NET ZERO INITIATIVE

The Pillar B Guide

Calculating and leveraging avoided emissions

carbone4

NET ZERO INITIATIVE

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Executive Summary

Executive summary

This document is the **guide to understanding the** second **pillar of the NZI dashboard, also referred to as pillar B**. Pillar B is aimed at quantifying a firm's positive impact on the greenhouse gas emissions of its ecosystem. It is composed of two major families:

- **B2:** how the company's solutions contribute to decarbonization,
- **B3:** the company's financial contribution to projects to reduce emissions outside its value chain.

B2) CONTRIBUTION OF SOLUTIONS: AVOIDED EMISSIONS

For the first family, this guide offers:

1) A **general methodological framework** for calculating and reporting avoided emissions generated by corporate solutions;
2) A **toolbox** containing:
   - Detailed methodologies for calculating avoided emissions for three economic sectors: Mobility, Construction and Energy;
   - Quantified applications for certain solutions in France: Avoidance Factors (FEv) to quickly estimate avoided emissions.

Synthesis of the general methodological framework

- **Conceptual framework**: avoided emissions are the difference between emissions in a reference situation and emissions in a situation with a decarbonizing solution. The emissions in these two situations depend on the context in which the solution is implemented: geography, client profiles, market segments, etc.
- **Choice of reference situation:** two main types of reference situations have been identified - the previous situation and the average of the market context. Net Zero Initiative describes a typology of contexts that enables the identification of a robust reference situation for a given context.
- **Timeframe:** Avoided emissions are calculated for the entire lifespan of the solution sold by the company. It is possible to update the calculation annually by using the input data corresponding to the year of calculation.
- **Perimeter:** The calculation of avoided emissions is done according to a life-cycle rationale: emissions from production, utilization, end of life, etc. have to be taken into account.
- **Evolution of emissions though time**: The projected decarbonization of energy and other dynamic effects must be taken into account in the calculations.
- **Precision level of hypotheses**: the calculation of avoided emissions may have varying levels of precision: specific to each solution sold, company average, or market average. The level of precision depends particularly on the type of solution and the availability of data.

Synthesis of the content of the toolbox

The toolbox compiles the findings of sector-specific methodological research. Three sectors are covered in the present report: **Mobility, Construction and Energy.**

The toolbox provides sector-specific methodological sheets on avoided emissions for each *solution/context* pair. For certain solutions, it also provides detailed methodological sheets and the first generation of Avoidance Factors (AFv) in France.

	Mobility	Buildings	Energy
Methodology sheets	**5 families of solutions**	**4 families of solutions**	**3 families of solutions**
Solution sheets	**5 solutions** analysed	**4 solutions** analysed	**2 solutions** analysed
Avoidance factor (AF)	**4 AFs** computed, for 4 solutions	**60 AFs** computed, for 4 solutions	**3 AFs** computed, for 1 solution

Table 1 – Synthesis of methodological sheets, solution sheets and avoidance factors (FEv) developed for the sectors of mobility, construction and energy in the toolbox.

B3) FINANCIAL CONTRIBUTION BEYOND THE VALUE CHAIN

The guide proposes a method for reporting additional avoided emissions generated by financing projects outside the company's value chain.

Building your pillar B strategy

Implementing a strategy that contributes to global net zero via the decarbonization of your ecosystem (Pillar B) can be broken down into three steps, similar to the process used to decarbonise your activities (Pillar A).

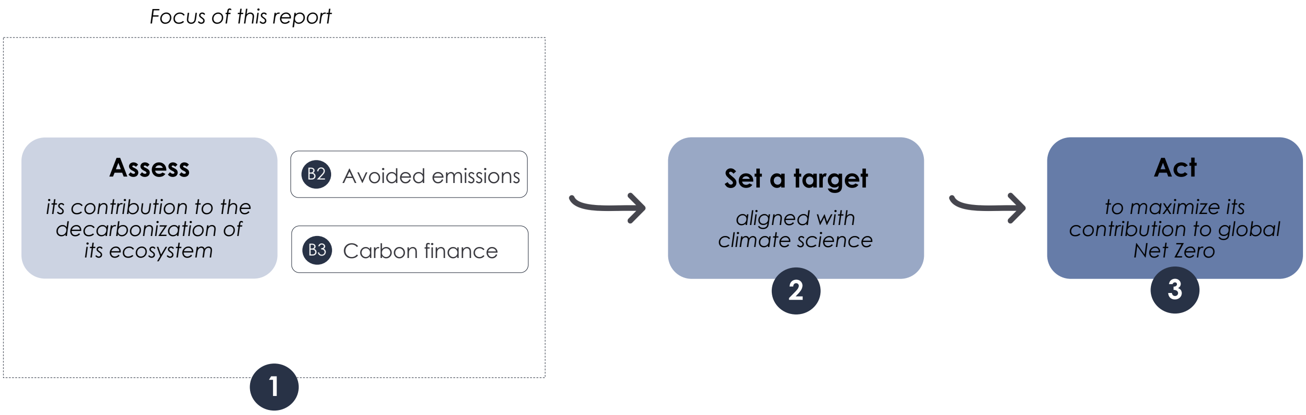


Figure 1 – A strategy in pillar B is composed of three steps: measuring, setting a target and acting.

The first step consists of:

- **calculating avoided emissions generated by solutions sold by the company**, by placing emphasis on the solutions most compatible with the global goal of 1.5°C. This diagnosis allows us to answer the following question: **to what extent do the solutions that I sell help my clients to reduce their emissions?**
- calculating **avoided emissions generated by the company's investments**, that is to say the avoided emissions related to its investments. Climate dividends are the mirror image of category 3.15 of pillar A (emissions linked to investments) for pillar B avoided emissions.
- evaluating **the company's financial contributions** to additional projects that avoid emissions or reduce them outside its value chain.

The three categories of avoided emissions – by the products and services sold, by investments and by financing projects outside the value chain – must be **reported separately.**

The second step consists of setting a target for the indicators measured in the first step. This step allows us to answer the following question: **What is the right level of climate performance that my pillar must reach to ensure my contribution to carbon neutrality is in line with science?**

Finally, the third step consists of orienting your business model, financing and investing to reach the targets set. This step allows us to answer the following question: **How can I act to maximise my positive impact in terms of the decarbonization of my ecosystem?**

This report focuses on the first step, but already provides some ideas for action on the following steps. In the short term, the Net Zero Initiative plans to enrich its framework with concrete recommendations on each of these two stages.

1

Assess

The company's contribution to the decarbonization of its ecosystem

B2 Avoided emissions

- **Select the solutions eligible for** an avoided emissions (AE) assessment, based on the criteria suggested in this report.
- **Assess avoided emissions :**
  - The calculation of avoided emissions for a solution is done in three steps:
    - **Step 1:** Calculation of emissions in the solution situation
    - **Step 2:** Calculation of emissions in the baseline scenario
    - **Step 3**: Calculation of avoided emissions
  - For each of the three stages of assessing AEs, Net Zero Initiative provides a **general methodological framework**, as well as a specific **booklet** for the concrete calculation of avoided emissions in three sectors: Mobility, Buildings, Energy.
  - The **general framework** provides precise indications on the following subjects: choice of the reference situation, calculation timeframe, calculation perimeter, evolution of avoided emissions over time, and the level of precision of the assumptions.
  - The **booklet** includes **12 methodological sheets** covering 12 families of solutions in 3 different sectors**, 11 solution sheets**, and **67 avoidance factors (AFs)** for 9 solutions. This very first database of avoidance factors aims to enable companies to easily estimate their avoided emissions for the solutions concerned, and is intended to be enriched over time.
- **Consolidate, leverage and report the amount of emissions avoided** by the products and services sold, by distinguishing as much as possible AEs of **« reduction type » (AE_R)** and **« lesser increase » type (AE_{LI})**. The **share of sales** corresponding to the products and services for which the avoided emissions were calculated must also be communicated. Beyond reporting, avoided emissions should also be used as a strategic planning tool to transform the company's business model and maximize its positive impact.

B3 Carbon finance

- **Financing additional reduction/avoidance projects** outside its value chain. This financing can take the form of: purchases of carbon credits, direct participation in the financing of projects, purchases of green bonds (under certain conditions), purchases of green electricity (under certain conditions), or financing of energy saving certificates (under certain conditions).
- Report the **amount of emissions avoided by these projects**, as well as **the total amount of funding** and **the cost per tonne of CO_2e avoided by the projects.**

2

Set a target

aligned with climate science

- 🎯 The **next work of NZI** will be to define science-based **pathways for** the Pillar B indicators.
- 🎯 These pathways will be defined in such a way as to **effectively guide the activities of companies** so that they contribute to the decarbonization of society in accordance with the global net zero target.

3

Act

to maximize its contribution to global Net Zero

Companies must think about how to **transform their products and services,** and how to **target the right markets** to increase their decarbonization impact. To implement a strategy to contribute its solutions to global carbon neutrality, companies can therefore:

👉 **Act on what they sell:**

- Ensure that their solutions sold are compatible with a carbon-neutral world, and if necessary remove incompatible solutions from their portfolio.
- Transform business model and focus on solutions with a high decarbonizing power.

👉 **Act on their end markets:** focus on markets that maximize the decarbonizing power of the sold solutions, *i.e.*, customers with carbon-intensive habits.

The guide to pillar B

Introduction

The purpose of this document is to explain the calculation rules of the second pillar of the Net Zero Initiative (NZI) reference framework, also referred to as Pillar B.

It should be read as a complement to the document *Net Zero Initiative: a reference framework for collective carbon neutrality*, published in April 2020.

A reminder regarding the Net Zero Initiative reference framework

In April 2020, Carbone 4 launched the Net Zero Initiative and laid the foundations for a new interpretation of the concept of "net zero emissions" for companies with the publication of the associated refence framework.

Since the only scientifically valid definition of net zero only applies to planet Earth[1], and possibly to countries[2], the Net Zero Initiative conceives the company as an object that must above all seek to properly **contribute to the goal of global and national carbon neutrality.**

On two occasions[3,4], the ADEME corroborated this vision by calling on organizations, individuals and the public authorities to shift away from an "accounting" perception of carbon neutrality at the company scale towards one of asking how they can **contribute to collective carbon neutrality.**

Thus, the notion of "net zero" or "neutral" company is set aside and replaced by a series of independent indicators used to **align the climate performance of a company with global net zero.**

This matrix can also be seen as **the generalization of the carbon footprint tool**, by enhancing new metrics capable of covering the blind spots of classical reporting methodologies, in particular:

- the concept **of the climate utility of a product/service,**
- the **protection and development of carbon sinks,**
- monitoring **financial contributions** to the low-carbon transition (by going beyond the notion of “offset”, which wrongly implies the possibility of "cancelling" one's footprint by purchasing carbon credits).

[1] IPCC (2018), *Global Warming of 1.5°C (SR15)*
[2] ADEME (2021), *Les avis de l’ADEME: la neutralité carbone*
[3] *Ibid*
[4] ADEME (2022), *Avis d’experts: Utilisation de l’argument de « neutralité carbone » dans les communications*

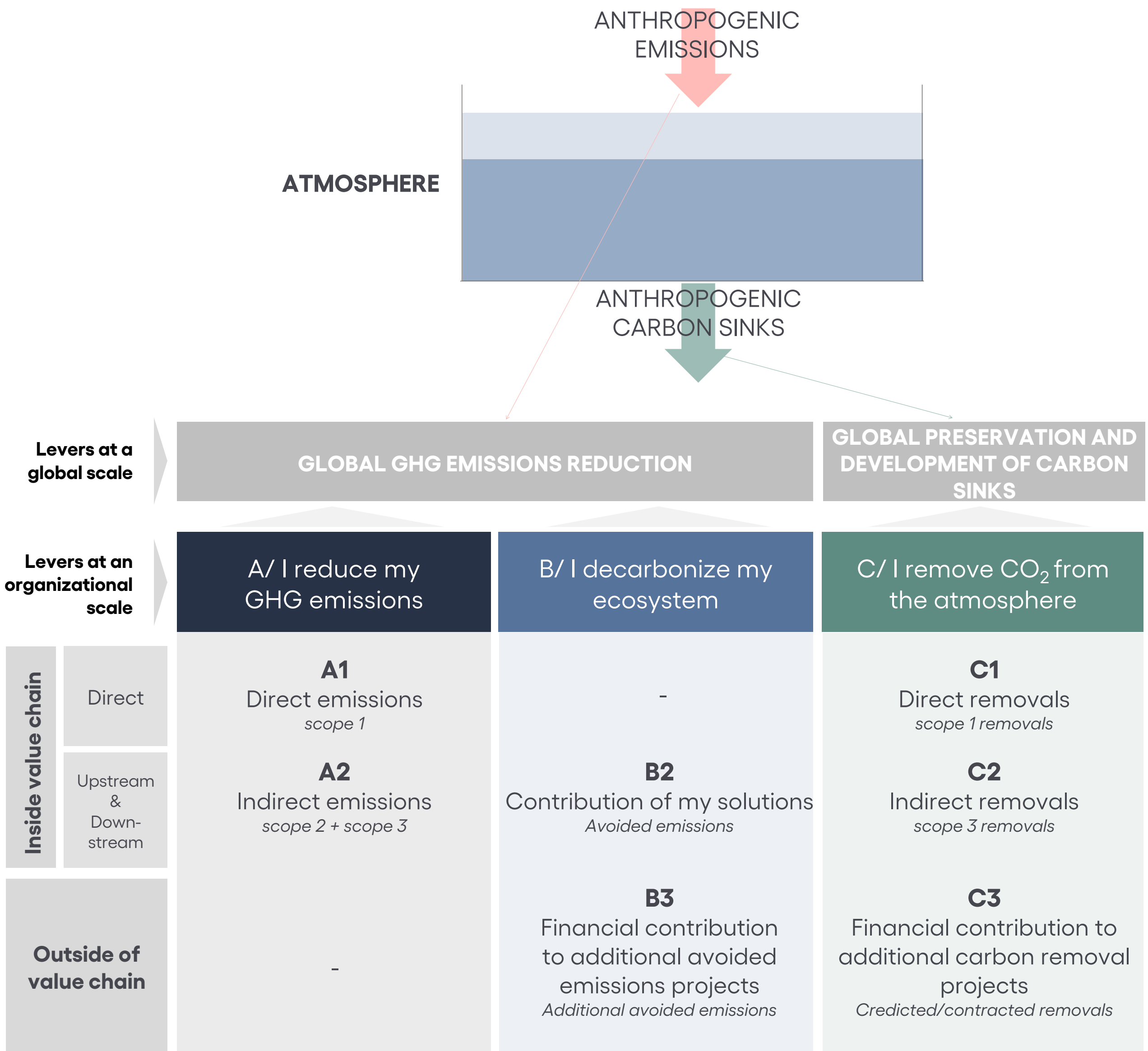


Figure 2 – The breakdown of the goal of global net zero emissions on the scale of a company shows three pillars of action: the reduction of the company's carbon footprint, avoiding the emissions of third parties, and the capture of CO_2 in the atmosphere in carbon sinks. The table at the bottom of the diagram is the dashboard of Net Zero Initiative.

Reminder regarding pillar B

Pillar B of the NZI dashboard aims to **quantify the company's impact on the decarbonization of its ecosystem**, outside its own reporting perimeter (pillar A)**.** It is composed of two main families:

- **The contribution of the company's solutions to decarbonization (B2)**, i.e., their **capacity to decarbonize their clients, in comparison to a reference situation** (avoided emissions);
- **The company's financial contribution to projects of additional projects to reduce/avoid emissions outside its value chain (B3),** and in particular – but not only - the purchase of "carbon credits" (certified emission reductions).

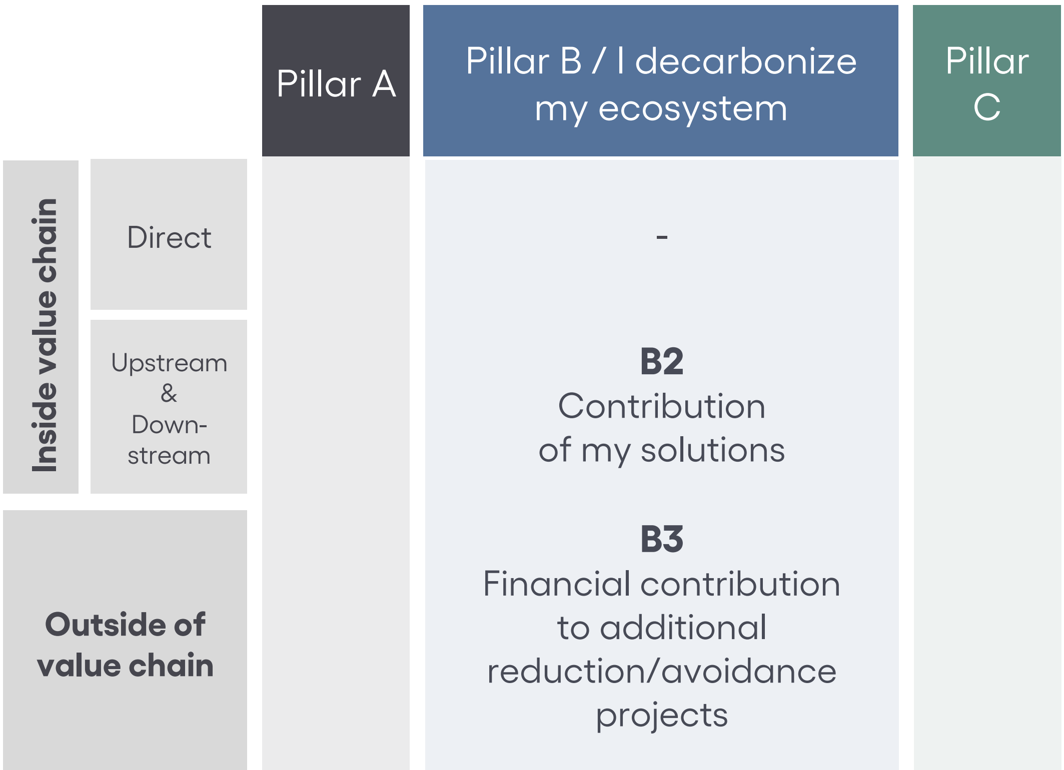


Figure 3 – Avoiding emissions can be done via products and services sold, investments and financing projects outside the value chain.

Note: *In the rest of the document, the expressions "products and services" and "solutions" will be used interchangeably. "Products and services" will sometimes be abbreviated "P&S". The word "company" should be understood in the sense of "organization".*

Measuring pillar B

B2 – The contribution of your products and services to global net zero

Avoided emissions

B2 – The contribution of your products and services to global net zero

This section focuses on the **contribution of products and services sold by the company towards reaching global net zero[5].**

Note: *as mentioned above, the expressions "products and services" and "solutions" will be used without distinction in the rest of the document. "Products and services" will sometimes be abbreviated as "P&S". "Companies" should be understood in the sense of "Organizations".*

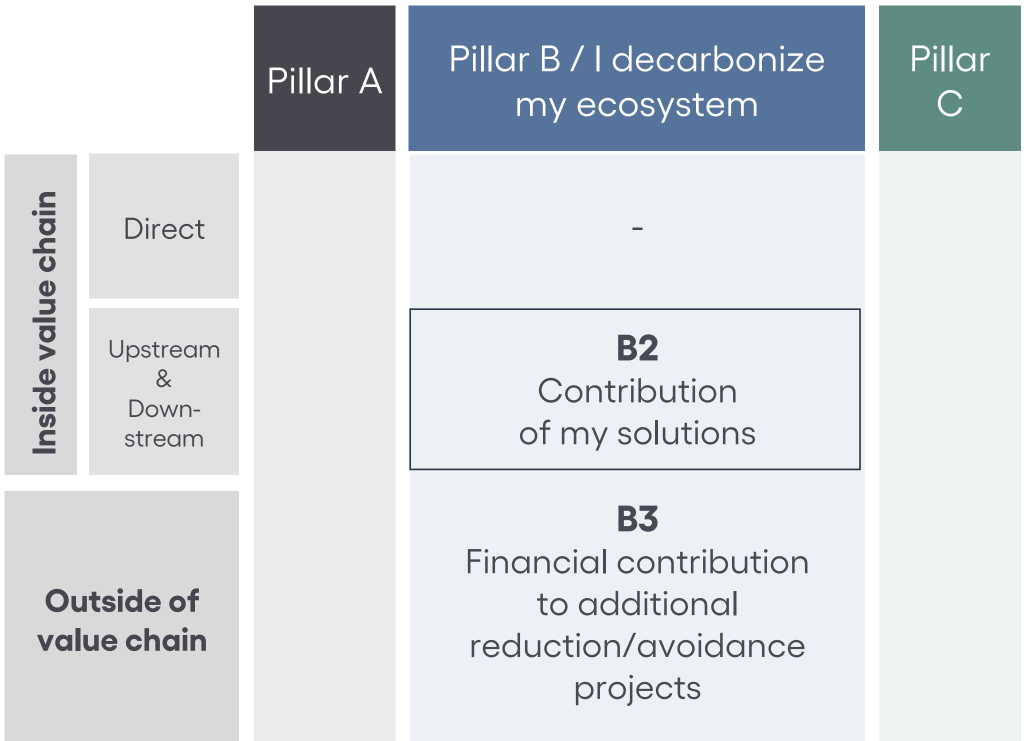


Figure 4 – The contribution of the company's solutions to global net zero: pillar B2.

[5] At this point, only companies producing and/or selling solutions are concerned. In the second stage, Net Zero Initiative will go into greater detail on the role of "influencers" of sales, financers, clients, installers, etc.

What is an avoided emission?

Principle

Avoided emissions measure the contribution of an organization to the decarbonization of the economy outside the scope of its activities[6]. Avoided emissions are estimated with respect to a counterfactual reference scenario that reflects the most probable situation that would have occurred in the absence of a low carbon solution.

A solution avoids emissions if it allows a reduction in emissions in comparison to a reference situation, i.e., if the emissions generated are lower in the situation with the solution than in the reference scenario. In this case, **the avoided emissions are calculated by subtracting the two situations.** If the situation with the solution generates more emissions than the reference situation, than we refer to them as added emissions.

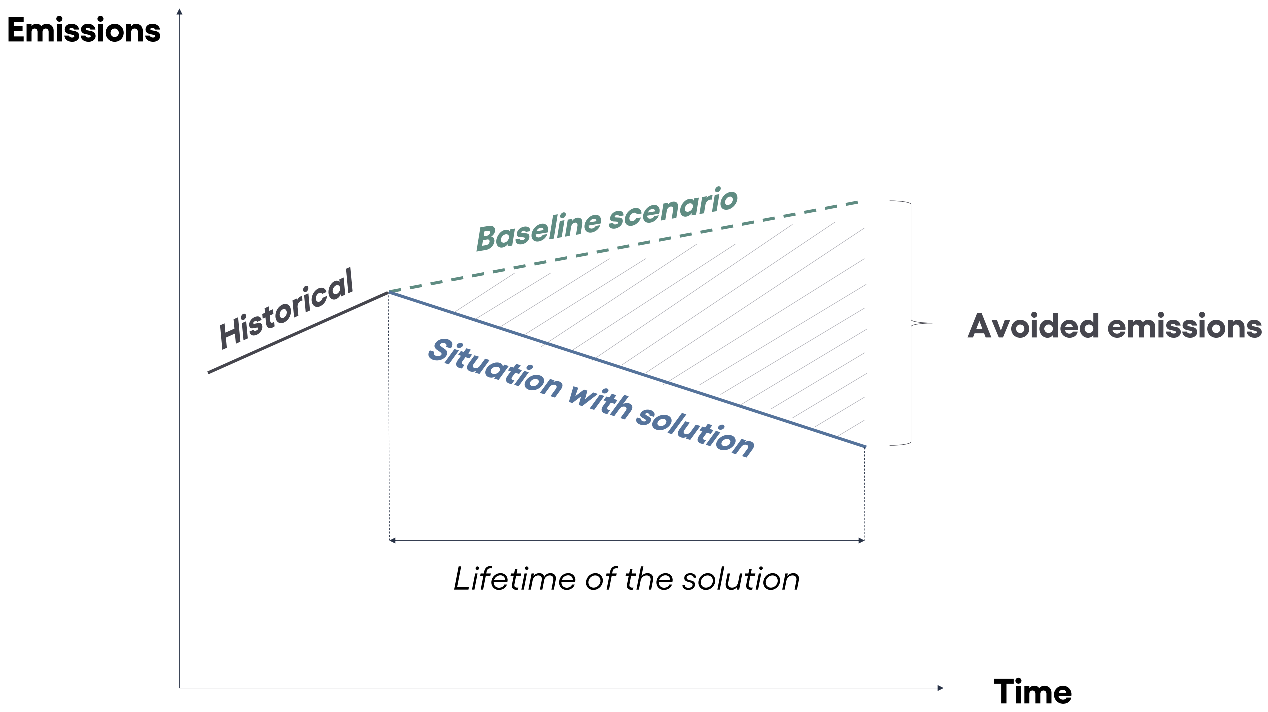


Figure 5 – Avoided emissions as the subtraction of the scenario with the solution and the reference scenario.

[6] ADEME. *Les émissions évitées, de quoi parle-t-on ?* 2020

Difference between the carbon footprint and avoided emissions

Whereas the carbon footprint measures a physical quantity – the greenhouse gases effectively emitted into the atmosphere – and its variations through time, the analysis of avoided emissions consists of a theoretical approach: the comparison, over a given timeframe, of a real situation (with the solution) with a counterfactual virtual situation (reference situation), i.e., which never took place.

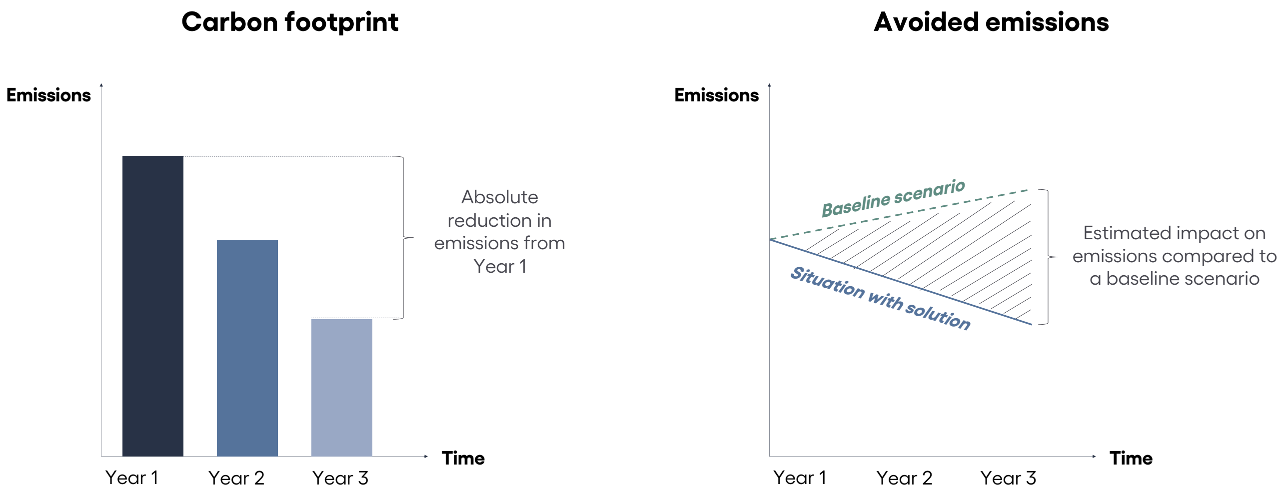


Figure 6 – Difference between a carbon footprint (left) and avoided emissions (right)[7].

	Carbon footprint	Avoided emissions
Principle	Measure of the greenhouse gas emissions of an activity for a given year. The reductions (or increases) of emissions reflect the **evolution of emissions through time.**	Estimation of the "positive" carbon impact of an action. Avoided emissions are the **comparison between a real situation** (situation with the solution) **and a fictional situation** (reference situation).
Reference	The reductions (or increases) of emissions are **quantified in comparison to the level of emissions of a historic reference year** in a constant perimeter.	The avoided emissions are **quantified in comparison to a counterfactual reference scenario**, that would have occurred in the absence of the solution.
Uncertainty	The measure is based on real emissions, **so the uncertainty is low.**	The reference is a non-verifiable fictional situation, **so the uncertainty is high.**

Table 2 – Main differences between a carbon footprint and avoided emissions.

[7] GHG Protocol. *The GHG Protocol for project accounting*. 2005

The notion of reducing one's carbon footprint, especially the reduction of the item scope 3 "utilization of products and services sold", is frequently confused with avoided emissions. The difference mainly stems from the **point of view taken:**

- **For carbon footprint reduction, we are in the company's perspective.** We compare emissions of the solutions sold year after year.
- **For avoided emissions, we are in the clients' perspective.** We compare two situations, one with and the other without the solutions sold by the company.

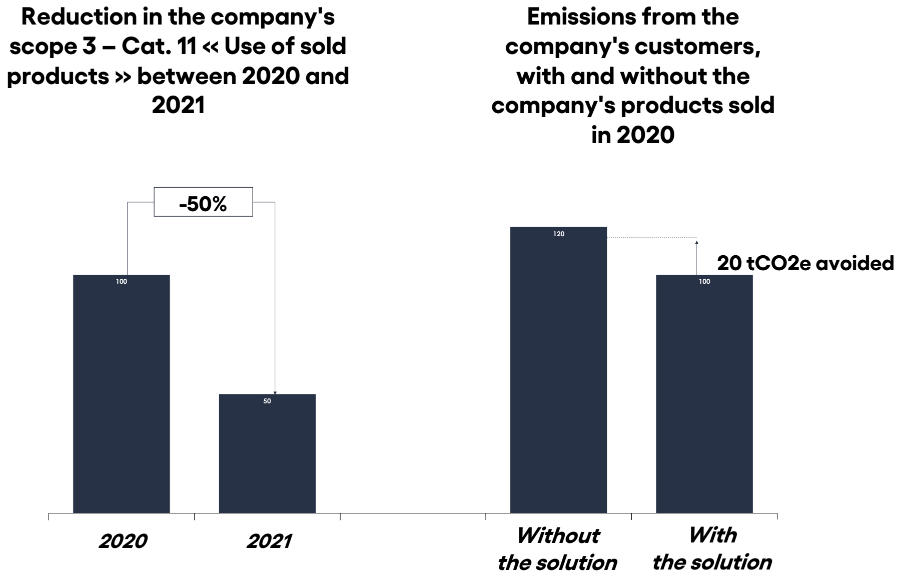
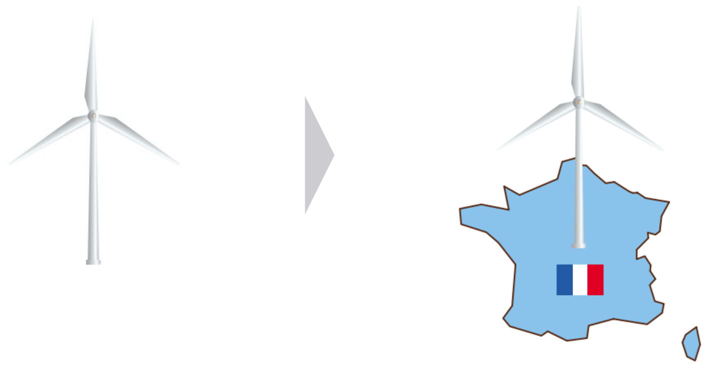


Figure 7 – Difference between reducing the carbon footprint of the products and services sold by the company and avoiding emissions thanks to the same products and services.

Accounting for induced emissions (Pillar A) and estimating avoided emissions (Pillar B) are **complementary approaches** in monitoring a company's impact on the climate. **However, they use fundamentally different methods.**

AVOIDED EMISSIONS ARE A "CONTEXT-DEPENDENT" MEASURE

In particular, **avoided emissions are by definition highly dependent on context**. Avoided emissions are therefore always dependent on the product (or service) sold and the context in which it is sold, which defines the reference scenario.



Solution X
Installing a wind farm to produce low-carbon electricity

Solution X, Context 1
Installing a wind farm to produce low-carbon electricity in France

Solution X, Context 2
Installing a wind farm to produce low carbon electricity in Germany

The amount of emissions avoided by a given solution depends on the context in which it is used.
In this example, the solution will avoid more emissions in context 2 than in context 1, because the electricity produced in Germany is more carbon intensive than in France.

Figure 8 – Dependence of avoided emissions on the context of low carbon solutions

It should be noted that in the previous example, the location in which the solution is implemented determines its context, and here it is defined at a national level.

TWO TYPES OF AVOIDED EMISSION

Depending on the case, avoided emissions can represent:

- The effective **reduction of emissions** in comparison to a previous more emissive situation;
- **The lower increase of emissions** in comparison with a fictional counterfactual scenario that would have generated more emissions.

This difference between the two types of avoided emissions is taken into account in the Net Zero Initiative reference framework. Thus, two subcategories of avoided emissions are established:

- **Avoided emissions (AE):** the difference in emissions between the situation with a solution and a counterfactual reference situation. They are broken down into two types:
    - **Avoided emissions of the "reduction" type (AE_R):** the share of avoided emissions (AE) corresponding to a real reduction of emissions in comparison with the previous situation.
    - **Avoided emissions of the "lower increase" type (AE_{LI}):** the share of avoided emissions (AE) corresponding to an increase in emissions in comparison to the previous situation, but lower than the reference scenario.

The AE, AE_R and AE_{LI} are linked using the following equation:

$$AE = AE_R + AE_{LI}$$

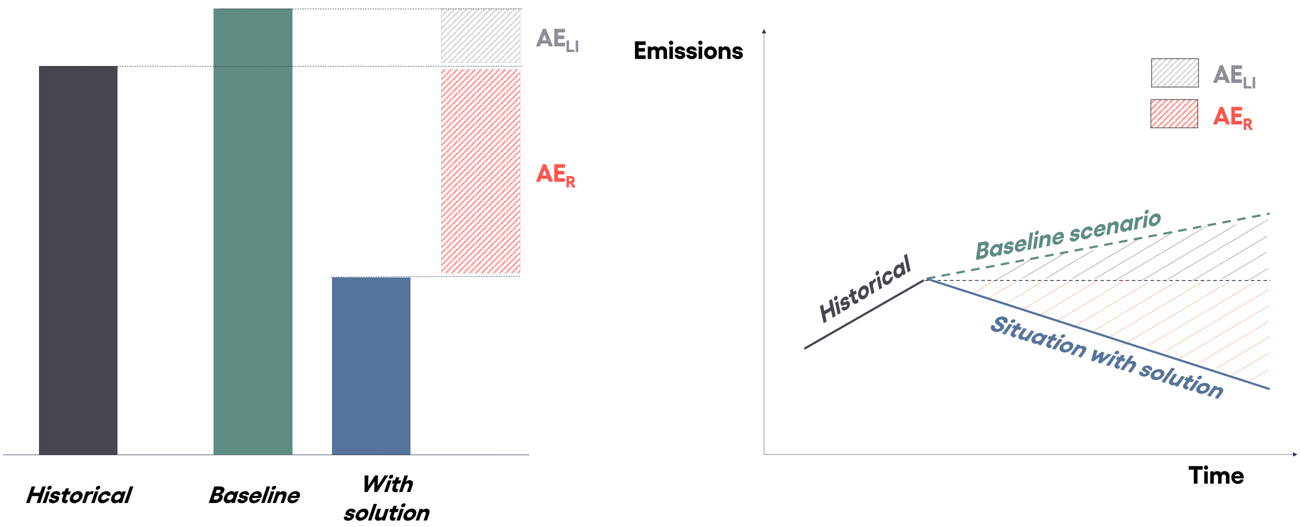


Figure 9 – Aggregated view over the lifetime of the solution (left) and yearly view (right) of the difference between the two types of avoided emissions – reduction (AE_R) and avoided emissions – lower increase (AE_{LI}).

Not all the avoided emission situations are "hybrid" situations containing both types. In some situations, AE_R will not be equal to the difference between the before/after project levels, but to the difference between the project and the refence scenario This is the case if, for example, the solution significantly decarbonizes the system in comparison to the previous situation but the system would have had a lower rate of carbon in any case, even if there were no project (lower reference situation, due for example, to market trends or regulations). In other words, AE_R is still a **share** of the total AE, a share that can never exceed 100%.

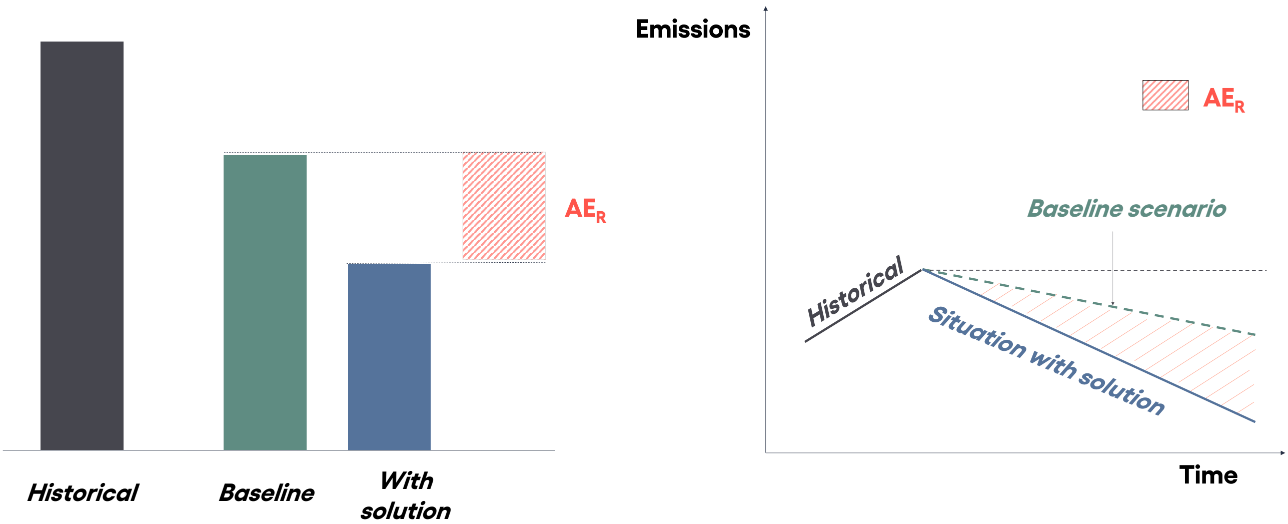


Figure 10 – Integrated view over the lifetime of a solution (left) and yearly view (right) where 100% of the avoided emissions are of type avoided emissions – reduction (AE_R).

Finally, in the case where the situation with the solution generates an increase of emissions in comparison to the previous situation, but not as much as would have been emitted in the absence of the solution, 100% of the avoided emissions are "lower increase" (AE_{LI}).

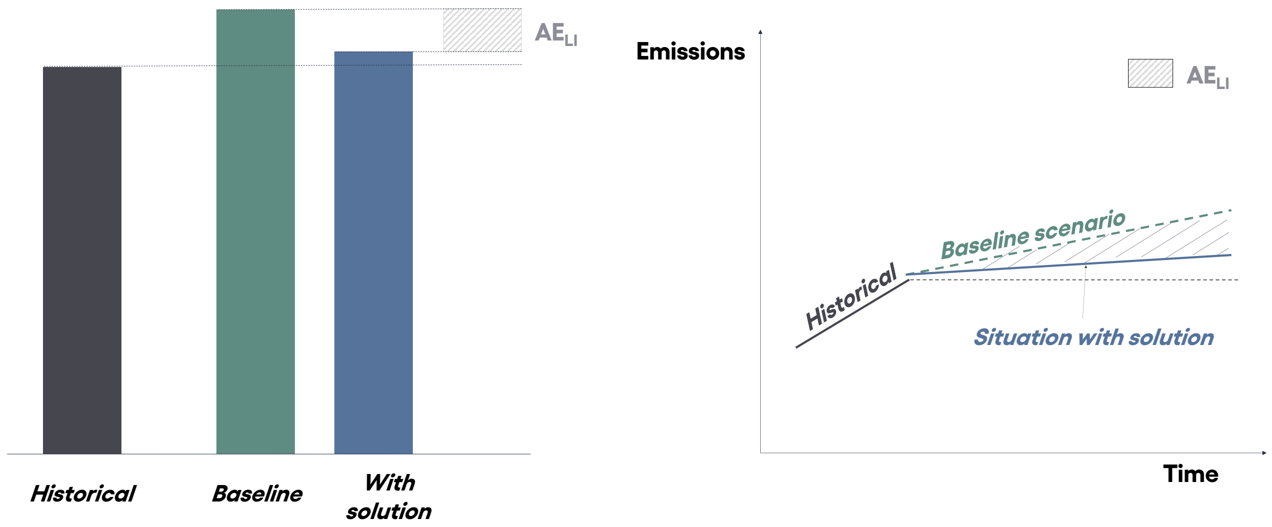


Figure 11 – Integrated view over the lifetime of a case (left) and yearly view (right) where 100% of avoided emissions are "lower increase" (AE_{LI}).

Distinguishing reduction type avoided emissions and lower increase type avoided emissions therefore allows the company to have a detailed view of the impact of its solutions in the decarbonization of its ecosystem, and to direct its strategy accordingly. The role played by this physical distinction of avoided emissions has not yet been determined in the Net Zero Initiative reference framework, but it will be in future updates.

The Net Zero Initiative recommends companies to:

1. **Calculate their total avoided emissions (AE);**
2. **As much as possible, calculate the share of reduction type avoided emissions (AE_R) and the share of lower increase type avoided emissions (AE_{LI}) in this total AE;**
3. **As much as possible, report and manage AE_R and AE_{LI} separately.**

Communication on the avoided emissions of a solution can be formulated as follows: *"Solution XX will avoid xx tCO2e of emissions throughout its lifetime [or avoid xx tCO2e annually]. x% of these avoided emissions corresponds to an effective reduction of emissions".*

We suggest not to impose the distinction between AE_R and AE_{LI} when communicating with the general public. However, it is important to make this distinction in publications intended for more expert readers (for example, extra-financial report).

Calculating avoided emissions

Definition

Avoided emissions are an estimation of the positive effect of a solution on GHG emissions in comparison to a reference situation that would have occurred without said solution. Avoided emissions are therefore the difference between the emissions of the reference situation and the emissions with the solution:

Avoided emissions

=

Emissions in the reference situation – Emissions in the situation with the solution

Avoided emissions are calculated **according to a lifecycle rational**, i.e., by taking into account all the emissions of manufacturing, transportation, utilization, end of life, etc., for both the reference situation and the situation with the solution.

To calculate the avoided emissions **of a solution**, the company must follow these steps:

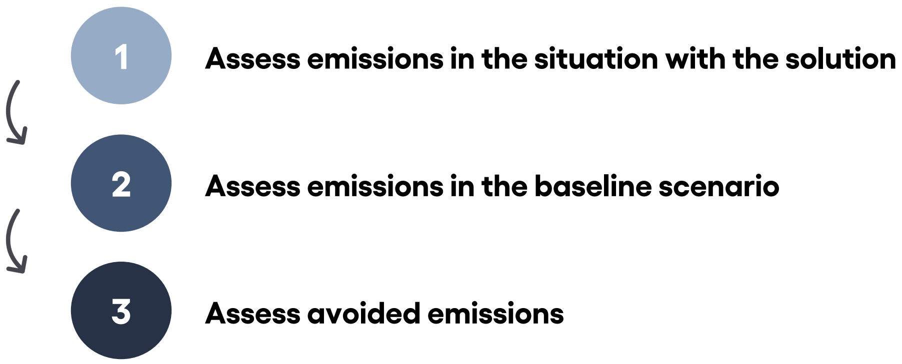


Figure 12 – The three steps to calculate avoided emissions.

Recommendations on which solutions to consider for calculating avoided emission

Although it is possible to calculate the avoided emissions of the company's entire portfolio of solutions, this would be time-consuming. NZI's recommendation is to select beforehand the most relevant solutions of the portfolio for this type of assessment based on the following criteria:

Compliance of the solution with the 1.5°C target:
This compliance can be assessed according to the following criteria:
- The solution is part of the solutions put forth in the AR6 report of Group III of the IPCC[8] for decarbonization;
- The solution is eligible for the European Taxonomy for sustainable activities[9];
- The carbon intensity of the solution is aligned with a 1.5°C pathway for its sector throughout its lifetime.

Non-preservation of an activity incompatible with the 1.5°C target
The solution must not promote the long-term existence of an activity incompatible with the 1.5°C target (examples: solar panels for new oil drilling rigs, optimization of private cars engines with very high carbon intensity, etc.).

"Do no significant harm"
The solution must not cause significant damage to other indicators other than climate indicators.

Important note: Net Zero Initiative is working to create a new indicator that will enable us to objectify the compatibility of a solution with the 1.5°C target. For further information, refer to the NZI's June 2022 publication: *Proposal for a new climate indicator: Compatibility of solutions with the Paris Agreement*.

Timeframe of the calculation

There are two different calculation timeframes for avoided emissions:

- **Option 1 – Calculation over the lifetime:** the avoided emissions are calculated only once at the year of sale/start-up of the solution and throughout all of its lifetime (calculation called *ex-ante*).
- **Option 2 – Annual calculation:** the avoided emissions are calculated every year, by monitoring the the solution over its lifetime (calculation called *ex-post*).

[8] https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/
[9] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

Recommendation for option 1 – Calculation over lifetime

If the solution avoiding emissions is a solution sold to a final user without monitoring nor an associated contract with a commitment over time, the Net Zero Initiative recommends that **its avoided emissions are calculated for its entire lifetime and declared on the year of sale.**

This recommendation ensures a temporal consistency between the company's reporting of the emissions linked to the solution's utilization phase, which are also calculated for the entire lifecycle of the solution and reported at the year of sale in the category Scope 3 "Use of sold products", and the reporting of emissions avoided by the same solution.

In this case, the company must:

1. **Establish the trend of future emissions of the solution**, and assess the volume of greenhouse gas that the solution is likely to emit throughout its lifetime;
2. **Establish the trend of emissions in the reference scenario**, and assess the volume of greenhouse gas that would have been emitted throughout the lifetime of the solution;
3. **Assess the avoided emissions** by calculating the difference.

The calculation must take into account **dynamic effects** such as the future decarbonization of the energy mix, the deterioration of the solution's performance through time. It must also use reasonable hypotheses based on the lifetime of the solution. Finally, the assessment must take into account possible rebound effects.

Example

A company produces and sells a heat pump to a final user that would have previously purchased an average boiler available on the market. Thus, the company must:

1. *Assess the emissions (provisional) of the heat pump during its lifetime, over its entire lifecycle (production, use, end of life, etc.);*
2. *Assess the emissions of the average boiler available on the market over the same period;*
3. *Estimate the avoided emissions over the lifetime of the heat pump and report them at the year of sale.*

For the emissions with the heat pump and the emissions with the average boiler available on the market, the company must take into account dynamic effects such as the decarbonization predicted with electricity and gas, and the deterioration of the efficiency of the heat pump and the boiler. It must also use reasonable hypotheses based on the lifetime of the heat pump. Finally, it must take into account possible rebound effects.

Recommendation for option 2 – Annual calculation

If the solution avoiding emissions is a solution rented to a client or is used directly by the company via a contract, the Net Zero Initiative recommends that **its avoided emissions be calculated and declared by the company each year, during the entire length of the contract.**

This recommendation ensures the consistency through time between the company's emissions reporting linked to the use phase of the solution, which are also calculated and declared on an annual basis, i.e., in scope 3 "Rented assets", or in scope 1&2, and the reporting of emissions avoided by the same solution.

In this case, the company must:

1. **At the start of the contract / start of use of the solution**, define the reference solution that would have been chosen without the company's solution, and estimate its operating performance over time throughout is lifetime or throughout the length of the contract, taking into account possible replacements or deterioration of performance.

2. **Every year:**
    - Assess the solution's real emissions;
    - Assess the emissions in the reference scenario based on the performance of the counterfactual situation determined in the year of starting operation, and on the real data of the energy mix of the current year;
    - Calculate and declare the emissions avoided by the solution for the current year.

Contrary to option 1 – Calculation over the solution's lifetime, it is not necessary to predict:
- the future decarbonization of the energy mix, since the real emission factor is known for the year of calculation.
- the future performance of the solution, since its real performance is known each year.

However, it is still necessary to estimate from the start of the contract or the start of operation, the pathway of the "life" of the counterfactual situation through time, such as the degradation of its performance over time, or its possible replacement after a certain number of years.

In other words, in the "annual calculation" option, the estimation of avoided emissions is partly based on real data during the year of calculation (emission factors, use of the solution, etc.), and partly based on hypotheses established in the year implementation of the solution, and not reviewed during the lifetime of the solution (estimated performance of the counterfactual situation through time).

Example
A company signs a contract for the installation and operation of energy efficient public lighting equipment for 10 years. Without this contract, the client would have kept the previous equipment that consumed more energy, and replaced it 7 years later with energy-efficient public lighting equipment.
The company must therefore:

1. *Define, in the year of the transaction, what would have been the trend of consumption of the reference situation throughout the duration of the contract for 10 years. It must take into account the fact that the equipment would have been replaced by energy-efficient equipment after 7 years, and that its yield would deteriorate over time.*
2. *Assess every year, throughout the term of the contract:*
    - *The real emissions of the lighting equipment during the reporting year on the basis of the real emission factor of the electricity consumed and the solution's real consumption;*
    - *The emissions in the reference scenario of the given year on the basis of the performance of the reference situation that was estimated in the year of the transaction, and by using the real emission factor of the electricity of the year in progress;*
    - *The avoided emissions, by comparing these two figures.*

Here again, the GHG emissions of the solution and the reference scenario are calculated according to a lifecycle rationale. The emissions outside the use phase are amortized throughout the lifetime of the equipment.

Regarding the timeframe of reporting avoided emissions, Net Zero Initiative recommends that the option chosen is consistent with the method used to report the emissions of the decarbonizing solution (Pillar A):

- If the emissions of the decarbonizing solution are calculated and reported **in the year of sale** in the company's carbon footprint, for its entire lifetime (e.g., in the category "Use of sold products" of scope 3), we recommend **calculating and reporting the avoided emissions for the year of sale over the entire lifetime of the solution.**

- On the other hand, if the emissions of the decarbonizing solution are calculated and reported **every year** in the company's carbon footprint (e.g., in the category "scope 1"), then we recommend **calculating and reporting every year the emissions avoided by the solution for the year in progress**.

Calculating avoided emissions step by step

These steps describe the general approach to calculating avoided emissions. To go further, specific methodological sheets have been drafted and are presented in the section *Pillar B*.

Step 1 - Calculating the emissions of the solution

The first step of the calculation consists of estimating the emissions generated by the solution. **These are the emissions that are effectively released into the atmosphere.**

To do this, it is necessary to define the **solution's use scenario. This scenario is defined by the context in which the solution is implemented** (context of sale, country of use, consumer profile, etc.). By defining the situation with the solution, it is therefore possible to also determine the context in which the solution will be implemented, which is essential for defining the reference situation (Step 2).

Example: *If the same heat pump is installed for a private house or an apartment block with individual heating, the emissions generated in both situations will generally not be the same, since the consumption of energy per m² for heating is generally higher in a house than in an apartment. The emissions of the solution are therefore different in both cases, since the solution is used in two different contexts.*

It should be noted that the context to which a solution is in most cases associated is location. The Net Zero Initiative recommends qualifying the geographical context with the finest possible resolution. The national-level resolution should be favoured by default.

The emissions generated by the solution must be calculated **in terms of its lifecycle**, in particular by taking into account the emissions from manufacturing, transport, use, and end of life.

It should be noted that the situation with the solution is always **a trend of emissions over time**. It can also take the form of a total quantity of emissions, which is the sum of the annual emissions over the lifetime of the solution. In the case of an annual calculation of avoided emissions, the trajectory of emissions is simply updated annually by using the input data corresponding to the year of calculation (emission factor of the energy mix, etc.).

EVOLUTION OVER TIME

- If the calculation is performed over the lifetime of the solution, the **decarbonization of energy** during the lifetime considered must be taken into account in the calculations of the emissions generated in the situation with the solution.
- The possible loss of **performance** during the lifetime of the solution must be taken into account.

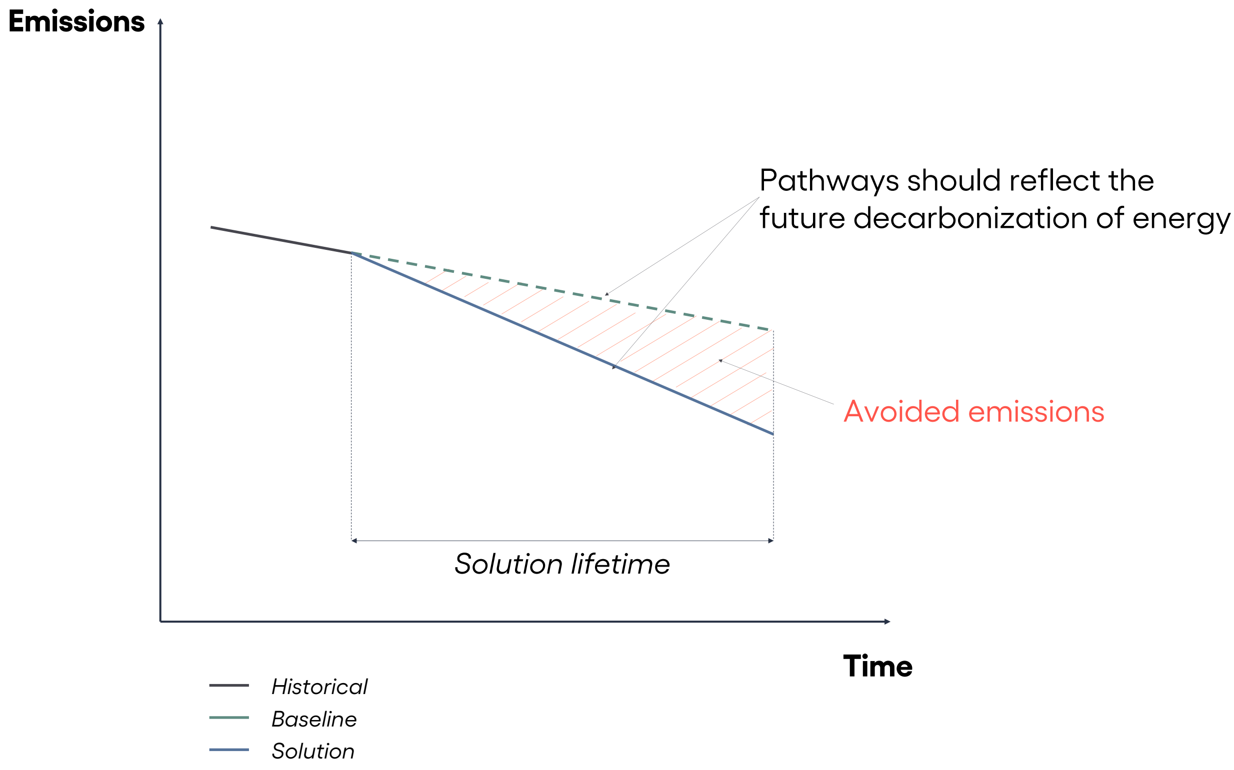


Figure 13 – Illustration of integrating energy decarbonization in the reference situation and the solution.

LEVEL OF PRECISION OF THE CALCULATION

The level of precision of the calculation depends on the information available, publicly and within the company, but also the complexity of the calculation for the company. Indeed, the level of precision possible will not be the same for a company that sells several thousand solutions a year and a company that sells or operates a smaller number of solutions.

The Net Zero Initiative distinguishes three visions that reflect the available levels of precision . Companies should always aim for the highest level of precision possible.

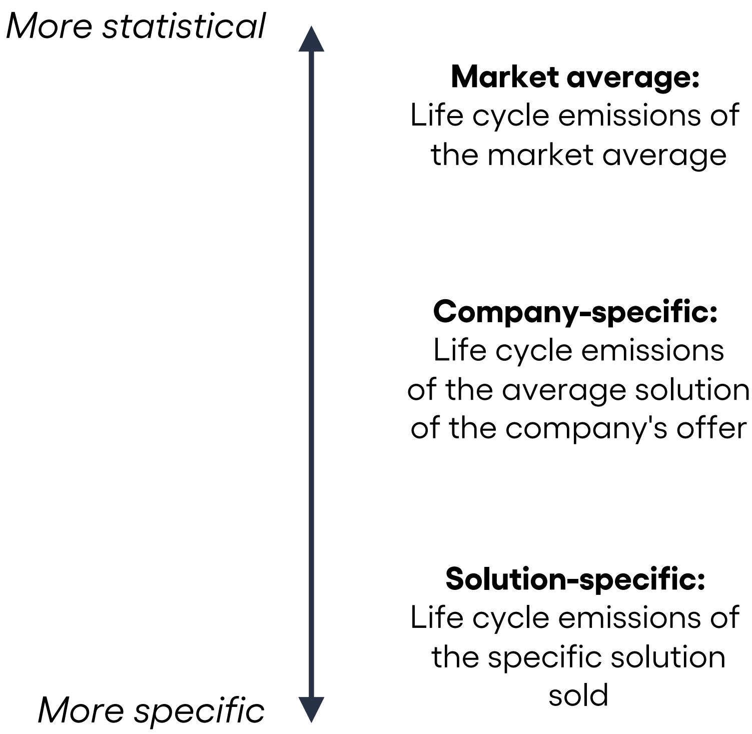


Figure 14 – Different levels of precision for calculating the emissions of a solution.

Approach	Precision	Description
Complete	**High** – ideal approach recommended by Net Zero Initiative, to be used when the data is available and if the calculation is not too time-consuming.	Carbon footprint specific to each solution sold. The company must conduct a detailed calculation for each solution with detailed knowledge of the sales context for the use scenario. ***Example***: *the carbon footprint of each electric vehicle sold by the company in France.*
Company average	**Average** – this approach should be adopted if it is too complicated to calculate the carbon footprint of each solution.	Average carbon footprint of the solution specific to the company. The company must perform a detailed calculation, by considering a use scenario by range of solutions and by market in which the solutions are sold. ***Example***: *average carbon footprint of electric vehicles of segment B sold by the company in France.*
Market average	**Low** – this approach should be adopted for a preliminary assessment of avoided emissions.	Average carbon footprint of the solution on a given market. In this vision, the carbon footprint is not specific to the company, it can be standardized for a given type of solution and a given geographical location. ***Example***: *average carbon footprint of an electric vehicle of segment B, all brands taken together, sold in France.*

Table 3 – Description of three levels of precision for calculating the emissions of the solution.

NB: In the average market approach, the **carbon footprint of the solution does not depend on the company considered**. It Is therefore possible to build a baseline with standardized data of average emissions for several products in a given geographical location.

For more information on the rules of calculating emissions generated in the situation with the solution, you should refer to the toolbox supplied in section *Pillar B*. In particular, this toolbox explains the calculation rules for several families of solutions in three sectors: Mobility, Construction and Energy.

Step 2 - Calculating emissions generated in the reference situation

The second step of the calculation of avoided emissions consists in calculating **the emissions that would occur in the absence of the solution.** This situation, which by definition does not take place, must be approached using a counterfactual scenario: the **reference scenario.**

As with the situation with the solution, **the emissions generated in the reference situation must be calculated in terms of lifecycle,** by taking into account in particular the emissions of manufacturing, transport, use, end of life, etc.

It should be noted that the reference situation is, like the situation with the solution, **always a trend of emissions over time**. It can also take the form of a total quantity of emissions, which is the sum of the annual emissions throughout the lifetime of the solution. In the case of an annual calculation of avoided emissions, the trend of the emissions is simply updated by using the input data corresponding to the year of calculation.

TYPES OF REFERENCE SCENARIO

Net Zero Initiative identifies two main types of reference scenario:

1) **Previous situation:** the extension over time of GHG emissions before the introduction of the decarbonizing solution. This trend of emissions takes into account the trend of energy decarbonization.

Example: *a company carries out heating renovations on a residential building, without regulatory constraints. In this case, the trend of the previous situation is the level of GHG emissions of the building before it undergoes heating renovation, a level of emissions that takes into account the decarbonization of energy vectors consumed by the building.*

2) **Average of the market context**: average of GHG emissions of alternative situations that would have occured instead of introducing the decarbonizing solution. These average situations should correspond to the context in which the decarbonizing solution is implemented. When the alternative situation is identified precisely (overall vision), the market average contains only one term: the emissions of the alternative situation.

Example 1: *a company installs a heat pump in a house whose oil-fired boiler has reached its end of life. The reference scenario is the average of solutions installed in this type of house to provide heating.*

Example 2: *a property construction company wins a public call for tenders to build a new administrative building. The reference scenario is the average carbon performance of solutions that competing companies have presented for this call for tenders.*

***Example 3:** a company sells an electric vehicle A to an individual. The company determines using a poll that, without placing A on the market, this individual would have purchased vehicle B of another brand. The reference scenario is therefore the emissions of vehicle B (the alternative situation is perfectly determined, and the "average" of the alternative solutions is not really an average since it contains only one term).*

These two types of reference scenario are not "choices". Depending on the context, one or the other must be applied to perform a rigorous calculation of avoided emissions. In the section *ChoiCE OF REFERENCE SCENARIO* , we explain the situations in which these reference scenarios must be used.

CONSIDERING REGULATION

Regulation and the anticipation of its change are essential components of the reference situation.

On the one hand it allows more precise determination of the context in which the solution must be implemented: Is the solution implemented in a context in which it would have been implemented in any case because required by regulation? In the section *ChoiCE OF REFERENCE SCENARIO* , we explain the situations in which regulation determines the reference scenario to be used.

On the other hand, it enables us to estimate the average of the market context and its evolution: regulation is therefore used as a proxy of the market average.

In the case where the reference situation is the average of the market context, but the latter is more carbon-intensive than regulation (the market solution does not comply on average with regulation), **the reference situation remains the average of the market context**. However, we advise declaring the emissions that would have been avoided if the average market context complied with regulation. That is to say, publish two avoided emission calculations, the first in which the reference situation is the average of market context, and the second in which the reference situation is that of the regulation, and by selecting only the first calculation to consolidate all the avoided emissions of the company's solutions.

CHOICE OF REFERENCE SCENARIO

The choice of the reference scenario is the keystone of the calculation of avoided emissions because it **must avoid overestimating the positive impact of a solution**. The credibility of the calculation depends on this choice.

The reference scenario must reflect as best as possible the situation that would have occurred without the solution: therefore it depends strongly on the context in which the solution is implemented. Two sales of the same solution can have different reference scenarios, depending on the context in which the solution is sold.

Example:

- *Case 1: an Individual purchases an electrical bicycle A to commute to work and no longer uses their car. The reference scenario is therefore the use of their car to commute to work.*
- *Case 2: an individual purchases an electrical bicycle A to commute to work and no longer uses public transport. The reference situation is therefore the use of public transport for these trips.*

Since the **context in which the solution is implemented has been defined during the calculation of the situation with the solution, it is reused to define the reference situation.**

The Net Zero Initiative defines a typology of contexts, each type having an associated reference scenario.

- **Context of new demand:** a context in which the solution responds to a growth in demand. In this context, the emissions are zero in the "previous situation".
- **Context of existing demand**: a context in which the solution responds to an already existing demand. It replaces or improves an existing system. In this context, the emissions of the previous situation are not zero.

It should be noted that in certain cases the solutions will be implemented in a hybrid context of existing demand and new demand. For example, a new decarbonized electricity power plant is brought on stream in a hybrid context: part of the electricity generated by the new plant will respond to an energy demand that was satisfied by the existing energy mix (context of existing demand), and part will respond to a new energy demand (growth of primary energy consumption) which would have been generated by new installations (context of new demand).

The choice of reference scenario is therefore done according to the process presented in Figure ***15***.

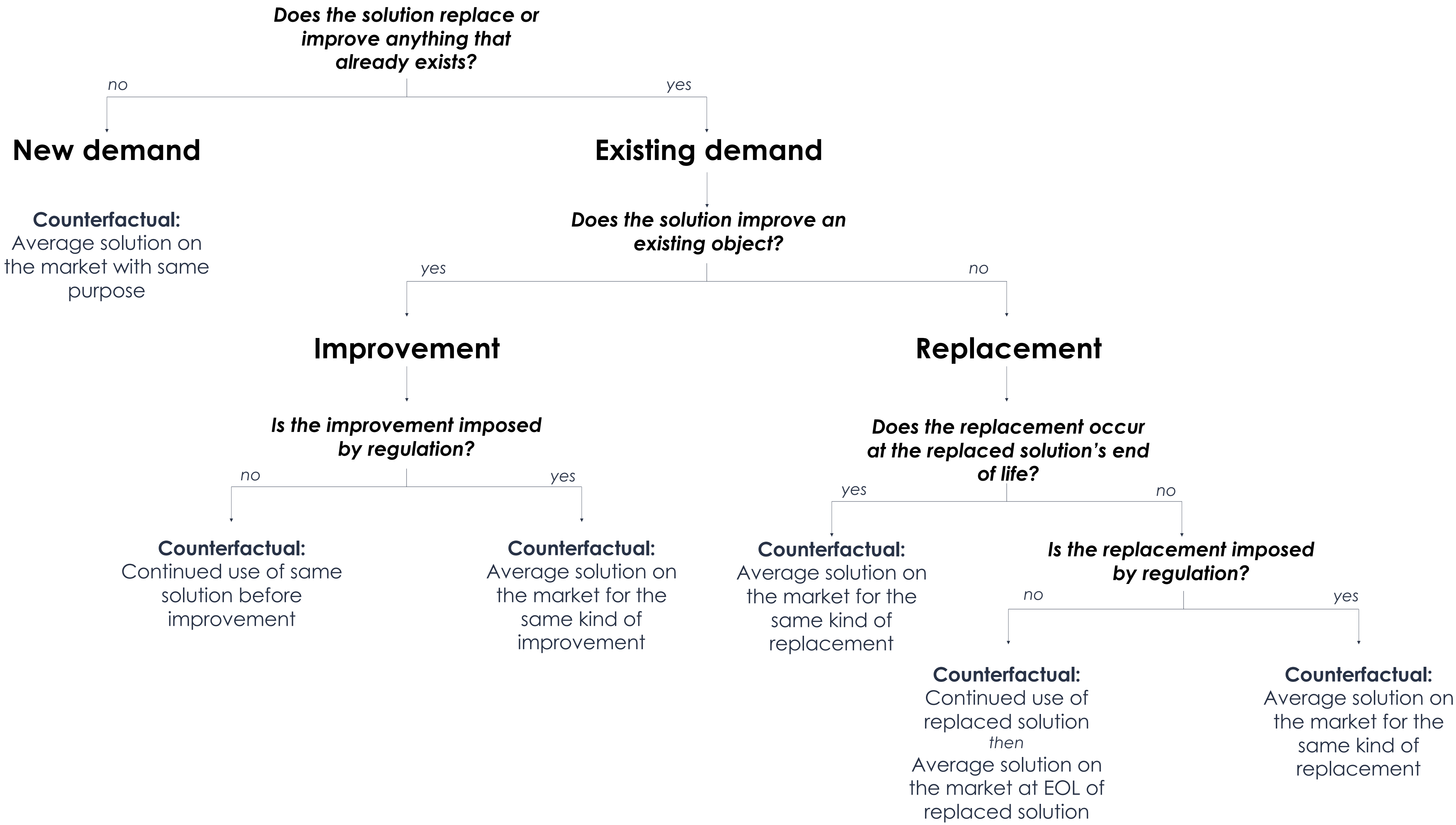


Figure 15 – Decision tree summing up the contexts and associated reference situations.

1) If the solution is implemented in a context of new demand

The solution is implemented in a completely new context, that is to say that it consists of a new object in the ecosystem.

The reference scenario is the average of solutions on the market that provide the same function in the year of sale.

Example 1: a company builds a new building with low carbon emissions (solution). The counterfactual is the average building of its category built the same year.

Example 2: a company sells an electric vehicle to an individual who did not own a vehicle previously. The reference situation is therefore the average of emissions of vehicles of the same range.

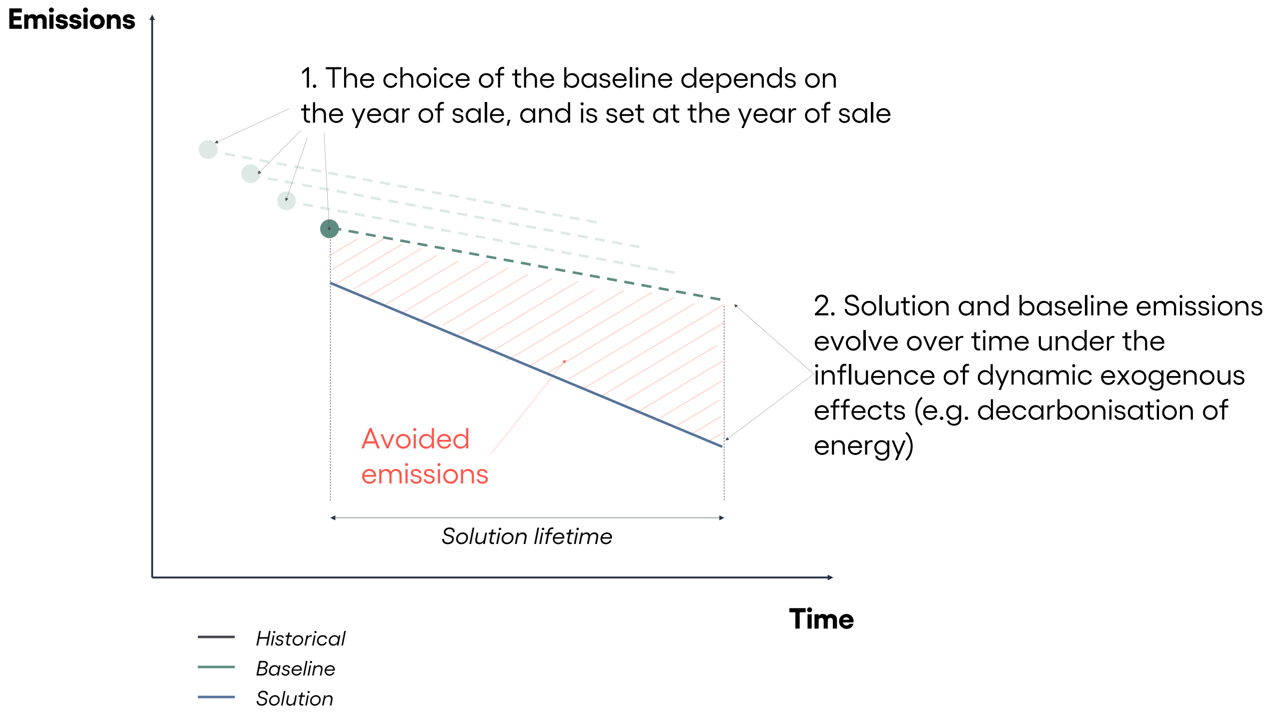


Figure 16 – Illustration of trends with solution and in the reference situation in a context of new demand. In this context, the historic situation is zero.

2) If the solution is implemented in a context of existing demand

The solution is implemented in an existing system and either **optimizes** the system or **replaces** all or part of the system.

a. If the solution optimizes an existing system:

- If the optimization of the existing system **is not required by regulation**, the reference scenario is the **previous situation**, that is to say the extension over time of the GHG emissions of the system if there had been no optimization. *Example: A company carries out* *the thermal renovation of a house, without the owner being legally obliged. The reference situation is the continuous use of the non-renovated house over time.*

- If the optimization of the existing system **is imposed by regulation**, the reference scenario is **the average of market context,** that is to say the average of solutions usually chosen by the market to carry out this type of optimization in the year of completion.

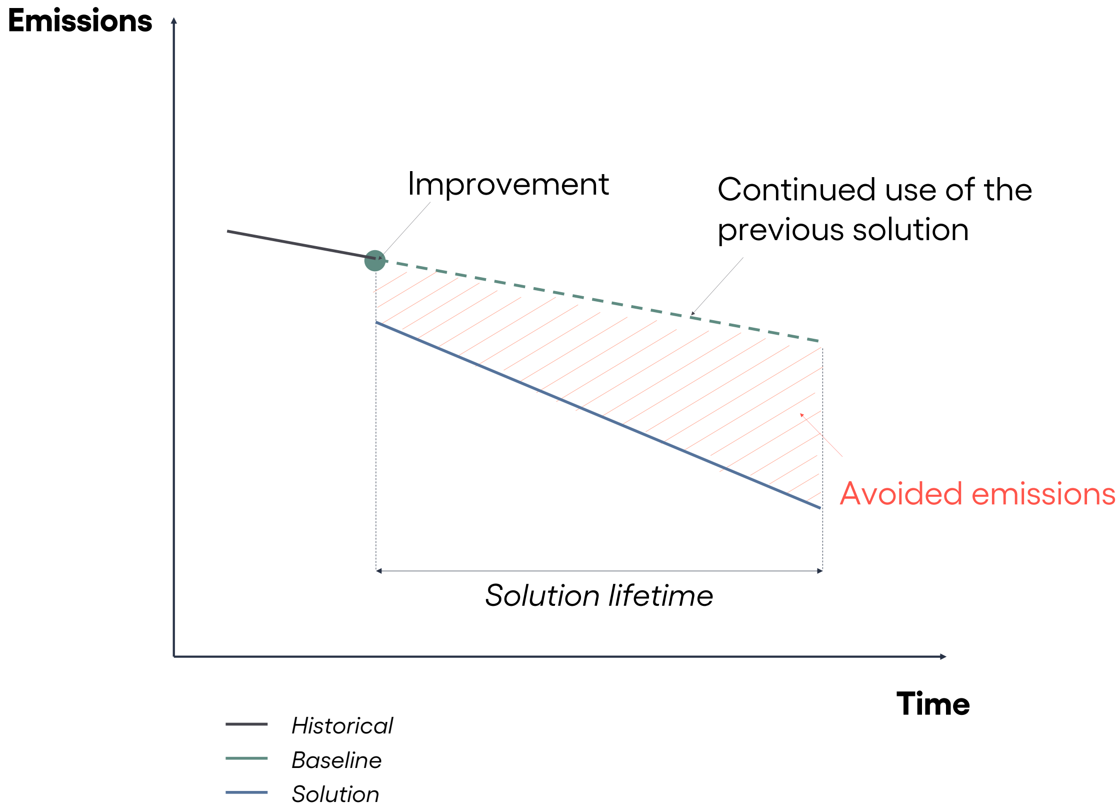


Figure 17 – Illustration of trends with solution and in the reference situation in a context of existing demand, in the case where the solution optimizes an existing system without regulatory requirements.

b. If the solution replaces all or part of an existing system:

- If the replacement takes place **at the end of life of the replaced solution,** the reference situation is the **average of market context**, that is to say the average of the solutions usually chosen by the market to replace the solution in the year of sale.

  Example 1: A company installs a heat pump to replace an old non-functional oil-fired boiler that had to be replaced in a house. The reference situation is the average of emissions of heating solutions currently sold for this type of house.

  Example 2: A company sells an electric vehicle to an individual whose old vehicle was no longer usable. The reference situation is therefore the average of emissions of vehicles of the same range on the market.
- If the replacement takes place **during the normal lifetime of the replaced solution** (early replacement):

- If the replacement **is not required by regulation**, the reference situation is:
  - From the year of transaction until the theoretical end of life of the replaced solution**: the previous situation**, that is to say the continued use of the replaced solution.
  - From the end of the theoretical life of the replaced solution until the end of life of the replacement solution: **the average of market context**, that is to say the average solution usually chosen by the market to replace the solution in the year of the theoretical end of life of the replaced solution.

- If the replacement **is required by regulation**, the reference situation is the **average of market context**, that is to say the average solution usually chosen to replace the solution in the year of sale.

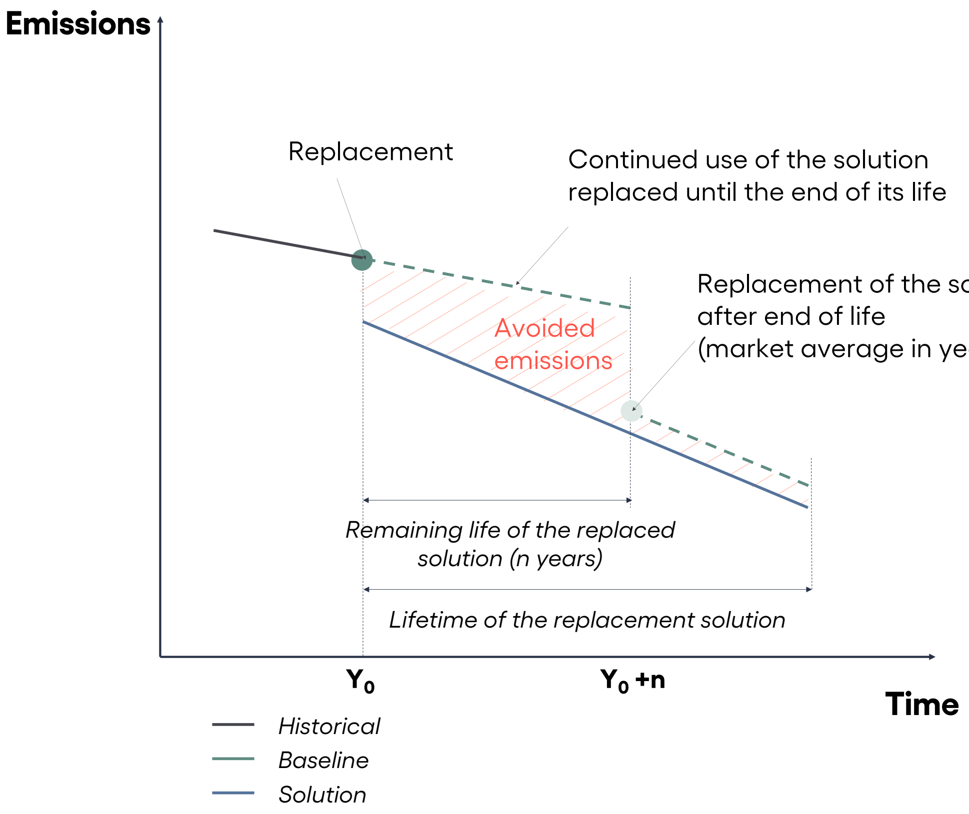


Figure 18 – Illustration of the trends with solution and in the reference situation in a context of existing demand, in the case of an early replacement without regulatory requirement.

EVOLUTION OVER TIME

If the calculation is performed over the lifetime of the solution, the **decarbonization of energy** over the defined time period must be taken into account in the calculation of generated emissions in the reference situation.
The possible **loss of performance** of the equipment of the reference scenario must be taken into account in the calculations.

LEVEL OF PRECISION OF THE CALCULATION

The level of precision of the calculation of the reference situation depends, as with the calculation of the situation with the solution, on the information available publicly and within the company and the complexity of the calculation for the company.

The Net Zero Initiative distinguishes three approaches that correspond to the available level of precision and companies are advised to always aim for the highest level of precision possible.

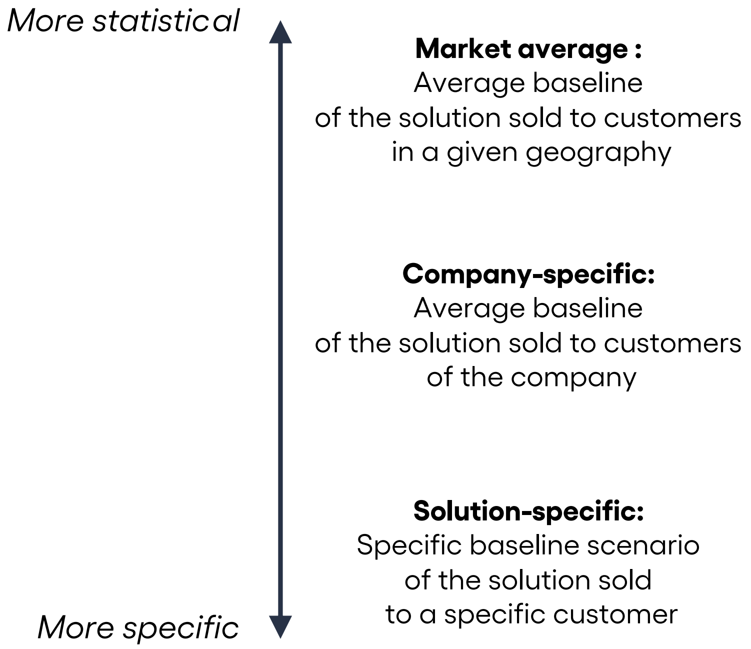


Figure 19 – Different levels of precision for the calculation of the reference situation.

Approach	Precision	Description
Complete	**High** – ideal approach recommended by Net Zero Initiative, to be adopted when the data available allows it and if the calculation is not too time consuming.	Reference situation specific to each client that purchases a solution from the company. The company must carry out a detailed calculation for each sale and be well-informed of the context.
Company average	**Average** – the approach to be taken if it is too complicated to calculate a specific reference situation for each solution sold.	Average reference situation for a given solution of the company and for a given market. The company must perform a detailed calculation, by considering a reference scenario by range of solutions and by markets in which the solutions are sold.
Market average	**Low** – the approach to be taken for a preliminary assessment of avoided emissions.	Average reference situation of the solution on a given market. In this approach, the reference situation is not specific to the company, so it can be standardized for a given geographical area and for a given solution.

Table 4 - Description of levels of precision for calculating the reference situation.

NB: In the market average approach, **the reference scenario does not depend on the company but only on the context**. It is therefore possible to build a standardized database of average reference scenarios for a given solution and a given geographical area.

For more information on the rules for calculating the reference situation, you should refer to the toolbox provided in the section *Pillar B*. This toolbox explains the calculation rules for several families of solutions in three sectors: Mobility, Construction and Energy.

Step 3 – Calculating avoided emissions

PRINCIPLE

The avoided emissions are calculated by taking the difference between the emissions of the reference situation (step 2) and the emissions with the solution (step 1):

Avoided emissions
=
Emissions in the reference situation – Emissions in the situation with the solution

The emissions of the reference situation and the solution can very well be calculated with different levels of precision. For example, the situation with the solution can be calculated with a company average approach, and the reference situation with a market average approach.

Notion of avoidance factor

In the market average approach, **neither the scenario with the solution nor the reference scenario depend on the company**. They depend only on the solution and the geographical area in which it is deployed. Thus, for a given solution and a given geographical area, **it is possible to build a standardized database giving the quantity of average avoided emissions for the sale of one unit of the solution.** These numerical factors are called "**avoidance factors"** (AFv).

The Net Zero Initiative, in the section *Pillar B*, offers the first generation of Avoidance Factors (AFv) for several solutions deployed in France. These avoidance factors are voluntarily conservative, in order to encourage companies to calculate their own avoided emissions with a higher level of precision: using the complete approach or average company approach.
In this report, the Net Zero Initiative proposes the first version of the AFv database comprising sixty entries. This database can be enriched in the future for other solutions and other geographical areas.

TAKING INTO ACCOUNT DIFFERENT TYPES OF AVOIDED EMISSIONS: CALCULATING THE SHARE OF AE_R AND AE_{LI}

Once the avoided emissions have been calculated, it is necessary to calculate the share of avoided emissions made up by the AE_R and the share made up by the AE_{LI}. This share is calculated as follows:

- If the solution is implemented in a **context of new demand**, 100% of the avoided emissions are AE_{LI}.
- If the solution is implemented in a **context of existing demand**:
  - If the emissions in the reference situation are lower than in the previous situation, 100% of the avoided emissions are AE_R.
  - If the emissions in the reference situation are higher than in the previous situation:
    - The AE_R correspond to the difference between the emissions in the situation with the solution and the emissions in the previous situation, provided that the emissions in the situation with the solution are lower than the emissions in the previous situation.
    - The AE_{LI} correspond to the difference between the emissions in the reference situation and the emissions in the previous situation.

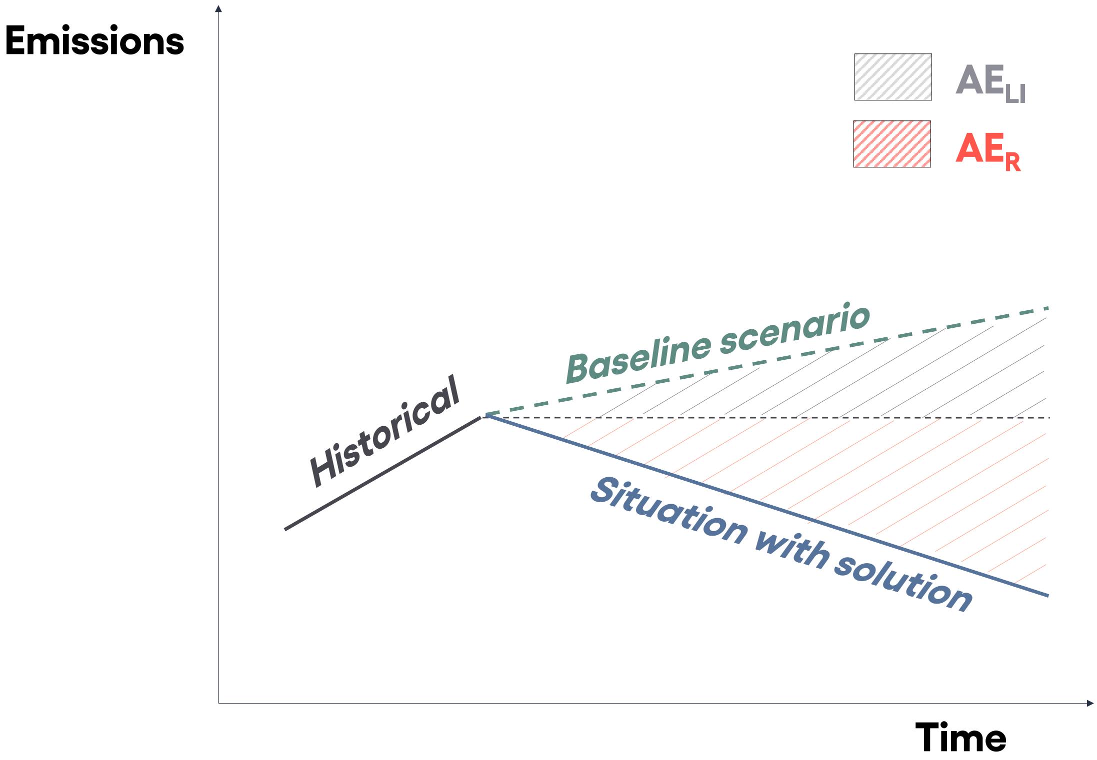


Figure 20 - Illustration of a case where the avoided emissions are a combination of AE-reduction (AE_R) and AE-lower increase (AE_{LI}).

ALLOCATION RULES IN THE CASE OF INTERMEDIATE SOLUTIONS

This mainly concerns companies that do not produce a solution that will be used directly by a final user, but **produce parts or components of such solutions.**

Companies that contribute only to a part of the "solution" system that avoids emissions can claim a fair share of avoided emissions that reflects their level of contribution.

The Net Zero Initiative recommends that companies ensure consistency between the avoided emissions (pillar B) and the induced emissions (pillar A) that they declare. The rule is as follows: the share of emissions avoided by the decarbonizing solution that the company is entitled to claim in its pillar B is equal to the share of emissions of the solution that the company reports in its pillar A[10].

[10] Note that the company must declare in its pillar A the emissions generated by the **decarbonizing solution** and not the emissions generated by all whole situation with the solution.

In general, this share is calculated according to the ratio between the emissions of the component and the total emissions of the solution:

$$\%_{\text{allocation}} = \frac{\text{Life cycle emissions of the intermediate product}}{\text{Life cycle emissions of the final product}}$$

Example of a solution that emits GHG in the use phase
Alpha is a company that produces car seats for electric vehicles (EV) produced by company Beta. As a supplier, Alpha wishes to claim a share of avoided emissions generated by the EV that it equips. In the reporting of its carbon footprint, Alpha only accounts for 1% of the emissions of EV in their lifecycle linked to the share of the weight of the seat in the total weight of the car. Therefore, Alpha only claims 1% of the total emissions declared by Beta.

Example of a solution that emits nothing in the use phase
Alpha is a company that produces saddles for bicycles produced and sold by company Beta. As a supplier, Alpha wishes to claim a share of the emissions avoided generated by the bicycles it equips. The saddle represents 5% of the GHG of the bicycle during its lifetime. Therefore, Alpha can claim 5% of the total avoided emissions declared by Beta for the sale of these bicycles.

It should be noted that the allocation ratio is relevant only when the solution is a share of the decarbonizing solution that avoids emissions. The company that sells the complete solution can declare 100% of the avoided emissions of this solution. The company that sells a part of the solution can declare a part of the avoided emissions corresponding to the rules set above.

The risk of double counting (the seller of the final product claims 100% of the AE, and that of the intermediate product x%; the sum exceeds 100%) is not a problem, no more than double counting in scope 3 (pillar A).

Reporting and using avoided emissions

Consolidating avoided emissions at the company level

To calculate avoided emissions at the scale of a company, it is enough to **sum all the avoided emissions by all of its sales.**

Avoided emissions of the company (B2)
=
Sum of the emissions avoided by each solution sold

In the case of the average market approach only, the **avoidance factors** (AFv) proposed by NZI can be used by companies to immediately calculate their avoided emissions, by multiplying the number of sales by the AFv.

Avoided emissions
=
Number of sales of solution X in geographical area Y * AFv specific to solution X and for geographical area Y

Reporting of avoided emissions

The emissions avoided by the company must be strictly separated:
- from the company's carbon footprint (pillar A)
- the company's carbon sinks (C1, C2)
- contributions to the reduction of emissions or absorptions outside of the value chain (B3, C3).

They can be reported visually in the NZI dashboard in category B2.

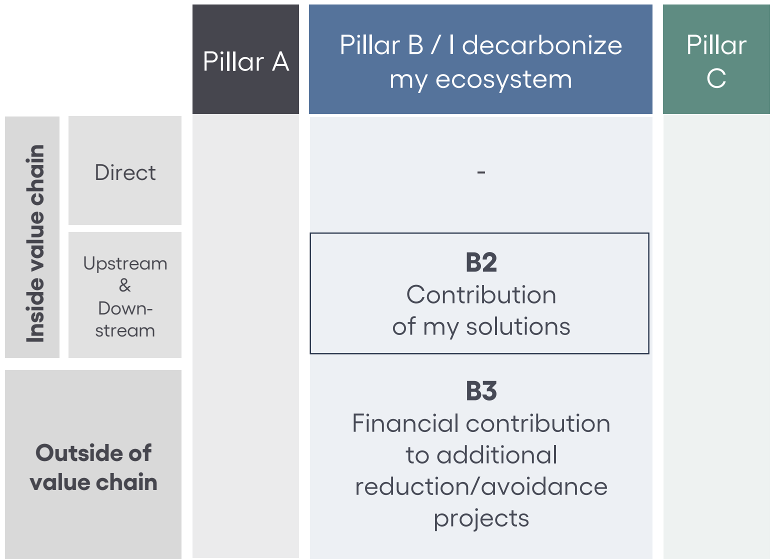


Figure 21 - Localization of reporting avoided emissions in the NZI matrix.

Avoided emissions must never be:
- subtracted from the company's carbon footprint,
- used to claim "carbon neutrality" or "net zero".

In its reporting, the company must ensure the transparency of the **percentage of sales generating avoided emission.**

Companies are encouraged to ensure the transparency of:
- the **methods and hypotheses** used to calculate the emissions of the solution and of the reference,
- whether the calculations have been **verifi**ed, or not, by a trustworthy third party,
- a qualitative estimation of the **quality of the data used,**
- possible **rebound effects**,
- the **limits of the calculations.**

Mandatory indicators	**Recommended indicators**
Share of sales generating avoided emissions.	Total volume of avoided emissions generated by the company, in avoided tCO_2.
Carbon footprint of the company (scope 1+2+3).	"Carbon impact ratio" (CIR), i.e., the emissions avoided by ton of emissions generated by the company (pillar B2 / pillar A).
	Breakdown of avoided emissions between AE_R (reductions) and AE_{LI} (lower increase).

Table 5 – Overview of indicators recommended relating to avoided emissions.

Communication on avoided emissions

Communications relating to avoided emissions must always be associated with the **percentage of sales they represent within the total sales of the company.**

Bad practices	Good practices
"We have avoided 100 tCO_2e this year."	"We have avoided 100 tCO_2e this year, thanks to products representing 17% of our sales."
"We are carbon neutral: we avoid as many emissions as we emit."	"Our Carbon Impact Ratio (CIR) is 1: we avoid as many emissions as we emit."
	"Out of our total avoided emissions, 65% have triggered a genuine reduction of emissions into the atmosphere."
	"For a ton of CO_2e emitted in our value chain, our solutions avoid 2.3 tons of CO_2e."

Table 6 – Examples of good and bad communication.

Using avoided emissions as a strategic decision indicator

In addition to their simple use for environmental reporting and communication, avoided emissions can and must be considered as a **powerful tool for identifying business opportunities** linked to the need to reduce emissions in our society, and as a **catalyst for reinventing the company's business model**. Avoided emissions can be seen as a tool for transforming companies to align them with the global 1.5°C target.

Companies must aim at **maximizing their avoided emissions**. Pushing to obtain the largest volume possible of avoided emissions:

- **guarantees the relevance of one's products and services** in a context of global net zero;
- **maximizes the impact** of one's solutions, by focusing on the context of selling the most decarbonizing products (location, type of clients, etc.).

Limits of avoided emissions and proposal for a new indicator

Claiming avoided emissions does not necessarily mean that the products and services sold by a company are relevant in a carbon neutral world.

Indeed, **some activities are intended to reduce the emissions of highly emissive activities.** For example, some companies offer maintenance services for gasoline powered vehicles to extend their lifetime and sometimes reduce their consumption. This effectively reduces emissions of clients and can entitle the company to claim avoided emissions. However, it is important to note that an activity that depends on combustion engine cars is not one destined to last in the long run in a world aiming to achieve global net zero. Some activities – and maintenance of gasoline powered cars is one of them – **have a short-term utility for reducing emissions but will have to shrink in the long term if we are to comply collectively to upholding our climatic commitments.**

This chart illustrates the four situations that can arise:

1) A product or service contributes to a low-carbon use and avoids emissions,
2) A product or service contributes to a carbon-intensive use and avoids emissions,
3) A product or service contributes to a carbon-intensive use and adds emissions,
4) A product or service contributes to low-carbon use and adds emissions.

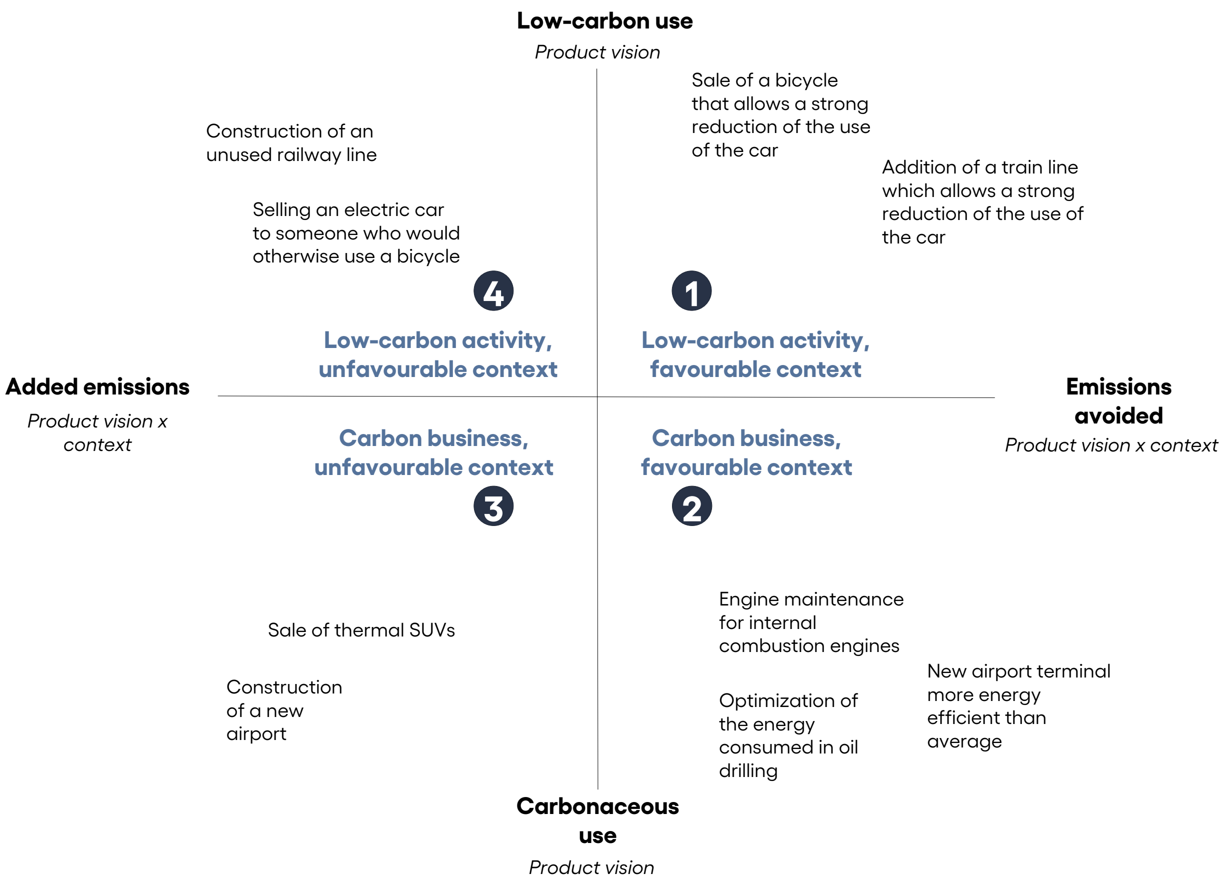


Figure 22 - Illustration of the difference between decarbonized effect (avoided emissions) and the decarbonized nature of a specific use.

Cases 1 and 3 are more intuitive:

- **Case 1:** the contribution to low-carbon uses such as bicycle and train mobility most often lead to avoided emissions;
- **Case 3:** It is logical that the contribution to carbonized uses by the sale of a gasoline powered SUV or the construction of an airport does not avoid emissions.

Cases 2 and 4 can be explained as follows:

- **Case 2:** as explained above, emissions can be avoided by optimizing carbonized uses. Although this is necessary in the short-term, these are activities that are destined to shrink progressively as the low-carbon transition continues.
- **Case 4:** Finally, case 4 is possible since the calculation of avoided emissions depends on the context of sales, which is more or less favourable. An activity that contributes to a low-carbon use in appearance can in fact be harmful for the climate if it is not implemented in a context in which it is useful.

Consequently, **using as basis avoided emissions alone to build a product strategy compatible with low-carbon transition leads to a poor understanding of the challenge.** The Avoided Emissions indicator must be enhanced to raise the climatic action ambition of companies. To this end, this year NZI has created a new indicator aimed at measuring the alignment of a product or service with low-carbon transition whose calculation is described in the publication *Proposal of a new climate indicator: Compatibility of solutions with the Paris Agreement*. NZI's work will refine this indicator and provide companies with the keys to calculating it easily.

B3 – Financial contribution outside the value chain

B3 – Financial contribution outside the value chain

The aim of this section is to account for the impact, in terms of avoided emissions, of a firm's financial contribution to projects outside its value chain.

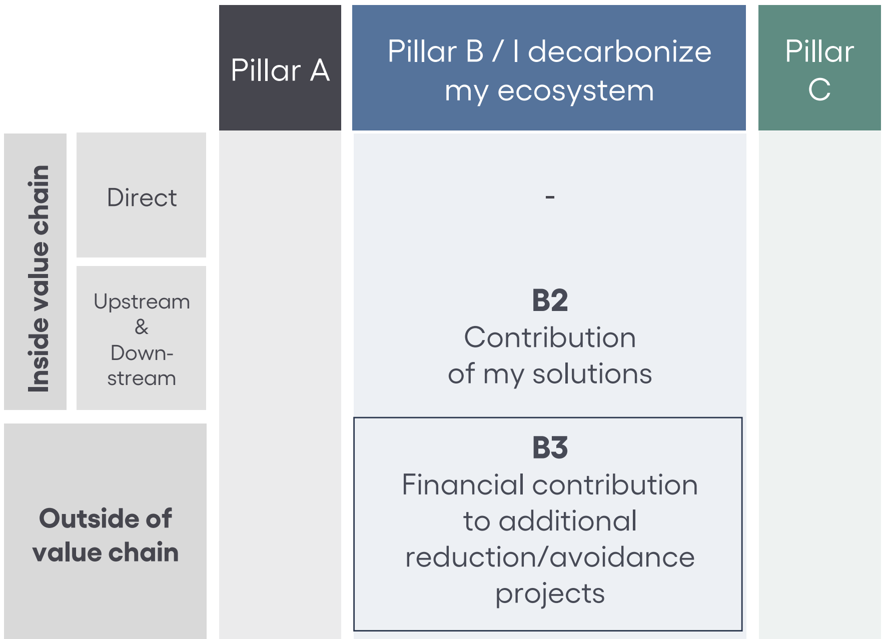


Figure 23 – Financial contribution to additional reduction/avoidance projects outside the value chain: pillar B3.

Types of objects that can be included in B3

Several objects can *a priori* be entered in category B3:

- **The funding of certified projects:**
  - Carbon credits for "reduction/avoidance"
- **The funding of non-certified projects:**
  - Purchases of emission reduction units (non-certified carbon credits)
  - Direct funding of low-carbon projects
  - The purchase of low-carbon energies (in particular via GO and PPA)
  - The purchase of green bonds
  - The funding of energy efficiency certificates (EEC).

1st category: funding certified projects (carbon credits)

The first example is the most traditional: an organization that wants to support net zero carbon transition outside its value chain chooses to fund an emission reduction project by purchasing "carbon credits" on the voluntary carbon market (VCM) and retiring them (*retirement*).

These carbon credits are the tangible proof of the reality, verifiability, credibility and additionality of the project. In compliance with the principle of the Net Zero Initiative, the organization must not claim the *ownership* of the carbon gain achieved (and thus use them for "offsetting" or "cancellation"), but can nonetheless claim the paternity of its funding[11].

Certifications can come from voluntary international (Gold Standard, Verra, Plan Vivo, etc.) or national (Label Bas Carbone, FES-CO2, Woodland Carbon Code, etc) labels.

Example: *Company Alpha, a property company, decides to contribute to the French goal of carbon neutrality by purchasing "Low Carbon" credits (for instance, the Label Bas Carbone) stemming from the thermal renovation projects of buildings. It enters this contribution in category B3 as "Funding certified carbon projects".*

[11] Or, more exactly, the paternity of the additional part of its funding (i.e., which allowed starting the project).

2nd category: funding non-certified projects

In this example, the organization chooses to provide financial support for low-carbon projects that are not specifically endowed with official labelling by an existing standard, but whose robustness has been verified by a third-party organization according to a recognised methodology.

Several cases can occur.

1. **Purchase of emission reduction units (URE)** from a project not certified by a standard, but calculated and validated by a third party according to an existing recognised methodology.

Example: *an improved cookstove project is recognised by an independent auditor according to a rigorous and official methodology as avoiding emissions. Non-labelled emission reduction units are issued and purchased by company Alpha and withdrawn.*

2. **Direct funding of carbon projects** whose reductions have been calculated and validated by a third party according to a recognised existing methodology. An allocation of avoided emissions must be accorded pro rata the funding.

Example: *the company Alpha invests directly in a project to reduce emissions validated by an external auditor according to an official methodology. It annually claims part of the total avoided emissions pro-rata its funding.*

3. **Taking out energy contracts (electricity, biogas, heating, etc.) under certain conditions.**

Accounting low-carbon energy purchases in pillar B3 depends on the type of contract. At this stage, three examples can be distinguished: the purchase of Guarantees of Origin (GO), Power Purchase Agreements (PPA), and self-consumption.

The accounting rules for purchasing green electricity feature in the part "Toolbox of Pillar B" of this report. A copy is shown below.

Guarantees of origin (GO)	Power Purchase Agreements (PPA)	Self-consumption
Location-based approach ▪ **Pillar A:** no Pillar A earnings ▪ **Pillar B**: no avoided emissions (additional development of low-carbon energy generation capacity is not demonstrated) **Market-based approach** ▪ **Pillar A**: count a gain in Pillar A when there is spatial and temporal coherence between production and consumption ▪ **Pillar B**: no avoided emissions (additional development of low-carbon energy generation capacity is not demonstrated)	**Location-based approach** ▪ **Pillar A:** no Pillar A earnings ▪ **Pillar B**: counting EEs as a financer of new low-carbon production means. Each kWh purchased gives the right to EE by comparison with the average network mix (see methodology Family 1). **Market-based approach** ▪ **Pillar A**: count the emissions induced by the contracted means of production for each kWh consumed. ▪ **Pillar B**: do not count any avoided emissions because the entire carbon gain belongs to the company and not to others. In the case where part of the production is not consumed by the company, count X% of the EE of the financed means of production, with X the share of surplus production injected into the network.	**Location-based and market-based approaches merge** ▪ **Pillar A:** count the emissions induced by the contracted means of production for each kWh consumed. ▪ **Pillar B**: do not count any avoided emissions because the entire carbon gain belongs to the company and not to others. In the case where part of the production is not consumed by the company, count X% of the EE of the financed means of production, with X the share of surplus production injected into the network.

Figure 24 – Accounting rules for purchasing green electricity.

***Example**: Company Alpha decides to power itself with low-carbon electricity. It signs a "Virtual PPA" contract with an electricity supplier, which starts building additional low-carbon capacity in the country of installation. Since there is no physical link between the production site and the Alpha site, electricity cannot be accounted as zero in scope 2 "location-based". Alpha therefore reports its scope 2 emissions as a function of the mix of the country. However, Alpha can claim that it has contributed to the global decarbonization of the country's mix via the construction of this power plant. It calls on an external auditor to calculate the emissions this new capacity can avoid at the scale of the country.*

4. **Purchase of green bonds,** provided that it is possible to exactly quantify the reduction of the emissions by each euro of bonds using a transparent and recognised methodology.

***Example**: Company Alpha purchases green bonds issued by a railway operator, which beforehand assessed the ton of CO_2 avoided by each euro of bonds by an independent third party, according to an official and recognised methodology.*

5. **Funding of projects generating energy efficiency certificates (EEC)**, provided that the conversion of kWh CUMAC (CUMAC = cumulated and updated, TN) into tCO_2e is done using a transparent and recognised methodology.

Example: *company Alpha funds projects to optimize boilers generating EEC, and converts them into GHG gains by an external auditor.*

Reporting B3 actions

With regards to the funding of projects outside the value chain, companies must communicate:

- the **quantity of avoided emissions generated** that they have contributed to (in avoided tCO_2e);
- the **amount of funding** associated (in monetary units);
- the **cost of a ton of CO_2 avoided** (i.e., the ratio of the first two indicators).

If the projects supported are long-term projects (R&D) whose impact is difficult to quantify, or "practice-based credits"[12], then it is possible to communicate only an **approximate amount of avoided emissions generated.** This approximation is not a problem since category B3 is not used to "offset" the company's emissions in pillar A.

NZI recommends the following type of communication:

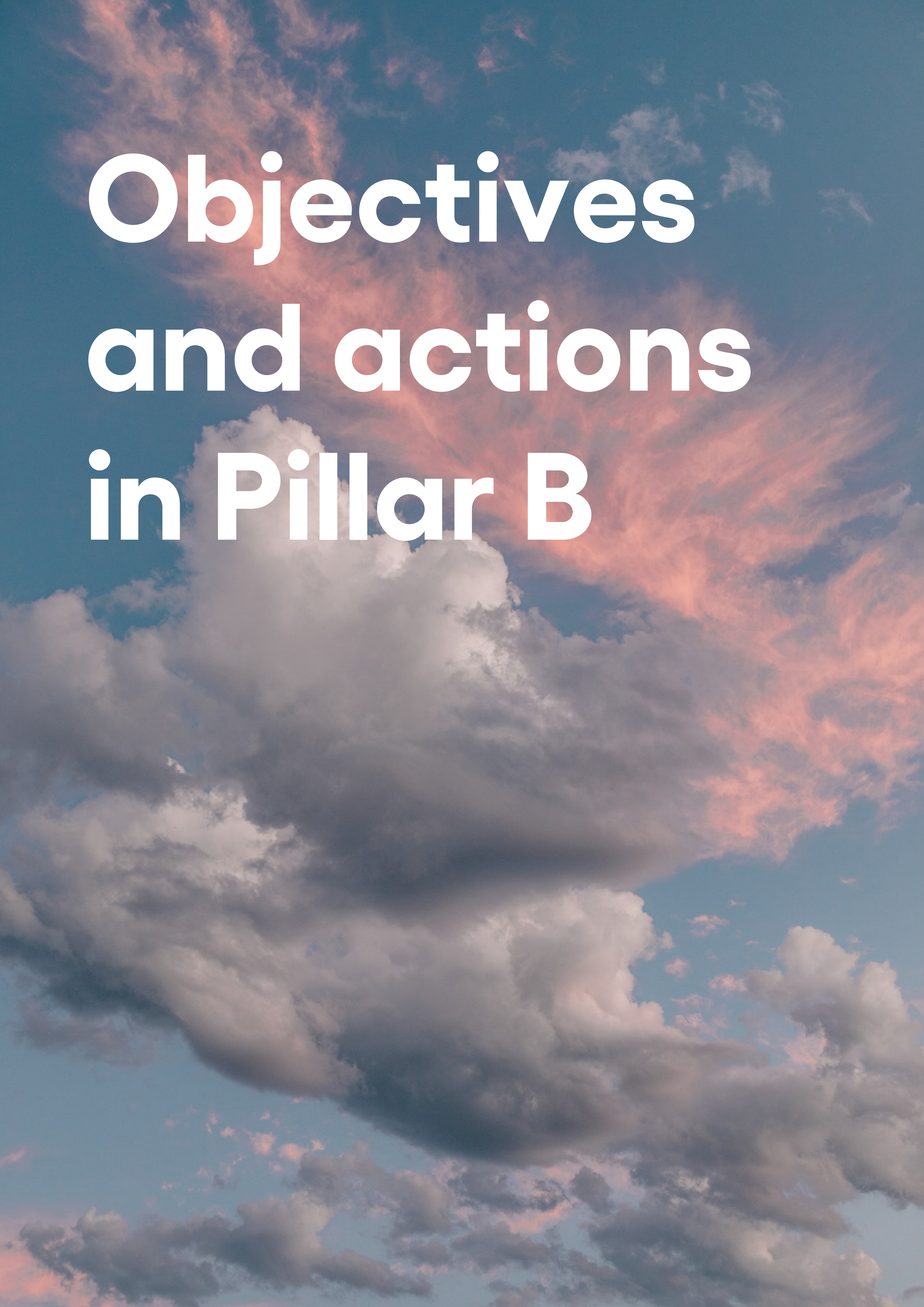
"This year, we have avoided the emission of XX tCO_2e through our funding of YY k€ in favour of low carbon projects. The average cost per ton avoided is YY/XX k€/tCO_2 avoided".

The Net Zero Initiative recommends always making the distinction between avoided emissions corresponding to a real reduction (EE_R), and avoided emissions that express only a lower increase in comparison to the previous situation (AE_{LI}).

Moreover, it is not possible to subtract this quantity of avoided emissions from Pillar A of NZI reporting, since the three pillars are strictly independent.

[12] Carbon Market Watch (2020), *Above and Beyond Carbon Offsetting – Alternatives to Compensation for Climate Action and Sustainable Development*

Objectives and actions in Pillar B



Setting a target in Pillar B

These developments will be carried out during 2022 by NZI.

Monitoring and managing Pillar B

These developments will be carried out during 2022 by NZI.

Pillar B Toolbox

Pillar B Toolbox

Contents

This toolbox centralizes the results of the sectoral methodological work. Three sectors are covered in the present report: Mobility, Construction and Energy. The toolbox provides sector-specific methodological sheets on avoided emissions.

Several families of decarbonized solutions have been identified for each sector. Each family corresponds to a solution-context typology for which a certain level of homogeneity has been identified in the reference situations. These solutions are therefore dealt with in a similar manner.

For each of these families, an explicit methodological sheet sets out a rigorous method to calculate emissions using a solution belonging to this family.

Finally, for certain families, specific solutions have been studied and methodological sheets for these solutions are also provided. These "Solution Sheets" supply quantitative applications of avoided emissions using an average market approach in France, i.e., the **avoidance factor (AVf)** associated with this solution.

Sector 1: Mobility

No	Family	Description	Specific solutions studies	Avoidance factor in France
1	**Decarbonizing existing vehicles**	Products and services that reduce emissions generated by **existing vehicles.** These solutions act on the **motorization** and/or **the energy efficiency of existing vehicles**.	Eco-maintenance of cars	Yes
2	**New vehicles**	Products and services that reduce transportation emissions through **new vehicles,** without modal transfer. These solutions enable the sale of **vehicles that emit less, that are lighter** and/or **more energy efficient,** for example.	Electric vehicle	Yes
3	**Densification of transportation**	Products and services that reduce carbon intensity in a given mode through the **improvement of the occupancy/load ratio**.	Car sharing	Yes
4	**Modal transfer**	Products and services that reduce the carbon intensity of transportation through **modal transfer to other less carbon-intensive ones**.	Bicycle	Yes
			Train for a new line	Yes
5	**Reduction of transportation needs**	Products and services that reduce the emissions of the transportation sector through r**educing transportation needs**.	None	-
6	**Decarbonizing energy vectors**	Products and services that reduce the emissions of the mobility sector by **decarbonizing energy vectors.** → **Covered in Sector 3: Energy**	-	-

Table 7 – Summary of families of solution analysed, the specific solutions covered and the AEv calculated for the Mobility sector.

Mobility Sector

Family #1:
Decarbonizing existing vehicles

Products and services to reduce emissions from **existing vehicles.** These solutions act on the **motorization** and/or **the energy efficiency** of **existing vehicles**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, for **each solution sold** :

- **Manufacturing** and **end-of-life** emissions of the decarbonising solution
- The **use phase** emissions of **the modified vehicle** over its **remaining lifetime taking into** account the **new performance**, after the introduction of the decarbonising solution. If the decarbonising solution extends the lifetime of the vehicle, the **additional lifetime** shall be taken into account
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonising solution are amortised over the **remaining life of** the modified vehicle. **One year** of amortization is considered.
- The **emissions from** the **use of** the modified vehicle are calculated over **a year** and based on the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, **by range of solution** sold :

- **Manufacturing** and **end-of-life** emissions of the decarbonising solution
- The **average use phase** emissions of the modified vehicles over their **average remaining lifetime taking into** account the **new average performance**, after the introduction of the decarbonising solution. If the decarbonising solution extends the life of the vehicle, the **additional average life** shall be taken into account
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonising solution are amortised over the **average remaining life of** the modified vehicles. **One year** of amortization is considered.
- The **average emissions from** the **use of** modified vehicles are calculated over **a year** and based on the **actual emission factors of the energy in the reporting year.**

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 1

Emissions in the situation with the solution (E_{sol})

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

Baseline emissions calculations must consider, for **each solution sold** :

- The emissions from **the use of the modified vehicle** over its **residual life,** taking into account its **past performance** before the implementation of the decarbonising solution.
- If the decarbonising solution extends the life of the vehicle, the **manufacturing**, **use** and **end-of-life** emissions of the new vehicle that would have replaced the modified vehicle, **prorated for the additional life of** the modified vehicle provided by the decarbonising solution
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **emissions from** the **use of** the modified vehicle are calculated based on the **actual emission factors of the energy in the reporting year** and accounted for annually **during its initial residual life.**
- If the decarbonising solution extends the life of the vehicle, the **manufacturing, use** and **end-of-life** emissions of the new vehicle that would have replaced the existing vehicle are amortized **over its lifetime**. **One year's** amortization shall be considered over **the additional lifetime.**

Company-specific approach

Lifetime calculation

Baseline emissions calculations should consider, by **range of solution sold** :

- The **average use phase** emissions of the modified vehicles over their **average remaining life, taking** into account the **average past performance**, before the implementation of the decarbonising solution.
- If the decarbonising solution extends the life of the vehicle, the **average manufacturing**, **use** and **end-of-life emissions** of the new vehicles that would have replaced the modified vehicles, **pro-rated to the average additional life** provided to the modified vehicles by the decarbonising solution
- **Future decarbonization of** energy carriers over the analysis period[1]

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- **Average emissions from vehicle use** are calculated based on **actual energy emission factors at the reporting year** and accounted for annually **over their average initial residual life.**
- If the decarbonising solution extends the life of the vehicle, the **average manufacturing, use** and **end-of-life emissions** of the new vehicles that would have replaced the modified vehicles shall be amortised over **their average life**. A **one-year** amortization is considered over **the additional average life.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 3

Calcu-lation of avoided emissions (AE)

The emissions avoided by a piece of equipment are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

It is possible to cross-reference the accuracy levels for the calculation of avoided emissions.
E.g.: the scenario with the solution may have been calculated with a company-specific approach and the baseline scenario with a market average approach.

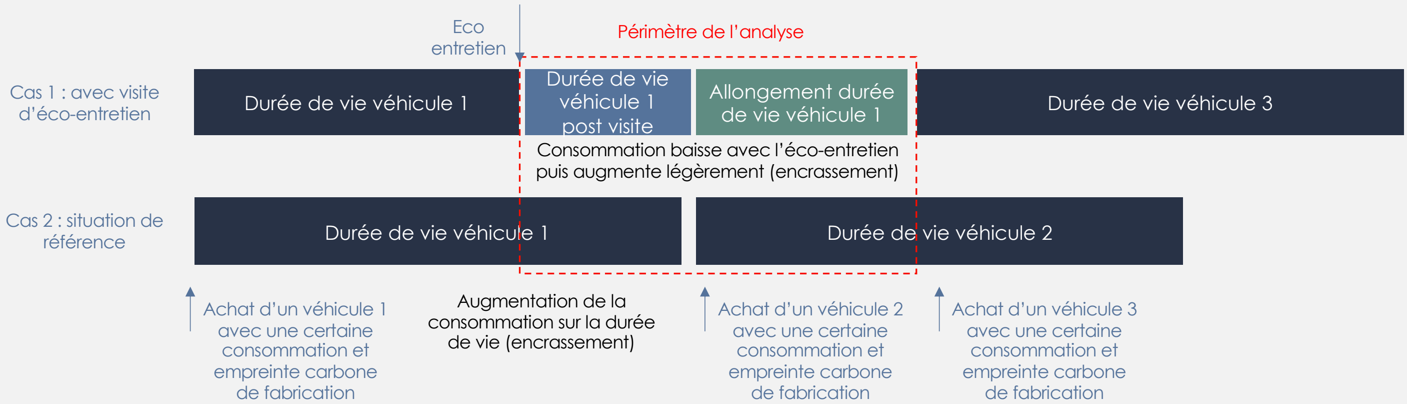
Since the emissions after vehicle modification are reduced compared to the previous situation (existing demand context), **100% of the avoided emissions in this family are of the "real reduction" type (AE_R).**

The avoided emissions calculated at the solution level can then be **multiplied by the number of solutions sold** to get the **company-wide total**. In some cases, a company will **only** need to count **a portion of the emissions avoided by the solutions it contributes to**, as described in the report.

Solution analysed n°1
Eco-maintenance of cars

Reduced emissions from the mobility sector due to **lower fuel consumption of eco-maintained vehicles and the extension of their service life.**

The carbon gain is calculated as the **difference in induced emissions between the situation with the eco-maintenance visit and the baseline scenario.**



Emissions from the eco-maintenance situation = Emissions from the eco-maintenance visit + Emissions from the use of the vehicle that received the eco-maintenance visit over its remaining life (remaining life + additional life)

Baseline emissions = Vehicle use phase emissions if the eco-maintenance visit did not take place + Vehicle 2 use phase emissions over the additional life allowed by the eco-maintenance visit on vehicle 1 + Vehicle 2 manufacturing and end-of-life emissions prorated for the additional life allowed by the eco-maintenance visit on vehicle 1 over its total life

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of each eco-maintenance visit. Requires a life cycle calculation.
Specific use phase emissions of the modified vehicle (vehicle 1)**.** Requires systematic **collection of customer data** on the following topics:
- Vehicle **consumption** after eco-maintenance
- **Age** of the vehicle

Then the following data can be **estimated**:
- **Residual life** of the modified vehicle, based on an average total life for vehicle 1 (depending on model, segment, etc.)
- **Additional life**, based on information on the average life extension of vehicles through the company's eco-maintenance service.

⋮

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach

Average carbon footprint of eco-maintenance services offered by the company. Requires life cycle calculation on representative cases, ideally by vehicle range.
Average use phase emissions of modified vehicles (vehicle 1), ideally by vehicle range. Requires data collection from a representative pool of customers on the following topics:
- Vehicle **consumption** after eco-maintenance
- **Age of** the vehicle

Then the following data can be **estimated**:
- **Residual** vehicle life, based on an average total life for modified vehicles (depending on models, segments, etc.)
- **Additional life**, based on information on the average life extension of vehicles through the company's eco-maintenance service.

Market average approach

Average carbon footprint of eco-maintenance visits in the **considered geography.**
Average use phase emissions of modified vehicles (vehicle 1), determined from the following data
- Average age of vehicles receiving an eco-maintenance visit
- Average early life consumption of vehicles with the average age
- Average fuel consumption deterioration of an average age vehicle compared to the consumption at the beginning of its life
- Average gain in consumption from an eco-maintenance visit
- Estimated increase in vehicle life due to eco-maintenance

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Baseline scenario specific to each client who benefits from an eco-maintenance visit.
In-use phase emissions specific to the existing vehicle and **life cycle emissions specific to** the vehicle that will replace it. Requires a systematic customer survey on the following topics:
- Vehicle **consumption** before the eco-maintenance visit
- **Age of** the vehicle and **residual life of** the vehicle
- **Model of the vehicle** likely to be purchased at the end of life of the vehicle receiving the eco-maintenance visit, in order to estimate its **life cycle emissions** in proportion to the remaining life of the existing vehicle (including additional life)

Company-specific approach

Baseline scenario specific to the company, or even to each range of vehicle processed.
Average use phase emissions of existing vehicles and **average life-cycle emissions** of vehicles that will replace them, ideally by vehicle line treated. Requires a survey of a representative pool of customers on the **same topics as for the unitary approach.**

⋮

Step 2

Emissions in the baseline scenario (E_{ref})

Market average approach

Average baseline scenario for an eco-maintenance visit in France, calculated from the following information:
- Average **weight** of a vehicle passing the eco-maintenance visit
- Average **consumption of** vehicles before the eco-maintenance visit and comparison with consumption after the eco-maintenance
- Average **age of** a vehicle passing the eco-maintenance visit and **remaining life of** the vehicle (+ estimated extension of the life of the vehicle due to eco-maintenance)
- Average **mass** and **fuel consumption** of the vehicle likely to be purchased at the end of the life of the vehicle benefiting from the eco-maintenance visit

Step 3

Calcu-lation of avoided emissions (AE)

Solution-specific approach

For **each eco-maintenance visit**, **specific avoided emissions** are calculated by the difference between the emissions of the baseline scenario and the situation with the eco-maintenance visit.
These are only **avoided emissions - real reduction** (AE_R)

Company-specific approach

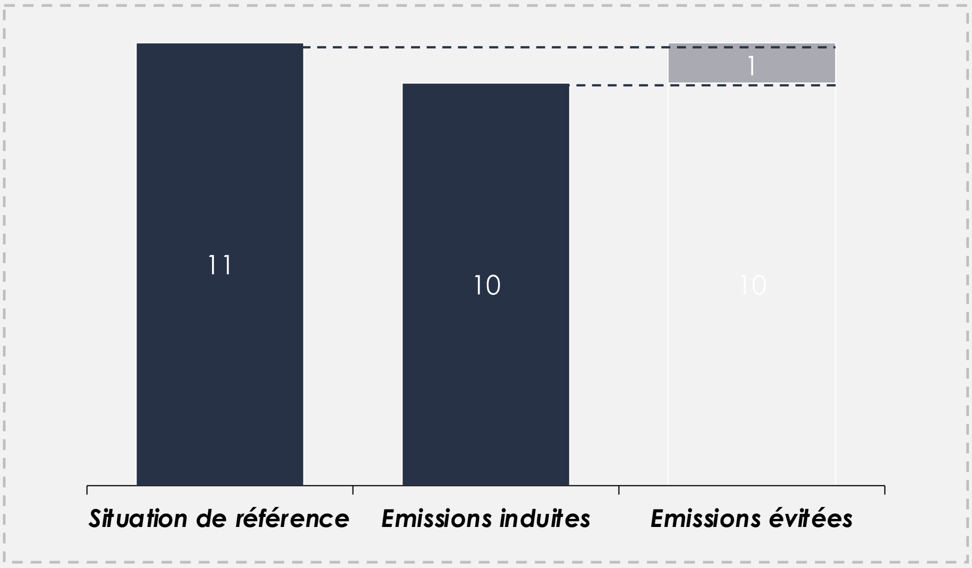
Company-specific avoided emissions shall be calculated as the difference between the emissions of the baseline and eco-maintenance visit situations. Where possible, specific avoided emissions for the main ranges of vehicles serviced are calculated.
These are only **avoided emissions - real reduction** (AE_R)

Market average approach

The average avoided emissions estimated in France for an eco-maintenance visit are calculated by the difference between the emissions of baseline scenarios and situations with an eco-maintenance visit.
These are only **avoided emissions - real reduction** (AE_R)

Result graph

1. **Summary of eco-maintenance results| tCO2e**



Avoidance factor for an eco-maintenance visit: **1.0 tCO_2 e**

Family #2:
New vehicles

Products and services to reduce transport emissions through **new vehicles,** without modal shift. These solutions allow the sale of **less emissive, lighter** and/or **more energy efficient vehicles** for example.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, for **each solution sold** :

- Emissions from the **manufacture**, **use** and **end of life** of the decarbonising solution (e.g. new vehicle), over its entire life span
- **Future decarbonization of** energy carriers over the life of the vehicle[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, by **range of solution sold** :

- Emissions from the **manufacture**, **use** and **end of life** of the decarbonising solution (e.g. new vehicle), over its entire life span
- **Future decarbonization of** energy carriers over the life of the vehicle[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

- **If replacement occurs at the end of life or is required by regulation: the baseline is** the average carbon footprint (life cycle) of equipment on the market that performs the same function in the year of sale.
- **If the replacement is anticipated :**
  - The baseline is the carbon footprint (life cycle) of the replaced equipment to its conventional end-of-life.
  - After this time, over the remaining conventional life of the replaced equipment, the baseline is the average (life cycle) carbon footprint of equipment on the market that performs the same function as the equipment sold, in the year that the replaced equipment would have reached end of life.

- The **decarbonisation trend of** energy carriers over the lifetime of the decarbonising solution must be considered.[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:
- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

- We consider here a **replacement at the end of life by default.**
- The baseline is the average (life cycle) carbon footprint of equipment on the market that performs the same function as the range of equipment sold by the company in the year of sale.
- The **decarbonisation trend** of energy carriers over the lifetime of the decarbonising solution range must be considered.[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:
- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 3

Calcu-lation of avoided emissions (AE)	The emissions avoided by a piece of equipment are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution: **It is possible to cross-reference the accuracy levels for the calculation of avoided emissions**. E.g.: the scenario with the solution may have been calculated with a company-specific approach and the baseline scenario with a market average approach. The avoided emissions calculated at the solution level can then be **multiplied by the number of solutions sold** to get the **company-wide total**. In some cases, a company will **only** need to count **a portion of the emissions avoided by the solutions it contributes to**, as described in the report.

Solution analysed n°2

Electric vehicle

Reduced emissions from road transport by **replacing carbon-based vehicles with electric vehicles.**

The carbon gain is estimated as the **difference in emissions per kilometre between the replaced vehicle and the electric vehicle.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of each electric vehicle model sold. Requires a **life cycle calculation**.
Essential information:
- Carbon footprint of manufacturing, transport, use and end of life
- Average life of the electric vehicle (in kilometres and years)

Company-specific approach

Average carbon footprint of electric vehicle models sold by the company. Requires **life cycle calculation on representative models**.
Essential information:
- Carbon footprint of manufacturing, transport, use and end of life
- Average life of the electric vehicle (in kilometres and years)

Market average approach

Average carbon footprint for an electric vehicle in France.
Electric vehicle, in life cycle: **81 gCO_2 e/km** (source: Carbone 4)
Average **lifespan of** an electric vehicle: **12 years and 175,000 km** (source: Carbone 4)

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Specific baseline scenario for each customer who purchases an electric vehicle. Requires a **systematic customer survey.**
Essential information:
- Replacement of a vehicle: early replacement, end of life or no vehicle replaced
- Replaced model if applicable
- Model (segment and engine at least) that would have been purchased instead of the electric vehicle
- Annual frequency of use (in km/year) and estimated length of ownership of the electric vehicle purchased

This information, together with the carbon intensities of the various vehicle models, makes it possible to estimate the **quantity of GHGs that would have been emitted without the purchase of the electric vehicle**. The calculation is as follows:

$$\sum_{Type\ of\ car} (Carbon\ intensity\ per\ pkm * Yearly\ mileage\ * Duration\ of\ vehicule\ ownership)$$

⋮

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach

Baseline scenario specific to the company, or even to each range of electric vehicle sold. Requires **partial surveys on a representative pool of customers for each vehicle range.** The information required and the calculation method are identical to the solution-specific approach.

Market average approach

Average baseline scenario for an electric vehicle sold **in France in 2020**: average of **new vehicles** sold in France in 2020.

Breakdown of new vehicles sold in France in 2020 by engine :
(source: Ministry of Ecological Transition)
- Gasoline: **56%.**
- Diesel: **32%.**
- Electric: **7%.**

Carbon performance, on the whole life cycle, of new vehicles sold in France in 2020 by engine[1] :
(source: Carbone 4)
- Petrol: **222 gCO_2e/km**
- Diesel: **271 gCO_2e/km**
- Electric: **81 gCO_2e/km**

This information makes it possible to estimate **the emissions that would have been induced by the carbon vehicle, replaced by the electric vehicle**. The calculation is as follows:

$$Yearly\ mileage\ *\ EF\ of\ replaced\ vehicle * Lifetime\ of\ car$$

Step 3

Calcu-lation of avoided emissions (AE)

Solution-specific approach

For **each sale of an electric vehicle**, specific avoided emissions are calculated as the difference between the amount of GHGs that would have been emitted in the absence of the purchase of the vehicle and the specific carbon footprint of each vehicle model sold.
These are only **avoided emissions - real reduction** (AE_R)

Company-specific approach

For **each range of electric vehicles**, average avoided emissions are calculated as the difference between the amount of GHGs that would have been emitted in the absence of the purchase of the vehicle and the specific carbon footprint of each vehicle model sold.
These are only **avoided emissions - real reduction** (AE_R)

Market average approach

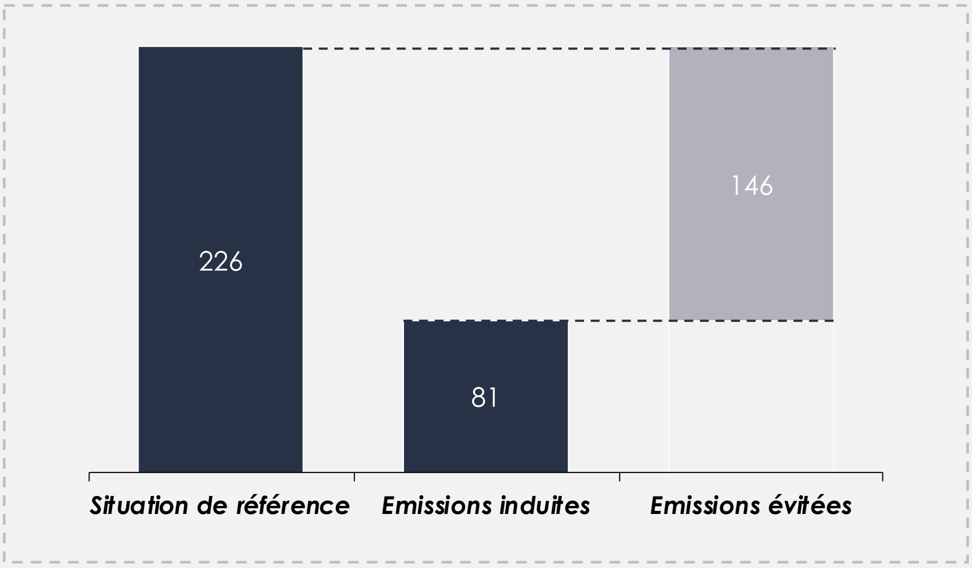
Calculation of **average avoided emissions for the sale of an electric vehicle in France** :
$AE = Emissions\ of\ replaced\ vehicle\ - Emissions\ of\ EV$
These are only **avoided emissions - real reduction** (AE_R)

⋮

(1) The decarbonisation trend of energy carriers is taken into account in the carbon intensities indicated

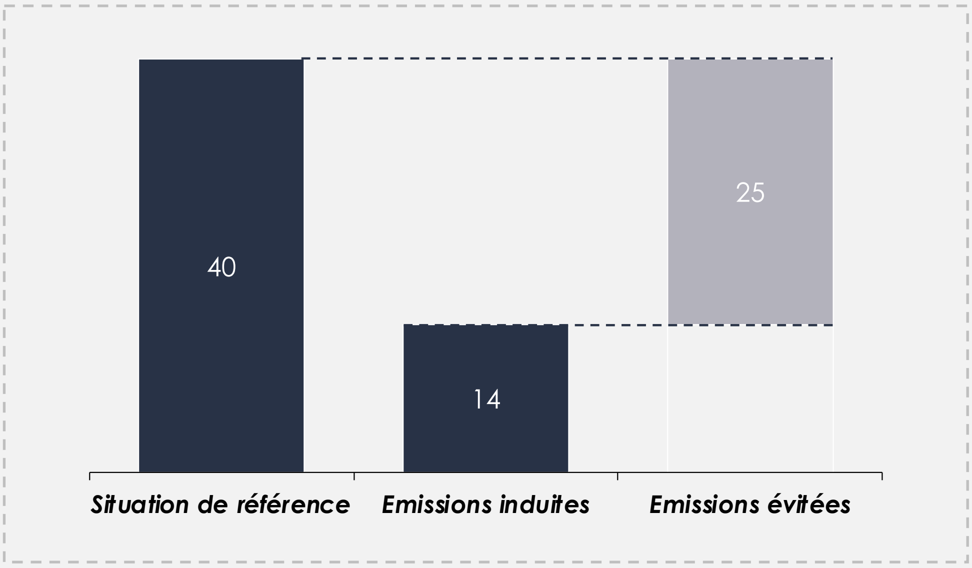
Result graphs

1. **Summary of results for electric vehicles| gCO2e/km**



Carbon intensity **avoidance factor: 146 gCO_2 e/km**

2. **Summary of results for electric vehicles | tCO2e**



Total emissions **avoidance factor: 25 tCO_2 e**

Family #3:
Transportation densification

Products and services that reduce the carbon intensity of a given mode by **improving its occupancy/loading rate**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, for **each solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the densified transport mode **on the trips concerned** by the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the densified transport mode for **the trips concerned** by the decarbonising solution
- The **additional trips generated** by the decarbonising solution (rebound effect)
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the densified transport mode **on the trips concerned** by the decarbonising solution are amortised annually.
- The **emissions from** the **use of** the densified transport mode **on the trips concerned by** the decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, by **range of solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the densified transport mode **on the trips concerned** by the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the densified transport mode for **the trips concerned** by the decarbonising solution
- The **additional trips generated** by the decarbonising solution (rebound effect)
- **Future decarbonization of** energy carriers over the analysis period[1]

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

Similar approach to lifetime calculation, with two particularities:
- The **manufacturing** and **end-of-life** emissions of the densified transport mode **on the trips concerned** by the decarbonising solution are amortised annually.
- The **emissions from** the **use of** the densified transport mode **on the trips concerned by** the decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

Baseline emissions calculations should consider, for **each solution sold** :
- The **manufacturing**, **use** and **end-of-life** emissions of the modes of transport that would have been used in the absence of the densification, **on the trips concerned** by the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the modes of transport that would have been used, for **the trips concerned** by the decarbonising solution
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:
- The **manufacturing** and **end-of-life** emissions of the transportation modes that would have been used in the absence of densification are amortized annually.
- The **emissions from** the modes of transport that would have been used in the absence of the densification are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

Baseline emissions calculations should consider, by **range of solution sold** :
- The **manufacturing**, **use** and **end-of-life** emissions of the modes of transport that would have been used in the absence of the densification, **on the trips concerned** by the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the modes of transport that would have been used, for **the trips concerned** by the decarbonising solution
- **Future decarbonization of** energy carriers over the analysis period[1]

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Annual calculation

Similar approach to lifetime calculation, with two particularities:
- The **manufacturing** and **end-of-life** emissions of the transportation modes that would have been used in the absence of densification are amortized annually.
- The **emissions from** the modes of transport that would have been used in the absence of the densification are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 3

Calculation of avoided emissions (AE)

The emissions avoided by a piece of equipment are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

It is possible to cross-reference the accuracy levels for the calculation of avoided emissions.
E.g.: the scenario with the solution may have been calculated with a company-specific approach and the baseline scenario with a market average approach.

The avoided emissions calculated at the solution level can then be **multiplied by the number of solutions sold** to get the **company-wide total**. In some cases, a company will **only** need to count **a portion of the emissions avoided by the solutions it contributes to**, as described in the report.

Solution analysed n°3
Carpooling

Passenger transport emissions decrease due to **increased car occupancy.**

The carbon gain is estimated as the **difference in emissions per passenger-kilometre between the modes replaced and carpooling.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of each carpooling trip. Requires a **life cycle calculation.**
Essential information:
- Carbon footprint of **manufacturing**, **use** and **end of life** of the vehicle used
- **Distance travelled** for the journey between the driver's origin and destination, including detours necessary to pick up and drop off passengers
- **Mode of transport and distance** travelled by passengers from origin to rendezvous point and from drop-off point to final destination

Company-specific approach

Average carbon footprint of carpooling trips by distance range. Requires **life-cycle calculation on representative trips**. Same information needed as for the solution-specific approach.

Market average approach

Net Zero Initiative has not yet calculated an average market value for this solution.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Specific baseline scenario for each customer using the carpooling service (drivers and passengers). Requires a **systematic customer survey.**
Essential information:
- **Primary mode of transportation and distance travelled in the** absence of carpooling, including the option of not making the trip
- **Mode of transport and distance travelled** for pre- and post-carriage (to and from the main mode of transport)

This information, enriched with the carbon intensities of the various modes of transport, makes it possible to estimate the **quantity of GHGs that would have been emitted in the absence of the carpooling trip**. The calculation is as follows:

$$\sum_{User} \begin{matrix} (Carbon\ intensity\ per\ km * mileage)_{main\ mode} + \\ (Carbon\ intensity\ per\ km * mileage)_{pre-trip} + \\ (Carbon\ intensity\ per\ km * mileage)_{post-trip} \end{matrix}$$

⋮

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach

Baseline scenario specific to the company or even to each distance range. Requires a **survey of a representative pool of customers in each distance range.**
The information required and the calculation method are identical to the solution-specific approach.

Market average approach

Net Zero Initiative has not yet calculated an average market value for this solution.

Step 3

Calcu-lation of avoided emissions (AE)

Solution-specific approach

For **each trip made by carpooling**, specific avoided emissions are calculated by the difference between the quantity of GHGs that would have been emitted in its absence and the emissions specific to the trips of all the users concerned (driver and passengers).

Company-specific approach

For **each range of distance carpooled**, average avoided emissions are calculated by the difference between the amount of GHGs that would have been emitted in the absence of the carpooling service and the emissions specific to the trips of all users concerned (driver and passengers).

Market average approach

Net Zero Initiative has not yet calculated an average market value for this solution.

Family #4: Modal shift

Products and services that reduce the carbon intensity of transport by **shifting the mode of transport to less carbon intensive modes**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, for **each solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the decarbonising solution, over its entire life span
- The **additional trips generated** by the decarbonising solution (rebound effect)
- **Future decarbonization of** energy carriers over the lifetime of the decarbonising solution[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, by **range of solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the decarbonising solution, over its entire life span
- The **additional trips generated** by the decarbonising solution (rebound effect)
- **Future decarbonization of** energy carriers over the lifetime of the decarbonising solution[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 1

Emissions in the situation with the solution (E_{sol})

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

Baseline emissions calculations must consider, for **each solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the transport modes that would have been used in the absence of the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the modes of transport that would have been used
- **Future decarbonization of** energy carriers over the lifetime of the decarbonising solution[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

Company-specific approach

Lifetime calculation

Baseline emissions calculations should consider, by **range of solution sold** :

- The **manufacturing**, **use** and **end-of-life** emissions of the transport modes that would have been used in the absence of the decarbonising solution
- Where applicable, emissions related to **pre- and post-transportation**, to and from the modes of transport that would have been used
- **Future decarbonization of** energy carriers over the lifetime of the decarbonising solution[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the decarbonizing solution are amortized annually.
- The **emissions from the use of the** decarbonising solution are calculated on the basis of the **actual emission factors of the energy in the reporting year.**

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 2

Emissions in the baseline scenario (E_{ref})

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 3

Calculation of avoided emissions (AE)

The emissions avoided by a piece of equipment are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

It is possible to cross-reference the accuracy levels for the calculation of avoided emissions.
E.g.: the scenario with the solution may have been calculated with a company-specific approach and the baseline scenario with a market average approach.

The avoided emissions calculated at the solution level can then be **multiplied by the number of solutions sold** to get the **company-wide total**. In some cases, a company will **only** need to count **a portion of the emissions avoided by the solutions it contributes to**, as described in the report.

Solution analysed n°4
Bike

Reduced emissions from the mobility sector by **replacing some carbon-intensive trips with trips made by bicycle.**

The carbon gain is calculated as the **difference in emissions between mobility with the new bike and the baseline scenario.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of each bike model sold. Requires a **life cycle calculation.**
Essential information:
- Carbon footprint of **manufacturing**, **transport**, **use** and **end of life** of the bicycle
- Estimated **life of** the bike (in kilometers and years)

Company-specific approach

Average carbon footprint of bikes sold by the company, ideally by range. Requires **life cycle calculation on representative models.**
Essential information:
- Carbon footprint of **manufacturing**, **transport**, **use** and **end of life** of the bicycle
- Estimated **life of** the bike (in kilometers and years)

Market average approach

Average carbon footprint for a bicycle or an electric bicycle sold in France.
Mechanical bike, manufacturing: **220 kgCO_2 e/unit** (source: NZI)
VAE, manufacture and use in France: **370 kgCO_2 e/unit** (source: NZI)
Average **life span of** mechanical bicycle and VAE: **12 years** (ADEME carbon base)

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Specific baseline scenario for each customer who buys a bike. Requires a **systematic customer survey.**

Essential information:
- **Distance per mode of transport** (at least for the car) that the use of the bicycle will allow to replace (ideally in distance or duration per week + motorization in the case of the car)
- Possible renunciation of the purchase of a car or sale of one's car following the purchase of the bicycle or the electric bike
- Additional journeys not made before the purchase of the bike (to highlight the average rebound effect, especially for electric bikes: *carbon intensity of use per km x additional kilometres travelled over the life of the bike*)

This information, together with the carbon intensities of the various modes of transport, makes it possible to estimate the **quantity of GHGs that would have been emitted without the purchase of the bicycle**.

⋮

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach *(cont.)*

The calculation is as follows:

$$\sum_{Mode}(Carbon\ intensity\ per\ km * Km\ per\ week\ replaced\ by\ buje * Lifetime\ of\ bikes\ in\ weeks)$$
$$+$$
$$\text{Construction phase emissions of car} * \text{Probability to renounce the purchase of a car}$$

Company-specific approach

Baseline scenario specific to the company, or even to each range of bike sold. Need to do **partial surveys on a representative pool of customers for the most popular ranges.** The information required and the calculation method are identical to the solution-specific approach.

Market average approach

Average baseline scenario for a bicycle or an electric bicycle sold in France: use of the ADEME study "ACTUALISATION DE L'ETUDE D'electric bikeALUATION DES SERVICES VELOS" of September 2021.

The parameters used for the sale of a **mechanical bicycle** :
- Average car use reduced by **929 km/year over the life of** the bike
- 10% of beneficiaries do not buy a car

The parameters retained for the sale of an electric bike**:**
- Average car use reduced by **1,817 km/year over the life of** the bike
- 13% of beneficiaries did not buy a car

The parameters retained for the manufacture and use of the car are :
- **Usage: 185 gCO_2 e/km** (ADEME carbon base)
- **Manufacturing: 6.8 tCO_2 e/unit** (Base Carbone ADEME for the mass FE and Car labelling ADEME for the unit mass of vehicles)

This information makes it possible to estimate **the reduction in emissions due to the modal shift to cycling**. The calculation is as follows:

$$Baisse\ de\ l'utilisation\ annuelle\ de\ la\ voiture * FE\ usage\ voiture$$
$$* Durée\ de\ vie\ du\ vélo\ en\ années + \text{Emission de fabrication d'une voiture}$$
$$* \text{Probabilité de renoncement à l'achat d'une voiture}$$

Step 3

Calculation of avoided emissions (AE)

Solution-specific approach

For **each bike sale**, specific avoided emissions are calculated by the difference between the amount of GHGs that would have been emitted without the purchase of the bike and the specific carbon footprint of each bike model sold (carbon footprint to be accounted for over the entire life cycle - manufacture + use).

Company-specific approach

For **each range of bicycles**, specific avoided emissions are calculated by the difference between the quantity of GHGs that would have been emitted without the purchase of the bicycle and the average carbon footprint of the ranges of bicycles sold by the company (carbon footprint to be accounted for over the entire life cycle - manufacture + use).

⋮

Step 3

Calcu-lation of avoided emissions (AE)

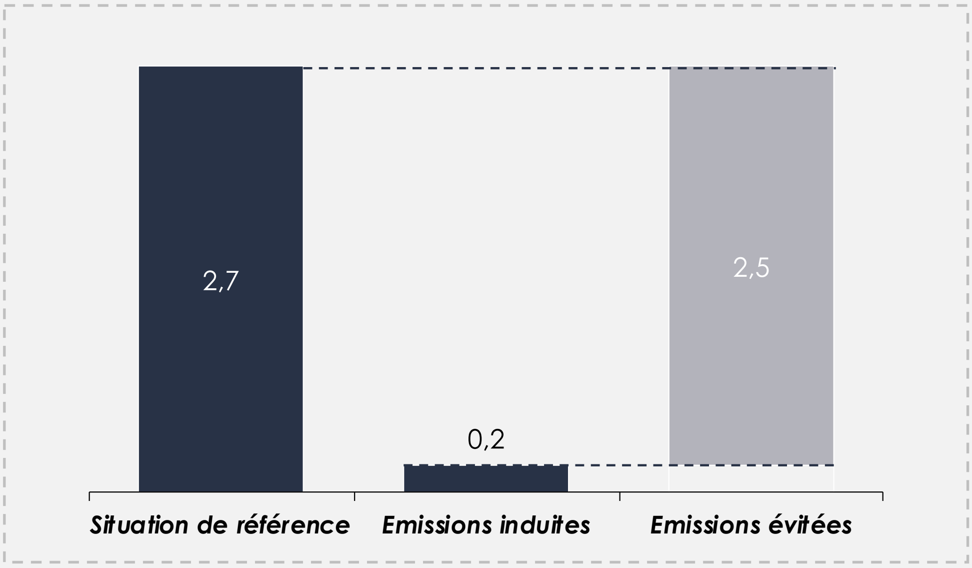
Market average approach

Calculation of the **average avoided emissions for the sale of a bicycle or an electric bike in France** :

$$AE = \text{Decrease in emissions thanks to the modal shift in favor of bike} - \text{Emissions of construction and use of bike}$$

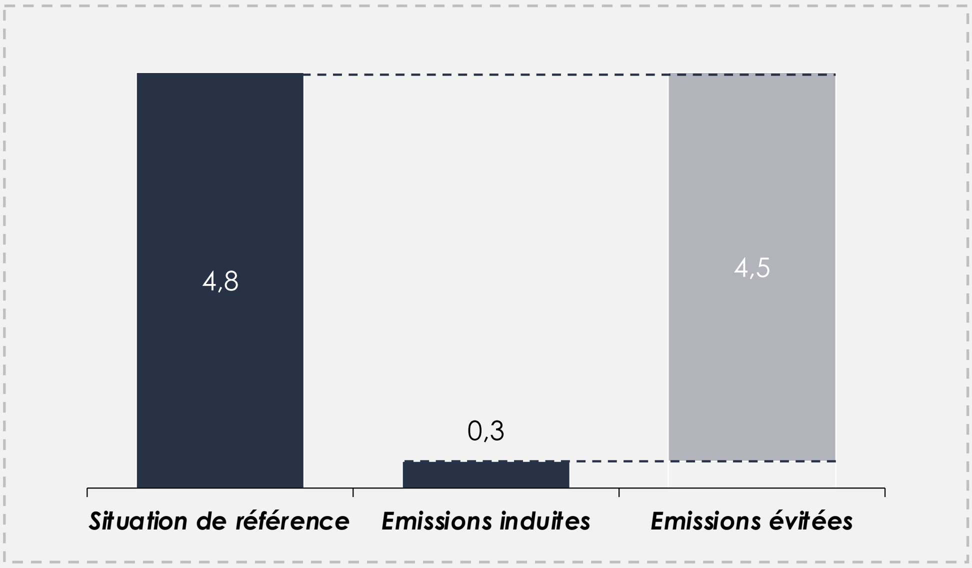
Result graphs

1. **Summary of results mechanical bicycle | tCO2e**



Avoidance factor for the mechanical bicycle: **2.5 tCO_2 e**

2. **Summary of VAE results | tCO2e**



Avoidance factor for the EAV: **4.5 tCO_2 e**

The emission factors (EF) used for the calculations change over the life of the bicycle. The EF for car use and the EF for the electricity used by the electric bike are modelled dynamically over the life of the bicycle, based on the AME scenario (trend scenario for France "With Existing Measures").

Solution analysed n°5
Train for a new line

Reduced emissions from the mobility sector by **replacing some carbon-intensive journeys with journeys made by train.**

The gain is estimated as the **difference in emissions per passenger-km between mobility with the new train and the baseline scenario.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Carbon footprint specific to each train sold. Requires a **life cycle calculation**.
Essential information:
- **Manufacturing**, **use** and **end-of-life** carbon footprint
- Average life of the train (in kilometres and years)
- **Capacity** and lifetime average **occupancy**
- **Travel** (distance and main modes) to and from stations

Company-specific approach

Average carbon footprint by engine of trains sold by the company, ideally by range.
Requires a **life cycle calculation on representative models**.
The information required and the calculation method are identical to the solution-specific approach.

Market average approach

Average carbon footprint for an average train in France.
- **Average train**, manufacturing emissions: **0.5 gCO_2 e/p.km**
- **Average train**, emissions from use in France: **14 gCO_2 e/p.km** (ADEME carbon base)
- Average **life span: 30 years**

The usage emission factor was projected over the life of the train, using the **IEA's 2017 ETP** scenario projections.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Project-specific baseline situation for each rail project where trains are deployed.
Requires a **travel demand study for each project**.

Essential information:
- Distance per mode of transport that the train will replace
- Travel (distance and main modes) to and from train stations and/or airports
- Additional journeys that would not be made in the absence of the rail offer (to highlight the average rebound effect: *carbon intensity of use per km x additional kilometres travelled over the life of the train*

⋮

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach *(cont.)*

This information, together with the carbon intensities of the various modes of transport, makes it possible to estimate the **quantity of GHGs that would have been emitted in the absence of the train**. The calculation is as follows:

$$\sum_{Mode} (Carbon\ intensity\ per\ km\ * Km\ per\ year\ replaced\ by\ train * Lifetime\ of\ train)$$

Company-specific approach

Average baseline by engine at each rail project where trains are deployed. Requires a **travel demand study for representative projects**.

The information required and the calculation method are **identical to the solution-specific approach.**

Market average approach

At this stage, the average baseline scenario is based on the evolution of the modal share of the various modes in travel in France (source: Transport Regulation Authority).

- **The private vehicle** is the only mode to have seen its modal share decline **between 2014 and 2019**.
- So, on **average in France**, the modal shift to rail transport comes mainly from the private vehicle.

Emission factors used for alternative modes to rail :

- **Private vehicle: 75 gCO_2e/p.km** (ADEME carbon base)
- **Bus: 30 gCO_2e/p.km** (ADEME Carbon Base)
- **Air: 258 gCO_2e/p.km** (ADEME carbon base)

Emission factors for alternative modes were projected over time based on the **IEA's 2017 FTE** scenario projections for each passenger mode.

This information makes it possible to estimate **the reduction in emissions due to the modal shift to the train**. The calculation is as follows:

$$Decrease\ of\ yearly\ use\ of\ car\ * EF\ use\ of\ car\ * Lifetime\ of\ train$$

Step 3

Calculation of avoided emissions (AE)

Solution-specific approach

For **each train sale**, specific avoided emissions are calculated as the difference between the amount of GHGs that would have been emitted without the train and the specific carbon footprint of each train model sold.

Company-specific approach

For **each train range**, specific avoided emissions are calculated as the difference between the amount of GHGs that would have been emitted without the train and the specific carbon footprint of each train model sold.

Step 3

Calculation of avoided emissions (AE)

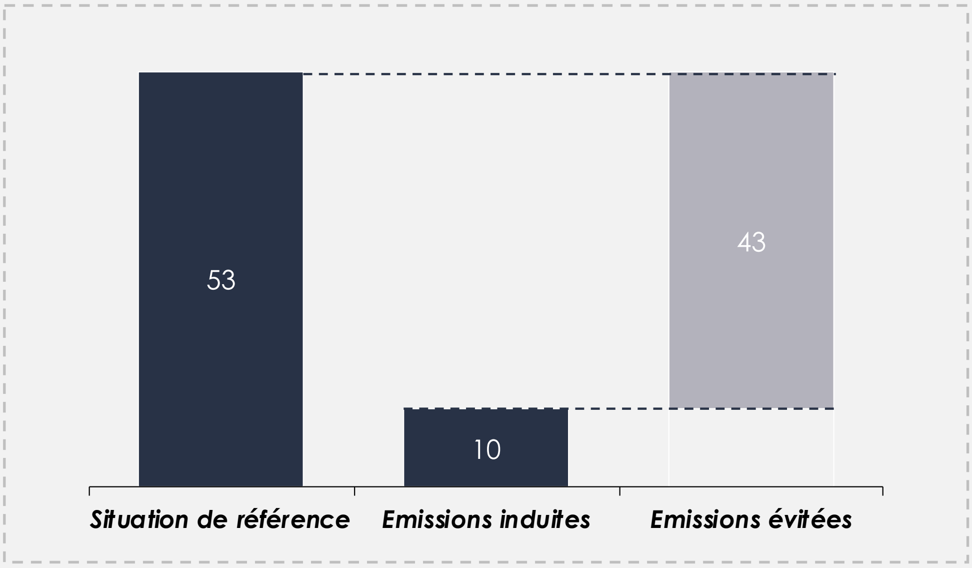
Market average approach

Calculation of the **average avoided emissions for the sale of a bicycle or an electric bike in France** :

$$AE = \text{Decrease in emissions thanks to modal shift in favor of bike} - \text{Construction phase emissions of bike}$$

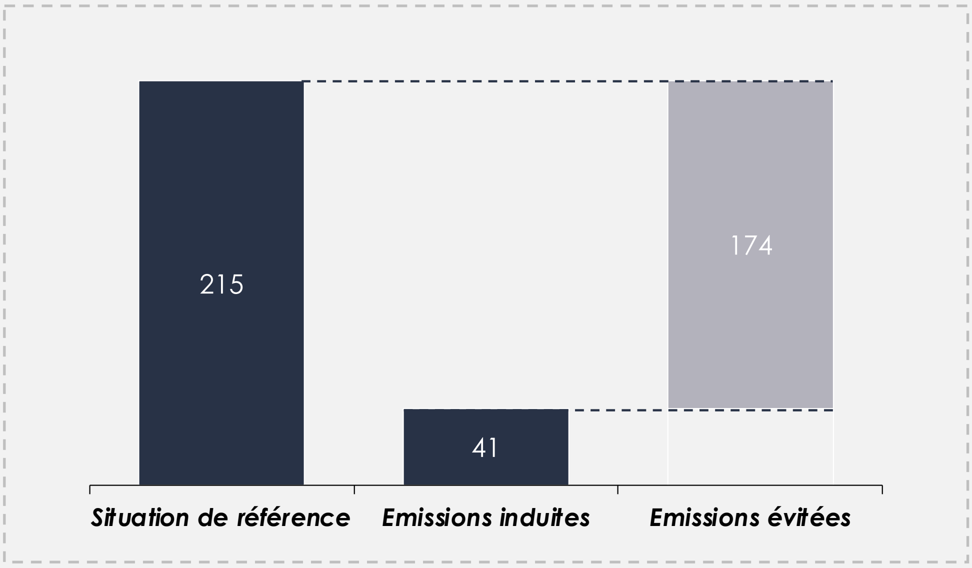
Result graphs

1. **Average train results in France | gCO2e/p.km**



Avoidance factor for an average train in France :
43 gCO_2 e/p.km

2. **Average train results in France | ktCO2e**



Avoidance factor for an average train in France over its lifetime: **174 ktCO_2 e**

At this stage, the evolution of the emission factors (EFs) is based on the IEA's ETP 2017 scenarios. In order to refine the calculation, Carbone 4 will develop the EFs for use based on the AME scenario (trend scenario for France "With Existing Measures").

Family #5: Reduced need for transportation

Products and services that reduce emissions from the transportation sector by **reducing transportation needs**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, for **each solution sold** :

- Emissions from the **manufacture**, **use** and **end of life** of the equipment and infrastructure necessary for the decarbonising solution
- If **the distances** travelled are **reduced** :
  - Emissions related to travel over **the residual distances**, for the **trips affected** by the solution over its lifetime
- If **the number of trips is reduced** :
  - No other emissions to consider
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the equipment and infrastructure required for the decarbonising solution are amortised annually.
- **Emissions from the use of equipment and infrastructure** required for the decarbonising solution and **emissions related to travel over the remaining distances** are calculated on the basis of the **actual energy emission factors in the reporting year.**

Company-specific approach

Lifetime calculation

The calculations of the emissions of the scenario with the decarbonising solution must consider, by **range of solution sold** :

- Emissions from the **manufacture**, **use** and **end of life** of the equipment and infrastructure necessary for the decarbonising solution
- If **the distances** travelled are **reduced** :
  - Emissions related to travel over **the residual distances**, for the **trips affected** by the solution over its lifetime
- If **the number of trips is reduced** :
  - No other emissions to consider
- **Future decarbonization of** energy carriers over the analysis period[1]

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

Similar approach to lifetime calculation, with two particularities:

- The **manufacturing** and **end-of-life** emissions of the equipment and infrastructure required for the decarbonising solution are amortised annually.
- **Emissions from the use of equipment and infrastructure** required for the decarbonising solution and **emissions related to travel over the remaining distances** are calculated on the basis of the **actual energy emission factors in the reporting year.**

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

Baseline emissions calculations must consider, for **each solution sold** :

- **Emissions related to travel** before the implementation of the decarbonising solution, for the travel **affected by the solution** over its lifetime
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Baseline emissions calculations must consider, for **each solution sold** :

- **Emissions related to travel** before the implementation of the decarbonising solution, for the trips **concerned by the solution** annually
- **Future decarbonization of** energy carriers over the analysis period[1]

Company-specific approach

Lifetime calculation

Baseline emissions calculations should consider, by **range of solution sold** :

- **Emissions related to travel** before the implementation of the decarbonising solution, for the travel **affected by the solution** over its lifetime
- **Future decarbonization of** energy carriers over the analysis period[1]

Annual calculation

Baseline emissions calculations should consider, by **range of solution sold** :

- **Emissions related to travel** before the implementation of the decarbonising solution, for the trips **concerned by the solution** annually
- **Future decarbonization of** energy carriers over the analysis period[1]

⋮

(1) The decarbonation scenario used for performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC for France)

Step 2

Emissions in the baseline scenario (E_{ref})

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but valid for equipment of the same type, on average for the market under consideration, at the default country level.

Step 3

Calcu-lation of avoided emissions (AE)

The emissions avoided by a piece of equipment are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

It is possible to cross-reference the accuracy levels for the calculation of avoided emissions.
E.g.: the scenario with the solution may have been calculated with a company-specific approach and the baseline scenario with a market average approach.

The avoided emissions calculated at the solution level can then be **multiplied by the number of solutions sold** to get the **company-wide total**. In some cases, a company will **only** need to count **a portion of the emissions avoided by the solutions it contributes to**, as described in the report.

Sector 2: Construction

No.	Family	Description	Specific solutions studied	Avoidance factor in France
1	**Replacing equipment in existing buildings**	Products and services that reduce emissions generated by **existing buildings**, by **replacing equipment.** These solutions act on the **energy mix** and/or **the energy efficiency of buildings**.	Heat pump in existing buildings	Yes
2	**Optimizing existing buildings**	Products and services that reduce emissions generated by **existing buildings by optimizing them.** These solutions mainly act on **energy efficiency** and in certain cases on the energy mix.	Actions to optimize energy use in existing buildings	Yes
3	**New low-carbon construction**	Products and services that lower the increase of emissions in the sector **due to energy efficiency**, energy sources and the materials and equipment used in new **constructions**.	Heat pumps in new buildings	Yes
			New low carbon buildings	Yes
4	**Densification of new and existing buildings**	Products and services that **avoid the construction of additional sq m** of new buildings through the **densification of new and existing buildings**.	None	-
5	**Decarbonization of energy souces**	Products and services that reduce the emissions of the construction sector through the **decarbonization of energy sources** → Covered in Sector 3: Energy	-	-

Table 8 – Summary of families of solutions analysed, specific solutions covered and AEv calculated for the construction sector.

Family #1:
Replace equipment in existing buildings

Products and services that reduce the emissions from **existing buildings** by **replacing equipment.** These solutions act on the **energy mix** and/or **the energy efficiency** of buildings.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

- The company calculates the **specific** carbon footprint **of the installed equipment** in a life cycle logic. The energy consumption of the equipment must be consistent with the energy requirement of the building, for the function that the equipment fulfils.
- In its calculation, the company considers an assumption of equipment lifetime and takes into account the **decarbonization of energy** during the lifetime of the equipment[1] .

Annual calculation

- The company calculates the **specific** carbon footprint **of installed equipment** in a life cycle logic.
- In its calculation, the company assumes a lifetime for the equipment and **amortizes all non-use phase emissions** over the considered lifetime.
- The emissions of the use phase are assessed on the basis of **the actual carbon intensity of the energy consumed in** the year of calculation and if possible the **actual energy consumption** of the equipment.

Company-specific approach

Lifetime calculation

- The company calculates the carbon footprint **of a range of equipment installed** in a life cycle logic. The energy consumption of the range of equipment considered must be consistent with the average energy requirement of the buildings where this range of equipment is installed, for the function that the range of equipment fulfils.
- In its calculation, the company assumes a lifetime for the equipment range and takes into account the **decarbonization of energy over the lifetime of** the equipment[1] .

Annual calculation

- The company calculates the carbon footprint **of a range of equipment installed** in a life cycle logic. In its calculation, the company assumes a lifetime for the range of equipment and amortizes all non-use phase emissions over the considered lifetime.
- Use phase emissions are assessed on the basis of :
    - An estimate of the energy consumption of the buildings where this range is installed, for the function that the range of equipment satisfies.
    - The actual carbon intensity of the energy consumed in the year of calculation.

Step 1

Calculation of emissions in the situation with the solution (E_{sol})

Market average approach

- For the Market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but derived from averages for equipment of the same type, in the market considered (country size recommended).

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

- **If the replacement occurs at the end of life or if it is forced by regulation:** the baseline scenario is the average of the market context, i.e. the average carbon footprint of the equipment on the market that fulfils the same function, in the year of sale.
- **If the replacement is anticipated :**
  - the baseline situation is the previous situation, i.e. the life cycle carbon footprint of the replaced equipment, up to its conventional remaining end of life.
  - After this time, over the remaining conventional life of the replaced equipment, the baseline is the average of the market context, i.e. the average carbon footprint of equipment on the market that performs the same function as the equipment sold, in the year when the replaced equipment would have reached end-of-life.
- In all cases, the energy consumption of the equipment(s) considered in the baseline situation shall be **consistent with the energy requirement of the specific building** where the equipment has been installed, for the function that the equipment sold fulfils.

Lifetime calculation

- The **decarbonisation of energy** must be taken into account in the calculations of the baseline scenario[1] .

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

Company-specific approach

A **replacement at the end of life** shall be considered **by default.**
The baseline scenario **is specific to a range of equipment sold by the company in a given market**.
The baseline is the average carbon footprint of equipment on the market that performs the same function as the equipment range under consideration, in the year of sale.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the French National Carbon Strategy)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Lifetime calculation

- The average energy consumption considered in the baseline situation shall be consistent with the average energy requirement of the buildings where the range of equipment is installed, for the function that the range of equipment considered fulfils.
- The **decarbonisation of energy** must be taken into account in the calculations of the baseline scenario[1] .

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

Market average approach

- For the Market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of equipment, but derived from averages for equipment of the same type, in the market considered (country size recommended).

Step 3

Calcu-lation of avoided emissions (AE)

- The emissions avoided by a piece of equipment (AE) are the difference between the emissions in the baseline situation (E_{ref}) and the emissions in the situation with the solution (E_{sol}):

$$AE = E_{ref} - E_{Sol}$$

- **It is possible to cross the levels of precision for the calculation of avoided emissions.** For example, the scenario with the solution may have been assessed with an average company vision and the reference scenario with an average market vision.

- Since the emissions after installation of the equipment are reduced compared to the previous situation (context of existing demand), **100% of the avoided emissions are a « real reduction » type (AE_R)**

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Solution analysed 1.1

Sale and installation of a heat pump (HP) as part of an equipment replacement

For a given end use, heat pumps have two effects on building emissions: **good energy efficiency**, by drawing calories from the outside environment, and **the use of electricity as an energy carrier**.
Thus, the heat pumps allow, on the one hand to improve the energy performance of an existing building, that is to say **to reduce** energy consumption for a given use and on the other hand to **use electricity as an energy vector**, which allows, in certain contexts, to substitute a more carbon-intensive energy.

Step 1

Emissions in the situation with the solution (E_{sol})	**Solution-specific approach** **Specific carbon footprint of each model of heat pump sold**. Requires a **life cycle calculation**. Essential information: • Carbon footprint of manufacturing, transport, use and end of life of the sold HP • For the calculation of emissions in the use phase: useful energy consumption of the building, for each use that the heat pump provides • Average life of the heat pump and its coefficient of performance (COP) <u>Lifetime calculation</u> The **decarbonisation of electricity**[1] during the lifetime must be taken into account in the calculation. <u>Annual calculation</u> • The emissions of the use phase are assessed on the basis of **the actual carbon intensity of the electricity consumed by the heat pump in** the year of calculation and if possible the **actual energy consumption** of the equipment. • Non-use phase emissions are amortized over their useful life. **Company-specific approach** **Average carbon footprint of HPs sold by the company**, ideally by range. Requires **a life cycle calculation on representative models.** Essential information: • Carbon footprint of manufacturing, transport, use and end of life of the HP range • For the calculation of emissions in the use phase: average useful energy consumption (assessed on a sample of representative buildings), for each use that the heat pump range provides • Average lifetime of the heat pump range and coefficient of performance (COP)

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Lifetime calculation

The **decarbonisation of electricity**[1] during the lifetime must be taken into account in the calculation.

Annual calculation

- The emissions of the use phase are assessed on the basis of **the actual carbon intensity of the electricity consumed by the heat pump in** the year of calculation and if possible the **actual energy consumption** of the equipment.
- Non-use phase emissions are amortized over their useful life.

Market average approach

- Net Zero Initiative has assessed **the average carbon footprint** of a heat pump installed on an **existing building in France** (single-family homes, collective housing and tertiary buildings) and for three types of heat pumps: **Air/Air, Air/Water, Water/Water**.
- The numerical values are provided in the **summary table** at the end of this Solution Sheet. The calculation is for the entire life cycle. They can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Specific baseline scenario for each customer who purchases a HP. Requires a **systematic customer survey.**
Essential information:

- Useful energy consumption for each use that the heat pump provides
- If replacement is anticipated: carbon performance and remaining life of replaced equipment
- Whether or not the replacement is anticipated: alternative equipment that would have been employed for the use

The calculation is as follows:

$$\sum_{t=year\ of\ sales}^{t=EoL\ of\ replaced\ equipment} (Final\ energy\ consumption * carbon\ intensity\ of\ the\ replaced\ equipment$$

$$+$$

$$\sum_{t=EoL\ of\ replaced\ equipment}^{t=EoL\ of\ HP} (Final\ energy\ consumption * carbon\ intensity\ of\ the\ alternative\ equipment)$$

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach

Company-specific baseline, ideally by type of HP sold. Requires **partial surveys of a representative sample of customers for the top selling ranges.**
We consider here a **replacement at the end of life by default.**

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

Market average approach

- Net Zero Initiative has assessed **an average baseline scenario** for a heat pump installed on an **existing building in France** (single-family homes, collective housing and tertiary buildings) and for three types of heat pumps: Air/Air, Air/Water, Water/Water. **The calculation is for the whole life cycle.**
- The numerical values are provided in the **summary table** at the end of this Solution Sheet. They can be used for France only. Other geographies will be covered by Net Zero Initiative in the future.

Step 3

Calculation of avoided emissions (AE)

- Since the emissions after installation of the equipment are reduced compared to the previous situation (existing demand context), **100% of the avoided emissions are a « real reduction » type (AE_R)**
- By using the average market numerical values for the situation with the solution and for the baseline scenario, we obtain an **avoidance factor, i**.e. the average avoided emissions for a heat pump installed on an existing building in France. Net Zero Initiative provides the avoidance factors resulting from the average market calculations for this solution in France**,** in the **summary table** at the end of this Solution Sheet**.**

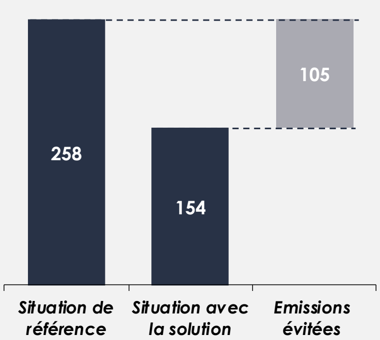
[Market average approach for France].

Summary table

kgCO2e/m² over lifetime	Baseline scenario	Situation with the solution	**Avoided emissions** (Avoidance Factor - AF)
Individual House			
Air-air heat pump			
Heating	258	154	105
Air-Water heat pump			
Heating	258	193	65
Heating and domestic hot water (DHW)	286	229	57
Water-water heat pump			
Heating	301	191	110
Heating and domestic hot water (DHW)	333	229	104
Collective housing			
Air-air heat pump			
Heating	207	82	125
Air-Water heat pump			
Heating	207	73	133
Heating and domestic hot water (DHW)	241	94	147
Water-water heat pump			
Heating	241	65	176
Heating and domestic hot water (DHW)	281	84	196
Tertiary building			
Air-air heat pump			
Heating	225	89	136
Air-water heat pump			
Heating	225	80	145
Heating and domestic hot water (DHW)	261	102	159
Water-water heat pump			
Heating	263	71	192
Heating and domestic hot water (DHW)	304	91	213
Average for all buildings			
Air-air heat pump			
Heating	238	105	133
Air-Water heat pump			
Heating	238	143	95
Heating and domestic hot water (DHW)	269	173	97
Water-water heat pump			
Heating	278	67	210
Heating and domestic hot water (DHW)	314	87	227

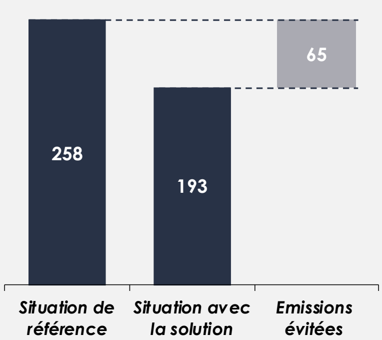
Illustration - Heat pump for heating only on an existing single-family house in France

PAC Air/Air sur MI - usage chauffage
$kgCO_2e/m^2$ sur toute la DV (17 ans)



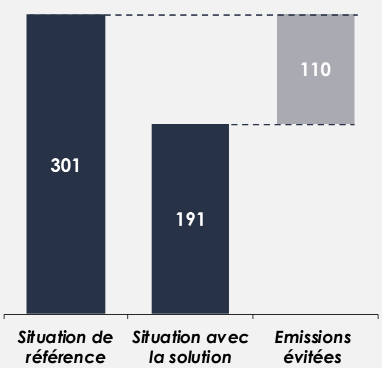
Facteur d'évitement d'une PAC Air/Air sur maison individuelle existante pour l'usage chauffage :
105 $kgCO_2e/m^2$

PAC Air/Eau sur MI - usage chauffage
$kgCO_2e/m^2$ sur toute la DV (17 ans)



Facteur d'évitement d'une PAC Air/Eau sur maison individuelle existante pour l'usage chauffage :
65 $kgCO_2e/m^2$

PAC Eau/Eau sur MI - usage chauffage
$kgCO_2e/m^2$ sur toute la DV (20 ans)



Facteur d'évitement d'une PAC Eau/Eau sur maison individuelle existante pour l'usage chauffage :
110 $kgCO_2e/m^2$

MI : Maisons individuelles
DV : durée de vie

Family #2:
Optimize existing buildings existing buildings

Products and services to reduce the emissions of **existing buildings by optimizing them**. These solutions act mainly on **energy efficiency** and in some cases on the energy mix.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

- The company calculates the carbon footprint of **the materials and equipment used for the optimization process**, from a life cycle perspective.
- For the specific building where the optimization action was performed, the company estimates the emissions induced by the building's energy consumption **after the optimization action was performed**. This is **approximated by the energy consumption of the building before the optimization action**, to which **the estimated energy gain** for the optimization action is applied. The emissions are then assessed using the emission factors specific to the building's energy consumption.
- The situation with the solution is the sum of the emissions of the materials and equipment used for the optimization action and the emissions induced by the energy consumption of the building after the optimization action has been carried out.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the situation with the[1] solution.

Annual calculation

- The emissions related to energy consumption in the situation with the solution are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions are amortized over the conventional life of the materials and equipment considered in the situation with the solution.

Company-specific approach

For the medium enterprise approach, the company follows the same calculation method as for the unit approach, except that it :

- calculates the emissions **for a range of representative optimization actions performed in a given market** (country grid recommended).
- takes as input data the average energy consumption of a **representative sample of buildings** where the range of optimization actions is performed.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the situation with the[1] solution.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Calculation of emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

- The emissions related to energy consumption in the situation with the solution are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions are amortized over the conventional life of the materials and equipment considered in the situation with the solution.

Market average approach

For the Market average approach, the company follows the same calculation method as for the company-specific approach, except that it uses input data and assumptions that are **not specific to its range of optimization actions**, but are derived from averages for optimization actions of the same type in the market considered (country mesh recommended).

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

- **If the optimization action is carried out voluntarily, without regulatory constraints:** the baseline scenario is the previous situation**, i**.e. the building's emissions before the optimization action. In this case, the company approaches these emissions through the building's energy consumption before the optimization action. This input data is used in the situation with solution. The emissions are then assessed using the emission factors specific to the building's energy consumption.

- **If the optimization action is carried out in a way constrained by the regulation:** the baseline scenario is the average of the market context, **i**.e. the emissions of the building after the realization of an optimization action of average performance on the market. In this case:
    - The company calculates the carbon footprint of the materials and equipment used for the **average** optimization action considered, in a life cycle logic.
    - The company also estimates the emissions induced by the building's energy consumption after the average optimization action. It is approximated by the building's energy consumption before the optimization action, to which is applied the estimated energy gain for the **average** optimization action. The emissions are then assessed using the emission factors specific to the building's energy consumption.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario[1] .

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions are amortized over the conventional lifetime of the materials and equipment considered in the baseline situation.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Calculation of emissions in the baseline scenario (E_{ref})

Company-specific approach

For the company-specific approach, the company follows **the same calculation method as for the unit approach**, except that it takes as input data the average energy consumption of a **representative sample of buildings** where the range of optimization actions considered is carried out.

Lifetime calculation

- The **decarbonisation of energy[1]** must be taken into account in the calculations of the baseline scenario[1] .

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions are amortized over the conventional lifetime of the materials and equipment considered in the baseline situation.

Market average approach

For the Market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses input data and assumptions that are not specific to its range of optimization actions, but are derived from averages for optimization actions of the same type in the market considered (country mesh recommended).

Step 3

Calculation of avoided emissions (EE)

- The emissions avoided by an optimization action are assessed as the difference between the emissions in the baseline scenario and the emissions in the situation with the solution:

$$AE = E_{ref} - E_{Sol}$$

- **It is possible to cross the levels of precision for the calculation of avoided emissions.** For example, the scenario with the solution may have been assessed with an average company vision and the reference scenario with an average market vision.

- Since the emissions after installation of the equipment are reduced compared to the previous situation (existing demand context), **100% of the avoided emissions are « real reduction » type (AE_R)**

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Solution analysed n° 2.1

Sale and installation of materials and equipment as part of energy optimization of existing buildings

Energy optimization measures make it possible to improve the energy performance of an existing building, i.e. to **reduce the amount of final energy consumed for a given use.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of the building after each energy optimization action taken. Key information:

- **Initial** energy consumption of the building, prior to the implementation of the energy optimization action(s).
- Carbon footprint of manufacturing, transport, use and end of life of materials and equipment used
- **Lifetime** and **specific energy gains** of the actions performed

Lifetime calculation

The **decarbonisation of energy**[1] during the lifetime of the materials and equipment used must be taken into account in the calculations.

Annual calculation

- The emissions related to energy consumption are assessed on the basis of the **actual carbon intensity of the energy consumed by the building** in the year of calculation.
- Non-use phase emissions are amortized over their useful life.

Company-specific approach

Average carbon footprint of the buildings after the representative energy optimization action(s) taken by the company. Key information:

- **Average initial** energy consumption of the buildings, before the implementation of the energy optimization action(s).
- Carbon footprint of manufacturing, transport, use and end of life of materials and equipment used
- **Average life span** and **average energy gains** of the actions performed

Lifetime calculation

The **decarbonisation of energy over the lifetime of** the materials and equipment used must be taken into account in the calculations.

Annual calculation

- The emissions related to energy consumption are assessed on the basis of the **actual carbon intensity of the energy consumed by the building** in the year of calculation.
- Non-use phase emissions are amortized over their useful life.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Market average approach

- Net Zero Initiative has assessed **the average carbon footprint of an existing building after energy optimization actions in France** (single-family homes, multi-family homes and commercial buildings). The actions covered are :
    - o Insulation of walls, attic or floor
    - o Installation of building management systems
    - o Heavy renovation (3 gestures)
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. The calculation is for the entire life span.
- They can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Baseline scenario **specific to each building** on which one or more energy optimization actions are carried out. Requires a **systematic customer survey.**
Essential information:

- **Initial** energy consumption of the building, for each use that the action(s) will optimize and for each energy vector
- If the optimization is constrained by regulations: energy gains of the alternative optimization gesture, average performance on the market
- This information, together with the carbon intensity of energy consumption, makes it possible to estimate the **quantity of GHGs that would have been emitted in the absence of the purchase of the energy optimization measure(s).**

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over their life.

Company-specific approach

Company-specific baseline scenario for each category of actions performed. Requires a **systematic customer survey.**
Essential information:

- **Average initial** energy consumption for each use that the representative action(s) will optimize and for each energy vector
- If the optimization is constrained by regulations: energy gains of the alternative optimization gesture, average performance on the market

This information, together with the carbon intensity of energy consumption, makes it possible to estimate the **quantity of GHGs that would have been emitted in the absence of the purchase of the energy optimization measure(s).**

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over their useful life.

Market average approach

- Net Zero Initiative has assessed **an average baseline scenario** for several optimization actions carried out on an **existing building in France** (single-family homes, collective housing and tertiary buildings)**.** The actions covered are :
  - Insulation of walls, attic or floor
  - Installation of building management systems
  - Heavy renovation (3 gestures)
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. The calculation is for the entire life span.
- They can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 3

Calcu-lation of avoided emissions (AE)

- Since the emissions after the optimization action(s) are reduced compared to the previous situation (existing demand context), **100% of the avoided emissions are « real reduction » type (AE_R)**

- By using the average market numerical values for the situation with the solution and for the baseline scenario, we obtain an **avoidance factor**, i.e. the average avoided emissions for an optimization action carried out on an existing building in France. Net Zero Initiative provides the avoidance factors resulting from the average market calculations for this solution in France in the **summary table** at the end of this Solution Sheet**.**

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

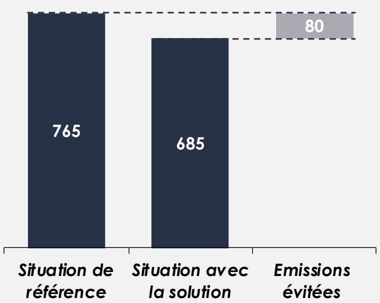
[Market average approach for France].

Summary table

In kgCO2/m2 over the entire lifetime	Baseline scenario	Situation with the solution	Avoided emissions (Avoidance Factor - AF)
Individual House			
Attic insulation	765	685	80
Wall insulation	765	570	195
Floor insulation	765	690	75
Heavy renovation (3 gestures)	765	558	207
Technical management of the building (GTB)	168	159	8
Collective housing			
Attic insulation	820	563	258
Wall insulation	820	227	593
Floor insulation	820	576	244
Heavy renovation (3 gestures)	820	155	665
Technical management of the building (GTB)	182	173	9
Tertiary building			
Attic insulation	1045	918	127
Wall insulation	1045	678	368
Floor insulation	1045	919	127
Heavy renovation (3 gestures)	1045	639	406
Technical management of the building (GTB)	240	229	11

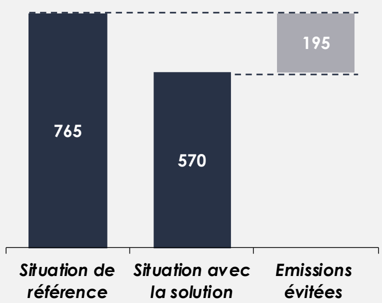
Illustration - Thermal insulation on an existing single-family house in France

Isolation combles sur MI
$kgCO_2e/m^2$ sur durée de vie



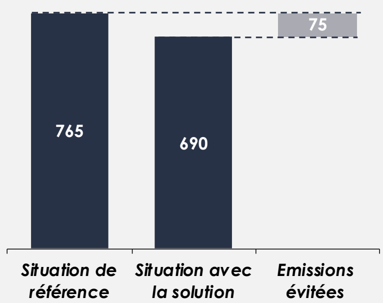
Facteur d'évitement d'un geste d'isolation des combles sur maison individuelle existante :
80 $kgCO_2e/m^2$

Isolation murs sur MI
$kgCO_2e/m^2$ sur durée de vie



Facteur d'évitement d'un geste d'isolation des murs sur maison individuelle existante :
195 $kgCO_2e/m^2$

Isolation plancher sur MI
$kgCO_2e/m^2$ sur durée de vie



Facteur d'évitement d'un geste d'isolation du plancher sur maison individuelle existante :
75 $kgCO_2e/m^2$

MI : Maisons Individuelles

Family #3:
Low carbon new construction

Products and services that **reduce the sector's emissions** through energy performance, energy carriers and materials and equipment used in **new construction**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

- The company calculates the **specific** carbon footprint of its product implemented in a specific new building, in a life cycle logic. If the product is a new building as a whole, the company calculates the specific carbon footprint of the building.
- In its calculation, the company assumes the life of its product and takes into account the **decarbonisation of energy**[1] during its life.

Annual calculation

- The company calculates the **specific** carbon footprint of its product used in the new building, in a life cycle logic. If the product is a new building as a whole, the company calculates the specific carbon footprint of the building.
- In its calculation, the company assumes the life of its product and **amortizes all non-use phase emissions** over the life of the product.
- Emissions due to energy consumption are assessed on the basis of **the actual carbon intensity of the energy consumed** in the year of calculation and, if possible, the **actual energy consumption** of the product used.

Company-specific approach

- For the company average approach, the company follows the same calculation method as for the unit approach, except that it calculates the **average** carbon footprint for a **range of** its representative products implemented in a given market (recommended country size).
- The average carbon footprint is assessed based on a **representative sample of new buildings** where the product range is implemented.
- If the product range is a new building as a whole, the company calculates the average carbon footprint of the new buildings constructed.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the situation with the solution.

Annual calculation

- The emissions related to energy consumption in the situation with the solution are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over the conventional lifetime considered in the situation with the solution.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Market average approach

- For the Market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of new products/buildings, but taken from averages for products/buildings of the same type, in the market considered (country grid recommended).

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

- The baseline scenario is **the average carbon footprint of the market context.** That is, the average emissions of the solutions usually implemented on the market.
- This average is **specific** to the new building sold or the new building in which the product is implemented.
- If there is a **regulatory constraint** on the carbon performance of new buildings or products used in new construction in the country of construction, and this is more ambitious than the average carbon footprint of the market context (the regulation is then not respected on average by the market solutions), Net Zero Initiative recommends declaring what the avoided emissions would be if the average of the market context respected the regulation. That is to say, publish two calculations of avoided emissions, one where the baseline scenario is the average of the market context, and a second where the baseline scenario is the regulation, and using only the first calculation to consolidate all the avoided emissions of the company's solutions.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over their lifetime.

Company-specific approach

- For the company-specific approach, the company follows the same calculation method as for the unit approach, except that it uses input data and assumptions that are not specific to a new building but are derived from averages carried out on a **representative sample of new buildings sold or in which its products are used**.

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime considered in the baseline situation.

Market average approach

- For the Market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to a representative sample of new buildings sold or in which its products are used, but are derived from averages for buildings of the same type, in the market considered (country grid recommended).

Step 3

Calcu-lation of avoided emissions (EE)

- The emissions avoided by a solution are assessed as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

$$AE = E_{ref} - E_{Sol}$$

- **It is possible to cross the levels of precision for the calculation of avoided emissions**. For example, the scenario with the solution may have been assessed with an average company vision and the reference scenario with an average market vision.

- Since the solutions are in a context of new demand (a context in which emissions are zero in the previous situation), **100% of the avoided emissions are « lesser increase » type (AE_{LI})**

Solution analysed 3.1

Sale and installation of a heat pump (HP) in a new building

For a given end use, heat pumps have two effects on building emissions: **good energy efficiency**, by drawing calories from the outside environment, and **the use of electricity as an energy carrier**.
Thus, the heat pumps allow to ensure a good energy performance of new buildings, i.e. **to minimize** the amount of final energy for a given use.
Heat pumps can also **use electricity as an energy carrier, which** in some contexts is an alternative to more carbon-intensive energy.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Specific carbon footprint of each model of heat pump sold. Requires an **life cycle calculation**.
Essential information:
- Carbon footprint of manufacturing, transport, use and end of life of the sold CAP
- For the calculation of emissions in the use phase: useful energy consumption of the building, for each use that the heat pump provides
- Average life of the heat pump and its coefficient of performance (COP)

Lifetime calculation

The **decarbonisation of electricity**[1] during the lifetime must be taken into account in the calculation.

Annual calculation

- Emissions from the use phase are assessed on the basis of **the actual carbon intensity of the electricity consumed by the heat pump in** the year of calculation and if possible the **actual energy consumption** of the equipment.
- Non-use phase emissions are amortized over their useful life.

Company-specific approach

Average carbon footprint of HPs sold by the company, ideally by range. Requires **life cycle calculation on representative models.**
Essential information:
- Carbon footprint of manufacturing, transport, use and end of life of the PAC range
- For the calculation of emissions in the use phase: average useful energy consumption (assessed on a sample of representative new buildings), for each use that the heat pump range provides
- Average lifetime of the heat pump range and coefficient of performance (COP)

Lifetime calculation

The **decarbonisation of electricity**[1] during the lifetime must be taken into account in the calculation.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

- Emissions from the use phase are assessed on the basis of the **actual carbon intensity of the electricity consumed by the CAP** in the year of calculation.
- Non-use phase emissions are amortized over their useful life.

Market average approach

- Net Zero Initiative has assessed **the average carbon footprint** of a heat pump installed on a **new building in France** (single-family homes, collective housing and tertiary buildings) and for three types of heat pumps: **Air/Air, Air/Water, Water/Water**.
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. The calculation is for the entire life cycle. They can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Specific baseline scenario for each customer who purchases a HP. Requires a **systematic customer survey.**
Essential information:

- Useful energy consumption of the new building for each use that the heat pump provides
- Alternative solution that would have been used for the

The calculation is as follows:

$$Use\ phase\ final\ energy\ consumption\ * carbon\ intensity\ of\ alternative\ solution$$

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

Company-specific approach

Baseline scenario specific to the company, ideally by range of heat pumps sold. Need to make **partial surveys on a sample of representative new buildings in which the range of heat pumps is implemented.**
Essential information:

- **Average** useful energy consumption for each use that the heat pump provides
- **Breakdown of** alternative solutions that would have been employed for the use

The calculation is as follows:

$$Use\ phase\ final\ energy\ consumption\ * average\ carbon\ intensity\ of\ alternative\ solutions$$

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Lifetime calculation

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- All non-use phase emissions shall be amortised over the conventional lifetime of the equipment(s) considered in the baseline situation.

Market average approach

- Net Zero Initiative has assessed **an average baseline scenario** for a heat pump installed on a **new building in France** (single-family homes, collective housing and tertiary buildings) and for three types of heat pumps: Air/Air, Air/Water, Water/Water. **The calculation is for the whole life cycle.**
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. They can be used for France only. Other geographies will be covered by Net Zero Initiative in the future.

Step 3

Calcu-lation of avoided emissions (AE)

- Since the solutions are in a context of new demand (a context in which emissions are zero in the previous situation), **100% of the avoided emissions are « lesser increase » type (AE_{LI})**

- By using the average market numerical values for the situation with the solution and for the baseline scenario, we obtain an **avoidance factor, i**.e. the average avoided emissions for a heat pump installed on a new building in France. Net Zero Initiative provides the avoidance factors resulting from the average market calculations for this solution in France**,** in the **summary table** at the end of this Solution Sheet**.**

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

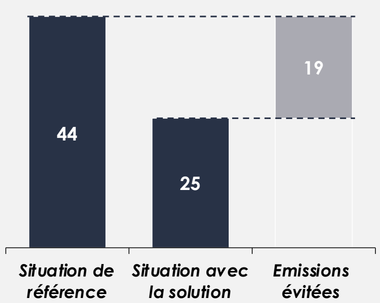
[Market average approach for France].

Summary table

kgCO2e/m² over lifetime	Baseline scenario	Situation with the solution	**Avoided emissions** (Avoidance Factor - AF)
Individual House			
Air-air heat pump			
Heating	44	25	19
Air-Water heat pump			
Heating	44	31	13
Heating and domestic hot water (DHW)	66	53	13
Water-water heat pump			
Heating	51	31	20
Heating and domestic hot water (DHW)	77	54	23
Collective housing			
Air-air heat pump			
Heating	48	16	32
Air-Water heat pump			
Heating	48	14	34
Heating and domestic hot water (DHW)	72	24	48
Water-water heat pump			
Heating	56	13	43
Heating and domestic hot water (DHW)	84	22	62
Tertiary building			
Air-air heat pump			
Heating	43	19	24
Air-Water heat pump			
Heating	43	17	26
Heating and domestic hot water (DHW)	52	23	29
Water-water heat pump			
Heating	50	15	35
Heating and domestic hot water (DHW)	61	20	41
Average for all buildings			
Air-air heat pump			
Heating	45	20	25
Air-water heat pump			
Heating	45	25	20
Heating and domestic hot water (DHW)	62	40	22
Water-water heat pump			
Heating	52	14	38
Heating and domestic hot water (DHW)	72	21	51

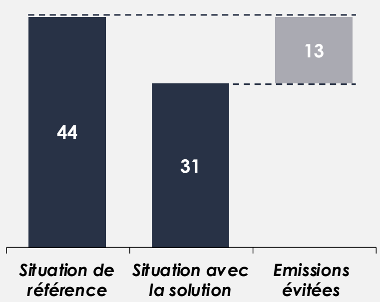
Illustration - Heat pump for heating only in a new single-family house in France

PAC Air/Air sur MI - usage chauffage
kgCO_2e/m² sur toute la DV (17 ans)



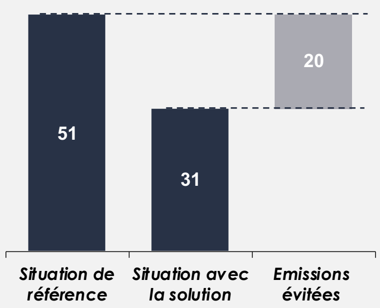
Facteur d'évitement d'une PAC Air/Air sur maison individuelle neuve pour l'usage chauffage :
19 kgCO_2e/m²

PAC Air/Eau sur MI - usage chauffage
kgCO_2e/m² sur toute la DV (17 ans)



Facteur d'évitement d'une PAC Air/Eau sur maison individuelle neuve pour l'usage chauffage :
13 kgCO_2e/m²

PAC Eau/Eau sur MI - usage chauffage
kgCO_2e/m² sur toute la DV (20 ans)



Facteur d'évitement d'une PAC Eau/Eau sur maison individuelle neuve pour l'usage chauffage :
20 kgCO_2e/m²

MI : maison individuelle
DV : durée de vie

Solution analysed n° 3.2

Design, construction or promotion of a new low-carbon building

Less increase in emissions from the building sector due to energy performance, energy carriers and materials and equipment used in **new construction**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

- **Specific carbon footprint of the new building, which must be subject to an official life cycle.**
- In France, this is a **dynamic life cycle** assessed according to the CEREMA reference system[1] .

Lifetime calculation

The **decarbonisation of energy[2]** during the lifetime must be taken into account in the calculation.

Annual calculation

- The emissions of the use phase are assessed on the basis of **the actual carbon intensity of the energy consumed by the building** in the year of calculation and if possible the **actual energy consumption** of the building.
- Non-use phase emissions are amortized over their useful life.

Company-specific approach

- **Average carbon footprint of the company's representative buildings, assessed from official life cycles.**
- In France, these are **dynamic life cycles** assessed according to the CEREMA standard[2] .

Lifetime calculation

The **decarbonisation of energy[2]** during the lifetime must be taken into account in the calculation.

Annual calculation

- The emissions of the use phase are assessed on the basis of **the actual carbon intensity of the energy consumed** by the representative buildings in the year of calculation and if possible the **actual energy consumption** of the building.
- Non-use phase emissions are amortized over their useful life.

Market average approach

- Net Zero Initiative has assessed **the average carbon footprint** of a new low-carbon building **in France** (single-family homes, multi-family homes and offices). The carbon performance of the "average low-carbon" new building is considered to be that of **the thresholds of the second period of the RE2020** (2025-2027)**.** These thresholds are assessed without modulating coefficients. The thresholds (energy and construction are summed up), in $kgCO_2$ e/m² over the whole life cycle (50 years by convention).

⋮

(1) CEREMA's RE 2020 guide: http://www.rt-batiment.fr/IMG/pdf/guide_re2020_dhup-cerema.pdf
(2) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Calculation of emissions in the situation with the solution (E_{sol})

Market average approach *(cont.)*

- The numerical values are provided in the **summary table at the** end of this Solution Sheet. The calculation is for the entire life cycle. They can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

The baseline scenario is the **average market** carbon performance (in the country of sale) of new buildings with the **same specificities as the project.**

<u>Lifetime calculation</u>

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.
- **For France :**
  - The baseline scenario can be approximated by the **thresholds of the first period of the ER2020** (2022-2024)**.** These thresholds must be assessed **with the modulating coefficients that correspond to the specificities of the new building** in the situation with project.
  - **The statutory thresholds should not be changed**, although they are assessed without incorporating energy decarbonisation forecasts. Thus, energy decarbonation should not be taken into account in the calculations of the situation with solution either.

<u>Annual calculation</u>

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over their useful life.

Company-specific approach

The baseline scenario is the **average market** carbon performance (in the country of sale) of **new buildings representative of those built by the company.**

<u>Lifetime calculation</u>

- The **decarbonisation of energy**[1] must be taken into account in the calculations of the baseline scenario.
- **For France :**
  - The baseline scenario can be approximated by **the average of the thresholds of the first period of the ER2020** (2022-2024) for a set of representative buildings of the company. These thresholds must be assessed with the modulating coefficients that correspond to the specificities of the representative buildings.
  - **The statutory thresholds should not be changed**, although they are assessed without incorporating energy decarbonisation forecasts. Thus, energy decarbonation should not be taken into account in the calculations of the situation with solution either.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Annual calculation

- Emissions related to energy consumption in the baseline scenario are assessed **with the emission factors corresponding to the year of calculation**.
- Non-use phase emissions are amortized over their useful life.

Market average approach

- Net Zero Initiative has assessed **an average baseline scenario** for a new low-carbon building **in France** (single-family homes, multi-family homes and offices). The baseline scenario corresponds to the thresholds of **the first period of the RE2020** (2022-2024). **These thresholds are assessed without the modulating coefficients.** The thresholds (energy and construction are summed up), in kgCO_2 e/m^2 over the whole lifetime (considered as 50 years).
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. They can be used for France only. Other geographies will be covered by Net Zero Initiative in the future.

Step 3

Calcu-lation of avoided emissions (EE)

- Since the solutions are in a context of new demand (a context in which emissions are zero in the previous situation), **100% of the avoided emissions are « lesser increase » type (AE_{LI})**
- By using the average market numerical values for the situation with the solution and for the baseline scenario, we obtain an **avoidance factor**, i.e. the average emissions avoided by a new low-carbon building in France. Net Zero Initiative provides the avoidance factors resulting from the average market calculations for this solution in France in the **summary table** at the end of this Solution Sheet**.**

NB: the share of new buildings that replace existing buildings, which is considered low, is neglected.

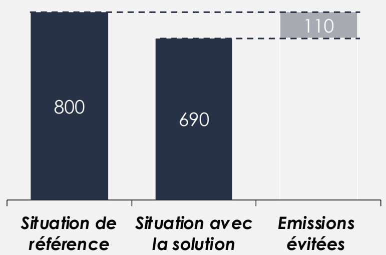
[Market average approach for France].

Summary table

In $kgCO_2/m^2$ over the entire lifetime	Baseline scenario	Situation with the solution	**Avoided emissions** (Avoidance Factor - AF)
Single-family or semi-detached houses	800	690	110
Collective housing connected to a district heating network	1300	970	330
Multi-family dwellings - other cases	1300	910	390
Offices connected to a district heating network	1230	1010	220
Offices - other cases	1150	1010	140

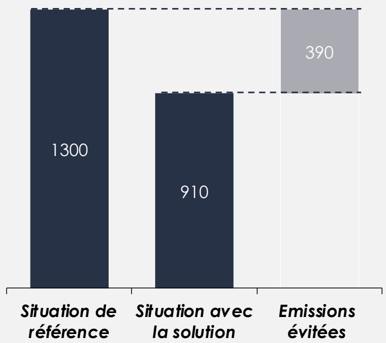
Illustration - New low-carbon buildings in France

Maison individuelle
$kgCO_2e/m^2$ sur toute la durée de vie



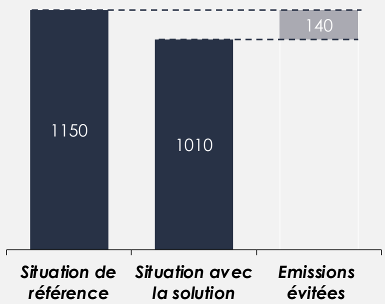
Facteur d'évitement d'une maison individuelle bas carbone :
110 $kgCO_2e/m^2$

Logements collectifs
$kgCO_2e/m^2$ sur toute la durée de vie



Facteur d'évitement d'un logement collectif bas carbone :
390 $kgCO_2e/m^2$

Bureaux
$kgCO_2e/m^2$ sur toute la durée de vie



Facteur d'évitement de immeuble de bureaux bas carbone :
140 $kgCO_2e/m^2$

Family #4:
Densify new and existing buildings

Products and services to **avoid the construction of m² of new buildings** by **densifying new or existing buildings**.

Step 1

Emissions in the situation with the solution (E_{sol})

For the calculation of emissions in the situation with the solution, only the solution-specific approach is possible because the emissions vary greatly depending on the densification actions.

Solution-specific approach

Densification solutions can be applied to new and existing buildings. They allow**:**

1. **avoid the construction of m² new buildings** by optimizing the **occupancy rate** of new or existing buildings
2. **avoid the construction of m² new buildings** by reducing the **vacancy rate of** existing **and dilapidated** buildings
3. **avoid the manufacture of equipment** by **pooling** it in new or existing buildings

Emissions induced by the manufacture, transport, use and end-of-life of materials and equipment **required** for the densification or pooling solution must be taken into account in the calculation of emissions with the solution.

Step 2

Emissions in the baseline scenario (E_{ref})

For the calculation of emissions in the baseline scenario, only the unit approach is possible because the gains in m² obtained vary greatly according to the densification action. Nevertheless, the carbon intensity per m² of new buildings constructed in the absence of the densification action can be assessed with an average company or Market average approach, refer to the Family 3 method.

Solution-specific approach

1. **Optimisation of the occupancy rate:** the baseline scenario corresponds to **the carbon footprint of the m² of new buildings avoided** by the densification solution. The carbon footprint of the avoided m² is approximated by the average carbon footprint of new buildings for the same use in the project area. The m² avoided are assessed as follows: (m² /person before project - m² /person after project)/(m² /person before project) * m² total of the project.

2. **Reduction in the vacancy rate of existing buildings**: the baseline scenario corresponds to **the carbon footprint of the m² of new buildings avoided** by the densification solution. The carbon footprint of the avoided m² is approximated by the average carbon footprint of new buildings for the same use in the project area. The m² avoided are the number of m2 rehabilitated.

3. **Equipment pooling:** the baseline scenario corresponds to **the carbon footprint of manufacturing and use of the equipment** whose purchase and use was avoided by the pooling solution (the number of equipment avoided is specific to the solution).

⋮

Step 3

Calculation of avoided emissions (AE)

- The emissions avoided by a solution are assessed as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:

$$AE = E_{ref} - E_{Sol}$$

- Since the solutions are in a context of new demand (new construction avoidance), **100% of the avoided emissions are « lesser increase » type (AE_{LI})**

Sector 3: Energy

No.	Family	Description	Specific solutions studied	Avoidance factor in France
1	**Installations acting on the carbon intensity of energy**	Installations that **reduce or limit the carbon intensity of final energy sources.** The solutions concerned are decarbonated energy production installations and/or the management of supply and demand balance and the intermittence of renewable energies.	Solar power plant (PV)	Yes
			Synthetic fuels	No
2	**Optimize the energy production of existing plants**	Products and services that **reduce the carbon intensity of energy sources**, **by optimizing the energy production of existing plants.** The solutions concerned are **resources (financial, technical, operational) implemented in existing energy production plants**.	None	-
s3	**Reduce the losses of existing energy transportation and distribution networks**	Products and services that **reduce the carbon intensity of energy sources**, **by optimizing the transportation and distribution of energy.** The solutions concerned are **resources (financial, technical, operational) implemented in energy transportation and distribution networks** to reduce losses and /or leaks in these networks.	None	-

Table 9 – Summary of families of solutions analysed, specific solutions covered and AEv calculated for the energy sector.

	Methodological questions specific to the energy sector
1	What are the rules for accounting and allocating avoided emissions in the energy sector?
2	How can AE be measured and accounted for the purchase of green energy contracts (PPA/GO)?

Table 10 – Summary of methodological questions covered for the energy sector.

Family #1: Facilities that affect the carbon intensity of energy

Facilities that **reduce or limit the carbon intensity of final energy carriers.** The solutions concerned are decarbonised energy production facilities or facilities for managing the supply-demand balance and the intermittency of renewables.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

The situation with the solution is a GHG emissions and energy production/injection **pathway that is specific to the studied facility**.

Lifetime calculation

- The company calculates the carbon footprint **of each facility,** using a life cycle approach. In its calculation, it assumes the lifetime of the facility and takes into account the **decarbonization of energy** during the facility's lifetime[1] .
- For the calculation of the baseline scenario (Step 2), the company also **estimates** the quantity of energy produced/injected by the installation over the considered lifetime.

Annual calculation

- The company calculates the carbon footprint **of each installation** from a life cycle perspective. In its calculation, it assumes that the installation will last for a certain period of time and amortizes all emissions outside of the use phase (*e.g.*, construction, end-of-life) over the period of time considered.
- The emissions of the use phase are calculated on the basis of the **actual energy consumption of the installation** and **the actual carbon intensity of the energy consumed** in **the year of calculation**.
- For the calculation of the baseline scenario (Step 2), the company also **measures** the quantity of energy produced/injected by the installation for the year of calculation of the avoided emissions.

Company-specific approach

The situation with the solution is a **pathway of** GHG emissions and **average** energy production/injection, **for a company-specific range of installations**.

Lifetime calculation

- The company calculates the average carbon footprint **per range of installation** (based on representative installations), using a life cycle approach.
- In its calculation, the company assumes an **average lifetime** for the range of installations and takes into account the **decarbonisation of energy** during the lifetime considered[1] .
- For the calculation of the baseline scenario (Step 2), the company also **estimates** the amount of energy produced/injected by the plant range over the considered lifetime.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

- The company calculates the average carbon footprint **per range of installation** (based on representative installations), using a life cycle approach.
- In its calculation, the company assumes an **average lifetime** for the range of installations and amortizes all non-use phase emissions over the considered lifetime.
- The emissions of the use phase are calculated on the basis of the **actual carbon intensity of the energy consumed** in **the year of calculation**.
- For the calculation of the baseline scenario (Step 2), the company additionally **measures** the **average** amount of energy produced/injected by the installation range for the year of calculation of the avoided emissions.

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses data and assumptions that are not specific to its range of installations, but taken from averages for installations of the same type, in the market considered (preferably at the country level).

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

- The baseline situation shall reflect, for the energy vector produced/injected by the installation, all emissions induced by the production/injection of the same energy vector that would have been achieved **by existing and new installations in the absence of the installation under study.**
- The baseline scenario is calculated by multiplying two pathways:
  - The **quantity of energy produced** or **injected into the energy networks of the facility in question**, over its entire lifetime (estimated in Step 1).
  - **The average carbon intensity** of the production of the same energy carrier of existing facilities and new facilities in the absence of the studied facility, over the lifetime of the facility, which is estimated by **a trend decarbonization pathway**[1] .

Annual calculation

- The baseline scenario shall reflect, for the energy vector produced/injected by the installation, all the emissions induced by the production/injection of the same energy vector that would have been carried out **by the existing installations in the absence of the installation under study.**
- The baseline scenario is calculated by multiplying :
  - The **actual** amount of energy produced or injected into the energy networks by the installation, for the year of the calculation (measured in Step 1).
  - **The average carbon intensity** of the production of the same energy vector of the existing installations in the year of calculation.

In both approaches (annual and lifetime), the company ensures that there is **spatial and temporal consistency** between energy production/injection into the networks and consumption of the energy vector in question. In particular, it must aim for the finest possible level of granularity.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach

For the company average approach, the company follows **the same calculation method as for the unit average approach**, except that it uses input data and assumptions that are not specific to one of its installations, but are derived from averages of its range of representative installations, for the market considered (preferably at the country level).

Market average approach

For the market average approach, the company follows **the same calculation method as for the company-specific approach**, except that it uses input data and assumptions that are not specific to its range of representative installations, but are derived from averages for installations of the same type in the market considered (preferably at the country level).

Step 3

Calcu-lation of avoided emissions (AE)

- The emissions avoided by a facility are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:
- **It is possible to cross the levels of precision for the calculation of avoided emissions**. For example, the scenario with the solution may have been calculated with a company-average approach and the reference scenario with a market average vision.
- The avoided emissions - "real reduction" type (AE_R) reflect the **decarbonization of the volume of primary energy historically consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
- The avoided emissions - "lesser increase" type (AE_{LI}), on the other hand, reflect the **decarbonization of the growth in the volume of primary energy consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
- Thus, the calculation of the share of AE_R and AE_{LI} is as follows:
  - Let ***CE_p*** be **the growth rate of primary energy consumption** in the geographical perimeter considered and over the time period considered in the baseline scenario (if calculated over a lifetime, take a trend projection). Then :
  - ***If $CE_p \geq 0$:*** $AE_R = (1-CE_p) * AE$ *and* $AE_{LI} = CE_p * AE$
  - ***If $CE_p < 0$:*** $AE_R = AE$ *and* $AE_{LI} = 0$

Solution analysed 1.1

Installation of a new photovoltaic (PV) power plant connected to the electricity grid

Photovoltaic power plants allow the production of decarbonised electricity, thus **displacing the more carbon-intensive electricity production of existing and future power plants.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

- The company calculates the carbon footprint **of each PV power plant** from a life cycle perspective.
- For the calculation of the baseline scenario (Step 2), the company makes an assumption about the **lifetime of** its PV plant and **estimates** the amount of electricity produced by the plant over the lifetime considered.

Annual calculation

- The company calculates the carbon footprint **of each power plant** from a life cycle perspective. In its calculation, it assumes a lifespan and amortizes all emissions over the considered lifespan.
- For the calculation of the baseline (Step 2), the company **measures** the **actual** amount of electricity produced by the PV plant in the year of the avoided emissions calculation.

Company-specific approach

Lifetime calculation

- The company calculates the **average** carbon footprint **of its power plants, by range of PV panels put into service**, in a life cycle logic.
- For the calculation of the baseline scenario (Step 2), the company makes an assumption of the **average lifetime of** each PV array and furthermore **estimates** the **average** amount of electricity produced over the considered lifetime.

Annual calculation

- The company calculates the **average** carbon footprint **of its power plants, by range of PV panels commissioned**, using a life cycle approach. The company assumes an **average lifetime** for each range of PV panels and amortizes all emissions over that lifetime.
- For the calculation of the baseline (Step 2), the company **measures** the **actual** amount of electricity produced by each PV plant in operation, for the year of the avoided emissions calculation.

Market average approach

- **The company uses the average LCA carbon footprint** of PV panels produced in **France, Europe or China**.
- Net Zero Initiative has further estimated the **average amount of electricity injected into the grid for 1 kWp installed in France**, over the conventional lifetime.

⋮

Step 1

Emissions in the situation with the solution (E_{sol})

Market average approach *(cont.)*

- The numerical values are provided in the **summary table at the** end of this Solution Sheet. The calculation is for the whole lifetime and is expressed in **kgCO_2 e / kWp.**
- These numerical values can be used for France only. Other geographies will be addressed by Net Zero Initiative in the future.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

- The baseline scenario is calculated by multiplying two pathways:
  - The **amount of electricity produced by the PV plant in question**, over its lifetime (estimated in Step 1).
  - **The average carbon intensity** of electricity generation in the geographical area considered. This average carbon content (over the lifetime of the PV plant considered), is estimated by **a trend decarbonisation pathway**[1] .

NB: Net Zero Initiative authorizes at this stage any other relevant and recognized method that takes into account the evolution of the carbon content of the electricity mix (the relevance of the method used must be justified). In particular, the company may, if it wishes, use the emission factors from the UNFCCC OM-BM method.

Annual calculation

- The baseline scenario is calculated by multiplying two pathways:
  - The **actual amount of electricity produced by the PV plant in question**, in the year of calculation (measured in Step 1).
  - **The average carbon intensity** of electricity production in the geographical area under consideration, in the year of calculation.

NB: In both approaches (annual and lifetime), the company must ensure **spatial and temporal consistency** between electricity production and consumption. In particular, it must aim for the finest possible level of granularity (hourly or even semi-hourly steps).

Company-specific approach

Lifetime calculation

- The company follows the same method as for the solution-specific approach, except that it uses as input the **average** amount of electricity **produced, per array of PV panels commissioned**, over the lifetime (estimated in Step 1).

NB: The company can if it wishes use the emission factors from the UNFCCC OM-BM method or directly the OM/BM emission factors standardized by the IFI TWG[3]

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)
(2) https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
(3) The OM/BM emission factors standardized by the IFI TWG are available here: https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting/ifi-twg-list-of-methodologies (reference AHG-001).

Step 2

Emissions in the baseline scenario (E_{ref})

Company-specific approach *(cont.)*

Annual calculation

- The company follows the same method as for the solution-specific approach.

Market average approach

- Net Zero Initiative has calculated **an average baseline scenario** for 1 kWp of PV panels installed **in France.**
- The numerical values are provided in the **summary table at the** end of this Solution Sheet. They can be used for France only. Other geographies will be covered by Net Zero Initiative in the future.

Step 3

Calcu-lation of avoided emissions (AE)

- The emissions avoided by a facility are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:
- **It is possible to cross the levels of precision for the calculation of avoided emissions**. For example, the scenario with the solution may have been calculated with a company-average approach and the reference scenario with a market average vision.
- Thus, the calculation of the share of AE_R and AE_{LI} is as follows:
    - Let CE_p be **the average annual growth rate of primary energy consumption** in the geographical area under consideration and over the time period under consideration in the baseline scenario (if calculated over a lifetime, take a trend projection). Then :
    - ***If*** $CE_p \geq 0$: $AE_R = (1-CE_p) * AE$ *and* $AE_{LI} = CE_p * AE$
    - ***If*** $CE_p < 0$: $AE_R = AE$ *and* $AE_{LI} = 0$

- *In France[1] , CEp ~= 0% between 2010 and 2019 (primary energy consumption is stable since 10 years). So, 100% of the emissions are* AE_R *for a PV plant installed in France.*

(1) https://www.statistiques.developpement-durable.gouv.fr/chiffres-cles-de-lenergie-edition-2021

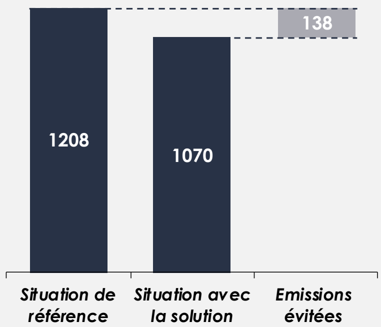
[Market average approach for France].

Summary table

In kgCO2/m2 over the entire lifetime	Baseline scenario	Situation with the solution	**Avoided emissions** (Avoidance Factor - AF)
PV manufacturing France	800	690	110
PV manufacturing Europe	1300	970	330
PV manufacturing China	1300	910	390

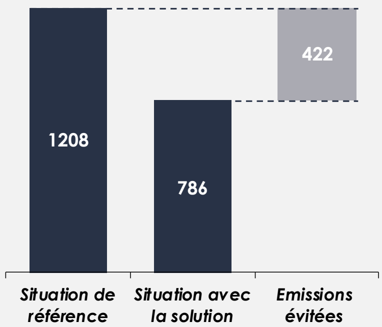
Illustration - PV power plant in France

Centrale PV 1kWc - fabrication Chine
kgCO_2e sur toute la DV (25 ans)



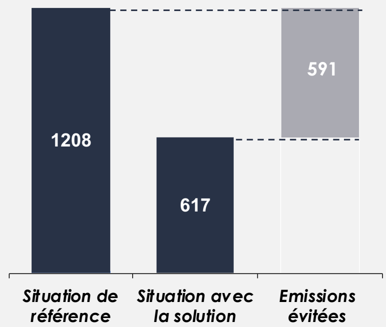
Facteur d'évitement d'une nouvelle centrale PV en France – fabrication Chine :
138 kgCO_2e/kWc

Centrale PV 1kWc - fabrication Europe
kgCO_2e sur toute la DV (25 ans)



Facteur d'évitement d'une nouvelle centrale PV en France – fabrication Europe :
422 kgCO_2e/kWc

Centrale PV 1kWc - fabrication France
kgCO_2e sur toute la DV (25 ans)



Facteur d'évitement d'une nouvelle centrale PV en France – fabrication France :
591 kgCO_2e/kWc

DV : durée de vie

Solution analysed 1.2
Production and sale of synthetic fuels

Synthetic fuels, when produced from decarbonized primary energy (renewable, nuclear), can replace **the use of fossil fuels**.

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach

Lifetime calculation

- For each production unit, the company makes an assumption about the **lifetime of** its production unit and **estimates** the amount of synthetic fuel produced by the unit over the lifetime.
- The company shall calculate the induced emissions of the entire production of the synthetic fuel under consideration, in a life-cycle (well-to-wheel) logic. The **decarbonisation of energy**[1] over the lifetime of the fuel shall be taken into account in the calculations.
- This calculation results in a **carbon intensity pathway per litre of fuel**, over the life of the production unit considered.

Annual calculation

- For each production unit, the company shall **measure** the **actual** amount of synthetic fuel produced by the unit for the year in which the avoided emissions are calculated.
- The company calculates the induced emissions of all the synthetic fuel production considered, in a life cycle logic (from well to wheel).
    - Emissions related to the plant's energy consumption are calculated on the basis of **the actual carbon intensity of the energy** in the year of calculation and the plant's **actual energy consumption.**
    - Non-use phase emissions are amortized over their useful life.
- This calculation results in **a carbon intensity per litre of fuel for the measurement year**.

Company-specific approach

Lifetime calculation

- The company assumes the **average life of** its production units and **estimates the average** amount of synthetic fuel produced by these units over the life of the unit.
- The company shall calculate the induced emissions of the entire production of the synthetic fuel under consideration, in a life-cycle (well-to-wheel) logic. The **decarbonisation of energy**[1] over the lifetime of the fuel shall be taken into account in the calculations.
- This calculation results in a **carbon intensity pathway per litre of fuel**, on average for the production units considered and over the average life considered.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Company-specific approach *(cont.)*

Annual calculation

- The calculation method is the same as that described in the Solution-specific approach.

Market average approach

- Net Zero Initiative has not yet calculated an average market value for this solution.

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach

Lifetime calculation

It is not possible to calculate a baseline scenario in the solution-specific approach and for the whole life of a production unit, refer to the company-specific approach.

Annual calculation

- For each fuel sale, the company knows through a systematic customer survey, which **fuel has been replaced** by the synthetic fuel sold.
- The baseline is the average **carbon intensity (well-to-wheel)** of the replaced fuels, weighted by fuel volume.

Company-specific approach

Lifetime calculation

- The company knows, through a customer survey, **the volume breakdown of the different fuels that are replaced** by the synthetic fuel produced by its production units.
- The baseline is the average (volume-weighted) **carbon intensity (well-to-wheel) of** the replaced fuels.
- The company then uses **decarbonisation pathways for the different fuels replaced**[1] over the life of the project to obtain **a reference carbon intensity pathway per litre of fuel.**

Annual calculation

- The company knows, through a customer survey, **the volume breakdown of the different fuels that are replaced** by the synthetic fuel produced by its production units.
- The baseline is the average (weighted by volume breakdown) of the **carbon intensities (well to wheel)** of the replaced fuels. The emission factors used are those corresponding to the year of calculation.

Market average approach

Net Zero Initiative has not yet calculated an average market value for this solution.

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 3

Calculation of avoided emissions (AE)	

Calculation of avoided emissions (AE)

- The emissions avoided by a facility are calculated as the difference between the emissions in the baseline situation and the emissions in the situation with the solution:
- **It is possible to cross the levels of precision for the calculation of avoided emissions**. For example, the scenario with the solution may have been calculated with a Solution-specific approach and the reference scenario with a market average approach.
- Thus, the calculation of the share of AE_R and AE_{LI} is as follows:
  - Let CE_p be **the average annual growth rate of primary energy consumption** in the geographical area under consideration and over the time period under consideration in the baseline scenario (if calculated over a lifetime, take a trend projection). Then :
  - ***If*** $CE_p \geq 0$: $AE_R = (1-CE_p) * AE$ *and* $AE_{LI} = CE_p * AE$
  - ***If*** $CE_p < 0$: $AE_R = AE$ *and* $AE_{LI} = 0$

- *In France*[1] *, CEp ~= 0% between 2010 and 2019 (primary energy consumption is stable since 10 years). So, 100% of the emissions are* AE_R *for a PV plant installed in France.*

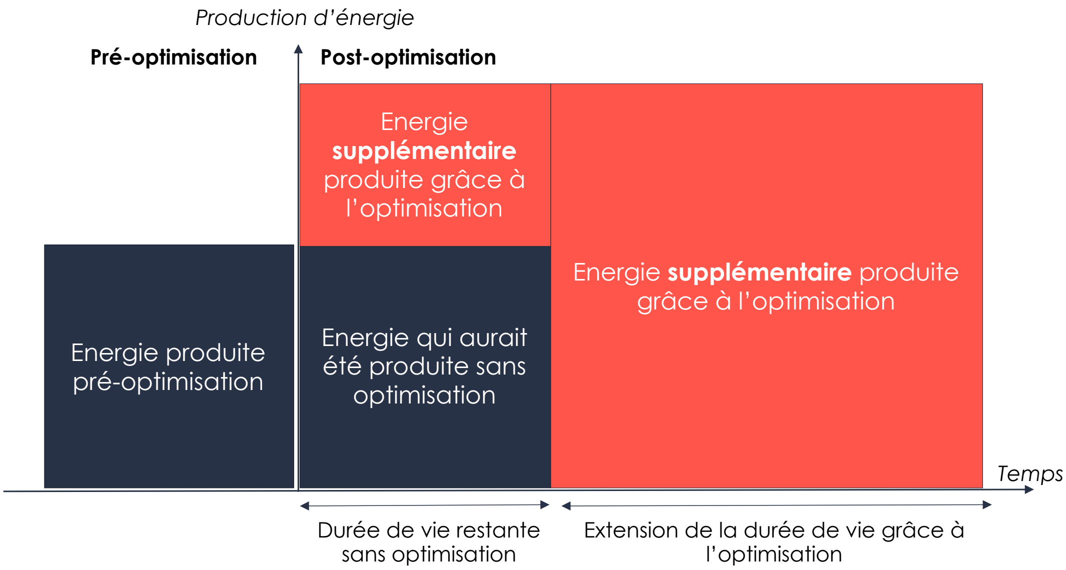
(1) https://www.statistiques.developpement-durable.gouv.fr/chiffres-cles-de-lenergie-edition-2021

Family #2:
Optimize the energy production of existing facilities

Products and services that **reduce the carbon intensity of energy carriers by optimising the energy production of existing installations.** The solutions concerned are **the financial, technical, operational means implemented on existing energy production facilities**. They can act on :

- **Extending the life of** existing facilities;
- **The amount of energy produced** over its conventional lifetime (pre-optimization) and, if applicable, over its extended lifetime (post-optimization)

Illustration of the method for calculating avoided emissions by optimization solutions for existing facilities



- Pour les solutions d'optimisation des installations existantes, **on valorise l'énergie supplémentaire produite grâce à l'action d'optimisation**.
- Pour cette quantité d'énergie supplémentaire, des émissions évitées sont calculées par rapport à **une situation de référence identique aux nouvelles installations (Famille 1).**

Step 1

Emissions in the situation with the solution (E_{sol})

For the calculation of emissions in the situation with the solution, only the solution-specific approach is possible because the gains obtained and the emissions induced by the optimization actions vary greatly between facilities.

The situation with the solution is a GHG emissions and **additional** energy production **pathway**, **specific to the studied facility**.

Solution-specific approach

<u>Lifetime calculation</u>

- The company estimates the possible gain in the lifetime **of** the installation obtained through the optimization.
- The company calculates the carbon footprint of **the optimization action** from a life cycle perspective, including any emissions induced by the extension of the lifespan**.**

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach
(cont.)

- The company considers in its calculation the **decarbonization of energy**[1] during the life cycle considered for the calculation of emissions induced by energy consumption (fuel, equipment, travel, etc.).
- For the calculation of the baseline scenario (Step 2), the company also **estimates** the amount of **additional** energy produced by the plant over the entire remaining lifetime after optimization.

Annual calculation

- The company estimates the possible **gain in the lifetime** of the installation obtained through the optimization.
- The company calculates the carbon footprint of **the optimization action** from a life cycle perspective, including any emissions induced by the extension of the lifespan and amortizes all non-use phase emissions over the lifespan considered.
- Emissions from the use phase (fuel, equipment, travel, etc.) are calculated based on the **actual energy consumption of the facility** and the **actual carbon intensity of the energy consumed** in **the year of calculation**.
- For the calculation of the baseline (Step 2), the company additionally **measures** the amount of **additional** energy produced by the facility in the year of the avoided emissions calculation.

Step 2

Emissions in the baseline scenario (E_{ref})

The baseline scenario assumes that all the **additional** energy production of the optimized plant would have been generated by existing plants and possibly by the addition of new plants. **Thus, for this amount of additional energy, the baseline scenario is the same as for Family 1.**

Here again, only the solution-specific approach is possible because the gains obtained by optimization actions vary greatly between facilities. Nevertheless, the carbon intensity of the energy produced in the absence of optimization can be calculated with an average company or market average approach.

Solution-specific approach

Lifetime calculation

- The baseline situation shall reflect, for the energy vector produced by the optimised installation, all the emissions induced by the production of the same energy vector that would have been achieved **by existing and new installations in the absence of the optimised installation.**
- The baseline scenario is calculated by multiplying two pathways:
    - The amount of **additional** energy produced by the optimised installation, **over its entire lifetime** (estimated in Step 1).
    - **The average carbon intensity** of the production of the same energy carrier by existing and new facilities in the absence of the optimized facility **over the entire lifetime**, which is estimated by **a trend decarbonization pathway**[1] .

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach
(cont.)

Annual calculation

- The baseline situation shall reflect, for the energy vector produced by the optimised installation, all the emissions induced by the production/injection of the same energy vector that would have been achieved **by the existing installations in the absence of the optimised installation.**
- The baseline scenario is calculated by multiplying :
  - The **actual** amount of **additional** energy produced by the optimised installation, **for the year of the calculation** (measured in Step 1).
  - **The average carbon intensity of the** production of the same energy carrier in the existing facilities in **the year of calculation**.

In both approaches (annual and lifetime), the company ensures that there is **spatial and temporal consistency** between energy production and consumption of the energy vector under consideration. In particular, it must aim for the finest possible level of granularity.

Step 3

Calcu-lation of avoided emissions (AE)

- The emissions avoided by an installation optimization are calculated as the difference between the emissions in the baseline scenario and the emissions in the situation with the solution:
- The avoided emissions - "real reduction" type (AE_R) reflect **the decarbonization of the volume of primary energy historically consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
- The avoided emissions – "lesser increase" type (AE_{LI}), on the other hand, reflect **the decarbonisation of the growth in the volume of primary energy consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
- Thus, the calculation of the share of AE_R and AE_{LI} is as follows:
  - Let CE_p be **the growth rate of primary energy consumption** in the geographical perimeter considered and over the time period considered in the baseline scenario (if calculated over a lifetime, take a trend projection). Then :
  - ***If*** $CE_p \geq 0$**:** $AE_R = (1-CE_p) * AE$ *and* $AE_{LI} = CE_p * AE$
  - ***If*** $CE_p < 0$**:** $AE_R = AE$ *and* $AE_{LI} = 0$

Family #3:
Reduce losses in existing energy transmission and distribution networks

Products and services to **reduce the carbon intensity of energy carriers by optimising energy transport and distribution.** The solutions concerned are **the means (financial, technical, operational) implemented on the energy transport and distribution networks to** reduce losses and/or leaks in these networks. These solutions can have two positive effects:

- **The provision of energy that is no longer lost to the grid**
- **Reduction of fugitive GHG emissions from certain networks** (e.g. methane from the natural gas network)

Step 1

Emissions in the situation with the solution (E_{sol})

For the calculation of emissions in the situation with the solution, only the Solution-specific approach is possible because the gains obtained and the emissions induced by the optimization actions vary greatly between networks.

The situation with the solution is a GHG emissions and end-use energy savings **pathway**, **specific to the optimized network or network segment**.

Solution-specific approach

Lifetime calculation

- The company estimates the possible **gain in** network lifetime obtained through its optimization.
- The company **calculates** the carbon footprint of **the optimization action** from a life cycle perspective, including any emissions induced by the extension of the lifespan**.**
- The company considers in its calculation the **decarbonization of energy**[1] during the life cycle considered for the calculation of emissions induced by energy consumption (equipment, travel, etc.).
- For the calculation of the baseline scenario (Step 2), the company additionally **estimates** the amount of **additional** energy consumed by end customers over the entire remaining lifetime after optimization, enabled by the network optimization.
- For the calculation of the baseline (Step 2), the company finally **estimates** the potential volume of fugitive GHG emissions avoided.

Annual calculation

- The company estimates the possible **gain in** network lifetime obtained through its optimization.
- The company calculates the carbon footprint of **the optimization action** from a life cycle perspective, including any emissions induced by the extension of the lifespan and amortizes all non-use phase emissions over the lifespan considered.
- Emissions from the use phase (equipment, travel, etc.) are calculated on the basis of **actual energy consumption** and **the actual carbon intensity of the energy consumed** in **the year of calculation**.

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 1

Emissions in the situation with the solution (E_{sol})

Solution-specific approach *(cont.)*

- For the calculation of the baseline scenario (Step 2), the company also **measures** the amount of **additional** energy consumed by end customers as a result of the network optimization in the year in which the avoided emissions are calculated.
- For the calculation of the baseline (Step 2), the company finally **measures** the **actual** volume of fugitive GHG emissions avoided.

Step 2

Emissions in the baseline scenario (E_{ref})

The baseline scenario assumes that all **additional** energy consumed by end customers (enabled by grid optimization) would have been generated by existing facilities and possibly by adding new facilities. **Thus, for this amount of additional energy, the baseline scenario is the same as for Family 1.**

If relevant, **fugitive GHG emissions avoided** are also included in the baseline.

Here again, only the Solution-specific approach is possible because the gains obtained by optimization actions vary greatly between networks. Nevertheless, the carbon intensity of the energy produced in the absence of optimization can be calculated with an average company or market average approach.

Solution-specific approach

Lifetime calculation

- The baseline should reflect, for the energy carrier transported/distributed through the network, all emissions induced by the production of the same energy carrier that would have been achieved **by the existing and new installations in the absence of the reduction of losses or leakages from the network.**
- The baseline scenario is calculated by multiplying two pathways:
  - The **amount of energy saved through optimization**, **over the entire lifetime** (estimated in Step 1).
  - **The average carbon intensity of the** production of the same energy carrier of existing facilities and new facilities in the absence of the studied facility, over the whole lifetime, which is estimated by **a trend decarbonisation pathway**[1] .
- If relevant, the company also counts in the baseline the avoided fugitive GHG emissions (estimated in Step 1).

Annual calculation

- The baseline should reflect, for the energy carrier transported/distributed by the network, all emissions induced by the production of the same energy carrier that would have been achieved **by the existing installations in the absence of the reduction of network losses or leakages.**
- The baseline scenario is calculated by multiplying :
  - The **actual** amount of **energy saved by the optimization in the year of the calculation** (measured in Step 1).
  - **The average carbon intensity of the** production of the same energy carrier in the existing facilities in the year of calculation.
- If relevant, the company also counts in the baseline the avoided fugitive GHG emissions (measured in Step 1).

⋮

(1) The decarbonation scenario used for the performance projections must be trend-based and not aligned with the Paris Agreement (e.g. AME scenario - With Existing Measures - of the SNBC)

Step 2

Emissions in the baseline scenario (E_{ref})

Solution-specific approach
(cont.)

In both approaches (annual and lifetime), the company ensures that there is **spatial and temporal consistency** between energy production/injection into the networks and consumption of the energy vector in question. In particular, it must aim for the finest possible level of granularity.

Step 3

Calcu-lation of avoided emissions (AE)

- The emissions avoided by the optimization of a network or network segment are calculated as the difference between the emissions in the baseline scenario and the emissions in the situation with the solution:
- For avoided emissions related to the reduction of fugitive GHG emissions, these are called avoided emissions - "real reduction" type (AE_R), since they represent a reduction in emissions compared to the previous situation (existing demand context).
- For avoided emissions related to energy savings :
    - the avoided emissions - "real reduction" type (AE_R) reflect the **decarbonization of the volume of primary energy historically consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
    - Avoided emissions – "lesser increase" type (AE_{LI}) reflect the **decarbonisation of the growth in the volume of primary energy consumed in the geographical area** considered in the baseline scenario, to which the solution contributes.
    - Thus, the calculation of the share of AE_R and AE_{LI} is as follows:
    - Let CE_p be **the growth rate of primary energy consumption** in the geographical perimeter considered and over the time period considered in the baseline scenario (if calculated over a lifetime, take a trend projection). Then :
    - ***If*** $CE_p \geq 0$: $AE_R = (1-CE_p) * AE$ and $AE_{LI} = CE_p * AE$
    - ***If*** $CE_p < 0$: $AE_R = AE$ and $AE_{LI} = 0$

Methodological issues
What are the rules for accounting and allocation of avoided emissions for energy producers?

We specify here the rules for accounting and allocation of avoided emissions **for energy producers and operators of energy transmission and distribution infrastructures**.

Case	Rule for calculating avoided emissions
The company contributes to the construction of a low-carbon energy production facility	**Allocation rule for avoided emissions in Net Zero Initiative**: if an allocation key for the emissions induced by the solution is used in Pillar A, the same allocation key is applied for the avoided emissions of the solution in Pillar B. For example, a company that sells wind turbine stators and only counts the emissions induced by the manufacturing of the stators in its carbon footprint (pillar A) will use the following allocation key: $AE_{company\text{-}stator} = AE_{wind\ power\ plant} \times (E_{stator\ -\ LCA} / E_{wind\ power\ plant\ -\ LCA})$
The company supplies energy to downstream decarbonising solutions (e.g. electric vehicles, heat pumps, etc.)	**The energy supplier contributes to the value chain of decarbonising solutions in the same way as the other players involved in its manufacture.** Thus, the supplier of the energy used by a decarbonising solution, can claim x% of the AEs by the latter, as long as he can prove that his energy constitutes x% of the LCA of this decarbonising solution.
The company transports / distributes low-carbon energy	• If the company builds the **connection of a new low-carbon generation facility to the grid**, it can consider that it is **contributing to the construction of the new low-carbon generation facility** and count avoided emissions as described above. • If the company **simply operates the network identically** and the means of production decarbonize without any action on its part, it **cannot claim any avoided emissions.**

Methodological issues
How to measure and accounting for EAs for the purchase of of green power contracts (PPA/GO)?

These rules specify the accounting of avoided emissions **for organizations purchasing green power**. Producers and other value chain players should refer to the avoided emissions calculation methods Family 1.

Guarantees of origin (GO)

Location-based approach

- **Pillar A:** no Pillar A earnings
- **Pillar B**: no avoided emissions (additional development of low-carbon energy generation capacity is not demonstrated)

Market-based approach

- **Pillar A**: count a gain in Pillar A when there is spatial and temporal coherence between production and consumption
- **Pillar B**: no avoided emissions (additional development of low-carbon energy generation capacity is not demonstrated)

Power Purchase Agreements (PPA)

Location-based approach

- **Pillar A:** no Pillar A earnings
- **Pillar B**: counting AEs as a financer of new low-carbon production means. Each kWh purchased gives the right to AE by comparison with the average network mix (see methodology Family 1).

Market-based approach

- **Pillar A**: count the emissions induced by the contracted means of production for each kWh consumed.
- **Pillar B**: do not count any avoided emissions because the entire carbon gain belongs to the company and not to others.
  In the case where part of the production is not consumed by the company, count X% of the AE of the financed means of production, with X the share of surplus production injected into the network.

Self-consumption

Location-based and market-based approaches merge

- **Pillar A:** count the emissions induced by the contracted means of production for each kWh consumed.
- **Pillar B**: do not count any avoided emissions because the entire carbon gain belongs to the company and not to others.
  In the case where part of the production is not consumed by the company, count X% of the AE of the financed means of production, with X the share of surplus production injected into the network.

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Carbone 4 is the first independent consultancy specialised in low carbon strategy and adaptation to climate change.

Constantly on the lookout for low amplitude signals, we deploy a systemic view of the energy-climate issue, and put all our rigour and creativity to work to transform our clients into leaders in the climate challenge.

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