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WHITEPAPER

CLIMATE METRICS

Do they really enable positive impact?

Is the climate data currently used in asset management a sound basis for managing portfolios with regard to decarbonization and the transition towards net zero? This paper highlights some of the challenges and key considerations in selecting and using climate data and metrics.

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Climate change is financially relevant for the public and for businesses

With the last ten years constituting the ten warmest years on record and global temperatures already being close to 1.5°C above pre-industrial average, climate change is becoming increasingly acute and severe.[1] Since 2014, global economic losses due to climate-related extreme weather events were estimated to be around USD 200 billion / year.[2] At the same time, global estimates for the social costs of emitting one additional ton of CO_2 emissions reach more than $400 / t CO_2[3], implying costs for current global CO_2 emissions of up to $13 trillion and more every single year. These costs pose enormous implications and financial risks for the economy, particularly in areas susceptible to extreme weather events and agricultural sectors. Despite this urgency, global CO_2 emissions have not significantly declined — on the contrary: the year 2023 was the year with the highest anthropogenic CO_2 emissions on record.[4]

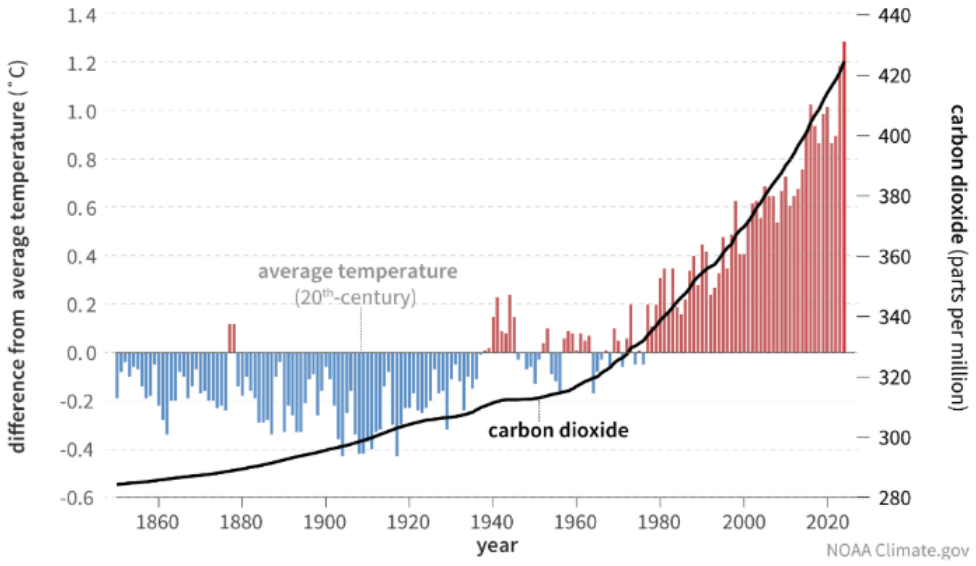


Figure 1: Increase in atmospheric carbon dioxide and global temperature. Source: NOAA, IAC.

1 https://climate.nasa.gov/vital-signs/global-temperature/?intent=121#:~:text=Overall%2C%20Earth%20was%20about%202.65,change%20in%20global%20surface%20temperatures.

2 https://iccwbo.org/wp-content/uploads/sites/3/2024/11/2024-ICC-Oxera-The-economic-cost-of-extreme-weather-events.pdf

3 Rennert et. al (2025): Social Cost of Carbon 101. Online: Social Cost of Carbon 101

4 Ritchie & Roser (2024): CO2 emissions. Online : CO_2 emissions - Our World in Data

Financial markets are relevant for climate

Financing the transformation towards net zero greenhouse gas emissions and sustainability will require substantial investment over the coming decades. In addition to the conversion and adaptation of infrastructure (transport, energy and water), there is also the climate-friendly refurbishment of buildings and the renewal of production processes. Initial rough estimates put the cost at USD 5 to 7 trillion per year in the energy sector alone[5]. This volume may appear high. However, a look at global economic output shows that the amount invested annually in fixed assets alone was USD 113 trillion for 2024[6].

Therefore, the amount of required capital is not the issue, but rather the channelling into the right direction. Financial markets play a key role in the allocation of capital in the economy. Through formal and informal markets, available capital and capital seeking investment are matched with those seeking financing. The financing terms, conditions, and volume are relevant to foster financing. This means that the financial market — besides other, potentially even more influential factors[7] — plays a decisive role in determining what is produced and consumed. The question is: Can the price mechanism be used to redirect capital to finance a sustainable economy?

There is a basic pattern directing the flow of capital: towards investments with the most attractive risk-return relationship — in standard financial terms. The higher the return and the lower the risks, the more capital will be attracted. In practice, capital does not follow 'green attractiveness' but rather what could be called “value for money”, or in economic terms, price mechanisms. This risk-return profile of an investment depends on many variables, such as the sector, the geographical location, company size, etc.[8]

To achieve a higher capital allocation towards transition activities, both investors and the real economy would need to address negative climate impacts (i.e. greenhouse gas emissions) as a cost factor due to a higher risk premium or expected changes in EBITDA level. Enough “green investors”, i.e. investors that value the decarbonization of companies, should ideally lead to a shift of financing towards more sustainable companies. This in turn should incentivize the demand for more sustainable investments.

5 B. Lorenz et. al.; Financing the green energy transition, Deloitte 2024.

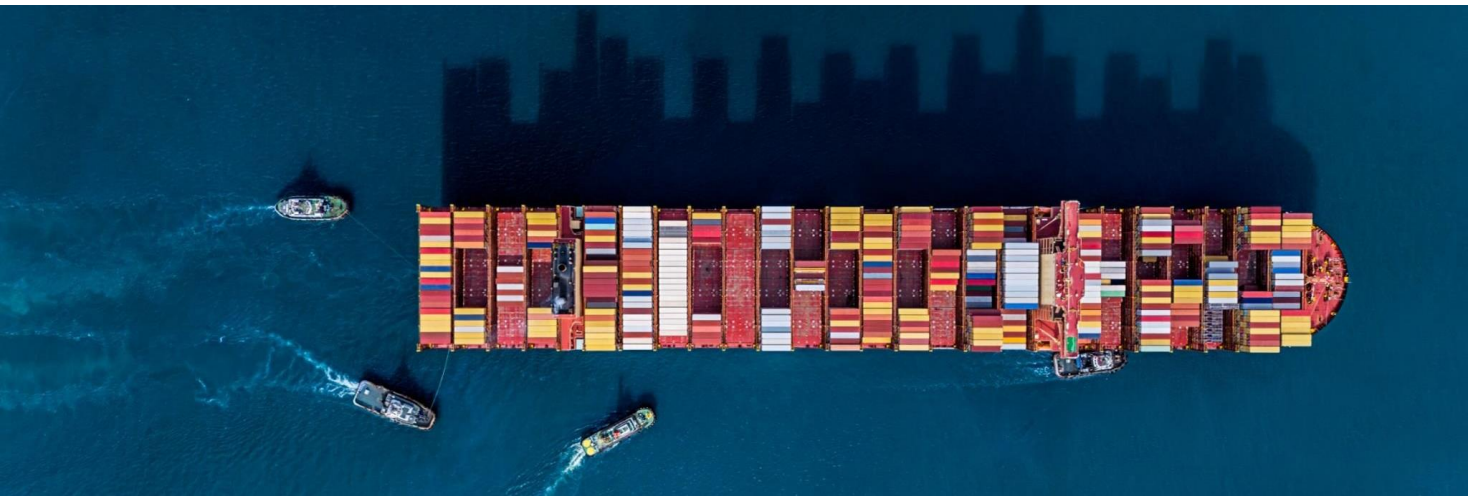
6 26% of global GDP in USD is fixed capital formation according to the World Bank., resulting into 113.33 trillion USD for 2024

7 Such as policy and regulation, consumer demand, etc.

8 E. Fama, K. French; A five-factor asset pricing model, Journal of Financial Economics, Vol. 116, 2015

Exercising shareholder rights with regard to climate issues can also support the transition. This is the second key mechanism alongside a 'green' risk premium. There are various motivations for active ownership, whereby traditionally the focus is also mostly on optimizing the risk and return of the respective company. One motivation may, however, be to encourage the company to decarbonize (more quickly). This can be motivated by both risk and climate impact considerations. Climate data can thus inform engagement processes and voting behaviour and determine the issues that are addressed.

How can asset managers incorporate climate in investments?



There are in principle two main approaches to incorporate aspects of climate change into investment decisions: Via an ESG integration approach or via a policy driven climate alignment approach.

The ESG Integration approach

ESG integration, or in this context rather climate integration, incorporates the climate topic into the risk-return assessment. This allows for the assessment of financial risks[2] linked to climate change. Traditionally, the main proxy for climate risks are the greenhouse gas emissions of the respective company as well as the company's targets, policies and managements systems regarding climate. Physical climate risks are also becoming increasingly relevant in risk analyses.

The challenge with this financial risk approach is assessing the financial impact of climate in relation to all other risk factors. As greenhouse gas emissions may affect profits, balance sheets and market valuations, the determination of the quantitative financial influence is complex, case-specific and depends heavily on the choice of the considered time horizon. The key issue with this approach is, however, that climate risk can easily be outweighed in the analysis by other risks factors as well as return expectations.

The portfolio decarbonization approach

The second main approach is to consider the climate dimension separately from the financial analysis when making investment decisions. At an operational level, this means comparing the climate performance of investments independently from the risk-return analysis. That is, the investable universe is restricted through climate data before or after the financial analysis, or a combination of both. This can be done by actively excluding or actively selecting companies based on certain climate metrics.

Thus, with this approach the climate performance of the investment serves as an additional layer of data. Compared to the ESG integration approach, this results in portfolios whose holdings reflect an evident positioning on the issue of climate change. Further, this approach enables an efficient and effective management of the portfolio's climate performance, because it is measured separately from other factors. In general, a climate alignment approach leads to a much higher potential for a capital allocation effect in the market.

[2] Typically this includes physical and transition related risks, which can be divided into regulatory risks, market risks, reputational risks and technological risks (see TCFD 2017).

Decisions about selection are at the heart of asset management

In portfolio management, the point of reference is a broad market benchmark which represents the standard available investment universe. In the context of climate investment, such a benchmark has two important functions: Firstly, it is used to reference a portfolio's basic risk exposure, and secondly, it is used to report the climate performance of the benchmark portfolio. It is a simplifying but overall adequate assumption that the broad liquid market represents the entire economy, albeit with some deviations. Therefore, the difference between the climate performance of a portfolio and the benchmark indicates the extent of climate-specific capital allocation.

Portfolios that incorporate climate targets deviate from broad market indices. Passive portfolios do so to a small extent, while active portfolios can deviate to a large extent. Portfolios that are highly focused on climate issues differ significantly from broad market benchmarks and therefore have a considerable tracking error. Such portfolios are thus only for investors with a corresponding risk tolerance.

Synergies between capital allocation and stewardship

It is noteworthy that both an ESG integration and a climate alignment approach can be combined with active ownership measures to enhance the effectiveness of each respective approach. Voting and engagement are key tools for representing the interests of shareholders within companies. These changes can be small, such as providing additional disclosures or setting a public target, in order to lead to incremental change. They can, however, also be substantial, such as discontinuing business areas related to high emissions.

Investment decisions and active ownership are strongly connected. Firstly, active ownership requires an actual investment being made to begin with. Secondly, a credible escalation strategy for engagement practices would typically involve (public) divestment at a certain stage. Thus, it is highly relevant that the targets and commitments of both capital allocation and stewardship strategy are streamlined and synergize with each other.

All investment decisions including the management of an investment selection and stewardship activities require the availability of meaningful and robust data. This holds true whether the investor simply wants to reduce risks or whether he wants to align his portfolio with the transition to net zero. It is also relevant for both passive and active portfolios. Therefore, using the right data is key. The following section will highlight the data most commonly used in current practices and dive into the problems, challenges and issues they entail.

What data is currently being used?

This section will first discuss the importance of including scope 3 emissions in the used climate data. Then, it will dive into the most commonly used climate metrics: intensities and footprints, exposure to fossil fuels and implied temperature rise scores.

The issue with emission scopes in climate data

While the greatest lever to change is usually associated with a company's own direct emissions (Scope 1), the largest part of the emissions, particularly for large broad market companies from software, technology, food and many other sectors stem from the supply chain (Scope 3). Figure 1 illustrates this with some examples. At the same time scope 3 emissions are notoriously underreported and inconsistent across company disclosures and data providers. Thus, although they are a crucial sign of where most emissions actually happen and thus also need to be reduced the most, they are hardly systematically used in the investment process.

From a climate perspective it is necessary that all emissions are reduced. This includes on the one hand upstream emissions from companies and sectors which are typically only in the supply chain of listed companies but not listed themselves (such as agriculture). On the other hands it involves downstream emissions which are produced during the use-phase of the product (such as the transport sectors). It is therefore crucial that investors consider scope 3 emissions for whatever climate strategy they have and make sure they are incorporated in the climate data they use.

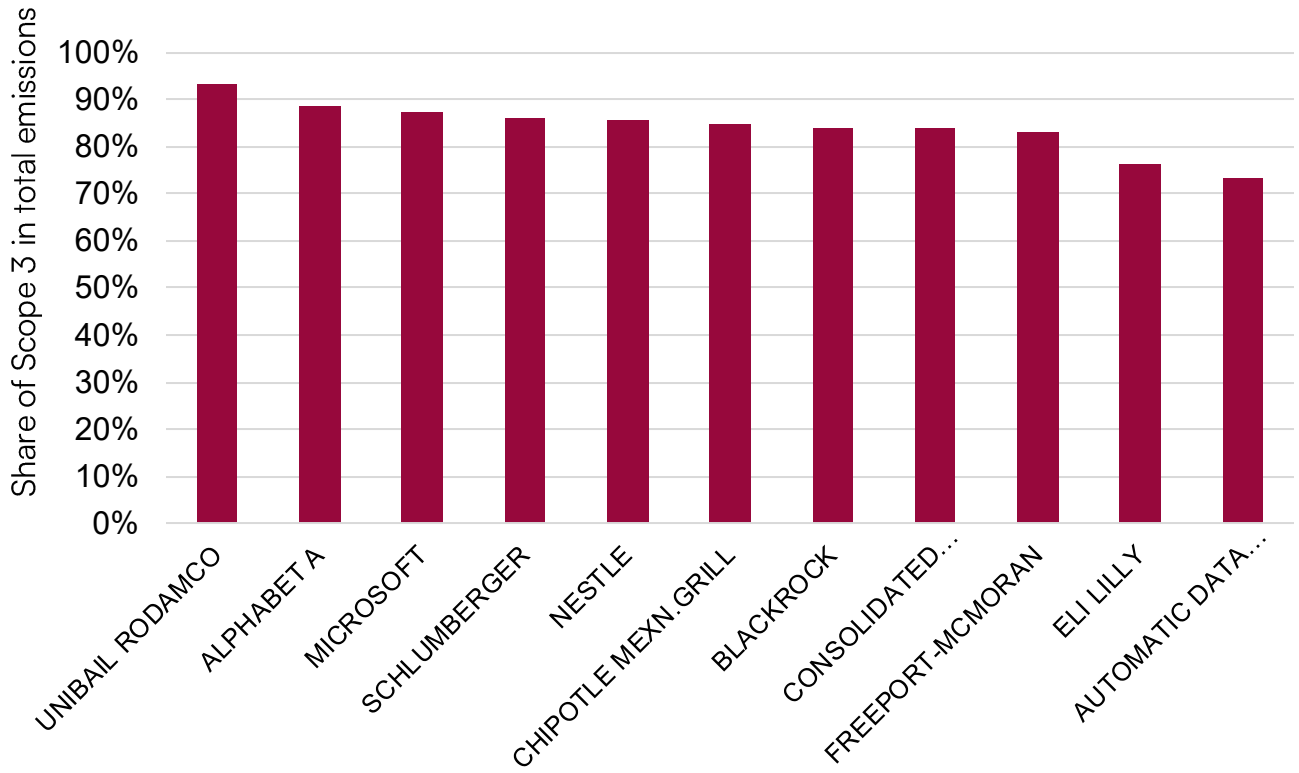


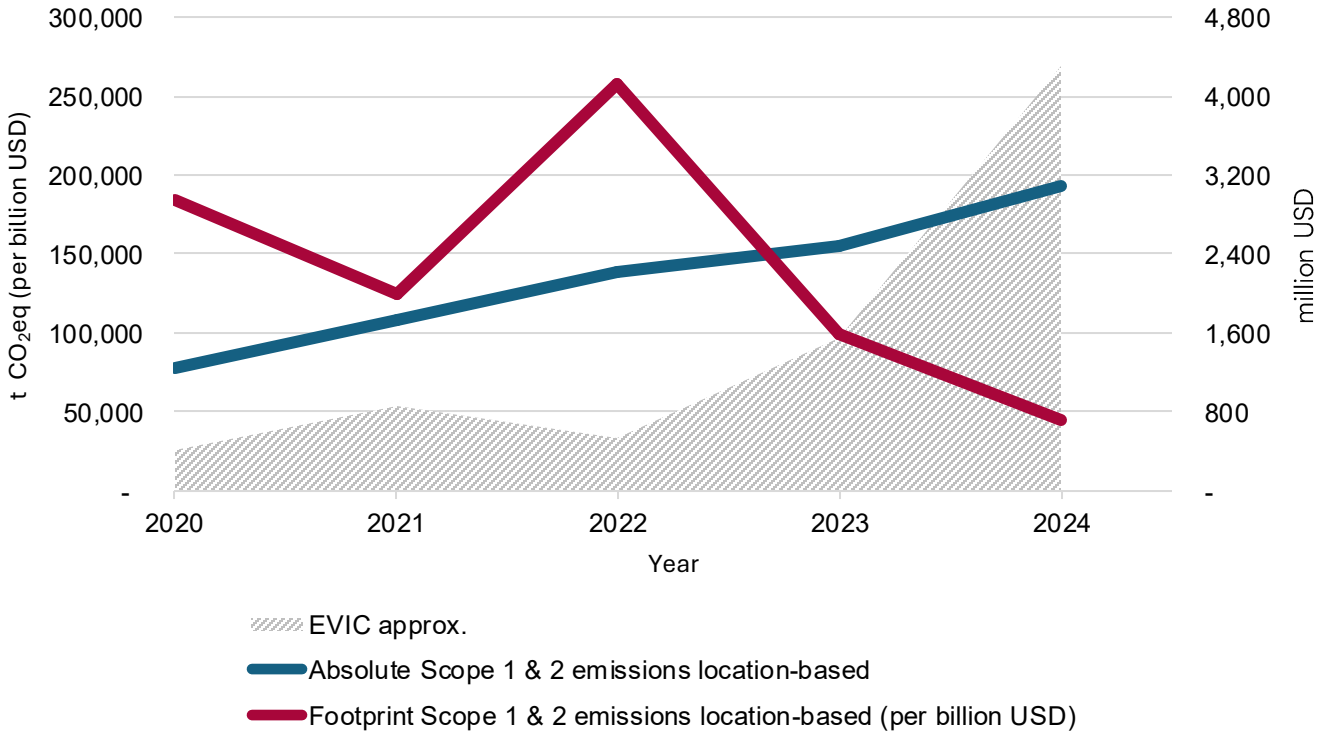
Figure 2: Share of Scope 3 in total emissions for 11 typical positions in a global equity portfolio. Source: Inrate Climate Data, Estimation for the year 2024.

Carbon intensities and footprints

Carbon intensities and footprints are by far the most widespread climate metrics used in the financial industry. These metrics take the absolute GHG emissions in CO_2 equivalents (CO_2eq) and divide it either by revenue or by enterprise value (resp. EVIC) in USD to result in so called GHG intensities and GHG footprints, respectively. GHG emissions are indeed directly linked to global warming and thus in physical terms the climate impact a company has. These metrics are relatively simple and well established; however, they bear two fundamental problems when comparing different companies:

- Both revenue and particularly EVIC can be very volatile and lead to less robust results. For instance, after the Russian invasion of Ukraine, oil & gas prices surged, and with it the financial valuations of some big-oil corporations. For instance, the market capitalization of Exxon rose from $174 billion at 31.12.2020 to $454.24 billion at 31.12.2022[10], an increase of around 260%. At the same time, production of oil and gas (and thus emissions) remained relatively stable.[11] This means that if the footprint was calculated for these specific points in time, it would have shrunk by more than 60% without actual material cuts in emissions (see also Figure 3 for another example).
- A company's absolute CO_2 emissions depend primarily on the very specific products and services it offers and to a much lesser degree on its road to a net zero transition. For instance, a waste management company naturally has a much higher carbon intensity than a communication company. A solar panel producer might have a higher footprint than a consulting company. Yet both the solar panels and waste management are essential for the transition to net zero. As such, using intensities or footprints will primarily incentivize capital allocation towards low-carbon sectors such as software, communication, consulting, insurance, etc., while the urgently necessary transition within the companies and industries is completely ignored.

Figure 3: Example of the volatility of intensities, compared to actual absolute emissions (NVIDIA).



[10] Exxon Mobil (XOM) - Market capitalization

[11] Looking At Climate Change Through The Eyes Of ExxonMobil

These challenges can be partially mitigated by using production units as denominator / reference for carbon emissions. These units ideally divide the emissions through a unit, which holds information on the quantity of the specific service that is provided and causes the emissions. To a limited degree such metrics are already used today, specifically in the energy and utility (t CO_2 / kWh energy), transport (e.g. t CO_2 / passenger kilometres), cement (t CO_2 / t clinker or cement) and steel (t CO_2 / t steel) sectors. These respective units can be very valuable to inform a best-in-class approach. They do, however, not allow for portfolio-wide comparison and are also very limited to a small number of sectors.

Exposure to fossil fuels

This indicator shows the proportion of investment that flows into fossil fuel activities. It therefore highlights activities that should be exited and phased-out as quickly as possible from a climate perspective. The metric is very simple and understandable, but at the same time also strongly limited, as it essentially only covers the energy sector and adjacent activities, but not the industries, which are dependent on these energy sources[12]. Thus, on portfolio-level, the exposure to fossil fuels correlates mainly with the exposure to the energy sector, rather than with the transition to net-zero.

Three things would be required to make this metric much more valuable:

1. The share of fossil fuels is only valuable if either the total exposure to energy production or the share of renewable energies is disclosed, additionally. Else it is not clear, whether a portfolio with higher exposure just invests more into the energy sector or indeed overweighs fossil energy sources.

2. Investments into the fossil fuel sector can make sense under certain circumstances, for instance, when projects are financed that lead to the managed decommissioning of coal or oil businesses. Companies active in the fossil fuel sector could furthermore also invest into renewable energies, which per se should not be restricted by lack of financing. Thus, the share of green bond[13] investments in the energy sector could add a very important nuance to this indicator.

3. To be really meaningful, the fossil fuel use in all sectors would need to be part of the assessment. The transition to net-zero will only happen if the energy-intensive industries and products are becoming electrified and fossil-free. As such, divesting the energy sector alone will likely have no significant effect, as energy companies would still thrive, as long as demand for fossil fuels remains high. Furthermore, the oil & gas sector is one of the sectors with the highest involvement and control through politics (see e.g. OPEC), including also subsidies, rendering pure market incentives rather useless. Instead, the dependency on fossil fuels should be disclosed for all companies, for both operations (e.g. manufacturing) and for their products (usage, e.g. cars). Only this information could enable investments away from fossil fuels and effectively decrease the demand side of fossil energy.

12 It also ignores the 15-20% of global emissions that do not originate from energy production but from chemical processes (cement, waste treatment), land use (change) or animal farming.

13 Should be restricted to use-of-proceed bonds that exclusively finance decommissioning of fossil businesses and/or expansion of renewable energy businesses.

Implied Temperature Rise (ITR) metrics

ITR metrics allocate emission budgets or specific reduction pathways to various sectors or economic activities[14]. These are derived from globally acknowledged climate scenarios. The budgets or pathways serve as benchmarks and are compared with the predicted future emissions of companies. These predictions are usually primarily based on the companies' climate targets and potentially other factors such as CapEx into green technologies, past reductions, overall credibility etc. As a result, ITR metrics indicate a certain temperature for the given company (e.g. 2.5°C). This then indicates how much climate would warm if all companies adhered[15] to their allocated emissions budgets as well or as poorly as the company in question. In theory, if firstly the transition pathway of a company were to be predicted robustly and if secondly carbon budgets were indeed distributed "fairly"[16] between subsectors, ITR metrics would indeed enable investors to make informed decisions that maximize impact on the climate transition. However, in practice both conditions are near impossible to fulfil since neither of the two can be done objectively and robustly. The predictive nature of ITR methods, combined with the fact that stated ambitions often do not correlate with actual decarbonization measures[17] leads to massive uncertainties in the resulting outcomes. This is also underpinned by statistical analyses between two prominent ITR metrics, which did not show any considerable correlation between company ITR results[18]. Instead, ITR metrics can be misleading, as the precise temperature outcome implied does not mirror the massive assumptions and uncertainties that are attached to it. Furthermore, "unfair" budget allocation could lead to significant sectorial biases, as some sectors are likely advantaged over others.

14 The same mechanism is applied at the Science Based Target Initiative for target setting of companies.

15 More precisely the prediction of their adherence until 2050.

16 In analogy to the fair-share mechanism of the Paris Agreement applying to countries, which takes into account the "common but differentiated responsibilities and respective capabilities, in the light of different [...] (technological and economic) circumstances" (Paris Agreement, Article 4.3)

17 Jiang et al. (2025): Limited Accountability and Awareness of Corporate Emissions Target Outcomes. Nature Climate Change. http://dx.doi.org/10.2139/ssrn.4676649

18 https://www.infras.ch/media/filer_public/54/65/5465c866-7395-4b1d-bdfb-f256cc4fd825/report_portfolio_climate_alignment_infras_hsg_220621.pdf , p. 78ff.

How should an effective climate metric look like?

Ideally, a climate metric should enable investors to make investment decisions that best support the real economy in its transition towards net zero. As described above, none of the currently applied climate metrics can effectively achieve this and designing such a metric is not straight forward. The following considerations are of importance, to achieve this:

- The transition to net zero has to happen systemically rather than in silos of different industries or even at single company level. A focus on the core services that our economy provides to our society and how these services can be provided for in the most efficient and climate neutral way can help with this. Such an approach leads to a much greater focus on (enabling) technologies, substitution potentials and interlinkages between industries than with traditional climate metrics. In terms of emission data, this implies the use of a service-specific denominator, which can reasonably quantify the “amount of service” that is provided per t of greenhouse gas emission. Revenues and EVIC are no good indicators for this.

- The adherence to a specific temperature outcome (e.g. 1.5°C) might be reasonable at real economy level but can be a hinderance to a systemic approach of an investor. Only investing in single companies that (on the paper) align with a 1.5°C pathway might lead to biases towards certain sectors, (essentially disadvantaging the provision of certain services to society) and neglecting the relevant interlinkages between the industries. Instead, an effective climate metric should highlight for every societal service those activities and companies that invest in climate solutions, climate neutral technologies and are most ambitious compared to providers of the same service. Furthermore, it should be kept in mind that the time horizon of climate scenarios is generally long-term when applied to the business world. This requires continuous updating, which could also lead to sudden changes and disruptions in the assessments.

- Similar to frameworks like the EU Taxonomy, an assessment should start at the activity level, rather than company level. Most companies have a mixed set of economic activities and "green activities"[19] to date often only make up a small share of a company's revenues. Yet, exactly those shares should be in focus and enabled to grow and are thus of great importance. Furthermore, it is fundamental from both a financial and climate risk perspective that an assessment should include the entire value chain of the respective activities.

- For the comparison between single companies in the investment selection process, it is equally important to quantitatively measure a company's current impact as it is to assess the ambition and credibility of a company's future transition efforts. The latter is naturally mainly based on qualitative information (such as transition plans, stated targets, policies, etc.), supported wherever available by information on concrete CapEx. Thus, it could be misleading to use quantitative scientific units such as an ITR for the assessment of a company's climate ambition. Nevertheless, such qualitative, forward-looking information also needs to play an essential role in capital allocation decisions.

Example of industrial interdependencies

The steel sector is a crucial part of the economy as many other sectors such as construction, infrastructure or machinery depend on it. It is therefore considered one of the "harder-to-abate" sectors featuring relatively high emission intensities and being difficult to decarbonize, while at the same time not fully substitutable. Thus, steel must also play a key role in the transition to net zero.

At the same time, the steel sector depends on many other sectors to be able to reduce its emissions: the machinery sector to provide electric arc furnaces or direct reduction furnaces working with hydrogen. It further needs the chemical or energy industry to provide hydrogen for the latter, infrastructure to transport the hydrogen to the steel mills, as well as all sectors using metal products to enable recycling of the used steel.

Additionally, much more electrical energy will be needed to fulfill the demand of electric arc furnaces and hydrogen production. A systemic investment approach should consider all these sectors and issues. Because it needs all of them, to make progress in decarbonizing the steel sector.

19 According to the EU Taxonomy definition of sustainable activities.

Conclusion

Clearly, the financial sector alone cannot solve the problem of climate change. It is not the role of the financial institutes to internalise the externalities of the real economy. However, the financial sector can play a very important role as enabler, facilitator and steering actor in the transition to net zero. Channelling financial flows into the most sustainable practices with the lowest externalities plays a key role in the transition of the real economy.

Yet, even if the commitment for climate targets and ambition is there, making the right investment decisions is not straight-forward and requires an elaborate approach as well as the right data. Most climate-related metrics currently in use to make portfolio level decisions are not effective in steering money in the best direction for the transition. Rather than simply investing into the title with the lowest greenhouse gas footprints, investors should adopt a systemic approach. Such an approach bases decisions on substitution potentials (mainly in the energy sector), electrification, technological developments and the inherent interlinkages between sectors. In order to make informed decisions on these issues, it is necessary to have the right, reliable data and in-depth knowledge of the relevant sectors.

To build such a climate alignment investment framework, advantages and disadvantages of the currently available datapoints should be acknowledged. Valuable input data includes information on activity-specific CapEx, intensities per production unit, degree of electrification, energy efficiency, products with low emissions during use phase among other things. INFRAS is an expert in deriving sector-specific indicators and building frameworks and methodologies to assess and manage impact. Inrate provides ESG Impact data with a best-in-service approach, acknowledging systemic affects and offers a suite of climate-specific data points.

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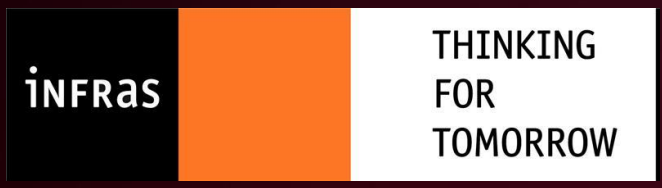

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