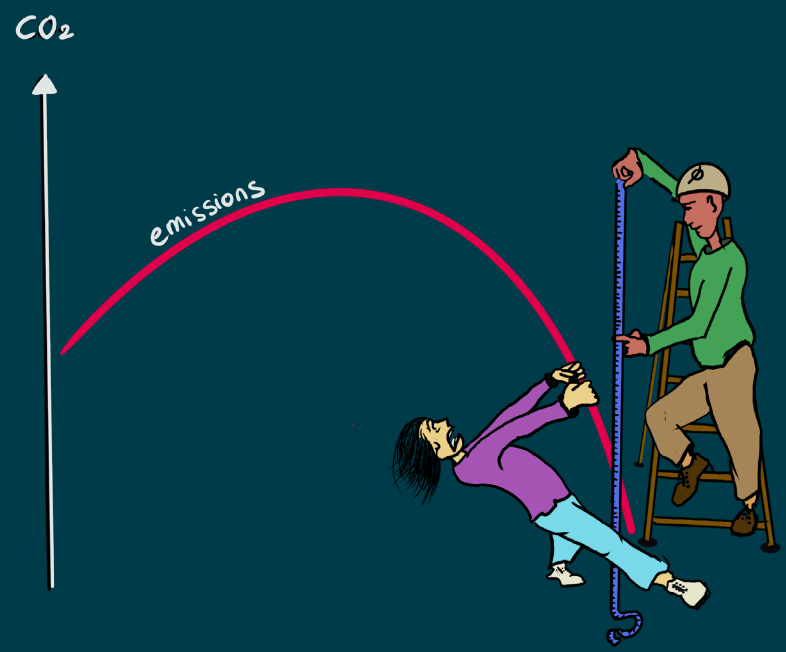
How to measure Climate Impact?



Shaping a methodology for the accounting of avoided greenhouse gas emissions

nysnø Climate Investments

Content

1. Avoided emissions: what does it mean?

1.1. Why do we need to account for the avoided emissions?

Nysnø Climate Investments (Nysnø) invests in companies that develop solutions contributing to reducing greenhouse gas (GHG) emissions globally, either directly or indirectly. Throughout this document, we will refer to these solutions as *climate solutions*.

In recent years, the number of investors dedicated entirely or partly to the reduction of GHG emissions has increased significantly. Pledges on climate impact has flourished and the associated number of tons CO_2 avoided have become a key parameter to measure the performance for many fund managers. As it has become a metric with direct financial implications, it needs to be accounted for in a reliable and transparent manner.

Since the inception of Nysnø in 2018, we have estimated the GHG emissions reduction potential for all our investments and we initiated public reporting on avoided emissions in our annual report in 2021 (Nysnø, 2021). This is a work we intend to develop in the coming years.

1.2. Background

Several initiatives have recently been launched to establish a methodology for accounting avoided GHG emissions. The search for a methodology should be based on existing and generally accepted carbon accounting methods, if possible and practical to do so. The GHG protocol sets a standard for measuring and managing emissions and is widely used. However, there is a need for a methodology to account for forward-looking estimations of avoided emissions, suited for investors seeking to quantify their climate impact from early-stage investments. The report A study on principles for avoided emissions accounting from Cleantech Scandinavia and the working paper Impact Methodology Landscape from Project Frame offer an overview of the topic.

Since 2021, Nysnø has participated in Project Frame led by the Prime Coalition. Project Frame is a rapidly growing global community that includes over 120 leading venture capital and private equity investors from around the world. Together, these investors represent over $60 billion in raised investments dedicated to climate technology, and approximately $200 billion in assets under management. Nysnø is contributing to Project Frame both by participation in working groups and in the steering committee, and we intend to follow its recommendations when the framework is published.

PROJECT
FRAME

The ambition of project FRAME is to build consensus around common terminology and best practices to increase our ability to invest in the highest potential climate solutions to safeguard our planet.

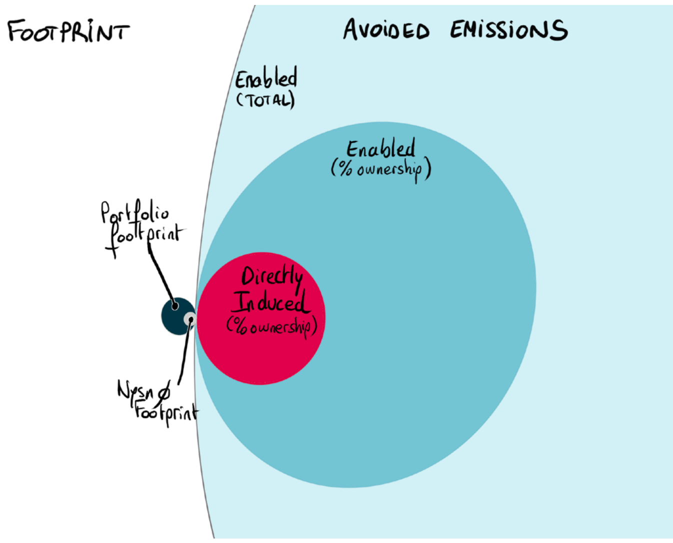


Figure 1: To get a good overview of the portfolio carbon footprint and avoided emissions, there is a need for a methodology and consensus around common terminology and best practices. It is particularly challenging to find a good common practice on how to quantify the future planned and potential avoided emissions from early-stage climate investments.

As the Norwegian state climate investment company, Nysnø follows high standards for transparency and reporting. The Norwegian government recently arranged a seminar on how to report on GHG emissions (scope 1, 2 and 3). Practical tips and tools can be found on eierskap.no.

1.3. How to calculate avoided emissions? The basics

1.3.1. Realized, planned and potential avoided emissions

The concept of *avoided emissions* is to quantify the GHG emissions reduction or removal that a given climate solution is contributing to. This exercise can be done by either looking backward or forward.

Looking backward means that we use the measured effect of a given solution continuously and report on them (also called *realized avoided emissions*). Realized avoided emissions are based on data issued from actual deployment or commercialization of the climate solution.

Looking forward means that we estimate the future effect of the climate solution (also called *planned avoided emissions*) based on a realistic scenario of commercial deployment. This is the most complicated exercise as it involves projections and subjective forward-looking assumptions. Still, for climate investors, this exercise is just as important as projecting future revenues and profitability for the same investment.

Finally, *potential avoided emissions* is a term that represents the maximum theoretical potential of a climate solution. This can be compared to the approach used for estimating the Total Addressable Market for a given product while assessing its commercial potential.

Quantifying avoided emissions is an important exercise for evaluating the effectiveness of a climate solution and to project potential returns for investors. By analyzing both realized and potential future avoided emissions, we get a more complete understanding of the solutions impact over time, and how it is contributing to combat climate change.

Figure 2 illustrates the difference between realized, planned and potential avoided emissions.

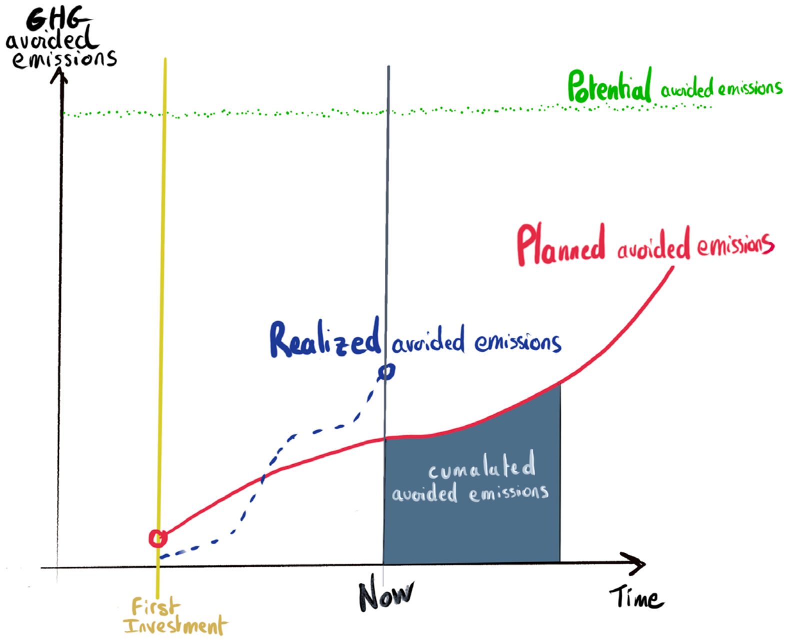


Figure 2: Illustration of realized, planned and potential avoided emissions of a climate solution.

1.3.2 Quantification of avoided emissions

The first sanity check we do in an investment process, is to ensure that the world with the proposed climate solution emits less than it would have by continuing to use the incumbent solutions. This is an obvious pre-requisite for any climate investment.

When it comes to quantifying the climate effect of a given solution, it is not always possible (or realistic) to perform a tangible calculation of the avoided emissions generated. This is either because the climate solution is exposed to a multitude of potential effects, making it virtually impossible to track down each and every one of them, or because the climate solution is part of a larger system in which individual contribution is hard to identify. It is important to note that a future net zero society is dependent on several such solutions, and the fact that their impact is hard to quantify should not discredit their status as climate solutions. One example of such climate solution is our portfolio company eSmart Systems, which provides services and solutions for the inspection and maintenance of critical energy infrastructure. Nysnø has, and will continue to invest in these technologies with the ambition to develop this framework to also account for such solutions in the future.

When the effect of a climate solution is quantifiable, we start by listing the different effects generated by the climate solution (ref 2.1) and establish a *baseline* against which the avoided emissions are estimated. The baseline aims at representing what the world would look like without the climate solution.

When it comes to the quantification of the climate effect of a given solution, it is not always possible (or realistic) to perform a tangible calculation of the avoided emissions generated.

The avoided emissions represent the difference between the emissions generated in a baseline scenario using existing solutions (or incumbents), and the actual emissions generated by the climate endre til solution (Project Frame). This can be expressed with a simple equation:

Avoided Emissions = Emissions of Icumbent Solution − Emissions of Climate Solution

The emissions of the incumbent solution or the climate solution are calculated by considering the GHG emissions that have been produced to deliver the service to the end user. This gathers the 3 scopes of a conventional Life Cycle Analysis (GHGprotocol, 2004):

- Scope 1: Direct GHG emissions from sources that are owned or controlled by the company delivering the solution.
- Scope 2: GHG emissions from the generation of purchased and consumed electricity, steam, heat, or cooling.
- Scope 3: Indirect GHG emissions that occur either upstream (e.g. sourcing of raw material) or downstream (e.g. emissions during use) in the value chain of the company providing the solution.

Once the avoided emissions have been quantified for each production and sale of the proposed climate solution, the projected sales volume are used to estimate the avoided emissions in the future.

Avoided emissions: A new and innovative solar panel

A new and innovative solar panel (PV) that produces 5% more energy than the standard competition with the same solar conditions, and in addition has a carbon footprint 10% lower than the standard competition.

The avoided emissions will then involve two parts:

1. *the additional low carbon power produced by the PV panels and*
2. *the reduction of the emissions related to the manufacturing of the PV panels*

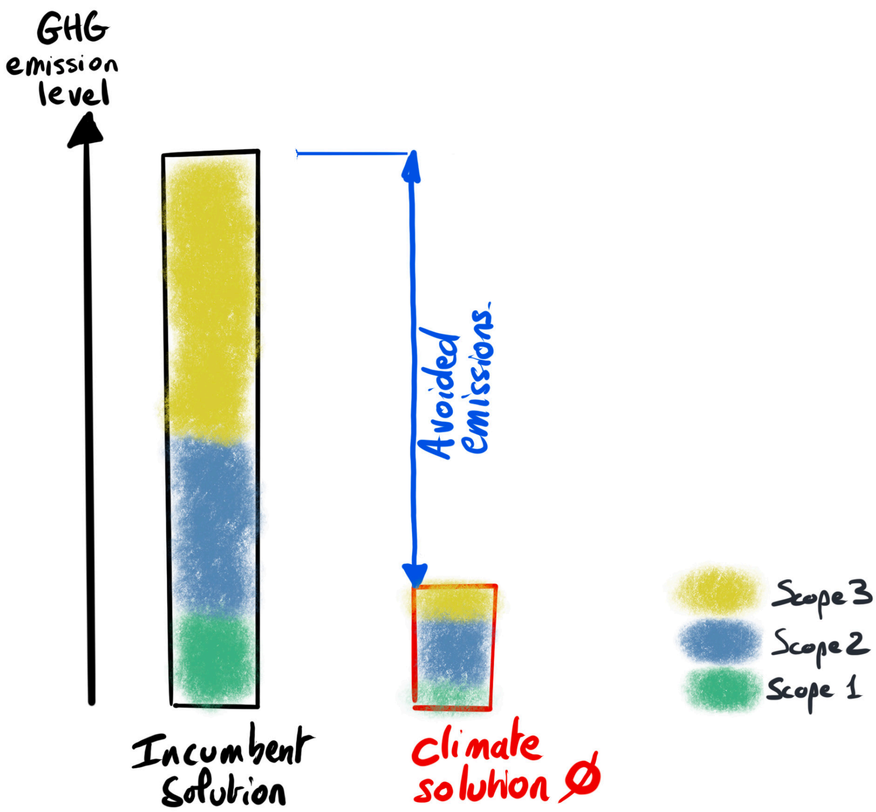


Figure 3: Quantification of avoided emissions: A climate solution is compared to the incumbent solution; the difference represents the avoided emissions.

2. Main methodological choices

2.1. List of Effects

The quantification of the avoided emissions of a climate solution starts with a clear description of the mechanisms through which the reduction occurs. To perform the quantification in a systematic way, we start by identifying these mechanisms one by one. It can be one single mechanism in the easiest case, and it can be several in the most complex ones (Table 1).

While identifying all the effects of a given climate solution, it is important to avoid overlapping effects, which occur when the same avoided emissions are counted more than once. Once all the effects are listed and qualitatively described, they are quantified by using two criteria: *recurrence and causality*, which are described in more detail below.

a) Recurrence

When quantifying the climate effect of a climate solution, it is important to distinguish between *one-off effects* and *recurring effects*. One-off effects are defined as a reduction in GHG emissions that occurs once during the production and/or consumption of the climate solution. This could be in the form of more energy-efficient steel components, or plant-based food, for example.

Recurring effects, on the other hand, refer to reductions in GHG emissions that can be repeatedly measured over an extended period. These effects occur from the continued use of the climate solution, such as a solar PV panel that generates clean energy over an extended period, as illustrated in Figure 4.

> **Recurrence**
> *It is natural to compare the segmentation of these effects with how we differentiate the revenue of a company between recurring and one-off revenues. By doing so, we implicitly give more weight to the avoided GHG emissions that is expected to continue over an extended period of time, much like how the financial markets value a recurring revenue stream higher than one-off sales.*

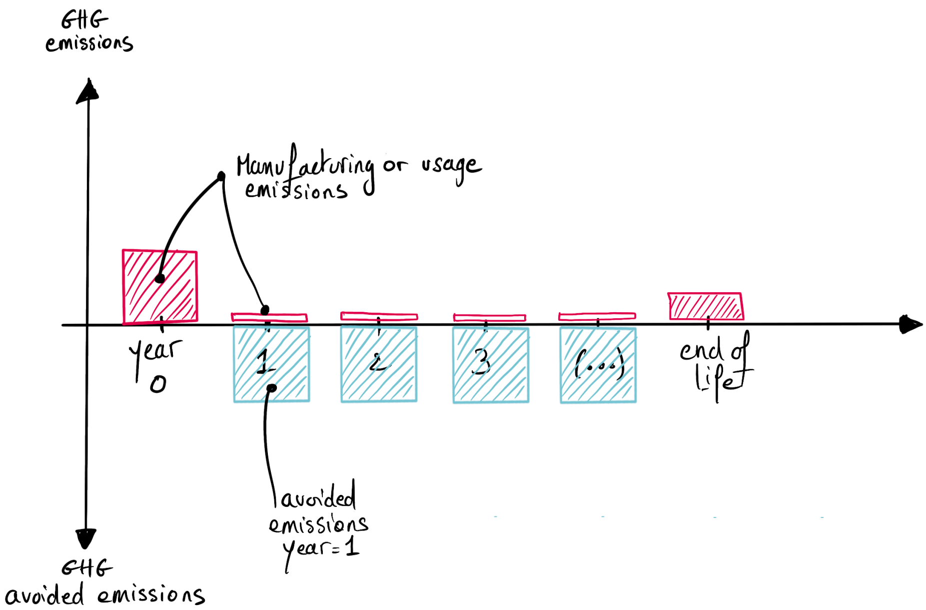


Figure 4: Recurring effects, illustrated in blue, occur when the climate solution generated a reduction of GHG emissions for a longer period after deployment. For most climate solutions, there will be GHG emissions related to production and/or deployment, illustrated in red.

b) Causality

The *Causality* intends to describe the cause of the effect that is contributing to the reduction of GHG emissions. This can be challenging, especially when the climate solution is part of a larger system. The intent is to give more weight to the climate solutions that have played an instrumental and unique role compared to the ones that have played an important, yet less unique role. The causality will change over time for a given climate solution, as the maturity of the technology and adaptation changes. This is illustrated in figure 5.

To qualify the causal link of the climate solution for a given effect, we use two terms: *Directly induced effect* when the causal link is especially strong and *enabled effect* for the others.

The Directly Induced effects are often attributed to a unique feature of a climate solution. This feature generates a distinguished improved performance that leads to a reduction of emissions in an ecosystem or value chain, also compared to competing solutions. In other words, without the climate solution this delta performance will not take place. There is a high degree of causality between the climate solution and the reduced climate gas reduction effect in that case.

The Enabled effects comes from a contribution that can be difficult to distinguish within an ecosystem or value chain, as well as among competitors. However, it's still important to acknowledge that the climate solution plays a crucial role in realizing the climate effect and justifying the additionality of the investment. The level of causality for each enabled effect will vary and should be thoroughly explained in the qualitative description of the effect.

The avoided emissions of a climate solution can be a combination of directly induced and enabled avoided emissions.

We establish certain parameters to determine the effects associated with a climate solution.

We consider the level of recurrence and select one of the following categories:

Recurring: For effects that generates GHG emission reductions throughout the lifetime of the climate solutions. **OR**
One-off: For effects that generates GHG emission reductions only once, i.e. during production or deployment.

We consider the causality and select one of the following categories:

Directly Induced: When the climate solution is the only one (or one of the few) able to generate the given effect for reducing GHG emissions. **OR**
Enabled: When the climate solution is critical for reducing GHG emissions but can be substituted by competition or within the value chain.

Table 1: Effect list

Effect list: a new and innovative solar PV panel			
Effect/Description	Recurrence	Causality	Calculation of avoided emissions (EI-ECS)
Effect A: A 5% increase of the solar production of a solar panel which will displace power from the grid	**Recurring** as this effect is generated throughout the lifetime of the panel	**Directly induced** effect as this is a unique feature	Consider the effect of the extra production of power (+5% compared to other panels)
Effect B: Contribution to a reduction of fossils fuels on the grid	**Recurring** as this effect is generated throughout the lifetime of the panel	**Enabled** effect as this is not a unique feature	Consider the effect of the total power from the panel and subtract the effect already accounted for in A
Effect C: A 10% reduction in the production emissions from the PV panel	**One-off** as this effect is produced only once at manufacturing stage	**Directly induced** effect as this is a unique feature	Consider the difference in footprint at manufacturing with the incumbent solution

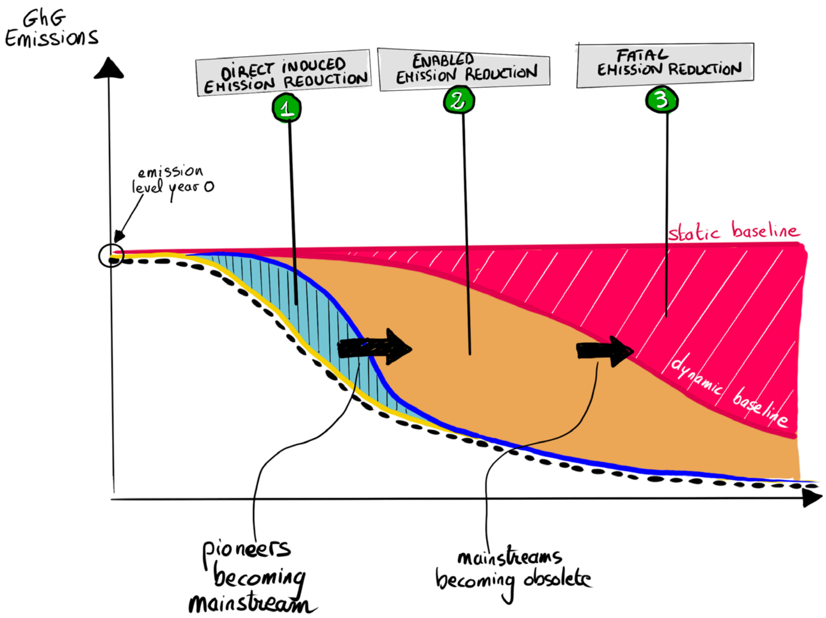


Figure 5: Illustration of directly induced vs. enabled effects in the perspective of a technological penetration cycle.

2.2. Baseline

The definition of a *baseline* is one of the key tasks to be concluded while assessing forward-looking emissions reduction. The baseline, also referred to as benchmark, intends to describe the emissions scenario in the absence of a climate solution in the market. The baseline carries several subjective assumptions that an analyst must make while building it. In an ideal world, all baselines should be standardized and used in a similar manner to allow for an accurate comparison of calculated avoided emissions. However, this is rarely the case. Today, this exercise is often still a case-by-case manual job done by the analysts. The construction of a baseline depends significantly on how precisely the development of the incumbent solution is identified and how optimistic (or pessimistic) the analyst is about future development.

The extent to which analysts are optimistic or pessimistic about the future will affect their assumptions for describing the development for the future. Analysts often build static baselines that assume that the world will remain unchanged. However, this approach does not reflect reality, as the adaption of climate technologies at a large scale will eventually move the world, and the baselines, toward a Net Zero scenario. Using static baselines will therefore give an evergreen effect that does not reflect reality. This is illustrated by a *dynamic baseline* in Figure 5.

In our calculations we account for the changes that needs to be done towards a Net Zero scenario, and the baselines are compatible with this. The overall GHG emissions shall reduce in the time coming, and we only claim the avoided emissions resulting from the fact that the climate solution is an early mover. This is illustrated in Figure 6.

A library of baselines that all actors could refer to in a consensual way would be very valuable for the development of standardized and comparable avoided emissions projections. These baselines should be updated on a regular base i.e., every year, and have stated pre-requisites.

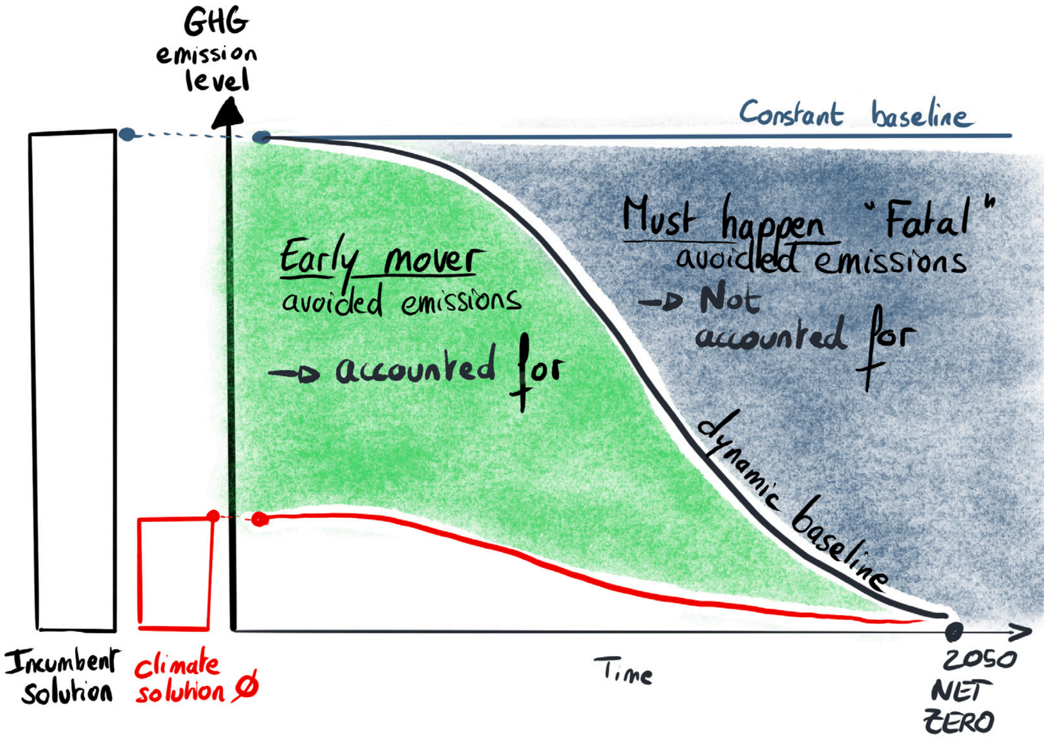


Figure 6: Illustration of static versus dynamic baseline.

Baseline:
A new and innovative solar PV panel

The baseline used to estimate the emissions avoided due to the increase of solar power production will correspond to the average carbon intensity of the grid mix. This carbon intensity of the grid is expected to decrease over time, according to stated policies, and this is embedded in the baseline. This means that the avoided emissions of our PV panel will decrease over time as the grid gets greener.

2.3. Attribution

The principles of *attribution* are another important consideration while doing an avoided emissions reduction analysis. Attribution refers to the allocation of the total amount of avoided emissions among all the actors that made this possible. This can either be a *horizontal attribution* where the avoided emissions are distributed within an ecosystem of contributors or a value chain, or be a *vertical attribution* where the avoided emissions generated by a given company are distributed among the shareholders. The two types of attribution are illustrated in figure 7.

Many have emphasized the importance of conducting a horizontal attribution of avoided emissions, as this helps avoiding double counting and over-inflated claims from minor actors in a chain of contributors. This exercise proves to be extremely complex due to the lack of a consensual method (Gopalakrishnan, 2022). As a quantitative method is currently difficult, we use a qualitative method as described in the effect list paragraph above. This qualitative method which qualifies each effect either as *directly induced* or *as enabled*, allows us to give more weight to the contributions that have been truly decisive.

The vertical attribution is more straightforward, as we simply report the avoided emissions of our portfolio companies adjusted by our equity ownership.

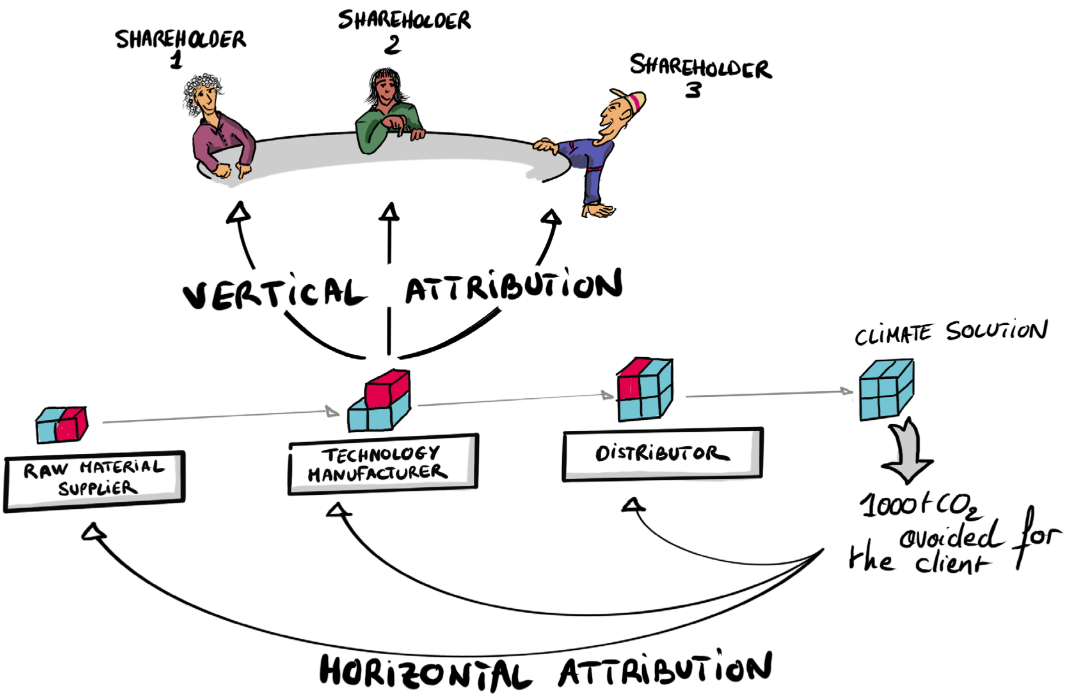


Figure 7: Illustration of horizontal and vertical attribution for a given climate solution.

Attribution: A new and innovative solar PV panel

The value chain for a PV panel consists of polysilicon raw material, ingot/wafer manufacturers, cells and module manufacturers, and ultimately installers and retailers. The avoided emissions generated by the installation of the PV panel are the result of all these contributions (horizontal attribution), and it is difficult to quantify each of them in a consensual way. In the absence of an accurate method, we use the categorization as described in section 2.1 and consider the effects related to the causality, and identify them as either directly induced or as enabled. If we own 10% of a company, we report on 10% of the future avoided emissions from the climate solution (vertical attribution).

3. Accounting and reporting

3.1. Emissions from our portfolio (financed emissions) and our own operations

In addition to calculating the avoided emissions generated by our investments, we also keep track of the annual emissions produced by our own operations and those of the companies we invest in (financed emissons). This monitoring helps us maintain a clear understanding of the total GHG emissions resulting from our direct actions and our indirect impact through our investment portfolio. This accounting is performed in accordance with the principles of carbon accounting, incorporating as much of Scope 3 emissions as feasible into the calculations.

3.2. Principles for our reporting

- For the avoided emissions generated by our portfolio companies, we yearly report the *aggregated realized emission reductions*, and *the aggregated planned cumulative avoided emissions* that will be achieved by 2030. This reporting is broken down into two categories: Recurrence, one-off effects vs. recurring effects, and Causality, directly induced vs. enabled.
- For the financed emissions of our portfolio, we yearly report Scope 1 and 2 emissions, and if available Scope 3 emissions, all adjusted to reflect our pro-portionate equity ownership (as we do for avoided emissions).
- For Nysnø's own emissions, we report annually on our Scope 1, 2 and 3.

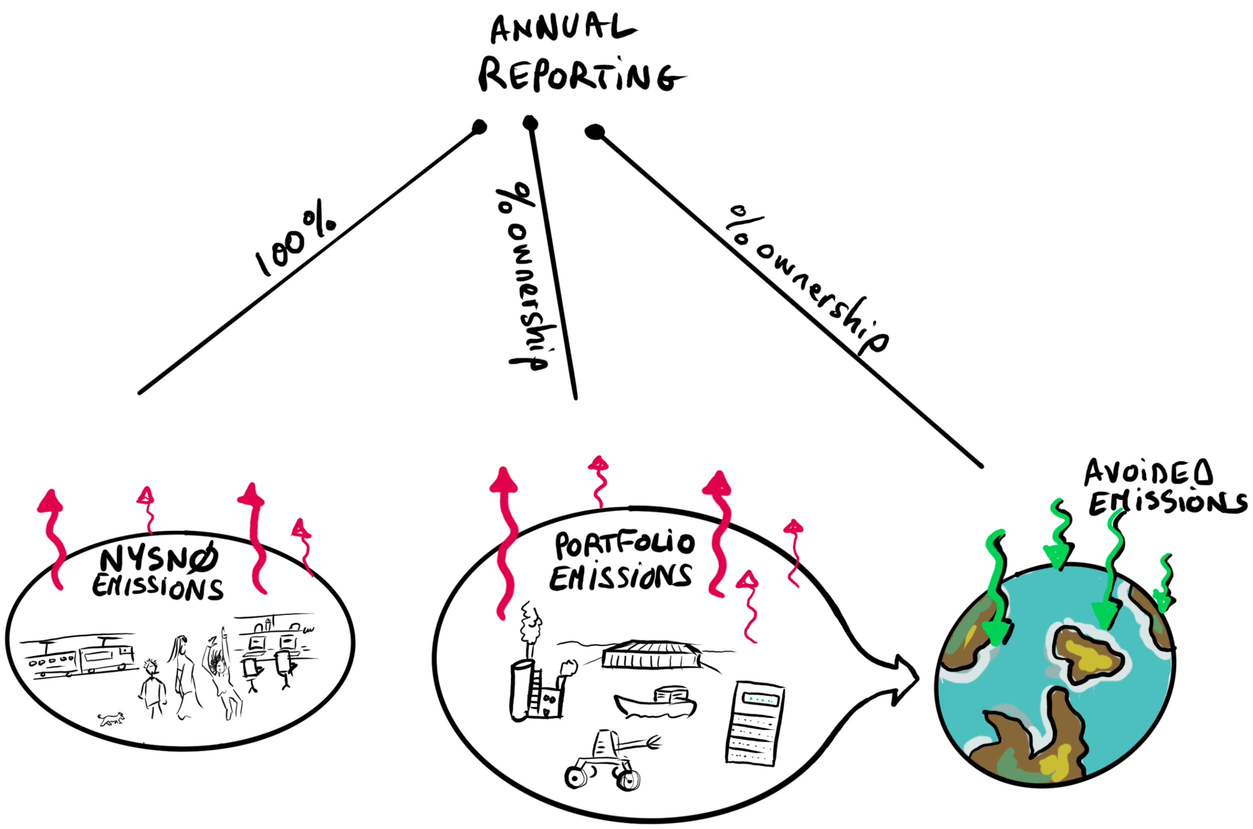


Figure 8: Nysnø aims at reporting both own emissions, our portfolio emissions and the aggregated avoided emissions.

4. Challenges, limitations, and work yet to be done

Carbon accounting, particularly the accounting of avoided emissions, is still in its early stages of development. Driven by government and public demand, several standards are now starting to be established. Our methodology is based on the best practices observed so far. There is still much work to be done to refine the methodology and obtain more accurate calculations. We have identified a range of methodological challenges in calculating avoided emissions. Listed below are the challenges we see as most critical to address in the coming years.

Our methodology is based on the best practices that we have been seen in our community.

1. **Data availability and reliability:** Any calculation is based on data that are either measured, documented, or estimated. Measured data are obviously the preferred source of data as they provide the best degree of precision and information. Unfortunately, the availability of measured data is often very limited, especially from early-stage companies. Currently, we often need to make assumptions based on experience or literature.

2. **Attribution along the value chain:** As described in 2.3, it is difficult to establish a quantitative method for distributing the avoided emissions among all the actors which contributed to its deployment. This means that there is a risk for double counting avoided emissions by several actors. This may erode the credibility of these figures if the communication is not done in a transparent manner. We have partly compensated this lack of quantitative allocation by a qualitative segmentation using categories such as *Directly Induced* and *Enabled*.

3. **Lack of consensual baselines:** It is critical to establish a baseline for the calculation of forward-looking avoided emissions as described in 2.2. A library of baselines that all stakeholders can use as common references would be beneficial. This would encompass, for instance, standardized projections of grid mix emission factors or technology penetration, as well as guidelines for updating these baselines over time.

4. **Third party verification against a common methodology:** Having a third party verifying the calculations is good practice. Our goal is to adopt this practice as the methodology and access to data become more robust over time.

5. **More research:** We need more academic work to address the challenges of the avoided emissions accounting. The work initiated by the FRAME community and other institutions should represent interesting issues for further research.

6. **Tools required:** We aim at establishing a methodology that can be widely used. For that, the methodology imperatively needs to be easy to use. We need tools (software) assisting us in the simplifying the calculations and reporting. Platforms such as Crane, xIQ and ClimatePoint are examples on such software. We are optimistic about the potential for innovation in this important field.

5. Glossary

Climate solution	A product or a service that enables the reduction of GHG emission compared to a standard scenario. This product or service can be for example a technical solution (hardware or software), a business model or an information tool.
Avoided emissions	(sometimes also referred to as Scope 4 emissions): The avoided emissions represent the quantify of GHG emissions that will not be released into, or that is removed from the atmosphere due to a given climate solution.
Realized avoided emissions	Avoided emissions that have been generated during the year of reporting.
Planned avoided emissions	The impact expected from a company, or a proposed climate solution based on a realistic scenario of commercial deployment.
Potential avoided emissions	When looking at potential avoided emissions, we hypothetically look at what would be the total effect of the climate solution if it was fully deployed immediately. This deployment is comparable to the Total Addressable Market (the market that makes sense from an economical point of view).
Attribution	The process of allocating credit for GHG impact based on the relative contributions of various contributors. It can either be horizontal attribution when allocating along the contributors of a value chain or vertical attribution when allocating among the shareholders of the company that has produced the climate solution.
Baseline	A projection of GHG emissions over time, representing what would have happened in the absence the given climate solution (and its closest competitors).
List of Effects	Implementing a climate solution in this context will have global implications for GHG emissions. Therefore, it is essential to identify and estimate the effects as accurately as possible.
Recurring effect	Effect generated by a climate solution that last over several years (e.g. production of low carbon power from a PV panel).
One-off effect	Effect generated by a climate solution that occurs only once (e.g. lowering of carbon footprint at manufacturing stage).
Causality	Term qualifying the dependency of a given effect to a given climate solution.
Directly induced effect	An effect that is the result of a differentiated capability of the climate solution. It results often from a unique feature that the climate solution proposes compared to the normal standard solution (e.g. differentiated contribution).
Enabled effect	En effect where the contribution can be difficult to distinguish within the ecosystem, value chain or among competitors.

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