

Introduction

This document provides input from 2 Degrees Investing Initiative, a non-profit Think Tank - to the “Call for evidence: information and data for the preparation of the 2020 Biennial Assessment and Overview of Climate Finance Flows” from the UNFCCC Standing Committee on Finance.

The input is based on the open-source and free-of-charge climate portfolio alignment tool Paris Agreement Capital Transition Assessment as developed by 2DII and its stakeholders. PACTA allows financial institutions and others to measure the alignment of their investments in 8 climate critical sectors to climate change mitigation scenarios, including a Paris-aligned scenario.

While the tool is originally intended to measure portfolio alignment, the tool and underlying physical asset-level data could also be used to measure alignment of global stock and bond markets. Moreover, since the tool is now operational for several years, it allows us to track changes in companies’ production and could potentially be used to try and assess investment flows.

This document is our attempt to provide initial input on the question of climate finance flows based on the PACTA methodology and whether from the end of 2018 to the end of 2019 stock and bond markets have become greener in terms of Power and Auto Manufacturing companies. More in depth statistical analysis based on our tool and underlying data is possible however and we may considering doing more substantive research in 2021. Exchanging views on this topic with the UNFCCC Standing Committee on Finance would be more than welcome.

The document first provides a brief explanation of the PACTA methodology. It then explains how we define the global bond and stock markets. The next section tries to assess whether stock and bond markets have become greener between the end of 2018 to the end of 2019 (and provide some initial thoughts on what drove that change: did greener companies become more valuable, or did companies just become greener? The document ends by assessing how aligned the global stock and bond markets are today, based on our standard 5-year forward-looking assessment.

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How to measure alignment: the PACTA methodology

The Paris Alignment Capital Transition Assessment (PACTA) is a free and open-source methodology and software tool developed by the 2° Investing Initiative (2DII) to assess the alignment of financial portfolios with climate goals. It contains different modules that are presented in this chapter.

The PACTA climate scenario analysis for listed equity and corporate bonds is the core module of PACTA. Since 2018, this core module has been used by over 1,500 organizations worldwide representing a total of USD 106 trillion in assets under management. The PACTA methodology has also been recently expanded to corporate lending portfolios, following road-testing by a group of 17 major international banks including UBS, BNP Paribas, ING, Standard Chartered, Barclays and Credit Suisse.

In addition to the PACTA climate scenario analysis, 2DII developed climate stress test scenarios and models in collaboration with a number of financial supervisors and central banks. Funding for the development of the methodology and tool has been provided by the European Union's Life Program as well as a range of governments and philanthropic institutions.

This section provides a brief overview of the core principles behind the PACTA methodology. More information on the methodology and data sources is provided in reports published by 2DII¹ as well as the PACTA Knowledge Hub.²

PACTA Climate Scenario Analysis

The PACTA climate scenario analysis assesses the exposure, as well as the alignment of a portfolio with different climate scenarios and the Paris agreement in nine key climate relevant sectors.

The analysis is based on forward-looking asset-level data in the following nine key climate relevant sectors: power, oil & gas, coal mining, automotive, shipping, aviation, cement, steel, and heavy-duty vehicles. Together, these sectors account for around 75% of global CO₂-emissions. This data is mapped to financial and ownership data and compared to climate scenarios that provide low-carbon energy transition roadmaps at technology-level.

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

1. *What share of the portfolio is currently exposed to activities in sectors 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. *What is the portfolio's technology mix in climate-relevant sectors expected to look like in five years based on current investment plans of the companies underlying the portfolio, and*

¹ Further details can be found on www.transitionmonitor.org.

² The knowledge hub can be found here: <https://app.gitbook.com/@2-investing-initiative/s/pacta-knowledge-hub/>

how does it compare to peers, the market, and a technology mix aligned with the Paris Agreement?

4. *What companies are driving the results of the portfolio's exposure and alignment?*

The following table provides an overview of key components and principles underlying the PACTA methodology.

Physical asset-level data	The analysis is currently based on data covering 40,000+ companies and 230,000+ energy-related physical assets from third-party data providers. This alleviates the necessity to rely on companies' self-reported data that is published in a non-standardized manner and often does not account for scope 2 and 3 emissions.
Forward-Looking	PACTA provides a forward-looking analysis of the production plans financed by a portfolio that are compared to climate scenarios.
Sector-specific approach	The outputs of the analysis are metrics and indicators at sector and technology-level that allow for a detailed evaluation of a portfolio's alignment, rather than one aggregated indicator at portfolio level. For sectors in which no low-carbon technologies exist, the sectoral decarbonization approach is used to benchmark the portfolio production against climate scenarios. The SDA was developed by the Science-based Targets Initiative. ³
Allocating macroeconomic goals to microeconomic actors	The PACTA analysis uses a <i>market-share approach</i> to allocate macroeconomic climate goals to companies: all market level trends and goals are allocated to companies based on their current market-share in the sector or technology, for low- and high-carbon technologies respectively.
Mapping company-level activities to financial instruments and portfolios	A key question addressed in this methodology is how to allocate company-level activities to financial instruments. A number of different approaches exist, two of which are used in this analysis: Portfolio Weight approach. This approach calculates the portfolios' technology exposures based on the weighting of each position within the portfolio. This approach is used for the analysis of corporate bonds. Ownership Weight approach: This approach assigns a share of the companies' activities to the portfolio based on the

³ <https://sciencebasedtargets.org/>

	percent of outstanding shares owned by the investor. This approach comes closer to allocating “responsibility” for the companies’ activities to the financial institution. This approach is used for listed equity portfolios.
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Data Sources and Coverage

The PACTA methodology is, in principle, agnostic to the data sources used to run it, as long as they meet the requirements specified above. The following three types of data input are needed:

Financial data	Data from financial databases and Lipper is used to assign securities to sectors and link them to parent and subsidiary companies.
Asset-Level data	For each sector covered in the analysis, 2DII sources data from independent industry data providers that source data on individual assets in climate-relevant industries using a variety of research capabilities, including web scraping, desk research and direct engagement with industry. These asset-level datasets cover more than 230,000 individual assets (power plants, oil fields etc.) and account for more than 75% of global carbon emissions.
Climate scenarios	Production plans are compared to climate scenarios published by the International Energy Agency and Joint Research Centre of the European Commission.

Asset Level Data		
Data provider	Sectors	Key data points
GlobalData	Power, oil & gas, coal mining	a. Power plant data, including installed capacity, technology, status (i.e., announced, active, decommissioned, etc.). b. Oil and gas field data, including annual production volume. c. Coal mine data, including annual production mass.
AutoForecast Solutions	Automotive	Production forecasts for light duty vehicles
RightShip	Shipping	Ship data, including ship type and GHG rating score
CIRIUM, AirNav	Aviation	Passenger, cargo and combined aircraft data, including number of seats or tons transported, aircraft model, etc.
PlantFacts	Steel	Steel plant data, including production and CO ₂ emissions

Global Cement Directory	Cement	Cement plant data, including production and CO ₂ emissions
Power Systems Research	Heavy Duty Vehicles	Production forecasts for heavy duty vehicles

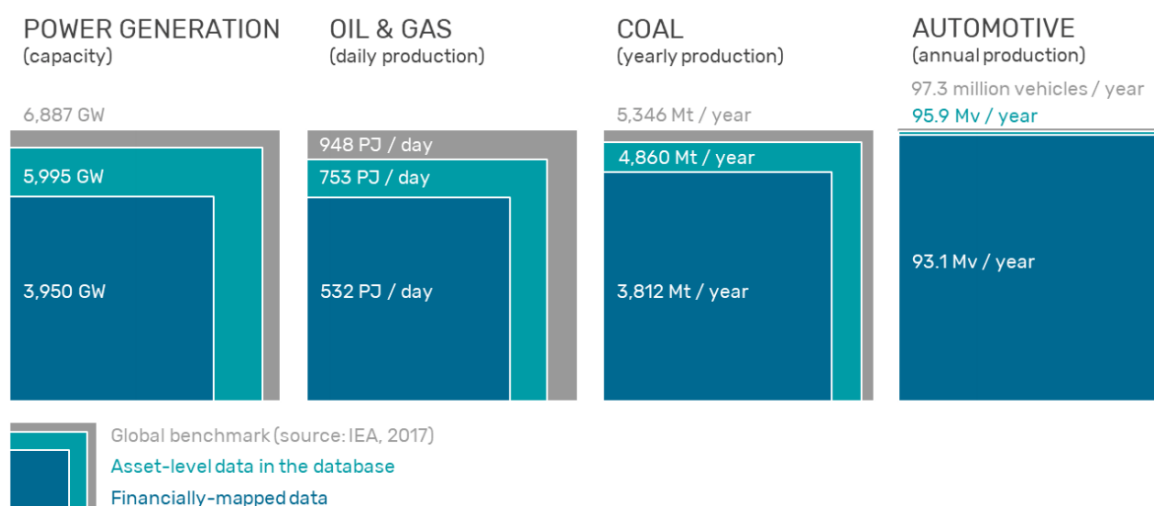


Figure 1: Coverage of the data sources in different sectors.

The portfolios of financial institutions are mapped to the asset level data based on the International Securities Identification Number (ISIN). Since this is not possible for loan books, the methodology was updated and is published as downloadable R packages.⁴

BOX: CLIMATE SCENARIOS

Stabilizing the global mean temperature increase to 2°C with some probability requires total anthropogenic CO₂ emissions to stay within a certain budget, estimated at around 1000 Gt CO₂ by the Intergovernmental Panel on Climate Change (IPCC). In conclusion, emissions will have to reach net zero by 2070, meaning that by that time, all remaining emissions will have to be compensated by removing CO₂ from the atmosphere. Achieving this goal requires profound shifts in our economy and energy system in particular.

A climate scenario is the result of a modelling exercise that aims to illustrate pathways for achieving this profound transition of the 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 assumption regarding future technological as well as socioeconomic development.

⁴ <https://www.transitionmonitor.com/pacta-for-banks-2020/>

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.

PACTA mainly uses climate scenarios published by the International Energy Agency, as well as the POLES model published by the Joint Research Centre of the European Commission.

Alignment with specific temperature targets: 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. Alignment or non-alignment in one technology therefore does not imply alignment overall, as there are different ways of distributing the carbon budget across different sectors.

<i>Scenario</i>	<i>Abbreviation</i>	<i>Estimated temperature increase</i>	<i>Source</i>
<i>POLES 1.9 SSP1</i>	POLES1.5	~ 1.5°C	JRC
<i>Beyond 2°C Scenario</i>	B2DS	< 1.75°C	ETP17
<i>Sustainable Development Scenario</i>	SDS	1.75 – 2°C	WEO19
<i>New Policies Scenario</i>	NPS	2 – 2.7°C	WEO19
<i>Current Policy Scenario</i>	CPS	> 2.7°C	WEO19

Limitations of the Analysis

There are a number of limitations to the PACTA climate scenario analysis. The first limitation relates to the climate scenarios used. The climate scenarios here present one possible manifestation of how the 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 carbon budget is distributed across sectors will be solved in different ways by different scenarios. Furthermore, different models will include different assumptions about the future development and potential of certain technologies. The analysis focuses on those technologies that are proven and available to the market. As a result, the analysis does not consider investments in R&D, which represent an important way for financial institutions to help bring new solutions to the market.

The second relates to the asset level data used. Although the 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 a companies. Furthermore, planned production plans do not necessarily materialize and production forecasts should be interpreted bearing this in mind.

The last relates to the 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.

How do we define the global bond and equities markets?

The global bond and equities markets are defined based on the investible universes.

The global bond market presented here is the total of all bonds listed on Bloomberg globally. The production is allocated to each corporate bond ticker with a financial classification in the automotive or power utilities sector. It does not take into account investment in power capacity by companies which are not in the power utility business (e.g. if Apple builds a wind farm which it uses itself).

The global equities market consists of the free flow share of most companies operating in the automotive and power sectors globally. The database of information used to create this market covers known listed companies operating in these sectors. The free float share of these companies (number of shares over the total shares outstanding) is multiplied by the total production to understand what share of the company's production is listed.

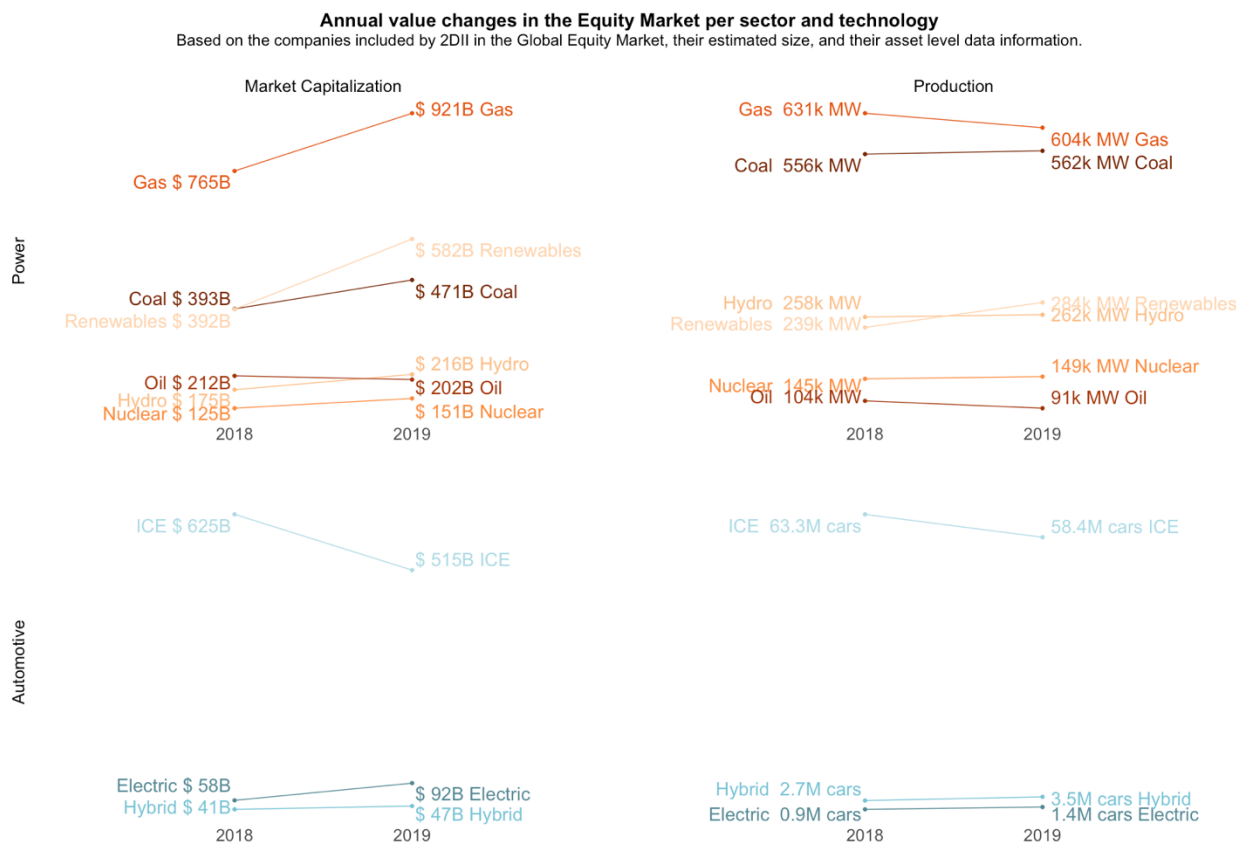
Are finance flows becoming greener?

Based on our asset-level data we can develop a “production picture” of each company. For each power company we will know both for 31-12-2018 and 31-12-2019 what their technology mix is (e.g. what % of their power capacity is in hydro, nuclear, renewables, etc.). For each auto manufacturer we can draw a similar picture based on production of ICE cars, electric cars or hybrid cars. We can then try to connect the changes in production to changes in market valuations of their stocks and bonds. Within the power sector, renewable power (representing solar, wind and biomass), hydro power and nuclear power can be considered as low carbon. Similarly, for the automotive sector, electric and hybrid vehicles are considered low carbon.

As this is only a preliminary assessment, we were not able to conduct a thorough statistical analysis to be able to filter out various drivers and to ensure statistical significance of the results. Instead, this is an initial exploration of whether we can indeed use our underlying data and methodology to begin to assess whether finance flows are becoming greener.

Changes in Market Capitalisation and Production

The first graph shows the changes in the market capitalization by different technologies. In addition, the corresponding changes in installed capacity or production of vehicles are presented. The equity market here represents the capacity or production allocated to the free floated share of listed companies with listed equity.



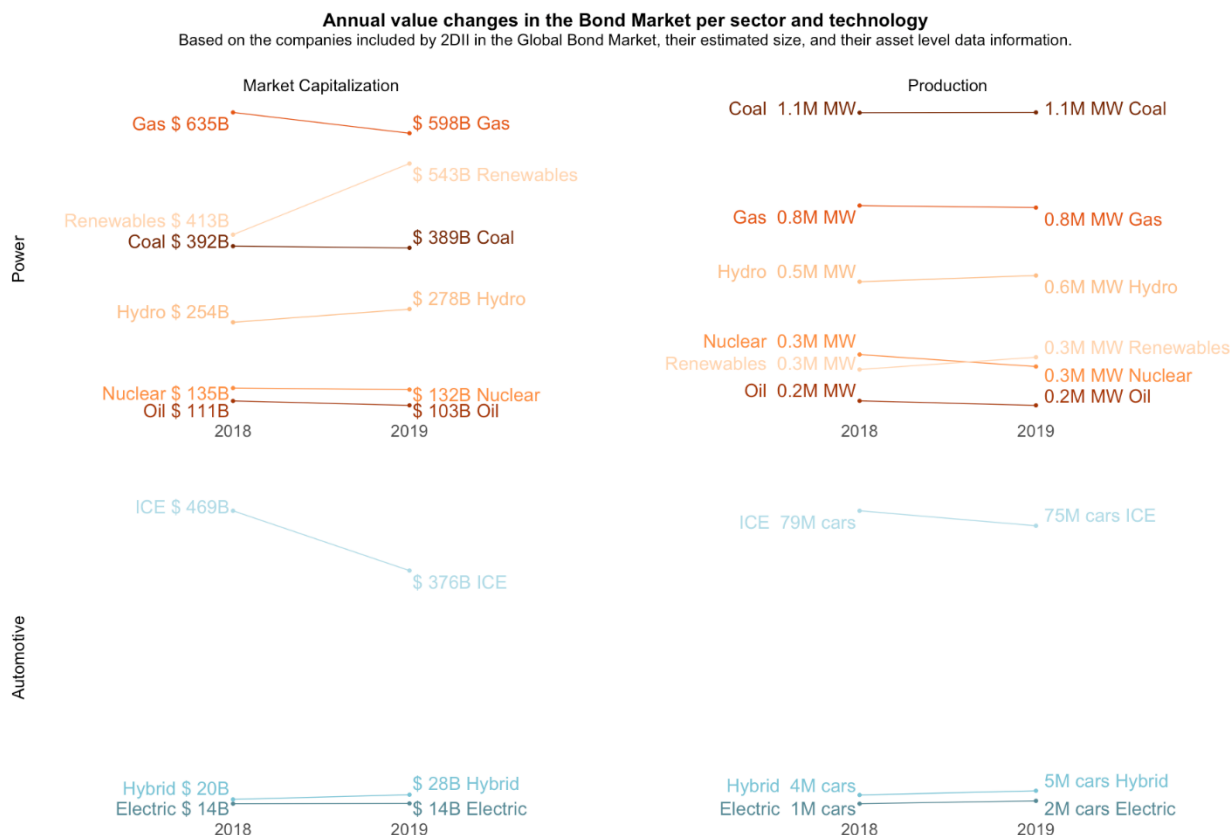
The first thing to note is that the overall stock market as a whole as defined by the MSCI All Country World Index became 12% more valuable between the end of 2018 and the end of 2019. This will be a driver as well for the results above, and something we have not had the time to filter out through proper statistical analysis. Nevertheless, various interesting observations can be made.

First, the market capitalization of listed companies with gas fired power capacity increases significantly, despite the overall installed gas power capacity allocated to the market decreasing. This indicates that the value of companies with gas capacity have increased more in comparison to companies with less installed gas capacity. The reduction of installed capacity allocated to the market is unlikely to represent the retirement of gas capacity, rather a reallocation of these assets to companies outside of the market.

Second, the increase in market value allocated to renewables (based on the overall technology mix of the market) has increased by far more (+48%) than the increase in installed renewable capacity (+18%), suggesting that markets have started to value renewable power more.

Third, the decline in market value of ICE cars (-12%) outpaces the decline in production (-8%), which hints at a lower valuation for this polluting technology.

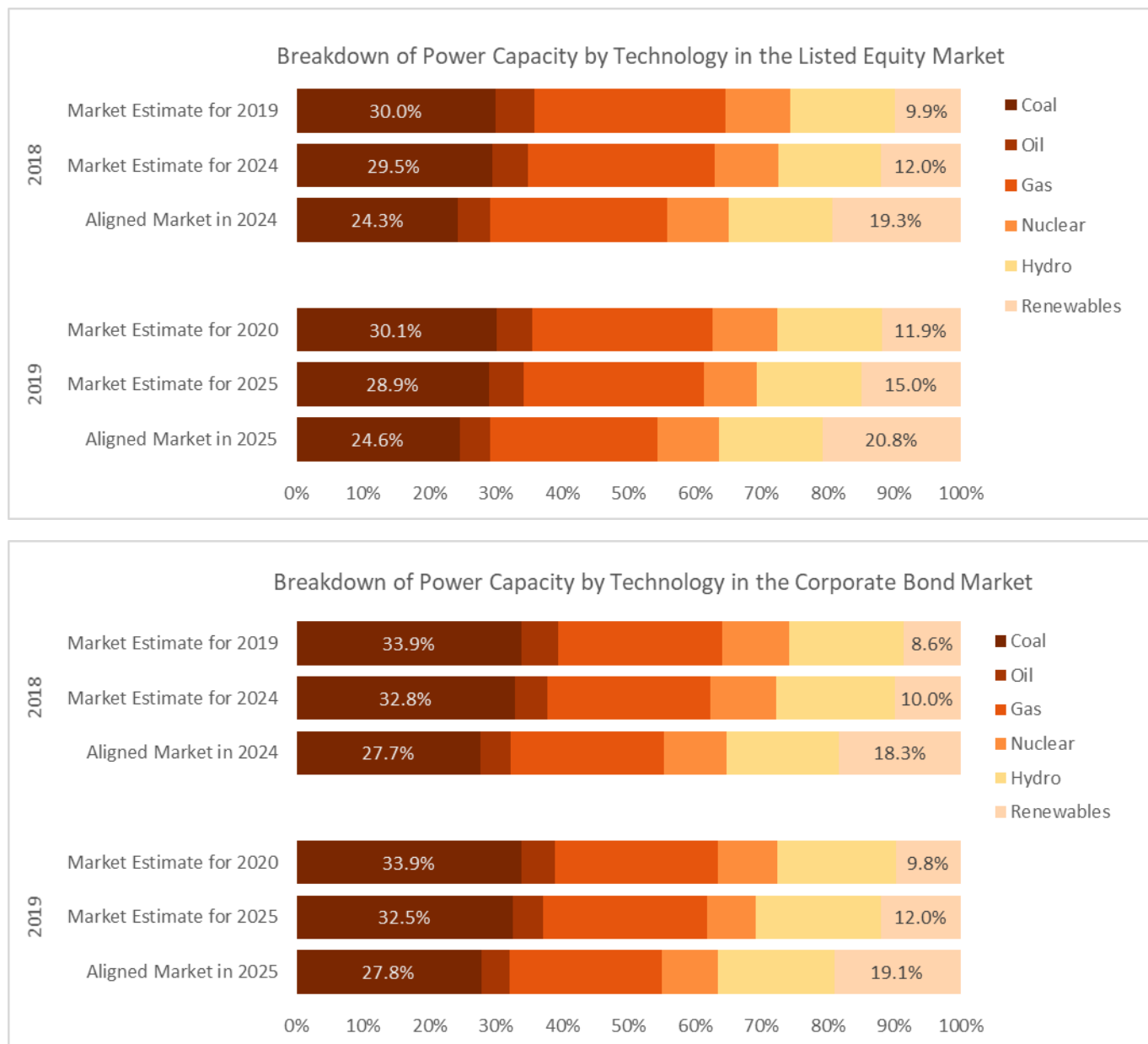
Overall, there has been more investment flowing into green technologies than high carbon and more capacity installed



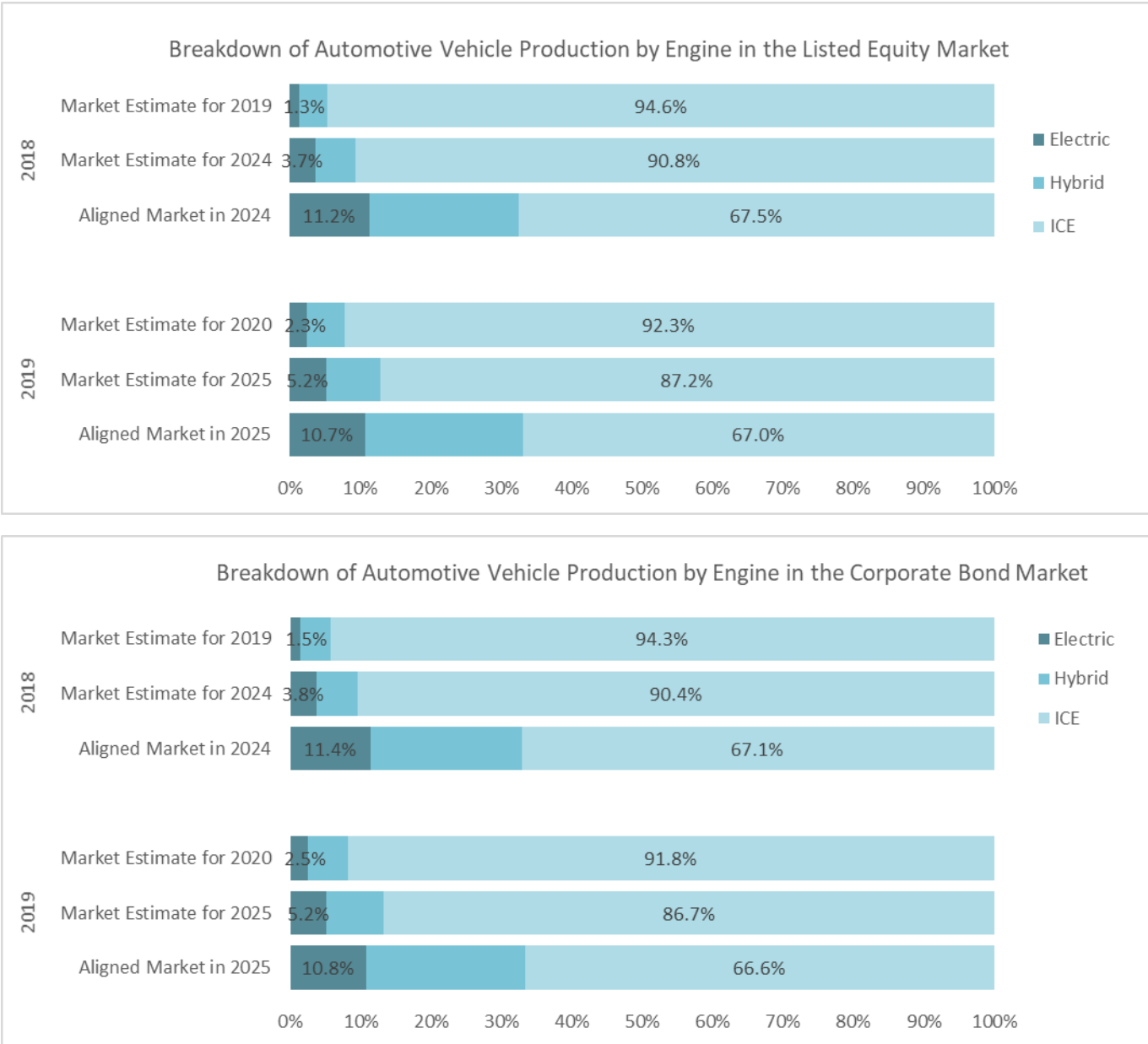
The trends in the bond market are rather similar, with one notable exception. Here too the decline in production of ICE cars outpaces the decline in market value. And the major growth in this market shows a transition towards renewable power capacity reflected in both changes in market capitalization and production. Interestingly enough, the market value of gas actually notes a decline, and a decline steeper than the actual decline gas capacity. All this supports the notion that there is a greening of the global bond market.

Technology Mix

To dive deeper into the current and future technology mix expected in the equity and bond markets, we can extract the information about the technology mix of the markets, based on the production. The following charts show how this has changed over time. There are two time frames presented here – the data from 2018 considers a baseline year of 2019 and looks ahead 5 years; whereas the 2019 data considers a baseline of 2020 and looks out to 2025. Additionally, these charts also showed what the market could look like if it were to be aligned with the B2DS scenario, or if each company in the market built out capacity in each technology at the rate indicated by the scenarios.



The above charts show similar trends in that there is strong growth in renewables even since 2018, with renewable power capacity making up 9.9% and 8.6% of the equity and corporate bond markets in 2019 and growing by 2%-points and 1.2%-points respectively. Looking at the five-year time horizon for the market in 2020, it seems that there is slightly higher growth predicted in renewables in the equity market compared with the bond market, even if the starting point is a little higher. Significant growth is still required for the markets to be on track with the growth of renewables or retirement of coal as suggested by the scenario within this five-year time frame.



The growth in electric vehicle production seen in the markets even between 2020 and 2019 and what is expected over a five-year time horizon is quite impressive. Comparing this growth to the scenarios however indicates the companies within the markets are not yet expanding this technology fast enough.

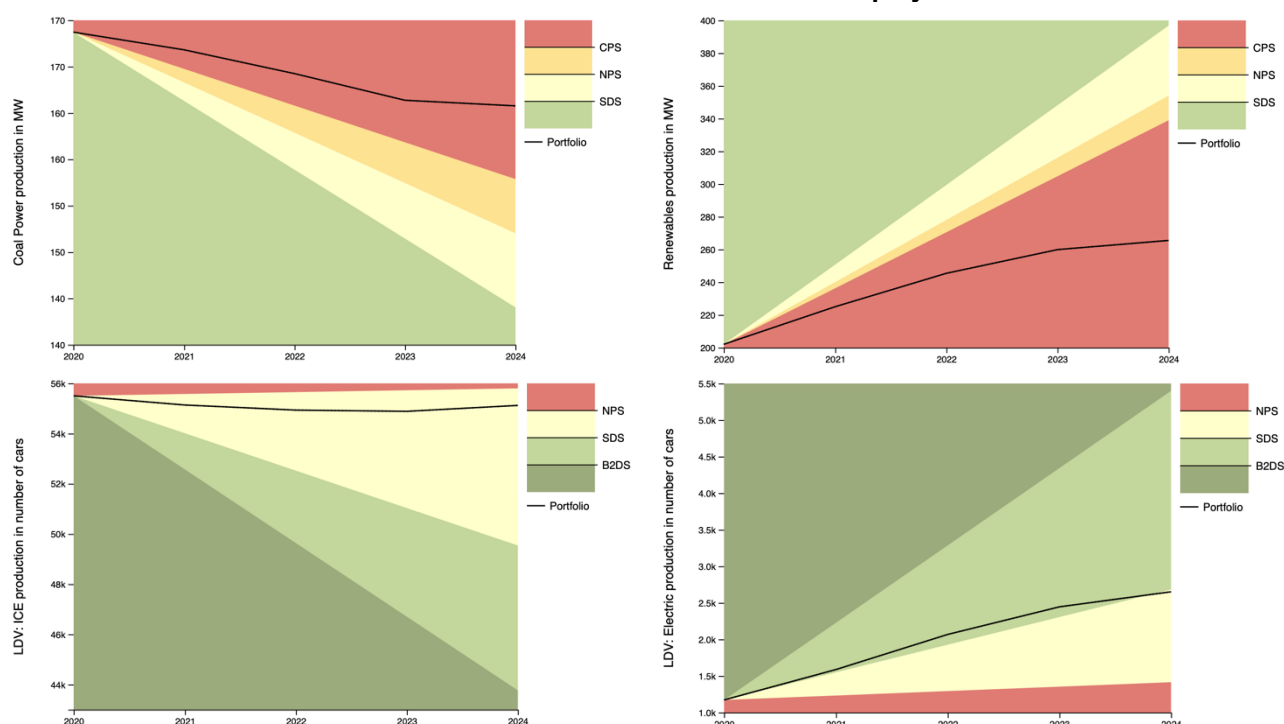
How aligned are the global stock and bond market today?

The underlying asset level data of this analysis is forward looking and shows how the investment plans of the companies within the equity and bond markets is set to change over time. The following charts represent the known investment plans in different technologies compared to different climate scenarios. For the equity market the black line represents the plans of the

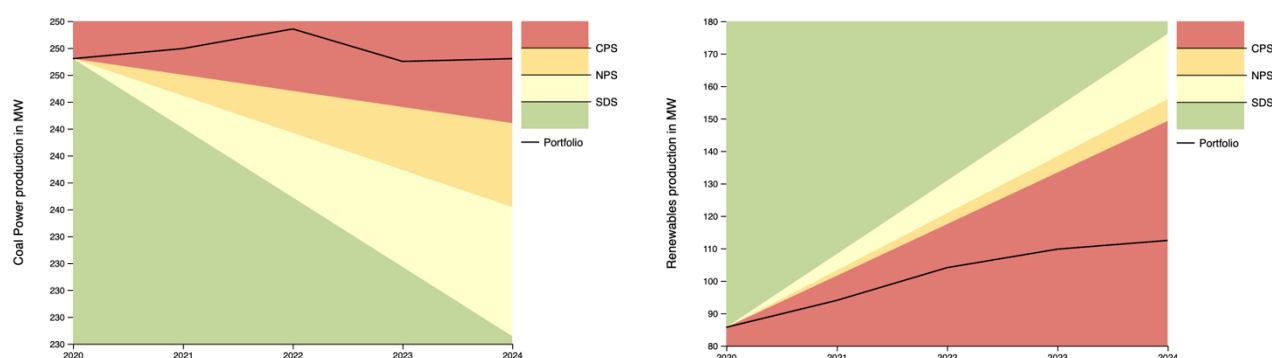
companies allocated to the equity market. This is overlaid over the technology roadmaps and the production or capacity that would be expected under the different climate scenarios. The technology roadmaps shown in these charts are adapted from the scenarios provided in the the World Energy Outlook and Energy Transition Perspectives from the Interational Energy Agency. This includes the Current Policy Scenario (CPS), the New Policy Scenario (NPS), the Sustainable Development Scenario (SDS) and the Beyond 2 Degree Scenario (B2DS).

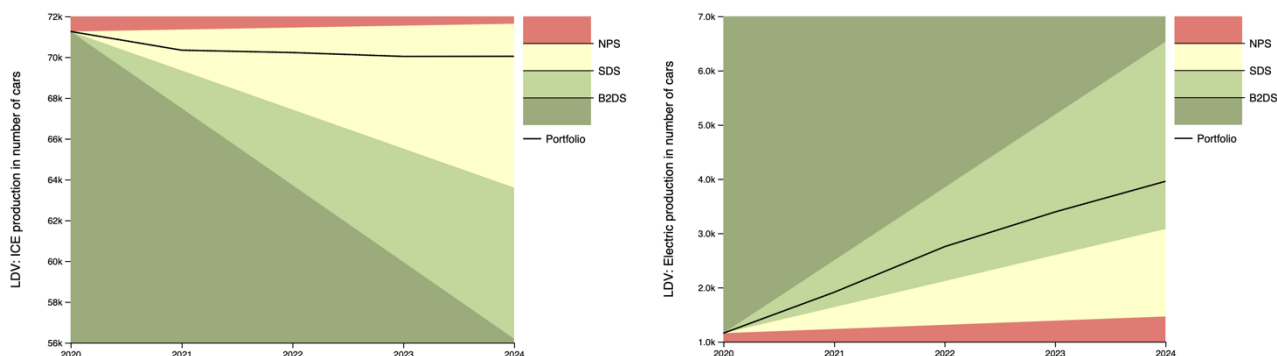
Expected Production Trajectories

Production trajectories and their alignment with climate scenarios for selected technologies in Power and Automotive sectors of the Global Equity Market



Production trajectories and their alignment with climate scenarios for selected technologies in Power and Automotive sectors of the Global Bonds Market





These charts show the alignment of the markets with climate scenarios. For example, the first chart shows the the coal power capacity is decreasing over time. However, the rate at which is decreasing is slower than that expected under even the Current Policy Scenario. This could be expected as the CPS reflects the policies that are implemented by different countries, however there may be some lag. The only technology that is developing at a rate expected under the SDS scenario is the electric vehicle production for both the equity and bond markets.