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# Climate scenario analysis on ESG impact valuation

## Integrating a novel forward-looking perspective

analytical. quantitative. tech.

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# Content

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# 01.

# A pioneering, forward-looking perspective on impact valuation

Relevant sustainability regulations include, amongst others, the Sustainable Finance Disclosure Regulation (SFDR), the Corporate Sustainability Reporting Directive (CSRD) and the EU Taxonomy.

In recent years, the quantification, assessment and reporting of sustainability information have surged dramatically in importance. Stakeholders, such as the capital market, are demanding greater amounts of data on sustainable practices and large companies are also obligated to report this information due to regulatory requirements. Many companies have already sought to improve their sustainability performance voluntarily over the past years and want to measure their impact even beyond financial value creation.

ESG impact measurement and valuation (hereafter simplified to "impact measurement and valuation") captures environmental and social impacts and values them in monetary terms, thereby complementing value to society (impact or inside-out perspective) with value to business (dependency or outside-in perspective).

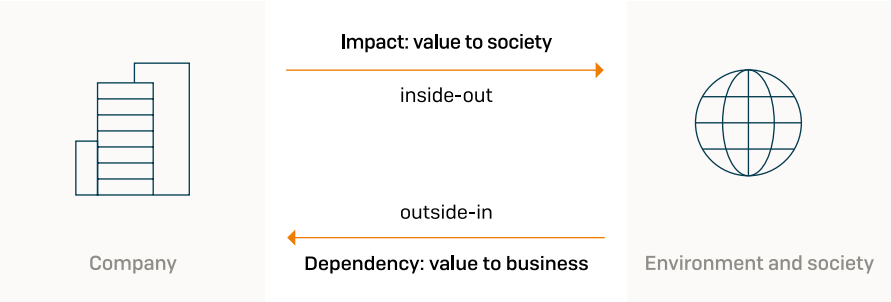


**Figure 1:** Principle of double materiality comprising both value to business and value to society.

Impact valuation methods allow companies to better manage their sustainability performance and establish targets, actions and policies in relation to different facets of sustainability.[1] However, the approach has been limited in its ability to incorporate future-oriented, strategic measures, such as company transition pathways described in the context of the Science Based Targets Initiative (SBTi), into the assessment, hampering the integration of external dependencies.

This white paper provides insights into an extended quantitative approach to impact valuation based on the Value Balancing Alliance (VBA) standards, including a novel forward-looking perspective. It determines future impacts through available business plans and transition pathways and values them with scenario value factors.[2] The projection of value factors into the future is performed in the context of well-established climate scenario frameworks such as the Network for Greening the Financial System (NGFS) and the Task Force on Climate-Related Financial Disclosures (TCFD) recommendations, which have been used by banks and regulators, e.g. the European Central Bank (ECB), for many years now.

The novel approach therefore facilitates the alignment of the company path with commonly used climate scenario pathways and, for the first time, enables contextualisation of risks and opportunities.

1 For further information regarding the background of impact measurement and valuation, compare standard Value Balancing Alliance publications.

2 These are numerical factors for economic valorisation, often derived from multi-step modelling approaches.

02.

# A significant effect of climate scenarios on valued impacts

First tests of the impact valuation approach reveal potential losses of millions or billions, depending on the company size. For three selected impact categories in the scope of a large corporate's own operations, the NGFS Net Zero 2050, Delayed Transition and Current Policies scenario have been applied in these first tests. The results show an impact value decrease between 40% and 800% until 2030, not considering other impact categories or value chain segments.

### Test parameters

**Scenario set:** NGFS

**Climate scenarios:** Net Zero 2050, Delayed Transition, Current Policies

**Climate model:** REMIND-MagPIE

**Time horizon:** 2019 (base), 2030 (scenario)

**Impact scope:** GHG, Tax, OHS for own operations

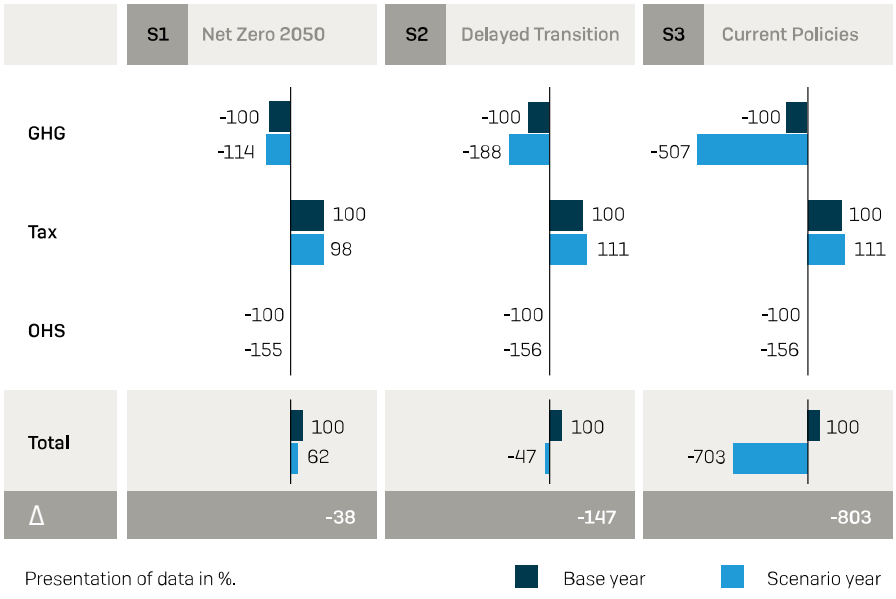


**Figure 2:** Anonymised test calculation results for a large corporate group. Scenario results are displayed relative to the base year's valued impact for the respective impact category or total impact. Also visible through the bar sizes are the relative valuations of different impact categories for a given scenario and between scenarios.

The most significant effect is displayed by the greenhouse gas emissions (GHG) impact category. The observed decrease in GHG value is caused by an increase in the utilised value factor, i.e. the social cost of carbon (SCC), of up to 400%, outweighing the company's planned decrease in GHG emissions by far. The increase of the SCC reflects the expected economic damages caused by additional emissions in the different climate scenarios.[3]

A second relevant scenario effect is observed for the valuation of company tax payments with purchasing power parity (PPP) factors. With either a slight decrease or an increase in tax value factor smaller than an increase in tax impact, all scenarios experience at least a relative loss. PPP factors are quite sensitive to the analysed scenarios due to their high and distinct impact in expected inflation and can therefore be relevant to a company's path in different future scenarios. Further repercussions for other PPP-adjusted impact categories are to be expected and can lead to significant changes in valuation.

The valuation of occupational health & safety (OHS) undergoes an effect that is less dependent on individual climate scenarios. On the one hand, the NGFS dataset does not provide differentiated parameters suitable for modelling the relation of health and climate issues. On the other hand, it is assumed that stronger effects resulting from this relation materialise only for a mid- to long-term time horizon.

3 For further information regarding the modelling approach, including the assumptions made, please see chapter 3.

In essence, the test results demonstrate an evident sensitivity of the impact valuation on climate scenarios. It is likely that a comprehensive scenario analysis will yield further changes in the overall value to society and is beneficial to a company's sustainability strategy and communication.

# 03. A methodology in line with ECB climate stress testing

**Preparation of the scenario analysis**

Before starting the scenario analysis, companies should decide on several scoping and prioritisation issues, the fundamental ones being the scenario set, climate scenarios and models, the impact scope (full statement including all value chain segments or a selection thereof) and the time horizon of the analysis.

To extend the scope of impact valuation by climate scenario analysis, the novel approach builds on existing impact statements prepared according to the VBA methodology and climate scenarios applied by the ECB for regulatory climate stress testing. According to the VBA methodology, social and environmental impacts are assessed with the help of specific value factors, which are derived through a variety of different economic, environmental and social models and are specific to each impact category.


**Figure 3:** Simplified model flow for climate scenario analysis on impact valuation.

To perform a scenario analysis on a given impact statement, the respective impacts are projected into the future according to available business plans, company transition pathways or, if necessary, through custom models. To project value factors in accordance with the selected climate scenarios, tailored models that consider the input variables specific to the examined value factors are developed. Valued impacts are then recalculated by combining projected impacts with scenario value factors.

In the following, this white paper details the scenario models developed for the tested impact categories.

## 3.1 Greenhouse gas emissions (GHG)

In the GHG impact category, company GHG emissions are valued with a social cost of carbon (SCC). The SCC estimates the economic damages done by each additional tonne of carbon emissions.

$$\sum_c Valued\ GHGs_c^{Base} = \sum_c GHGs_c^{Base} \cdot SCC^{Base}$$

Individual countries considered in the impact statement are denoted by the summation index $c$. For the scenario year, the GHG emissions are valued in an analogous manner.

$$\sum_c Valued\ GHGs_c^{Scenario} = \sum_c GHGs_c^{Scenario} \cdot SCC^{Scenario}$$

To determine the GHG emissions for the scenario year, business plans, transition pathways or custom models are used. The projection of the value factor is modelled for the respective climate scenarios.

SCCs are frequently derived from meta-analysis of different studies. For depiction of the SCC in accordance with the most optimistic climate scenario, i.e. the Net Zero 2050 scenario (abbreviated NZ), an SCC growth rate based on a meta-analysis of SCC projections for the SSP2 pathway is derived. All utilised scenarios (NGFS) are based on the SSP2 pathway, and it is assumed that the Net Zero 2050 scenario performs closest to regular SSP2 projections, while the Delayed Transition and Current Policies scenarios (abbreviated DT and CP respectively) lead to overall higher physical damages.

It is assumed that the economic damages in the less optimistic climate scenarios Delayed Transition and Current Policies used in the tests can be estimated by the cumulated GDP damages with medium chronic physical risks until 2100 given in the NGFS dataset. As a first linear approximation, the scenario SCC derived for the optimistic Net Zero 2050 scenario is then multiplied with a factor relative to the anticipated physical GDP damages for each scenario. The resulting SCC increase (base to scenario year) measures 26%, 107% and 457% for the Net Zero 2050, Delayed Transition and Current Policies scenario, respectively.

$$SCC_{DT\ or\ CP}^{Scenario} = SCC_{NZ}^{Scenario} \cdot \frac{GDP\ loss_{DT\ or\ CP}^{2020\rightarrow2100}}{GDP\ loss_{NZ}^{2020\rightarrow2100}}$$

Approximating the SCC value increase in relation to cumulated GDP losses from physical damages allows for describing the cost of an additional tonne of carbon in relation to the anticipated environmental changes starting to materialise already today.

As only physical damages are considered projecting the SCC, the model is biased to increase the SCC for the Current Policies scenario, which shows high physical damages. Future, further elaborated models will likely take into consideration abatement costs and/or additional parameters of SCC modelling. Further analysis could allow for integration of other types of damages. The SCC is generally estimated in a conservative manner, as damage factors such as biodiversity are not considered in today's SCC research.

## 3.2 Tax

In the tax impact category, taxes paid by the company are valued with purchase power parity (PPP) factors to reflect and align changes in welfare in different countries $c$.

$$\sum_c Valued\ Taxes_c^{Base} = \sum_c Taxes_c^{Base} \cdot PPP_c^{Base}$$

For the scenario year, the taxes are valued in an analogous manner.

$$\sum_c Valued\ Taxes^{Scenario} = \sum_c Taxes_c^{Scenario} \cdot PPP_c^{Scenario}$$

To determine taxes for the scenario year, business plans, transition pathways or custom models are used. The projection of the value factor is modelled for the respective climate scenarios.

The utilised NGFS scenario dataset does not directly disclose PPP factors, but data on inflation, which can be used to approximate the PPP development.

$$PPP_c^{Scenario} = PPP_c^{Base} \cdot \left( \frac{1 + inflation_{Company\ headquarters}^{Base\ year \rightarrow Scenario\ year}}{1 + inflation_c^{Base\ year \rightarrow Scenario\ year}} \right)$$

Both the Delayed Transition and the Current Policies scenario perform similarly, with an increase in PPP factors for approximately half of the countries disclosed and a decrease for the other half. In contrast, the Net Zero 2050 scenario reveals a decrease in PPP factors for over 90% of countries.

The developed modelling approach describes loss in foreign value creation, whenever the increase of foreign inflation rates is higher than the increase of the national inflation rate at the reporting company's headquarters.[4] It demonstrates the dependence of tax value creation on the economic development of individual countries.

## 3.3 Occupational health & safety (OHS)

In the OHS impact category, incidents of injuries and illnesses are valued with value factors, i.e. health costs, specific to the respective country $c$ and to the type of incident including severity (denoted by the summation index $i$).

$$\sum_{c,i} Valued\ OHS_{c,i}^{Base} = \sum_{c,i} Incidents_{c,i}^{Base} \cdot Value\ factor_{c,i}^{Base}$$

For the scenario year, the incidents are valued in an analogous manner.

$$\sum_{c,i} Valued\ OHS_{c,i}^{Scenario} = \sum_{c,i} Incidents_{c,i}^{Scenario} \cdot Value\ factor_{c,i}^{Scenario}$$

To determine incidents for the scenario year, business plans, transition pathways or custom models are used. The projection of the value factor is modelled for the respective climate scenarios.

Health spending is expected to increase over the upcoming years with a growth that is overproportional to GDP growth. Based on respective studies[5], the increase of health spending in relation to a country's GDP is calculated for all value factors utilised in the base impact statement. In this modelling approach, only the GDP data are scenario-dependent, while health spending is uniform across scenarios.

$$Value\ factor_{c,i}^{Scenario} = Value\ factor_{c,i}^{Base} \cdot \left( \frac{GDP_c^{Scenario} \cdot Health\ spending_c^{Scenario\ year}}{GDP_c^{Base} \cdot Health\ spending_c^{Base\ year}} \right)$$

4 Differences in scenarios are caused by influences of physical and transitional risks on inflation rates.

5 OECD "Health at a glance" (2019) | "Future and potential spending on health 2015–40" (2017, DOI 10.1016/S0140-6736(17)30873-5) | "Future health spending forecast in leading emerging BRICS markets in 2030" (2022, DOI: 10.1186/s12961-022-00822-5)

Individual countries such as Germany (⇧ 22%), the United States (⇧ 51%) or China (⇧ 229%) perform variedly (all values corresponding to the Current Policies scenario), but the paths for individual countries and total impact value are comparable for all scenarios. This result can be attributed to the identical assumptions made for the development of health costs and the similar GDP developments until the scenario year.

## 04. Looking ahead

With the increasing need for quantitative and holistic sustainability information, companies ought to improve their efforts further to meet stakeholder and regulatory demands. Climate scenario analysis is a central tool to complement knowledge on current sustainability performance with forward-looking information on company-specific risks and opportunities. The applied climate scenarios have proven to exercise an influence on impact valuation, with sometimes significant amendments to impact categories. In the future, this will become even more important, as it is expected that impact valuation will also influence enterprise value.

A climate scenario analysis yields relevant implications for projects, investments and a company's business model. For instance, companies might start to rethink their GHG reduction targets or start shifting business activities due to insights into their own sustainability value creation across different countries. Overall, deployment of scenario results strengthens company-wide reporting, risk management and strategy and establishes an improved communication towards stakeholders. Investors, clients as well as the public value the increased transparency, while banks can design structured financial products based on novel, quantitative sustainability indicators.

Therefore, by conducting climate scenario analysis on their ESG impacts, companies gain in attractiveness in the capital market, among their stakeholders and in the quality of their sustainability management.

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