PACTA 2020

Assessing the alignment of the Liechtenstein financial sector with the Paris Agreement

January 2021

2° Investing Initiative

PACTA
Paris Agreement Capital Transition Assessment

The 2° Investing Initiative (2DII) is an international, non-profit think tank working to align financial markets and regulations with the Paris Agreement goals.

Working globally with offices in Paris, New York, Berlin, London, and Brussels, 2DII coordinates some of the world's largest research projects on climate metrics in financial markets. In order to ensure our independence and the intellectual integrity of our work, we have a multi-stakeholder governance and funding structure, with representatives from a diverse array of financial institutions, regulators, policymakers, universities, and NGOs.

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Executive Summary

CONTEXT

One of the goals of the Paris Agreement is to make financial flows consistent with a low-carbon pathway. The "PACTA 2020" climate compatibility assessment measures the alignment of the Liechtenstein financial sector in this respect.

Article 2.1(c) of the 2015 Paris Agreement created the political mandate to ensure the consistency of financial flows with the goal to limit the increase of global mean temperature to well below 2°C. Responding to this mandate, the assessment and reduction of emissions from investments via financial assets was defined as one of the goals of the Climate Vision 2050, which was presented by the Government in October 2020.

The test was coordinated internationally, as part of a wider effort to standardize the measurement and monitoring of the financial sector's contribution to the Paris climate goals.

In 2020, the climate compatibility assessment was implemented in Switzerland and Liechtenstein. Next, the assessment will be implemented in a number of European countries such as Austria, Luxembourg, Norway and Sweden, as well as through the Swiss/Dutch initiative to align financial flows with the Paris Agreement. Committed countries help their financial institutions to test their investments for climate compatibility in an internationally comparable way. Lessons learned will be shared and fed into the international debate on measuring and monitoring progress towards climate alignment. With users in North and South America, Europe, and Asia, PACTA is developing into an international standard.

Recognizing the critical role of moving beyond portfolio alignment towards the impact of different portfolio strategies, the PACTA 2020 climate compatibility test combines the quantitative analysis of portfolio alignment with a qualitative survey on existing climate strategies. As part of a voluntary survey, financial institutions were asked to provide information on existing climate strategies. In addition, institutions had the opportunity to position themselves on different policy measures and agreements, including the Paris Agreement and the Agenda 2030 for sustainable development.

In addition to the country-level analysis, each participating institution receives a bespoke individual report on their climate alignment results, including benchmarking against peers, market portfolios and indices. Participating institutions are free to disclose the results of the analysis as they see fit.

METHODOLOGY

The climate relevant real economy sectors analyzed represent roughly 70-90 % of indirect emissions in capital markets. The underlining asset-level database consists of around a quarter of a million industrial assets.

The quantitative, scenario-based analysis focuses on the most climate relevant sectors across global corporate bonds and listed equity. The following sectors are covered by the PACTA analysis: oil and gas extraction and coal mining, electric power, transportation (automobile, aviation,

shipping), industry (steel, cement). The sectors included in this analysis together represent roughly 70-90 % of indirect CO2 emissions in capital markets.

In total, the analysis for the equity and corporate bond portfolios builds on over 77 thousand individual holdings uploaded across nearly 105 individual portfolios in Liechtenstein's PACTA test, of which 90 % could be mapped to the underlying company data and evaluated.

The assessment presented in this report seeks to answer three related questions:

- What is the *current exposure* of the Liechtenstein financial sector to climate-relevant sectors and technologies?
- What is the *forward-looking alignment* of the Liechtenstein financial sector with 2°C climate scenarios across key climate-relevant sectors and asset classes?
- What is the state of the art of financial institutions' *climate actions* and how do these relate to the quantitative alignment results?

The climate scenarios used in this report for assessing the climate compatibility of global sectors were published by the international energy agency (IEA) and the European Commission Joint Research Centre.

The PACTA model was developed by the independent, not-for-profit think-tank 2° Investing Initiative and is based on forward-looking, asset-level data and production plans for the real economy companies from external data providers from third-party data providers.

KEY FINDINGS

14 institutions in Liechtenstein participated in the PACTA exercise. In order to guarantee the anonymity of the participants, the results were grouped by 'Banks & Asset Managers' and 'Pension Funds & Insurance'. 2 participants were classified as "Others" and are out of the analysis. The small pool of institutions analyzed in the exercise is not a full representation of the individual sectors or of the Liechtenstein financial market, however, the groups comprise leading institutions in their sectors, which makes the general results a fair indication of the current alignment to the Paris Agreement principles.

CURRENT EXPOSURE OF THE LIECHTENSTEIN FINANCIAL MARKET TO CLIMARE-RELEVANT SECTORS AND TECHNOLOGIES

The extraction and burning of fossil fuels (oil, natural gas, coal) is the primary cause of anthropogenic climate change, while also covering around 80% of global primary energy demand. While oil is primarily used for transportation, both coal and gas are primarily used for electricity and heating. Around 3-4% of the listed equity and 5-7% of corporate bonds portfolios of participating Liechtenstein financial institutions is invested in the direct extraction of oil and gas as well as coal mining.

The exposure to upstream fossil fuel operations is noticeably higher for pension funds and insurance companies, both in the listed equity as well as the corporate bond portfolios. However, as shown in the figure below, the exposures are lower than the ones of the global equity and bonds market in these sectors. Compared to the Swiss results, the listed equities exposure is roughly the

same (around 2-4%), but Liechtenstein participants have notably more exposure to coal, oil and gas through their corporate bond investments (5-7% in Liechtenstein compared to 3-5% in Switzerland).

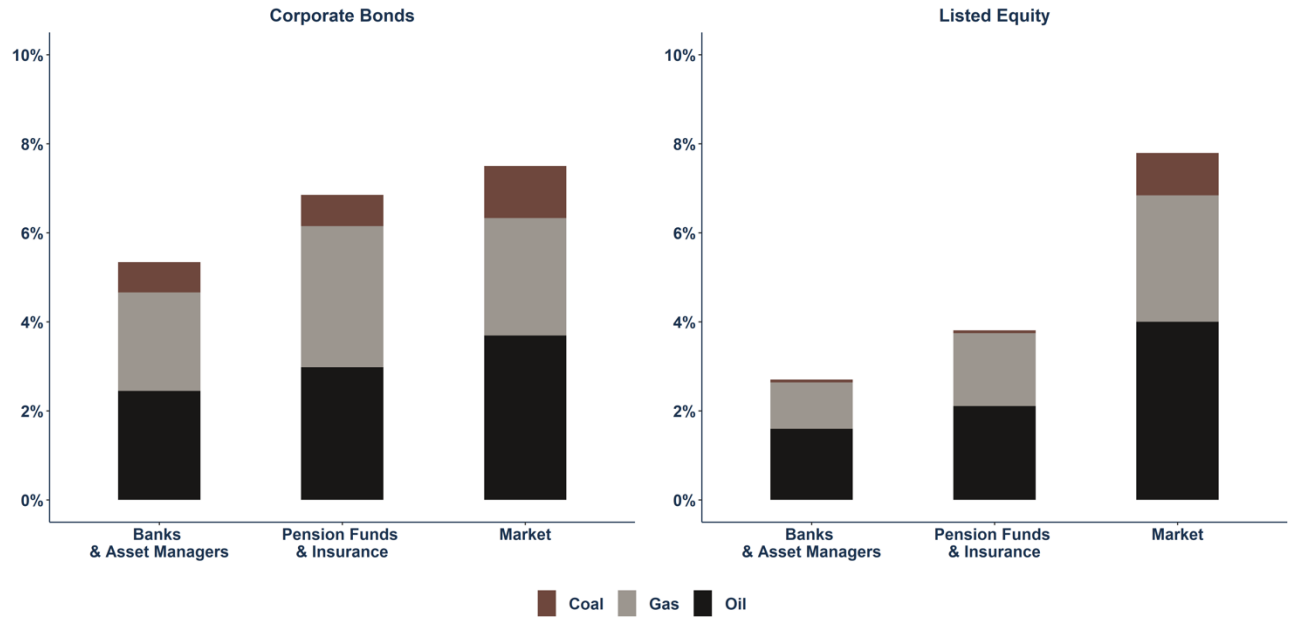


Figure 1: Exposure to coal mining, oil and gas extraction, as percent of total portfolio value

The power sector is at the center of the low-carbon transition and accounted for 42% of energy-related CO_2 emissions in 2018. 2-6% of the aggregate Liechtenstein portfolios are exposed to the power sector. In the Banks & Asset Managers peer group the aggregated exposure to high-carbon power capacity is around two and a half times as high as the share invested in renewable capacity in their corporate bonds' portfolios, however, in listed equities portfolios, the exposure is balanced between high-carbon and renewables power capacity. Pension Funds & Insurers are exposed three times more in high-carbon technologies than in renewables in corporate bonds and two times more in their listed equities portfolios. In terms of technology mix, Liechtenstein financial institutions are better positioned than the market.[1]

In this analysis, onshore wind, bioenergy, solar PV, solar CSP, offshore wind, geothermal and ocean tidal are categorized as renewable and low-carbon sources of electricity generation, while coal, gas and oil are classified as high-carbon sources, with hydro-power and nuclear energy treated separately due to their low CO_2 emissions, but partly high non-climate environmental impact.

The charts below show the exposure of the aggregate portfolios to the power sector. From the corporate bonds' perspective, pension funds and insurance companies are noticeably more exposed to nuclear power than banks and asset managers as well as the market. Hydro power

[1] In a previous version of this report, it read "*2-8% of the aggregate Liechtenstein portfolios are exposed to the power sector, whereby the share invested in high-carbon power capacity is still, on average, four times as high as the share invested in renewable capacity*". The previous information was inaccurate and was therefore replaced by the new figures.

exposure is higher than the market for both banks and asset managers and pension funds and insurers. In listed equities, pension funds & insurance companies are highly exposed to hydro power. This is consistent with portfolios submitted by Swiss pension funds that also showed a large share of hydro power, mainly located in Switzerland. On the other hand, banks and asset managers have an exposure to renewables in their listed equities portfolios that is considerably higher than the exposure of the Global Equity Market.

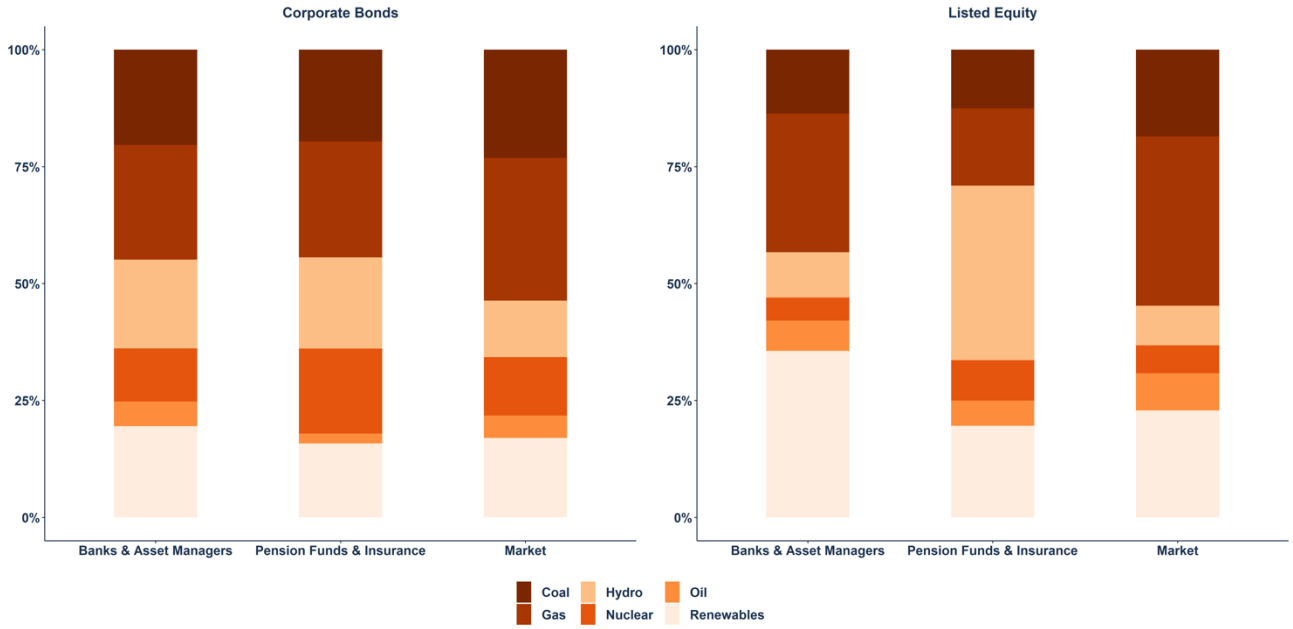


Figure 2: Technology mix of investments in the power sector by peer group, calculated using the ownership weight approach for listed equity and the portfolio weight approach for corporate bonds

FORWARD-LOOKING ALIGNMENT OF THE LIECHTENSTEIN FINANCIAL SECTOR WITH 2ºC CLIMATE SCENARIOS ACROSS KEY CLIMATE-RELEVANT SECTORS AND ASSET CLASSES

Climate scenarios in line with the Paris Agreement require steep reduction in oil extraction and coal mining. Neither Liechtenstein's banks and asset managers nor pension funds and insurance institutions are set to meet the required reductions on aggregate.

With regard to coal mining, companies that Liechtenstein's financial institutions are invested in are set to increase their production in the coming 5 years. This is the case both for listed equity as well as corporate bonds portfolios. In the case of the aggregate corporate bond portfolios analyzed, the forward production is in line with the production also invested in by the global bonds market. However, the aggregate equity portfolios show a significant deviation from the global equity market.

In both asset classes, the aggregate portfolios steer the economy towards a world in which no further climate action is implemented, which is the Current Policies Scenario (CPS) and that corresponds to a temperature increase of around 3ºC.

Exposures to oil production in corporate bonds shows more modest increases, though results are above the market benchmark. Pension funds and insurers' exposures to oil production in listed

equities are set to increase significantly, but asset managers and banks' exposures to oil production in listed equities portfolio will actually move towards a sustainable development path by from 2023 onwards.

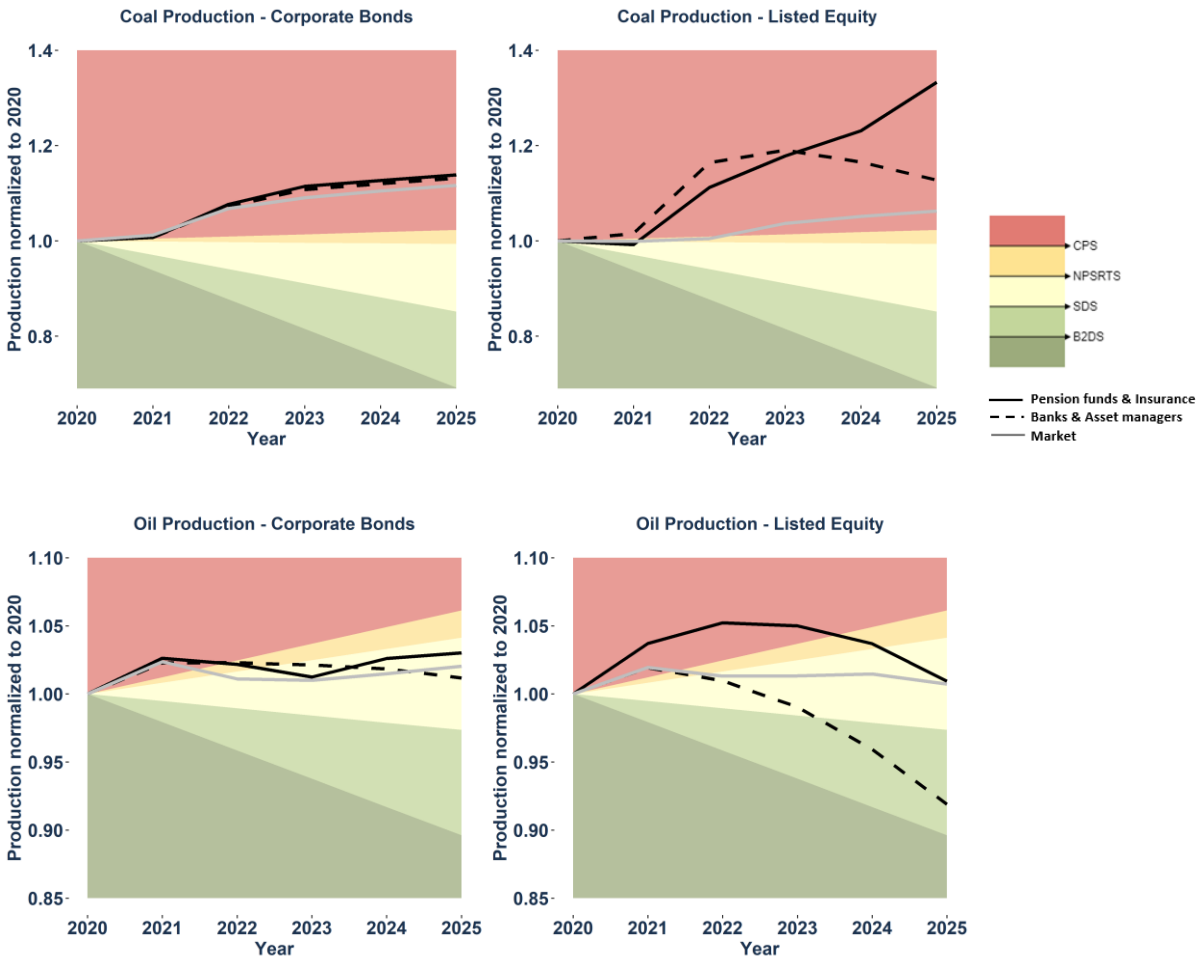


Figure 3: Production plans in coal mining and oil extraction, compared to the build-out required under different climate scenarios

The exposures to gas production are better aligned in both corporate bonds and equity portfolios, driven in part by the more generous treatment of that fuel in climate scenarios.

Gas production is set to increase even under a Beyond 2°C scenario in the short-term, a function of the role of gas in the IEA scenarios due its lower carbon intensity compared to oil and coal. This is somewhat controversial, and other scenarios do not allow such a "bridge fuel" function for gas. Given this caveat, almost all individual financial institutions assessed are aligned with the Sustainable Development Scenario with respect to gas production, and the aggregate portfolios are almost all aligned with the Sustainable development Scenario or the Beyond 2°C scenario.

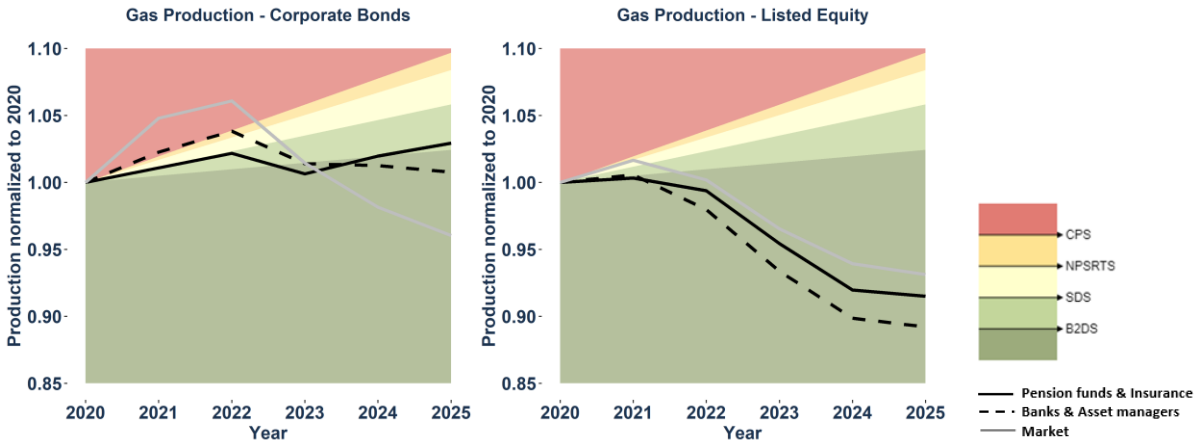


Figure 4: Production plans in gas production, compared to the build-out required under different climate scenarios

Ambitious build-out of renewable energy capacity and retirement of the most carbon intense source of power generation, coal, are necessary to meet the goals of the Paris agreement. The power capacity currently financed by Liechtenstein investors is neither set to increase fast enough in terms of renewables, nor retire fast enough with respect to coal capacity.

Although renewable power capacity is set to increase, based on current production plans, the increase is not fast enough to align with the IEA's sustainable development scenario. Only pension funds and insuranc e companies are financing a build-out of renewables in line with the 2°C scenario in the short-term, but the expansion is not sustained until 2025.

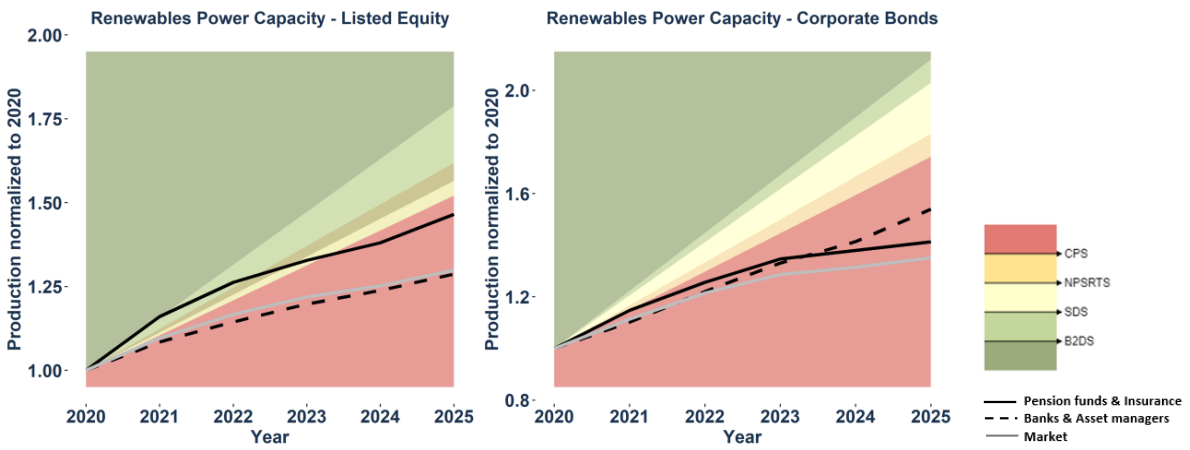


Figure 5: Build-out of renewables power capacity, compared to the build out required under different climate scenarios as well as the Global Market.

Exposure to coal power capacity, a technology that is expected to decrease even under the Current Policies Scenario, is set to stay rather stable or decline modestly in Liechtenstein financial institutions.

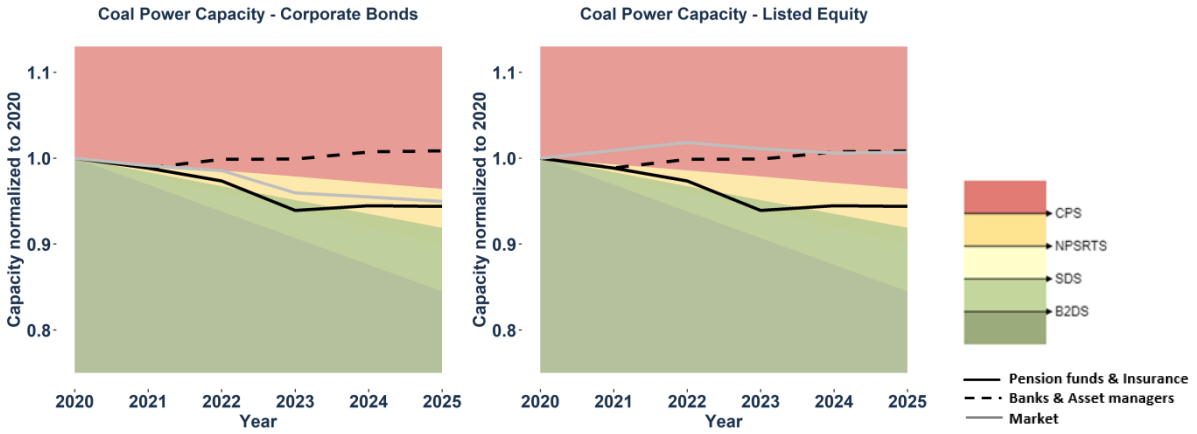


Figure 6: Build-out of coal power capacity, compared to the build out required under different climate scenarios as well as the Global Market.

Considering all climate-relevant sectors analyzed in the test, current investments made by participating organizations are not aligned with either the Beyond 2ºC scenario or the Sustainable Development scenario in coal and oil production, coal power capacity and internal combustion light/heavy-duty vehicles production. However, investments in electric vehicles production sector show a more positive picture, with most of the portfolios aligned with either the Beyond 2ºC scenario or the Sustainable Development Scenario along the forward-looking trajectory.

The tables below summarize the alignment by 2025 of the aggregate portfolios by technology, type of participating institution and asset class (corporate bonds and listed equity).

Table 1: Alignment of corporate bonds portfolios to different climate scenarios

	Fossil Fuels			Power		Automotive		
	Oil	Gas	Coal	Renewables	Coal	ICE-LDV	ICE-HDV	Electric
Pension Funds & Insurance								
Banks & Asset Managers								

Table 2: Alignment of listed equities portfolios to different climate scenarios

	Fossil Fuels			Power		Automotive		
	Oil	Gas	Coal	Renewables	Coal	ICE-LDV	ICE-HDV	Electric
Pension Funds & Insurance								
Banks & Asset Managers								

No Alignment	Current Policies Scenario	New Policies Scenario	Sustainable Development Scenario	Beyond 2ºC Scenario

FINCIAL INSTITUTIONS CLIMATE ACTIONS

Regarding climate strategies, participants most frequently reported engagement as well as coal exclusion policies, exercising voting rights as well as best-in class investing. However, all the financial institutions that reported a coal exclusion policy still had holdings in coal mining or coal power.

88% of survey respondents reported that their organization had a climate related target or aspiration or was in the process of developing one. This compares to 69% percent of respondents in Switzerland who reported a climate strategy. The climate strategies most frequently employed by participants include engagement as well as coal exclusion policies, exercising voting rights as well as best-in class investing.

70% of measures were taken 2019 or later, which means that they might not yet be fully implemented, and perhaps not visible in the quantitative analysis. This also indicates an increased uptake of climate strategies in the last two years.

75% of participants reported to be member in at least one sustainable finance organization. The most frequently cited organizations are Swiss Sustainable Finance (SSF) and UN Principles for Responsible Investment.

Only 10% of financial institutions reported to measure the impact of the actions taken, although two participants mentioned impact reporting conducted by the asset manager.

AREAS FOR IMPROVEMENT

The PACTA 2020 analysis demonstrates growing awareness of climate change in the Liechtenstein financial sector. However, there is need for improvement to ensure that overarching ambition translates more effectively into concrete real-world emission reductions.

According to the results of the qualitative survey, most of participants claimed to have a climate strategy in place, but high exposure to carbon intensive sectors and misalignment with Beyond 2°C or the Sustainable Development scenarios remains prevalent. Moreover, 90% of financial institutions reported not to measure the impact of the actions taken and 85% of actions implemented were not coordinated with other institutions.

The mechanisms in place for institutions to measure impact of financial institution's climate actions are still insufficient.

More research is needed to measure the impact of climate actions in terms of real-world greenhouse gas (GHG) emissions reductions. Anecdotal evidence based on the survey suggests that mechanisms in place to track "real world impact" are still quite rudimentary. This is not a criticism of the approach of financial institutions themselves, but rather a broader comment on the challenges of tracking real world impact of actions taken in the financial sector.

Pension funds and insurance companies have a key role in greening the financial system, but members of this group in Liechtenstein that participated in the test hold a relatively high

exposure to fossil fuels and, at the same time, their investment's production plans in renewables are not set to meet a sustainable development scenario.

These exposures are also not aligned from a forward-looking perspective with the Beyond 2°C or the Sustainable Development scenarios for either coal or renewables technologies. According to the International Renewable Energy Agency, institutional investors (which includes pension funds and insurance companies) manage around USD 87 trillion in assets worldwide.[2] Given their size, these investors have a key role to play in channeling additional capital into new renewable projects, either directly or indirectly, but also, more importantly, in re-financing already operating renewable energy assets to free up capital for new investments.

[2] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_CPI_Global_finance_2020.pdf

I. Introduction

The PACTA 2020 climate compatibility test in Liechtenstein aims to determine the extent to which the national financial sector is aligned with the Paris Agreement goals, building on a successful pilot test in 2017 in Switzerland.

Article 2.1(c) of the 2015 Paris Agreement created the political mandate to ensure the consistency of financial flows with the goal to limit the increase of global mean temperature to well below 2°C.

The Liechtenstein government laid out its sustainability goals for the sector in the Financial Center Strategy of 2019: "The creation of transparency about whether and how investment products meet sustainability criteria will become the standard in the medium term. As a clear differentiating feature, the Liechtenstein financial center strives to establish responsible, sustainable action as part of its culture already today."

The assessment and reduction of emissions from investments via financial assets is also one of the goals of the Climate Vision 2050, which was presented in October 2020. The overarching objective is to achieve net zero domestic GHG emissions by 2050. As a next step, the government plans to develop a long-term climate strategy, which is intended to lay out the pathway for achieving climate neutrality in Liechtenstein.

PACTA 2020 is being implemented in a number of European countries such as Austria, Luxembourg, Norway, Sweden, and Switzerland, as well as through the Swiss/Dutch initiative on aligning financial flows with the Paris Agreement. In March 2020, the Liechtenstein government decided to join this internationally coordinated test and recommended the participation to financial center actors.

In March 2020, the Liechtenstein Parliament sent a postulate[3] to the government calling for an assessment of the climate compatibility of government and quasi-government financial assets. In November 2020, in the report responding to the postulate[4], the government summarized the international developments in the field of sustainable finance and presented the PACTA model.

Regarding sustainable finance regulations, it is important to note that Liechtenstein is part of the European Economic Area (EEA) and therefore directly affected by EU's financial market legislative measures. The measures in the field of sustainable finance will provide higher transparency and better information for clients in the financial market regarding the sustainability of financial investments and will be instrumental in achieving the objectives of the Paris Agreement.

The climate compatibility test 2020 is conducted in the context of a number of initiatives from governments, the private sector, and NGOs:

- A growing number of EU and international initiatives, notably the implementation of the EU Sustainable Finance Action Plan and EU Taxonomy

[3] https://www.landtag.li/files/attachments/Postulat--Klimatest-fuer-die-staatlichen-und-staatsnahen-Anlagen.pdf
[4] https://bua.regierung.li/BuA/pdfshow.aspx?nr=104&year=2020

- The formation of the Network for Greening the Financial System (NGFS) and private sector initiatives (Katowice Commitment, Climate Action 100+, Collective Commitment on Climate Action, Net Zero Asset Owner Alliance, etc.)
- These exercises have been complemented by new analytical solutions and breakthroughs in terms of understanding climate issues in financial markets, notably the improvements around asset-level data, modelling advances related to climate stress-tests, and the development of "Inevitable Policy Response" (IPR) scenarios as a complement to traditional approaches.[5]

The past few years have also seen an increase of climate-related disclosure and measurement of portfolio alignment across the financial sector.

- The uptake of PACTA (and other metrics and methodologies to assess the climate compatibility of financial instruments), as well as climate disclosures in line with TCFD recommendations, indicate that there are a growing number of financial institutions that are starting to assess their alignment and risk with regards to climate change. This is a positive sign, as it can represent a first step towards the integration of climate consideration into financial decision making ("you manage what you measure").[6]
- As the PACTA 2020 test is implemented in different European countries, lessons learned will be shared and fed into the international debate on measuring climate alignment and monitoring progress.

Despite the momentum on sustainable finance and early evidence of actions, the broader trends on climate change over the past few years have arguably not matched the ambition of the 2015 Paris Agreement.

Up until 2020, greenhouse gas emissions have increased every year, moving us further away from the possibility of reaching the Paris climate goal to limit global mean temperature increase well below 2°C.[7] Moreover, advances in climate science suggests that 'benign' climate outcomes seem increasingly unlikely and significant impact can already be expected at a global mean temperature increase of 1.5°C.[8]

The global COVID-19 pandemic and the policy response measures have now caused a drop in GHG emissions in the first half of 2020. However, this abrupt shock has affected the most vulnerable countries and people most severely, and the effect is likely to rebound when economic activity restarts. While every crisis represents an opportunity for economic transformation, there is also a risk that public and private climate action budgets may be negatively affected.

[5] https://www.vivideconomics.com/casestudy/the-inevitable-policy-response/
[6] https://www.tandfonline.com/doi/full/10.1080/20430795.2019.1673142?scroll=top&needAccess=true
[7] https://www.unenvironment.org/resources/emissions-gap-report-2019
[8] IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways

While the financial sector appears as a key mechanism for achieving climate goals – which is also recognized in the Paris Agreement – the challenges of "decarbonizing finance" remain significant:

Disclosure and awareness within the financial sector are important first steps, but do not necessarily lead to better risk management or positive climate impact. In particular, the concept of "impact vs. exposure" was and is a critical point in the discussion about the contribution of the financial sector to the Paris Agreement and the way forward in terms of regulatory action and voluntary initiatives.

While from a government perspective, the overarching goal of *aligning* the financial sector with the Paris goals is important, the alignment of individual financial portfolios only represents one step in the journey. For example, if one financial institution ceases to invest in a coal power plant, this does not necessarily mean that it stops operating – emissions may have just been transferred across financial portfolios or even asset classes. These issues cannot be ignored when considering the real-world impact of climate actions of financial institutions and the definition of climate-related targets, especially those that should meet the threshold of being "science-based."

There is still a lack of evidence and frameworks around the concept of financial sector' climate impact. This limits progress in the transition from measuring alignment to measuring impact.

ALIGNMENT AND IMPACT

Over the past years, awareness has grown that aligning a portfolio with climate goals does not equate to impact, i.e., real-world emissions reductions. Lower emissions in a portfolio may be a function of drivers entirely independent of the investment decision of the portfolio manager such as changes in the company's production plans that occurred without the investor's involvement, company acquisitions or regulatory drivers.

Therefore, it is necessary to move beyond purely measuring alignment towards a better understanding of how investors can have impact in the real economy. Kölbel et al. (2020)[9] give the following definition of investor impact: the impact of an investor ("investor impact") is defined as the *change* that the investor has *caused* in the activities of the company benefiting from his investment.

There are a number of avenues outlined in the paper by which to achieve investor impact: In private markets, there is the possibility of enabling growth by increasing undersupplied markets, providing non-financial support or flexible capital. These avenues of impact are supported by empirical evidence. In public markets, investor impact is either based on encouraging improvement through shareholder engagement or market signals, or through non-market signals that impact matters. Especially for the latter two, the impact of this strategy is very difficult to evaluate.

[9] https://journals.sagepub.com/doi/10.1177/1086026620919202

More academic research is needed to establish the link between climate actions in financial markets and real-world emissions reduction. New initiatives from the University of Zurich, Oxford, and 2° Investing Initiative among others are increasingly looking into this issue.

II. Methodology and Data Sources

Overview of the PACTA Methodology

The Paris Agreement 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 2DII[10] as well as the PACTA Knowledge Hub.[11]

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 CO_2-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?*

[10] Further details can be found on www.transitionmonitor.org.

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

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

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.[12]
Allocating macroeconomic goals to microeconomic actors	The PACTA analysis uses a *market-share approach* 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 percent of outstanding shares owned by the investor. This

[12] https://sciencebasedtargets.org/

	approach comes closer to allocating "responsibility" for the companies' activities to the financial institution. This approach is used for listed equity portfolios.

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

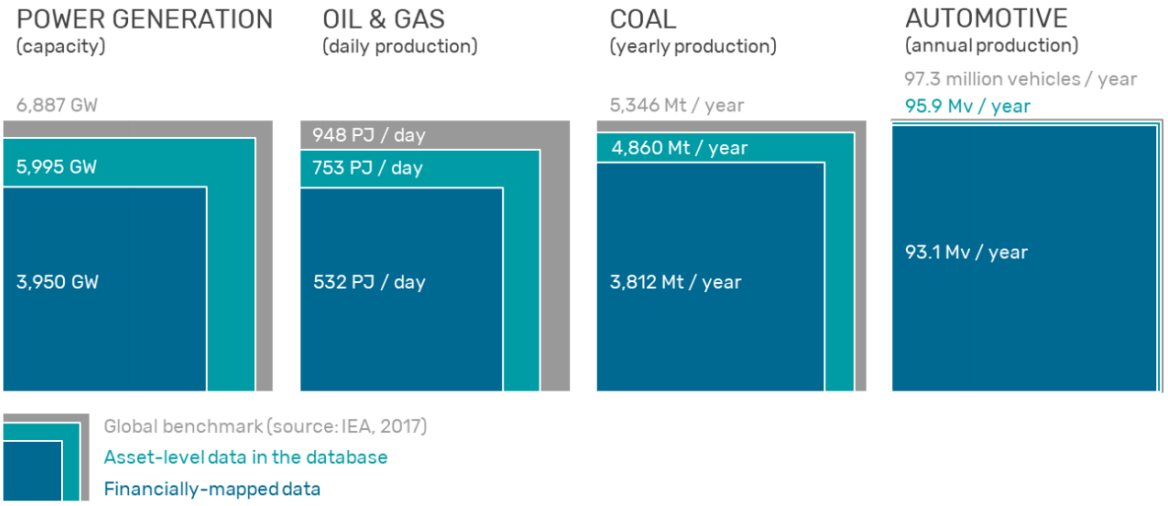


Figure 7: Coverage of the data sources in different sectors.

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.[13]

BOX: CLIMATE SCENARIOS

Stabilizing the global mean temperature increase to 2°C with some probability requires total anthropogenic CO_2 emissions to stay within a certain budget, estimated at around 1000 Gt CO_2 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 CO_2 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.

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

[13] https://www.transitionmonitor.com/pacta-for-banks-2020/

integrate models of the climate, economic, land-use and energy system and therefore are able to capture interactions between these systems.
This report 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.

The following climate scenarios are used in this report: More details on each individual scenario can be found in the annex.[14]

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

Limitations of the Analysis

There are a number of limitations to the PACTA climate scenario analysis for equity and corporate bonds conducted in this report. The first relates to the data received from financial institutions. Financial institutions are not obliged to upload their entire portfolios; therefore, this analysis does not necessarily cover all their climate relevant holdings.

The second 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. 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, which represent an important way for financial institutions to help bring new solutions to the market.

The third 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

[14] The annex is published in a separate document, available on the 2DII website.

ownership structure of a companies. Furthermore, planned production plans do not necessarily materialize and production forecasts should be interpreted baring this in mind.

A fourth limitation regards the current state of funds coverage in the PACTA analysis. Whenever institutions report funds in their portfolios those are converted in equities and bonds assigned to that fund ISIN. To complete this conversion, we count with external sources of data containing information on funds and their compositions. The PACTA team faced difficulties during the evaluation of Funds in Funds. While this issue will be solved soon and available to individual institutions, in this meta-analysis we estimate that around 10% of the value invested in funds is not covered.

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.

III. Participation and Coverage of the Analysis

Overview

14 financial institutions participated in the 2020 climate compatibility test. The participants include 5 pension funds, 1 insurance company, 2 banks, 5 asset managers and 1 institution classified as other.[15]

More than 77 thousand distinct ISINs were assessed in the analysis. The graph below shows that more than 90% were mapped to asset level data and, therefore, analyzed.

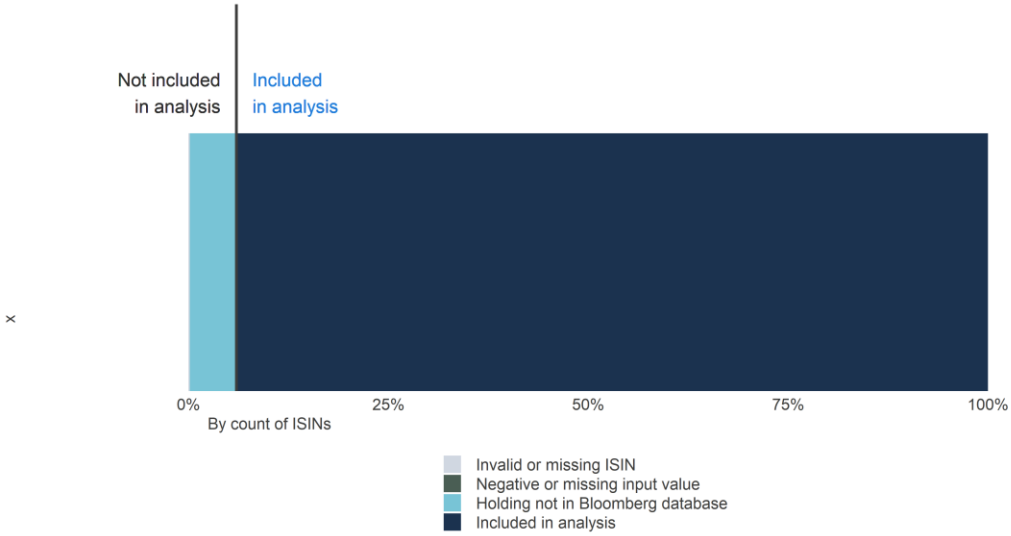


Figure 8: Coverage by number of holdings submitted by participants

In terms of amount, a total of USD 56 billion in holdings were submitted[16], from which USD 37.9 billion (68%) could be included in the analysis.

Climate scenario analysis of listed equity and corporate bonds portfolios

In order to ensure the anonymity of individual institutions, the results were grouped by 'Banks & Asset Managers' and 'Pension Funds & Insurance'. Two institutions are out of the analysis and their assets are not considered in the figures below.[17] It is important to notice that the sample is small given the total number of financial institutions in Liechtenstein, which means that the peers group are not necessarily representative for individual sectors. However, the peer groups comprise leading institutions in their sectors, making the results a good indication of alignment, nonetheless.

Taking into account the exclusion of institutions classified as "Others" and invalid inputs, a total amount of USD 33.6 billion in assets were included in the analysis. A total of USD 4.0 billion was

[15] Landeskasse is classified as "Other"
[16] Value achieved by converting assets to USD and excluding negative/missing values reported.
[17] AHV and Landeskasse

identified as climate relevant using the PACTA methodology, from which USD 2.1 billion allocated in corporate bonds and USD 1.8 billion allocated in equity holdings.

Sectors covered in the analysis represent around 75% of global CO_2 emissions and around 10-30% of the portfolio exposure of Liechtenstein's financial institutions.

The exposure to climate relevant sectors is higher for the corporate bonds than for the listed equity portfolios submitted. For pension funds and insurance, the exposure to climate relevant sectors ranges between 20-30% of total value allocated in each asset class, while the exposure of banks and asset managers ranges between 10-20%. This percentage is calculated as the share of those holdings in the portfolios that the analysis was able to map to a sector. This is slightly different from the exposure calculated in the analysis that shows the weight of holdings in specific sectors as percent of the total portfolio value.

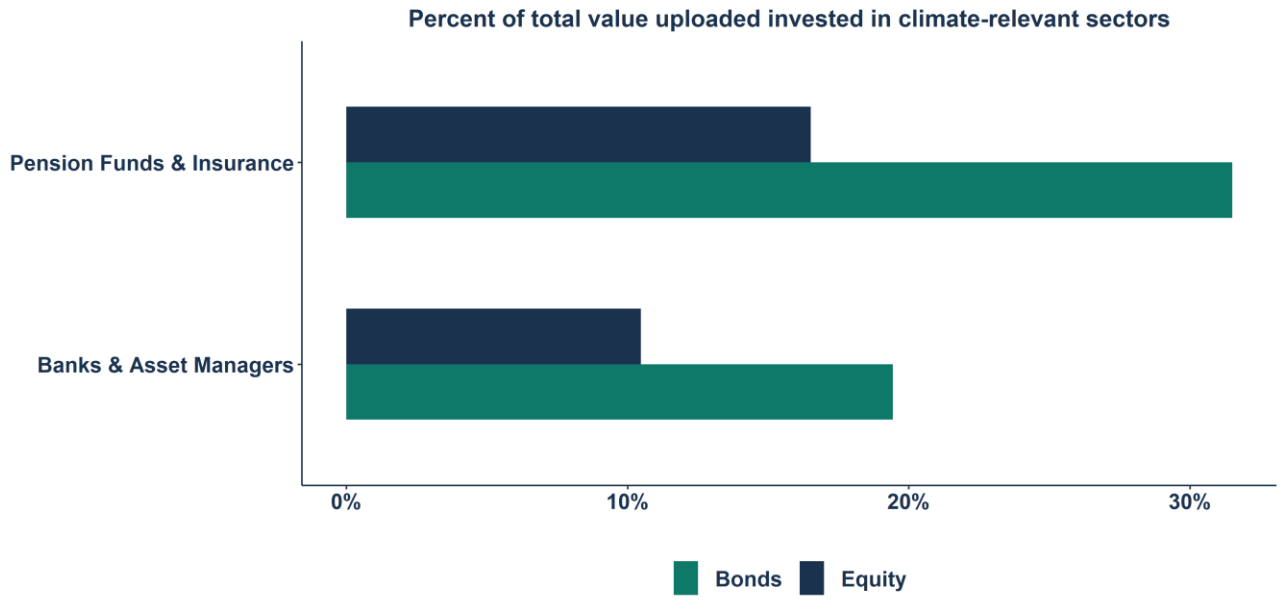


Figure 9: Percent of aggregate portfolio invested in climate-relevant sectors

Group	Asset class	Total submitted (USD million)	Total climate relevant sectors (USD million)
Pension Funds & Insurance	Listed Equity	594	98
	Corporate Bonds	153	48
Banks & Asset Managers	Listed Equity	16,039	1,680
	Corporate Bonds	10,662	2,072
Overall	Listed Equity	16,633	1,778
	Corporate Bonds	10,816	2,120

Within climate relevant sectors, oil & gas, coal, power, and automotive dominate the overall picture, representing around three-quarters of portfolio value across these sectors in equity portfolios, and around six-sevenths in bond portfolios (see figures 10 and 11).

Compared to the results for Swiss investors, the sector share of fossil fuel extraction and coal mining is slightly higher, whereas the share of exposure to the power sector is slightly lower.

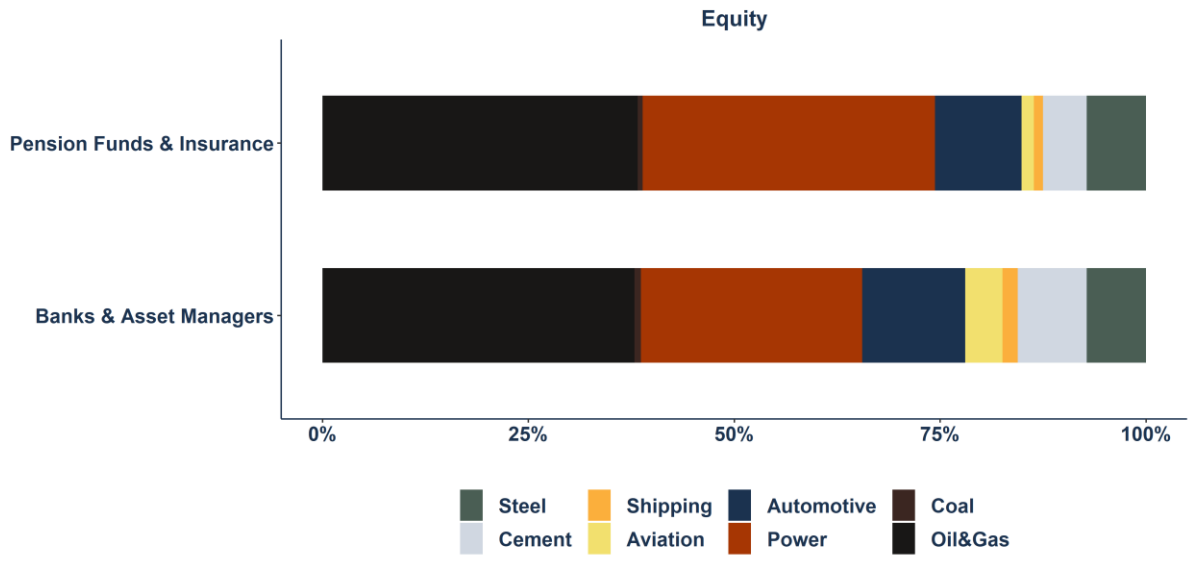


Figure 10: Listed Equity holdings in climate relevant sectors

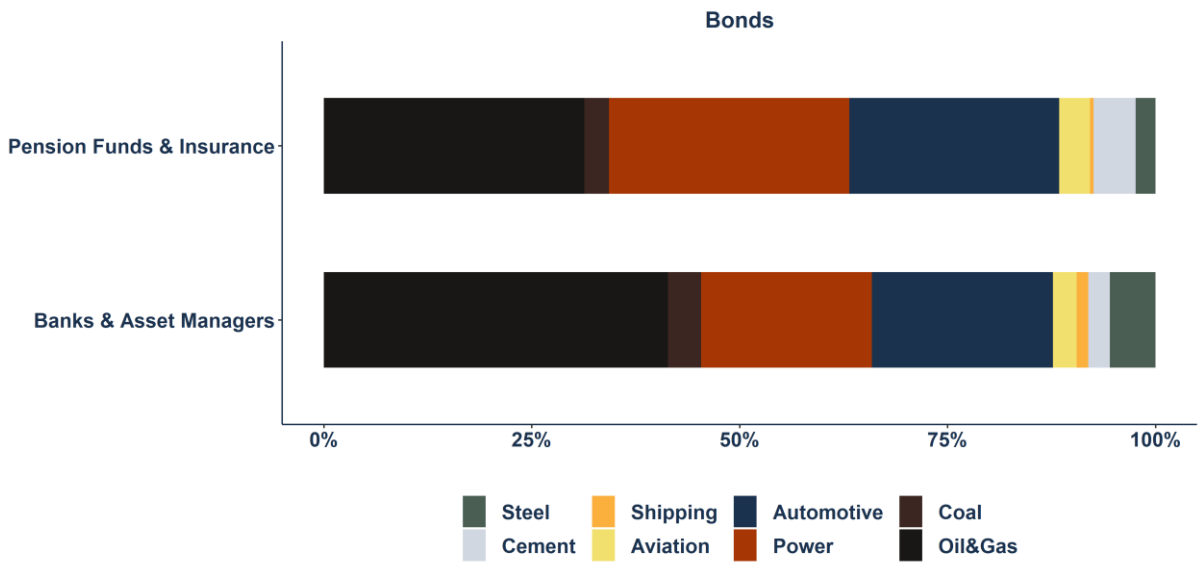


Figure 11: Corporate Bonds holdings in climate relevant sectors

IV. Climate Scenario Analysis

Fossil Fuels

The extraction and burning of fossil fuels (oil, natural gas, coal) is the primary cause of anthropogenic climate change, while also covering around 80% of global primary energy demand. While oil is primarily used for transportation, both coal and gas are primarily used for electricity and heating.

Around 3-4% of the listed equity and 5-7% of corporate bonds portfolios of Liechtenstein financial institutions is invested in the direct extraction of oil and gas as well as coal mining. Compared to the Swiss results, the listed equities exposure is roughly the same (around 2-4%), but the Liechtenstein financial sector has notably more exposure to coal, oil and gas through their corporate bond investments (5-7% in Liechtenstein compared to 3-5% in Switzerland). However, the exposure of Liechtenstein's financial institutions is still lower than the exposure of the global equity and bonds market to this sector.

The figure below shows the exposure to upstream operations in the fossil fuel sector (oil and gas extraction, coal mining) as percent of the total portfolio invested by type of financial institutions, as well as in relation to the global equity and bond market respectively.

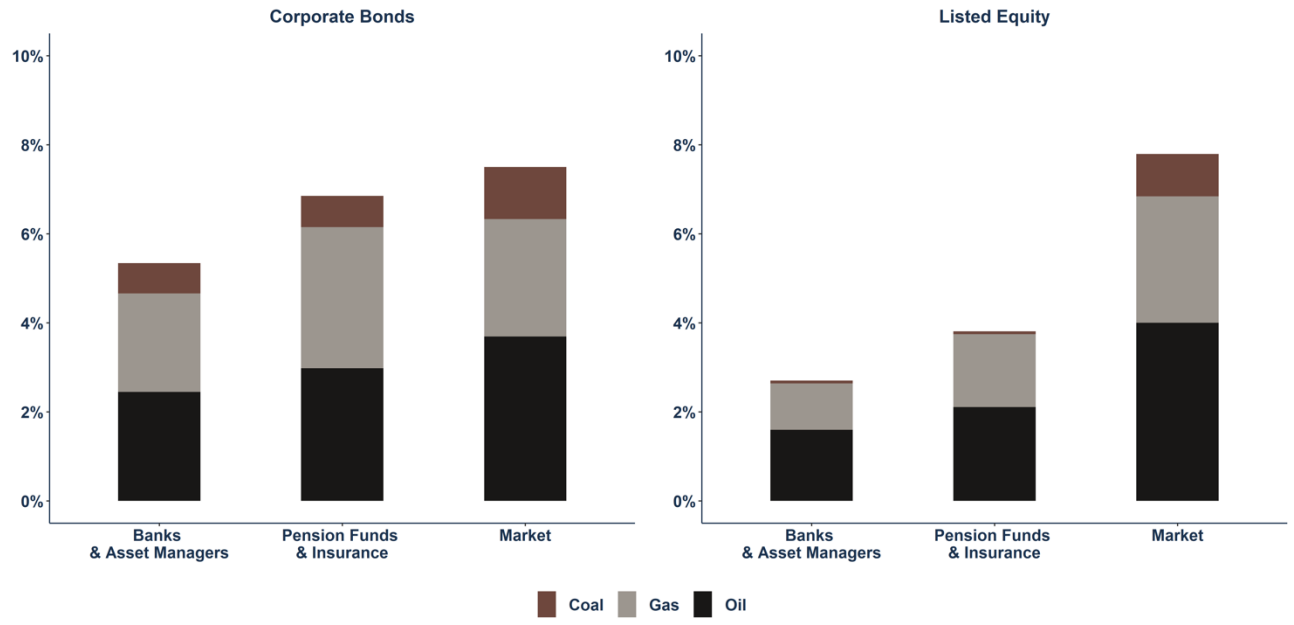


Figure 12: Exposure to coal mining, oil and gas extraction, as percent of total portfolio value

The exposure to upstream fossil fuel operations is noticeably higher for pension funds and insurance companies, both in the listed equity as well as the corporate bond portfolios.

These figures are higher than in Switzerland – the aggregate portfolios of Swiss pension funds and insurance companies did not show exposures higher than 4% of total investments for either corporate bonds or listed equities. However, it is important to consider that the small sample of portfolios submitted by Liechtenstein pension funds and insurance companies may bias a definitive conclusion about the exposure of such institutions to fossil fuels in the sector.

Figure 13 shows the exposure of individual portfolios submitted to operations in the fossil fuel sector. In line with the aggregate findings shown in figure 12, corporate bonds portfolios are more exposed to fossil fuels than listed equities. The average exposure of corporate bonds portfolios submitted is 2.5% while in listed equities portfolios the average portfolio exposure is 1.6%. Individual portfolios submitted by participating banks and asset managers are leading in terms of exposure to the sector.

44% of participants submitted listed equity portfolios that have less than 1% exposure to fossil fuel extraction (17% of participants for corporate bonds). Only 4 corporate bonds portfolios presented value higher than 5% exposed to fossil fuel extraction and coal mining; for listed equity, this number drops to 2 portfolios, from which one is 11% exposed.

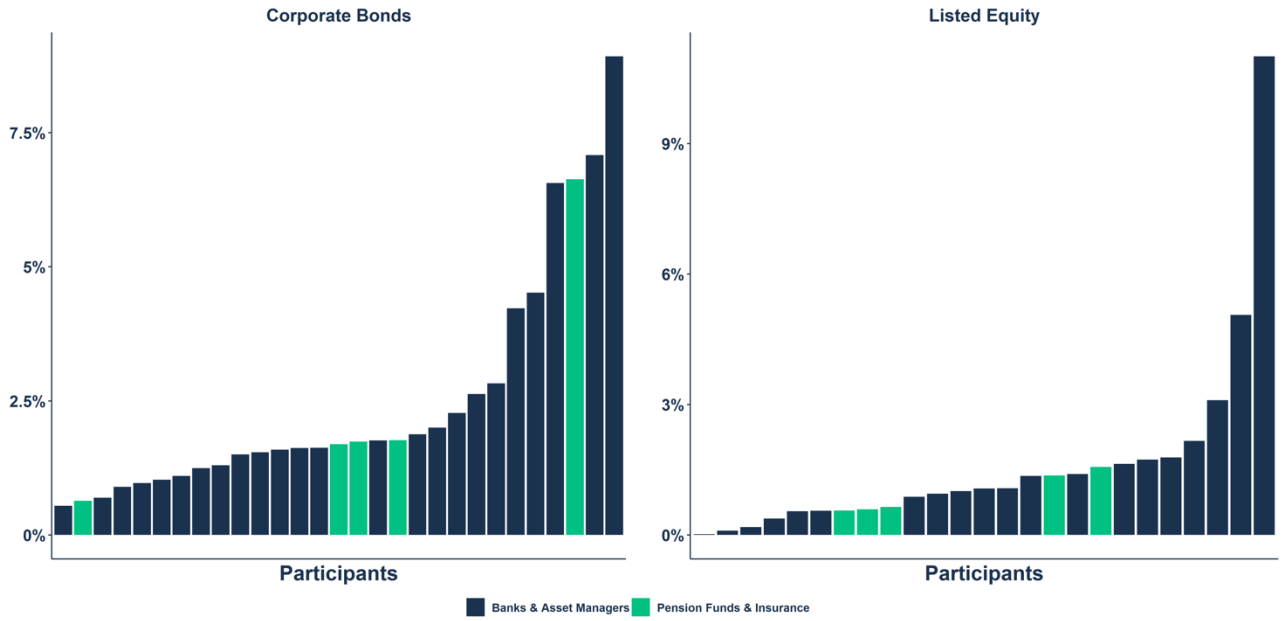


Figure 13: Share of holdings in Fossil Fuel sector as percent of total portfolio value

Climate scenarios in line with the Paris Agreement require steep reduction in oil extraction and coal mining. Neither Liechtenstein's banks and asset managers nor pension funds and insurance institutions are set to meet the required reductions on aggregate.

With regards to coal mining, companies that Liechtenstein's financial institutions are invested in are set to increase their production in the coming 5 years. This is the case both for listed equity as well as corporate bonds portfolios. In the case of the aggregate corporate bond portfolios analyzed, the forward production is in line with the production also invested in by the global bonds market. However, the aggregate equity portfolios show a significant deviation from the global equity market.

In both asset classes, the aggregate portfolios steer the economy towards a world in which no further climate action is implemented, which is the Current Policies Scenario (CPS) and that corresponds to a temperature increase of around 3°C.

Exposures to oil production in corporate bonds shows more modest increases, though results are above the market benchmark. Pension funds and insurers' exposures to oil production in listed equities are set to increase significantly, but asset managers and banks' exposures to oil production in listed equities portfolio will actually move towards a sustainable development path by from 2023 onwards.

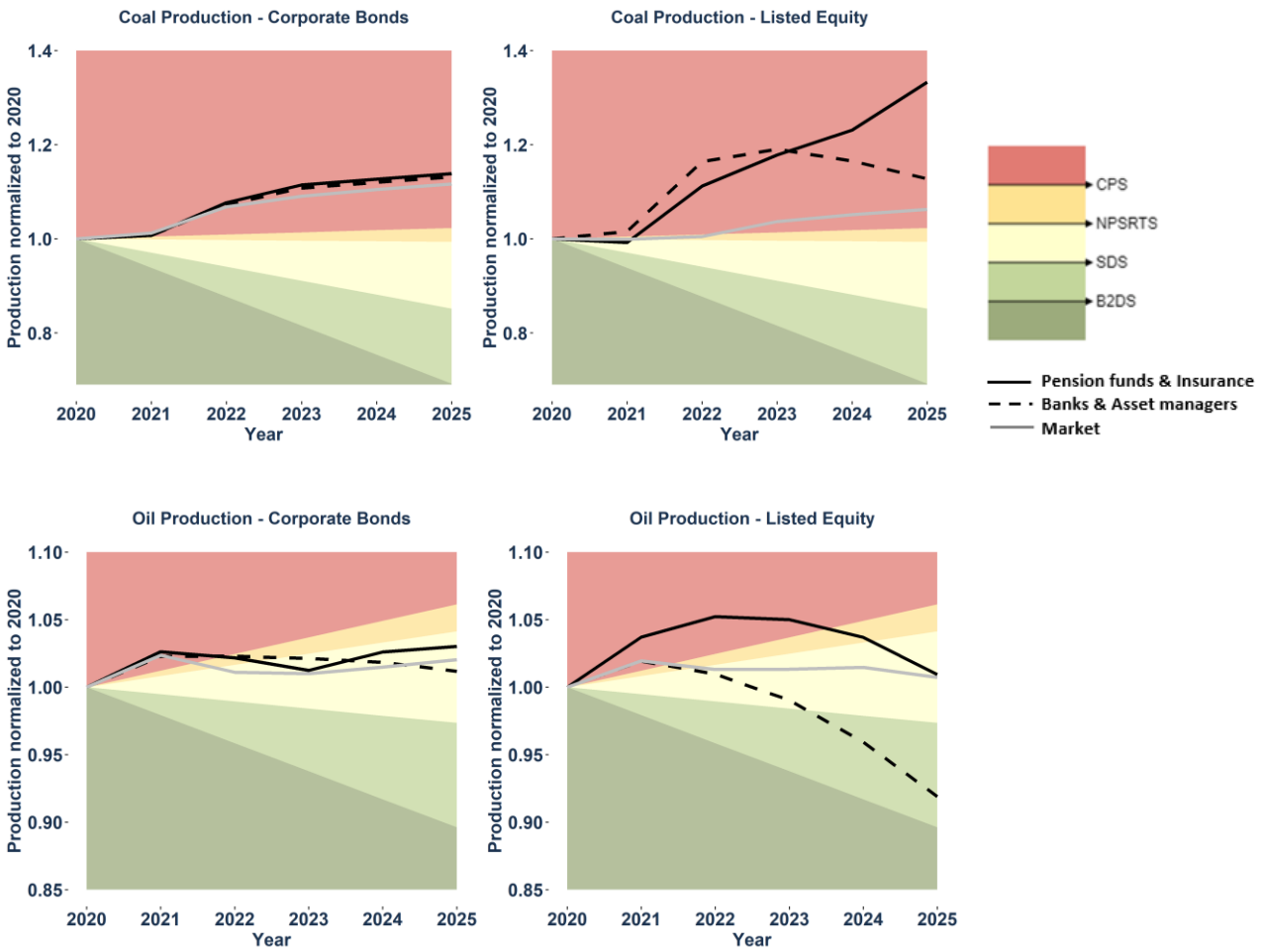


Figure 14: Production plans in coal mining and oil extraction, compared to the build-out required under different climate scenarios

Looking at the results for the individual portfolios, only 2 (out of 25 analyzed) listed equity portfolios are aligned with the sustainable development scenario for coal production by 2025, while 31

portfolios (out of 52 analyzed) allocated in oil & gas are aligned. In corporate bonds, no portfolio is aligned for coal production, and 29 portfolios (out of 58 analyzed) are aligned with the sustainable development scenario for oil & gas production by 2025.

The exposures to gas production are better aligned in both corporate bonds and equity portfolios, driven in part by the more generous treatment of that fuel in climate scenarios.

Gas production is set to increase even under a Beyond 2°C scenario in the short-term, a function of the role of gas in the IEA scenarios due its lower carbon intensity compared to oil and coal. This is somewhat controversial, and other scenarios do not allow such a "bridge fuel" function for gas. Given this caveat, almost all individual financial institutions assessed are aligned with the Sustainable Development Scenario with respect to gas production, and the aggregate portfolios are almost all aligned with the Beyond 2°C scenario.

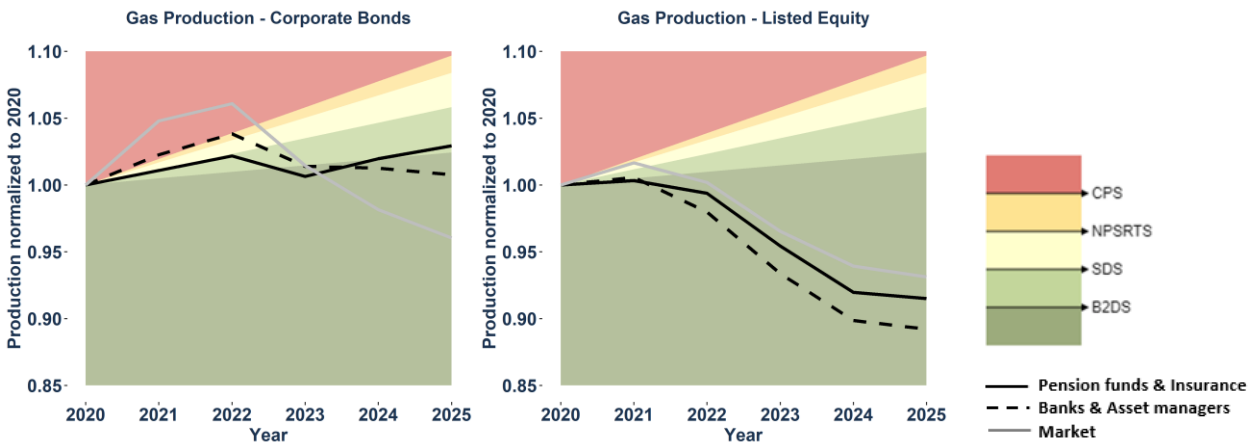


Figure 15: Production plans in gas production, compared to the build-out required under different climate scenarios

The COVID-19 pandemic has presented a major disruption to the energy system, with energy demand expected to drop by 5% in 2020 compared to 2019, and capital investments expected to decrease by 18%, most notably in oil and natural gas extraction.

This drop in investment is driven by weakened corporate balance sheets as well as a high degree of uncertainty regarding the evolution of future demand. Oil demand was heavily impacted by lockdown measures affecting road transport and aviation which together account for 60% of global oil use. Coal use is expected to fall by 7% in 2020 as it was in many regions the first power source to be scaled back. Given this dynamic, it is possible that some of the investment in the industry along the years is already being scaled back at time of publication.

A key question regarding climate strategies of financial institutions in the fossil fuel sector relates to the role today's oil and gas companies will take in a low-carbon energy transition.

No oil and gas company will be unaffected by the energy transition and there will be different strategies companies can take to respond to this. Although commitments to reduce emissions or emission intensities have become more common, current investments in low carbon business

activities (such as switching to renewable power production) do not represent more than 5% of investment of any single major oil and gas company.

Power

The power sector is at the center of the low-carbon transition and accounted for 42% of energy-related CO_2 emissions in 2018. 2-6% of the aggregate Liechtenstein portfolios are exposed to the power sector. In the Banks & Asset Managers peer group the aggregated exposure to high-carbon power capacity is around two and a half times as high as the share invested in renewable capacity in their corporate bonds' portfolios, however, in listed equities portfolios, the exposure is balanced between high-carbon and renewables power capacity. Pension Funds & Insurers are exposed three times more in high-carbon technologies than in renewables in corporate bonds and two times more in their listed equities portfolios. In terms of technology mix, Liechtenstein financial institutions are better positioned than the market.[18]

The costs of renewables have been declining sharply over the past years. According to recent analysis by the Carbon Tracker Initiative, renewable electricity is now the cheapest source of new baseload for 85% of the world and new investments in renewables are cheaper than new investments in coal in all major markets today. This was confirmed in the World Energy Outlook published by the IEA in October 2020. In addition, renewable energy has so far been the energy source most resilient to COVID-19 lockdown measures.[19]

Next to the importance of decarbonization in this sector due to the currently high emissions, the sector is also essential for the decarbonization of other sectors such as transport, industry and buildings that rely on electrification to move away from the use of fossil fuels.

In this analysis, onshore wind, bioenergy, solar PV, solar CSP, offshore wind, geothermal and ocean tidal are categorized as renewable and low-carbon sources of electricity generation, while coal, gas and oil are classified as high-carbon sources, with hydro-power and nuclear energy treated separately due to their low CO_2 emissions, but partly high non-climate environmental impact.

The graph below shows the exposure of the aggregate portfolios for different peer groups, divided by asset type, and compared to the Global Equity and Bonds Market, respectively. The share of high-carbon power capacity (coal, oil, and gas) is three times higher than renewables in corporate bonds when aggregating both peer groups, and one and a half time higher in equities portfolios.[20]

[18] In a previous version of this report, it read "*2-8% of the aggregate Liechtenstein portfolios are exposed to the power sector, whereby the share invested in high-carbon power capacity is still, on average, four times as high as the share invested in renewable capacity*". The previous information was inaccurate and was therefore replaced by the new figures.

[19] https://www.iea.org/reports/global-energy-review-2020/renewables

[20] In a previous version of this report, it read "*The share of high-carbon power capacity (coal, oil, and gas) is around four times as high across all aggregate portfolios*". The previous information was inaccurate and was therefore replaced by the new figures.

Figure 16: Technology mix of investments in the power sector by peer group, calculated using the ownership weight approach for listed equity and the portfolio weight approach for corporate bonds

From the corporate bonds' perspective, pension funds and insurance companies are noticeably more exposed to nuclear power than banks and asset managers as well as the market. Hydro power exposure is higher than the market for both banks and asset managers and pension funds and insurers. In listed equities, pension funds & insurance companies are highly exposed to hydro power. This is consistent with portfolios submitted by Swiss pension funds that also showed a large share of hydro power, mainly located in Switzerland. On the other hand, banks and asset managers have an exposure to renewables in their listed equities portfolios that is considerably higher than the exposure of the Global Equity Market.

Some participants are leading the way with respect to their current exposure to renewable power capacity: particularly across the listed equity portfolios submitted, 12 submitted portfolios have more than 25% of all their power equity investments in renewable power capacity; 3 portfolios have 100% of power equity investments into renewable power. With respect to corporate bonds, only 3 portfolios have exposure to renewables greater than 25%.

The following graph shows the share of renewable power capacity in the total power capacity of participants' total portfolios. The graph illustrates the more general point that while there are a small number of institutions that have allocated their investments towards low-carbon sources, this re-allocation is not yet implemented by mainstream financial institutions in Liechtenstein.

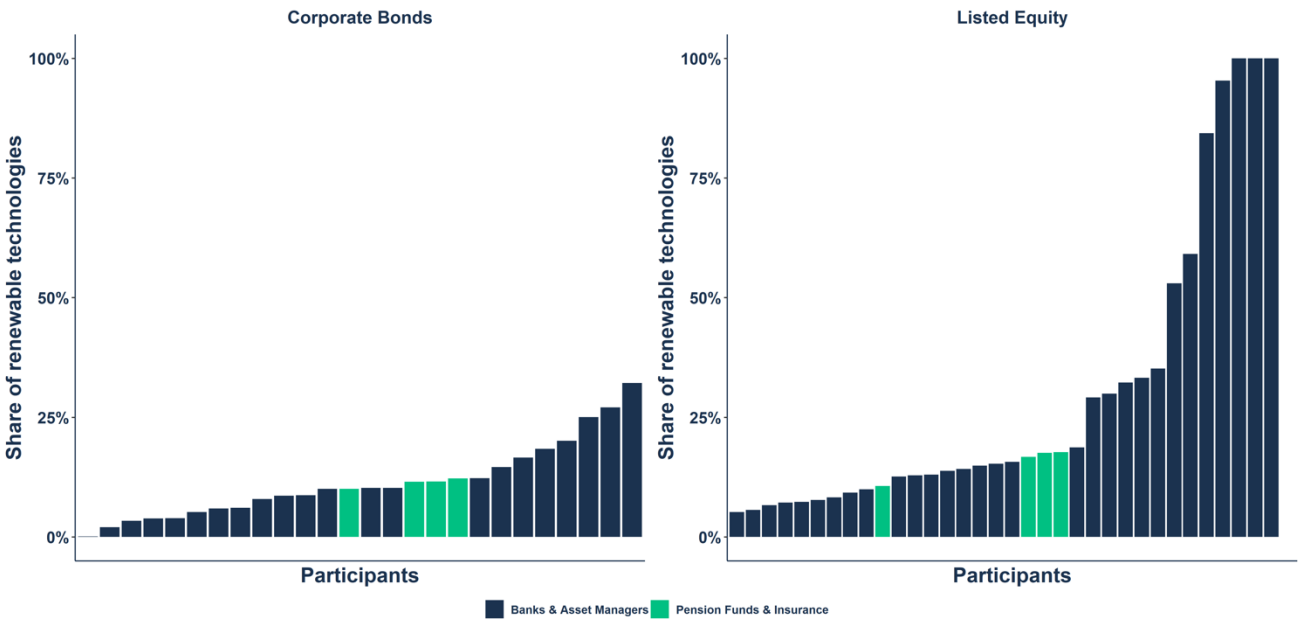


Figure 17: Share of renewables technologies (excluding hydro and nuclear) of the total investments in the power sector

Ambitious build-out of renewable energy capacity and retirement of the most carbon intense source of power generation, coal, are necessary to meet the goals of the Paris agreement. The power capacity currently financed by Liechtenstein investors is neither set to increase fast enough in terms of renewables, nor retire fast enough with respect to coal capacity.

Although renewable power capacity is set to increase, based on current production plans, the increase is not fast enough to align with the IEA's sustainable development scenario. Only pension funds and insurance companies are financing a build-out of renewables in line with the 2°C scenario in the short-term, but the expansion is not sustained until 2025.

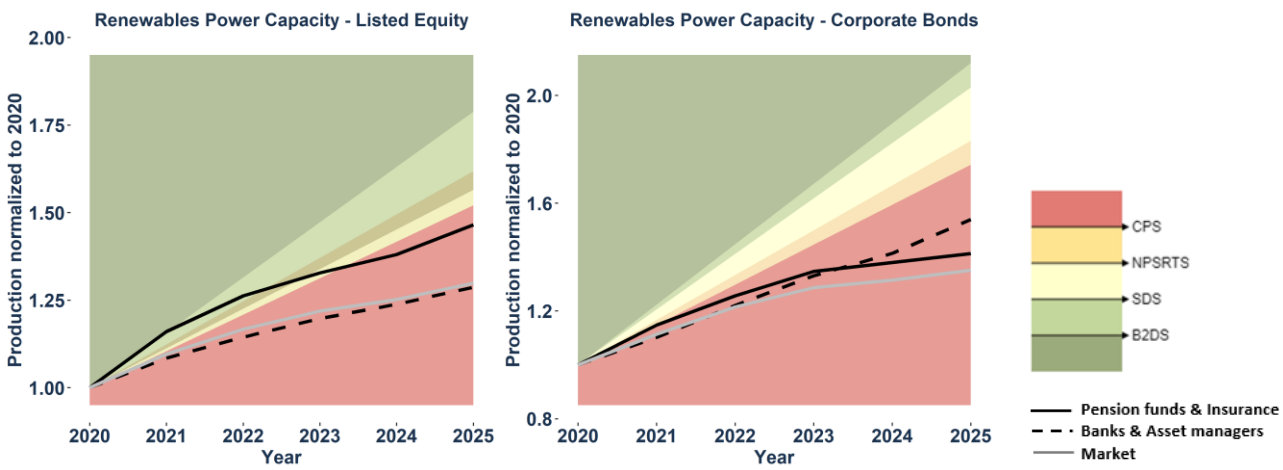


Figure 18: Build-out of renewables power capacity, compared to the build out required under different climate scenarios as well as the Global Market.

The following graph shows the current exposure to renewable power capacity and the build-out of corporates in the portfolios as a share of the build-out required by the Sustainable Development Scenario. We see that some portfolios are leading the way in terms of build-out and current exposure (dots in the green area), but that the majority remains at low build-out and low exposure to renewable energy capacity.

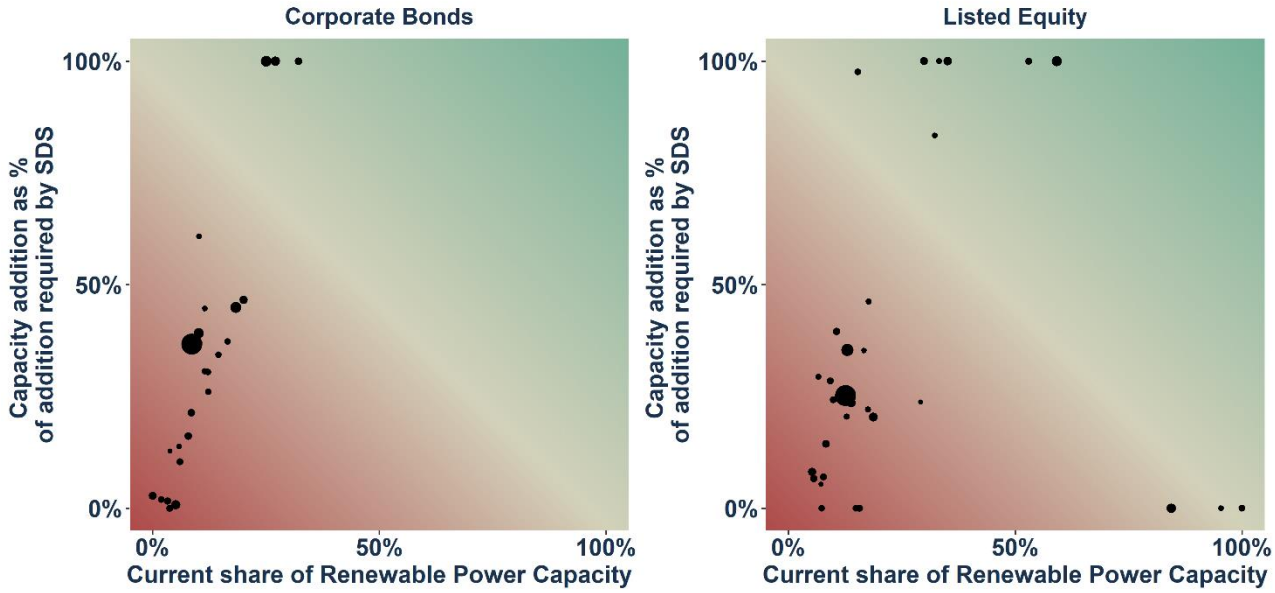


Figure 19: Build out plans of underlying companies in the portfolio as a percentage of build-out required by the SDS, plotted over the current exposure to renewables power capacity. Each dot represents one portfolio.

Exposure to coal power capacity, a technology that is expected to decrease even under the Current Policies Scenario, is set to stay rather stable or decline modestly in Liechtenstein financial institutions.

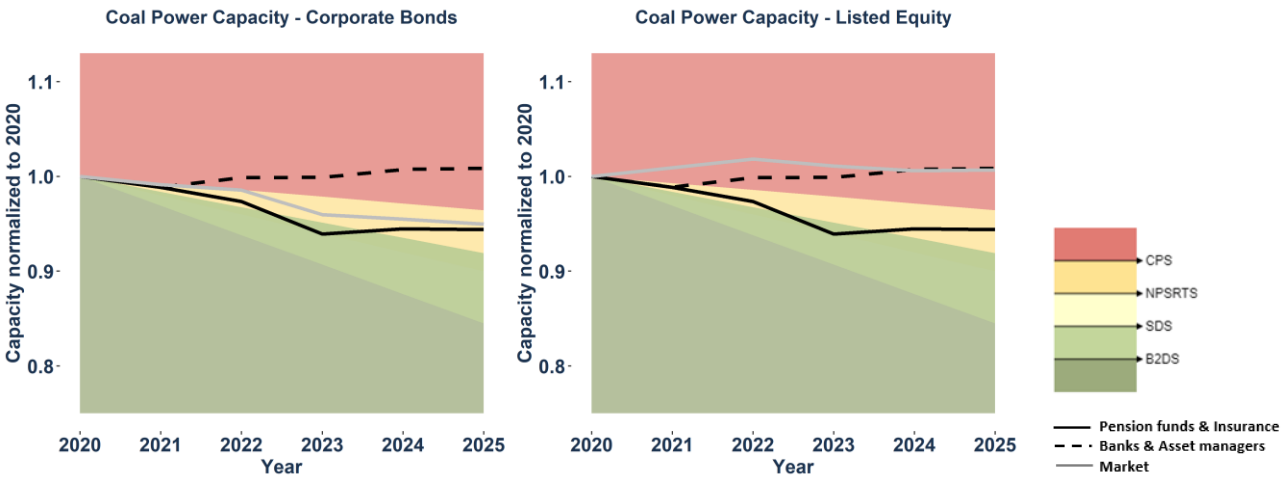


Figure 20: Build-out of coal power capacity, compared to the build out required under different climate scenarios as well as the Global Market.

Transportation

At present, the transportation sector relies almost exclusively on oil and accounts for one-quarter of global anthropogenic CO_2 emissions.

In addition to its considerable climate impact, the transportation system has significant non-climate related environmental impacts through other pollutants such as NOx, So2, carbon monoxide, black carbon and ozone.[21] These pollutants not only contribute to the warming impact of the sector, but also significantly contribute to air pollution – which causes around 4 million deaths per year, according to the World Health Organization.[22]

Road Transport - Light-Duty Vehicles

1-6% of the total portfolios of participants are invested in light-duty vehicles. The highest exposure is understandably to internal combustion vehicles, for all financial institutions and across the two asset classes. The share exposed to electric vehicles is still very small. In Switzerland, 1-3% of the total portfolios of participants are invested in light-duty vehicles.

Road transport accounts for almost 80% of global transport-related CO_2 emissions in 2020. Decarbonization pathways in this sector depend primarily on the build-out of electric and hybrid vehicles, R&D in low-carbon fuels (biofuels and eFuels) as well as modal shift.

Our analysis focuses on those engine technologies that are currently widely available in the market and that are forecast in the scenarios by the International Energy Agency. We recognize that finance for companies investing in R&D in even newer or better technologies has enormous potential to contribute to decarbonizing the economy, it is however out of the scope of this country-level alignment analysis, because there are no forward-looking scenarios on the deployment of such untested technologies.

Efficiency improvements of internal combustion engines are necessary to decrease emissions in the short-term,[23] and are currently targeted by a number of government policies in different countries. This analysis focuses on the build-out of existing low-carbon technologies (electric and hybrid), rather than efficiency improvements of internal combustion engines, as the build-out of these new technologies are necessary to actually transition the transportation sector and reach Net-Zero.

Estimations of the current full life-cycle emissions of electric and hybrid vehicles can vary widely, obviously depending on the carbon intensity of the grid they are operating in, as well as other assumptions around their use and lifetime.[24] Overall, electric and hybrid vehicles have lower average full-life cycle CO_{2eq} emissions than internal combustions engines, and, more importantly, offer the possibility to operate with significantly lower CO_2 emissions on a renewable grid. It is therefore important to bear in mind that electric and hybrid vehicles rely on the decarbonization of the electricity sector as a necessary condition for contributing to decarbonization.

[21] IPCC AR5

[22] https://www.who.int/health-topics/air-pollution#tab=tab_1

[23] https://theicct.org/publications/vision2050

[24] 'Estimation of CO2 Emissions of Internal Combustion Engine Vehicle and Battery Electric Vehicle using Life Cycle Analysis' *Sustainability*, 2019

The graph below shows the exposure of the submitted portfolios to light-duty vehicle production in different technologies, compared to the global equity market and corporate bonds market, respectively. Liechtenstein pension funds and insurers have significantly higher exposure to car production through their corporate bond investments than the global market.

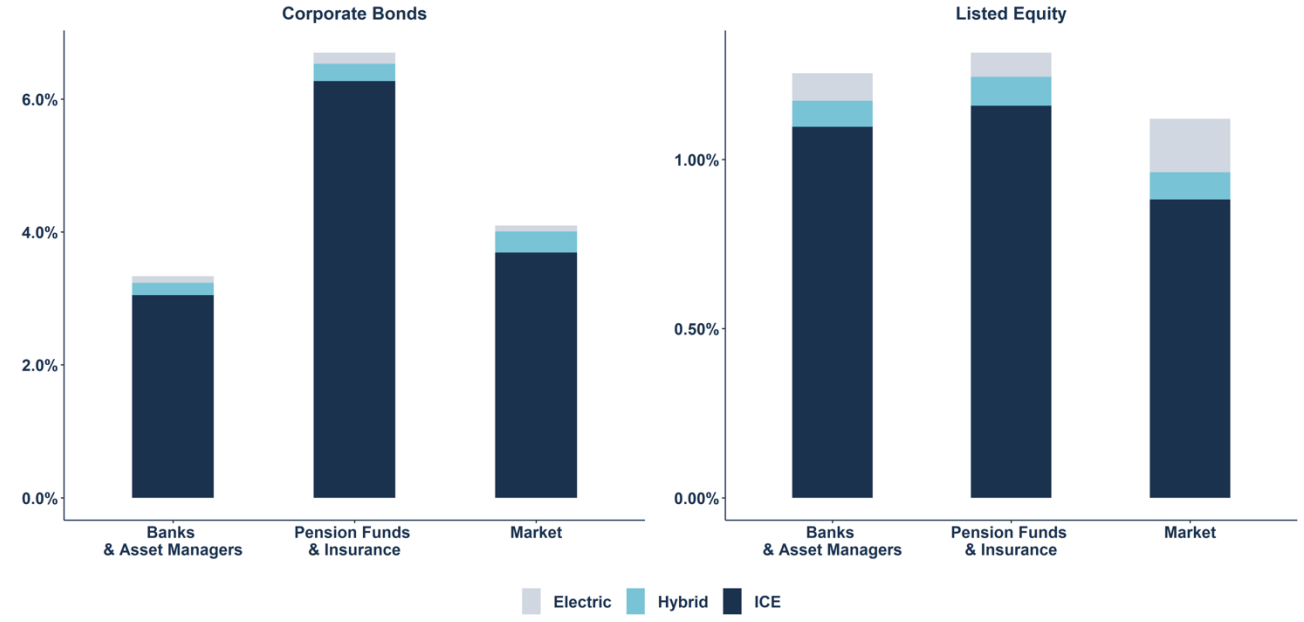
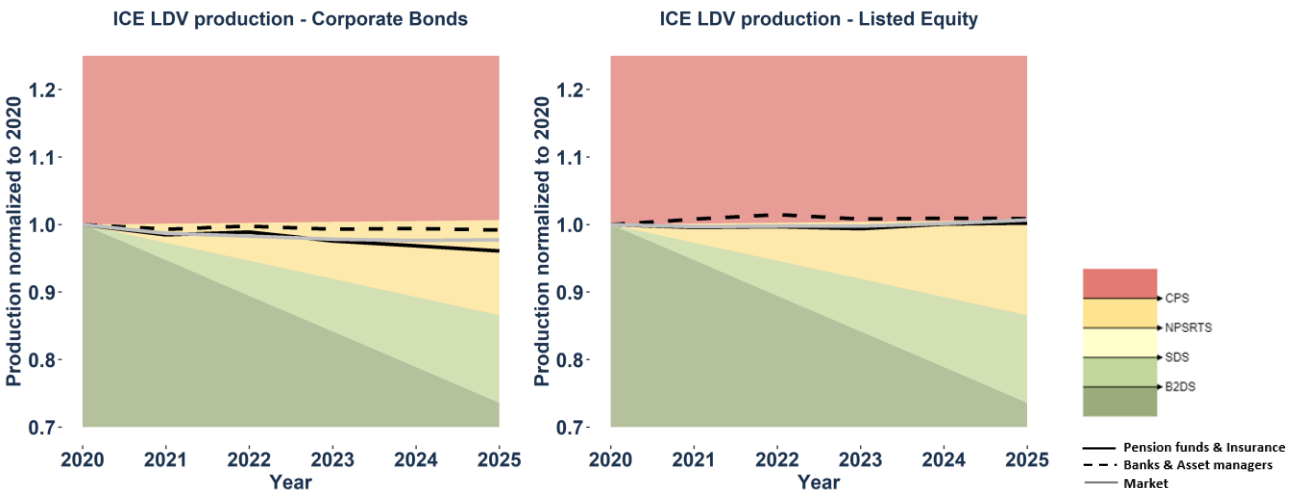


Figure 21: Exposure to different LDV technologies in the Automotive Sector, compared to the Global Equity and Bonds market, respectively.

The aggregate listed equity as well as corporate bonds portfolio are not aligned with the Paris Agreement in terms of their exposures to the production of internal combustion engine or hybrid across all peer groups. However, in terms of their exposures to electric vehicles, the aggregate portfolios are much better aligned with the 2°C scenario.



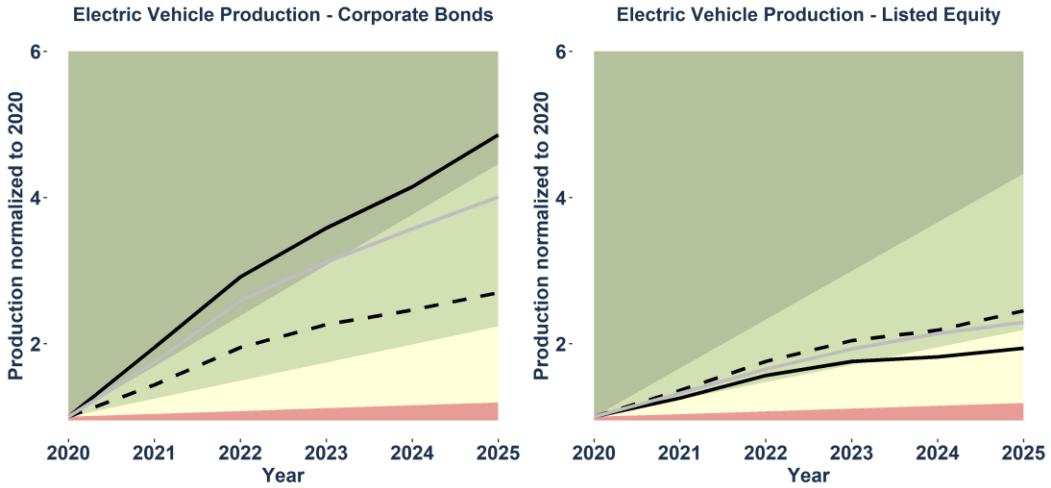


Figure 22: Production plans for ICE and Electric vehicles, compared to different climate scenarios and the Market

It is important to note in this graph that the 2°C scenario requires a reduction of the total ICE vehicle stock, as well as a doubling of electric vehicle stock by 2025, and even a five-fold increase in the case of the Beyond 2°C Scenario. Although groups are relatively aligned in terms of their exposures to electric vehicle production with the sustainable development scenario and, in the case of pension funds & insurance companies, even with the Beyond 2°C Scenario, the groups are still financing a stable production of ICE for the next 5 years.

The structure of the automotive sector is very different from the power sector in that global production of light-duty vehicles is mainly driven by a relatively small number of large international car manufacturers and as opposed to the power sector, production is less dependent on regional acceptance or availability of certain resources (nuclear, hydro). A recent in-depth study of the production plans and climate alignment of the 14 largest international car companies shows, that none have production plans for hybrid vehicles consistent with a 2°C pathway. None except one have production plans for ICE vehicles consistent with a 2°C pathway, and a handful of companies have production plans for electric vehicles compatible with a Beyond 2°C Scenario or 2°C Scenario.[25] Both banks and asset managers and pension funds and insurance in Liechtenstein reported exposure to these 14 companies.

Road Transport – Heavy-Duty Vehicles

Heavy-Duty vehicles (HDVs) are trucks, buses or coaches and are defined as freight vehicles of more than 3.5 tons or passenger transport vehicles of more than 8 seats.

HDVs contribute disproportionately to climate and air pollution, in part due to their significant non-CO_2 emission, including nitrous oxide and black carbon, which has a high, short-term warming potential.[26] HDVs are also used dramatically more than a typical car, covering more distance in the life-cycle use.

[25] 2DII, Changing Gear Report 2020
[26] ICCT Vision 2050

Although the HDV fleet is very heterogeneous, most vehicles are currently powered by diesel engines. Decarbonization of this sector requires efficiency improvements, a shift towards low-carbon technologies as well as an optimization of supply chain activities.[27] Low-carbon technologies currently make up a barely visible share of production, and slight expansion of production is still planned.

In Liechtenstein, while the share of portfolios exposed to the production of HDV ICE is low, the Liechtenstein financial sector is financing the production growth of HDV ICE production, and therefore not aligned with what is required for the Paris Agreement. The scenario is similar to that presented by Switzerland, where all groups of investors contribute to the expansion of production of HDVs.

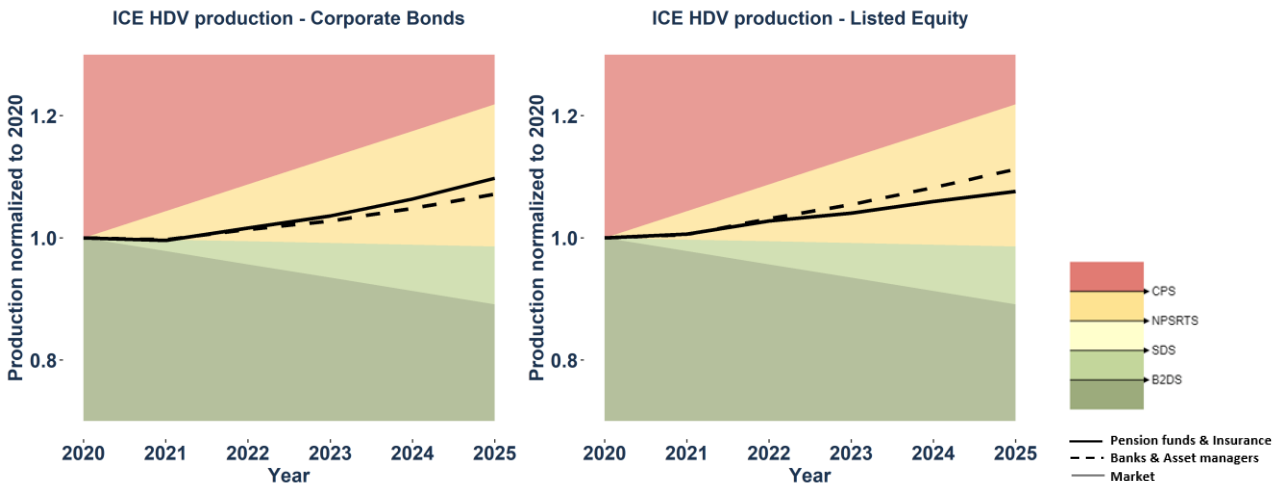


Figure 23: Production plans for ICE HDV, compared to different climate scenarios

Aviation

Aviation accounts for 2.4% of global CO_2 emissions from fossil fuel use and is the most emission intense form of travel.[28]

The total climate impact from aviation is even higher, as non-CO_2 emissions are estimated to currently account for twice the warming impact of CO_2.[29] Current fuel efficiency improvements in the sector are in the order of 2% per year compared to an annual 6% growth of flights taken. Alternative fuels are still in their infancy with some progress being made on a very small scale. In 2018, alternative fuels accounted for less than 0.1% of aviation fuel consumption.[30] In addition, most alternative fuels rely on the use of biomass which is potentially limited as it would compete with other types of land-use, for example for food production.

[27] https://theicct.org/heavy-duty-vehicles

[28] https://theicct.org/sites/default/files/publications/ICCT_CO2-commercl-aviation-2018_20190918.pdf

[29] https://elib.dlr.de/59761/1/lee.pdf

[30] https://www.iea.org/commentaries/are-aviation-biofuels-ready-for-take-off

Most climate targets set by airlines include carbon offsets. A carbon offset is the reduction of greenhouse gas emissions in one place, often by planting trees, to compensate for emissions somewhere else, in this case, the aviation industry.[31] This report does not integrate offsets into the analysis: even though offsets might reduce the carbon footprint of a company (given that the projects are legitimate), they do not indicate any improvement in the core business of an airline, namely flying.

For Liechtenstein, companies in the aviation sector account for 0.4% of the total portfolio value on average, across all types of financial institutions.

The following graph shows the current emission intensity of invested companies, as well as the emission intensity required in 2025 by the climate scenario.

Figure 24: Current fleet intensity vs reduction required under Sustainable Development Scenario

The sustainable development scenario requires a steep decline of emission intensity by aviation companies. Liechtenstein financial institutions, however, are aligned with a stable emission intensity pathway. The result reflects the disparity between emission intensity reductions that airlines should be aiming for, and their current plans. This finding is in line with a study published by the Transition Pathway Initiative which shows that most airlines do not have targets aligned with the Paris climate goals.

Shipping

International shipping currently accounts for 2% of energy related CO_2 emissions[32] and 11% of direct transport emissions.

Most of the emissions during the lifecycle of a ship stem from the combustion of fuels, whereby the carbon intensity of a ship varies significantly by size and vessel type.[33] Gains in efficiency can help

[31] For more information on this topic : https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx
[32] IEA 2020, *Report on International Shipping*, https://www.iea.org/reports/international-shipping
[33] Transition Pathway Initiative https://www.transitionpathwayinitiative.org/publications/42.pdf?type=Publication

reduce emissions in the short term, whereas a switch to low carbon fuels is necessary in the future to fully decarbonize the sector. However, low carbon fuels currently account for only 0.1% of total fuel used in the shipping sector.

Liechtenstein investors currently hold between 0.1-0.3% of aggregate listed equity or corporate bonds portfolios in the shipping sector.

This exposure is higher than in Switzerland, where investors hold less than 0.05% of aggregate listed equity or corporate bonds portfolios in the shipping sector.

This analysis uses a greenhouse gas emission rating for ships published by RightShip, which assesses the estimated emissions of a vessel compared to vessels of a similar size and rates the performance on a scale from A-G. More information on this methodology is available here.[34]

Banks and assert managers hold the largest share of A-C rated vessels in their listed equity portfolios and corporate bonds portfolio, compared to pension funds & insurance.

In 2050, the International Maritime Organization announced that it would aim to reduced emission by 50% by 2050, compared to 2008 baseline. For financial institutions, the Poseidon Principles, launched in 2019, provide a framework agreement for integrating climate considerations into lending decisions in the shipping sector.[35]

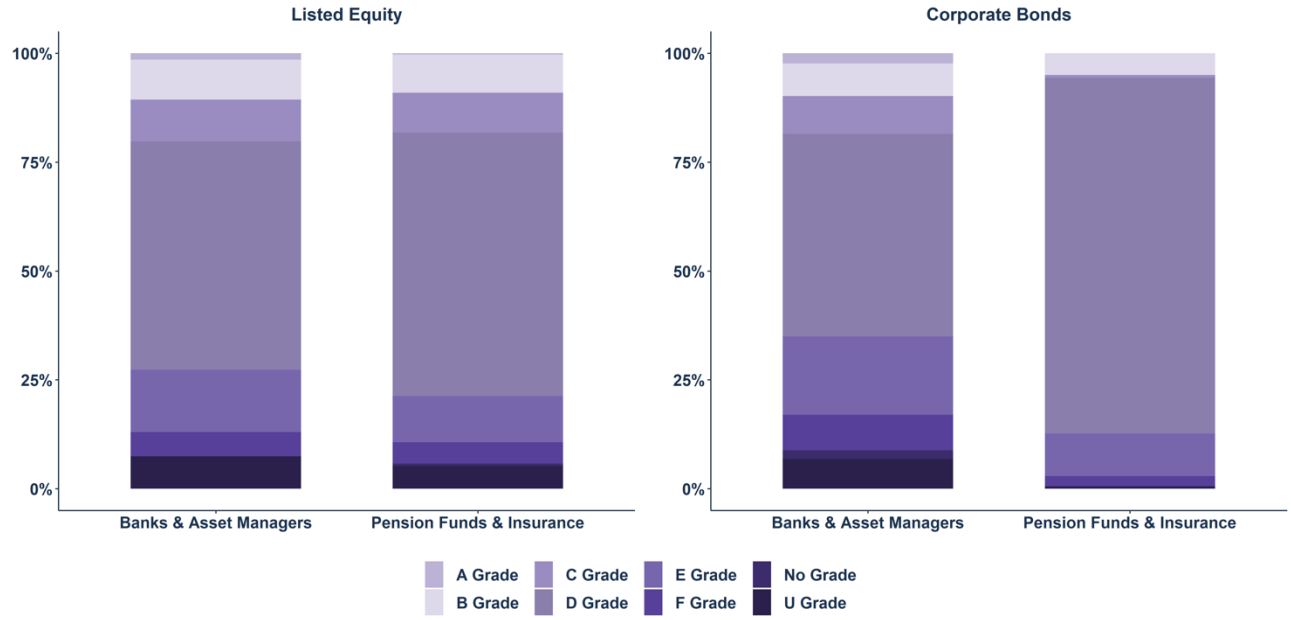


Figure 25: Technology mix of investments in the shipping sector by peer group, calculated using the ownership weight approach for listed equity and the portfolio weight approach for corporate bonds

[34] https://www.rightship.com/sustainability/ghg-rating/
[35] https://www.poseidonprinciples.org/

Steel

The steel sector accounts for 7% of CO_2 emissions from the energy sector and 8% of global final energy demand.[36] 0.4-0.8% of aggregate Liechtenstein portfolios are currently invested in the steel sector.

Global annual steel production has doubled over the past two decades from 850 to 1,850 tons, largely driven by the rapid expansion in emerging markets, where 85% of current global capacity is located. More specifically, China accounts for 51% of global steel production and therefore plays a pivotal role in the decarbonization of the steel sector. The steel sector is currently the largest industrial consumer of coal, which is used to cover 75% of its energy demand.

There are two routes of producing steel, corresponding to these different input materials and methods: one is in integrated steel plants either in an open-hearth (OHM) or a basic oxygen furnace (BOF) and fed by hot metal produced by a blast furnace. The other is in scrap-based mini mills, where an electric arc furnace (AC-EAF or DC-EAF) is fed mostly by scrap, which accounts for 29% of global production.

In the IEA's Sustainable Development Scenario, the energy intensity of crude steel is required to decline by 1% per year. In comparison, the actual energy intensity of steel fell by 0.7% per year between 2010 and 2016, and by 2.2% in 2017. According to the IEA, this drop in 2017 was driven by energy efficiency improvements and an increase in scrap-based production. However, deep decarbonization of this sector will require transformative change towards low-steel production methods.[37]

Currently, 30% of raw material input into the steel-making process comes from recycled steel scrap. Steel production from iron ore requires eight times the energy required for producing steel from scrap. Furthermore, this energy is mainly required in the form of electricity when steel is produced from scrap, which makes the process easier to decarbonize. However, due to the growing demand, the quantity of steel scrap cannot meet the current material requirements.

The graph below shows the current exposure of the aggregate portfolios to the different technologies. Corporate bonds portfolios hold higher exposure than listed equity portfolios and are mainly invested in basic oxygen furnace and Ac-Electric Arc Furnace, whereas listed equity are more exposed to only Ac-Electric Arc Furnace technology.

In Switzerland, the exposure of portfolios to the steel sector accounts for 0.1-0.6%. Listed equities portfolios are the most exposed and are mainly invested in basic oxygen furnace.

[36] International Energy Agency, ETP Iron and Steel Technology Roadmap, October 2020
[37] https://www.iea.org/fuels-and-technologies/iron-steel

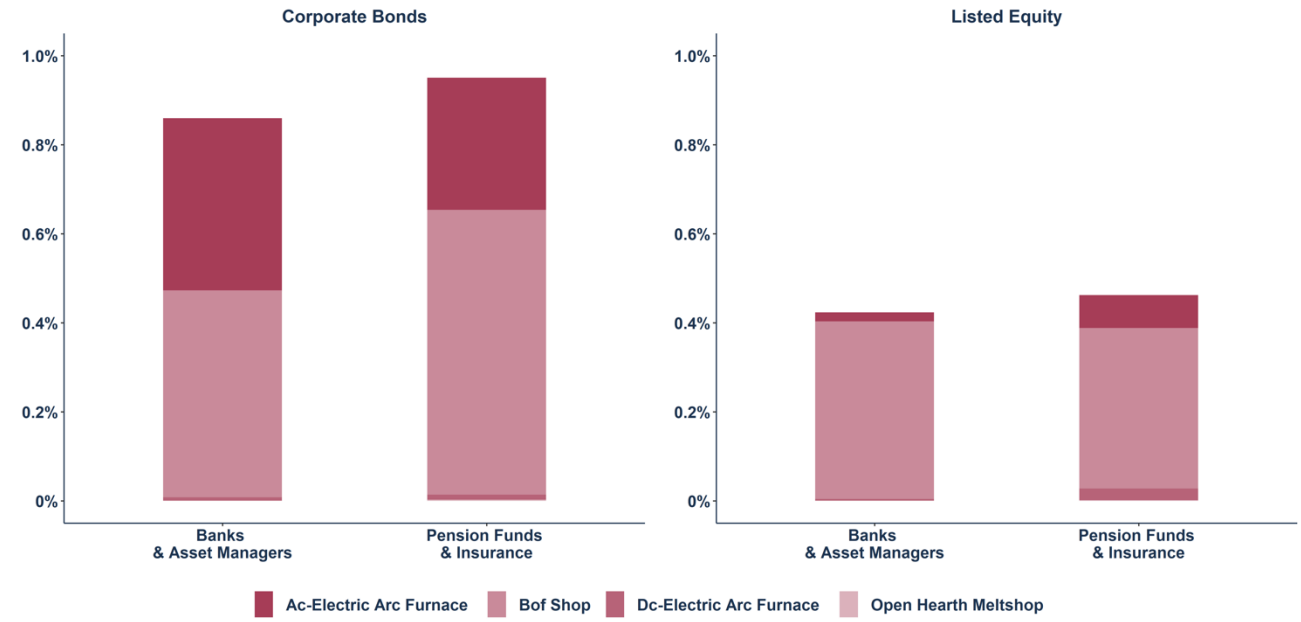


Figure 26: Exposure to different technologies in the steel sector, as percent of total portfolio value

The graph below shows the current emission intensity of the two technologies most present in Liechtenstein portfolios: basic oxygen furnace and Ac-electric arc furnace as a starting point in 2020. The estimate of the current emission intensity is available in the asset-level data. The colored line then represents the emission reductions necessary to align steel production with the Sustainable Development Scenario, based on the Sectoral Decarbonization Approach.

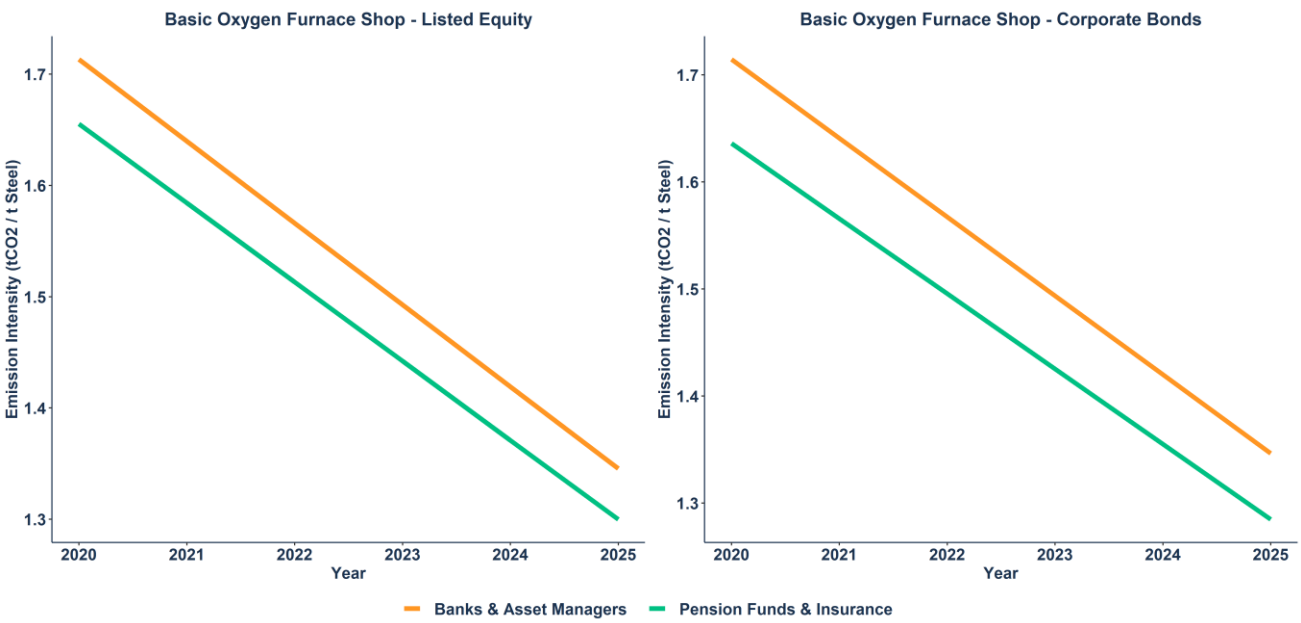


Figure 27: Current emission intensity and intensity reduction required under Sustainable Development Scenario in the next 5 years for Basic Oxygen Furnace

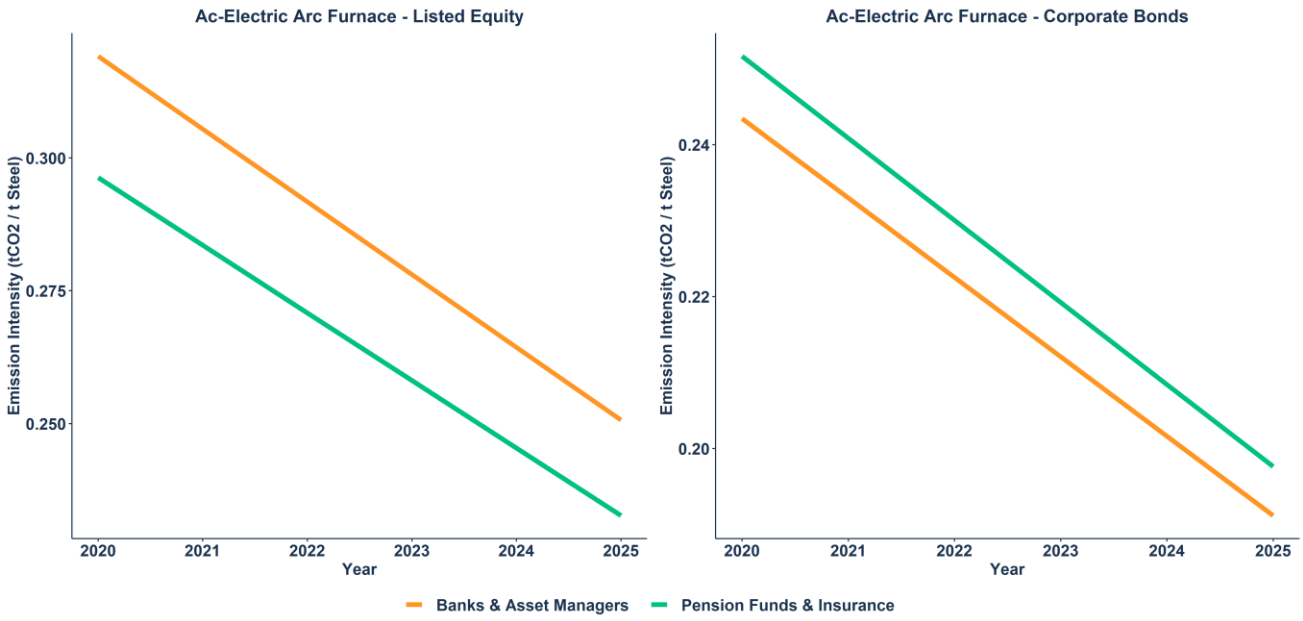


Figure 28: Current emission intensity and intensity reduction required under Sustainable Development Scenario in the next 5 years for Ac-Electric Furnace

Banks and asset managers have significantly higher emission intensity in Ac-Electric Arc Furnace than pension funds and insurers. In Switzerland, pension funds institutions are the ones holding a significantly higher emission intensity in steel sector considering the two technologies.

Cement

Cement is the second-largest industrial CO_2 emitter and accounts for 1% of value invested in Liechtenstein portfolios, on average.[38]

Used to bind together the elements that make up concrete, cement is the world's most widely used manufactured material.[39] Driven by population growth and urbanization, demand for cement is expected to continue to rise. The CO_2 intensity of cement production increased from 2014-18, but actually has to decrease at 0.8 % per year to meet the sustainable development scenario. Two key action points are recommended by the IEA: a reduction in the clinker-to-cement ratio, as well as the development of innovative technologies including carbon capture, use and storage.

The graph below shows the current emission intensity in 2020, and the emission reductions necessary to transition to a 2°C pathway.

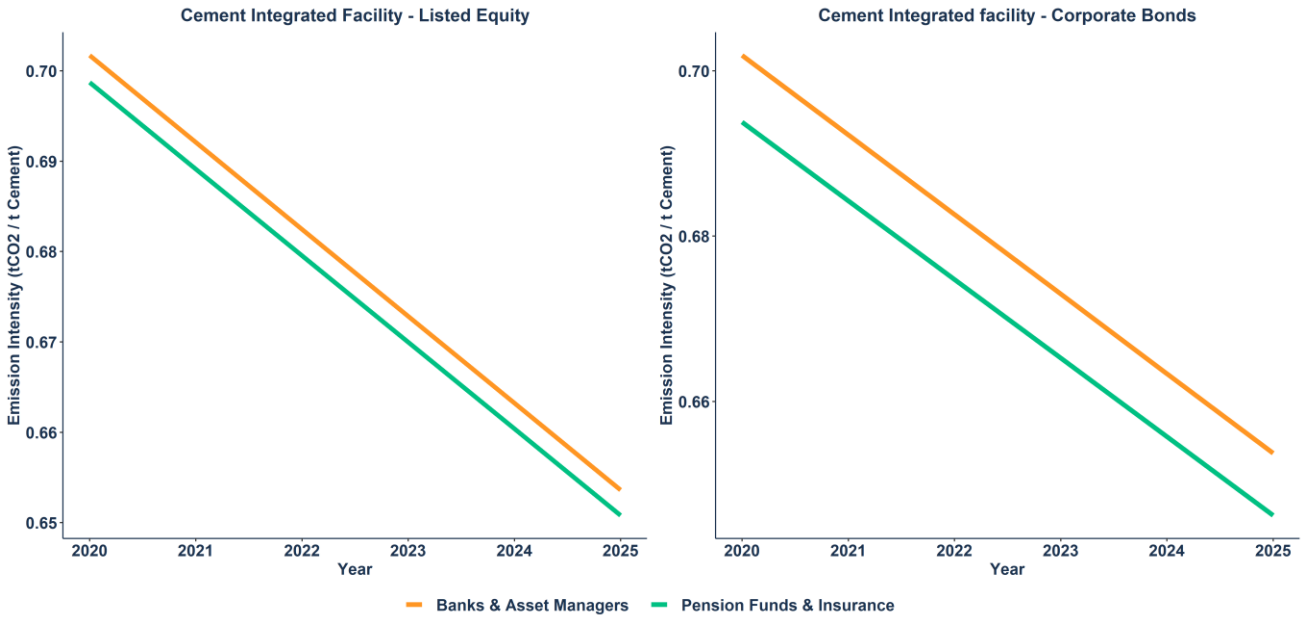


Figure 29: Current emission intensity and intensity reduction required under Sustainable Development Scenario in the next 5 years for cement

[38] https://www.iea.org/reports/cement

[39] https://www.transitionmonitor.com/wp-content/uploads/2020/09/cement_ef_final_pacta_banks_v1.2_14-09-2020.pdf

Scaling ambition to meet a 1.5°C temperature target

In article 2.1(a) of the Paris agreement, parties signed the long-term goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels."

Article 2.1(a) recognizes that the impacts and physical risks of climate change are highly unequally distributed across different countries and that significant impacts can be expected even below 2°C in some regions of the world.

The IPCC 1.5°C report published in 2018 provided more urgency to this matter, investigating how the impacts of a 2°C global mean temperature increase would differ from a 1.5°C increase. The report consolidates peer-reviewed literature on the topic. There is a robust difference between 1.5°C and 2°C not only in terms of mean temperature but also, among other things, in terms of hot extremes and heavy precipitation in the most inhabited regions, the probability of droughts in some areas and yield reduction in essential crops. The carbon budget for a 50% chance of limiting global mean temperature increase to 1.5°C lies at 580 Gt CO_2, which corresponds to 14 years of 2019-level emissions (instead of 1000 Gt CO_2 for reaching a 50 % chance of reaching 1.75°C), and the global economy would have to reach net-zero carbon emissions by around mid-century.

The report also laid out possible scenarios and pathways for achieving the transformation required, based on different integrated assessment models. To meet this more ambitious temperature goal, the energy system must be transformed at an unprecedented scale.

In addition to this, all models either rely on assumptions regarding negative emissions through bio-energy carbon capture and storage (or other related means) or significant behavioral change and, therefore, lower future energy demand.

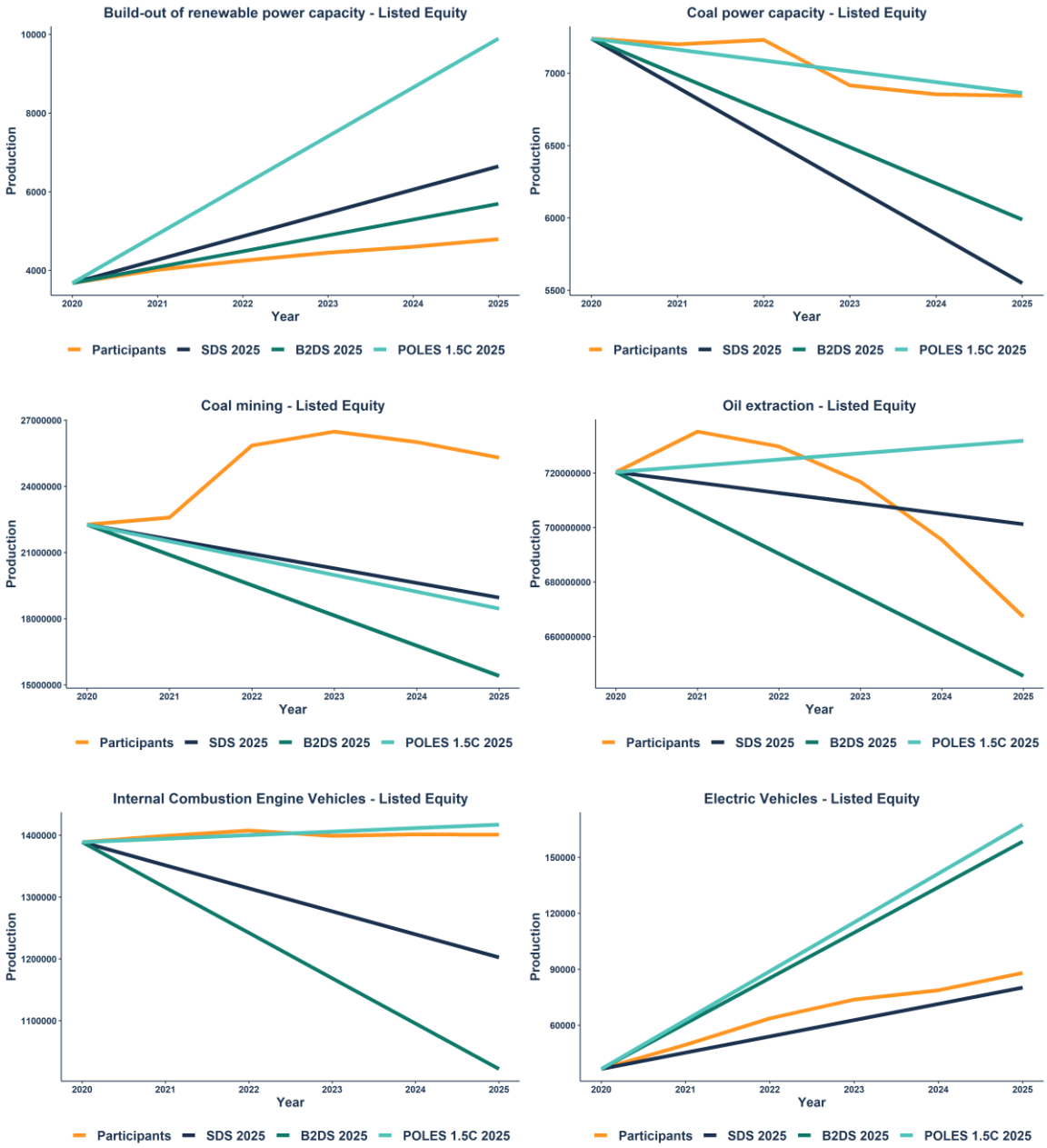
The International Energy Agency, whose *Energy Technology Pathways* and *World Energy Outlook* publications are currently used in the PACTA analysis, had so far not included an explicit 1.5°C scenario in their publications. Instead, the IEA published a Beyond 2°C Scenario (B2DS), which is used in this report. Note that for some sectors, the B2DS meets or exceeds the ambition of those 1.5°C scenarios published by the IPCC that rely heavily on Bio-energy with carbon capture and storage (BECCS), which B2DS does not as much. This underlines the importance of interpreting sector and technology pathways within scenarios not in isolation but considering them as a set of technology pathways that together achieve a certain temperature outcome.

The World Energy Outlook (WEO) published in October 2020 now included a net-zero in 2050 target that requires that *"low emission sources of electricity would need to provide nearly three-quarters of electricity generation in 2030, and more than half of passenger cars sold in 2030 would need to be electric."* The WEO net-zero scenario also requires behavioral changes as well as carbon capture utilization and storage. Given the timing, this scenario could not be considered for this analysis.

In order to investigate the ambition required to reach a 1.5ºC temperature target, this report shows the scenarios published in the *Global Energy and Climate Outlook 2019* using the POLES model.

POLES is an energy system model that is structurally similar to the energy models used by the IEA but is published by the European Commission Joint Research Centre.

The graphs below compare the production plans that would have to be financed by participants under different climate scenarios, as well as their actual production plans.



The POLES 1.5ºC scenario requires significantly steeper expansion of renewable energy capacity than the Sustainable Development Scenario or the Beyond 2ºC scenario. Neither of

these ambitions is met by the expansion plans of investors, as already discussed in the previous section.

The build-out of electric vehicles required under the POLES 1.5ºC scenario is also steeper than the build-out under the two IEA scenarios. This ambition is also not met by the portfolios analyzed. On the other hand, the POLES 1.5ºC scenario gives more leeway to high-carbon technologies such as internal combustion engines, coal power capacity and oil production. In the case of coal mining, the portfolios analyzed are still far from meeting the ambition required under any scenario. In the case of ICE vehicles and oil extraction on the other hand, portfolios analyzed align with the assumptions of the POLES 1.5ºC.

This section is not a direct comparison between the models, but rather an illustration of the different pathways possible to meet the 1.5ºC temperature goal.

It is important to note that the scenarios contrasted in this section are built with different models. These models use different baseline assumptions, different assumptions about the development of key socioeconomic indicators as well as the development of different technologies and allocate different shares of the carbon budget to different sectors.

V. Taking Action: Climate Strategies and Impact

Overview

This section discusses the climate strategies and actions undertaken by the Liechtenstein financial sector to complement portfolio exposures and alignment.

Portfolio alignment analyzes the production and investment plans of companies in financial portfolios and their consistency with climate goals. In aggregate, the analysis speaks to the broader trends in financial markets as it relates to the Paris Agreement. However, for an individual financial institution, such analysis only shows one side of the equation. The other side is the extent to which climate issues are integrated into the actions and strategies that these institutions deploy. For example, a financial institution may be highly exposed to fossil fuel sectors but use engagement tools to seek to influence these companies to decarbonize.

The results are based on the responses of 57% of participants that filled out the qualitative questionnaire. The questionnaire covered three major themes and areas of potential engagement: climate action and strategies in different asset classes, political engagement, and consultation of clients on climate and sustainability preferences.

Of those institutions who filled out the survey, a large share (88%) reported a climate strategy at institutional level and gave further details on climate actions already taken. However, some of the most frequently cited strategies, such as coal exclusion and ESG investing, are not applied consistently across the full portfolio. Additionally, the impact of the strategy on real-world emission reductions is not measured by 90% of participants. This suggests that although there is awareness around the topic of climate change and the energy transition, and first steps have been taken, we are still in the early stages of the engagement of participants with the topic.

Climate Actions and Strategies

88% of survey respondents reported that their organization had a climate related target or aspiration or was in the process of developing one.

This compares to 69% percent of respondents in Switzerland who reported a climate strategy. The majority of reported strategies consist of investing according to ESG criteria, either systematically across all asset classes, or applied to a subset of the assets held.

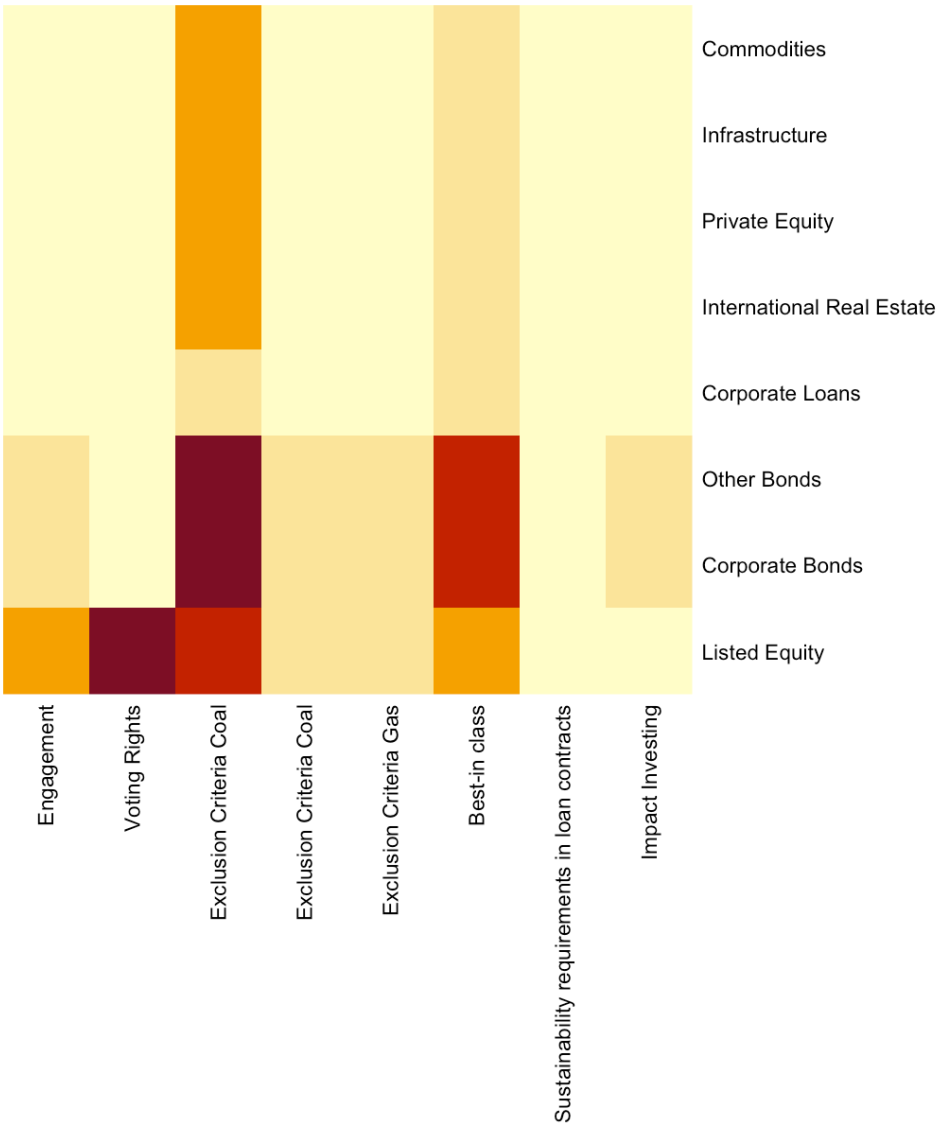
The climate strategies most frequently employed by participants include engagement as well as coal exclusion policies, exercising voting rights as well as best-in class investing.

The following chart shows the frequency of climate-relevant strategies used by participants in Liechtenstein in different asset classes. Climate relevant strategies that investors could choose from include engagement, exercising shareholder voting rights, exclusion criteria for oil, gas or coal, best-in-class investing, sustainability criteria in loan contracts and impact investing.

The strategies were “pre-defined” as options to select and thus may not fully capture all types of approaches deployed by participating financial institutions. Moreover, the distribution of strategies

is of course at least in part driven by the actual exposure to that asset class, with a large share of participants for example not invested in commodities.

The figure below shows the frequency with which participating financial institutions indicated to employ different strategies. The percentage ranges from 50% for coal exclusion policies in bond portfolios to 0% that employ the strategy of sustainability clauses in credit agreements.



88% of survey respondents provided more details on climate actions taken. The most frequently reported climate actions refer to either coal exclusion, investment along ESG criteria or engagement.

The climate strategies discussed here differ with respect to their impact on the results of the portfolio climate alignment assessment, as conducted in this report, as well as the evidence for their impact on real world emission reductions. The latter is important because, as highlighted in research conducted by 2DII as well as academic researchers, improved alignment results do not necessarily translate into real-world emissions reductions. A coal power plant that one institution

divested from will not necessarily have stopped operating and could have even expanded its operations. For example, the analysis of the Swiss financial market published in the "Bridging the Gap" report found that although the exposure of Swiss financial institutions to coal power capacity decreased from 2017 to 2020, the companies in those portfolios still built out their capacity in the meantime. On the other hand, engagement efforts will not immediately show in the portfolio alignment results but could provide a more effective way of driving companies' decisions. Research on the question of investor impact is still ongoing, and currently worked on by a range of universities and NGOs, including 2DII in the context of the Evidence for Impact project.

Currently, only 10% of financial institutions reported to measure the impact of the actions taken, although two participants mentioned impact reporting conducted by the asset manager.

All of the financial institutions who reported a coal exclusion policy still had holdings in coal mining or coal power.

It is worth noting here that the ambition of the coal exclusion policy was not part of the questionnaire. As a result, the results by themselves do not necessarily show that the coal exclusion policy is "misapplied". Coal exclusion policies may have carve-outs for certain types of coal (like thermal versus metallurgical), exceptions, or thresholds on revenues whereby some type of coal mining/exclusion is still tolerated. However, these findings raise concern as to the stringency of certain policies, potential gaps in implementation, as well as the need to communicate clearly on the details of the coal exclusion policies.

70% of measures were taken 2019 or later, which means that they might not yet be fully implemented, and perhaps not visible in the quantitative analysis. This also indicates an increased uptake of climate strategies in the last two years.

75% of participants reported to be member in at least one sustainable finance organization. The most frequently cited organizations are Swiss Sustainable Finance (SSF) and UN Principles for Responsible Investment.

Only 15% of climate actions reported were coordinated with other institutions, however 65% were communicated publicly. Participation in those types of initiatives can provide a helpful exchange on best practices for financial institutions, coordinate engagement efforts (such as for the CA100+) or require setting a climate target (such as the Net Zero Asset Owner Alliance). However, membership alone does not necessarily drive change within a financial institution.

Political Engagement and Consultation of Clients

Around 25% of respondents reported to position themselves on any of the climate policies or agreements mentioned in the survey, which included the Paris climate agreement as well as the totally revised CO_2-law in Switzerland.

As part of the survey, financial institutions were asked to position themselves on different policy measures and agreements, including the Paris Agreement, the Agenda 2030 for sustainable development, the totally revised CO_2 law in Switzerland, as well as specific measures within that law targeting transport and real estate.

Organizations only positioned themselves with respect to the international agreements (the Paris climate agreement and the Agenda 2030 for sustainable development), not with respect to national policy questions.

Low levels of active support for national policy measures were also observed in Switzerland. At times, this stands in contrast with the push from some financial institutions for regulations in the real economy as opposed to measure directed at the financial sector.

50% of participating financial institutions suggest that they consult clients regarding their climate or sustainability objectives. However, all of them do so only sporadically or when mentioned by the client.

Compared to Swiss participants, this is a high percentage. 50% of participants reported that they offered sustainable products that would also conform with the upcoming EU requirements.

VI. Conclusion

The PACTA 2020 test provides the first picture of the Liechtenstein financial sector across key climate-relevant asset classes and sectors.

The results show that financial institutions in Liechtenstein are considerably exposed in sectors with high emission intensities. The figures for fossil fuels require attention: 3-4% of the listed equity and 5-7% corporate bonds portfolios of Liechtenstein financial institutions are invested in the direct extraction of oil and gas as well as coal mining. For the power sector, the exposure of aggregate portfolios ranges between 2-6%.[40]

Pension funds and insurance companies are more exposed to fossil fuels than its peers' banks and asset managers and, at the same time, their investment's production plans in renewables are not set to meet a sustainable development scenario. This pattern indicates an inconsistency between the fiduciary duty of pension funds and the fossil fuel divestment movement that have been place for the past ten years. The 'Fossil Free Divestment Movement', for example, had accrued over €12.5trillion in pledged divestments by around 1200 institutions, including pension funds. According to Rempel & Gupta's study published in November 2020 proponents of divestment argue that, pension funds can only abide by their fiduciary duty by ridding themselves of fossil assets due to their negative environmental externalities. Furthermore, public divestments may have spill-over effects that stigmatize the fossil fuel industry, potentially prompting firms to redesign their businesses posing extra risk to pension funds' investments.[41] For such reasons, the relatively higher exposure of pension funds and insurance companies to fossil fuels sector in Liechtenstein is concerning. Additionally, pension funds and insurers are the key players in greening the financial system given the size of such institutions, these investors can channel additional capital into new renewable projects, either directly or indirectly, but also, more importantly, in re-financing already operating renewable energy assets to free up capital for new investments.[42]

Exposure to key climate relevant sectors of financial institutions in Liechtenstein is higher than its peers in Switzerland, but lower than the benchmark. In fossil fuel extraction and coal mining, Swiss institutions reported exposure of around 2-4% of the listed equity and 3-5% corporate bonds portfolios. In the power sector, the exposure of Swiss institutions does not go beyond 5% of total aggregate portfolios.

Current investments made by participating organizations are not aligned with either the Beyond 2°C scenario or the Sustainable Development scenario in coal and oil production, coal power capacity and internal combustion light/heavy-duty vehicles production. At the same time, while renewables power capacity production is set to increase in Liechtenstein portfolios, the growth is not steep enough to achieve the Beyond 2°C scenario. For electric cars, however, most

[40] In a previous version of this report, it read "For the power sector, the exposure of financial institutions ranges between 2-8%". This figure was inaccurate and was therefore replace by the new numbers.

[41] https://www.sciencedirect.com/science/article/pii/S221462962030311X#s0035

[42] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_CPI_Global_finance_2020.pdf

Liechtenstein financial institutions are aligned with the Sustainable Development Scenario or the Beyond 2ºC scenario for most of the period between 2020 and 2025.

The exercise also demonstrates that voluntary initiatives can engage the market. 14 financial institutions provided information on their portfolios, from which more than 77,000 unique ISINs could be mapped. A total of USD 4.0 billion were identified as climate relevant using the PACTA methodology, from which USD 2.1 billion are allocated in corporate bonds and USD 1.8 billion is allocated in equity holdings. Sectors covered in this report represent around 75% of global CO_2 emissions and around 10-30% of the portfolio exposure of Liechtenstein's financial institutions.

The large share of financial institutions who reported a climate strategy (88%) shows the growing awareness of the topic in Liechtenstein's financial sector. However, the strategies are not consistently applied across the full portfolio, and do not yet show in the results of the alignment analysis. In addition, only 10% of institution measured the impact of the actions taken.

While metrics to measure the climate alignment of financial institutions have now become more widespread, we are still at the beginning of understanding real world impact of the climate actions taken by financial institutions. Alignment as a concept is critical at system level and responds to the political objectives of the Paris Agreement. However, supporting private sector actions, target-setting, and effective implementation driving real world change requires looking beyond alignment and moving towards measuring the impact of different strategies on real world emission reductions. Further work is needed in supporting the private sector in designing effective climate actions and setting impact-oriented targets. Research is also needed on bridging methodological gaps for certain sectors (e.g., agriculture) and solutions (e.g., R&D), as well as making potential links to other sustainability issues. Nevertheless, the road taken here is necessary, pairing climate actions information through qualitative surveys with quantitative data from portfolios.