calculation rely mostly on energy emissions factors with a good level of accuracy. However, the forward-looking approach (discounting for future CO₂e decarbonisation of energy mix) relies on energy scenarios and increases the level of uncertainty</td>
</tr>
</tbody>
</table>
8. Recommended disclosure for transparency

To ensure transparency and comparability of CO₂e savings and avoidance published by companies, the following should be disclosed for each offer:

- Description of the offer
- Definition of greenfield reference situation
- Definition of brownfield reference situation
- Boundary of calculation
- Emission sources included in calculation
- Avoided CO₂e calculation formula
- Saved CO₂e calculation formula
- Source of data of each term used in saved CO₂e and avoided CO₂e calculation formulas, including origin of data (expert estimate, sales data, market data, etc.) and calculation granulometry (world average, regional data, country data, etc.)
- Frequency of data update
- Non-confidential calculation terms, that have a significant impact on results, notably offer expected lifetime
- Source of emission factors

9. Double-accounting

As defined in the GHG Protocol, scope 2 and 3 emissions are by definition direct (scope 1) emissions of another entity. Like with all CO₂e accounting methodologies, this methodology therefore generates double-accounting, between the reporting company (here Schneider Electric), its suppliers and its customers. This reflects the reality, as multiple entities in a value chain influence both emissions, and emissions savings and avoidance. Scope 3 accounting therefore facilitates the simultaneous action of multiple entities to reduce GHG emissions.

This methodology follows scope 3 guidance from ISO 14064 and GHG Protocol and considers all relevant upstream, internal and downstream emissions induced, avoided and saved with offers sold during the year.
Glossary

**Induced emissions of offers** – emissions generated by the goods and services sold by the company in the reporting year, over their expected lifetime, and covering the full lifecycle of the offer (manufacturing, installation, use and end-of-life).

**Induced emissions of reference situation** – emissions generated without the company offer either in brownfield or greenfield situation, over its expected lifetime, and covering the full lifecycle (manufacturing, installation, use and end-of-life).

**Brownfield sale** – is the situation where the offer sold replaces or upgrades an existing system.

**Greenfield sale** – is the situation where the offer sold equips a new infrastructure.

**Reference situation** – is the scenario that reasonably represents the anthropogenic emissions that would occur in the absence of the sale of the offer.

**Brownfield reference situation** – is the reference situation in the case of a brownfield sale. In this case, the reference situation is defined as the initial situation, meaning the greenhouse gas emissions that were emitted to the atmosphere before the sale of offer.

**Greenfield reference situation** – is the reference situation in the case of a greenfield sale. For a greenfield sale, the reference situation answers the following question: « What would the customer’s situation be if he was not implementing this offer? ». In other words, the reference situation reflects the most realistic market situation.

**Saved emissions** – of an offer are net emissions, calculated as the difference between induced emissions of an offer and induced emissions of the “brownfield reference situation”.

**Avoided emissions** – of an offer are net emissions, calculated as the difference between induced emissions of an offer and induced emissions of the “greenfield reference situation”.

**Yearly accounting** – the method takes into account induced and avoided emissions of the offers sold during the year, cumulated over the expected offers’ lifetime.

**Emission factor (EF)** – it is defined by the UNFCCC as the average emission rate of a given GHG for a given source, relative to units of activity.

**Forward-looking emission factor** – the average emission rate of a given GHG for a given source, adjusted for its lifetime accordingly to “Reference Technology Scenario” (RTS) by the International Energy Agency (IEA).  

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1 Energy Technology Perspectives 2017, International Energy Agency (IEA)
How investors can use the CO$_2$e impact metric

Following the dynamic created during the Paris Accord (COP21) in 2015, an increasing number of investors are investigating and valuating climate risks and opportunities in their portfolio. Notably, the Task Force on Climate-Related Financial Disclosure (TCFD) published in 2017 recommendations to improve communication on climate risks between investors and companies. Regulation is also evolving: for instance, the French law on Energy Transition for Green Growth (Article 173) defines a “comply or explain” rule for investors to report on how they integrate energy transition and climatic risks.

**Saved and avoided emissions can be used by investors to calculate “climate investment impact ratios”,** to assess how much CO$_2$e their investment in Schneider Electric enables to saved or avoid, in tCO$_2$e per € of equity and/or obligation.

**Credentials**

The methodology hereby presented has been developed in collaboration with Carbone 4 in 2017. Starting 2018, Schneider Electric discloses externally quarterly CO$_2$e savings enabled by its offers for customers. The version 1 of this methodology, published in July 2019, has been verified by EY (see assurance verification attached).
Detailed CO₂e impact methodology for Schneider Electric offers

The following section discloses CO₂e impact methodology for the following offers sold by Schneider Electric:

1. Variable Speed Drives
2. Process Automation for the O&G industry
3. Electricity Transformers
4. UPS Single phase
5. Power Purchasing Agreements (PPA)
6. Building Management Systems
7. Power Management Systems
8. Energy Performance Contracting

1. Variable Speed Drives (VSD)

Definition of the offer

A Variable Speed Drives (VSD) is an equipment that regulates the speed and rotational force of an electric motor, via the control of the power that the machine uses, allowing to operate at variable speeds depending on operational needs of the machine.

For instance, many industrial processes, such as assembly lines, must operate at different speeds for different products. VSD are equally useful when process conditions demand adjustment of flow, such as in a pump or a fan, where the variation of the drive's speed may save energy compared with other techniques for flow control.

Schneider Electric VSD offers are grouped into four main applications: machines, building, process and soft starters. For this methodology, soft starters are not considered to allow any efficiency benefit; machine application allow a limited saving; the most important savings are generated with building and processes applications (further details in the calculation terms table).

Boundaries

System boundary, considering electricity savings delivered by the VSD on motor's electricity consumption.

Emission Sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✓ Yes, emissions due to energy consumption of electric motor ✓ Yes, emissions due internal energy consumption of VSD</td>
</tr>
<tr>
<td>End of life</td>
<td>✗ No, negligible</td>
</tr>
</tbody>
</table>

Relevant emission sources haven been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEPs are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.
Calculation method

Method 1, based on the total volume of VSD sold during the year, in number of units sold per reference.

Definition of reference situation

**Brownfield reference situation**: Brownfield reference situation distinguishes two cases:

- VSD sales that are installed on existing machines, processes and buildings not previously equipped with a VSD
- VSD sales that are installed on existing machines, processes and buildings previously equipped with a VSD (replacement)

**Greenfield reference situation**: Greenfield reference situation is based on the actual market penetration (x%) of VSD in the greenfield electric motor market (greenfield scenario n°2). The calculation distinguishes two cases:

- For x% (=VSD market penetration) of sales volumes, VSD equip newly commissioned electric motors, where a VSD will be installed in current market conditions. Schneider Electric’s VSD are not considered to be more energy efficient than the industry average. The reference situation is the case where another VSD is installed, and avoided emissions are equal to 0.
- For (1-x)% of sales volumes, VSD equip newly commissioned electric motors, where no VSD will be installed in current market conditions. The reference situation is the case where no VSD is installed.

Saved and avoided emissions

**Calculation formula**

\[ \text{VSD Sold CO}_2 = \text{VSD sales (W/country)} \times \% \text{ brownfield new installation} (\%) \times \% \text{ brownfield replacement} (\%) \times \text{Country electricity EF (kgCO}_2e/kWh) \times \text{Infrastructure emissions (kgCO}_2e) \]

\[ \text{VSD Avoided CO}_2 = \text{VSD sales (W/country)} \times \text{Greenfield sales} (%) \times \% \text{ brownfield new installation}^* (\%) \times \% \text{ brownfield replacement} (\%) \times \text{VSD use case over lifetime (hour.yr)} \times \text{Country electricity EF (kgCO}_2e/kWh) \times \text{Infrastructure emissions (kgCO}_2e) \]

* Value depends on end-user segment (machine / other); Net EE: net energy efficiency, discounting internal VSD consumption
<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data</td>
<td>Schneider Electric sales database</td>
<td>For direct VSD sales: Nb of units sold per product reference number and per country. For system VSD sales: linear extrapolation based on direct VSD sales</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Power (W) and end-user segment</td>
<td>Schneider Electric technical database</td>
<td>Product reference number enables to know the power of each VSD, in Watt and the end-user segment (machine, soft starters, other applications)</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Use Case</td>
<td>World average</td>
<td>Is the usage of the products in terms of hours over its lifetime (details below)</td>
<td>Every 3 years</td>
<td>–</td>
</tr>
<tr>
<td>Lifetime</td>
<td>CEMEP: &quot;Energy-Efficiency with Electric Drive Systems&quot; (page 22)</td>
<td>World average</td>
<td>Every 3 years</td>
<td>12 years</td>
</tr>
<tr>
<td>Hours used per year</td>
<td>IEA EE Electric Systems</td>
<td>World average</td>
<td>Every 3 years</td>
<td>250 days/year, 12 hours/day</td>
</tr>
<tr>
<td>Internal VSD energy consumption</td>
<td>Expert estimate, based on Schneider Electric’s VSD LCA (PEP Ecopassport)</td>
<td>World average</td>
<td>Every 3 years</td>
<td>2% (VSD efficiency of 98%)</td>
</tr>
<tr>
<td>% Brownfield (new installation / replacements), greenfield sales</td>
<td>Expert estimate</td>
<td>World average</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>% market penetration of VSD in greenfield</td>
<td>Market study</td>
<td>World average</td>
<td>Every 3 years</td>
<td>30%</td>
</tr>
<tr>
<td>% Energy Efficiency (EE)</td>
<td>Expert estimate</td>
<td>World average, depending on end-user: machines, soft starters or other applications (building, process)</td>
<td>Every 3 years</td>
<td>Replacement: 4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>New installation for:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Machines: 5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Soft Starters: 0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Other applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(building, process, etc): 30%</td>
</tr>
<tr>
<td>Net Energy Efficiency</td>
<td>Is the calculated difference between the energy saved by the products and the energy consumed by it</td>
<td></td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
## Emission Factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA 2017</td>
<td>Country when available, or global average</td>
<td>Every 3 years</td>
<td>–</td>
</tr>
<tr>
<td>Electricity – Infrastructure and supply chain</td>
<td>IEA and IPCC, 2014</td>
<td>Country when available, or global average</td>
<td>Every 3 years</td>
<td>–</td>
</tr>
<tr>
<td>Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>–</td>
</tr>
<tr>
<td>Infrastructure emissions – Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO2e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions</td>
<td>World average</td>
<td>Every 3 years</td>
<td>SE carbon intensity factor: 315 tCO2e / M€</td>
</tr>
</tbody>
</table>
2. Process automation for the oil & gas industry

Definition of the offer

Process Automation is an integrated and global Sales & Delivery organisation for process & discrete automation, providing architectures and system solutions to end-users, capable of embracing the full Schneider Electric portfolio, utilising local Delivery teams, Engineering Excellence Centers and System Integrators for optimal performance in application competence, cost competitiveness and local coverage. In a nutshell, a combination of software and hardware, which enable management optimization for industrial production processes and consequently save energy and reduce CO₂ emissions.

The calculation of avoided and saved emissions focuses on Oil & Gas sector (O&G), which is historically an important end segment.

The O&G industry is typically categorized into three main segments: upstream, midstream and downstream. They define as follow:

- **Upstream** – searching for potential underground or underwater crude oil and natural gas fields, drilling exploratory wells, and subsequently drilling and operating the wells that recover and bring the crude oil or raw natural gas to the surface.
- **Midstream** – transportation (by pipeline, rail, barge, oil tanker or truck), storage, and wholesale marketing of crude or refined petroleum products
- **Downstream** – refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas.

Given the market structure of Schneider’s offers, CO₂e emissions of upstream operations have been calculated together with midstream operations (which include LNG plants, LNG regasification and Gas processing).

In addition, petrochemical activities (for ethylene, ammonia and methanol production) have been considered as another category in the methodology.

Boundaries

**System-level boundary:** considering electricity savings delivered by the automation processes installed or maintained in oil & gas facilities and operations.

**Emission sources**

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✔ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>☑ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>☑ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✔ Yes, emissions due to energy consumption of the oil &amp; gas facilities and operations ☑ No, negligible - it is estimated that the usage of these <strong>Process Automation Systems (PAS)</strong> induce negligible GHG emissions (compared to the above)</td>
</tr>
<tr>
<td>End of life</td>
<td>☑ No, negligible</td>
</tr>
</tbody>
</table>

Relevant emission sources have been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEPs are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.
Calculation method

Method 2: a ratio of saved and avoided emissions in kgCO₂e per € of sales has been created for this methodology. This ratio is multiplied by yearly sales to estimate CO₂ savings and avoidance.

Considering the important weight of energy costs in total operating costs of the O&G industry, O&G sector is mature in terms of energy efficiency. In this methodology, we considered that all relevant O&G operations are equipped with a process automation system. Recurring sales are mainly maintenance contracts renewed every year with the objective of maintaining and improving the energy efficiency of existing operations. Saved emissions are calculated for each year of sales, and not cumulated in time as yearly maintenance is needed to sustain performance.

Large project sales correspond to the installation of the new process automation system. In this case, total saved and avoided emissions are cumulative over the lifetime of the system. Sales are distinguished between recurring maintenance contracts and large project sales depending on order value (using a threshold limit).

Definition of reference situation

**Brownfield reference situation**: Brownfield reference situation distinguishes two cases:

- Replacement and maintenance of existing Process Automation Systems (or parts of it), in existing installations
- New Process Automation System projects that replace existing capacity being decommissioned

**Greenfield reference situation**: Greenfield reference situation refers to the installation of a PAS for a new plant or a plant extension. Greenfield reference situation is defined as the situation where another PAS system is installed, providing similar energy efficiency benefits. Avoided emissions are therefore equal to 0.(greenfield scenario n°3).

Saved emissions

**Calculation formula**

\[
\text{PA Saved CO}_2 = \left( \frac{\text{Average savings in CO}_2 \text{ emissions (kgCO}_2\text{e/€)}}{\text{Average emissions reduction per € of retrofit (kgCO}_2\text{e/€)}} \right) \times \left( \frac{\text{Total volume of orders (€) – brownfield retrofit}}{\text{Average emission per site (kgCO}_2\text{e/yr)}} \right) \times \left( \frac{\text{Average emissions savings per € of replacing existing capacity (kgCO}_2\text{e/€)}}{\text{Total volume of orders (€) – brownfield replacing capacity}} \right) \times \left( \frac{\text{Infrastructure emissions (kgCO}_2\text{e)}}{\text{Brownfield (retrofit) average order cost (€/yr)}} \right)
\]

Avoided emissions

There are no avoided emissions as it is estimated that the whole greenfield market is equipped with process automation systems, given the importance of energy costs in the Oil & Gas sector. In this methodology, we consider that Schneider Electric’s process automation systems deliver comparable savings to that of competitors.
### Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data (average order cost, volume of orders)</td>
<td>Process Automation sales database</td>
<td>Global sales</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Average reduction in CO₂ emissions for brownfield (maintenance)</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>0.5%</td>
</tr>
<tr>
<td>Average reduction in CO₂ emissions for brownfield (replacing existing capacity)</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>0.5%</td>
</tr>
<tr>
<td>Average CO₂ emission per site (MTONNES/Yr)</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>Upstream: 0.23 MtCO₂, Downstream: 1.88 MtCO₂, Petrochemicals: 0.92 MtCO₂</td>
</tr>
<tr>
<td>Average CO₂ emissions per new project (new site or extension) (MTONNES/YR)</td>
<td>MTO Market Report 2016 IEA</td>
<td>World</td>
<td>Every 3 years</td>
<td>Upstream: 0.15 MtCO₂, Downstream: 1.23 MtCO₂, Petrochemicals: 0.60 MtCO₂</td>
</tr>
<tr>
<td>Average lifetime equipment - for new projects sales (years)</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>15 years</td>
</tr>
<tr>
<td>Brownfield replacing capacity - Share of new projects replacing existing capacity</td>
<td>Capacity reduction over capacity addition - MTO Market Report 2016 IEA</td>
<td>World</td>
<td>Every 3 years</td>
<td>18%</td>
</tr>
</tbody>
</table>

### Emission Factors

The average emissions of CO₂ per site are based on average emission intensities of the industry, per unit of output. The average emission per site is calculated based on the average production output per type of site.

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions of ammonia production</td>
<td><a href="https://ammoniaindustry.com/ammonia-production-causes-1-percent-of-total-global-ghg-emissions/">https://ammoniaindustry.com/ammonia-production-causes-1-percent-of-total-global-ghg-emissions/</a></td>
<td>World average</td>
<td>Every 3 years</td>
</tr>
<tr>
<td>Infrastructure emissions - Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions.</td>
<td>World average</td>
<td>Every 3 years</td>
</tr>
</tbody>
</table>
3. Electricity transformers

Definition of the offer

Transformers are static electrical devices that transfer electrical energy between two or more circuits; they are used for increasing or decreasing the alternating voltages in electric power applications, and for coupling the stages of signal processing circuits.

A transformer is essentially characterized by its rating (the power it can transform), and its losses (no load losses and load losses). No load losses are independent from the load, while load losses are proportional to the load squared. To assess the energy consumed per year by the transformer (e.g. energy lost in the transformer), it is necessary to know the load squared at every moment. A load profile is therefore needed to estimate transformers’ energy losses.

Schneider Electric produces a large range of transformers, with ratings varying from a few kVA to dozens of MVA. This diversity enables Schneider Electric to address several markets; from commercial buildings to electric utilities, through to industry.

Boundaries

Product-level boundary: The boundary is set to the product itself, looking at the energy consumed and dissipated (joule effect) over the products’ lifetime.

Emission sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✓ Yes, emissions due internal energy consumption of transformers</td>
</tr>
<tr>
<td>End of life</td>
<td>✗ No, negligible</td>
</tr>
</tbody>
</table>

Relevant emission sources have been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEPs are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.

Calculation method

Method 1, based on the volume of transformers sold during the year. Total saved and avoided emissions are cumulative over the average lifetime of the products.

Definition of reference situation

**Brownfield reference situation:** Brownfield reference situation is defined as the share of today’s sales that replace transformers installed 25 years ago (average lifetime of transformers). This share is estimated using historical economic growth. Based on sales geographical split, a distinction is made between developing and developed countries (retrofit share is higher in developed countries).

**Greenfield reference situation:** Greenfield reference situation refers to the installation of a transformer to equip a new infrastructure. Avoided CO₂ emissions are estimated based on the performance of other transformers available on the market (greenfield scenario n°1).
Saved and avoided emissions

**Two load profiles have been defined, depending on the size of the transformer** (below or above 3150 kVA). The consumption profiles are defined considering periods of low consumption (ex: night, holidays, etc.) and periods of high consumption. Load profiles also takes into account end users’ needs (transformers for utilities or large industries have a higher load factor than transformers for buildings or small industries). Energy losses are assessed for each transformer, using the load profile, the transformer technical data (rating and loss values).

As technical characteristics of sold transformers are only available for some of the transformers, an extrapolation is made based on the ratings. This extrapolation enables to assess all total induced, saved and avoided emissions based on the emissions of known transformers.

**Calculation formula**

**Avoided emissions**

To assess avoided CO₂ emissions, it is necessary to evaluate the performance of other transformers available in the market. As a general rule, Schneider Electric’s transformers show similar performance than those of other global suppliers. Some local transformer suppliers sell transformers with lower performance levels. However, as a conservative hypothesis, this methodology estimates that the performance of Schneider Electric’s transformers’ is similar other transformers available on the market. We therefore quantify no avoided CO₂ emissions for Schneider Electric transformers.
Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Data: Quantity of unit sold</td>
<td>Sales data, in quantity of units sold per reference</td>
<td>Country</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Technical specificities of products: Rating, No Load Losses, Load Losses</td>
<td>Product technical specifications</td>
<td>Global</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Cos Phi</td>
<td>SE expert estimate</td>
<td>Global</td>
<td>Every 3 years</td>
<td>0.9</td>
</tr>
<tr>
<td>Load profile</td>
<td>SE expert estimate</td>
<td>World average</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>Average efficiency (calculated)</td>
<td>SE expert estimate</td>
<td>World average</td>
<td>Every 3 years</td>
<td>98.4%</td>
</tr>
<tr>
<td>Average efficiency of previous generation of transformers</td>
<td>SE expert estimate</td>
<td>World average</td>
<td>Every 3 years</td>
<td>25 years</td>
</tr>
<tr>
<td>% Brownfield</td>
<td>Weighted economic growth over the last 25 years in SE main sales countries</td>
<td>Developing / developed countries</td>
<td>Every 3 years</td>
<td>Developing countries: 24% Developed countries: 66%</td>
</tr>
</tbody>
</table>

Emission Factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – direct emissions</td>
<td>IEA, electricity emission factors, 2017 edition (2014 data)</td>
<td>Country</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA, 2017</td>
<td>Country when available, or global average</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – Infrastructure and supply chain</td>
<td>IEA and IPCC, 2014</td>
<td>Country when available, or global average</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Infrastructure emissions - Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions</td>
<td>World</td>
<td>Every 3 years</td>
<td>SE carbon intensity factor: 315 tCO₂e / M€</td>
</tr>
</tbody>
</table>
4. Uninterruptible Power Supply (UPS) single phase

Definition of the offer

UPS Single Phase are products that enable devices to be powered at the right voltage and frequency. They ensure that devices receive a continuous, supply of power, whatever may happen on the grid.

To transform the power from the grid into power that has the right characteristics tailored to the device, a UPS consumes energy. A ratio therefore exists between the energy supplied to the device and the energy entering the UPS.

New UPSs perform better than old ones given that for the same amount of energy supplied to the device, less energy enters into the UPS (the ratio increases). Therefore, replacing an older UPS by a new one enables to save energy.

Boundaries

**Product-level boundary:** The boundary is set to the product itself, looking at the energy consumed and dissipated (joule effect) over the products’ lifetime.

Emission sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✓ Yes, emissions due the UPS energy consumption</td>
</tr>
<tr>
<td>End of life</td>
<td>✗ No, negligible</td>
</tr>
</tbody>
</table>

Relevant emission sources have been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEP are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.

Calculation method

Method 1, based on the volume of UPS single phase sold during the year. Total saved emissions are cumulative over the average lifetime of the products.

Definition of reference situation

**Brownfield reference situation:** Brownfield reference situation is defined as the share of today’s UPS sales that replace old products installed 10 years ago (average lifetime of UPS). This share is estimated using a weighted average of historical market growth by geographical area, based on private market studies.

**Greenfield reference situation:** Greenfield reference situation refers to the installation of a UPS in a new facility. Avoided CO₂ emissions are estimated based on the performance of other UPS available on the market (greenfield scenario n°1).
Saved and avoided emissions

Calculation formula

\[
\text{UPS Saved CO}_2 = \frac{\text{Induced emissions (kgCO}_2\text{e/year)}}{\times \text{Brownfield %}} \times \frac{\text{Reference Induced emissions (kgCO}_2\text{e/year)}}{\times \text{Average lifetime of the product (years)}} \times \text{Average emissions per W per year (kgCO}_2\text{e/W/year)} - \text{per offer and generation}}
\]

\[
\text{UPS Avoided CO}_2 = \frac{\text{Induced emissions (kgCO}_2\text{e/year)}}{\times \text{Greenfield %}} \times \frac{\text{Reference Induced emissions (kgCO}_2\text{e/year)}}{\times \text{Average lifetime of the product (years)}} \times \text{Average emissions per W per year (kgCO}_2\text{e/W/year)} - \text{per offer and generation}}
\]

Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data, per reference (Output Wattage)</td>
<td>SE sales database</td>
<td>Sales per reference and generation</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>% Brownfield</td>
<td>UPS market growth forecast (private market study), CAGR of 1.2% with lifetime 10 years</td>
<td>World</td>
<td>Every 3 years</td>
<td>88,4%</td>
</tr>
<tr>
<td>% Greenfield</td>
<td>GF = 1-Brownfield %</td>
<td>World</td>
<td>Every 3 years</td>
<td>11,6%</td>
</tr>
<tr>
<td>Average lifetime</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Annual</td>
<td>10 years</td>
</tr>
<tr>
<td>Average efficiency of UPS sold in the market (greenfield sales)</td>
<td>SE expert estimate, based on EnergyStar market study</td>
<td>World</td>
<td>Every 3 years</td>
<td>Smart UPS On-Line : 0,64 kgCO\textsubscript{2}e/W/yr Smart UPS : 0,2 kgCO\textsubscript{2}e/W/yr Smart UPS VT : 0,39 kgCO\textsubscript{2}e/W/yr Back UPS : 0,92kCO\textsubscript{2}e/W/yr</td>
</tr>
<tr>
<td>Average efficiency of previous generation UPS (brownfield sales)</td>
<td>SE sales database from 10 years ago</td>
<td>World</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
</tbody>
</table>
Avoided CO₂ emissions

To assess avoided CO₂ emissions, it is necessary to evaluate the performance of other UPSs available in the market and used for the same applications. A benchmark is available, as EnergyStar label compares the performances of all UPS ranges in order to identify the highest performing ones.

For greenfield sales, it is therefore been possible to assess the average performance of sold UPSs and to compare this with Schneider Electric's UPS performance.

Emission Factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
</table>
| World electricity emission factor over the studied period - RTS | • Direct emissions: IEA, electricity emission factors, 2017 (2014 data)  
• Upstream and T&D losses: DEFRA, 2017  
• Infrastructure and supply chain, IEA and IPCC, 2014 | World average | Every 3 years | 573 gCO₂eq/kWh |
| Infrastructure emissions - Schneider Electric Scope 1-2-3 | Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M€) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions | World | Every 3 years | SE carbon intensity factor: 315 tCO₂e / M€ |
5. Power Purchase Agreements

Definition of the offer

A Power Purchase Agreement (PPA) is a contract between two parties, one which generates electricity and one which is looking to purchase electricity.

Within Schneider Electric, the Energy & Sustainability Services (ESS) division provides advisory services to negotiate and sign PPA contracts, providing market, accounting, procurement and legal expertise. This enables customers to source renewable electricity, mitigate the risk of energy cost volatility and negotiate better contracts in energy markets.

This methodology has been developed specifically for medium to long term (several years) PPA agreements concerning the development of new (or very recent) renewable power capacities and is not applicable to electricity contracts with existing renewable capacities. To date, all projects considered are solar or wind (both onshore and offshore) power plants, but the methodology is applicable to all electricity renewable PPA contracts.

Boundaries

Ecosystem-level boundary: considering saved emissions during the whole duration of power purchase agreements compared to a situation without this project.

Emission sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes (included in “Infrastructure &amp; supply chain” emission factor)</td>
</tr>
<tr>
<td>Distribution</td>
<td>✓ Yes (included in “Infrastructure &amp; supply chain” emission factor)</td>
</tr>
<tr>
<td>Installation</td>
<td>✓ Yes (included in “Infrastructure &amp; supply chain” emission factor)</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✓ Yes, direct CO₂ emissions are included (0 for renewable, emissions from fossil fuel consumption in reference situation)</td>
</tr>
<tr>
<td></td>
<td>★ No, other emissions from operation and maintenance activities are negligible</td>
</tr>
<tr>
<td>End of life</td>
<td>★ No, negligible</td>
</tr>
</tbody>
</table>

Renewable LCA studies\(^5\) show the significant impact of the construction phase (~90%) on lifecycle CO₂ emissions, and negligible CO₂ emissions during the use phase (due to operation and maintenance activities). End of life (EoL) CO₂ emissions are estimated around 10% of total lifecycle emissions. However, these emissions are considered negligible compared to CO₂ emissions of the reference situation. For instance, infrastructure emissions of onshore wind power (15 kgCO₂e / MWh) represent less than 5% of reference situation emissions (340 kgCO₂e / MWh, see details below). In this example, EoL CO₂ emissions represent less than 0.5% of total lifecycle CO₂ emissions, which is negligible. Similar magnitude of results can be derived from solar power plant LCAs\(^6\).

Calculation method

Method 1, based on the installed capacity contracted (MW). Total saved emissions are cumulative over the lifetime of the PPA contract.

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\(^5\) The “Wind Energy - The Facts” - European project financed by the Intelligent Energy - Europe program of the Executive Agency for Competitiveness and Innovation, published and LCA of wind energy.

Definition of reference situation

**Brownfield reference situation**: Brownfield reference situation refers to the situation where the PPA contract replaces existing power capacity in the grid. As a conservative hypothesis, the methodology considers the average forward-looking electricity emission factor of the country where the contract is signed, (see detailed discussion below on the choice of the relevant brownfield emission factor).

The brownfield percentage is calculated based on national electricity scenario planning by government agencies and defined as the ratio between the electricity capacities (in MWh of annual production volume) that will be decommissioned in the coming years and the capacities that will be installed over the same period.

**Greenfield reference situation**: Greenfield reference situation refers to the situation where the PPA contract contributes to answer electricity demand growth, without replacing existing power capacity in the grid. The greenfield percentage is calculated based on national electricity scenario planning by government agencies (greenfield scenario n°3). The greenfield reference emission factor is the average emission factor of future installed capacities in the country where the contract is signed.

Saved and avoided emissions

**Calculation formula**

**Calculation terms: source, frequency of update and value**

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data</td>
<td>SE sales database</td>
<td>Specific to each contract signed during the current year</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Use case (Load factor, operating time)</td>
<td>SE expert estimate, based on historical sales data</td>
<td>Load factor per technology (Wind, Solar)</td>
<td>Annual</td>
<td>Wind: 42% Solar: 28% Operating time = 365 days * 24h</td>
</tr>
<tr>
<td>% Brownfield</td>
<td>World: IEA, WEIO 2014 USA; EPA, Outlook on Electricity Supply, 2018 India: Ministry of Power, National Electricity Plan, 2017</td>
<td>Per country*</td>
<td>Every 3 years</td>
<td>Brownfield %: USA: 56% India: 26% World: 31%</td>
</tr>
</tbody>
</table>

*95% of PPA sold by Schneider Electric are based in USA or in India, which is why a specific methodology has been developed for those countries. The World average is used for other contracts.*
Emission Factors

Several methodologies have been considered to define the electricity emission factor of the brownfield reference situation.

The UNFCCC\(^7\) prompts the use of Combined Margins (CM) emissions factors (EF) to evaluate CDM\(^8\) project activities. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the "operating margin" (OM) and the "build margin" (BM). For the presented methodology the CM emission factor has been considered but not chosen, due to the complexity of calculation process, high volatility of the emission factor depending on the source and year of analysis, and overall high resulting EF.

Two other options have been considered to define the electricity emission factor of the reference situation:

• Country electricity EF, forward-looking to take into account evolution over the PPA contract duration (same as for other technologies in this methodology)
• Average EF of decommissioned capacities, based on energy scenario planning of government agencies. This EF is calculated as the average electricity emission factor of electricity capacities that will be decommissioned and replaced in the coming years.

This EF can only be used for new developing projects which allow an addition of renewable capacity on the grid.

The forward-looking country electricity EF is the lowest of the three emission factors considered above, for all geographies studied (World, USA, India). Considering that there is no agreement from CO\(_2\) experts on which EF to use in this case, this methodology uses the average forward-looking country electricity EF (over contract duration), as a preliminary conservative assumption.

For the greenfield reference situation, the average emission factor of future installed capacities is taken into account, according to national electricity scenario planning.

The emission factor for the wind or solar capacities during use phase is equal to zero.

\(^7\) United Nation Framework Convention on Climate Change  
\(^8\) Clean Development Mechanism
## Emission Factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – direct emissions</td>
<td>IEA, electricity emission factors, 2017 edition (2014 data)</td>
<td>Country</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA 2017</td>
<td>Country when available, or global average</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Brownfield: Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Renewable manufacturing emissions</td>
<td>IPCC AR 5 WG3, Annex III</td>
<td>World average</td>
<td>Every 3 years</td>
<td>Solar: 48 kgCO₂e / MWh Onshore wind: 15 kgCO₂e / MWh Offshore wind: 17 kgCO₂e / MWh</td>
</tr>
<tr>
<td></td>
<td>Electricity: infrastructure &amp; supply chain</td>
<td>World average</td>
<td>Every 3 years</td>
<td>Onshore wind: 15 kgCO₂e / MWh Offshore wind: 17 kgCO₂e / MWh</td>
</tr>
<tr>
<td>Brownfield: Average country electricity – replaced capacity (not used in this methodology as a preliminary conservative assumption)</td>
<td>USA – Energy Information Administration (EIA), 2018 India - Ministry of Power, National Electricity Plan, 2017 World – IEA, WEIO 2014</td>
<td>Country</td>
<td>Every 3 years</td>
<td>USA: 0.52 kgCO₂e / kWh India: 0.94 kgCO₂e / kWh World average: 0.43 kgCO₂e / kWh</td>
</tr>
<tr>
<td>Greenfield: average electricity emission factor reference situation</td>
<td>USA – Energy Information Administration (EIA), 2018 India - Ministry of Power, National Electricity Plan, 2017 World – IEA, WEIO 2014</td>
<td>Country</td>
<td>Every 3 years</td>
<td>USA: 0.14 kgCO₂e / kWh India: 0.52 kgCO₂e / kWh World average: 0.34 kgCO₂e / kWh</td>
</tr>
<tr>
<td>Infrastructure emissions - Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions</td>
<td>World</td>
<td>Every 3 years</td>
<td>SE carbon intensity factor: 315 tCO₂e / M€</td>
</tr>
</tbody>
</table>
6. Building management systems

Definition of the offer

A building management system (BMS), also known as a building automation system (BAS), is a computer-based control system installed in buildings that controls and monitors the building’s mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. A BMS is composed by both software and hardware and it is a critical component to managing energy demand in buildings.

Building management systems are most commonly implemented in large sites with extensive mechanical, HVAC, electrical systems. Systems linked to a BMS typically represent 40% of a building’s energy usage.

Considering the wide variety of products and software needed to install a full BMS, and the subsequent risk of multiple accounting, this methodology focuses on Automation and Enterprise Servers sales. Servers deliver data management and supervisory services core to BMS systems and are a good proxy to estimate the volume of BMS sold during the year. The number of buildings equipped with a BMS is estimated based on the number of servers sold, further enabling to estimate energy and CO₂ savings.

Boundaries

System-level boundary: considering saved emissions of the building in which the servers are installed.

Emission sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>▼ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>▼ No, negligible</td>
</tr>
</tbody>
</table>
| Use-phase        | ✓ Yes, emissions due to energy savings in the building thanks to the BMS
|                  | ▼ No, emissions from energy consumption of BMS are considered negligible (compared to total energy usage and savings in the building) |
| End of life      | ▼ No, negligible                 |

Relevant emission sources have been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEPs are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.

Calculation method

Method 1, based on the total volume sold of automation and enterprise servers per year. Total saved emissions are cumulative over the average lifetime of the products.

Brownfield and greenfield shares are calculated based on prospective (future) market data. The methodology looks at the global share of buildings expected to be retrofitted, destroyed and newly built in the coming years, to estimate the share of Schneider Electric’s sales for brownfield and greenfield markets.

Definition of reference situation

Brownfield reference situation: Brownfield reference situation distinguishes two cases:

- BMS installed on existing buildings, not previously equipped with such a system
- BMS installed on new buildings, which are replacing a demolished building
The total brownfield percentage is calculated as the sum of retrofit sales (%, provided by Schneider Electric experts) plus the share of new buildings that allow to replace demolitions, based on building market forecast from IEA (see formula below).

**Greenfield reference situation**: Greenfield reference situation refers to the installation of a BMS in a new site. Greenfield reference situation is defined as the situation where another BMS system is installed, providing similar energy efficiency benefits 0 (greenfield scenario n°3).

**Saved emissions**

**Calculation formula**

9 IEA (2013) Transition to Sustainable Buildings, Strategies and Opportunities to 2050
### Avoided emissions

Avoided emissions are equal to 0 (greenfield scenario n°3).

#### Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automation Servers, Smartx Controllers and Entreprise Servers sales</td>
<td>SE Sales data</td>
<td>Country</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Share of Automation servers’ sales used for HVAC control and for Field Control applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of automation and enterprise servers installed per building</td>
<td>SE expert estimates</td>
<td>World</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>Share of small buildings equipped with Enterprise Server</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average energy savings enabled by BMS - Brownfield</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average size of small, medium and large buildings equipped with BMS (in m²)</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>Small: 5000 m² Medium: 50000 m² Large: 100000 m² Weighted average: 43750 m²</td>
</tr>
<tr>
<td>Energy consumption of buildings (kWh/m²)</td>
<td>International Institute for Applied System Analysis, Global Energy Assessment (GEA), Chapter 10 Energy End-Use: Buildings; Carbone 4 expertise</td>
<td>Country</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Average lifetime of the offer</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>10 years</td>
</tr>
<tr>
<td>% Brownfield sales with buildings’ retrofit</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>% Brownfield sales with new buildings that replace demolitions</td>
<td>IEA (2013) Transition to Sustainable Buildings, Strategies and Opportunities to 2050</td>
<td>OECD, Non OECD</td>
<td>Every 3 years</td>
<td>OECD: 40% Non OECD: 30%</td>
</tr>
</tbody>
</table>
### Emission factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – direct emissions</td>
<td>IEA, electricity emission factors, 2017 edition (2014 data)</td>
<td>Country</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA 2017</td>
<td>Country when available, or</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>global average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity – Infrastructure and supply chain</td>
<td>IEA and IPCC, 2014</td>
<td>Country when available, or</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>global average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Infrastructure emissions – Schneider Electric</td>
<td>Schneider Electric Annual Report – The carbon intensity factory</td>
<td>World</td>
<td>Every 3 years</td>
<td>315 tCO₂e / M€</td>
</tr>
<tr>
<td>Scope 1-2-3</td>
<td>(CO₂e/M €) is multiplied by the revenues (M€) of each offer in order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to estimate infrastructure emissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuels</td>
<td>Bilan GES, Ademe, Europe data; Carbone 4 expertise</td>
<td>World</td>
<td>Every 3 years</td>
<td>Natural Gas : 239 gCO₂e / kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oil &amp; Coal : 323 gCO₂e / kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commercial heat : 239 gCO₂ / kWh</td>
</tr>
</tbody>
</table>
7. Power Monitoring Systems

Definition of the offer

A Power Monitoring System (PMS) is a system that gather energy and power data in a facility. Stand-alone or embedded meters measure, collect and deliver essential data from key distribution points across the entire electrical network. It gives the capability to manage on-site operations, with day-to-day optimization of energy consumption. The PMS can be used for very different applications, such as buildings, marine vessels, industrial processes, etc.

Considering the wide variety of products and software needed to install a full PMS, and the subsequent risk of multiple accounting, this methodology focusses on edge control software sales. Edge control software deliver data management and supervisory services core to PMS systems and are a good proxy to estimate the volume of PMS sold during the year. The number of facilities equipped with a PMS is estimated based on the number of software license sold, further enabling to estimate energy and CO₂ savings.

Saved and avoided emissions are calculated based on average energy savings allowed by PMS, used in service buildings (such as commercial or healthcare building) and industrial facilities (including data centres, utility, food and beverage, automotive, mining, minerals and metals, oil & gas, transportation, water and wastewater and other industries).

Boundaries

System-level boundary: considering saved emissions of the building in which the software is installed.

Emission sources

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✅ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>★ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>★ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✅ Yes, emissions due to energy consumption of Automation and Enterprise servers for HVAC management  &lt;br&gt; ★ No, emissions from energy consumption of PMS are considered negligible (compared to total energy usage and savings in the facility)</td>
</tr>
<tr>
<td>End of life</td>
<td>★ No, negligible</td>
</tr>
</tbody>
</table>

Relevant emission sources haven been identified using Life Cycle Assessment results available in Product Environmental Profiles. The PEPs are publicly available in Schneider Electric “Check a Product” website or via the PEP EcoPassport association website.

Calculation method

Method 1, based on the total volume sold of software per year. Total saved emissions are cumulative over the estimated average lifetime of the products.

Brownfield and greenfield shares are calculated based on prospective (future) market data. The methodology looks at the global share of buildings expected to be retrofitted, destroyed and newly built in the coming years, to estimate the share of Schneider Electric’s sales for brownfield and greenfield markets.
Definition of reference situation

**Brownfield reference situation:** Brownfield reference situation distinguishes two cases:
- PMS installed on existing facilities, not previously equipped with such a system
- PMS installed on new facilities, which are replacing a demolished facility

The total brownfield percentage is calculated as the sum of retrofit sales (in %, provided by Schneider Electric experts) plus the share of new facilities that allow to replace demolitions, based on market forecast provided by the IEA\(^\text{10}\) (see formula below).

**Greenfield reference situation:** Greenfield reference situation refers to the installation of a PMS in a new site. Greenfield reference situation is defined as the situation where another PMS system is installed, providing similar energy efficiency benefits. Avoided emissions are therefore equal to 0 (greenfield scenario n°3).

Saved emissions

**Calculation formula**
Avoided emissions

Avoided emissions are equal to 0 (greenfield scenario n°3).

Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of PMS sales</td>
<td>SE Sales data</td>
<td>Country</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Average energy savings enabled by PMS - Brownfield</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>Average energy savings enabled by PMS in new facilities - Greenfield</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 years</td>
<td>2 MW</td>
</tr>
<tr>
<td>Average installed electricity power capacity of facilities equipped with a PMS</td>
<td>SE expert estimates</td>
<td>World</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>Percentage of sales for services buildings ( = commercial and healthcare buildings)</td>
<td>SE expert estimates – sales data</td>
<td>World</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Percentage of sales for industrial facilities ( = Data center, Utility, Food and beverage, Automotive, Mining, minerals and metal, Oil and Gas, Transportation, Water and waste water, and Other Industry)</td>
<td>SE expert estimates – sales data</td>
<td>World</td>
<td>Annual</td>
<td>Confidential</td>
</tr>
<tr>
<td>Average lifetime of the offer</td>
<td>SE expert estimate</td>
<td>World</td>
<td>Every 3 year</td>
<td>7,5 years</td>
</tr>
<tr>
<td>Energy sources for commercial building</td>
<td>IEA (2015) Energy Technology Perspectives; IEA (2013) Transition to Sustainable Buildings, Strategies and Opportunities to 2050;</td>
<td>World</td>
<td>Every 3 years</td>
<td>Electricity: 51% Natural Gas: 24% Oil &amp; Coal: 16% Commercial Heat: 5% Biomass: 3% Other renewables: 1%</td>
</tr>
<tr>
<td>Energy sources for industrial facilities</td>
<td>SE expert estimates, based on SE own internal energy consumption profile</td>
<td>World</td>
<td>Every 3 years</td>
<td>Electricity: 71% Natural Gas: 27% Oil &amp; Coal: 1% Commercial Heat: 2%</td>
</tr>
<tr>
<td>% Brownfield sales with facilities’ retrofit</td>
<td>Retrofit sales: SE expert estimates</td>
<td>World</td>
<td>Every 3 years</td>
<td>Confidential</td>
</tr>
<tr>
<td>% Brownfield sales for new facilities that replace demolitions</td>
<td>IEA (2013) Transition to Sustainable Buildings, Strategies and Opportunities to 2050</td>
<td>OECD, Non OECD</td>
<td>Every 3 years</td>
<td>OECD: 40% Non OECD: 30%</td>
</tr>
</tbody>
</table>
## Emission Factors

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Source</th>
<th>Scope</th>
<th>Update frequency</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – direct emissions</td>
<td>IEA, electricity emission factors, 2017 edition (2014 data)</td>
<td>Country</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA 2017</td>
<td>Country when available, or</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>global average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity – Infrastructure and supply chain</td>
<td>IEA and IPCC, 2014</td>
<td>Country when available, or</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>global average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Infrastructure emissions - Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions</td>
<td>World</td>
<td>Every 3 years</td>
<td>SE carbon intensity factor: 315 tCO₂e / M€</td>
</tr>
<tr>
<td>Fuels</td>
<td>Bilan GES, Ademe, Europe data; Carbone 4 expertise</td>
<td>World</td>
<td>Every 3 years</td>
<td>Natural Gas: 239 gCO₂e / kWh Oil &amp; Coal: 323 gCO₂e / kWh Commercial heat: 239 gCO₂e / kWh</td>
</tr>
</tbody>
</table>
8. Energy Performance Contracting

Definition of the offer

Energy Performance Contracting (EPC) is a mechanism to unlock the potential of energy efficiency. Energy performance contracts are used as an alternative financing mechanism to accelerate investment in cost effective energy conservation measures in existing buildings, districts or industrial facilities. EPCs allow public and private actors to accomplish energy savings projects without up-front capital costs and following specific accounting and validation rules. EPC involves an Energy Service Company (ESCO) which provides financing and guaranteed energy savings. The remuneration of the ESCO depends on the achievement of the guaranteed savings. The ESCO stays involved in the measurement and verification process for the energy savings during the repayment period.

Boundaries

**Ecosystem-level boundary**: considering saved emissions of the performance contract compared to a situation without energy efficiency measures.

Emission sources

An EPC is typically composed by several energy efficiency measures (such as isolation, double windows, energy management systems, etc.). All Life Cycle Analysis (LCA) of such examples look alike: significant CO₂ impacts are found during the manufacturing and the use phase. The emission sources illustrated below are based on this hypothesis.

<table>
<thead>
<tr>
<th>Emission sources</th>
<th>CO₂ impact calculation perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>✓ Yes</td>
</tr>
<tr>
<td>Distribution</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Installation</td>
<td>✗ No, negligible</td>
</tr>
<tr>
<td>Use-phase</td>
<td>✓ Yes, CO₂ are calculated from energy savings for each contract</td>
</tr>
<tr>
<td>End of life</td>
<td>✗ No, negligible</td>
</tr>
</tbody>
</table>

Calculation method

Method 1, based on the total volume of kWh savings contracted per year. Total saved emissions are cumulative over the lifetime of the EPC contract.

Definition of reference situation

**Brownfield reference situation**: Given the nature of energy performance contracting, all contracts are considered to be brownfield, where the reference situation refers to the absence of the EPC. The methodology considers the average emission factor of the country where the contract is signed, with forward-looking discounting over the duration of the contract.

**Greenfield reference situation**: Greenfield reference situation does not apply for this offer.

Saved emissions

**Calculation formula**

\[
\text{EPC Saved CO₂} = \text{Contracted savings (MWh/year)} \times \text{Contract length (years)} \times \text{Country electricity or specific fuel EF (kgCO₂e/kWh)} \times \text{Infrastructure emissions (kgCO₂e)}
\]
Avoided emissions

Given the nature of Energy Performance Contracting, there are no avoided emissions.

Calculation terms: source, frequency of update and value

<table>
<thead>
<tr>
<th>Calculation term</th>
<th>Source</th>
<th>Granulometry</th>
<th>Update frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales data:</td>
<td>SE Sales database</td>
<td>Specific to each contract</td>
<td>Annual</td>
<td>Confidential, specific to each contract</td>
</tr>
<tr>
<td>- Contracted savings (MWh/year);</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Contract length (yr);</td>
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<td></td>
<td></td>
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<tr>
<td>- Project location</td>
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Emission Factors

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<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Electricity – upstream and T&amp;D losses</td>
<td>DEFRA 2017</td>
<td>Country when available, or global average</td>
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<td>-</td>
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<tr>
<td>Electricity – Infrastructure and supply chain</td>
<td>IEA and IPCC, 2014</td>
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<tr>
<td>Electricity – forward-looking</td>
<td>Forward-looking discounting: ETP 2017, RTS scenario</td>
<td>Region</td>
<td>Every 3 years</td>
<td>-</td>
</tr>
<tr>
<td>Emission Factors of fuels</td>
<td>Bilan GES, Ademe, Europe data; Carbone 4 expertise</td>
<td>World</td>
<td>Every 3 years</td>
<td>Natural Gas – 239 gCO₂e / kWh Oil &amp; Coal – 323 gCO₂e / kWh Commercial heat – 239 gCO₂e / kWh</td>
</tr>
<tr>
<td>Infrastructure emissions - Schneider Electric Scope 1-2-3</td>
<td>Schneider Electric Annual Report - The carbon intensity factor (CO₂e/M €) is multiplied by the revenues (M€) of each offer to estimate infrastructure emissions</td>
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