PACTA for Investors Methodology Document

Climate scenario analysis for Investment portfolios

Paris Agreement Capital Transition Assessment

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About PACTA: The PACTA tool aggregates global forward-looking asset-based company data (such as the production plans of a manufacturing plant over the next five years), up to the parent company level. The tool then produces a customized, confidential output report, allowing investors to assess their portfolios' overall alignment with various climate scenarios.

A note on our Funders

PACTA is supported by the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag. The views expressed here are the sole responsibility of the authors and do not necessarily reflect the views of the funders.

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EXECUTIVE SUMMARY

According to the Intergovernmental Panel on Climate Change (IPCC), **human influence has warmed the climate at an unprecedented rate over at least the last 2000 years.**[1] **Many of the climate changes already triggered - such as increased storms, droughts, and sea level rise - are irreversible over hundreds or thousands of years.** To have a reasonable probability of keeping warming to well below 2°C and ideally 1.5°C, the latest report from the UNFCCC shows that emissions will need to decline by 45% by 2030 compared to 2010. Unfortunately, based on the most recent Nationally Determined Contributions, emissions are in fact expected to rise by 16%.[2]

Commitments are needed to reduce emissions to the required levels. Not simply by taking daily individual actions to avoid further impact on natural resources, but by supporting long-term projects that will enable a transformation to a more sustainable economy. Furthermore, for companies to be resilient in the face of these new changes, they need the support of financial institutions and investors who can see the opportunities that this transition brings and who can then support companies in these initiatives, as significant capital investments will be required to move into clean energy, new forms of mobility, etc.

A crucial component of the Paris Agreement is Article 2.1(c), which requires making finance flows to be consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. However, progress in aligning capital flows at the global level has been difficult, mainly because of the challenges in adequately measuring climate-related financial flows. The open-source Paris Agreement Capital Transition Assessment (PACTA) tool can play a helpful role in this regard. **PACTA measures the (mis)alignment of investor and bank portfolios with climate goals.** PACTA compares what needs to happen in sectoral decarbonization pathways with what the companies in those sectors are planning to do as reflected in their production plans for the coming five years. This approach allows financial institutions to measure the alignment of their exposures to these companies. A misalignment indicates a potential exposure to transition risk in the event of a disruptive transition, i.e., in the event of a rapid and disorderly shift from a high-carbon to a low-carbon economy.

PACTA is a free, open-source climate scenario analysis tool for financial institutions. PACTA allows users to measure the alignment of their financial portfolios to various climate scenarios across a set of key climate-relevant sectors, based on granular, physical asset based company-level data.

[1] https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/
[2] https://unfccc.int/news/full-ndc-synthesis-report-some-progress-but-still-a-big-concern

This granular level of analysis allows users to take concrete climate action based on the alignment or misalignment of the companies they finance. The main goal of PACTA is to foster the **alignment of financial markets and the real economy with a Paris Agreement-compatible world –** one that limits global warming to well below 2°C warming.

PACTA was first developed by 2° Investing Initiative (2DII) for equity and corporate bond portfolio analysis. Since 2018, PACTA has had **over 3,000 users worldwide, including a number of financial supervisors and central banks** (e.g. European Insurance and Occupational Pensions Authority (EIOPA), California Department of Insurance, Bank of England, and more).

As of June 2022, 2DII transferred the stewardship of PACTA to RMI in order to scale up the impact of the tool in the financial sector and in the real economy. Under RMI's stewardship, PACTA remains a free, independent, and open-source methodology and tool.

PACTA now forms part of the Climate Finance programme at RMI, and supports RMI's mission by helping to shift capital flows in greener directions and enabling the financial sector to contribute to the goals of the Paris Agreement. PACTA does so by providing the financial and supervisory community with forward-looking, science-based analysis.

This document presents the **PACTA for Investors Methodology**. This methodology is a crucial first step for financial institutions to understand their **contributions to climate change** and to **begin defining climate strategies that have meaningful impact**.

The PACTA output metrics look to control two key climate issues:

- **Controlling for the absolute production limits of high carbon technologies**. For example, fossil fuel production must ultimately decrease to achieve the goals set out in the Paris agreement.
- **Identify the required production shift from high-carbon to low-carbon production needed to be compatible with a Paris-aligned world**. In other words, identifying the required shift from high- to low-carbon technologies.

PACTA covers eight climate-critical sectors: **Power, Oil and Gas, Coal, Automotive, Steel, cement, and Aviation**. Alignment results are given at the level of each **sector and technology level within those sectors**.

The climate alignment of these sectors and their companies is calculated differently depending on whether clearly identified technology decarbonization pathways exist for these sectors. For Power, Fossil Fuels and Automotive, there are clear low- or zero-carbon technologies available. For example, in the Power sector, power generation has to transition from fossil fuels to renewables. For these sectors, two metrics are used to measure alignment:

- **Production Volume Trajectory –** This measures the alignment of financial portfolios in terms of production per technology/fuel against trends prescribed in climate change scenarios.
- **Technology/Fuel Mix –** This metric shows the sectoral technology/fuel mix of a portfolio and how this mix should evolve to be considered aligned with various climate change scenarios. This identifies the required shift to low-carbon technologies.

Results are calculated using different accounting principles at the portfolio level. The details behind these accounting principles and alternative options are described in this methodology document.

For sectors where technology decarbonization pathways **are not defined,** such as **Steel, Aviation** and **Cement**, a different approach is used. For these sectors, climate change scenarios do not currently prescribe production to **specific technologies producing the economic units of output** (e.g. a ton of steel), although trials for some solutions may already exist. They do however give **absolute values of production and carbon emissions**. From this, an emission intensity is calculated and used to measure alignment.

- **Emission Intensity –** This metric compares the current and projected emission intensity of a sector within a portfolio to an emission intensity prescribed by climate change scenarios. The emission intensity of the portfolio is calculated **based on production coming from the technologies a portfolio is exposed to in these sectors**. An emission intensity model is applied here.

For each metric, results are given at **present and up to 5 years in the future**, and results can be compared to various market benchmarks which are available in the online tool.

This document presents the methodology and mathematical formalization of the metrics included in the PACTA tool for investors. A PACTA scenarios document for investors is also available on the Transition Monitor website, which presents a summary of the scenarios available in the online tool along with a guide explaining how to upload a portfolio and generate results in the online tool.

Climate Scenario Analysis and Portfolio Alignment with PACTA

PACTA AT A GLANCE

Measures a portfolio's climate alignment
It assesses the alignment of a financial portfolio with climate scenario, revealing where the portfolio stands between business as usual and scenarios with different climate goals.

Covers key climate-critical sectors
It tackles key climate-critical sectors: Fossil Fuels, Power, Automotive, Cement, Steel and Aviation which together account for over (70%) of global CO_2 emissions.

Uses granular physical asset based company-level data
It provides a precise, technology-focused insight into the current and future activities of companies, mapped over a five-year time horizon.

Forward-looking
It tracks the forward-looking alignment of the economic activities financed by the portfolio and uses long-term macroeconomic decarbonization scenarios.

Enables steering and comparison between peers
It informs the design of portfolio-steering strategies to reach an alignment to set targets, the identification of best and worst in class companies, and the benchmarking of a portfolio against commonly used benchmarks.

Allocates necessary collective greening efforts
It translates scenarios into portfolio-specific targets by allocating the macroeconomic trends prescribed by climate scenarios to the companies and assets in the portfolio, based on market share.

Allows the use of multiple climate scenarios
The methodology is adaptable to any climate scenario (IEA, IPCC, NDC, etc) that models the evolution of the economy (specifying by sector and technology) under a decarbonization pathway.

Sector-specific approach
It provides specific metrics and targets for each type of economic activity in different sectors – as opposed to an aggregated portfolio-level target.

PACTA CORE COMPONENTS

Scenarios

A climate scenario is the result of a modeling exercise that aims to illustrate pathways for achieving profound shifts in our economy and energy system under a certain set of assumptions. It is not a forecast or prediction of the future. Every climate scenario relies on a set of assumptions regarding future technological and socio-economic development.

Two main categories of models are used to study possible low-carbon transition scenarios: Energy System Models that provide a detailed study of the energy system and the development of different technologies, and Integrated Assessment Models that integrate models of the climate, economic, land-use, and energy system and therefore are able to capture interactions between these systems.

Each climate scenario operates within the constraints of a global carbon budget that then corresponds to a global mean temperature increase, with a certain probability. This carbon budget can be allocated to different sectors and technologies in different ways, based on the assumptions of the model.

The PACTA tool is scenario agnostic. Therefore, any climate scenario can be used in the PACTA analysis on condition that the scenario lays out targets in production capacity at the technology level or – for the relevant sectors – emission intensity units measured in terms of production. It is essential to be mindful that the choice of the scenario will dramatically influence the results. It is, therefore, imperative that the scenario assumptions are well understood.

Note that the targets laid out in climate scenarios can vary by region depending on the sector's value chain and geographic constraints (e.g. power distribution). It is advisable to measure alignment at the geographical level in which the sector tends to operate. For example, for the power sector, markets tend to be regional or national, and as such alignment should be measured at that level. However, the oil sector operates in a global market and in such a case it makes more sense to use a global scenario target.

Scenarios may differ in the following aspects:

- The speed at which decarbonization occurs (rapid ramp-up or long-term adjustment).
- Different assumptions about innovation and, therefore, about the availability, scalability, and cost of technologies.
- Levels of granularity of information. For example, they are expressed at different time and geographic scales.

- Decarbonization pathways with different levels of ambition.

The use of multiple scenarios with varying levels of climate ambitions is strongly encouraged. This provides the financial institutions with a better understanding of their current and future alignment to them.

The PACTA for Investors tool has multiple built-in climate scenarios, among which the user can choose which one to use. Additional scenarios are periodically included or updated in the tool. For more information about the scenarios available in the tool, please refer to the PACTA for Investors Scenario document.

ABCD (Asset Based Company-level Data)

The PACTA Methodology relies on an assessment of physical assets linked to companies, and then linked to financial securities, to compare their alignment with climate scenarios. While PACTA as a methodology is data-agnostic, meaning any data provider/source can be used, in the online tool, we use data provided by Asset Impact for all covered sectors.

The data used in PACTA records current and future production levels, enabling a forward-looking analysis. However, this information is consolidated differently, depending on whether the analysis is performed for corporate bonds or listed stocks. Differences in how the information is consolidated are intended to best reflect the particularities of the product being analyzed.

- **Equity Ownership (EO):** The EO consolidation methodology aggregates the relevant asset-based activity (activity, capacity, or emissions) for each successive level of the ownership tree (from subsidiary or affiliate to parent company) weighted by the parent company's equity stake in the subsidiary or affiliate. This also includes subsidiaries and affiliates in which the parent company has minority equity stakes (<50%). The sum of the asset-based indicators across all the subsidiaries and affiliates of a parent company is reflected in its relevant indicator column.

  For example, see *figure 1*, Subsidiary X has 50 MW installed capacity, Subsidiary Y has 20 MW, and Subsidiary Z has 10 MW. The parent Company A has 35% ownership stakes in Subsidiary X, 70% ownership stakes in Subsidiary Y, and 100% ownership stakes in Subsidiary Z, and directly owns 50% stakes in assets with 8 MW of installed capacity. Then, Company A's aggregated, equity-weighted installed capacity is 45.5 MW. This consolidation methodology is applied all the way up the corporate ownership tree to the ultimate parent company.

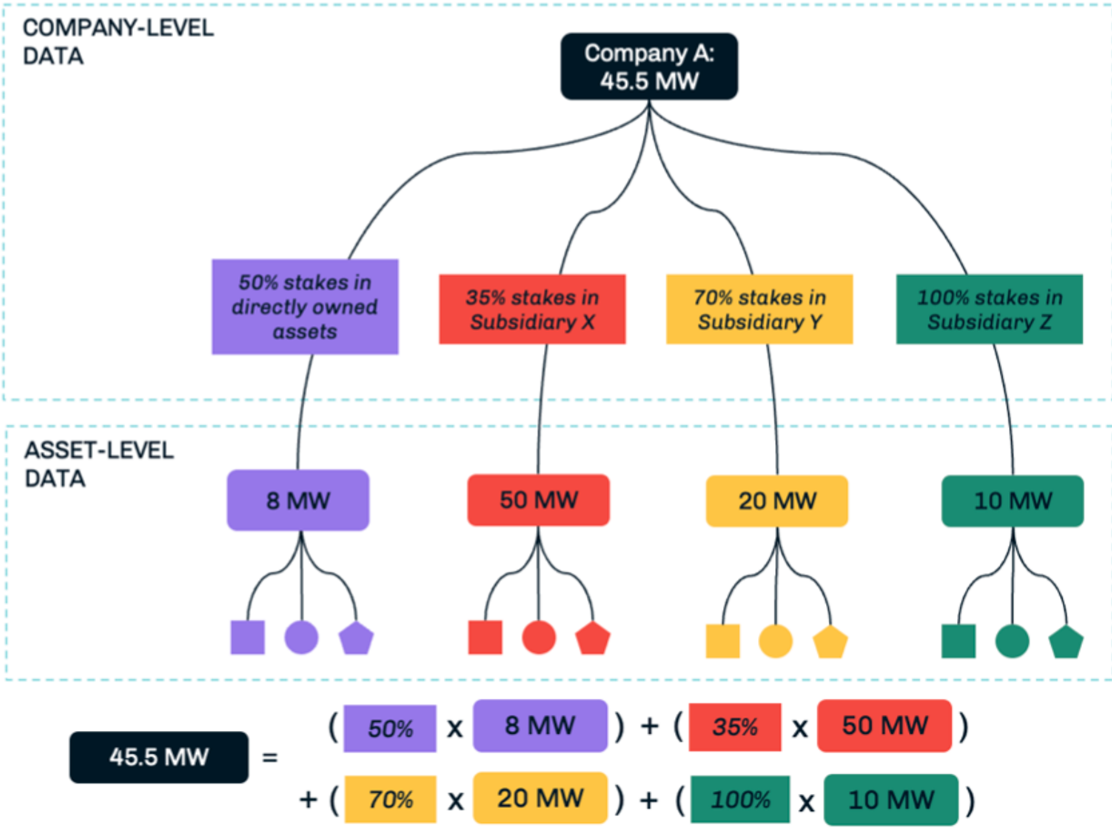

Figure 1. Example of Equity Ownership Consolidation, provided by Asset Impact.

- **Credit Ownership (CO):** The CO consolidation methodology aggregates the relevant asset-based indicator (by activity, capacity, or emissions) to the "credit parent" of the company, unweighted by the credit parent's equity stake, if any, in that company. The credit parent of a company is the obligor for the debt (including bonds, notes, loans, etc.) of that company. Since the ultimate (equity) parent may not inherit the credit risk associated with a company's debt, the credit parent and ultimate parent may not be the same entity. The CO methodology is designed to be more closely aligned to credit risk methodologies and is the most suitable for loan book/ corporate bonds analysis.

  A company's credit parent is identified as follows:
  - If company X is a direct subsidiary (100% owned) of company Y, the credit parent is company Y.
  - If company X is majority-owned by company Y, such that X is not a direct subsidiary of Y, then company X is its own credit parent because it carries the credit risk associated with its debt.
  - If company X is purchased by holding company Y, in which several firms hold interests, and company X issues debt to finance the acquisition, company X is also its own credit parent.

- Where company X has no identifiable majority shareholder, company X is the credit parent.

For example (see *Figure 2*), Company A is the credit parent of Subsidiary Z, but not the credit parent of Subsidiary X and Subsidiary Y (despite holding 35% and 70% stakes, respectively). Subsidiary X and Subsidiary Y are their own credit parents and are allocated their respective installed capacities (50 MW and 20 MW). Company A is allocated the capacity of Subsidiary Z, but not of Subsidiary X & Y. Company A directly owns 50% stakes in assets with 8 MW of installed capacity, but is not the credit parent for these assets. Therefore, Company A's aggregated, unweighted installed capacity on a Credit Ownership basis is 10 MW, where the capacity from Subsidiaries X and Y, and directly owned assets, are excluded. This consolidation methodology is applied only once, since the credit line ends at the credit parent (a credit parent is its own credit parent).

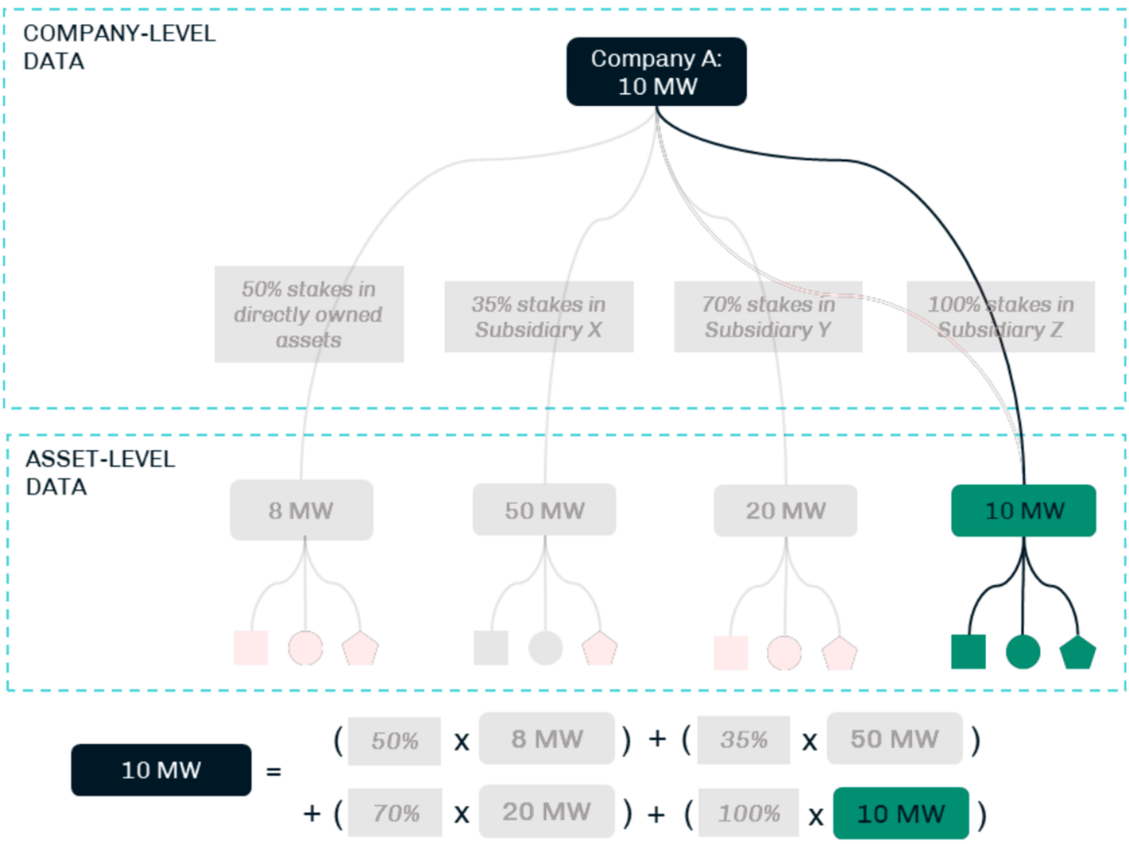

Figure 2. Example of Financial Control Consolidation, provided by Asset Impact.

Financial data

To perform the analysis, financial information of listed companies, such as market prices, outstanding shares, and issued bonds, is required. This information allows us to attribute companies' production to financial assets. Information regarding the funds and their composition is also sourced to apply the analysis to them. This information is embedded in the online tool and is sourced from FACTSET.

Portfolio data

To perform the PACTA analysis of a financial portfolio, the tool requires the data points mentioned below as input to the assessment framework. This information must be organized by columns in a comma-delimited CSV file, which can then be uploaded to the platform for analysis.

- ***Investor's Name:*** Name of the financial institution uploading the portfolio
- ***Portfolio Name:*** The analysis may be applied to many portfolios simultaneously. Please note that the tool will generate a report for each portfolio uploaded, so if one hundred lines are uploaded in the file, corresponding to the holdings of five portfolios, the tool will generate five individual reports, which can be later combined to generate a single report, according to the user's preferences in the platform.
- ***ISIN:*** International Securities Identification Number, assigned to the analyzed security, according to the ISO 6166.
- ***Market Value:*** Amount invested in the specific ISIN. Decimal values must be separated by periods.
- ***Currency:*** Currency in which the investment is made.

Benchmarks included in the analysis

Exchange-Traded Funds (ETFs) are funds that track a basket of securities and can be used as a proxy of world indexes. In the online tool, the following ETFs have been included as benchmarks for analysis:

- iShares core S&P 500 ETF
- iShares MSCI ACWI ETF
- iShares MSCI Emerging Markets ETF
- iShares MSCI World ETF
- iShares Global Corp Bond UCITS ETF

More detailed information regarding these ETFs and their constituents can be found in iShares website.

Methodology

SCOPE AND MAIN ASSUMPTIONS OF THE METHODOLOGY

PACTA compares what needs to happen in sectoral decarbonization pathways, here referred to as "climate scenarios", with financial actors' exposures to companies in climate-relevant sectors. PACTA provides a five-year forward-looking, bottom-up analysis. It looks at the investment and production plans of companies, which are in turn based on physical asset-based company-level data, and consolidates that information to identify the energy transition profile of the companies and their related financial instruments. **This information is aggregated at the portfolio level and compared to the production plans projected in different climate scenarios. The (mis-) alignment between the portfolio and these scenarios allows users to infer on the potential exposure to transition risks and opportunities.** Further details on the accounting principles behind the methodology are provided in this section.

The PACTA methodology covers eight of the most carbon-intensive sectors in the economy (i.e., the sectors most exposed to transition risks) – oil and gas, coal, power, automotive, cement, aviation, and steel (the "PACTA sectors"). Together, they are responsible for around 70% of all CO_2 emissions[3]. In each sector, PACTA focuses on the part of their value chain with the highest contribution in terms of CO_2 emissions. For example, in the oil and gas sector, the focus is on upstream activities related to production, while in the power sector, the focus is on power generation and related sources of energy. *See figure 3*

[3] Based on 2019 Greenhouse Gas emissions data taken from the IEA (2021) and IPCC (2021), the PACTA sectors — power, automotive, steel, cement, and aviation — account for just under 70% of the global CO_2 emissions and approximately 42% of the global GHG emissions. Fossil fuel production for all sectors of the economy, including the PACTA sectors, accounted for approximately 63% of the global GHG emissions in 2019.

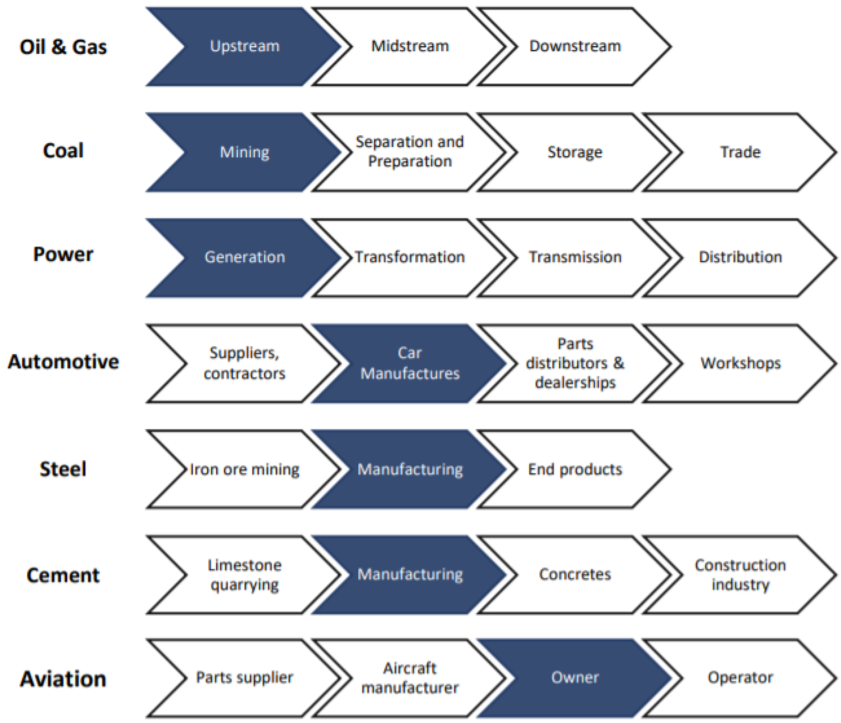

Figure 3. Part of the value chain analyzed by PACTA methodology

The PACTA climate scenario analysis provides answers to the following three questions:

1. What is the current exposure of the portfolio to the economic activities that are most affected by the transition to a low carbon economy?
2. How aligned are the investment and production plans of companies in the portfolio with different climate scenarios and the Paris Agreement?
3. How the exposure of the portfolio will change in the next five years, and how does it compare to a portfolio that is aligned with a 1.5°C scenario?

The information provided by the PACTA analysis can be used by investors for transition risk management, for the identification of engagement opportunities with companies, for disclosure and reporting, and for strategy setting and decision making.

COVERAGE OF FINANCIAL ASSET CLASSES

PACTA was initially designed as a tool for listed equity and corporate bonds portfolios in 2015 and has since been expanded to corporate credit portfolios. This methodology document focuses on the PACTA for Investors methodology, which covers long positions in listed equity and corporate bonds.

While there is a growing interest in applying the PACTA approach to other financial products, such as private equity, sovereign debt, derivatives, and short positions, the incorporation of these types of financial assets still requires further research. Therefore, please note that even if such products are included in the uploaded file, they will not be included in the analysis.

ACCOUNTING PRINCIPALS

Production attribution to Financial Assets

While company-level production information is consolidated by our data provider as presented in section 1.2.3, **a key aspect addressed in PACTA's methodology is how to attribute companies' activities to financial instruments.** Various approaches exist for attributing this data, but at PACTA, we use two of them:

Ownership weight approach. This approach assigns a share of the companies' activities to the portfolio based on the percent of outstanding shares owned by the investor. As the owner of a proportion of the company, he has control over that same proportion in decision-making. This approach is available only for equity portfolios.

As an example, (*see figure 4*) assume there are two companies that compose a portfolio, each one of them issued four shares, and the portfolio is owner of one share of the blue company and the four shares of the yellow company. Under the ownership approach, 25% of the production of the assets owned by the blue company (1 power station) and 100% of the assets owned by the yellow company (2 power station) will be attributed to the portfolio.

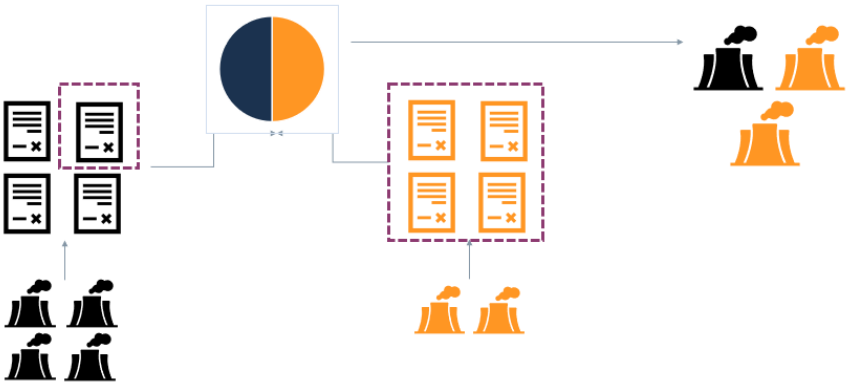

Figure 4. Example of ownership weight approach.

Portfolio weight approach. This approach assigns a share of the companies' activities to the portfolio based on the weighting of each position within the portfolio's total investments into the specific sector. This approach is available for the analysis of both corporate bond and equity portfolios.

The result of the previous example under the portfolio approach would be as follows (*see figure 5*): If the same portfolio is composed of two companies equally weighted, half of the production of the assets owned by the blue company and half of the production owned by the yellow company will be attributed to the portfolio. Thus, two power stations from the blue company, and one power station from the yellow company will be attributed to the portfolio.

Figure 5. Example of Portfolio weight approach.

Scenario allocation to Companies

The PACTA for investors analysis uses the market-share approach, to allocate macroeconomic climate goals targets to companies:

The decarbonization efforts are equally distributed amongst companies depending on the market share of the company within the sector: a 10% market share means having to contribute 10% of decarbonization efforts. In other words, companies are expected to provide the same proportion of efforts relative to their size, and regardless of their initial starting point.

In the methodology, companies are prescribed custom targets that are calculated using the same required rate of change. Assigning companies targets under the form of industry-wide required change guarantees that the methodology keeps market shares constant.

The required change applied to companies' technology-specific production figures are calculated using the pathways laid out in climate scenarios, expressed in absolute values.

Two ways market definitions are combined:

- **for low-carbon technologies,** what matters is how much of a sector's total production (i.e. across all technologies – e.g. the whole power sector) the portfolio holds.
- **for high-carbon technologies,** what matters is how much of total production powered by a single technology (e.g. all coal-powered production capacity) the portfolio holds. This serves the purpose of distributing the decarbonization effort only to companies that can take action, i.e. only those that do currently operate some of that technology's existing production. Without this, and given the market share approach adopted, macroeconomic goals would not be reached.

Accounting for the current global lag in low-carbon technologies

Targets are applied differently for high-carbon and low-carbon technologies:

For high-carbon-technologies,[4] the required change used is simply the rate by which the climate scenario prescribes that the global production volume should decrease. This is the *technology market share* ratio mathematically formalized below.

For low-carbon technologies, the required additional production is expressed as a share of initial total production within the sector. This is the *sector market share* percentage mathematically formalized below.

Portfolios are being prescribed identical changes: a same rate of reduction of their financing to high-carbon activities, and a same additional volume (expressed as a share of the portfolio's total activities) by which to increase their financing to low-carbon activities.

In other words, depending on a portfolio's initial distribution, this low-carbon increase prescribed under the form of an addition of percentage points of the initial total is such that a 'laggard' portfolio (i.e. one that initially displays exposure to a low-carbon technology that is smaller than that technology's prominence in the market) will see its share of that technology - when studied in isolation - grow faster than a 'leader' portfolio.

Two portfolios of identical size – i.e. both deemed to finance a same-size market share – will be required to add the same volume (expressed as share of their total) of low-carbon technology production to the activities they finance. Only when we look at the internal shift that undertaking this addition amounts to, does this same target represent varying levels of effort.

4 And for all technologies for the fossil fuels sector

Indeed, if a portfolio finances no renewable power production capacity, applying any rate of change to it will leave that production capacity at zero in the portfolio's custom pathway. Therefore, laggards would not be expected to build out renewable power production capacity; they would fall behind in terms of market share as the sector shifts towards an increasing volume of renewable power, and the bulk of the necessary build-out would fall upon historical leaders in the field. Therefore, the target is set in the form of a percentage-point increase that is expressed in relation to the initial distribution. A portfolio is not required to increase its low-carbon production capacity by x%, but rather to increase it by a volume equivalent to y% of its total production capacity within the sector. Conversely, for decreasing (high carbon) technologies, the pace at which production has to decline is set in isolation from initial distribution across technologies.

Both calculation rules yield the same result, wherein all decarbonization efforts are distributed to microeconomic actors. However, the combination of the two generates a different distribution than if either had been exclusively used. It is not feasible to use one exclusively due to the relative lack of low carbon technologies. Hence, a combination of the two is required. This is consistent across all portfolios.

Mathematical formulation for applying technology market share ratio to set targets (High-carbon technologies):

Consider a scenario, $S_j(t)$, prescribing a pathway for high-carbon technology, j. We define the technology market share target as:

$$P_{i,j}^{tmsr} = P_{i,j}(t_0) * \frac{S_i(t)}{S_i(t_0)}$$

for some initial production value, $P_j(t0)$.

We define the "technology market share ratio" as:

$$\frac{S_i(t)}{S_i(t_0)}$$

Mathematical formulation for applying the sector market share percentage (smsp) to set targets (Low-carbon technologies):

With P_j and S_j being the portfolio production and scenario production of some technology, j, let P and S be the portfolio and scenario production of the sector, across all technologies, i.e.:

$$P \equiv \sum_j P_j \quad \& \quad S \equiv \sum_j S_j$$

We define the sector market share target, for low-carbon technology j, as:

$$P_j^{smsp} = P_j(t_0) + P(t_0) * \left(\frac{S_i(t) - S_i(t_0)}{S(t_0)}\right)$$

We define the “sector market share percentage” as:

$$\left(\frac{S_i(t) - S_i(t_0)}{S(t_0)}\right)$$

METRICS

The PACTA methodology has three core metrics: Technology Mix, Production Volume Trajectory, and Emission Intensity. The metric used in each sector depends on the availability of clearly defined technology decarbonization pathways. Scenario providers develop these pathways, and they describe the path each sector should follow to achieve a specific climate goal also defined by the scenario provider. These pathways are already defined for some sectors where it is possible to switch from high-carbon emitter technologies to low-carbon emitters. For these sectors PACTA provides the Technology Mix, the Production Volume Trajectory, and the Emission Intensity. Nevertheless, there are some sectors where the decarbonization pathways are not well defined, as it is the case for steel, cement, and aviation. For these sectors, given that the climate change scenarios do not prescribe technology roadmaps but give absolute values of production and carbon dioxide emissions, the approach PACTA takes is to measure alignment using Emission Intensity per unit of production.

This results in a portfolio profile defined by outputs from the previously mentioned metrics, which are described in more detail below. Portfolio results are calculated for the baseline year of the analysis and five years into the future and can be compared to market benchmarks and, most importantly, to different climate scenarios.

Technology Mix

The Technology mix metric shows the sectoral technology/fuel mix of companies that make up a bond or equity portfolio and informs how this mix should evolve to be considered aligned with various climate change scenarios. In other words, it represents the weight of each technology in the sector as a percentage of investment therein.

PACTA assumes a static balance sheet. As such, the difference in the technology mix between the baseline year of the analysis and the future Technology Mix, five years forward-looking, is solely a result of the production plans of the companies that make up the portfolio and not a result of any change in the portfolio composition.

Currently, the methodology calculates the portfolio's financial exposure to different technologies for the following sectors:

- Automotive: Engine types for light-duty vehicle production
- Power: Electricity-generation technologies across the installed capacity
- Fossil Fuels: Energy sources across primary energy extraction (Just available for the baseline year of analysis, considering that production in all these technologies should phase down over time)

Modelling choices to allocate company-specific technology exposures to the portfolio

Consider some indicator, P, for some company, i. This could represent production, capacity, CO_2 -efficiency or some other economic indicator. In general, this indicator will vary with time:

$$P_i \equiv P_i(t)$$

In general, t is not written. It is implied throughout.

For any given sector, we can split P by the technology, j, used to generate the indicator in question:

$$P_i = \sum_j P_{i,j}$$

It follows that the company's share, ρ, of technology j is:

$$\rho_{i,j} = \frac{P_{i,j}}{\sum_j P_{i,j}}$$

In practice, a portfolio will be composed of many companies, with varying financial exposures to each company.

We define the portfolio's technology share, ɣ as the portfolio-weighted average of each client company's technology share, ρ:

$$\gamma_j = \sum_i \left[\rho_{i,j} * \frac{A_i}{\sum_i A_i}\right]$$

where A_i is the investment into a company i, and the summation occurs only over companies within the sector (e.g. "power").

Disambiguation: under the portfolio-weight approach:

$$\gamma_j \neq \frac{P_{i,j}^{pf}}{\sum_j P_{i,j}^{pf}}$$

In plain terms, if the portfolio's share of nuclear is equal to x%, this does not mean that in absolute values, x% of all installed MW of all clients are powered by nuclear. It means that x% of the value of the portfolio is exposed to nuclear.

In practice, the "technology mix" is the set of technology shares for each technology in a sector:

$$\{\gamma_1, \dots, \gamma_j\}$$

Note that PACTA assumes the composition of the portfolio to be static, therefore exposure to companies is kept constant over time. The time dependency of the technology share is entirely driven by changes in the production.

$$\gamma_j(t) = \sum_i \left[\rho_{i,j}(t) * \frac{A_i}{\sum_i A_i}\right]$$

Figure 6 shows the visual representation of this metric. The example shows, the high and low carbon technology mix for the power sector in a bond portfolio, where:

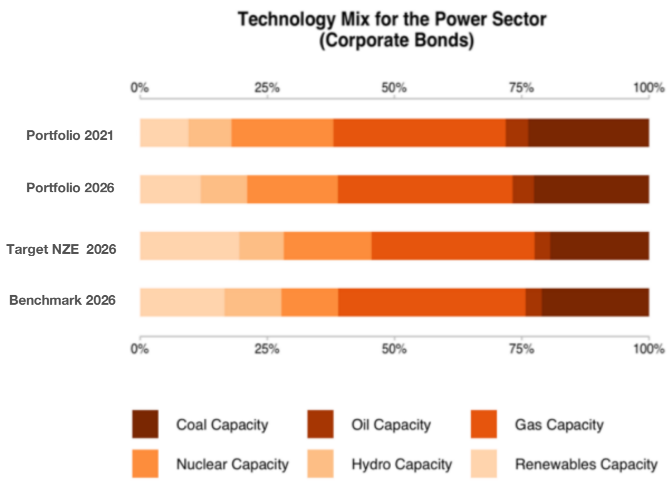

Figure 6. Example of the technology mix metric.

- Portfolio 2021: reflects the current technology mix of the power sector in the analyzed portfolio.
- Portfolio 2026: reflects the projected future technology mix of the power sector in the analyzed portfolio.
- Target NZE 2026: shows the anticipated technology mix of the portfolio in 2026 based on the NZE scenario.
- Benchmark 2026: reflects the projected technology mix in 2026 for the selected benchmark, based on the companies' capital plans for the next five years.

Production Volume trajectory

The production volume trajectory metric aims to measure the alignment of a portfolio's projected production volumes to those given in climate scenarios. This metric is available for fossil fuels, power, and automotive sectors, and it is presented at a five-year horizon at a technology level.

Changes in production volumes result either from transfer of production from one technology to another (e.g. internal combustion engines to electric vehicles) or from sheer expansion or contraction in the production coming from the technology/fuel. The resulting volume trajectories are then compared with the trends set as targets in climate scenarios and can also be compared to different benchmarks available in the interactive report.

The production-volume trajectory metric **displays trends that may not be visible in the technology mix exposure metric**, e.g. an increase in coal-fired power generation that would not be observable if renewable-fuelled power generation increased faster.

PACTA offers two options of the production-volume trajectory:

1) **The Ownership weighted production trajectory**, which takes the owned production (See ownership approach in section 2.3.3.) of all companies that make up the portfolio in the sector and technology being analyzed.

   In this approach, the owned production of companies that make up the portfolio is aggregated:

$$\mathrm{P}_j = \sum_i \left[P_{i,j} * \frac{A_i}{M_i} \right]$$

   where M_i is the market capitalization of company i. This shows the volume of production trend over time associated with the portfolio, considering portfolio's equity holdings in the companies.

2) **The portfolio-weighted production trajectory** proxy, which weights the total absolute production of the clients within the portfolio by the investment size to reflect the financial allocation

The same portfolio-weighting as explained in the technology mix can be applied to the investees' production volumes to calculate the portfolio-weighted production proxy, P':

$$P'_j = \sum_i \left[P_{i,j} * \frac{A_i}{\sum_i A_i} \right]$$

The proxy i is an aggregation of the investees production volumes, weighted by the relative amount of capital invested in each company. The portfolio-weighting of the production proxy reflects the investor's money allocating decisions.

Figure 7 shows the production volume trajectory metric for electric vehicles as an example. This metric measures the alignment of a portfolio's projected production volume over the next five years with the ranges of change in production volumes derived as targets from different climate scenarios.

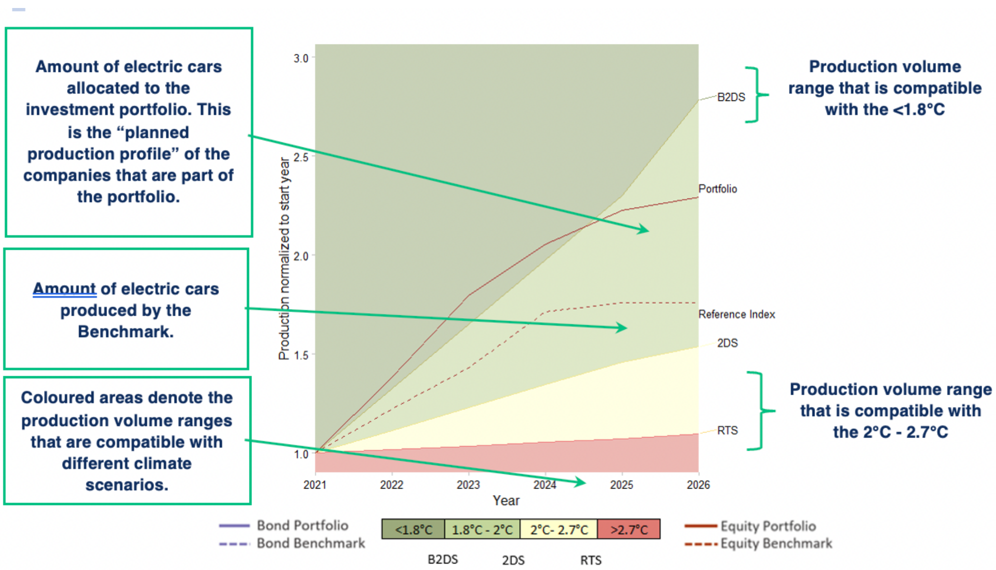

Figure 7: Example of the Volume Trajectory Chart Electric Automotive production alignment relative to the IEA's scenarios

Changes in production volume result either from the transfer of production from one technology to another (e.g., internal combustion engines to electric vehicles) or from the expansion or contraction in production related to the technology/fuel (e.g., a company brings a new coal-fired power plant online). The Y-axis shows the normalized production change planned for the next five years, with the current capacity represented as 1.

In Figure 7, the portfolios' electric vehicle production trajectory falls within the light green area and increases between 2021 and 2026. This means that portfolio companies' production plans for electric vehicles for the next five years are compatible with the 2 Degrees scenario (2DS), but production is not increasing enough to be aligned with the Beyond 2 Degrees (B2DS) scenario. In this example, the portfolio is outperforming the results obtained for the benchmark.

Emission Intensity

The emission intensity metric measures the average CO_2 intensity of the portfolio in terms of an economic unit of output (for example, CO_2/per ton of steel produced). This is then compared to an emission intensity reference point set by a climate scenario.

The emission intensity of the activities financed by the portfolio is the first metric in sectors for which no clear technology pathways have been set out (namely, steel, cement, and aviation). Put differently, for these sectors, no zero-carbon alternative yet exists. As such, it is not possible to use the technology mix metric or the volume production volume trajectory metric to measure alignment. However, it is still imperative to steer capital in a way that aims to decrease carbon emissions in these sectors – hence the emission intensity metric is used. For sectors where technological pathways exist, this metric is provided as a complementary metric.

To obtain the metric, PACTA assigns ‘emissions factors’ to the physical assets. For example, a steel plant in Sweden will be assigned an average emissions intensity based on either the known emissions of that plant or will be estimated based on the characteristics of the asset. Hence, tons of economic output (e.g. tons of steel) are converted to tons of CO_2 per ton of steel. The scenarios for these sectors are also reconstructed in such a way as to measure emissions intensity.

COMPLEMENTARY METRICS (ONLY AVAILABLE IN THE INTERACTIVE REPORT)

CO_2 emissions chart

The PACTA analysis core metrics are based on assets production at a company level for sectors where this information is available and emission intensity for sectors without defined technology roadmaps. While estimating the absolute CO_2 emissions can help inform about the relative importance of the analyzed sectors, it is still a challenge to source reliable and accurate data about absolute emissions; that's why as a part of the report, this metric is presented as a complementary metric. For companies for which emissions data is not available, a sectoral CO_2 emissions average is used as an approximation.

In this complementary metric, the pie chart reveals the contribution of each of the sectors to the total emissions assigned to the equity and bond portfolio.

The data used to build this metric is sourced from FACTSET/ISS, and they provide information on scope 1,2 and 3 emissions for more than 20,000 companies. For companies where there is no emission data available, the average emissions of the sector to which the company belongs is assigned. Subsequently, each portfolio is assigned the proportion of the company's emissions, taking into consideration its equity stake over market capitalization, or its debt investments over the total outstanding debt of the company.

The graph included in the interactive report shows this information in percentages, but the user can hover-over the different sections of the pie chart, to obtain the absolute emissions assigned to the portfolio.

Transition Disruption Metric

The Transition Disruption Metric (TDM) is complementary to the PACTA alignment model. It provides a score of the medium-term potential disruption of the portfolio under the Forecast Policy Scenario (FPS) developed by IPR. It measures how much the companies that compose the portfolio have left to do relative to how much time they have left. In this way, it's a progress indicator tracking disruption.

The metric creates a quantitative score of the potential disruption in ten years based on how far the portfolio lags / leads the FPS scenario in the first five years. The indicator is available at technology, and portfolio level. The higher the metric, the higher the disruption.

Figure 8 shows an example for the power sector. The score of the metric should be interpreted as follows:

- **Full mitigation (0):** The portfolio has fully mitigated the FPS transition disruption modelled until 2030.
- **Managed mitigation (from 0 to 1):** The portfolio is ahead or on track (when the value is 1) to fully mitigate the FPS transition disruption by 2030.
- **Managed disruption (1 to 1.5):** The portfolio has not fully mitigated the FPS transition disruption by 2030, but the residual disruption can be 'managed'.
- **Unmanaged or high disruption (over 1.5):** A score over 1.5 suggest an increased unmanaged or high disruption, where the portfolio significantly lags in the mitigation of the FPS transition disruption by 2030. The acceleration of the pace of the capital stock evolution must be much higher than in the first five years.

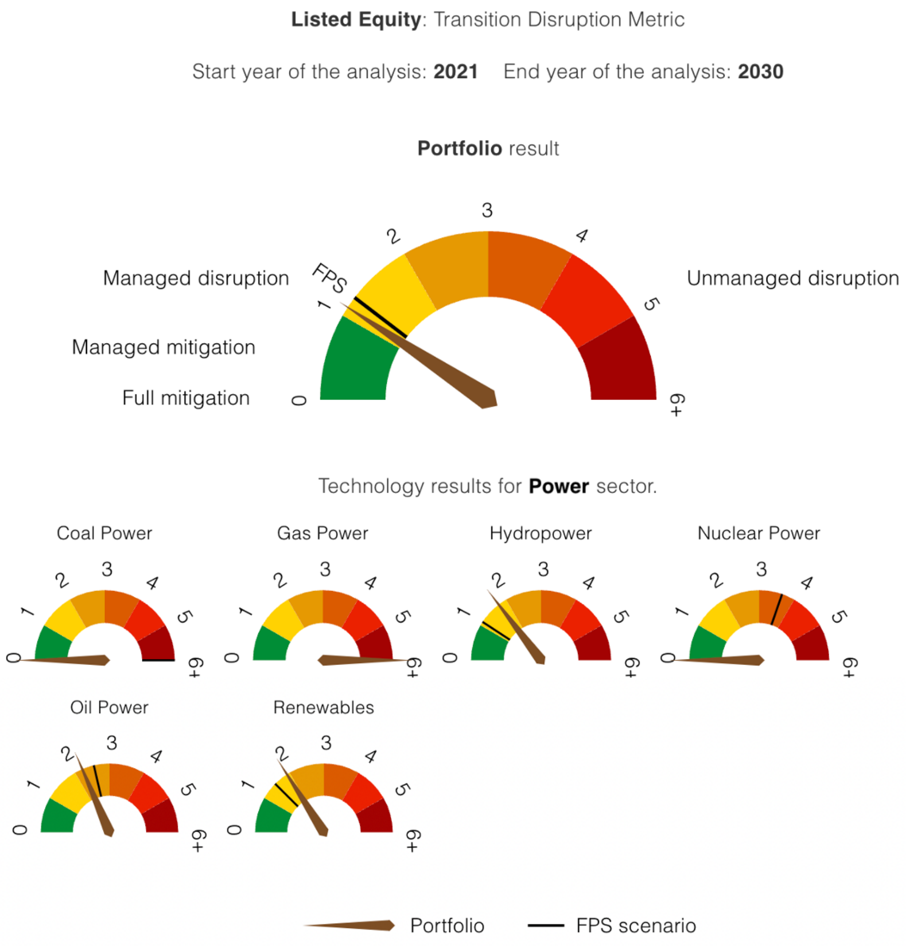

Figure 8: Example of the Transition Disruption Metric for the power sector.

Company level results

In the PACTA for Investors online tool there's a section dedicated to company level results. This information is currently available for the automotive and the power sector, and the results are based on the same principals of the pacta methodology.
There are two metrics available at a portfolio level:

- Company technology mix

The climate transition requires a transition from high-carbon technologies to low-carbon technologies. Assessing the technology mix of companies, and its evolution over time, helps financial institutions to analyze the compatibility of the transition of microeconomic actors with their climate strategy.

The analysis focuses on the **changes in the technology used to produce the sector's given output** (e.g. shift from coal-fueled to renewable-fueled power generation), and on **changes in the nature of the output** itself (e.g. shift from combustion engines to electric vehicles).

- Company low and high carbon split

The second metric available at the company level is the current low carbon technology share vs. future scenario compatibility of planned production. This metric reflects on the X-axis the current share of low-carbon technologies in companies' production, and on the Y-axis the company's future share of low-carbon technologies relative to what the IEA NZE scenario requires. Therefore, companies located in the upper right quadrant of the chart are the ones that have a higher exposure to low-carbon technologies and those that have more ambitious built-out plans for the upcoming five years.

Sectors Covered in the PACTA analysis

POWER

The **transformation and ramp-up of the power sector** is at the heart of the transition to a low-carbon energy system. A growing share of total primary energy will have to be converted into (low-carbon) electricity as ever more industrial sectors switch from fossil fuels to clean power. Increases in electricity demand in developed economies will be mitigated by energy efficiency gains, such that 90% of additional power demand will stem from emerging economies.[5]

In 2018, the power sector accounted for 42% of global carbon dioxide emissions. The majority of these came from coal fired electricity generation, which alone accounted for 30% of global CO_2 emissions. In addition, the IEA has found that coal combustion has been responsible for 0.3°C of the 1°C increase in global temperature above pre-industrial levels and thus represents the single largest source of temperature increase.[6]

Accordingly, the transitioning of the power sector is crucial to meeting the Paris Agreement's goal of limiting the global average temperature rise to well below 2°C above pre-industrial levels.

Power generation at the heart of the power sector's transition

The power sector can be broken down into up-, mid- and downstream:

- The upstream segment covers actual **power generation** and is dominated by electric utilities. This segment accounts for the vast majority of emissions in the value chain. The majority of decarbonization efforts will come from a shift in from high-carbon to low-carbon technologies, with additional efforts coming from improved efficiencies in the process.
- The midstream segment refers to the **distribution and transmission of power**. This segment is often but not necessarily owned by different entities distinct from the power generating utilities (e.g. National Grid in the UK). Most decarbonization efforts in this segment will come from improved efficiencies via minimizing energy leakage, and further investments in grids.
- The downstream segment relates to the **consumption of electricity**. Here,

5 IEA-WEO (2019) p. 253
6 IEA – status report (2019)

decarbonization efforts are related to demand side changes, in part coming from improved efficiency (e.g. more efficient household appliances), and innovations around decentralized energy production, opening the sector to new players and innovative business plans.

In the methodology, the alignment of the sector is studied via an analysis of **power generation,** i.e. the **upstream segment**, as (i) it is by far the most carbon intensive segment of the sector, (ii) supply-side emissions are the most relevant in terms of steering capital, (iii) asset level data in this sector covers individual power plants and comparable datasets on transmission or distribution assets have not yet been developed.

Primary energy sources for power

Coal is both the first global source of generated power and the most carbon-intensive one. As a result, it is prescribed the steepest reduction rates in Paris-aligned climate scenarios.

Oil is highly carbon-intensive and plays a sizeable role as a backup technology. It is used in places with limited electricity infrastructure.

Gas is generally considered as a transition fuel and hence in different scenarios and different regions it is treated differently. In most scenarios it is required to decrease in the long term but is allowed a steady increase in the short to medium term. The regional distribution is also highly variable.

Renewable technologies (onshore wind, bioenergy, solar PV, solar CSP, offshore wind, geothermal and ocean tidal) are massively relied upon by most climate scenarios in order to deliver a significant reduction of the emission intensiveness of power generation globally. All are at different stages of development and deployment and will require significant R&D investments to further scale these technologies to the extent that is required by climate scenarios.

For the most part, nuclear – a very low-carbon, baseload technology - is given increasing though limited targets in climate scenarios.

Hydropower currently accounts for a larger share of global installed capacity than all other renewables combined. Large-scale global potential has however largely been tapped already, and environmental issues surrounding the technology are rife. Potential and therefore targets vary widely regionally.

Climate scenario alignment in the power sector is measured through a combination of the technology mix – i.e. the mix of primary energy sources used in overall power generation –

and production volume trajectory metrics. Production volume trajectory is provided at a technology level.

RMI's analysis of the upstream segment of the power sector is based on one key measurement: the **installed capacity of power generating** assets. Forward-looking data on installed capacity is vastly more reliable than generation/emission data, as it is tied to the physical asset itself, whereas capacity, efficiency- and emissions-factors vary.

FOSSIL FUELS

More than any other industry, the fossil fuels industry has been the catalyst of unprecedented economic growth as well as responsible for the majority of global emissions. Even today, fossil fuels, such as coal, oil and gas, account for around 80% of the world's energy consumption.

Fossil fuel extraction is at the heart of PACTA's fossil fuels sector analysis

The fossil fuels sector can be broken down into up-, mid- and downstream:

- The upstream segment covers actual **extraction of fossil fuels** out of the ground. This segment constitutes the most climate critical part of the value chain. If the world is to achieve the goals set out by the Paris Agreement, there will need to be a decrease in extraction across all fossil fuel resources.
- The midstream segment refers to the **refining, processing, and transportation**. This segment is often but not necessarily owned by the same entities that hold the upstream assets. This segment will be directly affected by changes in the segment before it. Most decarbonization efforts in this segment will come from improved efficiencies via minimizing leakage, and more efficiency improvements in processing.
- The downstream segment relates to the **consumption of the final products.** This is wide-ranging and covers the power sector, transportation, petrochemicals and various other industries. The decarbonization efforts needed for downstream are captured by the decarbonization effort needed for the various sectors that use fossil fuels. Some of these downstream sectors are covered in this document or currently fall out of scope of the PACTA analysis.

In this methodology, the alignment of the fossil fuels sector is studied via an analysis of the **upstream segment**, as alignment here will have a knock-on effect throughout the rest of the value chain. Emissions related to the downstream of this segment are covered in the scope of Automotive, Power, Cement and Steel sectors in this methodology or currently fall out of scope. Furthermore, this segment is also highly vulnerable to transition risk. With the ever-looming risk of stranded assets, it is important that financial institutions understand their climate scenario alignment in this part of the value chain.

Climate scenario alignment in the fossil fuels sector is measured by the combination of the technology mix (i.e. mix of fossil fuel resources that are being extracted) and volume trajectory metrics.

RMI's analysis of the upstream fossil fuels sector is based on one key measurement: the **production capacity of fossil fuel extracting physical** assets, i.e. oil fields, gas fields, coal mines.

For coal, **total** coal production is considered regardless of the type of coal or the use of the coal, given that we cannot distinguish between thermal and metallurgical coal production at this state. While the current formatted input scenario uses total coal, further research will be done to assess possibilities to distinguish between these two use cases. Ultimately most scenarios will require thermal coal production to decline faster than the metallurgical coal production.

AUTOMOTIVE

The transportation sector accounts for 14% of global emissions, with the majority of emissions produced by light-duty vehicles.[7] Over the last decade, automotive emissions have continually risen, offsetting the declines in other sectors. Emerging markets are increasingly a significant source of demand growth, but **developed markets are still responsible for the largest proportion of vehicle miles**.[8]

For measuring climate scenario alignment, the manufacturing segment of the automotive value chain is considered. This segment is deemed the most climate critical as it is at the root of decarbonization efforts in the sector. Furthermore, it is directly linked to the rest of the value chain, so any changes in production will have a knock-on effect both up and down the value chain.

Climate scenario alignment in the automotive sector is measured by a combination of the technology mix (i.e. what part of your car production is based on what kind of engine technology) and volume trajectory metrics.
RMI's analysis of the automotive sector is based on one key measurement: the **number of cars produced by each asset.** An asset in this sector is defined as a light duty vehicle (LDV) production line.

7 EIA (2019)
8 IEA (2019)

CEMENT

Cement is used to bind together the elements that make up concrete (sand, gravel), which is the world's widest-used manufactured material. Cement is produced by decomposing and calcinating limestone in a rotating kiln heated up to 1,450°C (where limestone is sintered with other materials, in a very emission-intensive process), thereby creating clinker, which is finally grinded with other components.

Emissions from cement production can be categorized in **process related** emissions, as well as **direct and indirect energy** related emissions.

- The process-related emissions are due to a chemical process called limestone *calcination*. For the production of clinker (the main component in cement), limestone is heated in a rotary kiln. It causes the calcium carbonate $CaCO_3$ present in the limestone to decompose into calcium oxide (CaO) and carbon dioxide (CO_2). The limestone calcination process accounts for about 50% of emissions from cement production[9].
- Fossil fuel is combusted to reach the high kiln temperatures that are required to produce clinker. This direct energy related emissions account for about 40% of emissions from cement production.
- Finally, indirect emissions are the result of electricity consumption for powering additional plant machinery.

As raw materials are available globally and transportation is costly, cement production is spread across the globe. Global cement production was estimated at 4.1 billion tons in 2017 by the United States Geological Survey,[10] of which 52% is produced in China, ahead of India (6.2%), the European Union (5.3%) and the USA (1.9%).[11]

According to IEA estimates, the emissions caused by cement production accounted for **7% of anthropogenic carbon dioxide emissions in 2017**, and global cement production is **set to grow by 12 to 23% by 2050 in comparison with 2018 levels**.[12]

The PACTA methodology measures the alignment of the cement sector to climate change scenarios by using the Emission Intensity metric described in section 2.4.3. This metric is different from e.g. the automotive or power sectors, where 'technology switching' plays a big role (i.e. moving from fossil fuel power generation to renewable). This is because for those sectors, clear low- or zero-carbon technologies already exist today, while for cement this is

9 Columbia Climate Centre (2012)
10 USGS (2012-2018)
11 GCCA (2017)
12 IEA & CSI (2018), p. 8

not the case. Hence emissions intensity (absolute emissions divided by production) is used as there is currently no well-defined decarbonization technology pathway available for the cement sector.

As with the other sectors covered in this methodology, production figures at the asset level are a key part of measuring portfolio alignment. Assets are defined as integrated cement manufacturing facilities. An emission factor is then applied to the production figures from each asset, giving an emission intensity. The emission factor is based on the most granular level data available, which can be as granular as the technology that is being used, or more higher-level regional emission averages for specific technologies.

STEEL

As an essential material to industrialized economies, global annual steel production has doubled over the past two decades from 850 to 1,850 tones. Most of the increased steel output has been driven by the rapid expansion of emerging economies, in particular China, which now accounts for 51% of global crude steel production.[13]

According to the IEA (2019) steel now accounts for 8% of global carbon emissions and is the largest consumer of energy in the manufacturing sector. While the emission intensity has declined by an average of 0.7% from 2010 to 2016, under the IEA’s Sustainable Development Scenario this curtailment must rise to an annual rate of 1% until 2030. With 75% of steel production’s primary energy consumption derived from coal, simple fossil fuel switching will only achieve marginal emissions reductions. In the long-term, deep decarbonization will require more ambitious technologies and production methods.[14]

The PACTA methodology measures the alignment of steel portfolios to climate change scenarios by using the emission intensity metric described in section 2.4.3. This metric is used as there are currently no well-defined decarbonization technology pathways available for the steel sector, meaning that a technology mix of volume trajectory by technology is not feasible.

As with the other sectors covered by the PACTA Methodology production figures at the asset level are a key part to measuring portfolio alignment. Assets are defined as steel manufacturing plants. An emission factor is then applied to the production figures from each asset, giving an emission intensity. The emission factor is based on the most granular level

13 World Steel Association (2018)
14 IEA SDS (2018)

data available, which can be as granular as the technology that is being used, or more higher-level regional emission averages for specific technologies.

AVIATION

Although aviation fuel efficiency has increased by 1.9% each year over the previous decade, aviation still has to reduce its intensity by 24% in 2030 from its pre-pandemic level to follow the zero-emissions pathway outlined by the IEA.[15]

For the aviation sector, PACTA provides alignment results on emission intensities, since the scenario providers have not defined technology roadmaps for this sector. Assets are defined as owned aircraft, and an emission factor is applied to the asset based on flight attendance, distance, and aircraft model, resulting in an emission intensity per passenger per kilometer.

15 https://www.iea.org/reports/aviation

Annex

HOW TO READ THE REPORT AND INTERPRET THE RESULTS

The report is organized so that the user first gets a background on the methodology and the sectors covered by PACTA, followed by a summary of the analyzed holdings and a visual representation of the PACTA coverage of the total portfolio.

In the next section of the interactive report, the user has access to the core PACTA metrics explained section 2.4. Please note that as mentioned before, metrics are available depending on the sector being analyzed, and they are complementary to each other. The technology mix metric and the production volume trajectory metric both provide an indication of the alignment of portfolio companies with the Paris Agreement goals. However, they differ in that the technology mix metric is a measure of the relative amounts invested in different climate relevant technologies within the portfolio, while the production volume trajectory measures whether the rate of change in the production amount is sufficient to meet the benchmark scenario that is in line with Paris Agreement goals. For example, it is possible that renewable power generation makes up a large portion of a credit portfolio relative to carbon intensive power generation, resulting in a portfolio that is aligned with the Sustainable Development Scenario (Paris Agreement aligned) from a technology mix perspective. Yet the rate of increase of renewable power generation may be too small to meet the same scenario from a production volume trajectory perspective, because companies in the portfolio might not be planning an increase in their production plans in the next five years. On the other hand, the emission Intensity information can be helpful for understanding the effort companies still should make, to achieve the emission intensity levels required by the scenarios.

As part of the climate scenario analysis section, company-level results are provided for the automotive and energy sectors. This information has great relevance for users, as it not only allows to identify the companies that are driving the results, but also provides material information useful to start engaging with the companies.

Finally, a section with brief information on PACTA's data inputs and the methodology is included.

LIMITATIONS OF THE ANALYSIS

As in any other model, there are a number of limitations to the PACTA climate scenario analysis for equity and corporate bonds conducted in this report, some of which are mentioned below.

1. Data received from financial institutions: To perform the exercise, financial institutions upload their portfolios. RMI does not perform any validation or audit of the data, so the study relies on the commitment of the entities to upload the required portfolio information.

2. Climate scenario assumptions: The climate scenarios used in the analysis present one possible manifestation of how an energy transition aligned with the Paris climate agreement could look like. Even though the necessary actions are not controversial (expansion of renewables, retirement of high-carbon technologies), the precise way in which a remaining carbon budget is distributed across sectors will be achieved in different ways by different scenarios. In this sense, different models will include different assumptions about the future development and potential of certain technologies. This analysis therefore focuses on those technologies that are proven and available to the market. As a result, this analysis does not consider investments in R&D or early-stage private equity, which represent an important way for financial institutions to help bring new solutions to the market. Additionally, while scenarios are expected to incorporate all socioeconomic considerations, they do not consider regional-specific policies or regulation. For this reason, it is expected that for some technologies alignment may be more difficult or even unfeasible.

3. Asset based company level data used: Although data is sourced from reliable third-party data providers, errors are possible, either in the production plans themselves, or in mapping the ownership structure of companies. Furthermore, planned production plans do not necessarily materialize and production forecasts should be interpreted bearing this in mind.

4. Scope of the analysis. PACTA does not cover certain sectors, such as agriculture and forestry, even though they are highly relevant for limiting future GHG emissions, due to lack of available data. Furthermore, asset classes such as sovereign bonds or private equity are also not included in the analysis.