



**Department of  
Financial Services**



# **An Analysis of New York Domestic Insurers' Exposure to Transition Risks and Opportunities from Climate Change**

Published June 10, 2021

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## Acronyms

AuM	Assets Under Management
2DII	2 Degrees Investing Initiative
2DS	2 Degrees Scenario; ~2°C
B2DS	Beyond the 2° Scenario; <1.75°C
CPS	Current Policy Scenario; >2.7°C
DFS	Department of Financial Services
ESG	Environmental, social, and governance
ETP	Energy Technology Perspectives

EV	Electric Vehicle
GDP	Gross Domestic Product
HDV	Heavy duty vehicles
ICE	Internal Combustion Engine
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
LDV	Light duty vehicles
NAIC	National Association of Insurance Commissioners
NGFS	Network for Greening the Financial Systems
OECD	Organization for Economic Co-operation and Development
PACTA	Paris Agreement Capital Transition Assessment
PRI	Principles for Responsible Investment
RTS	Reference Technology Scenario
SBT	Science Based Target
SDS	Sustainable Development Scenario; 1.75 – 2°C (this is Paris Agreement-aligned)
STEPS	Stated Policy Scenario; 2 – 2.7°C
TCFD	Task Force on Climate-related Financial Disclosures
WEO	World Energy Outlook

## Disclaimer

This report reflects a study (the “Study”) performed by 2 Degrees Investing Initiative (“2DII”), an independent, non-profit think tank working to align the financial sector with international climate goals, at the request of the New York State Department of Financial Services (“DFS”). The Study uses certain methodologies to analyze data from the 2019 Schedule D of 250 New York domestic insurers. The purpose of the report is to provide an example of a tool that insurers can use to assess their transition risks, as well as investment-related strategies that insurers can implement to mitigate those risks. DFS expressly disclaims legal liability and/or responsibility for reliance on information or data contained in this report. If DFS receives a Freedom of Information Law (“FOIL”) request for an individual insurer’s data in the report that DFS considers subject to FOIL under the New York State Public Officers Law, DFS will assert exemptions under FOIL that DFS deems applicable in response to that request to protect the confidentiality of the data, and notify the insurer of such request.

## Executive Summary

Climate change poses wide-ranging and material risks to the financial system. This is especially true for the insurance industry, where the physical and transition risks resulting from climate change affect both sides of insurers’ balance sheet—assets and liabilities—as well as their business models. Climate change also presents tremendous opportunities for insurers, which play a critical role in the management of climate-related financial risks (“climate risks”) in their capacity as risk managers, risk carriers, and investors.

DFS recently issued proposed [Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change](#), which highlights the importance for insurers to consider the impact of both physical and transition risks on their assets and liabilities. As a general matter across the industry, the impact of climate change on insurers’ investments receives less attention than the impact of climate change on insurers’ liabilities, and low-carbon transition risks are less understood than climate-related physical risks.

To support insurers in their efforts, DFS asked 2DII to analyze the transition risk exposure of New York domestic insurers (“insurers”) based on the equity and corporate bond holdings from their 2019 Schedule D data. **Based on the methodologies used in the Study, the data shows that, in the aggregate, insurers’ assets were meaningfully exposed to transition risks.** There are several tools available to help insurers analyze their transition risks and inform actions that they can take to mitigate them.<sup>1</sup> The Study provides one example and also outlines investment-related strategies that insurers can consider to mitigate their transition risk exposure. DFS recognizes that climate risks are one of many factors, including financial returns and risk controls, that an insurer should consider when making investment decisions.

## Physical and Transition Risks from Climate Change Are Accelerating

Climate-related natural disasters have continued to worsen in recent years. The number of billion-dollar disasters in 2020 was twice the average number of annual billion-dollar disasters for the 2010s, and more than three times the corresponding figure for the 2000s.<sup>2</sup> At the current rate, we are likely to reach the 1.5°C warming limit, the preferred goal set forth in the Paris Agreement, in less than a decade.<sup>3</sup>

**While the physical risks from climate change continue to worsen, risks arising out of the low-carbon transition are also accelerating as a result of three primary transition risk drivers: policy and regulation changes, low-**

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<sup>1</sup> [Climate scenario analysis](#), Principles for Responsible Investment, accessed on May 25, 2021.

<sup>2</sup> National Oceanic and Atmospheric Administration, [Billion-Dollar Weather and Climate Disasters: Overview](#), accessed on March 15, 2021.

<sup>3</sup> Hausfather, Z., [Analysis: When might the world exceed 1.5C and 2C of global warming?](#), December 4, 2020.

**carbon technology advancement, and changing public sentiment and demand patterns.** The most recent global energy roadmap of the International Energy Agency (“IEA”), which is used by countries and corporations to plan for energy investments,<sup>4</sup> forecasts that coal, oil, and gas demand will fall by 98%, 75%, and 55%, respectively, between 2020 and 2050.<sup>5</sup> Examples of key milestones in the IEA pathway to net-zero emissions include ensuring that all new buildings are zero-carbon-ready and that 60% of global car sales are electric by 2030.

Insurers may be exposed to these transition risks, as well as the opportunities presented by these risks, on the asset side through their holdings of corporate bonds and equities. On the policy and regulation front, the U.S. has rejoined the Paris Agreement, whose goal is to keep global temperature rise in this century to well below 2°C above pre-industrial levels. As of March 2021, ten G20 jurisdictions have announced net-zero greenhouse gas emission targets.<sup>6</sup> Multiple countries and the State of California have plans to ban gasoline car sales in the coming decades.<sup>7</sup> Further policy changes are likely in the pipeline, such as the introduction of a national carbon pricing system in the U.S. and more countries banning fossil fuel cars and vans.<sup>8</sup>

Innovation in low-carbon technologies is also growing rapidly. The IEA expects renewables to overtake coal and become the largest source of electricity generation worldwide, supplying one-third of the world’s electricity, by 2025.<sup>9</sup> The lifetime ownership cost of electric vehicles for most models in the market right now is approximately \$6,000-\$10,000 less than the cost of owning gasoline cars.<sup>10</sup> Public sentiment on climate change has shifted significantly over time as well. According to a 2020 Yale University survey, 63% of U.S. adults are worried about global warming compared to 52% in 2014.<sup>11</sup> There has also been a proliferation in climate-related lawsuits worldwide, with 1,763 cases pending as of March 2021.<sup>12</sup>

**Responding to the change in public sentiment, many corporations have made net zero carbon emission pledges.** As of September 2020, more than 1,100 businesses with a combined revenue of over \$11.4 trillion (equivalent to more than half of the U.S. GDP) have pledged to be net zero by the end of the century, with the majority aiming for 2050.<sup>13</sup> **Asset owners, asset managers, and banks have made similar pledges.** The Net Zero Asset Owner Alliance is comprised of 35 institutional investors, including several insurers, with assets under management of \$5.5 trillion that have committed to transition their investment portfolios to net zero by 2050.<sup>14</sup> While net zero commitments are not the same as actions, they are a good indication of where the market is headed.

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<sup>4</sup> Rathi, A., et. al., [The World’s Top Energy Agency Reckons With Net-Zero Emissions](#), Bloomberg Green, May 18, 2021.

<sup>5</sup> [Net Zero by 2050 – A Roadmap for the Global Energy Sector](#), the International Energy Agency, May 2021.

<sup>6</sup> [The Inevitable Policy Response 2021: Policy Forecast](#), Principles for Responsible Investment, March 17, 2021. These countries are Argentina, Brazil, Canada, China, France, U.K., Germany, South Africa, Japan, Korea, and the E.U. As of 2020, more than 900 cities have net zero targets as well.

<sup>7</sup> Calma, J., [The UK moves up deadline to ban the sale of combustion-engine vehicles](#), The Verge, November 17, 2020. [Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California’s Fight Against Climate Change](#), CA.gov, September 23, 2020.

<sup>8</sup> [The Inevitable Policy Response 2021: Policy Forecast](#), Principles for Responsible Investment, March 17, 2021.

<sup>9</sup> [Renewables 2020 - Analysis and forecast to 2025](#), International Energy Agency, November 2020.

<sup>10</sup> Harto, C., [Electric Vehicle Ownership Costs: Today’s Electric Vehicles Offer Big Savings for Consumers](#), Consumer Reports, October 2020.

<sup>11</sup> [Yale Climate Opinion Maps 2020](#), Yale Program on Climate Change Communication, September 2, 2020. [Yale Climate Opinion Maps – U.S. 2014](#), Yale Program on Climate Change Communication, April 6, 2015.

<sup>12</sup> [Climate Change Litigation Databases](#), Sabin Center for Climate Change Law at Columbia Law School and Arnold & Porter, accessed on March 23, 2021.

<sup>13</sup> [Net Zero Asset Managers Initiative Triples in Assets Under Management as 43 New Asset Managers Commit to Net Zero Emissions goal](#), NET ZERO ASSET MANAGERS INITIATIVE, accessed on March 29, 2021.

<sup>14</sup> [UNITED NATIONS-CONVENED NET-ZERO ASSET OWNER ALLIANCE](#), UN Environment Programme Finance Initiative, accessed on March 29, 2021.

## Climate Risks have Manifested in the Financial Market and Drawn Regulators' Attention

These transition risk drivers can lead to stranded assets, which “turn out to be worth less than expected as a result of changes associated with the energy transition.”<sup>15</sup> The total value of stranded assets across upstream energy, power generation, industry and buildings under a delayed policy action scenario has been estimated at \$20 trillion.<sup>16</sup> The impacts of transition risk drivers have manifested themselves in the financial market. Fossil fuel companies' stocks have significantly underperformed relative to renewable companies in the past few years, while loan spreads for new coal mines have risen by 65% in the last decade compared to the previous one.<sup>17</sup>

Rating agencies have taken notice, with S&P downgrading several oil producers because of “growing risks from energy transition due to climate change” and those companies' insufficient actions to mitigate these risks.<sup>18</sup> Institutional investors like BlackRock,<sup>19</sup> the largest U.S. pension fund CalPERS,<sup>20</sup> and the largest U.K. corporate defined benefit pension scheme BT Pension Scheme<sup>21</sup> also view climate risks as investment risks.

U.S. federal financial regulators have started to focus on the financial risks from climate change. The Federal Reserve Board recently created a Supervision Climate Committee and a Financial Stability Climate Committee.<sup>22</sup> Globally, central banks and financial supervisors have continued to strengthen their work on climate change. The Network of Central Banks and Supervisors for Greening the Financial System (“NGFS”) has 90 members and 14 observers as of April 2021.<sup>23</sup> The U.K. and New Zealand governments have mandated that large financial institutions and listed companies provide climate-related financial disclosures in accordance with the recommendations of the Task Force on Climate-related Financial Disclosures (“TCFD”).<sup>24</sup> Financial supervisors like the Bank of England and the European Central Bank are also increasingly turning to scenario analysis and stress testing to gauge firms' exposure to the financial risks from climate change.<sup>25</sup>

## Methodology

2DII analyzed the equity and corporate bond investment portfolios of 250 insurers, including health, life, and property and casualty insurers, based on their 2019 Schedule D data. Insurers that held only asset-backed securities, government bonds, and/or mortgage securities as of 2019 were not covered by the analysis. While

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<sup>15</sup> Carbon Tracker Initiative, [Stranded Assets](#), August 23, 2017.

<sup>16</sup> [STRANDED ASSETS AND RENEWABLES - How the energy transition affects the value of energy reserves, buildings and capital stock](#), International Renewable Energy Agency, July 2017.

<sup>17</sup> Calculated with data from Google Finance and [Renewable Energy Producers ETF](#), Global X by Mirae Asset, accessed on March 24, 2021. Webb, D., [Cost of capital for coal soars as renewables debt costs continue to fall](#), Responsible Investor, April 19, 2021.

<sup>18</sup> [The Big Picture on Climate Risk](#), S&P Global, accessed on March 24, 2021.

<sup>19</sup> BlackRock's Global Executive Committee, [Net zero: a fiduciary approach](#), BlackRock Client Letter, accessed on March 22, 2021.

<sup>20</sup> [Climate Change](#), California Public Employees' Retirement System, accessed on May 19, 2021.

<sup>21</sup> BT Pension Scheme, [Responsible Investment Transparency Report 2020](#).

<sup>22</sup> [Kevin Stiroh to Step Down as Head of New York Fed Supervision to Assume New System Leadership Role at Board of Governors on Climate](#), Federal Reserve Bank of New York, January 25, 2021. Governor Lael Brainard, [Financial Stability Implications of Climate Change](#), Board of Governors of the Federal Reserve System, at "Transform Tomorrow Today" Ceres 2021 Conference, Boston, Massachusetts (via webcast), March 23, 2021.

<sup>23</sup> [Membership of NGFS](#), Network for Greening the Financial System, accessed on May 19, 2021.

<sup>24</sup> Holger, D., et. al., [U.K. Requires Companies to Report on Climate Change by 2025](#), Wall Street Journal, November 9, 2020; Azizuddin, K., [New Zealand becomes world's first country to introduce mandatory TCFD disclosure](#), Responsible Investor, September 15, 2020.

<sup>25</sup> [The Bank of England is restarting the Climate Biennial Exploratory Scenario \(CBES\)](#), Bank of England, November 13, 2020. de Guindos, L., [Shining a light on climate risks: the ECB's economy-wide climate stress test](#), the ECB Blog, March 18, 2021.

those three types of fixed income securities are not immune to transition risks,<sup>26</sup> their transition risks are much less severe than those affecting the energy, utilities, manufacturing, and transportation sectors that are the focus of the Study. Of the more than 130,000 individual securities analyzed, nearly 125,000, or 95%, were successfully matched with 2DII's financial data.

**The Study provides an example of a tool that can be used to analyze insurers' transition risks and inform actions that insurers can take to mitigate them.** As the data is from 2019, the results are not intended to reflect the current transition risk exposure of insurers. The exposure and scenario analysis in the Study is based on the open-source [Paris Agreement Capital Transition Assessment](#) ("PACTA") model, which has been used by more than 3,000 financial institutions, governments, supervisory authorities, and industry associations. The model assesses the alignment of investors' and banks' portfolios with different climate scenarios, ranging from business-as-usual to alignment with the Paris Agreement ("Paris-aligned"),<sup>27</sup> and helps us understand the extent to which financial portfolios may be exposed to transition risks arising from those scenarios. **Not preparing for the transition today may increase future losses.**

**PACTA provides a five-year forward-looking, bottom-up analysis that looks at the investment and production plans of investee companies at the physical asset level, and consolidates that information to identify the energy transition profile of the companies and their related financial instruments.** The model measures what companies are doing in terms of their capital planning for the next five years, not what they have pledged to do. PACTA compares what needs to happen in specific sectors to decarbonize in accordance with the Paris Agreement with the companies' plans in those sectors over the next five years. The results are given by sector and sometimes by technology within a sector. For example, the transition risk exposure of an insurer's investments in the oil and gas industry depends on the amount of oil and gas that companies in the insurer's portfolio plan to produce. For the power sector, the exposure depends on the amount of renewables relative to the amount of coal or oil or gas-based electricity that the investee companies plan to produce.

**The PACTA model is available for corporate bonds and listed equity portfolios, and covers eight of the most carbon intensive sectors in the economy – oil and gas, coal mining, power generation, automotive, aviation, shipping, cement, and steel** (the "PACTA sectors"). Together, they are responsible for over 75% of all CO<sub>2</sub> emissions by companies represented in the global equity and corporate bonds markets.<sup>28</sup> In each of these sectors, PACTA focuses on the part of their value chain with the highest impact in terms of CO<sub>2</sub> emissions. For example, in the oil and gas sector, the focus is on upstream activities related to production, while in the power sector the focus is on power generation and related sources of energy.

## Climate Scenarios Used in the Study

The scenarios used in the PACTA analysis are:

a. **For Fossil Fuel Production and Power Generation:**

The following scenarios are taken from the IEA's World Energy Outlook ("WEO") 2020 publication.<sup>29</sup>

- i. Current Policy Scenario (CPS): This is a business-as-usual scenario based on policies that currently exist. It equates roughly to a  $\geq 3.2^{\circ}\text{C}$  global average temperature rise by 2100.

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<sup>26</sup> For more information on the transition risks of these securities, see Cevik, S., *et. al.*, [This Changes Everything: Climate Shocks and Sovereign Bonds](#), IMF Working Paper, June 5, 2020; Schwartzkopff, F., *et. al.*, [Sovereign Rating Cuts Coming to Those Who Ignore the Climate](#), Bloomberg Green, March 17, 2021; St. Peter, E., [Climate-Related Muni Bond Risk: A Q&A with Breckinridge Capital Advisors](#), University of Pennsylvania Wharton Business School, January 8, 2020; and Reid, B., [Measuring Climate Risk in Real Estate Portfolios](#), MSCI, July 8, 2020.

<sup>27</sup> [PACTA / Climate Scenario Analysis Program](#), 2-Degrees Investing Initiative, accessed on May 19, 2021.

<sup>28</sup> This high-level estimate by 2DII is based on the World Resources Institute's greenhouse gas emissions data.

<sup>29</sup> [World Energy Outlook 2020](#), International Energy Agency, October 2020.



- ii. Stated Policy Scenario (STEPS): This scenario assumes that announced policies will be implemented in the future. It equates roughly to a 2.7°C global average temperature rise by 2100.
- iii. Sustainable Development Scenario (SDS): This scenario looks to achieve the goals set out in the United Nations Sustainable Development Goals. It equates roughly to a 1.75 – 2°C global average temperature rise by 2100. **This scenario is Paris-aligned.**

**b. For Automotive:**

The following scenarios are taken from the IEA’s Energy Technology Perspectives (“ETP”) 2017 publication.<sup>30</sup>

- i. Reference Technology Scenario (RTS): This is a business-as-usual scenario. It equates roughly to a ≥ 3.2°C global average temperature rise by 2070.
- ii. 2 Degrees Scenario (2DS): This scenario aims to limit global average temperature rise to 2°C by 2100.
- iii. Beyond 2 Degrees Scenario (B2DS): This scenario aims to limit global average temperature to ≤ 1.75°C by 2100. **This scenario is Paris-aligned.**

Low-carbon technology pathways to achieve the 2 Degrees Scenario have not been established for the steel, cement, aviation, and shipping industries. As a result, the Study merely analyzes insurers’ holdings in these industries as a percentage of their overall equity and corporate bond portfolios.

## Analysis Findings

### The Study shows that:

- **New York domestic insurers’ investments in 2019 had meaningful exposure to carbon intensive sectors.**
- **The five-year forward-looking capital plans of most insurers’ investee companies in these sectors were not Paris-aligned, except for natural gas production, natural gas-fired power generation, and electric vehicle production.**
- **In many cases, insurers’ portfolios were less Paris-aligned than market benchmarks (i.e., iShares Global Corp bond UCITS ETF<sup>31</sup> for corporate bonds and iShares MSCI ACWI ETF<sup>32</sup> for equities).**

**Carbon intensive sectors make up about 11% of all insurers’ assets in equities and fixed income** (inclusive of government bonds and other fixed income securities), or 17.2% of their holdings in equities and corporate bonds. **Life insurers’ exposure to these sectors in their corporate bond portfolios was 20%**, which was much larger than the corresponding exposure of P&C and health insurers. This is due in large part to life insurers’ greater exposure to power generation. This is not surprising given that electric utility companies have long-dated assets funded through the issuance of long-dated bonds, which match the long duration of life insurers’ liabilities. This can be seen in *Figure 0.1* and *Figure 0.2*.

<sup>30</sup> [Energy Technology Perspectives 2017](#), International Energy Agency, June 2017.

<sup>31</sup> [iShares Global Corp Bond UCITS ETF](#), iShares by BlackRock, accessed on March 29, 2021.

<sup>32</sup> [iShares MSCI ACWI ETF](#), iShares by BlackRock, accessed on March 29, 2021.

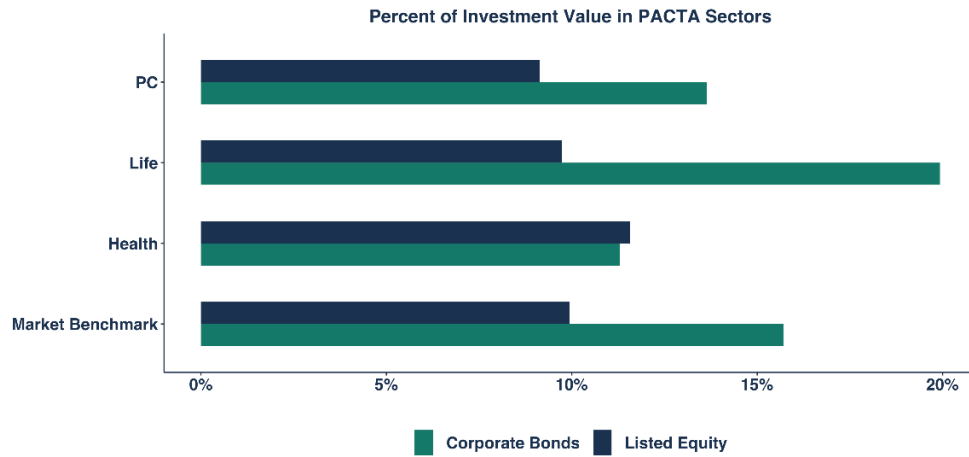


Figure 0.1. Percentage of Investments in the PACTA Sectors for Corporate Bonds and Listed Equities Holdings

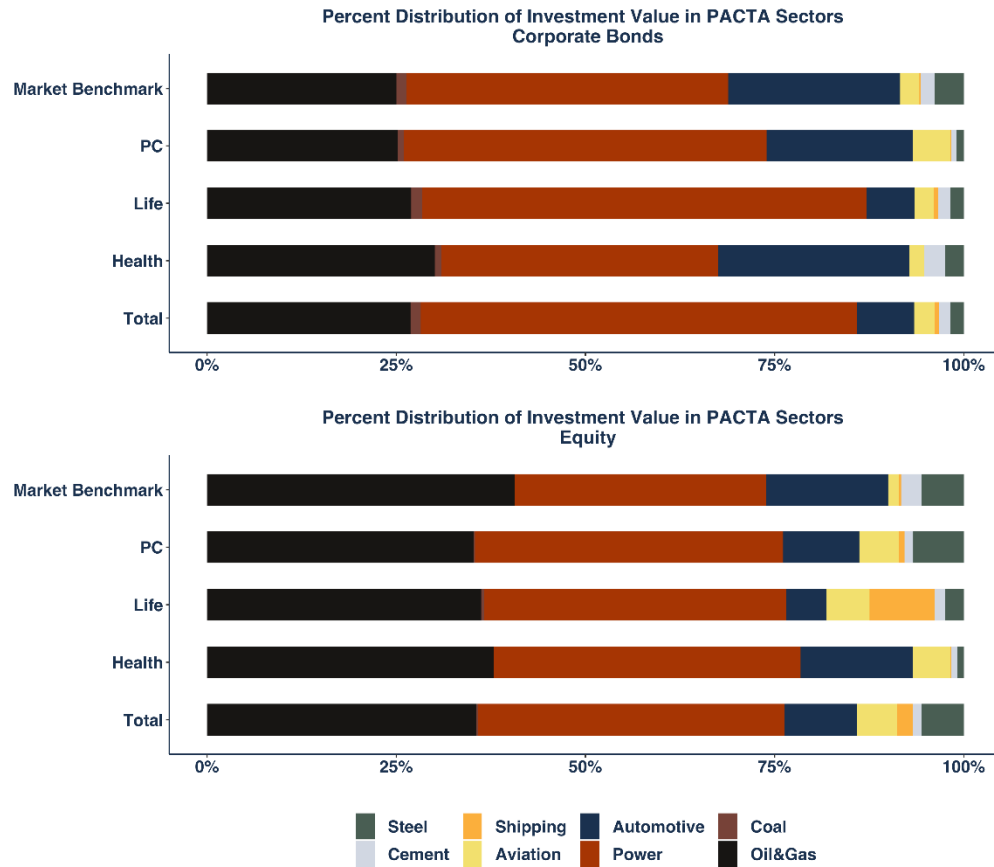


Figure 0.2. Percent Distribution of Investment Value in the PACTA Sectors

**Exposure to high-carbon technologies varies dramatically among individual insurers.** Figure 0.3 shows insurers' holdings in fossil fuel production as a percentage of their corporate bond and equity portfolios. Each vertical line represents one insurer. The color of the line reflects the insurance segment – Health, Life, or P&C. **While most**

insurers had single-digit exposures to the fossil fuel sector, multiple P&C insurers and a few Life insurers had exposures that were significantly higher. One Life entity was exposed more than 50% and one P&C entity was exposed more than 40% in their corporate bond portfolios, while one P&C insurer had all its equity investments in the fossil fuel sector.

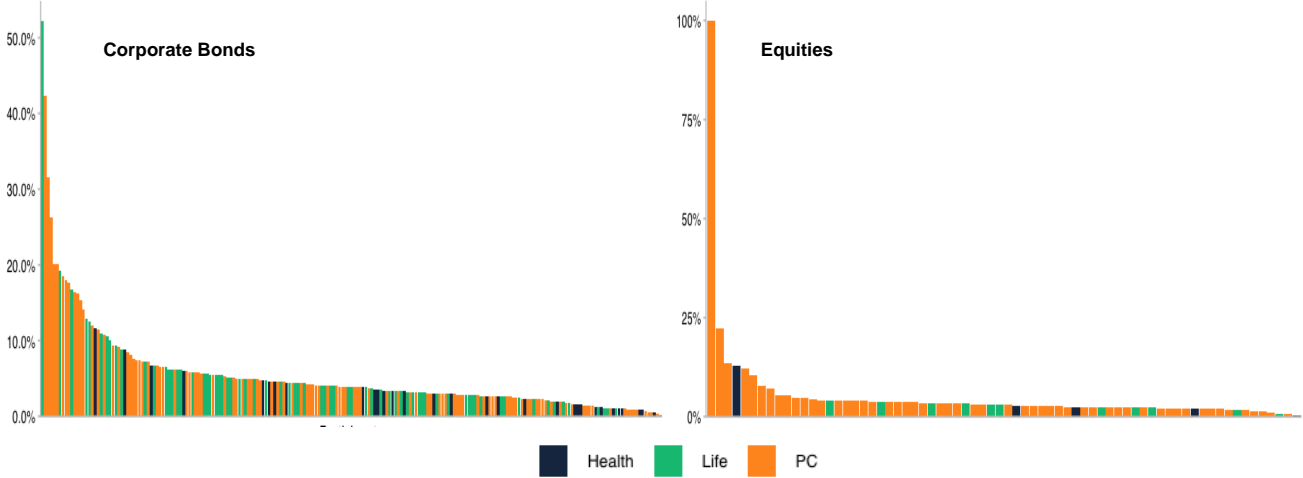


Figure 0.3. Peer Comparison of Insurers’ Holdings in Fossil Fuel Production (Coal, Oil, and Gas Production) as a Percentage of the Corporate Bond and Equity Portfolios

Going beyond the percentage holdings of carbon intensive sectors, the picture of insurers’ investments in high- and low-carbon technologies (“technology mix,” see *Table 0.1*) and their alignment with the Paris Agreement was somewhat mixed. **For fossil fuel production, while the five-year capital plans of gas production by the companies that insurers invested in were Paris-aligned, the five-year capital plans of coal and oil production were not.** For example, the alignment of coal production in the insurers’ corporate bond portfolios relative to the various climate scenarios is shown in *Figure 0.4*.

*Figure 0.4* depicts the production volume trajectory metric, which measures the alignment of a portfolio’s projected production volume over the next five years with the production volume ranges set as targets in different climate scenarios. The Y-axis shows the normalized production capacity planned for the next five years, with the current capacity represented as 1. The solid line in the figure represents the change in production volume of the insurer’s portfolio, while the dotted line represents the change in production volume of the market benchmark (i.e., iShares Global Corp bond UCITS ETF for corporate bonds and iShares MSCI All Country World Index ETF for equities), between 2020 and 2025. The colored areas represent the production volume ranges that are compatible with different climate scenarios. The colored area(s) that any given production volume trajectory falls in indicates the climate scenario with which that production volume is aligned. As shown in *Figure 0.4*, the five-year capital plans of coal production by insurers’ investee companies were aligned with a >3.2°C scenario.

	High-Carbon Technologies	Low-Carbon Technologies
<b>Power Generation</b>	Coal, oil, and gas-fired power plants	Renewable power (solar, wind)
<b>Transportation</b>	Internal combustion engine vehicles	Hybrid and electric vehicles

Table 0.1. Technology Mix – High- and Low-Carbon Technologies for Carbon Intensive Sectors

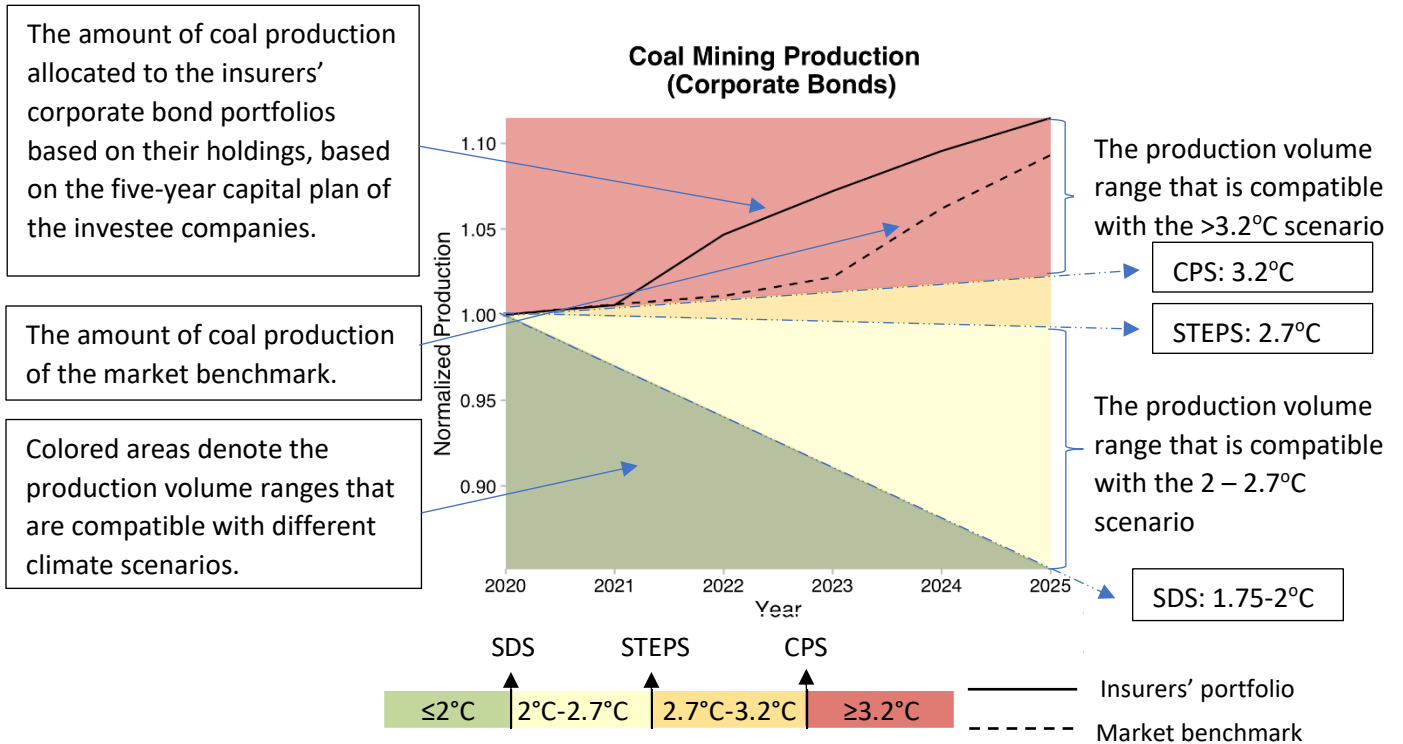


Figure 0.4. Alignment of Coal Production in the Corporate Bond Portfolio Relative to the IEA Transition Scenarios

For power generation, the technology mix and the projected trajectories of production volume for high- and low-carbon technologies over the next five years (“production volume trajectories”) tell a similar story. **Insurers were overinvested in coal and oil-fired power generation and underinvested in renewables, while their investments in gas-fired power generation were Paris-aligned (see Figure 0.5). For coal-fired power generation, while the rate of reduction by the utility companies that insurers invested in was fast enough to be Paris-aligned (see Figure 0.6), the size of coal-fired power generation relative to other forms of power generation was too large to be Paris-aligned (see Figure 0.5).** See the box below for a comparison of the different metrics used to measure climate scenario alignment.

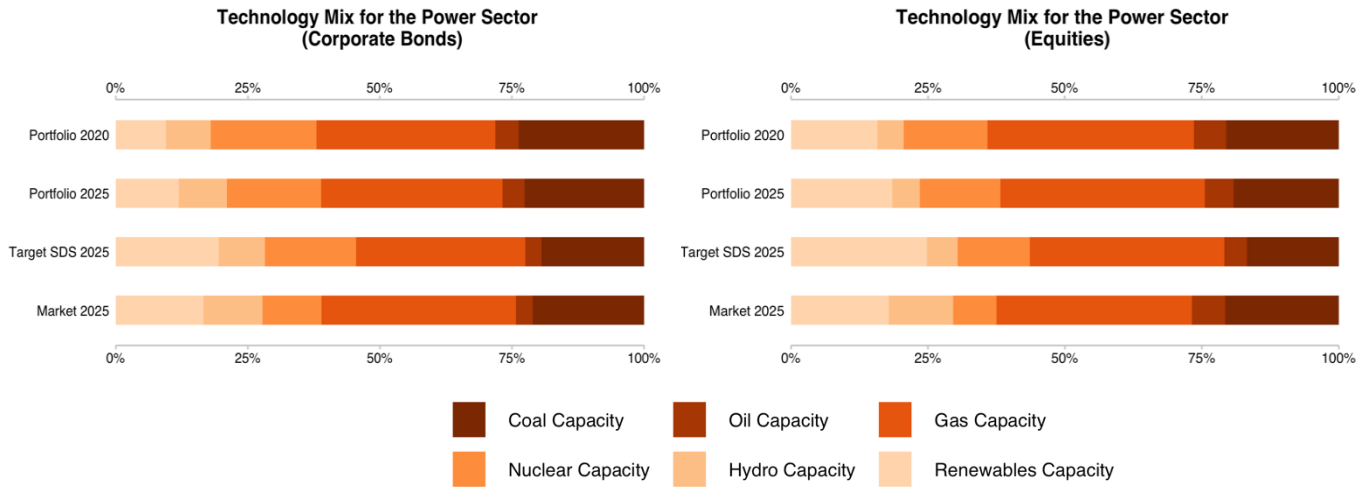


Figure 0.5. High-Carbon and Low-Carbon Technology Mix for the Power Sector

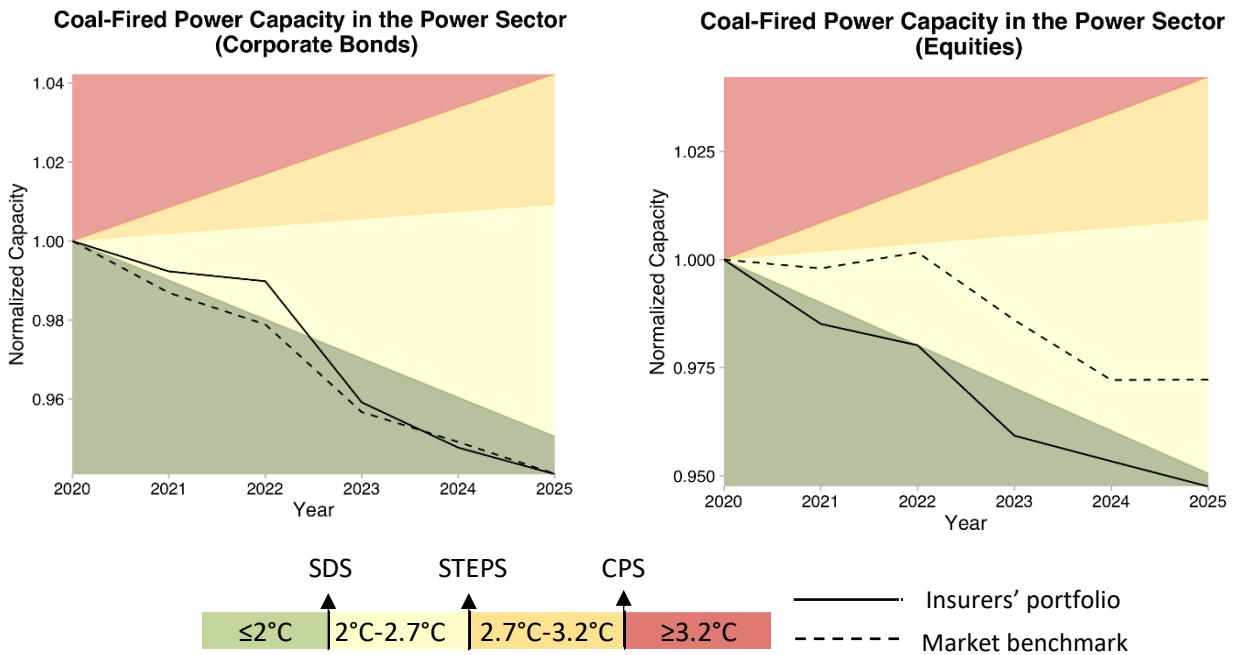


Figure 0.6. Coal-Fired Power Production Volume Trajectories Relative to Climate Scenarios

For transportation, although insurers invested sufficiently in electric vehicles to be Paris-aligned, they underinvested in hybrid vehicles and overinvested in internal combustion vehicles.

When insurers underinvest in low-carbon technologies, they miss out on many of the opportunities that arise from the transition. This means that the potential loss in returns from carbon intensive technologies are unlikely to be offset by the potential increase in returns from low-carbon technologies.

Table 0.2 summaries insurers’ investments in high- and low-carbon technologies and their alignment with the Paris Agreement. For example, for coal power generation under “Technology Mix Relative to Paris Goal”/“Corporate bonds,” “too much” means that the ratio of coal power generation to low-carbon power generation planned by the investee companies in insurers’ corporate bond portfolios was too high to be Paris-aligned. The “<2°C” in the same row under “Implied Temperature by Production Volume Trajectory”/“Corporate bonds” means that the production volume planned by insurers’ investee companies in coal power generation for the next five years is sufficiently small relative to the total amount of electricity that can be generated by coal to be Paris-aligned. The two metrics (technology mix and production volume trajectory) illustrate different aspects of climate scenario alignment and can provide different answers. The box below entitled “Different Metrics of Measuring Climate Scenario Alignment” provides a more detailed explanation of the differences.

	Technology Mix Relative to Paris Goal		Technology Mix Relative to Market Benchmark		Temperature Scenario with which Production Volume Trajectory is Aligned		Paris-Alignment of Production Volume Trajectory Relative to Market Benchmark	
	Corporate bonds	Equities	Corporate bonds	Equities	Corporate bonds	Equities	Corporate bonds	Equities
Coal production					>3.2°C	>3.2°C	Worse	Worse
Oil production					2.7-3.2°C	2.7-3.2°C	Better	Worse
Natural gas production					<2°C	<2°C	Better	Worse
Coal power generation	Too much	Too much	Slightly more	Slightly less	<2°C	<2°C	Similar	Better
Oil power generation	Too much	Too much	Slightly more	Slightly less	>3.2°C	>3.2°C	Worse	Better
Natural gas power generation	Sufficient	Sufficient	Similar	Similar	<2°C	<2°C	Can be greater	Can be greater
Renewable power generation	Too little	Too little	Less	Similar	>3.2°C	>3.2°C	Similar	Worse
Electric vehicles	Sufficient	Sufficient	Similar	Similar	1.75-2°C	1.75-2°C	Similar	Similar
Hybrid vehicles	Too little	Too little	Less	Less	>3.2°C	>3.2°C	Similar	Similar
Internal combustion engine vehicles	Too much	Too much	Slightly less	Slightly less	2.7-3.2°C	2.7-3.2°C	Similar	Similar

Table 0.2. Summary of Technology Mix and Production Volume Trajectory Alignment Relative to the Paris Agreement Goal and Market Benchmarks

## DIFFERENT METRICS OF MEASURING CLIMATE SCENARIO ALIGNMENT

The technology mix metric and the production volume trajectory metric both provide an indication of how aligned the investee companies' capital plans are with the Sustainable Development Scenario. However, they differ in that the technology mix metric is a measure of the relative amounts invested in different climate-relevant technologies within an investor's portfolio, while the production volume trajectory measures whether the rate of change in the production amount is sufficient to meet the Sustainable Development Scenario. For example, it is possible that renewable power generation makes up a large portion of an investor's portfolio relative to carbon intensive power generation, resulting in a portfolio that is aligned with the Sustainable Development Scenario from a technology mix perspective. Yet the rate of increase of renewable power generation may be too small to meet the same scenario from a production volume trajectory perspective.

Translating this to monetary terms, if the economy were to follow the Sustainable Development Scenario, then the power generation portion of the insurer's investment might not be negatively affected but the upside from the investment in renewable power generation would be limited. In other words, there would be an opportunity cost as the investor is not financing the required increase in renewables.

The global economy reflected by the equity and bond markets is not yet Paris-aligned. In that case, how much room is there for insurers to adjust their investments and reduce their transition risk exposure? This can be analyzed by comparing the alignment of their investments with those of market benchmarks. On power generation, insurers underinvested in renewables compared to the market benchmark for corporate bonds. Therefore, even the simple act of bringing their portfolios in line with market benchmarks would reduce insurers' transition risk exposure. This is especially true for coal production in both corporate bond and equity investments, where the production volume trajectories were aligned with a >3.2°C world and worse than the market benchmarks.<sup>33</sup>

To help insurers assess, and develop strategies to mitigate, their exposure to transition risks, DFS also requested that 2DII generate individual reports for insurers covered by the Study, which will be shared with each such insurer. Any insurer can create its own report by uploading its bond and equity positions into the open-source [PACTA model](#). In addition to the analysis set forth in the Study, individual reports include information on investee companies that have the biggest influence on an insurer's portfolio's technology mix and production volume trajectory. This information could help an insurer in its efforts to mitigate its exposure to transition risks, such as identifying priority investee companies that are most misaligned with a 2°C scenario for potential engagement, as described below.

### Strategies for Mitigating Transition Risks

Insurers can use several investment-related strategies to mitigate their exposure to transition risks, including:

- **Divestment:** selling instruments from issuers in carbon intensive sectors who are not making the low-carbon transition or are not transitioning fast enough.

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<sup>33</sup> Obviously, an investment decision requires many considerations, including price, liquidity, and asset-liability matching, which may prevent insurers from matching the market benchmark.

- **Investment:** investing in issuers whose businesses support the low-carbon transition, such as renewables and electric vehicles, or in their suppliers. Green bonds are one type of fixed income instrument whose proceeds are earmarked for climate-related or environmental projects.<sup>34</sup>
- **Exclusion:** systematically excluding issuers with high climate risks based on a set of criteria, which can come in the form of thresholds (e.g., excluding companies that derive more than 10% of their revenue from mining thermal coal or account for more than 1% of total global production), a theme (e.g., excluding construction of new and improvements to existing coal-fired thermal power plants), or an industry (e.g., excluding thermal coal producers).
- **Engagement:** using their power as investors to influence corporate behavior on climate-related topics. Forms of engagement may include direct corporate engagement (e.g., communication with company boards and senior management), proxy voting, and filing or co-filing shareholder proposals.
  - o Although insurers are primarily bond investors that, unlike equity investors, do not have proxy voting rights, engagement is still possible. Bondholders provide capital to corporations and often have a direct line of access and communication to management. They can express their views on climate-related topics during the underwriting process by incorporating certain contractual provisions in the financing documentation prior to any new issuance.<sup>35</sup> As bonds frequently need to be refinanced at maturity, bondholders potentially have a lot of leverage over the companies they invest in if they choose to reinvest only if the companies undertake certain practices.<sup>36</sup> Bond investors can also link the interest rate of a bond to certain covenants and climate-related key performance indicators, as with sustainability-linked bonds (see below).
  - o Although this strategy may be more effective for insurers with large allocations at bond issuance, smaller insurers can band together, either directly or through industry networks or their asset managers, to implement this strategy.
- **Setting climate-related investment conditions:** including climate-related factors as part of the contractual conditions of a financial instrument. These conditions seek to influence the climate performance of issuers to reduce their potential risk exposure. Sustainability-linked bonds are one such example where “the financial and/or structural characteristics can vary depending on whether the issuer achieves predefined sustainability/ESG objectives.”<sup>37</sup> These objectives must be science-based and the financial and/or structural characteristics must be material to ensure performance change in borrowers and avoid greenwashing.<sup>38</sup>

As stated in DFS’s proposed [Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change](#), DFS is focused on the financial stability of insurers in the face of climate change. While insurers are expected to understand and manage their exposure to climate-related financial risks, DFS does not dictate insurers’ investment activities. In addition, each insurer should take a proportionate approach to managing climate risks that reflects its unique exposure and the nature, scale, and complexity of its business. Accordingly, the strategies outlined above are provided as potential options for insurers to evaluate and may not be applicable to all insurers. When evaluating any transition risk mitigation strategy, insurers should consider financial returns and asset-liability matching, among other factors. Insurers that outsource their investment function to third-party

<sup>34</sup> [Explaining green bonds](#), Climate Bonds Initiative, accessed on May 26, 2021.

<sup>35</sup> Phillips, Y., [No voting rights? Engagement still matters in fixed income](#), Russell Investment Blog, August 4, 2020.

<sup>36</sup> Inderst, G., et. al., [Incorporating ENVIRONMENTAL, SOCIAL and GOVERNANCE \(ESG\) Factors into FIXED INCOME INVESTMENT](#), World Bank Group publication, April 2018.

<sup>37</sup> International Capital Market Association, [Sustainability-Linked Bond Principles Voluntary Process Guidelines](#), June 2020.

<sup>38</sup> Hurley, M., [Nuveen: Sustainability-linked bonds fail our impact credibility test](#), Environmental Finance, May 25, 2021.



asset managers can request that the asset managers evaluate and, if appropriate, adopt any of these strategies on their behalf. Insurers are also encouraged to reach out to networks like the Principles for Responsible Investment, Net Zero Asset Owner Alliance, and Climate Action 100+ to learn more about what they can do individually and collectively to mitigate transition risks.

## Conclusion

Based on their 2019 Schedule D data and the methodologies used in the Study, in the aggregate, **insurers' assets were meaningfully exposed to transition risks.** There are several tools available to help insurers analyze their transition risks and inform actions that they can take to mitigate them. The Study provides one example and outlines investment-related strategies that insurers can consider to mitigate their transition risk exposure.

## QUESTIONS ANSWERED IN THE STUDY

The Study allows insurers to answer the following questions to understand their exposure to transition risks and opportunities, listed from the simplest to the most nuanced:

1. **What holdings in my portfolio are most exposed to transition risks and how much do they comprise of my total portfolio?** These questions can be answered by categorizing the holdings by sectors/industries and quantifying the percentage of carbon intensive sectors/industries as part of the total portfolio, as shown in *Figure 0.1* and *Figure 0.2*.
2. **Some of my holdings in carbon intensive industries are transitioning already by making investments in renewables or electric vehicles. Some have even set net zero carbon emission targets. How do these investments or commitments affect my exposure to transition risks and opportunities?** PACTA does not consider whether a company has net zero targets. It looks at the company's production plans, which are based on the physical assets that it owns and plans to build. PACTA answers this question by comparing the technology mix of the investee companies with those of the market benchmark (iShares Global Corp bond UCITS ETF for corporate bonds and iShares MSCI ACWI ETF for equities) and what is needed to achieve Paris Agreement goals. *Figure 0.5* shows the technology mix for corporate bonds and equities in the power sector. The results of other carbon intensive sectors are also summarized in *Table 0.2*.
3. **There are multiple scenarios covering whether the world would transition towards a low-carbon economy. With which scenario is my portfolio aligned?** This can be answered by plotting the production volume trajectories for high- and low-carbon technologies against the trajectories needed to meet different climate/temperature scenarios. The production volume trajectories are produced based on the capital plans of insurers' investee companies for the next five years. *Figure 0.4* gives the example of coal production. The temperature scenarios that the production volume trajectories of various technologies of the carbon intensive sectors fall under are also summarized in *Table 0.2*.

A separate but related question is: **How does the transition risk exposure of my holdings compare to those of the market benchmarks and my peers?** The aggregate data includes the results of market benchmarks. A peer comparison is provided in *Figure 0.3* for insurers' holdings in the fossil fuel sectors as a percentage of their corporate bond and equity portfolios. Peer comparison can also be done by comparing the results in the individual report for each insurer covered in the Study and the aggregate data. DFS will provide the individual reports to the relevant insurers.

Lastly, in Section 4. Strategies for Mitigating Transition Risks, the report offers options to respond to the question: **How can I mitigate the transition risks in my portfolio?** The individual reports that will be shared with insurers also answers the question: **Which companies are driving the results of my exposure and alignment?**

# 1. Introduction

As one of the most critical risk-management issues of our generation, climate change poses wide-ranging and material risks to the financial system. This is especially true for the insurance industry, where the physical and transition risks resulting from climate change affect both sides of insurers' balance sheets—assets and liabilities—as well as their business models. Climate change also presents tremendous opportunities for insurers, which play a critical role in the management of climate risks in their capacity as risk managers, risk carriers, and investors.

In September 2020, the New York State Department of Financial Services (“DFS”) issued Insurance Circular Letter No. 15 (2020) on [Climate Change and Financial Risks](#) outlining its expectation that insurers start integrating the consideration of the financial risks from climate change (“climate risks”) into their governance frameworks, risk management processes, and business strategies, and start developing a climate risk disclosure framework. Since then, the U.S. has continued to experience a series of devastating natural disasters. 2020 tied with 2016 as the hottest year on record.<sup>39</sup> In 2020, there were 22 weather/climate disaster events in the U.S. with losses exceeding \$1 billion each, more than twice the average number of annual billion-dollar disasters for the 2010s and more than three times the corresponding figure for the 2000s.<sup>40</sup> The unseasonable February freeze in 2021 in Texas led to massive electricity generation failure, related shortages of water, food, and heat, and estimated property damage in excess of \$195 billion.<sup>41</sup>

Unless society makes major changes, this worsening trend is going to continue and likely accelerate as a result of the feedback loops caused by the warming: the ice sheet melt that allows the Earth to absorb more heat; the thawing of permafrost, which releases methane, a gas with 21 times the global warming potential of carbon dioxide (“CO<sub>2</sub>”); more intensive fire seasons resulting in the release of more CO<sub>2</sub>; and Amazon rainforests starting to emit rather than absorb carbon due to drought, higher temperatures, and deforestation.<sup>42</sup> The goal of the Paris Agreement, which was signed by 196 countries, is to “limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.”<sup>43</sup> We are likely to reach the 1.5°C warming limit within a decade.<sup>44</sup>

## 1.1. The Low-Carbon Transition Is Accelerating

While the physical risks from climate change continue to worsen, risks arising out of the low-carbon transition are also accelerating as a result of three primary transition risk drivers: policy and regulation changes, low-carbon technology advancement, and changing public sentiment and demand patterns. The International Energy Agency's most recent global energy roadmap, which is used by countries and corporations to plan for energy investments,<sup>45</sup> forecasts that coal, oil, and gas demand will fall by 98%, 75%, and 55%, respectively, between 2020 and 2050.<sup>46</sup> Examples of key milestones in the IEA pathway to net-zero emissions include ensuring that all new buildings are zero-carbon-ready and that 60% of global car sales are electric by 2030. Insurers may be exposed to

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<sup>39</sup> Thompson, A., [NASA Says 2020 Tied for Hottest Year on Record](#), Scientific American, January 14, 2021.

<sup>40</sup> National Oceanic and Atmospheric Administration, [Billion-Dollar Weather and Climate Disasters: Overview](#), accessed on March 15, 2021.

<sup>41</sup> Ivanova, I., [Texas winter storm costs could top \\$200 billion — more than hurricanes Harvey and Ike](#), CBS News, February 25, 2021.

<sup>42</sup> [2020 Tied for Warmest Year on Record, NASA Analysis Shows](#), The National Aeronautics and Space Administration, January 14, 2021. Harvey, F., [Tropical forests losing their ability to absorb carbon, study finds](#), the Guardian, March 4, 2020.

<sup>43</sup> [The Paris Agreement](#), United Nations Climate Change, accessed on April 18, 2021.

<sup>44</sup> Hausfather, Z., [Analysis: When might the world exceed 1.5C and 2C of global warming?](#), December 4, 2020.

<sup>45</sup> Rathi, A., et al., [The World's Top Energy Agency Reckons With Net-Zero Emissions](#), Bloomberg Green, May 18, 2021.

<sup>46</sup> [Net Zero by 2050 – A Roadmap for the Global Energy Sector](#), the International Energy Agency, May 2021.

these transition risks, as well as the opportunities presented by these risks, on the asset side through their holdings of corporate bonds and equities.

### 1.1.1. Transition Risk Driver – Policy and Regulation Change

On the day of his inauguration, President Biden issued an executive order beginning the 30-day process for the U.S. to rejoin the Paris Agreement, which is signed by 196 countries committed to keeping global temperature rise within the century to well below 2°C above pre-industrial levels. The goals of the January 27, 2021 executive order include **a carbon-free power sector by 2035 and a net-zero economy for the U.S. by 2050.**<sup>47</sup> On April 22, 2021, Earth Day, the Biden administration announced a new target for the U.S.: “a 50-52 percent reduction from 2005 levels in economy-wide net greenhouse gas pollution in 2030.”<sup>48</sup> **U.S. Treasury Secretary Janet Yellen created a new Treasury climate “hub”** to examine financial system risks arising from climate change and related tax policy incentives and has called climate change an “existential threat.”<sup>49</sup> Climate change and its potential impact on financial stability were discussed at a Financial Stability Oversight Council meeting on March 31, 2021 with members publicly indicating their support for the Council to explore the issue of climate change.<sup>50</sup>

**Globally, governments are taking climate measures.** As of March 2021, ten G20 jurisdictions have announced net zero greenhouse gas emission targets.<sup>51</sup> China, the largest emitting country in the world, plans to launch a national emission trading scheme by the end of June 2021, which means that one-fifth of all global emissions will fall under a tax or trading scheme.<sup>52</sup> Canada plans to increase carbon prices by CAN\$15 per metric ton per year after 2022 through 2030,<sup>53</sup> which means that the price could reach CAN\$170 (approximately US\$136) per metric ton by 2030. The U.K. and Germany have plans to phase out coal by 2024 and 2038, respectively. On the transportation front, the U.K. government has planned to ban the sale of new combustion-engine vehicles by 2030,<sup>54</sup> and California has announced a similar ban by 2035.<sup>55</sup> In July 2020, a group of 15 U.S. states and the District of Columbia signed a joint memorandum of understanding aimed at boosting the market for electric medium- and heavy-duty vehicles and phasing out diesel-powered trucks by 2050.<sup>56</sup>

**Further policy changes are likely in the pipeline.** Principles for Responsible Investment, which had 3,038 signatories with \$103.4 trillion assets under management as of the end of 2020 (including 38 insurance companies),<sup>57</sup> recently analyzed likely policy responses to achieve the Paris Agreement. It estimated that the U.S. would announce a national carbon pricing system by 2025, and perhaps even as early as 2023, with the goal of reaching a carbon price of at least \$65 per metric ton by 2030, and implementing a binding and credible 100%

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<sup>47</sup> [FACT SHEET: President Biden Takes Executive Actions to Tackle the Climate Crisis at Home and Abroad, Create Jobs, and Restore Scientific Integrity Across Federal Government](#), the White House, January 27, 2021.

<sup>48</sup> [FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies](#), the White House, April 22, 2021.

<sup>49</sup> Warmbrodt, Z., [Yellen names Treasury climate czar](#), Politico, April 19, 2021.

<sup>50</sup> Lang, H., [Yellen's priorities at FSOC: Climate risk, hedge funds, bond market](#), American Banker, March 31, 2021.

<sup>51</sup> [The Inevitable Policy Response 2021: Policy Forecast](#), Principles for Responsible Investment, March 17, 2021. These countries are Argentina, Brazil, Canada, China, France, U.K., Germany, South Africa, Japan, Korea, and the E.U. As of 2020, more than 900 cities have net zero targets as well.

<sup>52</sup> Murtaugh, D., [China's Carbon Market to Grow to \\$25 Billion by 2030, Citi Says](#), Bloomberg Green, March 8, 2021.

<sup>53</sup> [A Healthy Environment and a Healthy Economy](#), Government of Canada, March 8, 2021.

<sup>54</sup> Calma, J., [The UK moves up deadline to ban the sale of combustion-engine vehicles](#), The Verge, November 17, 2020.

<sup>55</sup> [Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California's Fight Against Climate Change](#), CA.gov, September 23, 2020.

<sup>56</sup> Shepardson, D., [15 U.S. states to jointly work to advance electric heavy-duty trucks](#), Reuters, July 14, 2020.

<sup>57</sup> [About the PRI](#), Principles for Responsible Investment, accessed on March 22, 2021.

clean power standard by 2040.<sup>58</sup> It also estimated that China, France, Germany, Italy, and Korea will prohibit the sale of fossil fuel cars and vans by 2035.

While delayed policy actions might lead to smaller transition risks in the short term when compared to immediate policy actions, **stranded assets** – which “turn out to be worth less than expected as a result of changes associated with the energy transition”<sup>59</sup> – **could be three times higher in a Delayed Policy Action scenario** than in a scenario with accelerated renewable energy and energy efficiency deployment.<sup>60</sup>

### 1.1.2. Transition Risk Driver – Low-Carbon Technology Advancement

Low-carbon technologies have been advancing rapidly in the past few decades. Renewables have now reached a price point where many consumers are using them to replace fossil fuel-based power generation. According to the International Energy Agency, **solar and onshore wind are already the cheapest ways to add new electricity-generating plants** in most countries, and renewables are set to account for 95% of the net increase in global power capacity through 2025.<sup>61</sup> **Renewables** are expected to overtake coal to become the largest source of electricity generation worldwide, **supplying one-third of the world’s electricity, by 2025.**

In addition to the drastic reduction in cost of renewable electricity generation, **the lifetime ownership costs of the nine most popular electric vehicles** in the market under \$50,000 are estimated to be **lower by many thousands of dollars** relative to those of comparable internal combustion engine vehicles, with most electric vehicles offering savings of between \$6,000 and \$10,000.<sup>62</sup>

### 1.1.3. Transition Risk Driver – Changes in Public Sentiment and Demand Patterns

**The public sentiment on climate change has shifted significantly over time.** According to a 2020 Yale University Climate Opinion Survey, 72% of U.S. adults think that global warming is happening compared to 63% in 2014, and 63% are worried about global warming compared to 52% in 2014.<sup>63</sup> According to a recent survey by the global consulting firm McKinsey & Company, more than 50 percent of respondents said that they were “really worried” about climate change and roughly a third said that they were planning to reduce their air travel because of climate concerns.<sup>64</sup>

**Worldwide there has been a proliferation in climate-related lawsuits,** with 1,763 cases pending as of March 23, 2021.<sup>65</sup> While many of these lawsuits are directed at governments, fossil fuel companies are often targeted as well. For example, in February 2021, the City of Annapolis filed a lawsuit against BP, Chevron, and other fossil fuel companies seeking damages and other relief based on the companies’ alleged concealment of information about their products’ contribution to climate change.<sup>66</sup> In September 2020, Hoboken sued ExxonMobil, other large oil

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<sup>58</sup> [The Inevitable Policy Response 2021: Policy Forecast](#), Principles for Responsible Investment, March 17, 2021.

<sup>59</sup> Carbon Tracker Initiative, [Stranded Assets](#), August 23, 2017.

<sup>60</sup> [STRANDED ASSETS AND RENEWABLES - How the energy transition affects the value of energy reserves, buildings and capital stock](#), International Renewable Energy Agency, July 2017.

<sup>61</sup> [Renewables 2020 - Analysis and forecast to 2025](#), International Energy Agency, November 2020.

<sup>62</sup> Harto, C., [Electric Vehicle Ownership Costs: Today’s Electric Vehicles Offer Big Savings for Consumers](#), Consumer Reports, October 2020.

<sup>63</sup> [Yale Climate Opinion Maps 2020](#), Yale Program on Climate Change Communication, September 2, 2020. [Yale Climate Opinion Maps – U.S. 2014](#), Yale Program on Climate Change Communication, April 6, 2015.

<sup>64</sup> [How airlines can chart a path to zero-carbon flying](#), McKinsey & Company, May 13, 2020.

<sup>65</sup> [Climate Change Litigation Databases](#), Sabin Center for Climate Change Law at Columbia Law School and Arnold & Porter, accessed on March 23, 2021.

<sup>66</sup> [City of Annapolis v. BP p.l.c.](#), Climate Change Litigation Database, accessed on March 23, 2021.

companies, and the American Petroleum Institute for misinformation related to climate change and its devastating impact on Hoboken.<sup>67</sup>

**Responding to the change in public sentiment, many corporations have made net zero carbon emission pledges,** including Ford, Microsoft, and IKEA.<sup>68</sup> Net zero carbon emission means that a company will not be a net greenhouse gas emitter and is typically achieved by using renewable energy and offsetting any greenhouse gas emissions that cannot be avoided. Even major fossil fuel producers, such as BP and Shell, have committed to be net zero by 2050.<sup>69</sup> As of September 2020, 1,101 businesses with a combined revenue of over \$11.4 trillion (equivalent to more than half of the U.S. GDP) have pledged to be net zero by the end of the century, with the majority aiming for 2050.<sup>70</sup>

**Asset owners, asset managers, and banks have made similar pledges.** The Net Zero Asset Owner Alliance is a group of 35 institutional investors with assets under management of \$5.5 trillion that have committed to transition their investment portfolios to net zero by 2050.<sup>71</sup> Its members include insurers like Allianz, Aviva, AXA, Munich Re, QBE, SCOR, Swiss Re, and Zurich Insurance Group. The Net Zero Asset Managers Initiative has 73 signatories representing \$32 trillion in assets under management, 36% of total global assets under management, with members like BlackRock and Vanguard.<sup>72</sup> Signatories must implement a stewardship and engagement strategy with a clear escalation and voting policy consistent with the 2050 net zero goal.<sup>73</sup> Several insurers' asset management arms are signatories.<sup>74</sup> Six major U.S. banks have committed to net zero for their operations and the projects and companies that they finance by 2050.<sup>75</sup> At least 65 insurers (including those in the Net Zero Asset Owner Alliance) with combined investments worth \$12 trillion — more than 40% of the industry's total assets — have either adopted a divestment policy or committed to making no new coal investments.<sup>76</sup>

**While net zero commitments are not the same as actions,<sup>77</sup> they are a good indication of where the market is headed.**

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<sup>67</sup> [Hoboken Becomes First Nj City to Sue Big Oil Companies, American Petroleum Institute for Climate Change Damages](#), City of Hoboken, September 2, 2020.

<sup>68</sup> [Ford Expands Climate Change Goals, Sets Target to Become Carbon Neutral by 2050: Annual Sustainability Report](#), Ford Media Center, June 24, 2020. Smith, B., [Microsoft will be carbon negative by 2030](#), Official Microsoft Blog, January 16, 2020. [What does being climate positive mean for IKEA?](#), IKEA, accessed on March 23, 2021.

<sup>69</sup> [BP sets ambition for net zero by 2050, fundamentally changing organisation to deliver](#), BP, Press Release, February 12, 2020. [Shell accelerates drive for net-zero emissions with customer-first strategy](#), Shell, 2021 media release, February 11, 2021.

<sup>70</sup> [Commitments to Net Zero Double in Less Than a Year](#), United Nations Climate Change, Press Release, September 21, 2020.

<sup>71</sup> [UNITED NATIONS-CONVENED NET-ZERO ASSET OWNER ALLIANCE](#), UN Environment Programme Finance Initiative, accessed on March 29, 2021.

<sup>72</sup> [Net Zero Asset Managers Initiative Triples in Assets Under Management as 43 New Asset Managers Commit to Net Zero Emissions goal](#), NET ZERO ASSET MANAGERS INITIATIVE, accessed on March 29, 2021.

<sup>73</sup> Gambetta, G., [Brookfield among 43 investors to join Net Zero Asset Managers initiative](#), Responsible Investor, March 29, 2021.

<sup>74</sup> DFS's expectations on insurers' management of financial risks from climate change do not apply to third-party funds managed by insurers.

<sup>75</sup> Barrett, E., [Wells Fargo is the last of the Big Six banks to issue a net-zero climate pledge. Now comes the hard part](#), Fortune, March 9, 2016.

<sup>76</sup> Marsh A., *et. al.*, [France's AXA Drops German Power Giant RWE as a Client over Large Coal Operations](#), Insurance Journal, March 12, 2021. Some insurers, such as AXA and Swiss Re, have also divested from coal on the underwriting side.

<sup>77</sup> Gambetta, G., [CA100+ benchmark reveals 'painful' progress on climate as investors turn attention to pay, accounting, Just Transition](#), Responsible Investor, March 22, 2021. Clifford, C., [60 largest banks in the world have invested \\$3.8 trillion in fossil fuels since the Paris Agreement](#), CNBC Make It, March 24, 2021.

More broadly, the number of money managers using environmental, social, and governance (“ESG”) criteria rose sharply in 2020, representing 33% of the \$51.4 trillion in total U.S. assets under professional management.<sup>78</sup> Among the various ESG issues, climate change was the primary issue of concern for these money managers.

**1.1.4. Transmission Channels of Transition Risks to Insurers’ Assets**

Transition risk drivers influence the global economy and the financial markets in which insurers operate. They can lead to stranded assets in the fossil-fuel industry and in carbon intensive infrastructure, real estate, and vehicles. The value of stranded assets in the energy sector alone could be as high as \$900 billion, or one-third of the current value of big oil and gas companies.<sup>79</sup> The total value of stranded assets across fossil fuel production and reserves, power generation, industry and buildings under a delayed policy action scenario has been estimated at \$20 trillion.<sup>80</sup> Transition risk drivers can also result in costs to replace and reinvest in infrastructure, as well as increased litigation against fossil-fuel companies. As previewed in [Insurance Circular Letter No. 15 \(2020\)](#), transition risks can lead to corporate asset devaluation, lower corporate profitability, lower property values, and lower household wealth. In turn, related financial and credit market losses could affect insurers’ assets, while increased litigation will impact insurers’ liabilities and the long-term viability of certain business lines. Figure 1 illustrates the transmission pathways of the various transition risk drivers.<sup>81</sup>

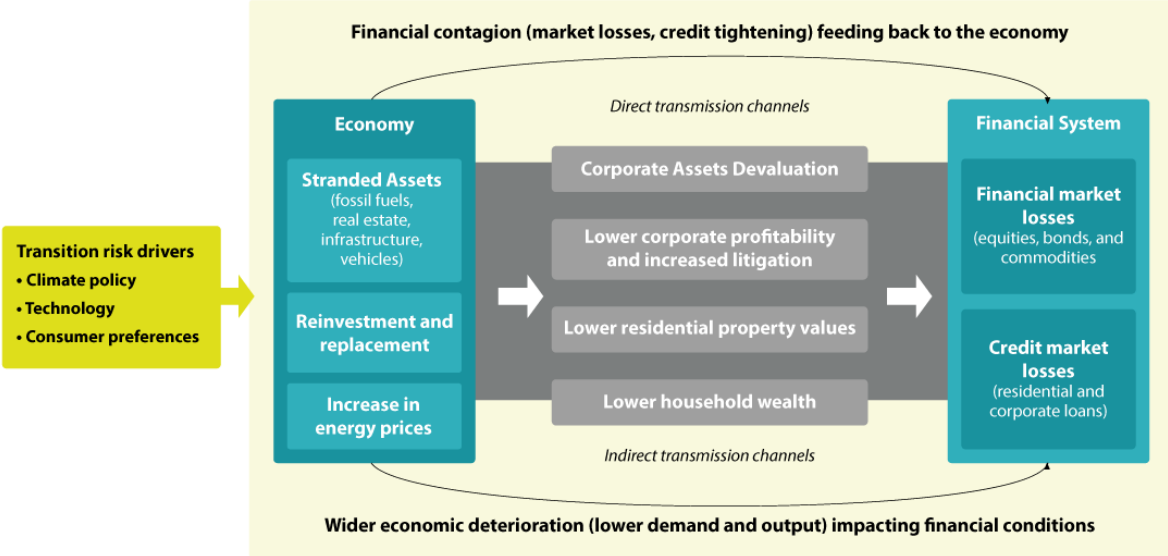


Figure 1. Transmission Mechanisms of Transition Risk Drivers to Financial Stability

**The impacts of transition risk factors have manifested themselves in the financial market.** Researchers have found that there is already a meaningful carbon premium in stocks around the world, as companies with high-carbon emissions, and slow rates of reduction in their emissions, have been penalized in stock valuation.<sup>82</sup> Coal mining stocks have lost on average more than 65% of their market valuation compared to their mid-2018 high.

<sup>78</sup> [Report on US Sustainable and Impact Investing Trends – 2020](#), US SIF Foundation, November 2020.  
<sup>79</sup> Livsey, A., [Lex in depth: the \\$900bn cost of ‘stranded energy assets’](#), Financial Times, February 4, 2020.  
<sup>80</sup> [STRANDED ASSETS AND RENEWABLES - How the energy transition affects the value of energy reserves, buildings and capital stock](#), International Renewable Energy Agency, July 2017.  
<sup>81</sup> Network for Greening the Financial System (NGFS), [Guide for Supervisors: Integrating climate-related and environmental risks into prudential supervision](#), May 2020.  
<sup>82</sup> Bolton, P., et. al., [Carbon Premium around the World](#), Harvard Law School Forum on Corporate Governance, May 11, 2020.

Peabody Energy Corp, the largest coal producer in the U.S., has lost approximately 94% of its stock value.<sup>83</sup> Oil and gas producers have fared a bit better, with ExxonMobil losing 34%, and BP losing 48%, of their stock values compared to their mid-2018 highs. In contrast, renewable energy producers have experienced a positive return of about 17% in the past three years.<sup>84</sup> Loan spreads for new coal mines and coal power stations rose on average by 65% and 56%, respectively, from 2000-2010 to the subsequent decade. In contrast, loan spreads from 2015-2020 for renewable energy projects fell by 15-33% compared to those from 2010-2014.<sup>85</sup> Globally, green bonds, whose proceeds are used for projects with environmental benefits such as renewable energy or low-carbon transportation, have seen a record issuance of \$269.5 billion by the end of 2020.<sup>86</sup>

**Rating agencies have taken notice.** In December 2020, Moody's identified 16 sectors with \$4.5 trillion in rated debt as having very high or high inherent exposure to transition risk.<sup>87</sup> Among the 16 sectors, automobile manufacturers, independent oil and gas exploration and production, coal mining, and coal terminals were identified as very high risk. Electric and gas utilities, integrated oil companies, steel, shipping, airlines, and others were identified as high risk. Similarly, in February 2021, S&P downgraded Exxon, Chevron, and Conoco by a grade, reflecting the "growing risks from energy transition due to climate change, weak industry profitability, and greater expected volatility in the oil & gas markets." The oil and gas industry has taken several steps to work through the energy transition but "S&P did not see these strategies as providing material credit differentiation."<sup>88</sup>

**Institutional investors agree that there is a need for greater focus on climate risk.** BlackRock believes that sustainability risk, particularly climate risk, is an investment risk,<sup>89</sup> and has established expectations that its investee companies mitigate climate risk and consider the opportunities presented by the net zero transition.<sup>90</sup> The United Kingdom's largest corporate defined benefit pension scheme, BT Pension Scheme, with assets of about £58 billion (US\$80 billion), has stated that, "in the short to medium term our work and analysis suggests transition risks are more significant to our portfolio. As we move out longer term, physical risks become more impactful."<sup>91</sup> This sentiment has been echoed by large insurers that are leaders in the climate space during DFS's engagement with the insurance industry.

Despite some carbon intensive companies making ambitious commitments or taking bold steps to transition, these targets and actions are uneven. Therefore, insurers need to understand how the companies they invest in manage climate risk.

### 1.1.5. U.S. and Global Financial Regulators Increase Their Focus on Climate Change

**U.S. federal financial regulators have started to focus on climate risks.** The Federal Reserve has been participating in the Basel Committee on Banking Supervision's Task Force on Climate-Related Financial Risks.<sup>92</sup> It noted in its November 2020 Supervision and Regulation Report that its supervisors "are responsible for ensuring

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<sup>83</sup> Data from Google Finance.

<sup>84</sup> [Renewable Energy Producers ETF](#), Global X by Mirae Asset, accessed on March 24, 2021.

<sup>85</sup> Webb, D., [Cost of capital for coal soars as renewables debt costs continue to fall](#), Responsible Investor, April 19, 2021.

<sup>86</sup> Chestney, N., [Global green bond issuance hit new record high last year](#), Reuters, January 24, 2021.

<sup>87</sup> [Moody's - Thirteen sectors with \\$3.4 trillion of debt face heightened environmental credit risk](#), Moody's Investors Service, December 14, 2020.

<sup>88</sup> [The Big Picture on Climate Risk](#), S&P Global, accessed on March 24, 2021.

<sup>89</sup> BlackRock's Global Executive Committee, [Net zero: a fiduciary approach](#), BlackRock Client Letter, accessed on March 22, 2021.

<sup>90</sup> [Climate risk and the transition to a low-carbon economy](#), Investment Stewardship Commentary, BlackRock, February 2021.

<sup>91</sup> BT Pension Scheme, [Responsible Investment Transparency Report 2020](#).

<sup>92</sup> Stiroh, K., [The Basel Committee's initiatives on climate-related financial risks](#), Basel Committee on Banking Supervision speech, the Bank for International Settlements, October 14, 2020.



that supervised institutions operate in a safe and sound manner... in the face of all types of risks, including those related to climate change.”<sup>93</sup> The Federal Reserve also signaled that climate risk is relevant to its macroprudential oversight of the overall financial system in its November 2020 Financial Stability Report.<sup>94</sup> In December 2020, the Federal Reserve joined the Network of Central Banks and Supervisors for Greening the Financial System (“NGFS”), a group of central banks and supervisors sharing best practices on environmental and climate risk management in the financial sector and mobilizing finance to support a sustainable transition. In January 2021, it announced the creation of a Supervision Climate Committee, a newly formed system-wide group with the mandate of building its capacity to understand the implications of climate change on financial institutions, infrastructure, and markets.<sup>95</sup> In March 2021, the Federal Reserve established a Financial Stability Climate Committee to identify, assess, and address climate-related risks to financial stability.<sup>96</sup> Governor Lael Brainard has indicated the usefulness of calibrating climate risks through climate scenario analysis<sup>97</sup> and the limitations of voluntary disclosure on climate risks.<sup>98</sup>

In February 2021, the U.S. Securities and Exchange Commission appointed its first ever Senior Policy Advisor for Climate and ESG in the office of Acting Chair Allison Herren Lee to advise the Commission on environmental, social, and governance matters and advance new ESG initiatives across its offices and divisions.<sup>99</sup> In March 2021, Acting Chair Lee mapped out the Commission’s work on climate and ESG issues<sup>100</sup> and requested public input on climate change disclosures.

In January 2021, the Federal Housing Finance Agency requested input on what kind of risk climate change poses to the mortgage financing system and how to identify threats that could lead to “increased delinquency rates, default rates, credit losses, credit related expenses, and loan loss frequency and severity” within the portfolios of Fannie Mae, Freddie Mac, and the Federal Home Loan Banks.<sup>101</sup>

**Globally, central banks and financial supervisors have continued to strengthen their work on climate change.** As of June 1, 2021, NGFS had 91 members and 14 observers.<sup>102</sup> In 2020, NGFS reviewed 107 central banks’ institutional frameworks and balance sheets and surveyed 26 central banks representing 51 countries.<sup>103</sup> It found that “all central banks consider climate change to be a challenge, both on account of its potential threat to the economy and its impact on central banks’ operational frameworks... Most central banks see scope in their

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<sup>93</sup> [Supervision and Regulation Report – November 2020](#), Board of Governors of the Federal Reserve System, November 2020.

<sup>94</sup> [Financial Stability Report – November 2020](#), Board of Governors of the Federal Reserve System, November 2020.

<sup>95</sup> [Kevin Stiroh to Step Down as Head of New York Fed Supervision to Assume New System Leadership Role at Board of Governors on Climate](#), Federal Reserve Bank of New York, January 25, 2021.

<sup>96</sup> Governor Lael Brainard, [Financial Stability Implications of Climate Change](#), Board of Governors of the Federal Reserve System, at “Transform Tomorrow Today” Ceres 2021 Conference, Boston, Massachusetts (via webcast), March 23, 2021.

<sup>97</sup> Governor Lael Brainard, [Strengthening the Financial System to Meet the Challenge of Climate Change](#), Board of Governors of the Federal Reserve System, at “The Financial System & Climate Change: A Regulatory Imperative” hosted by the Center for American Progress, Washington, D.C., December 18, 2020.

<sup>98</sup> Governor Lael Brainard, [The Role of Financial Institutions in Tackling the Challenges of Climate Change](#), Board of Governors of the Federal Reserve System, at 2021 Institute of International Finance U.S. Climate Finance Summit: Financing a Pro Growth Pro Markets Transition to a Sustainable, Low-Carbon Economy, Washington, D.C., February 18, 2021.

<sup>99</sup> [Satyam Khanna Named Senior Policy Advisor for Climate and ESG](#), U.S. Securities and Exchange Commission, February 1, 2021.

<sup>100</sup> Acting Chair Allison Herren Lee, [A Climate for Change: Meeting Investor Demand for Climate and ESG Information at the SEC](#), Speech, U.S. Securities and Exchange Commission, March 15, 2021.

<sup>101</sup> [Climate and Natural Disaster Risk Management at the Regulated Entities - Request for Input](#), the Federal Housing Finance Agency, January 2021.

<sup>102</sup> [Membership of NGFS](#), Network for Greening the Financial System, accessed on June 7, 2021.

<sup>103</sup> Two monetary unions are included in the responding central banks.

respective mandates for adjusting their operational frameworks to reflect climate-related risks, albeit with considerable institutional differences across central banks... The main argument put forward in favor of adopting proactive measures reflects the primary objective of most central banks, i.e. supporting an orderly transition towards a low-carbon economy to ensure a smooth monetary transmission over the long-term.”<sup>104</sup>

Article 173 of the 2015 French Law on Energy Transition and Green Growth has required major institutional investors and asset managers to explain how they consider ESG criteria and climate risks in their risk management and investment policies since 2017.<sup>105</sup> The U.K. and New Zealand governments have mandated corporate disclosure on climate risks in accordance with the recommendations of the Task Force on Climate-related Financial Disclosures (“TCFD”).<sup>106</sup> In March 2021, the Bank of England was given an explicit mandate to support the U.K. government's economic strategy to transition to a net zero economy by 2050.<sup>107</sup> The Bank of England will potentially adjust its corporate bond purchase scheme to account for the so-called “climate impact” of bond issuers.<sup>108</sup>

**Financial supervisors are increasingly turning to scenario analysis and stress testing to gauge firms’ exposure to climate risks.** Banque de France announced the results of its stress tests in May 2021,<sup>109</sup> while Bank of England started its biennial stress testing in June 2021.<sup>110</sup> The European Central Bank will test significant eurozone banks in 2022, and authorities in Australia, Brazil, Canada, Hong Kong, Japan, and Singapore have also announced tests for 2021 and 2022.<sup>111</sup> While current stress tests in the U.K. and Europe will not test capital adequacy, credit rating agency Fitch has stated that, “in the longer term, we expect climate stress tests to feed into prudential capital requirements.”<sup>112</sup>

## 1.2. Purpose of the Study

On March 25, 2021, to support insurers’ journey in managing climate risks, DFS published proposed [Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change](#), which highlights the importance for insurers to consider the impact of both physical and transition risks on their assets and liabilities. As a general matter across the industry, the impact of climate change on insurers’ investments receives less attention than the impact of climate change on insurers’ liabilities, and low-carbon transition risks are less understood than climate-related physical risks. To support New York domestic insurers (“insurers”) in their efforts, DFS asked 2DII to analyze the transition risk exposure of insurers based on the equity and corporate bond holdings from their 2019 Schedule D data. As the investment holding data used in the Study was from insurers’ 2019 filings, and insurers’ holdings are likely to have changed since then, the results are not intended to reflect insurers’ current exposure to transition risks.

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<sup>104</sup> NGFS, [Survey on monetary policy operations and climate change: key lessons for further analyses](#), December 2020.

<sup>105</sup> [French Energy Transition Law: Global investor briefing on Article 173](#), Principles for Responsible Investment, April 22, 2016.

<sup>106</sup> Holger, D., *et. al.*, [U.K. Requires Companies to Report on Climate Change by 2025](#), Wall Street Journal, November 9, 2020; Azizuddin, K., [New Zealand becomes world’s first country to introduce mandatory TCFD disclosure](#), Responsible Investor, September 15, 2020.

<sup>107</sup> Sunak, R., [REMIT FOR THE MONETARY POLICY COMMITTEE \(MPC\)](#), Letter from the U.K. Chancellor to the Bank of England Governor, March 3, 2021.

<sup>108</sup> [Bank of England Remit Updated to Include Climate Change](#), Agence France Presse, Barron’s, March 3, 2021.

<sup>109</sup> [Analysis and synthesis no. 122: The main results of the 2020 climate pilot exercise](#), Banque de France Autorite de Controle Prudentiel et de Resolution, May 4, 2021.

<sup>110</sup> Jones, H., [Bank of England launches climate stress test for banks and insurers](#), Reuters, June 8, 2021.

<sup>111</sup> [Climate Change Stress Tests Are Becoming Mainstream](#), Fitch Ratings, March 15, 2021. Kihara, L., *et. al.*, [BOJ to highlight climate risks as key theme of bank tests this year: sources](#), Reuters, February 26, 2021.

<sup>112</sup> [Climate Change Stress Tests Are Becoming Mainstream](#), Fitch Ratings, March 15, 2021.

The Study does not quantify how much loss would be attributed to transition risk exposure. Insurers interested in the quantification of transition risks can refer to the study by the European Insurance and Occupational Pensions Authority (“EIOPA”) titled [Sensitivity analysis of climate-change related transition risks: EIOPA’s first assessment](#) and the climate stress test in the individual reports that have been generated for insurers.

In addition to the PACTA tool used in the Study, there are many other approaches,<sup>113</sup> each with its own strengths and limitations, to understanding and assessing transition risk exposure. Insurers are encouraged to explore the various approaches and select those that suit their needs. This report only presents results from the analysis on an aggregate basis.

To help insurers assess and develop strategies to mitigate their exposure to transition risks, DFS also requested that 2DII generate individual reports for insurers included in 2DII’s analysis, which will be shared with such insurers. Any insurer can create its own report by uploading its bond and equity positions into the open-source [PACTA model](#).

Finally, transition risks are most pronounced when the low-carbon transition is occurring and potentially accelerating. There is a possibility that the transition will slow down or even reverse its course, as evidenced by Mexico’s recent plan to support coal and oil while curtailing clean energy.<sup>114</sup> This uncertainty requires insurers to consider various scenarios in its strategic planning and risk management.<sup>115</sup>

DFS recognizes that climate risks are one of many factors, including financial returns and risk controls, that an insurer should consider when making investment decisions.

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<sup>113</sup> [Climate scenario analysis](#), Principles for Responsible Investment, accessed on May 25, 2021.

<sup>114</sup> Agren, D., [Mexico was once a climate leader – now it's betting big on coal](#), the Guardian, February 15, 2021.

<sup>115</sup> Please refer to DFS’s proposed [Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change](#) for guidance on scenario analysis and stress testing.

## QUESTIONS ANSWERED IN THE STUDY

The Study allows insurers to answer the following questions to understand their exposure to transition risks and opportunities, listed from the simplest to the most nuanced:

1. **What holdings in my portfolio are most exposed to transition risks and how much do they comprise of my total portfolio?** This question can be answered by categorizing the holdings by sectors/industries and quantifying the amount of carbon intensive sectors/industries as a percentage of the total portfolio. See *Figure 5. Percentage of Investments in the PACTA Sectors for Corporate Bonds and Listed Equities Holdings*. *Figure 6. Percent Distribution of Investment Value in the PACTA Sectors* shows how the holdings of these sectors are distributed. This approach does not differentiate between companies that are in the same industry but have very different plans for the low-carbon transition. For example, Royal Dutch Shell Plc and ExxonMobil are both in the oil and gas industry, but the former has set net zero targets and plans to reduce its reliance on fossil fuel product revenue while the latter has not.
2. **Some of my holdings in carbon intensive industries are transitioning already by making investments in renewables or electric vehicles. Some have even set net zero carbon emission targets. How do these investments affect my exposure to transition risks and opportunities?** This can be answered by comparing the percentages of high-carbon and low-carbon technologies of the investee companies with those of the market benchmark and what is needed to achieve Paris Agreement goals. See *Figure 12. High-Carbon and Low-Carbon Technology Mix for the Power Sector* and *Figure 17. High-Carbon and Low-Carbon Technology Mix for Light-Duty Vehicles in the Automotive Sector*, where the percentages of the high-carbon (risk side) and low-carbon (opportunity side) technology mixes are presented.
3. **There are multiple scenarios covering whether the world would transition towards a low-carbon economy. With which scenario is my portfolio aligned?** This is answered by plotting the production volume trajectories for high- and low-carbon technologies against the trajectories needed to meet different climate/temperature scenarios. The production volume trajectories are produced based on the capital plans of insurers' investee companies for the next five years. *Figure 9. The Coal Mining Production Volume Trajectory Relative to Climate Scenarios* provides an example.

Here, **alignment with climate scenarios is used as a proxy for risk and opportunity** because the scenarios represent potential pathways the transition to the low-carbon economy will take. For example, the Sustainable Development Scenario represents the policy, technology, and market changes that need to occur to achieve the 2-degree scenario. If a portfolio is aligned with this scenario and the scenario were to happen, its holdings are unlikely to be negatively affected, and in fact are likely to benefit from the transition.

A separate but related question is: **How does the transition risk and opportunity exposure of my holdings compare to those of the market and my peers?** For the graphs mentioned above, market benchmarks are also provided. *Figure 7. Peer Comparison of Insurers' Holdings in the Fossil Fuel Sector (Coal, Oil, and Gas Production)* provides an anonymous comparison of the share of high- and low-carbon technologies in the power sector for insurers' holdings.

Lastly, the report offers options to the question: **How can I mitigate these risks?** Some options are offered in Section 4. Strategies for Mitigating Transition Risks. The individual reports that will be shared with the insurers covered by the Study also answers the question: **Which companies are driving the results of my exposure and alignment?**

## 2. Methodology

### 2.1. Insurers' Asset Holding Data

For purposes of this analysis, DFS used insurers' equity and corporate bond holdings from Schedule D of the 2019 NAIC Annual Statement. Insurers that held only asset-backed securities, government bonds, and/or mortgage securities as of 2019 are not covered by the analysis. While those three types of fixed income securities are not immune to transition risks,<sup>116</sup> their transition risks are much less severe than those affecting the energy, utilities, manufacturing, and transportation sectors that are the focus of the Study. The table below shows the corporate bond portfolio as a percentage of the full bond portfolio for different types of insurers as reflected in insurers' 2019 Schedule D filings.

(in billions USD)	P&C	Life	Health
Full bond portfolio	118	716	10
Corporate bond portfolio	45	456	8
Percentage	38%	64%	80%

Table 1. Insurers' Corporate Bond Portfolio as a Percentage of the Full Bond Portfolio

**250 insurers' portfolios were analyzed as part of the Study, including the portfolios of P&C, Health, and Life insurers.** Over 130,000 individual securities were analyzed and nearly 125,000, or 95%, were successfully matched with 2DII's financial data. Figure 2 shows the data coverage of the Study. ISIN, which stands for International Securities Identification Number, is a unique code that is used to identify securities.

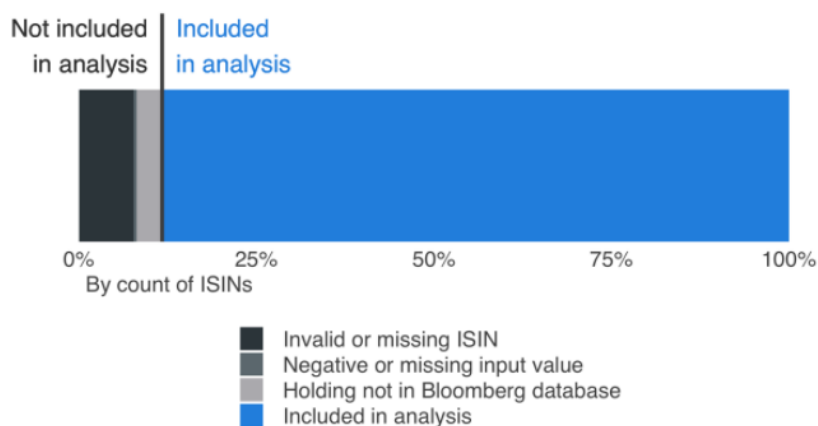


Figure 2. Data Coverage of the Study

Insurers' holdings were mapped to sectors and companies using Bloomberg. Underlying data on investment funds' holdings were sourced from the Lipper Fund Research Database,<sup>117</sup> a service offered by Refinitiv.

<sup>116</sup> For more information on the transition risks of these securities, see Cevik, S., *et. al.*, [This Changes Everything: Climate Shocks and Sovereign Bonds](#), IMF Working Paper, June 5, 2020; Schwartzkopff, F., *et. al.*, [Sovereign Rating Cuts Coming to Those Who Ignore the Climate](#), Bloomberg Green, March 17, 2021; St. Peter, E., [Climate-Related Muni Bond Risk: A Q&A with Breckinridge Capital Advisors](#), University of Pennsylvania Wharton Business School, January 8, 2020; and Reid, B., [Measuring Climate Risk in Real Estate Portfolios](#), MSCI, July 8, 2020.

<sup>117</sup> [Funds \(Lipper\)](#), REFINITIV, access on March 29, 2021.

## 2.2. PACTA – Transition Risk Exposure and Scenario Analysis<sup>118</sup>

The exposure and scenario analysis used in the Study is based on the open-source [Paris Agreement Capital Transition Assessment](#) (“PACTA”) model. The PACTA model assesses the alignment of investors’ and banks’ portfolios with different climate scenarios. It allows us to understand the extent to which financial portfolios may be exposed to transition risks arising from a disruptive transition. Not preparing for the transition today (i.e., being misaligned) may increase future losses as valuations fail to anticipate and integrate changes in companies’ capacity to adapt to the technology and policy trends that result from the transition to a low-carbon economy.

This model, developed by 2DII, has been used by more than 3,000 financial institutions, governments, supervisory authorities, and industry associations, including the California Insurance Commissioner, the Swiss Federal Office for the Environment, and the French Insurance Federation.<sup>119</sup> An online version of the tool can be accessed at [Transition Monitor](#).

**PACTA provides a five-year forward-looking, bottom-up analysis that looks at the investment and production plans of investee companies at the physical asset-level, and consolidates that information to identify the energy transition profile of the companies and their related financial instruments.** This information is aggregated at the portfolio level and compared to the production plans projected in different climate scenarios. The current (mis-)alignment between a portfolio and these scenarios allows users to infer potential exposure to transition risks and opportunities as if a scenario is realized. **The model measures what companies are doing in terms of their capital planning for the next five years, not what they have pledged to do.**

**Sectoral Scope and Sources.** The PACTA model is available for corporate bonds and listed equity portfolios. It covers eight of the most carbon intensive sectors in the economy (i.e., the sectors most exposed to transition risks) – **oil and gas, coal mining, power generation, automotive, aviation, shipping, cement, and steel** (the “PACTA sectors”). Together, they are responsible for over 75% of all CO<sub>2</sub> emissions in capital markets.<sup>120</sup> In each of these sectors, PACTA focuses on the part of their value chain with the highest impact in terms of CO<sub>2</sub> emissions. For example, in the oil and gas sector, the focus is on upstream activities related to production, while in the power sector the focus is on power generation and related sources of energy. For details on the parts of the value chain that PACTA focuses on, see Appendix 6.1.

For limitations of the PACTA climate scenario analysis used in the Study, see Appendix 6.2.

## 2.3. Inputs and Outputs of the PACTA Model

### 2.3.1. Inputs of the PACTA Model

Three main types of inputs are used:

1. **Financial portfolio data**, including International Securities Identification Numbers (“ISINs”), market value, and the currency of each security.
2. **Investee companies’ physical asset-level data and production plans**, which are updated at least quarterly and sourced from market intelligence data providers covering more than 230,000 individual assets globally, 40,000 companies, and 30,000 securities. All real economy data (e.g., production values) is sourced from [Asset Resolution](#), which in turn acquires it from various other third-party business intelligence data providers. The data looks forward five years and is derived from corporate capital expenditure data.

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<sup>118</sup> For an extensive explanation of the methodology, see [the PACTA Knowledge Hub](#).

<sup>119</sup> [PACTA / Climate Scenario Analysis Program](#), 2-Degrees Investing Initiative, accessed on May 19, 2021.

<sup>120</sup> This is the high-level estimate done by 2DII based on the World Resources Institute’s greenhouse gas emissions data.

### 3. Climate scenario data.

#### a. Fossil Fuel Production and Power Generation:

The following scenarios are taken from the International Energy Agency's (IEA) World Energy Outlook (WEO) 2020 publication.<sup>121</sup>

- i. Current Policy Scenario (CPS): This is a business-as-usual scenario based on policies that currently exist. It equates roughly to a  $\geq 3.2^{\circ}\text{C}$  global average temperature rise by 2100.
- ii. Stated Policy Scenario (STEPS): This scenario assumes that announced policies will be implemented in the future. It equates roughly to a  $2.7^{\circ}\text{C}$  global average temperature rise by 2100.
- iii. Sustainable Development Scenario (SDS): This scenario looks to achieve the goals set out in the United Nations Sustainable Development Goals. It equates roughly to a  $1.75 - 2^{\circ}\text{C}$  global average temperature rise by 2100. **This scenario is aligned with the Paris Agreement ("Paris-aligned").**

#### b. Automotive:

The following scenarios are taken from the International Energy Agency's (IEA) Energy Technology Perspectives (ETP) 2017 publication, which contains the most up-to-date automotive scenarios used by the PACTA methodology.<sup>122</sup>

- i. Reference Technology Scenario (RTS): This is a business-as-usual scenario. It equates roughly to a  $\geq 3.2^{\circ}\text{C}$  global average temperature rise by 2070.
- ii. 2 Degrees Scenario (2DS): This scenario aims to limit global average temperature rise to  $2^{\circ}\text{C}$  by 2100.
- iii. Beyond 2 Degrees Scenario (B2DS): This scenario aims to limit global average temperature rise to  $\leq 1.75^{\circ}\text{C}$  by 2100. **This scenario is Paris-aligned.**

It should be noted that the Sustainable Development Scenario and the Beyond 2 Degrees Scenario assume smooth, coordinated, and early actions by policymakers and market players. In reality, a more likely scenario is a delayed action policy scenario where business as usual continues for the next ten years and then drastic policies, such as a very high carbon price and/or a ban on internal combustion cars, come into effect in response to worsening climate disasters. In a delayed policy action scenario, the value of stranded assets is likely to be three times higher than in a scenario involving a smooth and early transition.<sup>123</sup>

Because low-carbon technology pathways to achieve the 2 Degrees Scenario have not been established for the steel, cement,<sup>124</sup> aviation, and shipping industries, only the holdings in these industries as a percentage of the overall equity and corporate bond portfolios were analyzed in this report.<sup>125</sup>

**Market Benchmarks** – To illustrate the relevant metrics of a potential investable universe, two market benchmarks were used:

- For corporate bonds – iShares Global Corp bond UCITS ETF<sup>126</sup>
- For equities – iShares MSCI All Country World Index ETF<sup>127</sup>

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<sup>121</sup> [World Energy Outlook 2020](#), International Energy Agency, October 2020.

<sup>122</sup> [Energy Technology Perspectives 2017](#), International Energy Agency, June 2017.

<sup>123</sup> [STRANDED ASSETS AND RENEWABLES - How the energy transition affects the value of energy reserves, buildings and capital stock](#), International Renewable Energy Agency, July 2017.

<sup>124</sup> For steel and cement, there are no low-carbon technology alternatives yet.

<sup>125</sup> In the individual report for each insurer, the CO<sub>2</sub> intensity pathway, such as the grams of CO<sub>2</sub> emission per pound of cement produced, is provided.

<sup>126</sup> [iShares Global Corp Bond UCITS ETF](#), iShares by BlackRock, accessed on March 29, 2021.

<sup>127</sup> [iShares MSCI ACWI ETF](#), iShares by BlackRock, accessed on March 29, 2021.

### 2.3.2. Outputs of the PACTA Model

The model provides sector or technology-specific analysis that includes:

1. **The portfolio's holdings in the eight carbon intensive sectors as a percentage of total holdings.** This output does not differentiate between companies that are in the same industry but have very different plans for the low-carbon transition. For example, according to Bloomberg New Energy Finance and Bloomberg Intelligence, Europe's largest oil and gas companies, such as Total SE and Royal Dutch Shell Plc, are far more advanced than U.S. firms like ExxonMobil and Chevron when it comes to net zero targets, cutting their reliance on fossil-fuel sales by investing in renewable energy, battery storage, electric-vehicle charging points, carbon-capture technology, and other decarbonization efforts.<sup>128</sup> The financial performance of Total SE during the low-carbon transition could be very different from the financial performance of ExxonMobil.
2. **The portfolio's technology mix compared to the IEA Sustainable Development Scenario and a market benchmark** (see Figure 3 as an example). Technology mix compares insurers' exposure to different high- and low-carbon technologies within a sector with the technology mix required under a certain climate change scenario.

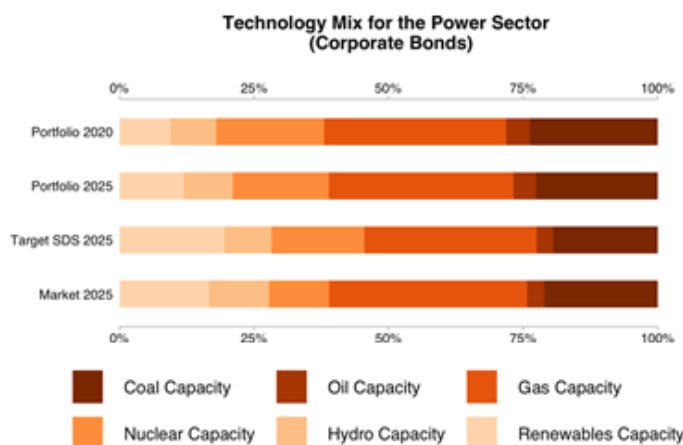


Figure 3. High and Low-Carbon Technology Mix for the Power Sector in Insurers' Corporate Bond Portfolios

Figure 3 shows the technology mix for the power sector in insurers' corporate bond portfolios:

- Portfolio 2020 reflects the current technology mix of the power sector in insurers' holdings.
- Portfolio 2025 shows the projected technology mix in 2025 based on the investee companies' capital plans for the next five years.
- Target SDS 2025 indicates what the technology mix needs to look like in 2025 to meet Sustainable Development Scenario (i.e., Paris-aligned) goals.
- Market 2025 shows the projected technology mix in 2025 based on the five-year capital plans of the investee companies in the benchmark. The benchmark in this case is iShares Global Corp bond UCITS ETF for corporate bonds.

The difference in the technology mix between Portfolio 2020 and Portfolio 2025 is not a result of any change in the investors' holdings, but rather a reflection of the difference between the technology mix in the investee companies' capital plans and the technology mix currently in production.

<sup>128</sup> Quinson, T., [U.S. Oil Companies Lag Far Behind Greener Europe Rivals](#), Bloomberg Green, March 24, 2021.



The **technology mix metric** focuses on technology shifts in the power, fossil fuel, and automotive sectors, namely: (i) **changes in the technological processes by which outputs are produced** (e.g., shift from coal-powered to renewable power capacity), and (ii) **changes in the nature of the output itself** (e.g., shift from internal combustion engines to electric vehicles). This metric measures the insurers’ **relative exposure to the economic activities that are impacted by the transition to a low-carbon economy**. It is a function of how diversified the insurers’ portfolios are across the companies they invest in, and how diversified these investee companies’ activities are across technologies or output types.

3. **The portfolio’s production volume trajectory relative to what is required by different climate scenarios** for the fossil fuel, power, and automotive sectors<sup>129</sup> (see Figure 4 as an example). Production volume trajectory compares the planned future production of a technology based on the capital plans of investee companies with the production rate required under different climate scenarios.

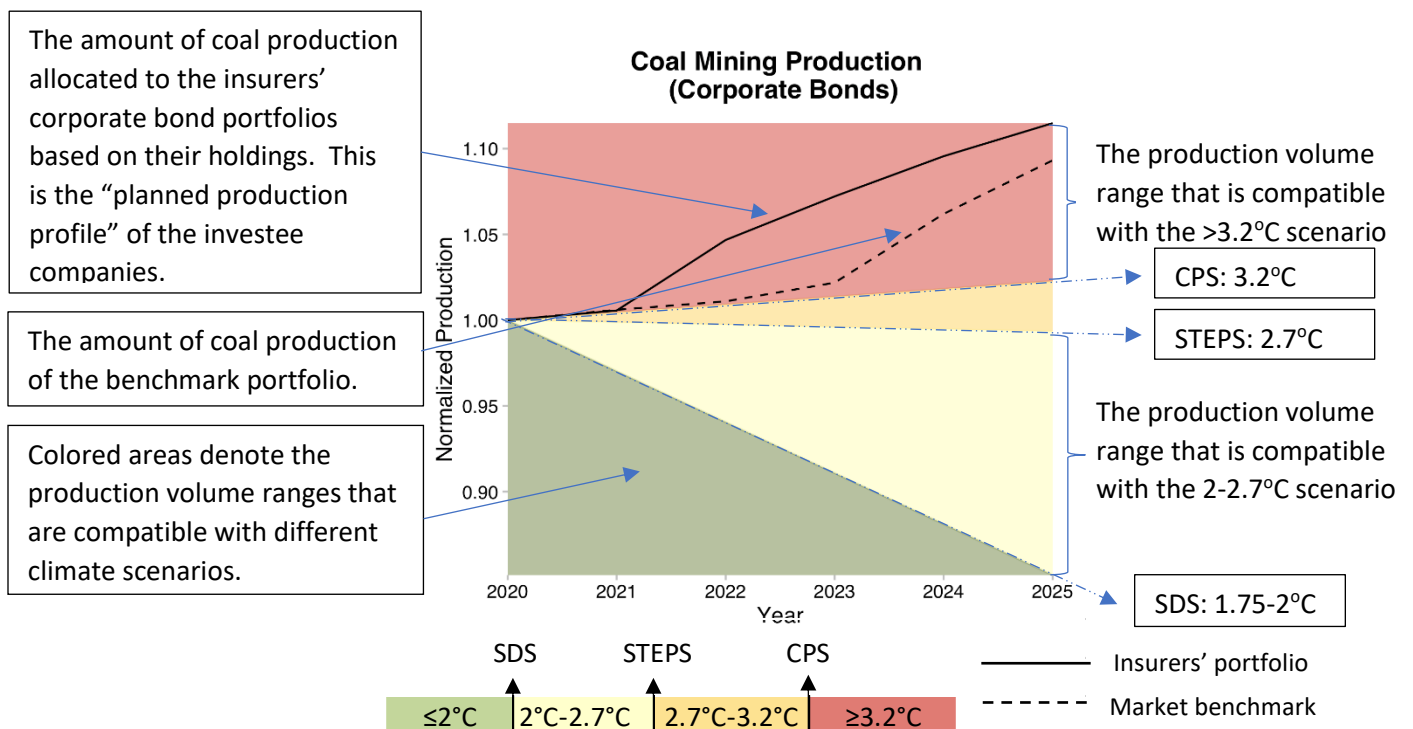


Figure 4. Alignment of Coal Production in the Corporate Bond Portfolios Relative to the IEA Transition Scenarios

Figure 4 shows the **production volume trajectory metric** for corporate bonds using coal mining production as an example. This metric measures the alignment of a portfolio’s projected production volume over the next five years with the production volume ranges set as targets in different climate scenarios. Changes in production volume result either from the **transfer of production from one technology to another** (e.g., internal combustion engines to electric vehicles) or from the **sheer expansion or contraction in production coming from the technology/fuel** (e.g., a company brings a new coal-fired

<sup>129</sup> Alignment for the steel, cement, and aviation sectors can be accessed at the individual company level in the individual reports. Alignment metrics in the shipping sector are still under development.

power plant online). The Y-axis shows the normalized capacity planned for the next five years with the current capacity represented as 1.

In Figure 4, insurers' coal mining production trajectory falls within the red area and increases significantly between 2020 and 2025. This means that the insurers' investee companies' capital plans for coal mining for the next five years were completely incompatible with the Sustainable Development Scenario, worse than the stated policy scenario, and even worse than the market benchmark.

For information on how PACTA allocates production volumes and attributes climate scenarios to an investment portfolio, please see the [PACTA Knowledge Hub](#).

## DIFFERENT METRICS USED TO MEASURE CLIMATE SCENARIO ALIGNMENT

While the **technology mix** metric and the **production volume trajectory** metric both provide an indication of how aligned the investee companies' capital plans are with the Sustainable Development Scenario, they differ in that the technology mix metric measures the proportion of different climate-relevant technologies in an investor's portfolio while the production volume trajectory measures the rate of change in the production volume over time. **Alignment in one metric does not equate to alignment in the other.** For example, it is possible that an investor's renewable power generation makes up a large amount of the portfolio relative to carbon intensive power generation, resulting in a technology mix that is Paris-aligned. However, the rate of increase of renewable power generation may be too small for the production volume trajectory to be Paris-aligned.

**Translating this to monetary terms**, if the economy were to follow the SDS, then the power generation portion of the insurer's investment might not be negatively affected, but the upside from the renewable power generation would be limited. In other words, there would be an opportunity cost as the investor is not financing the required increase in renewables.

## 3. Transition Risk Exposure of New York Domestic Insurers

### 3.1. Insurers' Exposure to High-Carbon Sectors

Of all the financial assets analyzed (equities and corporate bonds), 17.2% of the insurers' assets were in carbon intensive sectors. Insurers' exposure to the PACTA sectors is shown in Figure 5, broken down by type of insurer and security. The market benchmarks' exposure is also provided. This equates to **about 11% of the insurers' total assets in equities and fixed income (including mortgages and government bonds)**. Although insurers' listed equity exposure to carbon intensive sectors was similar to the market benchmark of 9.8%, **life insurers' exposure to these sectors on the corporate bonds side was 20%**, much larger than the exposure of health and P&C insurers and larger than the market benchmark of 16%.

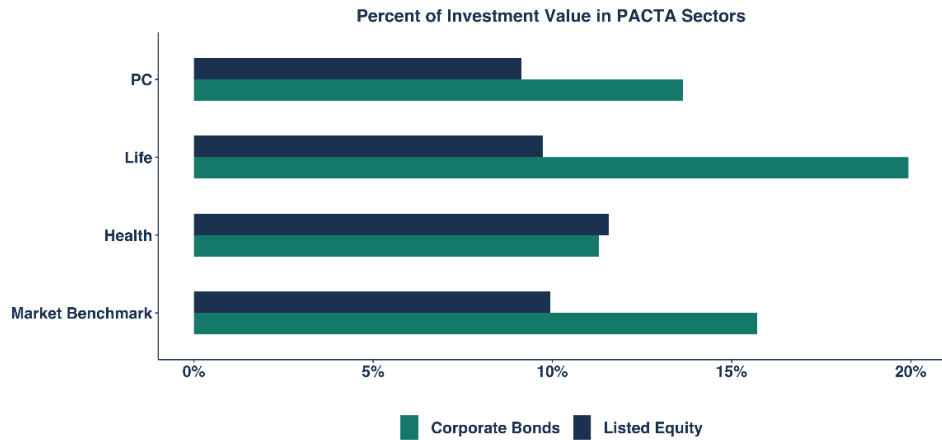


Figure 5. Percentage of Investments in the PACTA Sectors for Corporate Bonds and Listed Equities Holdings

Breaking this down further, Figure 6 shows how each type of insurer, all insurers in the aggregate, and the market benchmark are distributed across these high-carbon sectors. For corporate bonds, while insurers' percentage distributions of coal and oil & gas were like those of the benchmark, **life insurers invested more in power generation than the benchmark**. For equities, life insurers stood out with their larger exposure to shipping and smaller exposure to automotive compared to other types of insurance and the benchmark.

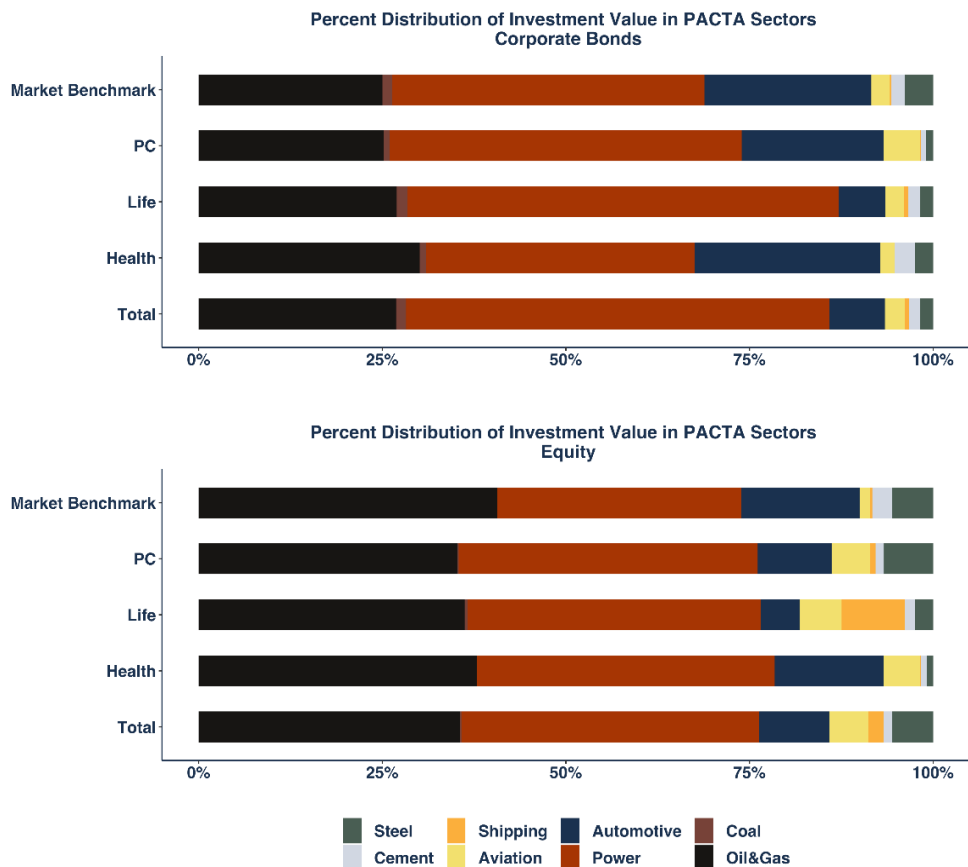


Figure 6. Percent Distribution of Investment Value in the PACTA Sectors

### 3.2. Peer Comparison of Insurers' Holdings in High-Carbon Sectors and Technologies

It is important to note that the **exposure to high-carbon sectors and technologies may differ dramatically from one insurer to the next**, as shown in Figure 7 and Figure 8. Each vertical line in the figures represents one insurer and the color of the line reflects the insurance segment – Health, Life, or P&C. Figure 7 shows that, while most of the insurers had single-digit exposures to fossil fuel production, **multiple P&C insurers and a few Life insurers had exposures in their corporate bond portfolios that were significantly higher** – more than 50% for one Life entity and more than 40% for one P&C entity. On the equity side, one P&C insurer went so far as to make all its investments in the fossil fuel sector. Figure 8 provides a similar comparison for insurers' holdings in coal, oil, and gas-fired power generation, with **a few insurers whose holdings in these high-carbon technologies were much higher than those of their peers**.

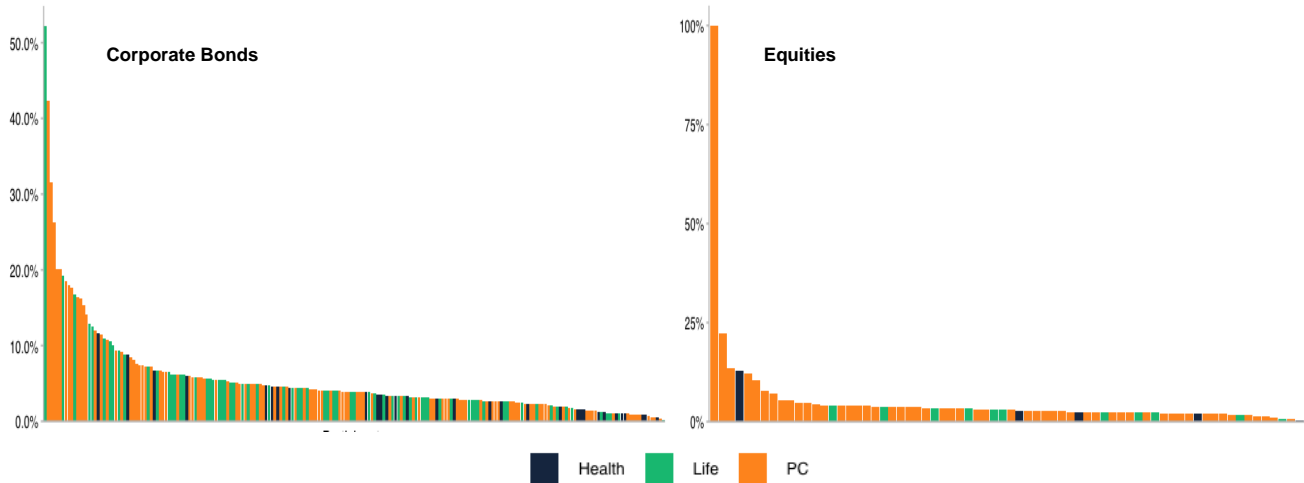


Figure 7. Peer Comparison of Insurers' Holdings in Fossil Fuel Production (Coal, Oil, and Gas Production) as a Percentage of the Corporate Bond and Equity Portfolios (Each Vertical Line Represents an Insurer)

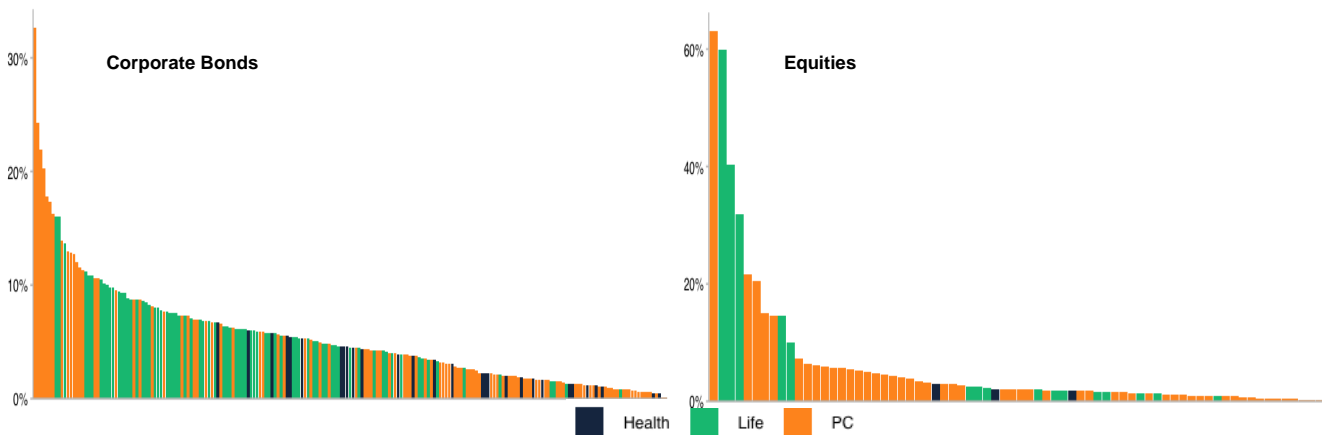


Figure 8. Peer Comparison of Insurers' Holdings in Coal, Oil, and Gas-Fired Power Generation as a Percentage of the Corporate Bond and Equity Portfolios (Each Vertical Line Represents an Insurer)

### 3.3. Insurers' Alignment with Climate Scenarios

**Climate scenario alignment metrics** were calculated for insurers in the aggregate for the **power, fossil fuel, and automotive sectors** (i.e., those sectors with viable low-carbon alternatives) using the climate change scenarios described in Section 2.3. Inputs and Outputs of the PACTA Model, with the most important one being a **Paris-aligned scenario** (i.e., SDS for the fossil fuel and power sectors and B2DS for the transportation sector).

Scenario alignment is measured across two metrics:<sup>130</sup>

- **Technology Mix** – which compares insurers' exposure to different high- and low-carbon technologies within a sector with the technology mix required under a certain climate change scenario.
- **Production Volume Trajectory** – which compares the planned future production of a technology based on the capital plans of investee companies with the production rate required under different climate scenarios.

In both cases, the technology mix and production volume trajectory look forward five years. The metrics of the market benchmarks are provided as a reference as well.

#### 3.3.1. Fossil Fuels

More than any other industry, the fossil fuel sector has been the catalyst for unprecedented economic growth in the past few centuries while also generating the most global emissions. Even today, fossil fuels like coal, oil, and gas still supply 84% of the world's energy.<sup>131</sup> At the same time, the sector is highly vulnerable to transition risks. Therefore, it is important that insurers understand their climate scenario alignment (i.e., their potential transition risk exposure) in this sector.

It is important to note that no technology mix metric is provided as the fossil fuel sector is supposed to mostly disappear to reach the Sustainable Development Scenario.

#### *Production Volume Trajectory*

##### **Coal Mining**

Figure 9 shows coal mining production volume trajectories for corporate bond and equity portfolios. The insurers' trajectories, reflected as solid lines, fall in the red areas and above the market benchmarks' trajectories, which are reflected as dotted lines. This means that insurers' investments overweighted coal relative to the benchmarks in both portfolios. It also means that the five-year capital plans of insurers' investee companies for coal mining were aligned with a more than 3.2°C world, and therefore would be adversely affected if the low-carbon transition were to happen based on the Current Policy Scenario. This adverse effect would be even greater if the transition happened according to the Sustainable Development Scenario.

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<sup>130</sup> For a detailed explanation of how to read the graphs of these two metrics, see Section 2.3. Inputs and Outputs of the PACTA Model.

<sup>131</sup> [Statistical Review of World Energy 2020](#), 69th edition, BP, 2020.

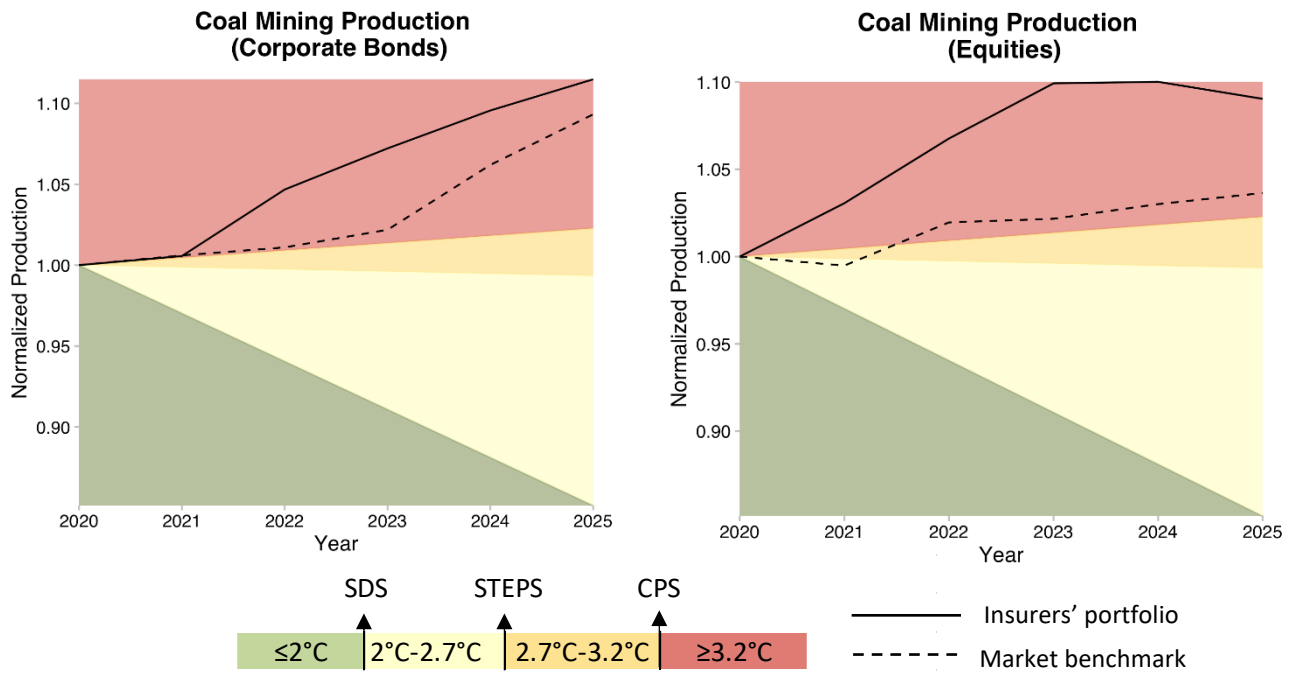


Figure 9. The Coal Mining Production Volume Trajectory Relative to Climate Scenarios

## Oil Production

Figure 10 reflects oil production volume trajectories for insurers' corporate bond and equity portfolios. The solid lines show that insurers' investments in 2019 were aligned with a 2.7-3.2°C world by the end of 2025. The trajectory of the corporate bond portfolio, however, ended at a production volume lower than that of the market benchmark. In other words, the insurers' corporate bond holdings were better aligned with the low-carbon transition than the market benchmark. For equities, the reverse was true.

## Natural Gas Production

Figure 11 shows natural gas production volume trajectories for insurers' corporate bond and equity portfolios. Here, the investee companies' capital plans reduce natural gas production at a rate faster than required to reach the ≤2°C world scenario.<sup>132</sup> Although there is room for insurers' investee companies to increase the production of natural gas over the next five year and remain Paris-aligned, there is also the risk that most natural gas usage in the developed world, without the large-scale capture of CO<sub>2</sub> from the atmosphere and the storage of that CO<sub>2</sub> in a stable environment, will need to be replaced in the long term with zero-carbon sources, which could lead to financial losses.<sup>133</sup>

<sup>132</sup> The upward sloping line between the green and light-yellow sections indicates that natural gas production can increase over the next five years and still be compatible with the Sustainable Development Scenario.

<sup>133</sup> Rogelj, J., et al., [Energy system transformations for limiting end-of-century warming to below 1.5 °C](#), Nature Climate Change 5, 519-527 (2015), May 21, 2015.

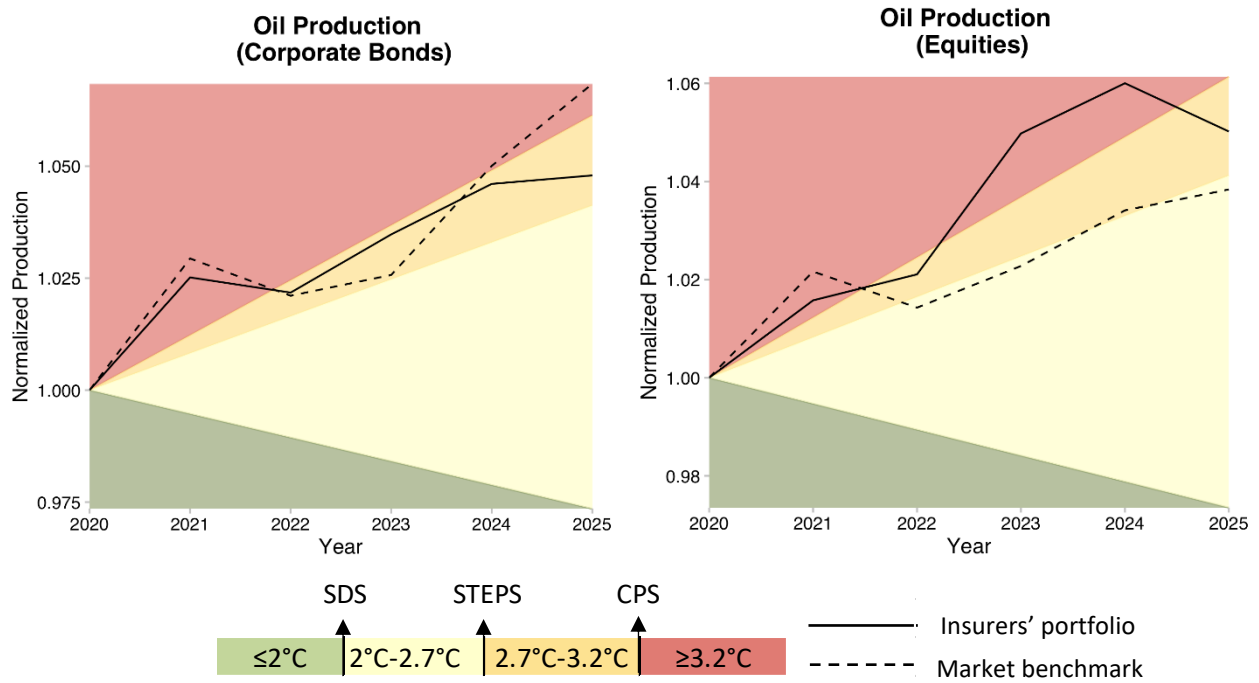


Figure 10. The Oil Production Volume Trajectory Relative to Climate Scenarios

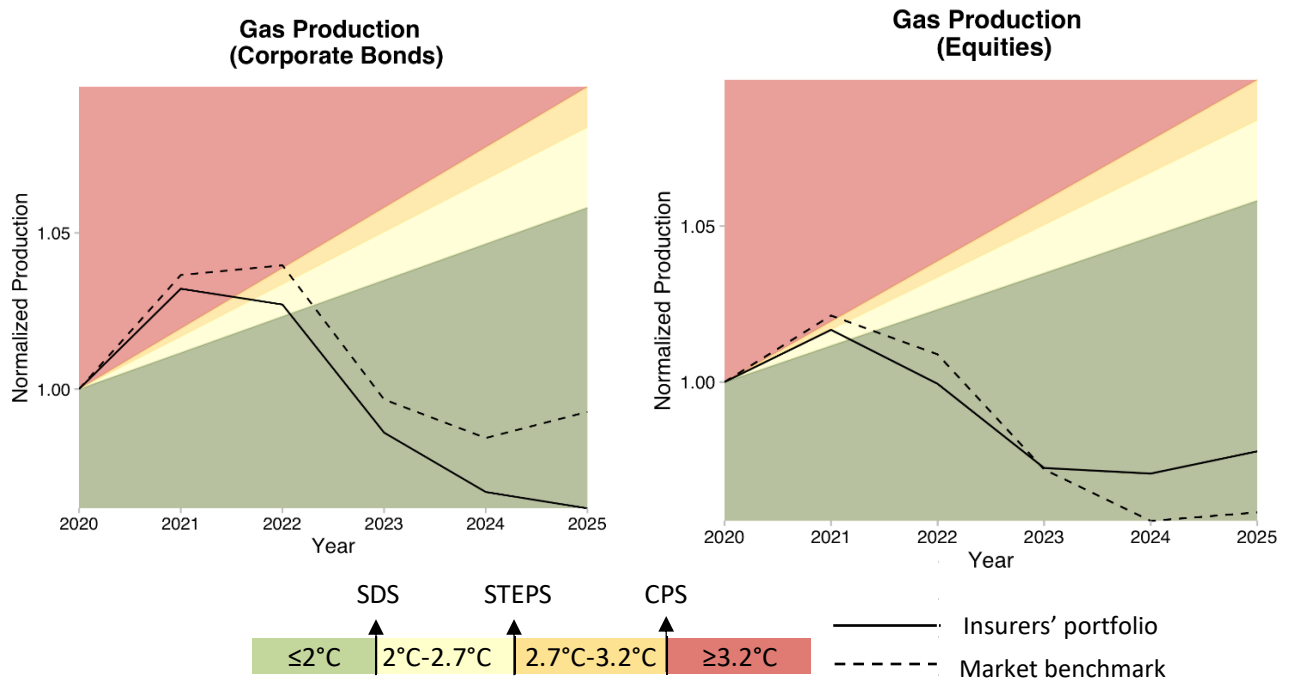


Figure 11. The Natural Gas Production Volume Trajectory Relative to Climate Scenarios

### 3.3.2. Power Generation

The transformation of the power sector is at the heart of the transition to a low-carbon energy system. In 2018, the power sector accounted for 42% of global carbon dioxide emissions, most of which were generated by coal-fired electricity.<sup>134</sup> In addition, the International Energy Agency found that coal combustion is responsible for 0.3°C of the 1°C increase in global temperature above pre-industrial levels, and thus represents the single largest source of global temperature increase. A growing share of the global use of energy will have to be converted into low-carbon electricity as more industrial sectors switch from fossil fuels to fossil-free power.

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

#### Technology mix

Figure 12 shows insurers’ technology mix for the power sector as of 2020 and 2025 based on the investee companies’ capital plans, as well as the 2025 market benchmark and 2025 target technology mix needed to be Paris-aligned (Target SDS 2025). For both corporate bonds and equities, insurers’ investments in renewables were insufficient to be Paris-aligned by 2025. Notably, insurers’ corporate bond holdings’ exposure to coal in 2025 was higher than the market benchmark while the reverse was true for insurers’ equity holdings.

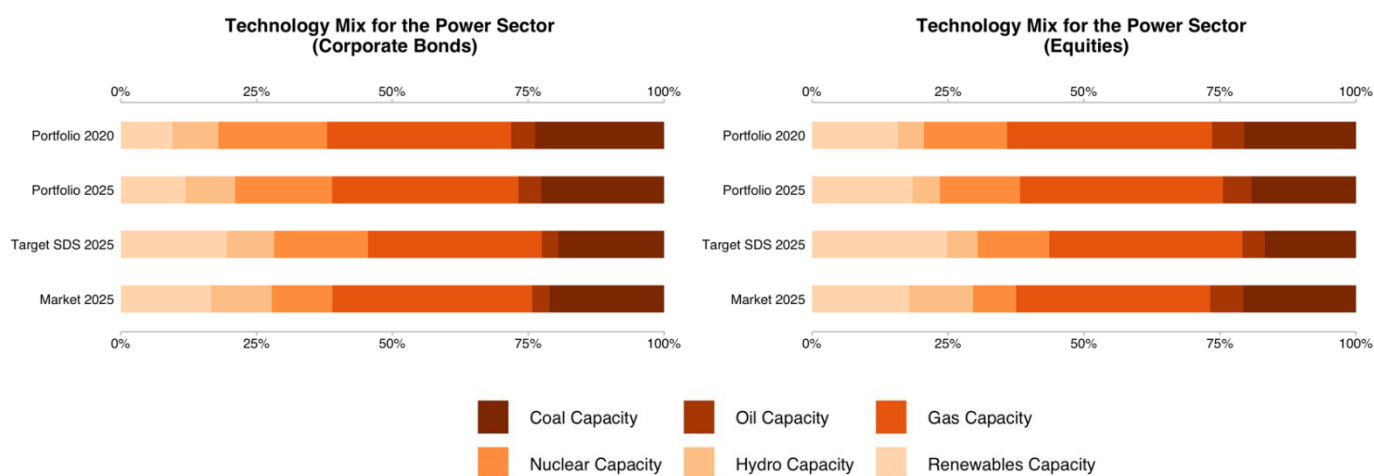


Figure 12. High-Carbon and Low-Carbon Technology Mix for the Power Sector

#### Production volume trajectory

##### Coal-Fired Power Generation

Figure 13 shows the production volume trajectories of coal-fired power generation relative to what is needed for the different climate scenarios. In both equities and bonds, insurers’ investments were expected to be Paris-aligned by 2025. The equity portfolio was more Paris-aligned than the benchmark while the alignment of the corporate bond portfolio was close to that of the benchmark.

Based on the two metrics (production volume trajectory and technology mix), the rate of decrease in coal power capacity was fast enough for insurers’ holdings to be Paris-aligned but the expansion of low-carbon power

<sup>134</sup> [Global Energy & CO2 Status Report 2019](#), International Energy Agency, March 2019.



generation technologies relative to the decrease in coal power capacity was insufficient for Paris-alignment. Put simply, insurers were underinvested in renewables.

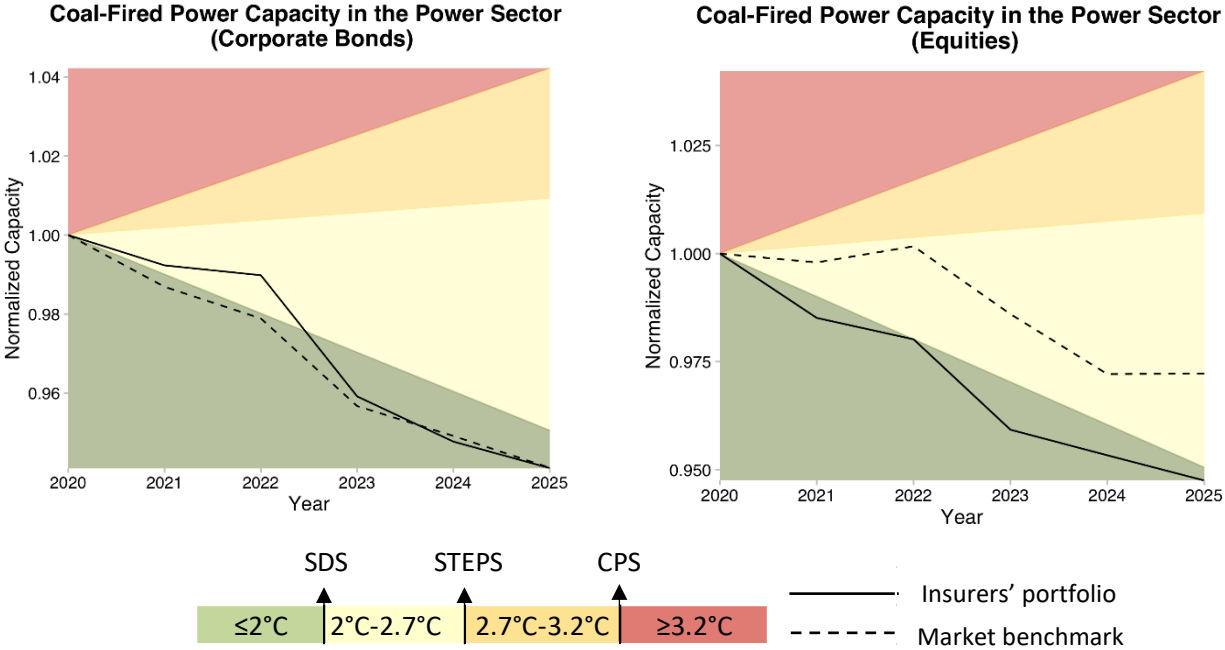


Figure 13. Coal-Fired Power Production Volume Trajectories Relative to Climate Scenarios

**Oil-Fired Power Generation**

Figure 14 shows the capacity (i.e., production volume) trajectories for oil-fired power generation. For both equities and corporate bonds, the insurers’ trajectories fell under a scenario worse than 3.2°C through the five-year time horizon. For equities, the insurers’ trajectory points to a lower temperature scenario than that of the market benchmark. The fact that the trajectory of the market benchmark for equities is almost flat shows how misaligned oil-fired power generation capacity is compared to the <2°C goal.

**Gas-Fired Power Generation**

Figure 15 shows the capacity trajectories of gas-fired power generation. Insurers’ corporate bond and equity holdings are Paris-aligned through the five-year time horizon. Both were more Paris-aligned than the market benchmarks.

**Renewable Power Generation**

Figure 16 shows the capacity trajectories of renewable power generation. The green section is at the top (rather than at the bottom as in the trajectory graphs for fossil fuel-based power generation) because renewable capacity needs to increase. Insurers’ corporate bond and equity holdings fell into a scenario worse than 3.2°C through the next five years, which means that insurers underinvested in renewables compared to the Sustainable Development Scenario. Although the corporate bond portfolio matches the market benchmark, the equity portfolio points to a higher temperature scenario than the benchmark.

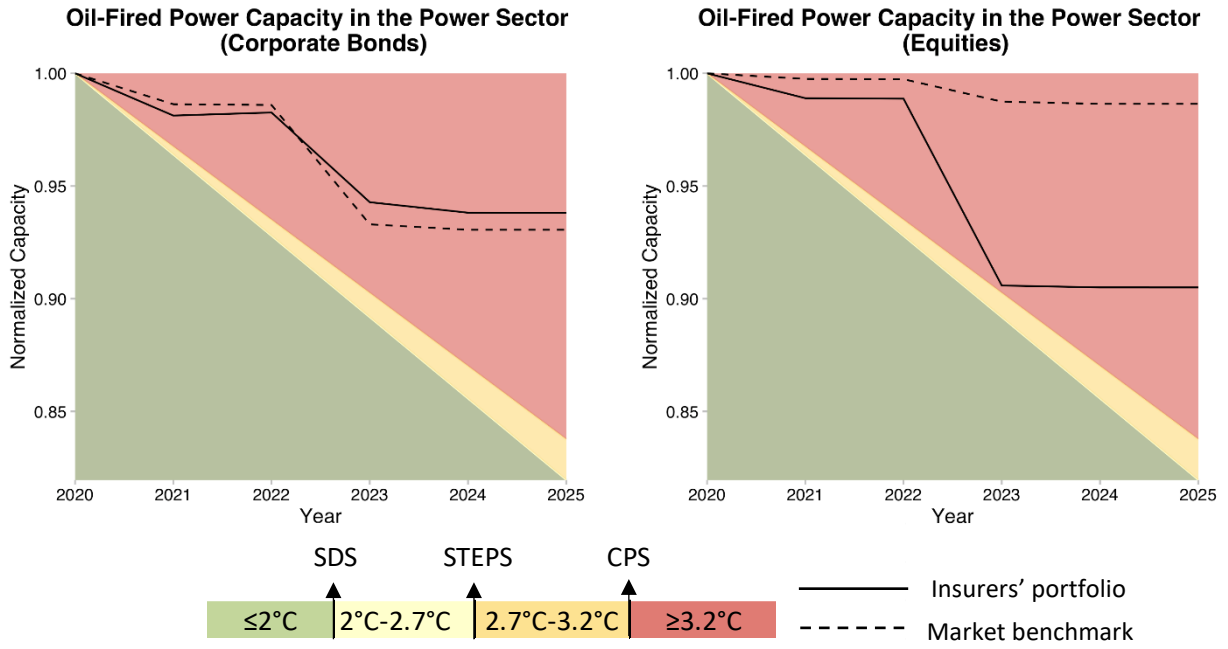


Figure 14. Oil-Fired Power Capacity Trajectories Relative to Climate Scenarios

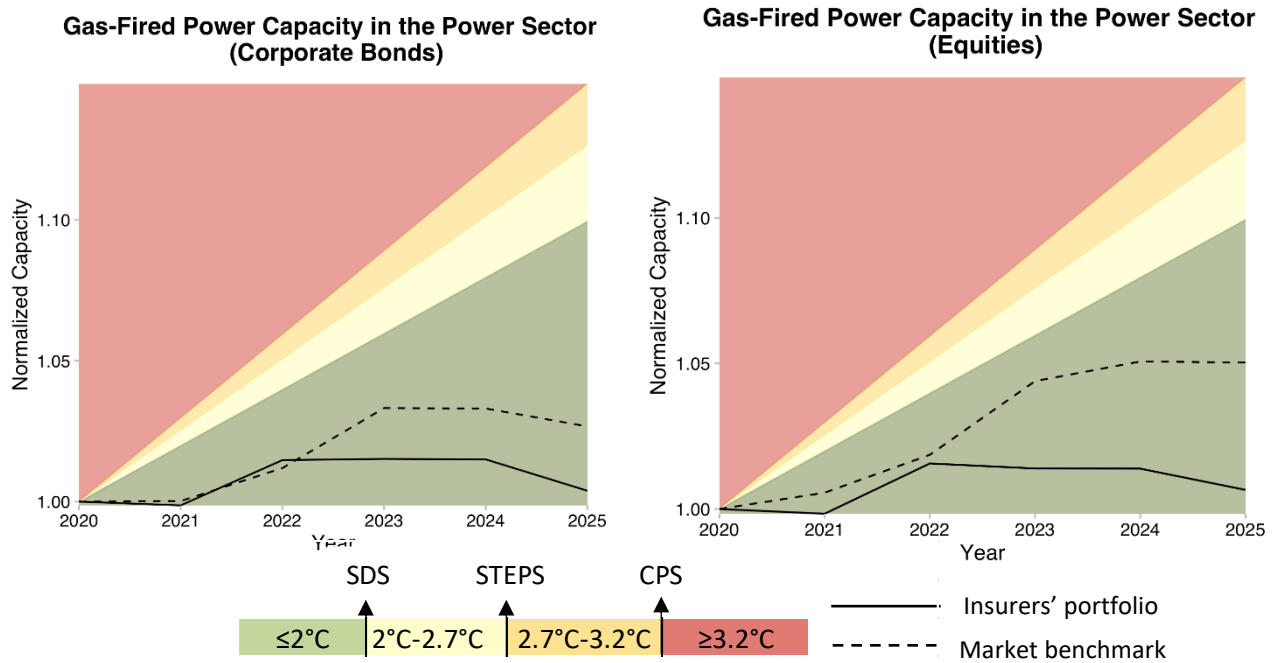


Figure 15. Gas-Fired Power Capacity Trajectories Relative to Climate Scenarios

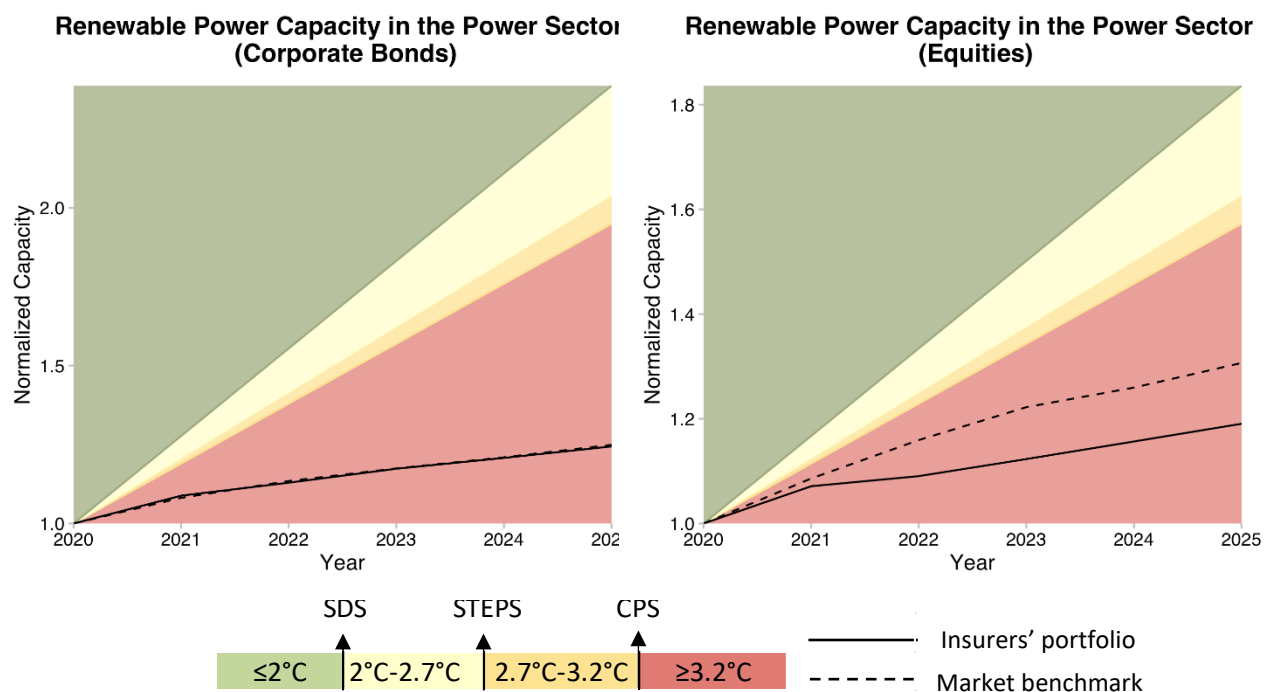


Figure 16. Renewable Power Capacity Trajectories Relative to Climate Scenarios

### 3.3.3. Automotive

The transportation sector accounted for about 28% of total U.S. greenhouse gas emissions in 2018, making it the largest contributor of U.S. greenhouse gas emissions.<sup>135</sup> Within the sector, light-duty vehicles (i.e., passenger cars and small vans) generated the most emissions at 59% of the total while medium- to heavy-duty vehicles generated 23% of the total.<sup>136</sup> PACTA focuses on the manufacturing segment of the automotive value chain when measuring climate scenario alignment. This segment is deemed the most climate critical as it is at the root of decarbonization efforts in the sector and affects the demand for fossil fuel up the value chain.

For purposes of the Study, only light-duty vehicle production was analyzed as it is the primary contributor of greenhouse gas emissions for the transportation sector.

<sup>135</sup> [Carbon Pollution from Transportation](#), the United States Environmental Protection Agency, accessed on March 20, 2021.

<sup>136</sup> [Fast Facts on Transportation Greenhouse Gas Emissions](#), the United States Environmental Protection Agency, accessed on March 20, 2021.

## Technology mix

Figure 17 shows insurers' technology mixes for the light-duty vehicles sector as of 2020 and 2025, as well as the 2025 market benchmark and 2025 target technology mix needed to be Paris-aligned (Target B2DS 2025). Although their exposure to electric vehicles was expected to be close to Paris-aligned in 2025, the insurers' exposure to internal combustion engine (ICE) vehicles in both portfolios was significantly higher.

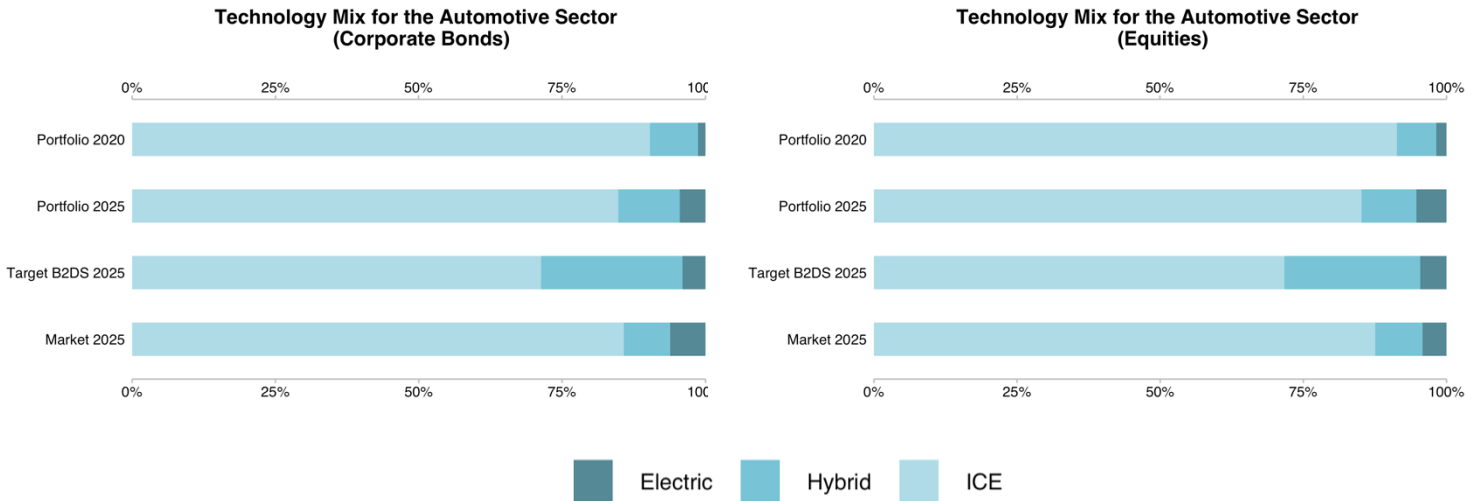


Figure 17. High-Carbon and Low-Carbon Technology Mix for Light-Duty Vehicles in the Automotive Sector

## Production volume trajectory

### Internal Combustion Engine-Based Light-Duty Vehicles

Figure 18 shows the production volume trajectories of ICE-based light-duty vehicles. For both corporate bond and equity portfolios, insurers' holdings fell within a 2°C - 3.2°C scenario between 2020 and 2025. Both trajectories were like those of the market benchmarks.

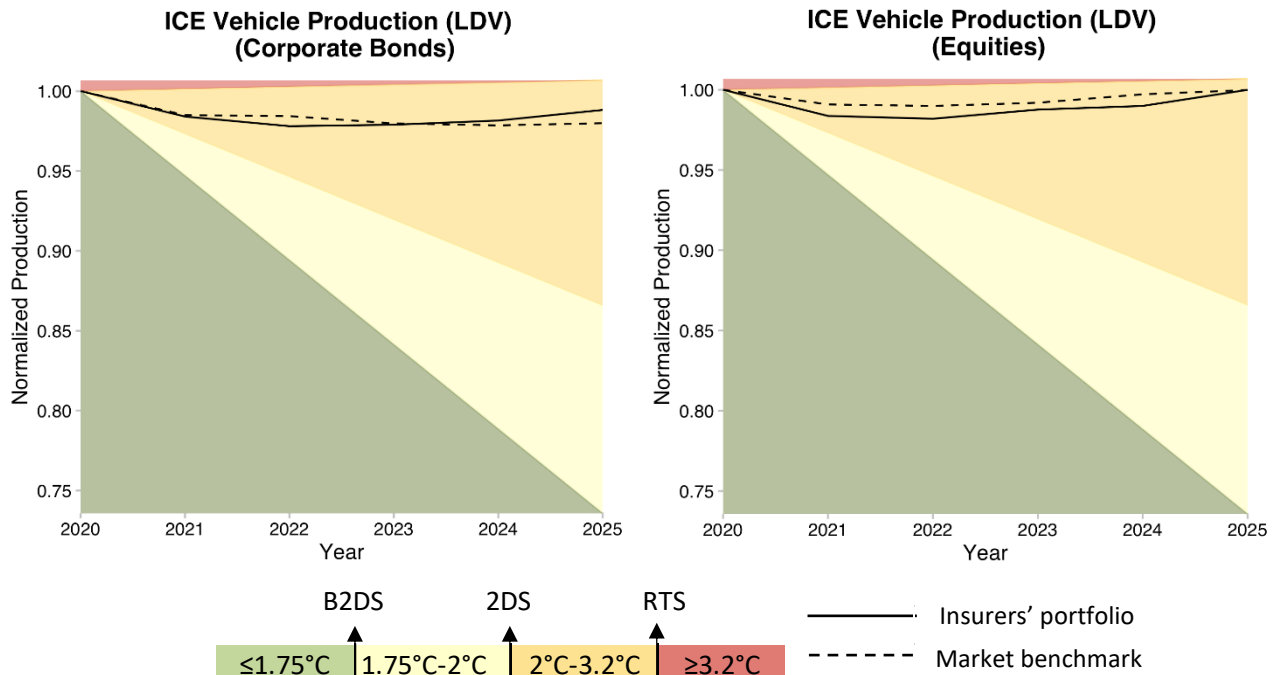


Figure 18. Production Volume Trajectories of Internal Combustion Engine-Based Light-Duty Vehicles (LDV) Relative to Climate Scenarios

### Hybrid Light-Duty Vehicles

Figure 19 shows the production volume trajectories of hybrid light-duty vehicles.<sup>137</sup> As with renewables, the lines that separate the climate scenarios slope upwards as the production volume of hybrid cars needs to increase. For both equity and corporate bond portfolios, the trajectories of insurers' holdings and the market benchmark fell within a scenario worse than 3.2°C between 2020 and 2025.

### Electric Light-Duty Vehicles

Figure 20 shows the production volume trajectories of electric light-duty vehicles, which fell within a 1.75°C - 2°C scenario for both equity and corporate bond portfolios. The trajectory of insurers' corporate bond holdings is slightly further away from the 1.75°C scenario than that of the market benchmark while the reverse is true for their equity holdings.

<sup>137</sup> Only three colors are shown in this figure because the  $\leq 1.75^\circ\text{C}$  and  $1.75^\circ\text{C} - 2^\circ\text{C}$  scenarios overlap.

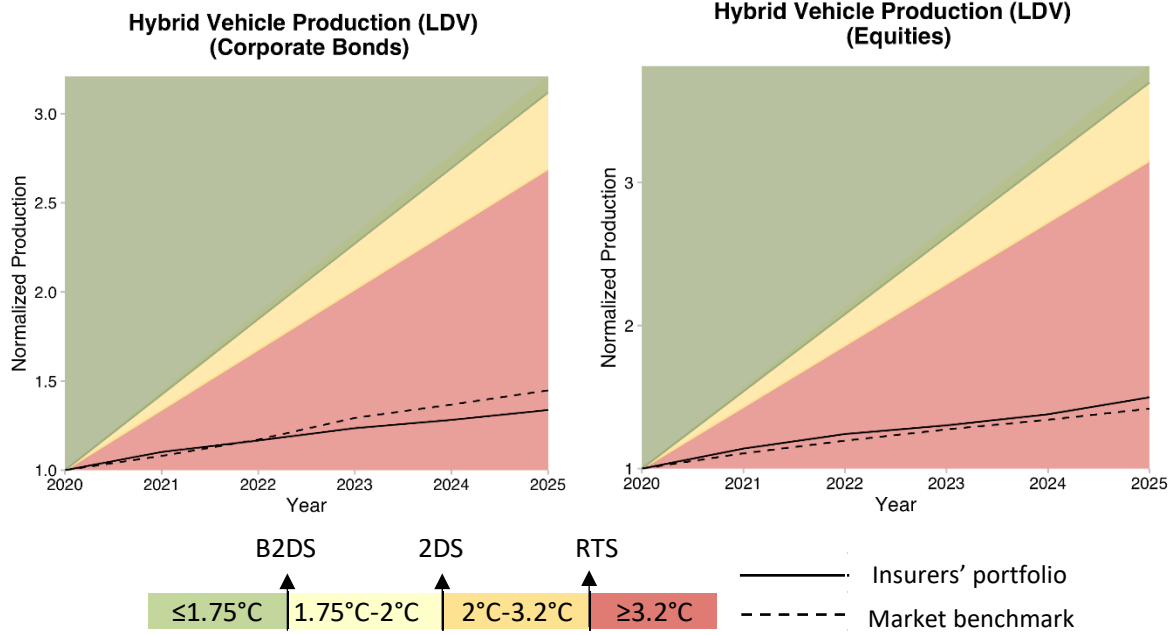


Figure 19. Production Volume Trajectories of Hybrid Light-Duty Vehicles (LDV) Relative to Climate Scenarios

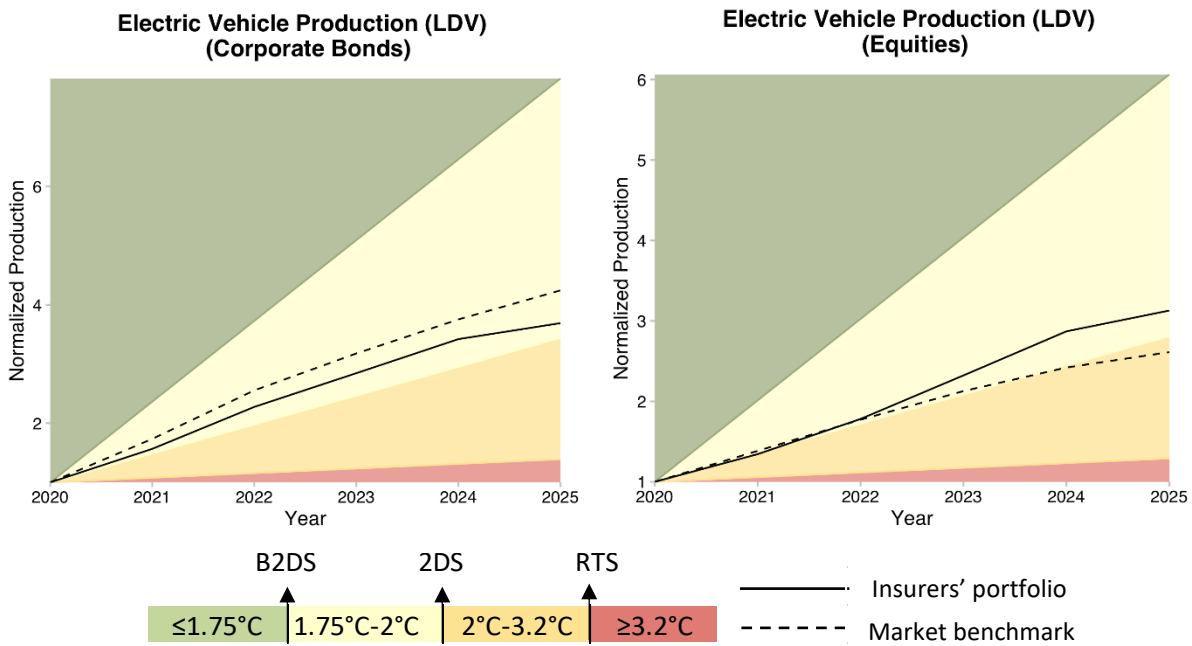


Figure 20. Production Volume Trajectories of Electric Light-Duty Vehicles (LDV) Relative to Climate Scenarios

Table 2 summarizes the alignment of insurers' investments in high- and low-carbon technologies with the Paris Agreement. For example, for coal power generation under "Technology Mix Relative to Paris Goal"/"Corporate bonds," "too much" means that there is too much coal power generation planned by the investee companies in insurers' corporate bond portfolios relative to the amount needed to be Paris-aligned. The "<2°C" in the same

row under “Implied Temperature by Production Volume Trajectory”/“Corporate bonds” means that the production volume planned by insurers’ investee companies in coal power generation for the next five years is sufficiently small relative to the amount of electricity that can be generated by coal to be Paris-aligned.

	Technology Mix Relative to Paris Goal		Technology Mix Relative to Market Benchmark		Temperature Scenario with which Production Volume Trajectory is Aligned		Paris-Alignment of Production Volume Trajectory Relative to Market Benchmark	
	Corporate bonds	Equities	Corporate bonds	Equities	Corporate bonds	Equities	Corporate bonds	Equities
Coal production					>3.2°C	>3.2°C	Worse	Worse
Oil production					2.7-3.2°C	2.7-3.2°C	Better	Worse
Natural gas production					<2°C	<2°C	Better	Worse
Coal power generation	Too much	Too much	Slightly more	Slightly less	<2°C	<2°C	Similar	Better
Oil power generation	Too much	Too much	Slightly more	Slightly less	>3.2	>3.2	Worse	Better
Natural gas power generation	Sufficient	Sufficient	Similar	Similar	<2°C	<2°C	Can be bigger	Can be bigger
Renewable power generation	Too little	Too little	Less	Similar	>3.2°C	>3.2°C	Similar	Worse
Electric Vehicles	Sufficient	Sufficient	Similar	Similar	1.75-2°C	1.75-2°C	Similar	Similar
Hybrid Vehicles	Too little	Too little	Less	Less	>3.2°C	>3.2°C	Similar	Similar
Internal Combustion Engine Vehicles	Too much	Too much	Slightly less	Slightly less	2.7-3.2°C	2.7-3.2°C	Similar	Similar

Table 2. Summary of Technology Mix and Production Volume Trajectory Alignment Relative to the Paris Agreement Goal and Market Benchmarks

### 3.4. Individual Insurers Reports – A Mock Example

To help insurers assess, and develop strategies to mitigate, their exposure to transition risks, DFS also requested that 2DII generate reports for individual insurers covered by the Study, which will be shared with each such insurer. Any insurer can create its own report by uploading its bond and equity positions into the open-source PACTA model. In addition to the analysis provided in this report, individual reports include information on the investee companies that have the biggest influence on an insurer’s portfolio’s technology mix and production volume trajectory. Insurers can use this information to identify investee companies that are most misaligned with a 2°C scenario for potential engagement. Strategies to mitigate transition risk are covered in Section 4.

Figure 21 is an illustrative example of this analysis and reflects the technology mix of the largest holdings (by portfolio weight) for the power sector. The weights to the right of the graph reflect the size of the investment as a percentage of the portfolio. The graph shows the breakdown of each investee company’s production capacity

by technology. This is compared to the insurer’s portfolio and a Paris-aligned portfolio. Companies that have higher exposure to a technology than the insurer’s portfolio drive the exposure of the portfolio to this technology up. In this example, compared to a Paris-aligned portfolio, the insurer’s portfolio overweighted coal power generation. The investee company that had the largest share of coal power was American Electric Power Co Inc. While Duke Energy Corp. had a smaller proportion of coal power relative to that of American Electric Power, its larger size in the portfolio makes it an important company to consider if the insurer were interested in reducing its coal power exposure.

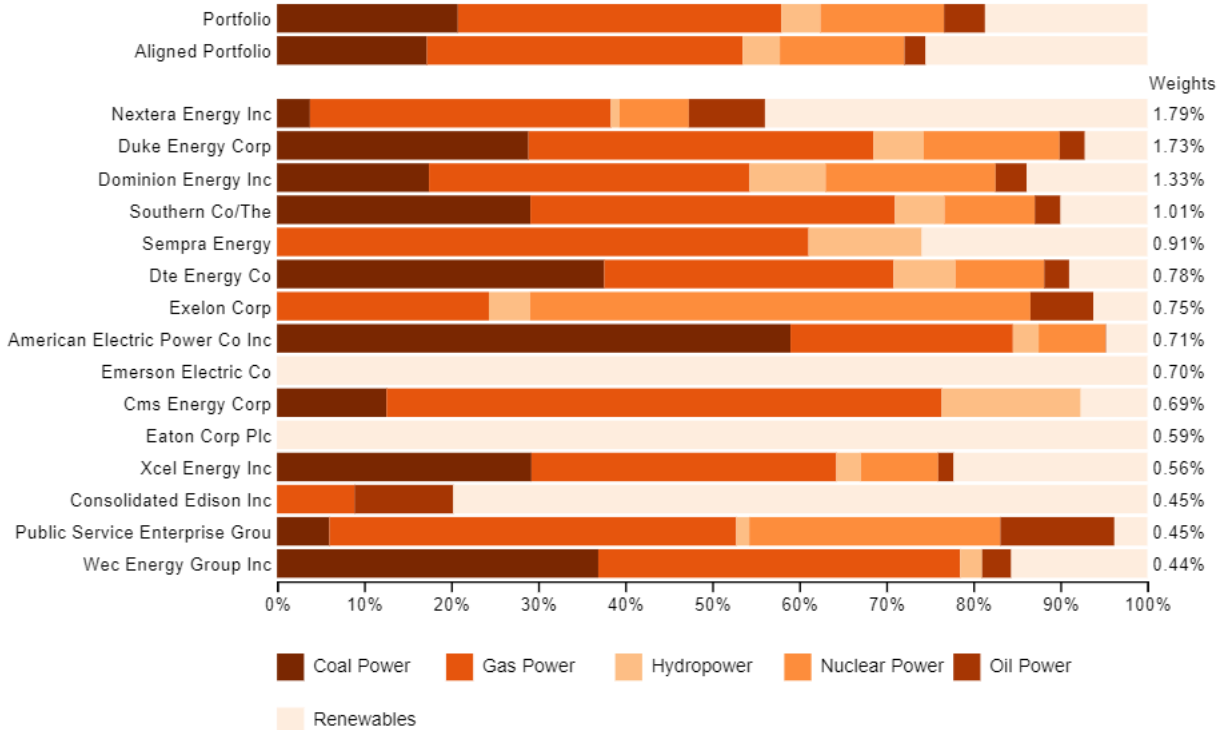


Figure 21. A Mock Example of Automotive Technology Mix of Investee Companies

### 4. Strategies for Mitigating Transition Risks

Once they have identified and measured their exposure to climate risks, insurers can use several investment-related strategies to mitigate that exposure. Common mitigating strategies include:<sup>138</sup>

- **Divestment:** selling instruments from issuers in carbon intensive sectors that are not making the low-carbon transition or are not transitioning fast enough. According to a 2020 paper, about 20% of surveyed institutional investors have used divestment to manage climate risks.<sup>139</sup> As described in Section 1.1.3. Transition Risk Driver – Changes in Public Sentiment and Demand Patterns, some insurers have taken this approach. This strategy can also be used in connection with setting exclusion criteria (see below).
- **Investment:** investing in issuers whose businesses support the low-carbon transition, such as renewables and electric vehicles, or in their suppliers. As illustrated in the Section 3.3. Insurers’ Alignment with

<sup>138</sup> This section is partially adopted from another 2DII report “[Transition Risks Assessment of Latin American Financial Institutions and the use of Scenario Analysis.](#)”

<sup>139</sup> DeWeerd, S., [Big investors are starting to sweat the details of climate risk](#), Anthropocene, February 25, 2020.



Climate Scenarios, insurers underinvest in these technologies relative to what is needed to achieve the Paris Agreement goal. Green bonds are one type of fixed income instrument whose proceeds are earmarked for climate-related or environmental projects.<sup>140</sup>

- **Exclusion:** systematically excluding issuers with high climate risks based on a set of criteria, which can come in the form of thresholds (e.g., excluding companies that derive more than 10% of their revenue from mining thermal coal and/or account for 1% or more of total global production<sup>141</sup>), a theme (e.g., excluding construction of new and improvements to coal fired thermal power plants<sup>142</sup>), or an industry (e.g., excluding thermal coal producers).
- **Engagement:** using their power as investors to influence corporate behavior on climate-related topics. Forms of engagement may include direct corporate engagement (e.g., communication with company boards and senior management), proxy voting, and filing or co-filing shareholder proposals.

For example, Climate Action 100+ is an investor-led initiative seeking to ensure that the world's largest corporate greenhouse gas emitters take necessary action on climate change. It engages with emitters to obtain clear commitments to cut emissions, improve governance, and strengthen climate-related financial disclosures.<sup>143</sup>

Although insurers are primarily bond investors that, unlike equity investors, do not have proxy voting rights, engagement is still possible. Bondholders provide capital to corporations and have a direct line of access and communication to management. As bonds frequently need to be refinanced at maturity, bondholders potentially have a lot of leverage over the companies they invest in if they choose to reinvest only if the companies undertake certain practices.<sup>144</sup> Bond investors can also link the interest rate of a bond to certain covenants and climate-related key performance indicators, as with sustainability-linked bonds (see below).

“Engagement should commence well in advance of the issuance process itself, both as a key part of the research informing investment strategy and decisions and to set clear expectations of companies in relation to alignment criteria that should be demonstrated to secure financing.”<sup>145</sup>

Bond investors in institutions that also invest in equity can leverage their equity counterparts to increase influence when engaging with the underlying companies. Those without equity investments can partner with other bond investors to increase influence. For example, Climate Action 100+ helps facilitate collaboration among bond managers and investors. Bondholders can also express their views on climate-related topics during the underwriting process by incorporating certain provisions in credit agreements at bond issuance.<sup>146</sup>

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<sup>140</sup> [Explaining green bonds](#), Climate Bonds Initiative, accessed on May 26, 2021.

<sup>141</sup> BNP Paribas Asset Management, [BNP Paribas Asset Management Announces Tighter Exclusion Policy on Coal Companies](#), March 4, 2019.

<sup>142</sup> [Swiss Investment Fund for Emerging Markets Exclusion List](#), accessed on April 17, 2021.

<sup>143</sup> [Climate Action 100+](#), accessed on March 24, 2021.

<sup>144</sup> Inderst, G., et. al., [Incorporating ENVIRONMENTAL, SOCIAL and GOVERNANCE \(ESG\) Factors into FIXED INCOME INVESTMENT](#), World Bank Group publication, April 2018.

<sup>145</sup> [Net Zero Investment Framework Implementation Guide](#), Paris Aligned Investment Initiative, April 13, 2021.

<sup>146</sup> Phillips, Y., [No voting rights? Engagement still matters in fixed income](#), Russell Investment Blog, August 4, 2020.

Although this strategy may be more effective for insurers with large allocations at bond issuance, smaller insurers can band together, either directly or through industry networks or their asset managers, to implement this strategy.

- **Setting climate-related investment conditions:** including climate-related factors as part of the contractual conditions of a financial instrument. These conditions seek to influence the climate performance of issuers to reduce their potential risk exposure. Sustainability-linked bonds are one such example where “the financial and/or structural characteristics can vary depending on whether the issuer achieves predefined sustainability/ ESG objectives.”<sup>147</sup> These objectives must be science-based and the financial and/or structural characteristics must be material to ensure performance change in borrowers and avoid greenwashing.<sup>148</sup>

As stated in DFS’s proposed [Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change](#), DFS is focused on the financial stability of insurers in the face of climate change. While insurers are expected to understand and manage their exposure to climate-related financial risks, DFS does not dictate insurers’ investment activities. In addition, each insurer should take a proportionate approach to managing climate risks that reflects its unique exposure and the nature, scale, and complexity of its business. Accordingly, the strategies outlined above are provided as potential options for insurers to evaluate and may not be applicable to all insurers. When evaluating any transition risk mitigation strategy, insurers should consider financial returns and asset-liability matching, among other factors.

Insurers can employ more than one of these strategies at the same time. For example, Swiss Re planned to exit from coal, increase investments in renewable and social infrastructure by \$750 million, and expand its green, social, and sustainability bond exposure from \$2.6 billion at end of 2020 to \$4 billion by the end of 2024.<sup>149</sup> The use of one strategy may support others. For example, divestment of a company in an insurer’s portfolio could cause the divested company to engage.<sup>150</sup> Insurers can also adopt different strategies for different asset classes, such as engaging with the companies in which they have equities investments and requiring the issuance of sustainability-linked debt for the companies in which they have fixed income investments.<sup>151</sup>

Insurers that outsource their investment function to third-party asset managers can request that the asset managers evaluate and, if appropriate, adopt the above-referenced strategies on their behalf. Insurers are also encouraged to reach out to network coalitions, such as the Principles for Responsible Investment, Climate Action 100+, and Net Zero Asset Owner Alliance, to learn more about what they can do individually and collectively to mitigate transition risks. Finally, although it focuses more on alignment with the Paris Agreement than prudent risk management, the [Net Zero Investment Framework Implementation Guide](#) by the Paris Aligned Investment Initiative contains useful information on strategies to mitigate transition risks.

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<sup>147</sup> International Capital Market Association, [Sustainability-Linked Bond Principles Voluntary Process Guidelines](#), June 2020.

<sup>148</sup> Hurley, M., [Nuveen: Sustainability-linked bonds fail our impact credibility test](#), Environmental Finance, May 25, 2021.

<sup>149</sup> Marsh, A., [Swiss Re Plans Coal Exit, \\$100 Carbon Levy on Road to Net Zero](#), Bloomberg Green, March 16, 2021.

<sup>150</sup> Global Association of Risk Professionals, [podcast interview](#) with Meryam Omi, Head of Sustainability and Responsible Investment Strategy at LGIM, April 15, 2021.

<sup>151</sup> Baker, S., [ESG laggards could discover debt drying up](#), Pension & Investments, November 16, 2020.

## 5. Conclusion

Climate change poses wide-ranging and material risks to the financial system. Insurers need to understand and manage climate risks – both physical and transition – while also taking advantage of the opportunities that they present. The Study focuses on transition risks on the asset side of insurers’ balance sheets, which is an area that has received less attention than physical risks.

Based on their 2019 Schedule D data, the Study shows that, in the aggregate, **New York domestic insurers’ investments had meaningful exposure to carbon intensive sectors.** The **five-year forward-looking capital plans of most of these sectors were not aligned with the goals of the Paris Agreement, except for natural gas production, natural gas-fired power generation, and electric vehicles.** DFS recognizes that the global economy, which is reflected by the equity and bond markets, is not yet Paris-aligned. However, in many cases, **insurers’ portfolios were less Paris-aligned than market benchmarks.**<sup>152</sup> When insurers underinvest in low-carbon technologies, they miss out on many of the opportunities that arise from the transition. This also means that the potential loss in returns from carbon intensive technologies may not be offset by the potential increase in returns from low-carbon technologies. **Insurers differ widely in their percentage holdings of high- and low-carbon technologies within a given sector. However, the Study confirmed that some insurers are much more exposed to fossil fuel production than their peers.**

The Study provides an example of a tool that insurers can use to analyze transition risks and outlines investment-related strategies that insurers can consider to mitigate their exposure to those risks, including divestment, investment, exclusion, engagement, and setting climate-related investment targets. DFS recognizes that climate risks are one of many factors, including financial returns and risk controls, that an insurer should consider when making investment decisions.

## 6. Appendix

### 6.1. Parts of Value Chains Covered by the PACTA Methodology

In each of the eight most carbon intensive sectors in the economy (i.e., oil and gas, coal mining, power generation, automotive, aviation, shipping, cement, and steel), PACTA focuses on the part of their value chain with the highest impact in terms of CO<sub>2</sub> emissions (see Figure 22). For example, in the oil and gas sector it focuses on upstream activities related to production while in the power sector it focuses on power generation and related sources of energy. This allows the PACTA tool to efficiently use data inputs while minimizing potential double-counting issues (e.g., oil and gas downstream operations are not considered because part of those emissions would be considered in power generation). Furthermore, if decarbonization (i.e., reducing or eliminating carbon emission) is achieved in one part of the value chain, then the rest of the value chain will be decarbonized as well.

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<sup>152</sup> Obviously, an investment decision requires many considerations, including price, liquidity, and asset-liability matching, which may prevent insurers from matching the market benchmark.

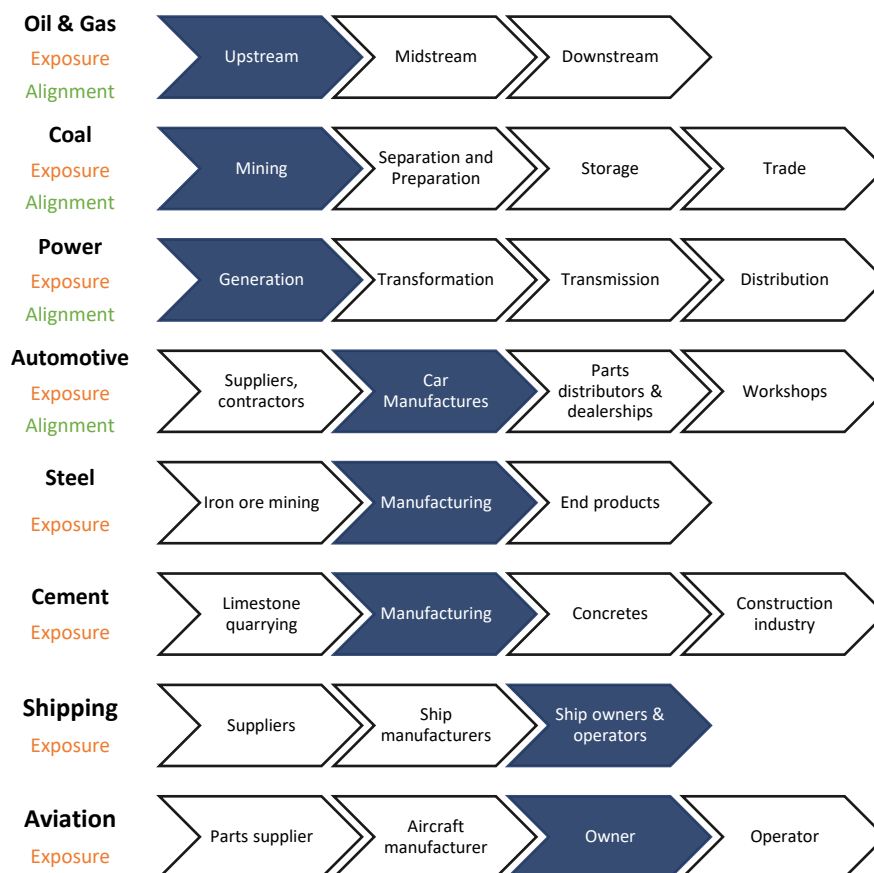


Figure 22. The Parts of Value Chains Covered by PACTA Model (Shaded in Blue) (Source: 2DII)

## 6.2. Limitations of the Study

There are several limitations to the PACTA climate scenario analysis conducted in connection with this report:

**Climate Scenarios:** The climate scenarios in the report present one possible manifestation of how an energy transition aligned with the Paris Agreement might look. Even though the necessary actions are not controversial (e.g., expansion of renewables, retirement of high-carbon technologies), the precise way in which a carbon budget is distributed across sectors is modeled in different ways by different scenario providers. Furthermore, different models include different assumptions about the future development and potential of certain technologies. In this analysis, scenarios are taken from the IEA, which relies on technologies that are proven and available to the market.

**Asset-Level Data:** Although the data is sourced from reliable, third-party data providers, errors are possible, either in the production plans themselves or in mapping the ownership structure of companies. Furthermore, production plans may not materialize, and production forecasts should be interpreted bearing this in mind.

**Data Coverage:** 2DII does not have coverage for private investments, which could contain companies that are in the eight high-carbon industries.

**Data Timing:** The data used for purposes of this analysis is from insurers' 2019 filings and is less useful for decision-making purposes than if more real-time data had been used.

**Fund Coverage:** 2DII relies on external data sources to identify the securities in the relevant investment funds. These external data sources may not always be up to date and accurate.

**Sector Scope:** Low-carbon technology pathways to achieve the 2 Degrees Scenario have not been established for the steel, cement, aviation, and shipping industries. As a result, their production volume trajectories were not analyzed as part of the Study. PACTA also does not cover certain sectors, such as real estate, agriculture, and forestry, even though they are highly relevant for limiting future greenhouse gas emissions. Finally, asset classes such as sovereign bonds, mortgages, private equity, and private debt were excluded from the analysis even though they also face climate risks. These limitations in scope are due to a lack of available data.

