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Climate Transition Risk for General Insurers

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Abstract

The landscape of general insurance is changing, driven not just by the physical impacts of climate change, but also by stakeholders such as regulators and investors concerned about climate change, and economic and technological change.

Such factors include the transition to renewables within the energy sector, the impact of emission reductions on agriculture and infrastructure, shifts in global consumer preferences, and increasing demand for climate risk disclosure.

This paper considers various scenarios for how these drivers may play out in the future. It considers the implications for general insurers and discusses where actuaries can provide insight into the possible implications of different climate change scenarios.

Keywords: Climate change, transition risk, decarbonisation, climate change scenarios, scenario analysis, Paris Agreement, actuaries, underwriting, investments, disclosure, TCFD.

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Any opinions in this report are those of the Authors and not necessarily those of the Institute or our employers.

Introduction

Globally, general insurers are facing pressure to respond to climate change. Primarily, this is being driven by **investors** seeking transparency from companies, so that they can reduce their exposure to industries that are heavily dependent on fossil fuels and other sources of greenhouse gases. In addition, **regulators** are increasingly concerned on the potential risk of falls in asset values for general insurer investments, driven by rapid decarbonisation of the economy. This paper focuses on these **transition risks** for insurers.

Our aim is to assist general insurers in considering their exposure to transition risks and assessing what this may mean for their business and strategy. We focus on how general insurers might disclose their transition risks under the standards developed by the Taskforce for Climate-Related Financial Disclosures (TCFD). We do not develop any specific recommendations for general insurers; instead we discuss the potential issues that general insurers need to consider and hope that this is a useful introductory guide for the industry.

After discussing **transition risk** in detail, and the increasing pressure for general insurers to disclose in line with the **TCFD recommendations**, we also consider the **opportunities** that arise for general insurers from the transition to a low-carbon economy.

Globally, climate change is also expected to result in increased insurance losses from increased **weather-related natural disasters** in the longer term. This **physical risk** is not the focus of this paper. We note that climate change may also give rise to **liability risks**, where proponents undertake legal action in order to be compensated from the costs of climate change. These costs may fall to insurers via insurance policies such as professional indemnity, directors and officers and other liability covers. We have not considered these in detail and hope to do so in a forthcoming paper.

We consider in detail **scenarios** developed by the International Energy Authority (IEA) and projections by the Bloomberg New Energy Finance on the potential transition within the energy industry. These scenarios have been deployed by the energy industry in disclosing their transition risks under the TCFD recommendations and are a natural starting point for general insurers.

We discuss the various factors that drive the speed and type of transition considered in each of these global scenarios, and the **range of choices** that may need to be considered by general insurers in developing their own scenarios.

We then consider the impact of general insurers **withdrawing insurance** for energy companies who rely on fossil fuels, which many insurers have signalled as their intention, in order to reduce their exposure to transition risk, as well as to act in support of the Paris Agreement target of keeping temperature rises below 2˚C. Temperature rises could negatively impact general insurers if they lead to unanticipated increases in natural disaster costs.

We move onto discuss transition impacts on **non-energy industries**. We consider in detail the potential **new products** for general insurers arising from transition, and the potential impact on **investment strategy** for general insurers.

Lastly, we discuss some of the recent **TCFD disclosures** made by banks and insurers as an illustration of the above points.

Conclusion

While we do not reach any firm recommendations or conclusions, we outline several considerations general insurers will need to reflect on in relation to transition risk. These include:

- Identifying and understanding the impact of transition on their markets, products and customers, including where those markets may contract or expand;
- Developing opportunities to expand existing insurance products or develop new products;
- Reviewing investment strategies to understand exposure to transition risk, and developing new approaches to manage this risk as well as taking advantage of new opportunities that open up;
- Preparing detailed scenario analyses of future transitions on insurance and investment markets, as well as the economy in general;
- Developing approaches to align insurers with the Paris agreement targets, as well as considering opportunities to encourage orderly transition within investment and insurance markets.

Given their financial analysis skills and deep understanding of insurance products and strategy, actuaries have a leading role to play in this area.

Transition risk and general insurers

Transition risk

The Bank of England[i] defines climate transition risk as risks that could arise from the process of adjusting to a lower-carbon economy, such as changes in policy, technology, or investor sentiment. These changes could prompt a reassessment of a large range of asset values, and if this happens more rapidly than businesses are prepared for, it may threaten financial stability and the economy.

Climate transition risks and opportunities may arise from:

- **Policy and legal changes** relating to energy generation, renewable energy targets, sustainable land use, water efficiency etc.;
- **Technological advancement** in renewable energy, battery storage and electrification of transport, aviation and agriculture;
- **Change in demand** for products and commodities, such as fossil fuels or lithium, leading to market risk;
- **Reputational risk** arising from shareholder, consumer or investor concerns, reflecting the transition in views regarding fossil fuels.

Climate transition risks are distinct from the physical risks of climate change that arise from increased frequency and severity of climate-related events that cause property damage and disruption to businesses.

The general insurance industry has significant expertise in quantifying the risk of losses from natural hazard events; however, the assessment and measurement of the impact of policy action, technological advancement and consumer sentiment on an insurance company requires a different approach. The Task Force on Climate-related Financial Disclosures[ii] (TCFD) also includes the use of scenario analysis as a tool for understanding the financial and strategic impact of climate change on a company (including both physical and transition risk).

Transition risks for general insurance companies

The TCFD recommendations report[iii] categorises the different types of risks and opportunities that might arise from climate change. Table 1 describes the climate risks that the general insurance industry is exposed to and provides some examples of potential transition risk impacts.

Table 1: Climate transition risks for general insurance

Climate transition risks	Potential transition risks for a general insurer
Policy and Legal • Increased pricing of greenhouse gas emissions • Enhanced emissions-reporting obligations • Mandates on and regulation of existing products and services • Exposure to litigation	• Increased claims on directors & officers, professional indemnity and other liability insurance • Shareholder actions against Boards of insurers for breach of fiduciary duty relating to insufficient risk disclosure • Failure to deliver on emission reductions and/or reporting requirements, leading to reputation impacts and loss of investor support
Technology • Substitution of existing products and services with lower-emission options • Unsuccessful investment in new technologies • Costs to transition to lower-emission technology	• Reduction in commercial insurance (including workers compensation, construction, engineering, liability) underwriting opportunities for carbon-intensive industries and related industries due to contraction in these sectors • Redundancy of high carbon technologies leading to stranded assets in the investment portfolio • Insufficient investment in systems and processes to measure and manage climate risks, leading to missed opportunities and strategic consequences
Market • Changing customer behaviour • Uncertainty in market signals • Increased cost of raw materials	• Cost of running carbon-intensive businesses and/or changing consumer preferences, leading to shrinkage of the existing market and reduced premium revenue
Reputation • Shifts in consumer preferences • Stigmatization of the sector • Increased stakeholder concern or negative stakeholder feedback	• Negative media attention on the decision to underwrite (or not underwrite) carbon-intensive projects or properties exposed to high physical risk • Public or government pressure to pay claims that are not strictly within coverage terms • Failure to manage climate risk leading to loss of social licence to operate

Opportunities for general insurance companies

The transition to a low-carbon economy will bring new opportunities as well as risks. These include opportunities to use resources more efficiently, enter new markets, and develop new products and services to meet customers' changing needs. Table 2 describes some examples of potential opportunities for the general insurance industry.

Table 2: Climate transition opportunities for general insurance

Climate transition opportunities	Potential transition opportunities for a general insurer
Resource efficiency • Use of more efficient modes of transport • Use of more efficient production and distribution processes • Use of recycling • Move to more efficient buildings • Reduced water usage and consumption	• Use of technology to reduce staff travel • Product offerings for staff to make homes more energy efficient • Good management of physical risks leading to improved employee health, safety and satisfaction
Energy source • Use of lower-emission sources of energy • Use of supportive policy incentives • Use of new technologies • Participation in carbon market • Shift toward decentralised energy generation	• Insurance underwriting of renewable energy projects • Innovative risk transfer products to support renewable energy projects, e.g. weather derivatives to protect wind farms from unexpected low winds • Returns on investment opportunities in low-emission technologies
Products and services • Development and/or expansion of lower-emission goods and services • Development of climate adaptation and insurance risk solutions • Development of new products or services through R&D and innovation • Ability to diversify business activities • Shift in consumer preferences	• Insurance products with resilience features, such as cyclone- or flood-proofing when rebuilding properties after claims • Insurance products tailored for new climate-related technologies, including electric vehicles, batteries etc. • Innovative new products such as parametric insurance or energy savings insurance
Markets • Access to new markets • Use of public-sector incentives • Access to new assets and locations needing insurance coverage	• Reputation and competitive position benefits of being proactive in managing climate change • Diversification of financial assets, by adding green bonds to the investment mix • Issue climate bonds (catastrophe bonds with resilience funding features)
Resilience • Participation in renewable energy programs and adoption of energy-efficiency measures • Resource substitutes/diversification	• Purchasing agreements with energy efficient suppliers to reduce emission footprint and increase reliability of supply chain

Transition scenarios for the energy sector

The COP 21 Paris Agreement seeks to ensure effective measures are taken to keeping the rise in global temperatures well below 2 degrees Celsius, relative to pre-industrial levels, by 2100[iv].

As noted by the Intergovernmental Panel on Climate Change (IPCC), the main driver of climate change is the emission of greenhouse gases (GHGs). The main GHGs and their sources are summarised below[v] in Table 3.

Table 3: Greenhouse gases[vi]

Greenhouse Gas	Sources
Carbon Dioxide (CO_2)	Burning fossil fuels and cement production. In addition, destruction of trees reduces CO_2 absorption.
Methane	Production and transport of fossil fuels, livestock and organic decay.
Nitrous Oxide	Burning fossil fuels, fertilizer and various industrial processes.
Fluorinated gases (including hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride)	Various industrial processes, and household products including refrigerators.

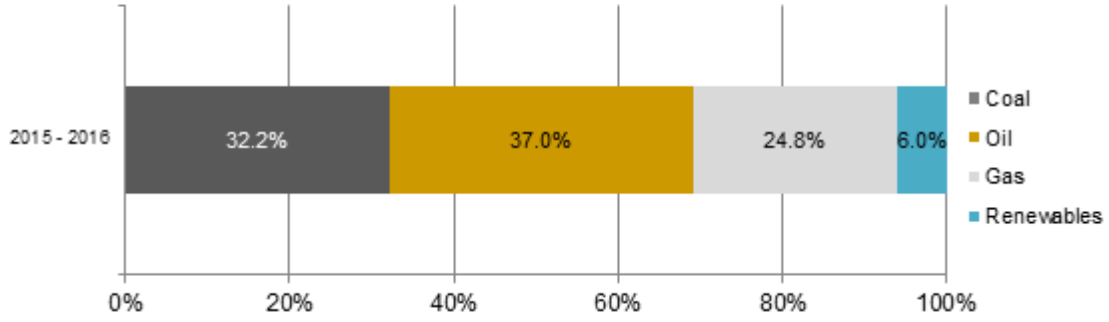
Most GHGs arise from the use of fossil fuels, so reducing the burning of fossil fuels is a key aspect of transitioning to a lower-carbon economy and achieving the Paris Agreement targets. Since a significant amount of energy generation relies on burning fossil fuels, the energy sector is impacted by transitioning to a lower carbon economy.

Transition risk in the energy sector can arise from:

- Changes in government policy, for example through taxes to limit supply or demand; and
- Improvements in technology enabling more efficient and cheaper supply, or changing the demand for energy through electrification.

In Australia, energy consumption by fuel type can be broadly categorised into the following energy sources: coal, oil, gas, and renewables. Between 2015 and 2016, the proportion of consumption for each fuel type is broken down as shown in Figure 1.

Figure 1: Australia Energy Consumption by Fuel Type[vii]

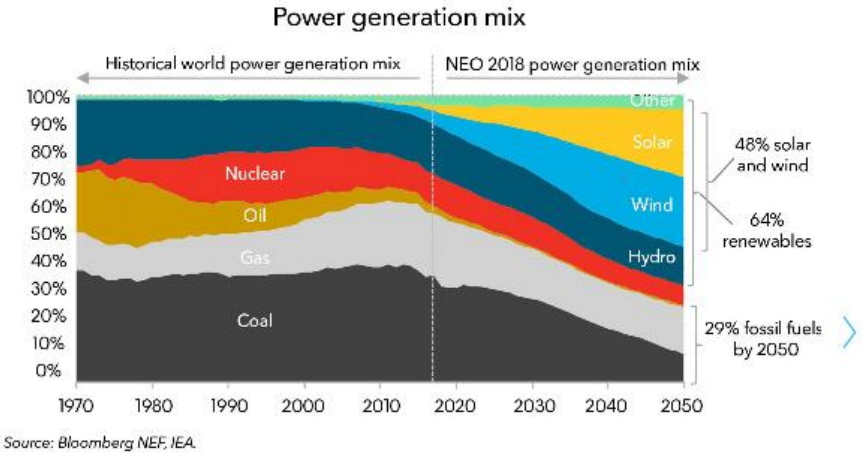


Trends over the past 10 years show a slight decrease in coal consumption, whereas the other fuel types have increased[viii].

Given the complex forces at play, predicting the future course of changes to the global energy market is technically challenging. Some researchers, such as Bloomberg, attempt to project future changes in the energy market. Others, such as the IEA, adopt a scenario approach, where pathways are designed to achieve temperature targets as well as other objectives. We discuss these projections and scenarios below.

As shown in Figure 2, Bloomberg's New Energy Outlook 2018 projects that globally, by 2050, 29% of power generation is expected to come from gas and coal, with 64% from renewables, and the remainder from nuclear[ix].

Figure 2: Bloomberg's global New Energy Outlook 2018

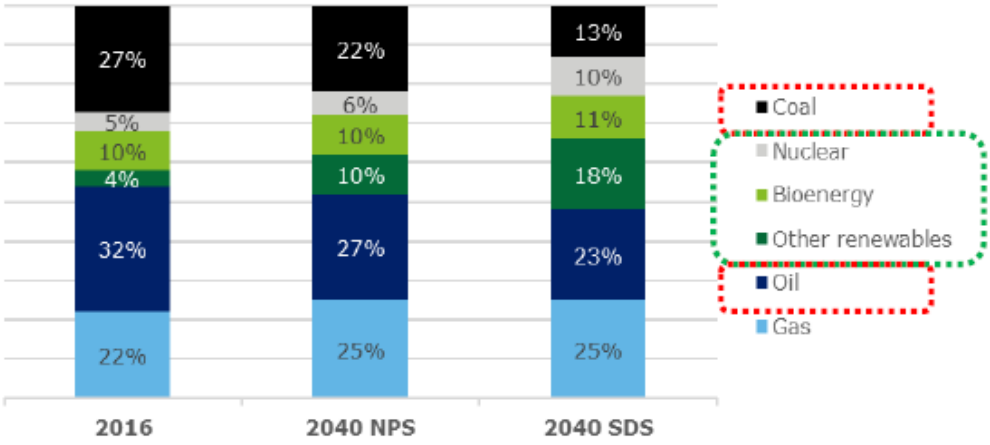


There is a material shift expected from the current mix of fuel type consumption to the projected global mix in 2050. This presents risks and opportunities for the energy sector in Australia in transitioning to a lower carbon economy.

This projection shows an expected 64% of power to be generated through renewables. This is just one view of the power generation mix in the transition to a

lower-carbon economy. The International Energy Agency (IEA) shows two scenarios below, a new policies scenario (NPS), and a sustainable development scenario (SDS)[x].

Figure 3: IEA scenarios[xi]



Source: IEA, World Energy Outlook 2017

The SDS and NPS are scenarios based on the IEA World Energy Outlook (WEO)[xii]. The NPS is based on existing policy ambitions and likely effects of announced policies from governments around the world. The SDS refers to an integrated approach to achieving internationally-agreed objectives on climate change, air quality and universal access to modern energy. The IEA research shows that the world is currently not on track to meet the main energy related components of the Sustainable Development Goals (SDG). The SDS aims to show how a major transformation of the energy system can help in reaching the three main energy-related SDGs. Below are key assumptions that differ between the SDS and NPS.

Table 4: Comparison of IEA energy scenarios

Assumption	SDS	NPS
CO_2 Emissions	• Energy-related CO_2 emissions peak around 2020, and decline thereafter. • By 2040, CO_2 emissions are around half of current levels, trending towards zero. In line with goals of the Paris agreement of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C". • Most of the decrease in emissions is assumed to arise from a combination of efficiency improvements and renewables.	• CO_2 emissions continue to increase beyond 2020.
Access to energy	• Assumes everyone has access to modern energy, mainly through electrification. • Aligned with SDG 7 (access to affordable and clean energy). • Access to energy assumed to increase both on and off the grid, with increased access to clean cooking.	• Limited improvement in access to energy
Deaths	• Premature deaths reduced through: o Reduction in outdoor air-pollution o Increased access to clean cooking	• Estimated 3.1m higher premature deaths in 2040 (compared to SDS)
Investment	• Increase in energy investment required is only 15% of that compared to the NPS. Energy transition under SDS driven by: o Efficiency improvements o Renewables o Reductions in emissions through electrification	

The level of transition risk depends on the scenario assumed – and the faster the energy sector has to change, the greater the likelihood of shocks to the economy, and the greater the level of transition risk. Factors that affect the speed of transition are discussed below.

Allowance for Carbon Capture and Storage (CCS)

CCS is a technology that captures carbon dioxide (CO_2) emissions produced from the use of fossil fuels in electricity generation, preventing the CO_2 from entering the

atmosphere. CCS is not currently available in a cost-effective form, and there is little sign of breakthrough[xiii]. Including CCS within scenarios is often controversial for this reason.

The greater the extent that any scenario allows for CCS, the longer the time horizon for transitioning to a lower-carbon economy, as future CCS is expected to result in negative GHG emissions. This allows for a slower transition to renewable energy, resulting in a lower transition risk[xiv].

Coal-based businesses will directly benefit from CCS technology as the economy decarbonises. Other sectors which are difficult to decarbonise, including aviation, heavy transportation, iron and steel, glass, cement, petrochemicals, and agrochemicals[xv] also benefit from the inclusion of CCS within scenarios.

Proportion of biofuels used

The Bloomberg projection discussed above assumes a small proportion of biofuels (captured in the 'Other' category), and almost no growth over the projection horizon. Assuming an increasing proportion of biofuels, for example through public policy enabling specific types of plants being grown, could speed up the transition process, and reduce generation of power through coal, gas, and oil faster.

Transitioning through higher biomass energy could impact types of plants farmed. This could then have implications for agriculture, and hence crop insurance and other opportunities for insurance product development. Considerations that may arise from these changes include the shifts in underwriting and risk profiles that insurers are exposed to.

There has been a feasibility study conducted in India in 2008[xvi], where Indian insurance companies indicated that failure to procure fuel was not considered to be an insurable risk, regarding fuel supply and pricing risks. One of the challenges raised was the absence of organised market and transparency, meaning loss assessments were likely to be difficult and subjective.

The US Department of Agriculture has also begun investigations into the feasibility of developing a crop insurance product for crop residues as biofuel feedstock[xvii].

Gas as an interim solution

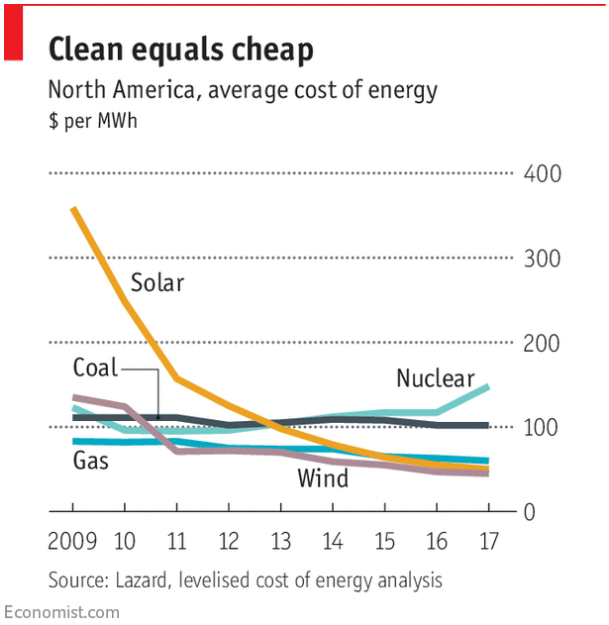
Gas could be used as an interim solution, as it can be turned on as required, and more easily than coal fired power stations, so that it can improve the reliability of solar and wind. Gas can be more efficient, resulting in less GHG emissions for each unit of energy produced, when compared with other fossil fuels, provided wellhead leakage is controlled. In the scenario above, gas power generation is assumed to be constant. Gas power can alleviate some of the dependency on fossil fuels, and thus extend the time horizon of transitioning.

Some scenarios consider CCS applied to Gas, resulting in longer transition periods and lower transition risk.

Reducing costs of renewables

Figure 4 tracks the cost of different sources of energy in North America. Trends show renewable energy costs are decreasing over time, whereas coal and gas have remained relatively stable[xviii].

Figure 4: Cost of sources of energy in North America[xix]



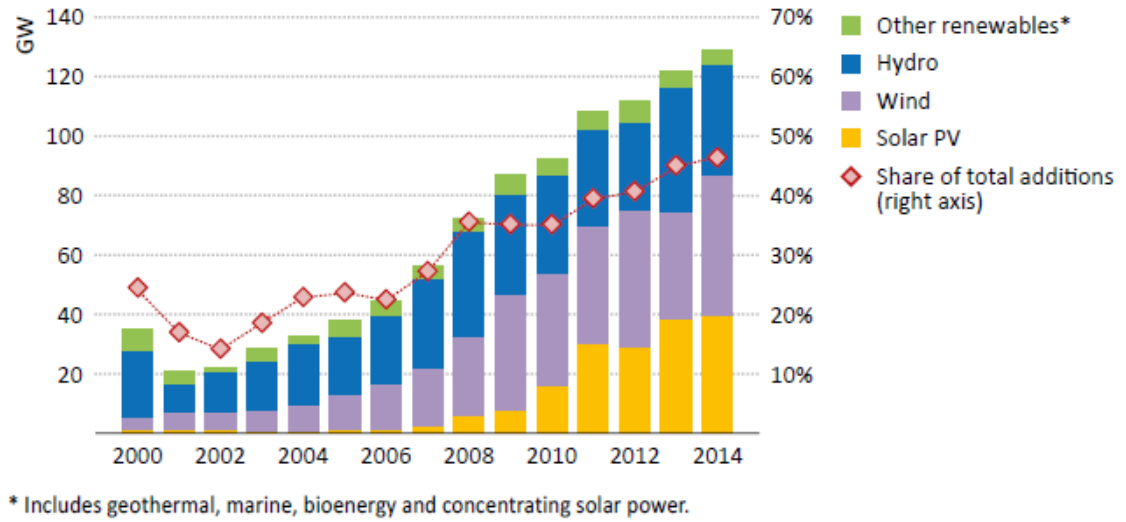
Each scenario will make different assumptions on the speed of price reduction in different technologies.

Storage solutions available

Assumptions around the efficiency and cost of battery storage solutions impact the increase in solar and wind power generation in the total mix. The Bloomberg scenario also projects a 71% decrease in the cost of solar photovoltaic (PV) plants, and 58% decrease in the cost of wind energy.

With the reduction in the cost of batteries, energy can be stored and discharged to better meet shifts in demand and supply. Bloomberg estimates that by 2050, 50% of energy will come from wind and solar sources, whereas coal is projected to reduce to only 11% of the world's energy production. More efficient storage solutions for wind and solar could lead to faster transition, as these forms of energy generation can be used when the sun is not shining, or the wind not blowing. Conversely, if battery storage does not develop as expected, there may be a slower transition, and other power sources (e.g. gas) may need to be relied upon in the interim.

Figure 5: Global renewables-based power capacity additions by type and share of total capacity additions[xx]



Extent of electrification

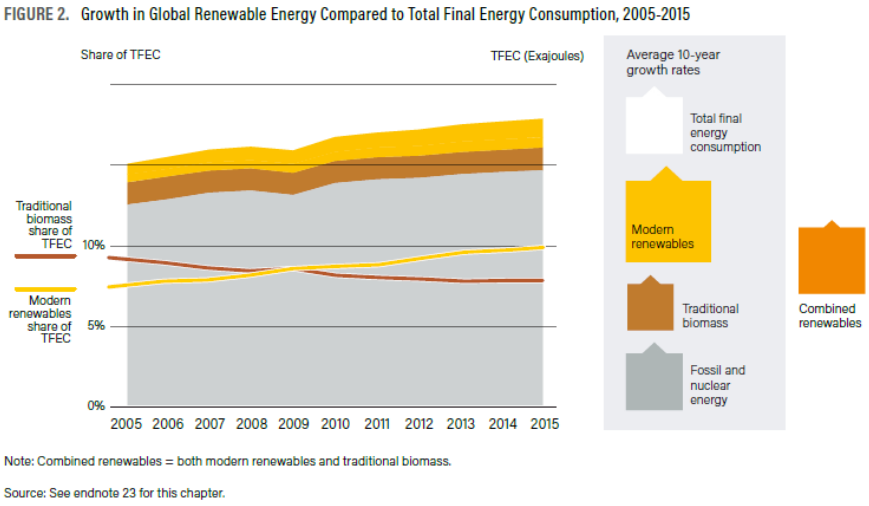
Changes in the way automobiles, industrial processes, and heating use energy can change the demand for carbon-based power. The development of electric (and hybrid) cars, and electric heating systems, result in potentially increasing the renewable share of total energy consumption from oil. There are added incentives for solar PV plants, wind farms, and hydropower arising from increased demand through electrification.

Currently, some jurisdictions around the world offer incentives for businesses and consumers to choose electric vehicles, including some states in Canada, the US, UK, Europe, and China. Countries have also announced bans on future sales of fossil-fuel-powered cars, for example in Paris and London from 2040[xxi]. Replacing fossil-fuel-powered cars with electric cars is a key action in reducing GHG emissions, provided the electricity generation is not reliant on fossil fuels.

Decarbonising through electrification can provide opportunities for the electronic equipment and car manufacturing industries. At the same time, it reduces demand for fossil fuels and coal and gas energy production. For Australia, as coal, gas, and oil make up 94% of energy production, electrification through renewables is likely to impact demand in the energy sector significantly.

Figure 6 shows renewable energy sources (such as solar, hydro, and wind) already increasing in consumption globally. Technological advances have also benefitted renewable energy sources, for example through battery storage[xxii].

Figure 6: Growth in renewable energy[xxiii]



Australia's National Energy Market

Currently in most Australian states, the National Energy Market prices energy in 30 minute blocks. The prices are set based on the bid prices in each 30 minute block. Bid prices are determined by the most expensive fuel[xxiv], which typically are gas prices. Thus, although renewables are cheaper, their impact on prices in the national energy market is currently small. Changes in prices and regulations present uncertainty around energy prices in Australia, and industries reliant on different sources of energy.

Introducing 5-minute settlement blocks by 1 July 2021 could also impact energy prices[xxv] in the National Energy Market. As gas currently dominates in the 30-minute blocks, more granularity may mean different sources of energy are used to price energy.

In Australia, with the closure of coal power stations (the last power station shutting down by 2035), supply of coal power will reduce, and therefore also impact overall energy prices. For example, electricity prices are likely to be driven up due to demand, and may impact industries that are heavily reliant on electricity, including aluminium smelting.

Over time, comprehensive reforms of global energy systems may be "required to facilitate decarbonisation of electricity generation and manage intermittency in renewable power generation"[xxvi]. Some of the changes suggested include "adjustments to grid-scale storage, supply and demand management through smart grids and distributed power generation". It is uncertain whether these changes will impact the Australian energy market, and to what extent each of the sources of energy will be affected by public policy changes.

Reducing transition risk for insurers

Currently there is a drive from European-based insurers and reinsurers to withdraw insurance capacity for energy generation from fossil fuels.

Proposed insurance withdrawals are usually where the policyholders' revenue is reliant on thermal coal related activities (e.g. >30% of revenues), and these actions are phased in over time. Other insurers focus less on the current revenues from coal, and more on withholding insurance support for new coal mines or construction of new fossil fuel plants.

For the leaders in this area, this decision to exclude fossil fuels from underwriting is driven both by ethical and reputational aspects and the obvious congruency of reducing exposure to physical risks by reducing support for GHG emissions.

Many insurers want to demonstrate alignment with the Paris Agreement targets in order to reassure their institutional investors that they are actively reducing their climate-related risks. Institutional investors are expected to continue to apply pressure on other insurers (e.g. American, Japanese and Australian) to adopt similar measures.

The consequences of insurance withdrawal for fossil fuel energy generation could also mean a reduction in mining and exploration activities for fossil fuels. Insurance for mining and exploration is and has been difficult to obtain, and is only offered by a few insurers.

While many insurers have withdrawn from construction, engineering and property insurance for fossil fuels, some have sought to continue to offer workers' compensation and liability covers. Partly this is because insurers cannot exclude customers when offering compulsory statutory classes of insurance, and because insurers continue to want to offer protection for workers in those industries.

At the same time, transitioning will likely mean increased insurance support for renewable energy construction and generation activities. Traditional insurance products and innovative risk transfer forms could both be expanded to better fit renewable energy risk characteristics.

There is much debate about the role of insurers in driving transition in the energy sector. While insurance remains a competitive market, such actions will only have an impact where insurers collaborate. However, even if there were concerted efforts to withdraw insurance capacity, energy companies could form their own mutual insurers to provide coverage or seek other forms of risk transfer to manage their risks.

However, the forces driving transition, including policy action in support of the Paris Agreement, as well as the economic effects of reducing prices for renewables, and the technological impact of battery storage, are likely to have a far greater impact on transition than withdrawal of insurance coverage. Insurers are much more likely to be takers of transition risk than drivers of transition. Insurers with large energy underwriting businesses will need to consider how they adapt their insurance products to the changing needs of the industry.

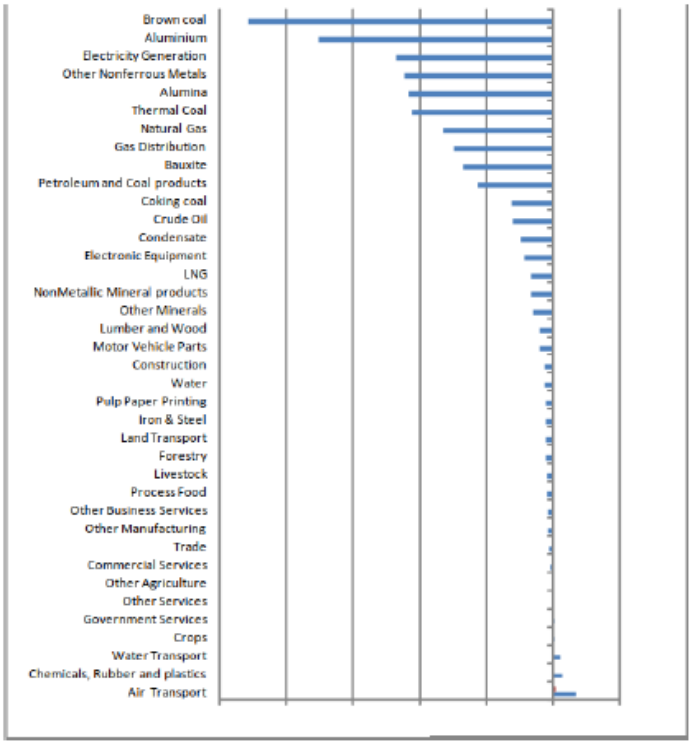
Transition risk impacts on other sectors

Transition risk will also impact sectors other than energy, either directly, or as a flow on from changes in the energy sector.

According to the International Actuarial Association Resource and Environment Working Group, decarbonisation will affect economies globally, and most aspects of economic activity.

Public policy and changes in technology are the main drivers of transition risk for other sectors.

Figure 7: Illustrative potential impacts based on carbon intensity of industry[xxvii]



Transition to a lower-carbon economy is expected to present opportunities and favourable impacts on "green or related industries", whereas there is an expected strong negative impact on industries related to and dependant on fossil fuels[xxviii].

Direct impacts on general insurance sector

Transition risk also impacts the insurance industry, including through premiums, risk ratings, and investments. Below are some examples of scenarios in which transition can give rise to changes to insurance.

Workers' Compensation

Uncertainty and transition risk on industries related to and dependant on fossil fuels, as well as the secondary transition impacts from the energy sector, can reduce GDP or employment, at least in the short- to medium-term. There is evidence of increasing Workers' Compensation costs during retrenchment[xxix]. In a shrinking industry (e.g.

carbon-based energy), the number of retrenchments and layoffs is likely to increase, thereby increasing the cost of Workers' Compensation in the medium term. Over the longer term, reductions in employment would then lead to reductions in workers' compensation premiums in these industries.

Agriculture

Farming and agriculture are estimated to be directly responsible for up to 15% of global greenhouse gas emissions. Allowing for land use (e.g. the opportunity cost of using land as a farm instead of a forest) and transportation, the total emissions from agriculture are estimated to be approximately 25% of total global greenhouse gas emissions[xxx].

Climate change affects agriculture directly through physical risks, which are visible through droughts, bushfires, and severe weather events. As a sector with high GHG emissions, transition risks are likely to also impact agriculture.

Emissions can be reduced through shifts in farming practices, and towards more plant-based diets. These changes may present challenges, if there is insufficient funding to support changes in practice, and these changes also heavily reliant on consumer preferences.

In addition to agriculture, companies dependent on natural resources that may become scarce, such as fresh water or deforestation of the rainforests for palm oil production, could be affected by reputational damage, regulatory changes affecting their natural resource access rights or capital access through divestment campaigns.

Infrastructure and buildings

Government policy has introduced measures to reduce emissions, for example through carbon taxes or incentives for households to install solar panels, or subsidisation of public transport. This extends to transport accessibility and could impact road and city design to ensure there is reduced incentive to drive personal vehicles.

Electric cars currently make up 9% of total electricity demand in the world[xxxi]. An increase in electric cars (possibly due to public policy incentives) may also introduce greater uncertainty in the short and medium term on repair costs, both for consumers and insurers, as the technology develops.

Globally, a major use of coal, oil, and gas fuel sources is heating. Changes in the regulations on building construction to require better insulation and more efficient cooling, as well as the development of heating systems that rely on renewable energy sources, could present opportunities to the building and infrastructure industry[xxxii].

Financial Services

Transitioning to a lower-carbon economy could give rise to several increased risks for the financial services sector. If transition were to occur through government policy,

financial institutions may face increased exposure to credit and legal risks. Policies to reduce greenhouse gas emissions could result in mining and energy sectors being impacted, leading to higher credit risk. Increased disclosure requirements could also lead to higher legal risk and cost of compliance for companies to mitigate against climate change.

Financial institutions are not only impacted by transition through government policy, but also through technological improvements. Shifts in supply and demand in commodities and services could bring about increased market risk and uncertainty. For example, Bloomberg predicts a 71% decrease in the cost of a photovoltaic plant, meaning solar energy could be more accessible, thereby altering the supply for solar panels, and potentially demand for other energy sources[xxxiii].

Green Bonds

The impact of transitioning to a lower-carbon economy also extends to the types of assets available in the finance market. Transitioning to a lower-carbon economy can provide more investment opportunities. According to the Financial Stability Board (FSB), green bonds "offer [to investors] a stable, rated and liquid investment with long duration. To issuers, they could tap the USD$100 trillion global institutional fixed income investor base.[xxxiv]" Growth in the green finance market through labelled green bonds continues, reaching $118bn USD worldwide in 2016[xxxv], and $9.5bn AUD[xxxvi]. In 2016, Poland issued the first sovereign green bond.

As green bonds are a relatively new and growing investment option, there are uncertainties arising from lack of availability of data, consistency across global standards, and increased costs of monitoring compliance with green criteria.

Reputation

Finally, transitioning to a lower carbon economy may also lead to heightened reputational risk for the finance sector, as communities' and customers' perceptions of an organisation's contribution to a lower carbon economy change. For example, investment in carbon-intensive industries could be viewed negatively by clients and potential stakeholders.

Shifting Awareness

Other than public policy and technological advances, a key driver of transition to a lower-carbon economy is the change in global consumer preferences as awareness increases. These changes impact almost every sector as consumer demands change and bring about unexpected transition impacts.

As mentioned above, changes in diet preferences, for example towards less meat, eggs and dairy, would also impact emissions in the agricultural sector[xxxvii]. This is an area where shifting awareness would impact demand in certain industries.

Increasing awareness to mitigate carbon emissions calls into question the relatively mainstream preference of low-cost, disposable goods. By producing fewer goods, emissions from the manufacturing sector are directly impacted. A shift towards items

that can be reused, or recycled, and away from goods that have a limited life may arise. Technology, in the form of mobile phones, cars, and fashion, are a few areas of the economy that may be impacted[xxxviii].

Although transition risk may present challenges to these sectors, managing this risk may allow the economy to separate growth from greenhouse gas emissions[xxxix].

Opportunities for Insurers arising from transition risk

The transition to a low carbon economy means that the insurance needs of affected sectors will evolve, and insurers of these businesses may need to consider new or modified product offerings to meet societal needs.

Insurance products to support the renewable energy sector

Insurance of renewable energy activities is not a new concept; it has been around for over 20 years. However, interest in this area has been increasing in recent years, as it is seen to be a key growth area in the energy insurance field and aligns with the environmental goals of insurers and reinsurers.

Most renewable energy insurance is still in the traditional form, and similar in structure to energy insurance for coal, oil and gas-powered stations. Risks during construction of the infrastructure are like any other construction and engineering project, and the insurance needs are therefore similar.

Table 5 gives some examples of insurance products currently available to the renewable energy industry.

Table 5: Types of insurance products purchased by the energy industry

Type of insurance product	Description
Construction and Engineering	Insurance of renewable energy infrastructure construction to enable the transition to renewable energy. This may include product / manufacturing insurance, erection insurance, delay in start-up (DSU), and professional indemnity.
Property and Industrial Risks	Insurance of property, plant and equipment in the traditional format for ongoing operation. This may include coverage for fire, natural catastrophe, business interruption, machinery breakdown etc., as well as transmission and distribution insurance products and liability insurance for operators and owners.
Innovative forms of insurance	Products may cover volume, yield, production or other risks, and often have parametric coverage triggers. These are covered in further detail in the next section.

Parametric energy insurance products

Energy companies routinely use weather derivatives to hedge demand risks, such as excessive heat causing excess demand, leading to a need to buy additional power on the spot market, and therefore a spike in electricity generation costs. As renewable energy generation becomes more prevalent, there will be increased demand for risk management tools to hedge supply fluctuations driven by the uncertainty relating to sources of renewable power (e.g. the amount of solar radiation or wind levels).

Currently only a limited subset of insurers and reinsurers offer such risk management products, and there are opportunities for increased involvement by the insurance industry. Traditional insurance tends to cover high-risk, low-probability events (such as damage caused by a cyclone), whereas weather derivatives tend to hedge against low-risk, high-probability events (such as wind power being 10% lower than the historical average)[xl]. One additional challenge is a regulatory expectation that insurance has an indemnity feature on economic losses, whereas weather derivatives are strictly parametric contracts based on weather metrics (amount of solar radiation or wind levels).

The products that currently exist are generally marketed as risk management or risk hedging solutions and are designed to cover the risk of shortfall in energy yields for a limited number of years. Insurer appetite for price risk, such as insuring the price per MW/hour, is generally very limited. Box 1 describes an example of how such a product might be applied on a wind farm.

Box 1: Wind farm risk management

The following scenario describes a hypothetical situation in which a weather derivative product may be useful for a wind farm.

1. At the time of construction or production, the wind farm owner or investor may seek to hedge future wind yields.
2. Construction takes place in 2018 with construction costs of $10 million dollars. Energy production starts in 2019.
3. Investor returns will be paid from wind generation activities until 2030 (10 year payback horizon), potentially with outtake agreements.
4. In order to meet investor return expectations, the wind farm needs to generate 80MW of wind power. The risk of insufficient yield can be managed by purchasing insurance which provides a payout if wind generation falls short of expectations, resulting in a mean yield of less than 80MW.

This type of product is currently easier to write for existing wind farms with proven historical yields, as engineering reports for planned projects may overstate expected yields. The key risk faced by insurers is 'wind drought', as was experienced in the first half of 2015 in the USA[xli], and more recently in the summer of 2018 in the UK[xlii].

While 55% of power companies have used insurers in the past to manage business risk, many currently choose to retain risks on their balance sheet. For example, as at 2011, only 4% of wind power producers had insurance against weather-related volume risk[xliii].

The following table summarises the current availability of insurance for the renewable energy industry.

Table 6: Availability of renewable energy insurance

Type of energy generation	Availability of energy insurance
Solar	Can be either commercial or personal. High availability of solar panel warranty insurance and solar panel yield products.
Wind	Generally only medium-sized commercial policies. High availability of wind yield insurance and industrial risks insurance.
Hydroelectricity	More common in New Zealand. Use of rainfall insurance or derivatives is common.
Geothermal	Very limited in Australia, more common in New Zealand.
Wave power generation	Only in pilot phase.
Batteries and energy storage	Commercial applications are still limited, but rapid growth is expected. Hydro storage is a developing option.

New products and partnerships to meet changing needs

The climate transition provides opportunities for insurers to develop new products to meet customers' changing needs. Some examples include insurance of batteries in residential houses, and car insurance for electric vehicles (further explored in Box 2).

Box 2: Electric vehicle insurance

While electric car insurance is mostly like regular car insurance, electric cars can present unique problems for insurers, including[xliv]:

- Costs of specialised parts
- Repairs that need to be done by specialist mechanics
- Expensive batteries
- Potentially greater risk of pedestrian accidents due to quiet running

Aviva Canada is one insurer that offers an insurance product targeted at electric vehicle owners. Aviva gives a discount for insuring a 'green vehicle' and offers a repair network that specialises in electric vehicles, with repairs carried out by certified electric vehicle specialists[xlv].

Some insurers have partnered with conservation groups to create new products that support the transition to a low carbon economy;

Box 3 describes one example.

Box 3: XLCatlin Blue Carbon Resilience Credits

XLCatlin, a global insurer and reinsurer (now part of the AXA Group), has partnered with the Nature Conservancy to develop Blue Carbon Resilience Credits. These aim to assign a market value to the carbon storage and coastal resilience benefits provided by coastal wetland ecosystems. These areas, including salt marshes, seagrass meadows and mangroves, store carbon from the atmosphere at much higher concentrations than terrestrial forests[xlvi].

The initiative assigns a dollar value to wetland preservation and will allow businesses to purchase carbon credits to offset their carbon emission footprints, while directing the investment into preservation and restoration of wetlands[xlvii].

The insurance industry has an interest in coastal resilience due to its effect on insurance losses, as well as its mitigating effect on climate change. Both XLCatlin and any insurers who purchase the carbon credits would potentially benefit from this type of product.

Impacts on investments

Only a limited proportion of our existing fossil fuel reserves can be burnt if we are to achieve the Paris Agreement target of well below 2˚C temperature increase since pre-industrial times. As at 2014, the Carbon Tracker Initiative[xlviii] estimated this proportion to be 20%; that is, the 'carbon budget' constraint means that there is significant risk that 80% of the value of today's carbon intensive assets will never be realised in future. These 'stranded assets' and potential investment losses are of significant concern to investors, including insurers who may hold carbon-intensive investments assets.

Related industries and service providers to carbon-intensive businesses may also be indirectly impacted by the climate transition, depending on how they operate and how they have managed their climate risks. The value of investments in these companies may be affected.

Australian sovereign debt may also be impacted by climate transition, due to Australia's carbon-intensive economy.

Global action on investments

An increasing number of insurers are seeking to consider some aspect of climate change or sustainability priorities across their investment decision-making, however, the depth of commitment varies across organisations[xlix]. A recent survey found that even though 56% of the 80 assessed insurers reported that they invest in low-carbon investments, on average these only represent 1% of assets under management[l].

Action to divest of high carbon investments has been more widespread. Global insurers and reinsurers including Allianz, AXA, Aviva, Lloyds, Munich Re, SCOR and Swiss Re have already divested or announced that they will divest of coal companies from their investment portfolios[li]. The approach here has been to exclude companies that have a 30% or higher reliance on thermal coal.

BlackRock, the world's largest fund manager, has even threatened to vote out directors who fail to adequately address the threats posed by climate change[lii].

Actions like these are expected to gain momentum as the transition to a low carbon economy progresses. The duration of investments for general insurers is typically shorter compared to life insurers and wealth management funds. However, actions already being taken by investors, such as those described above, now mean that the potential reduction in value of carbon-intensive investments is well within the investment term of a general insurer. Investors who act early to manage climate risk in their portfolios are at an advantage compared to those who act only after the financial markets have fully priced in carbon constraints.

Such divestment by general insurers is much more likely to encourage transition to a low-carbon economy compared to the withdrawal of insurance capacity for ongoing operations. As discussed above, fossil fuel companies have alternative sources of

insurance, but are much more limited in sources for investment and financing. This action is even more effective where insurers screen out fossil fuel companies based on their alignment to the Paris agreement targets. The focus here is less on the current reliance of revenue on fossil fuels, and instead on the extent to which companies are investing in new fossil fuel sources, such as new coal mines or power plants.

Scenario analysis

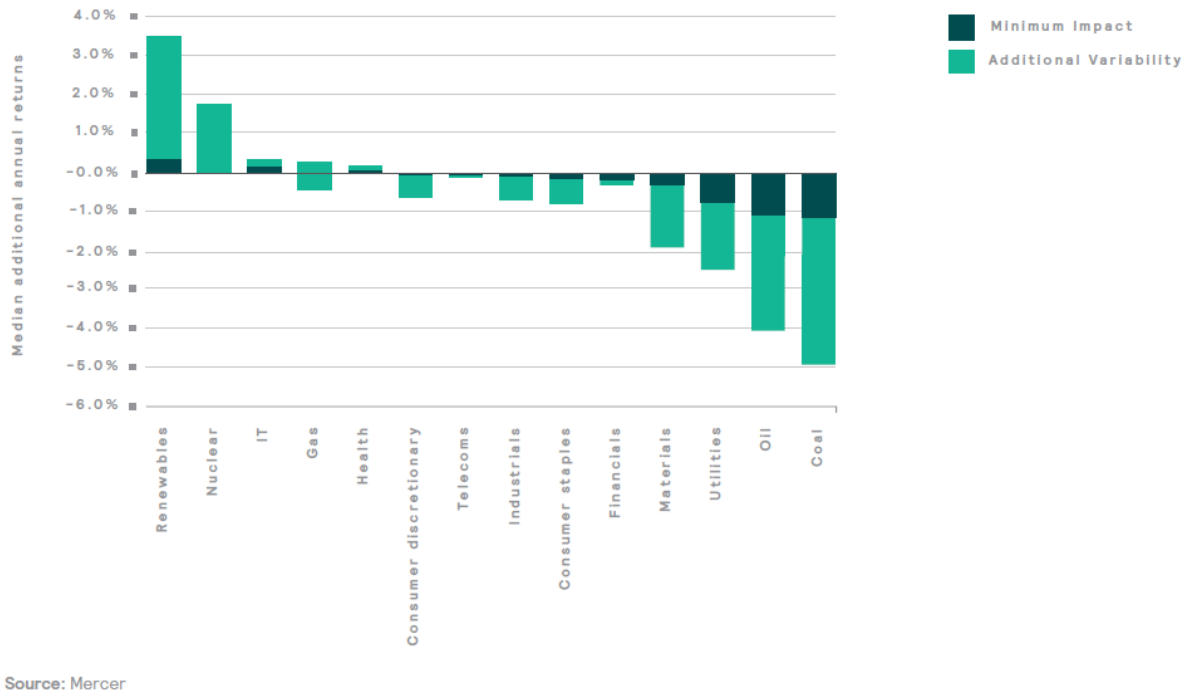
One way to approach the analysis of investment risk is to consider impacts by industry sector. Mercer's research indicates that:

- The coal sub-sector could experience falls in average annual returns by between 18% to 74% over the next 35 years, with effects more pronounced over the coming decade, and
- The renewables sub-sector could experience increases in average annual returns by 6% to 54% over a 35-year time horizon[iii].

The wide range of possible outcomes reflects that sector-level returns can be highly sensitive to the climate scenario that is assumed.

Figure 8 shows Mercer's estimate of the climate impact on returns, by industry sector, over 35 years to 2050. The range is presented as the minimum impact and additional variability, to reach a maximum potential impact by industry sector under various climate scenarios.

Figure 8: Climate impact on returns by industry sector[iv]



Source: Mercer

Investment strategy

In considering their exposure to climate transition risk through their investment assets, an insurer should consider both direct holdings of bonds, equities and other investments, as well as indirect exposures through managed funds.

BlackRock's 'Climate Change Rulebook', shown in Table 7, gives a hypothetical example of how exclusion and addition rules could be applied to an insurer's corporate bond portfolio in order to align the portfolio to positive climate outcomes. In this particular simulation, BlackRock excluded two-fifths of the insurer's existing portfolio and replaced them with a mixture of cleantech bonds and additional investment in existing bonds that were not excluded by the rulebook. The resulting portfolio had 70% lower carbon dioxide emissions per invested dollar, and had an improved Environmental, Social and Governance (ESG) score, but the simulated yield was almost unchanged[lv].

Table 7:BlackRock's illustrative climate change rulebook[lvi]

Climate change rulebook

Rules used to make an insurer's corporate bond portfolio climate friendly, July 2016

Exclusions	Rule	Reasoning
Fossil fuel reserves	Companies reporting fossil fuel reserves as assets — unless 25% or more of their revenues are from renewables.	Reduces risks from the transition to a less carbon-intensive world and from stranded assets.
Carbon emissions intensity	Energy, materials, utilities and industrial companies with a carbon intensity greater than their subsector's average.	Screens out the worst performers in four sectors that account for the majority of CO_2 emissions.
Coal revenue or generation	Companies that receive 30% of revenue from extracting coal or using it for power generation.	Companies relying on coal face high regulatory, technological and energy transition risks.
Water withdrawal intensity	The top 50% most water-intensive companies in the metals and mining, beverage and utility sectors.	Companies that use the most water are most exposed to scarcity and regulatory risks.
Toxic emissions	The bottom 50% of companies that have toxic emissions as an environmental key performance indicator.	Reduces toxic emissions to limit damage to the environment and air pollution.
Forestry commitments	Companies failing to address deforestation risks in their supply chains, including retailers and food producers.	Deforestation and forest degradation contribute to 10%-20% of global CO_2 emissions.
Additions	**Rule**	**Reasoning**
Green bonds	Green bonds with similar maturity and risk profiles. They can be of excluded companies as proceeds are ring-fenced.	Uses debt capital markets to finance projects that have a positive impact on the environment.
Clean tech or green companies	Companies deriving 50%-100% of revenues from clean technologies such as renewables and energy efficiency.	Increases exposure to climate change solutions and sustainability initiatives.

Source: BlackRock Investment Institute, July 2016. Notes: The example is for illustrative purposes only. It does not represent an investment recommendation, nor a portfolio BlackRock currently manages.

Case studies on TCFD

The Task Force on Climate-related Financial Disclosures (TCFD) was formed by the Financial Stability Board (FSB) in response to the threat posed by climate risk to global financial stability. In 2017, the TCFD produced its final report[lvii], recommending a single international cross-industry standard for disclosing climate risk in the mainstream financial reporting of companies. These recommendations aim to improve transparency, assist financial markets to allocate capital more efficiently, and create more resilient economies.

The TCFD recommendations have gained widespread support from companies, regulators and investors. While the recommended disclosures are voluntary, it is likely that financial institutions will respond to pressure from investors and regulators to provide them.

The TCFD recommendations contain four core categories: Governance, Strategy, Risk Management and Metrics and Targets. EY's Carbon Risk Disclosure Barometer 2018[lviii] found that of the eight ASX200 companies assessed in the insurance sector, most entities addressed the majority of the TCFD recommendations, but the amount of detail provided in the disclosures was limited. Disclosures in the Strategy category were the least comprehensive, and there was limited disclosure of how the results of scenario analysis are being used to support climate strategy and risk management.

The Centre for Policy Development also reviewed scenario analysis and disclosures on climate change, providing some useful recommendations.[lix]

Case study: Aviva 2017

TCFD implementation strategy

Aviva was one of the early adopters of climate-related disclosures in their 2016[lx] and 2017[lxi] annual reports. Aviva also provided a more detailed Climate Related Financial Disclosure in 2017[lxii] in line with the TCFD recommendations.

Aviva operates across general insurance, life insurance and pensions. Their 2017 disclosure notes that general insurance has primarily an 18-month outlook and focuses on the physical impacts of climate change, while their life insurance and pension division focuses on climate transition risks through their long-term investment exposures.

Aviva's TCFD implementation strategy includes conducting climate-related scenario analysis, using commonly agreed sector or subsector scenarios and time horizons where possible. Aviva is currently working to identify appropriate climate-related scenarios, assess the scenarios and develop reporting formats for the outputs of the scenario analysis. The work involves an inter-disciplinary team that draws expertise from many functions across the business. They aim to report the results of the scenario analysis in their 2018 disclosures.

Transition risk scenario analysis

Aviva recognises that there will be an increasing number of climate-related policies and regulations to assist the transition to a 2˚C economy. Aviva monitors investments in sectors and subsectors that are particularly exposed to climate transition risk, and have worked with the 2 Degree Investing Initiative to analyse alignment of their equity and bond portfolios with a 2°C future. The results were considered in investment strategy reviews and help shape their ongoing strategy. Further work is now being done to understand transition risk impacts on all asset classes, and on a more granular basis.

Climate transition opportunities

Aviva integrates ESG and climate-related factors into their investment process, and tracks measures such as a carbon exposure metric based on the carbon-intensity of business activities, the extent of operations in jurisdictions with stringent carbon emission regulations, and the quality of a company's carbon management.

Aviva expects companies to begin reporting in the TCFD framework, including stress testing of business models against climate policy scenarios. Aviva have said that they will vote against annual reports and accounts of companies that do not make sufficient progress towards adopting the TCFD recommendations[lxiii].

Aviva invests into renewable energy efficiency and are progressively increasing their holdings in Green bonds. They have actively identified companies with more than 30% of their business revenue associated with thermal coal mining or coal power generation and have engaged with them, setting out expectations for a strategy to transition to a low carbon economy. In some cases, Aviva have chosen to divest of high carbon investments.

Aviva has also developed insurance products and services to support customers' choices, including bespoke electric vehicle policies and generation of domestic scale renewables.

Case study: Commonwealth Bank 2018

During 2018, the Commonwealth Bank (CBA) published their first report with the TCFD recommendations as a subsection within their annual report. They are currently in Phase 2 of TCFD implementation, having completed initial scenario analysis and considered portfolio-level strategic responses, with more detailed scenario analysis and further development of strategic responses expected in the following year.

Scenario analysis program

CBA conducted climate change scenario analysis on 3 scenarios, as detailed in Table 8.

Table 8: CBA TCFD scenarios[lxiv]

	Global coordination	Disruptive decarbonisation	Policy inertia
Scenario description	2˚C scenario reflecting a smooth transition to a low carbon economy, driven by supportive national and international climate policy and global emissions trading.	2˚C scenario where decarbonisation is achieved in a disorderly transition, with inconsistent climate policy and a strong reliance on bottom up action by consumers and businesses.	3˚C scenario reflecting current national and international policies, but no further commitments to decarbonisation. The transition is disorderly with a reliance on bottom up, small-scale technologies.
Reference scenarios	Deep Decarbonisation Pathways Project, IEA 2DS	Deep Decarbonisation Pathways Project, Review of disruptive technologies and business models	Deep Decarbonisation Pathways Project, IEA 4DS
Target	66% likelihood of limiting global warming to 2˚C	66% likelihood of limiting global warming to 2˚C	66% likelihood of limiting global warming to 3˚C
Proportion of renewables of total generation in 2050 (from baseline of 15% in 2017)	73%	94% Distributed generation increases from 4% of total generation in 2017 to 39% in 2050	58%

CBA analyses transition risks in the wealth and business lending portfolios, and physical risks in the retail home lending and insurance portfolios.

It is important to note that while the "Global coordination" and "Disruptive decarbonisation" scenarios both represent 2˚C scenarios, they describe very different transition pathways. The pathway affects the types of risks and opportunities that are associated with the scenario, as well as the timing and severity of their occurrence.

Transition risk analysis

CBA analysed the expected growth or contraction by industry for each of the three scenarios over the medium term to 2035, as shown in the heat map in Figure 9. The "Disruptive decarbonisation" scenario is associated with the greatest amount of expected contraction across affected sectors of the economy, and therefore the highest amount of transition risk, followed by the "Global coordination" and then the "Policy inertia" scenarios.

Further analysis was done by overlaying the business lending and wealth portfolios to identify the expected size and direction of climate transition risk impact on their mix of business.

Figure 9: CBA Transition risk heat map by industry

The results of the scenario analysis will be used both to help with understanding their own risk exposure, and to inform future engagement with clients.

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