Climate Change
Portfolio Transition Plan

Prepared November 2019

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Executive Summary

In 2015 First State Super (**FSS**) approved its first Climate Change Adaptation Plan (**CCAP**). This plan outlined a series of proposals and recommendations to help build greater resilience in the FSS portfolio in the face of increasing impact from climate change. At that time, FSS demonstrated leadership in its thinking and implementation of this plan.

Since 2015 and approval of the FSS CCAP, the rate of change in the science and the response to a changing climate has been significant. The climate scientists have reached consensus that the earth's average temperature is increasing due to higher man-made carbon dioxide emissions, primarily as a result of fossil fuel burning. Observable changes, even in such a short period of time, include the four warmest years on record having been recorded since 2015. Additionally, the magnitude of extreme weather events and the physical impacts of climate change, increasingly have significant impacts on parts of society, including on FSS members and on the assets FSS invests in.

The Paris Agreement, which came into effect in 2016, has helped create a platform for the commencement of far-reaching action to minimise global temperature rise. The Agreement has helped mobilise and create urgency around the need to rapidly decarbonise the economy in order to avert potentially irreversible impacts to both society and the economy from a changed climate. Importantly from a fiduciary perspective, the conversation has moved beyond any notion of morally 'doing the right thing' with respect to climate change and has now shifted into a fundamental economic and financial risk return discussion.

Around the globe, regulation and legislation is starting to tackle the large, systemic and structural changes that limiting climate change will require. The EU has been a leader in this aspect with its extensive EU Emissions Trading Scheme and a range of other emissions reduction legislation and policies. Elsewhere, even in the face of less coordinated central government backed response, local states and governments, corporate sectors and everyday citizens and communities are driving change and action on climate change. Australia is a case in point where even in the absence of a long-term federal policy to reduce carbon emissions, the States and Territories are driving their own emissions reduction and renewable energy targets. Furthermore, from a regulatory perspective the last twelve months has seen heightened engagement, supervision and recommendations from the RBA, APRA, ASIC, Australian Accounting Standards Board (AASB) and Auditing and Assurance Standards Board around response to and obligations related to the financial risks of climate change. Finally, there have been several Australian climate change related legal test cases heard over the last twelve months which could have a range of potential consequences. These have included the member case against REST trustees and the Rocky Hill and Bylong coal mining development refusals with some basis in climate change. Part 1 of this paper seeks to provide a summary of a range of background climate change science and global responses to climate change.

Part 2 of this paper provides an overview of activities FSS has undertaken following the 2015 CCAP recommendations. Finally, the analysis and research from Part 1 of this paper culminates in an updated framework of recommended actions and targets for FSS to:

- provide a pathway for decarbonisation of the FSS investment portfolio, with consideration to a 'Just Transition';
- address climate change risk embedded within the FSS investment portfolio and to adapt, where possible;
- capture opportunities that will emerge in a decarbonising economy; and
- lower risk through actively managing and engaging with portfolio investments on their climate change transition pathway.

A three-pronged transition plan has been recommended:

A key highlight of the framework is the overarching emissions reduction target. FSS will actively advocate for an economy-wide 45 per cent reduction in greenhouse gas emissions by 2030. In order to support this economy-wide target, FSS is exploring ways to replicate this in its portfolio in the same timeframe. This target is based on science and aligns with the target to limit warming globally to 1.5°C, where possible.

For FSS this means, as a responsible owner, being accountable for targeted emissions reduction through the investment and portfolio decisions made across listed and unlisted assets, while considering the impacts and opportunities created for workers and society more broadly. In order to underwrite this in a meaningful way, FSS must define, understand, measure and monitor its investment portfolio emissions profile and set medium term goals to reduce these emissions, where possible, by June 2020. Additionally, FSS must understand what its future carbon liability may be as assets become responsible for paying for their emissions as carbon pricing schemes are implemented.

Low carbon investment activities recommended to support this overarching goal include:

- implementing a minimum 30% reduction in emissions in First State Super's listed equities portfolio by 2023 - which will also incorporate the introduction of a new low-carbon index
- the setting of emissions reduction targets for the unlisted asset portfolio to contribute to the overarching emissions reduction target, following emissions analysis and measurement of this portfolio;
- setting targets to annually increase investments in renewable energy, clean technologies and climate change transition businesses and technologies;
- implementing a green and sustainable bond strategy.

Portfolio future-proofing will likely entail understanding and adjusting accordingly the FSS investment portfolio. This will require up to date analysis of physical risks as well as transition risks and opportunities for assets as they adapt to a decarbonising economy and changing climate. It is noted that uncertainty and non-linear changes in industries and asset values are an inevitability in such large, global transitions. Activities proposed include assessing the potential to divest sectors of the economy or specific companies that are deemed unable to transition or adapt in a lower carbon economy which may ultimately devalue FSS members retirement savings. For existing or potential assets being considered for the portfolio, the FSS investment teams must assess and understand the risks, costs and work required to adapt and transition.

The final element is continued build-out of the active engagement program across both listed and unlisted assets as well as fund managers on approach to climate change. FSS will continue to work both independently and alongside industry policy and advocacy groups on this agenda, such as the Climate Action 100+ initiative.

The proposed FSS Climate Change Portfolio Transition Plan is recognised to incorporate stretch targets, corresponding to the identified urgency with which the economy must decarbonise to limit serious temperature rise. Despite this urgency, implementation of these activities in an authentic and meaningful way will require a considered approach over three years, at a minimum. Responsibility for achieving proposed targets must be owned by all the FSS investment team and the organisation more broadly.

In conclusion, implementing a climate change plan now enables FSS to demonstrate it is fulfilling its fiduciary responsibility by acknowledging and managing some key risks now that could have significant impacts on FSS members retirement savings in the future.

Part 1

Climate Change in 2019

Climate change data

In terms of global climate data, the 4 year period since the 2015 CCAP is statistically insignificant. Review of climate data which includes these intervening years however was considered useful to help underpin the discussion and subsequent recommendations in this paper that form the FSS investment portfolio climate change transition plan.

Global Green House Gas (GHG) levels and land temperature

GHG concentration in the atmosphere and the impact of these on the earth's natural systems is a critical aspect in the climate change discussion. GHGs include carbon dioxide (**CO_2**), methane, water vapour, nitrous oxide and ozone, which occur naturally in the earth's atmosphere plus synthetic gases including chlorofluorocarbons. Naturally occurring GHGs help maintain the earth at a habitable temperature. This occurs through gradual release of some of the thermal energy (heat) that's been generated by the sun's rays on the earth and oceans into the upper atmosphere whilst trapping the remainder within the earth's atmosphere. The trapped heat energy creates the greenhouse effect. Increased levels of both naturally and synthetic GHG concentrations are known to facilitate an "enhanced greenhouse effect" by trapping more of the thermal energy within the earth's atmosphere, and subsequently increasing the earth's average surface temperature over time.[1,2] CO_2 is discussed most in the public forum given its one of the longest lived GHG and is assessed as contributing to around two thirds of the earth's temperature rise.[3]

It is known that the earth has gone through natural periods of warming and cooling over time. Historically, this is likely as a result of volcanic activity, mass changes in land plant cover, formation of mountain ranges and solar activity relating to changes in the earth's orbit around the sun. Scientific research data, which is graphically displayed in Figure 1 below, shows probable CO_2 variations over the last 800,000 years. The peaks in CO_2 levels correspond with warmer interglacial periods and the troughs with ice age periods.[4]

Figure 1: Carbon Dioxide during ice ages and warm periods - 800,000-year history to 2018

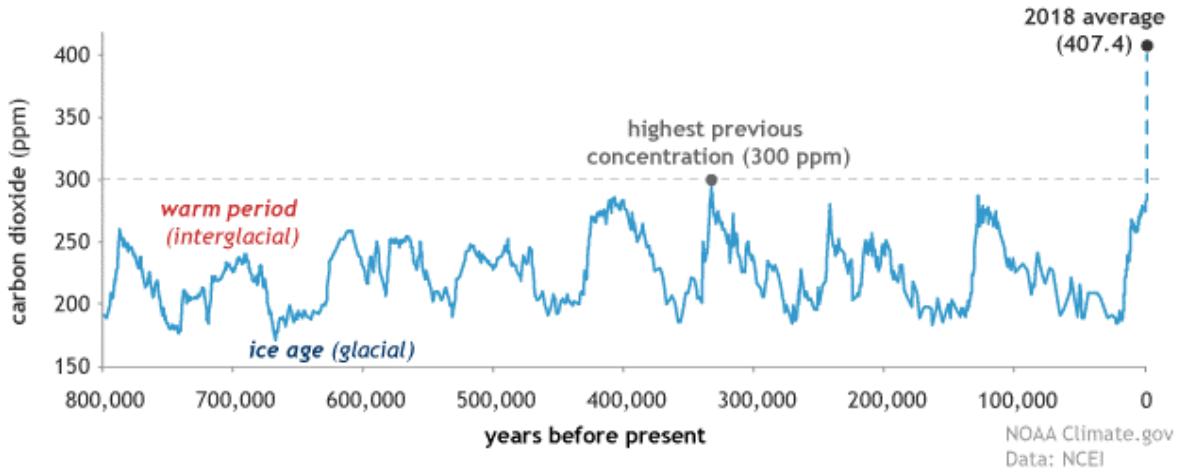

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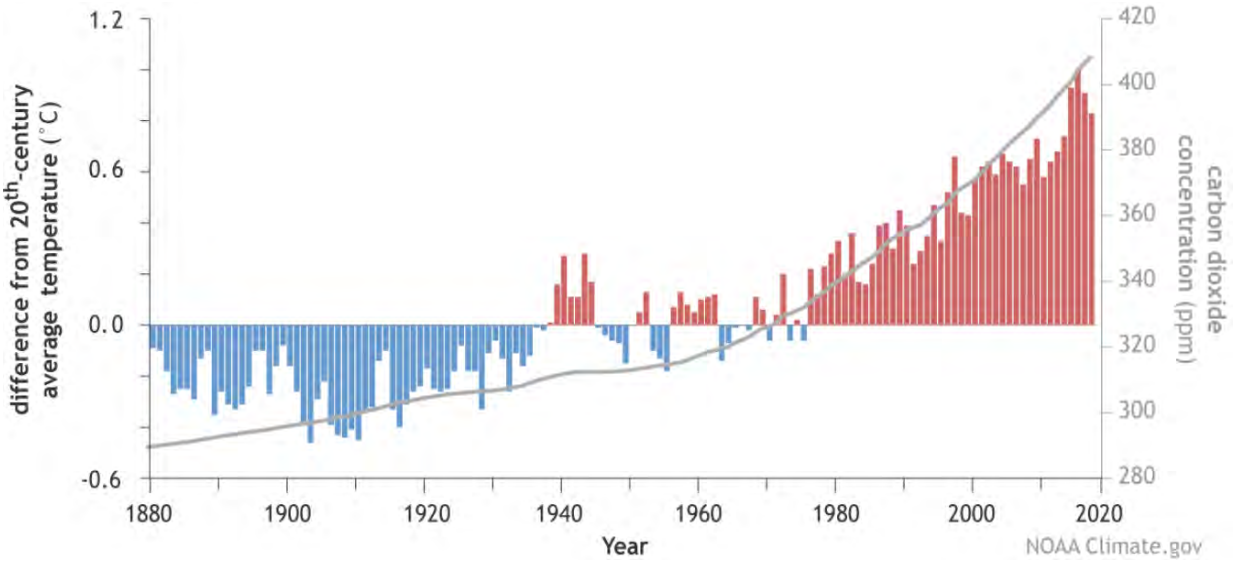
Figure 2: Atmospheric CO_2 and earth's surface temperature variance from the 20th century average (1880-2018)



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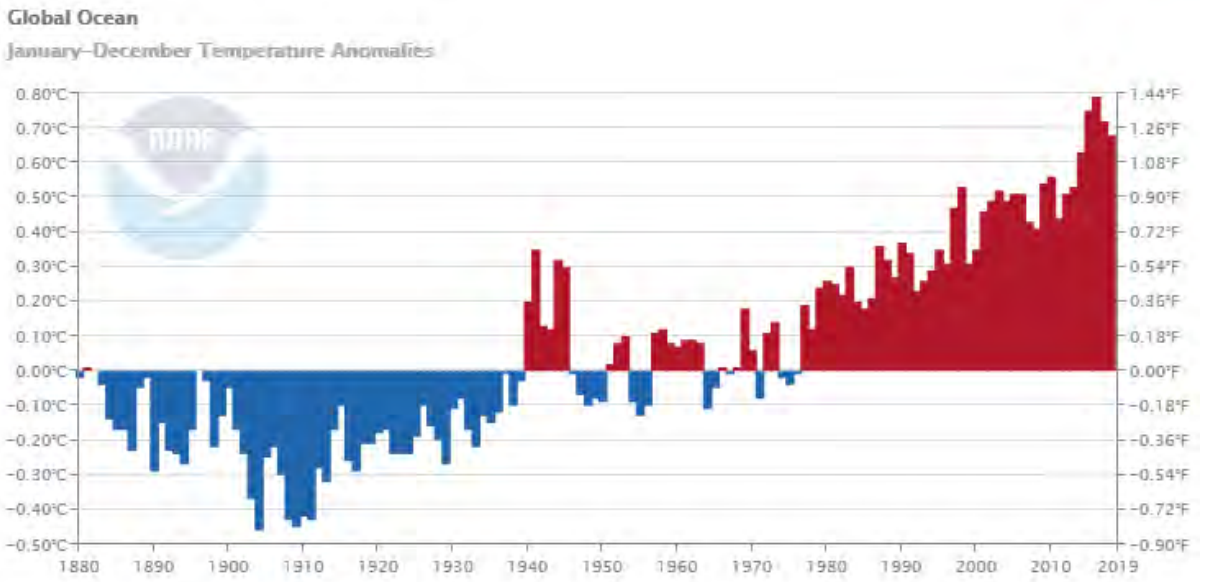
The relationship between CO_2 and temperature rise is clearly revealed by Figure 2 above. From this data it has been determined that the CO_2 rise occurring over the last 60 years, in an equivalent pre-industrial period (i.e. a previous period when the earth has been coming out of an ice age), would have taken between 5,000 to 20,000 years to have been emitted. This rapid increase in CO_2 levels has coincided with rapidly increasing rates of temperature change, with the four warmest years on record being recorded in 2015, 2016, 2017 and 2018. Additionally, 9 out of the 10 warmest years on record have been reported since 2005.[7,8] Evidence shows that atmospheric CO_2 levels have potentially been this high before, approximately 3 million years ago when temperatures were 2-3°C warmer than pre-industrial times and sea-levels were up to 25 meters higher than present times.[9] This type of data enables scientists to make predictions around future scenarios the earth may be facing.

The vast majority of CO_2 produced by humans comes from the burning of fossil fuels for transport and for energy (76% of the manmade GHGs and 93% of CO_2 produced by the US in 2017).[10] The Intergovernmental Panel on Climate Change (**IPCC**) estimates that human activities are likely to have caused around an average of 1°C of warming above pre-industrial levels.[11]

Climate change and global oceans

Global oceans absorb huge amounts of both heat and CO_2 from the earth's atmosphere. With oceans able to hold around 60 times more CO_2 than the atmosphere, the majority of the increase in warming at the earth's surface is absorbed by the earth's oceans.[12] The ocean then acts as a climate stabilizer through absorbing, storing and releasing heat over long periods of time, as demonstrated in Figure 3.[13]

Figure 3: Global ocean temperature anomalies 1880 - 2019



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Note: ocean temperatures are compared to the long-term average (1901-2000).

With higher CO_2 emissions, the oceans are absorbing higher volumes of CO_2 from the atmosphere. Research has determined that in the 13 year period from 1994 to 2007 global oceans absorbed an average of four times the annual CO_2 absorbed between 1800 and 1994.[15] Additionally, the rate of ocean warming has more than doubled since 1993.[16]

CO_2 is acidic and the consequence of this additional ocean absorption is the creation of carbonic acid when combined with water. In turn this increases the acidity of the oceans.[17] Increased ocean temperatures have a range of detrimental effects including thinning of ice shelves and sea ice and rising sea levels from heat induced ocean expansion. Increased ocean acidity also threatens shellfish and corals ability to build their skeletons.[18, 19]

The oceans capacity to absorb CO_2 has provided the environment with a temporary buffer to the full effects of the quantum of CO_2 that has been emitted since industrial times. The downside however is that even after anthropogenic emissions are cut, the ocean - atmosphere heat exchange will likely continue to result in higher temperatures for a period of time due to the carbon already emitted and stored by the oceans.[20]

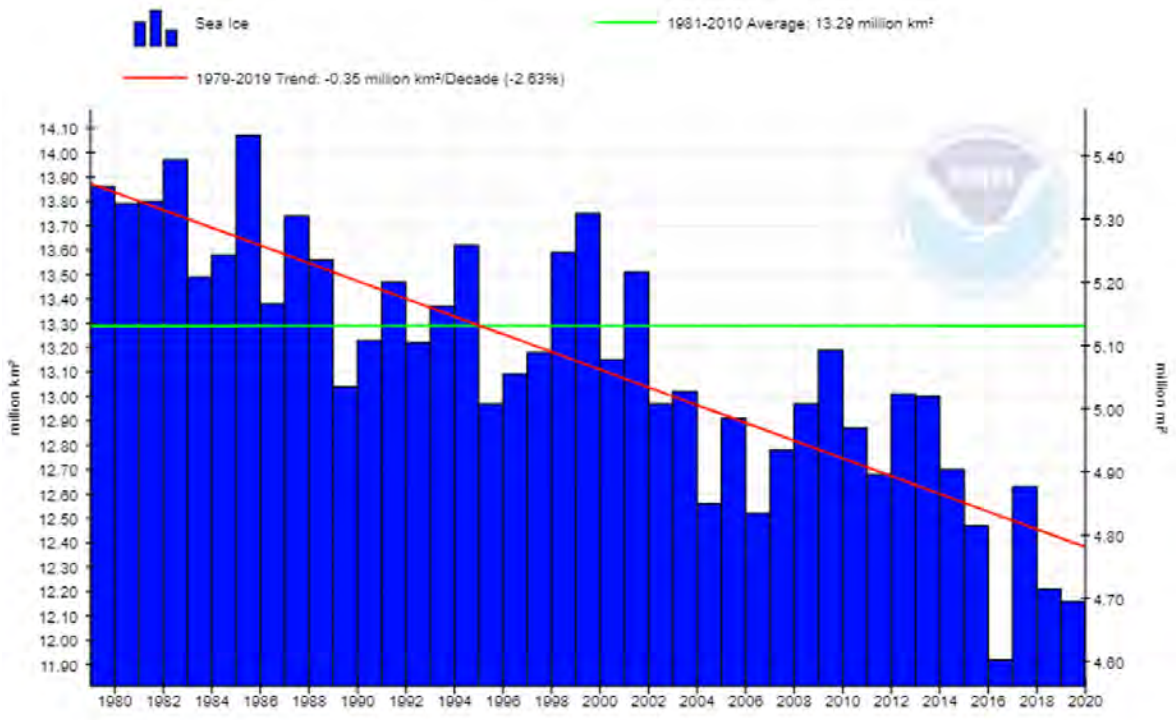
Ocean warming is also linked to changing weather systems, likely contributing to increases in intensity of storms[21] and accelerating the hydrological cycle over the oceans, thus resulting in wet regions receiving more rain and dryer areas becoming even drier.[22]

For the purposes of this paper the base assumption is taken as accepted that atmospheric GHG's have risen largely due to fossil fuel combustion and rapid deforestation occurring since the industrial revolution.

Sea ice and sea level

Rising ocean, land and atmospheric temperatures are highly likely to have caused warmer Arctic temperatures and contributed to the melting of the Arctic sea ice. In 2018, the land temperature of the Arctic was 1.2°C warmer than the 1981 – 2010 average. It can be inferred that this was the probable cause of the second smallest Arctic sea ice maximum seen during that same period.[23]

Figure 4: May northern hemisphere sea ice extent

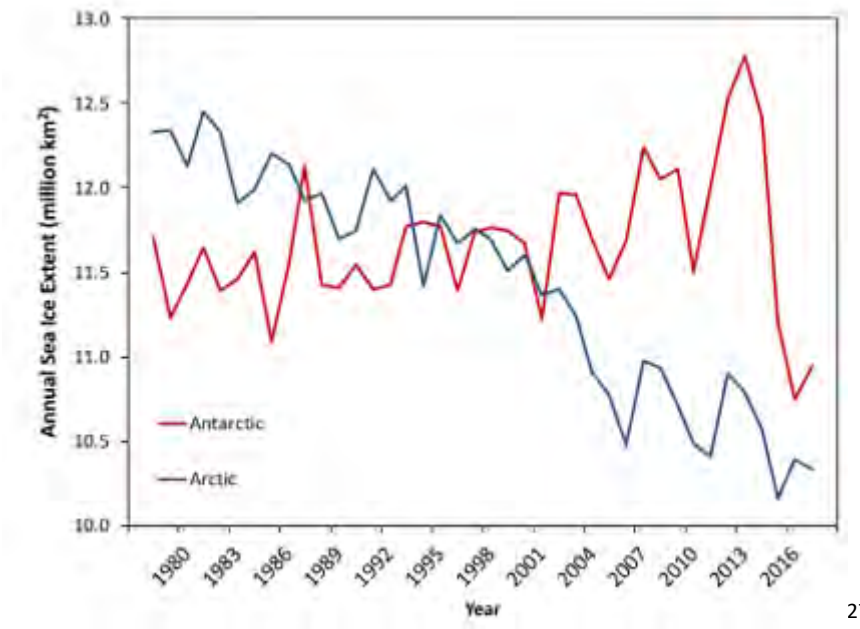


[24]

Once sea ice melts, the darker ocean absorbs more of the thermal energy from the atmosphere than sea ice, which is more reflective given it is light in colour. This then becomes a cycle of additional warming of the ocean, further melting remaining sea ice.[25]

Conversely, Antarctic sea ice has on average been increasing. Whilst this represents a complex system that is still being researched, changes in the "Antarctic Oscillation" result in increasing strength of the westerly winds causing ice to converge in coastal areas. Additionally, research has shown that the deeper Antarctic oceans are warming, which will inevitably increase ice sheet melt. Melting ice however creates cooler water at the Antarctic's ocean surface which facilitates more ice forming. It is thought this will reverse when the deep ocean temperature reaches a certain tipping point.[26] Research however is indicating there may also be a link between increased ice in Antarctica and to changing ocean-surface temperature exchanges in the North Atlantic. Conversely, warming in the North Atlantic impacts temperature and rainfall in the northern hemisphere however may also be affecting the Antarctic Oscillation.

Figure 5: Annual mean sea ice extent in the Northern and Southern Hemispheres



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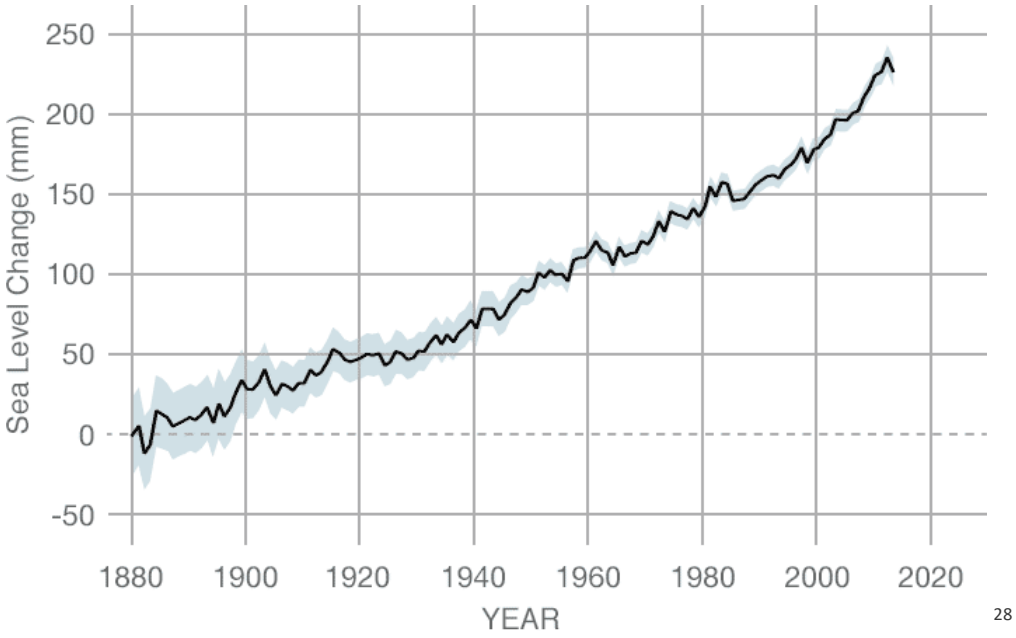
Melting sea ice and ocean warming result in expanding oceans, which have an obvious consequence on sea level rises. There has been reported a global average of 3.3mm of sea level rise per annum since 1993.

Figure 6: Sea level change 1870-2013 (CSIRO)



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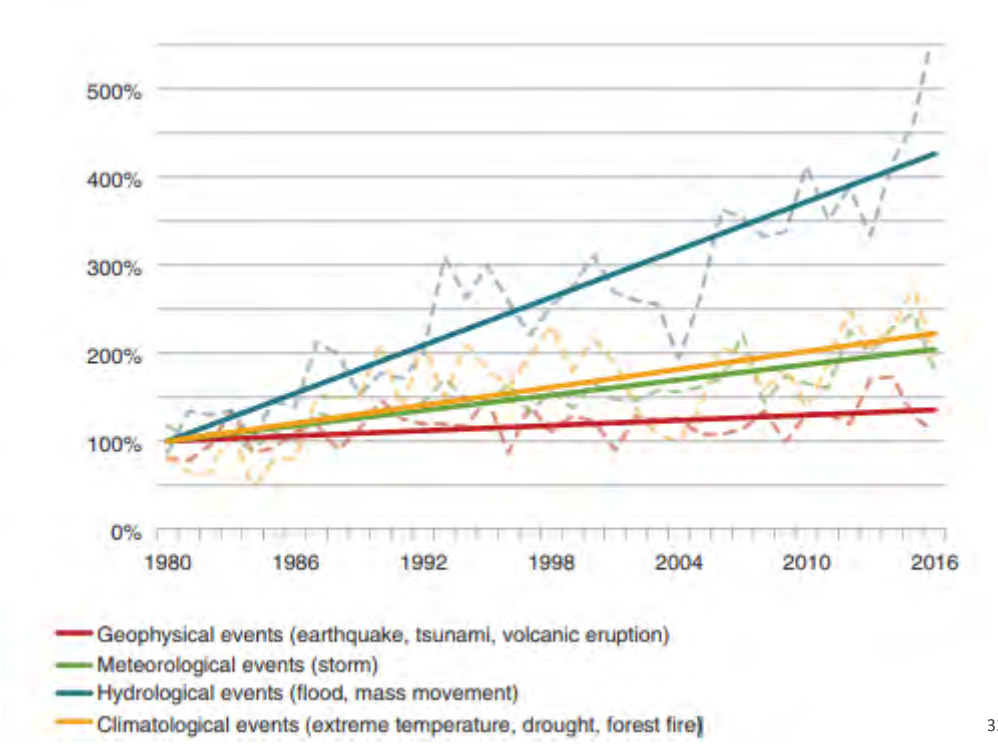
Over and above the potential impact on low lying communities and island nations, sea level rise can have significant impact on coastal erosion and flooding of coastal communities, particularly during storm and cyclone surges. This was recently seen in Australia in the Gold Coast, Sydney's Northern Beaches and parts of the WA coastline. Importantly, sea level rise also can result in flooding of salt water into fresh water sources including into domestic drinking water supplies and agricultural irrigation, in

addition to disruption of the ecosystems in those aquifers. In Australia, it has been estimated that c.1.4% of Australia's irrigation area is less than 5 meters above sea level, which could be threatened by salinisation through inundation or gradual intrusion of salt water into fresh ground water below the surface.[29, 30, 31]

Climate related physical risks - Extreme weather events

Historically it has been complex to determine the degree to which climate change influences extreme weather events. Advancing scientific research methodologies are now able to better determine correlation between human induced climate change and extreme weather events. Numbers of extreme weather events have been trending upwards over the last 38 years demonstrated by the following chart. Magnitude of events have also intensified.

Figure 7: Trends in different types of natural catastrophes worldwide 1980–2016



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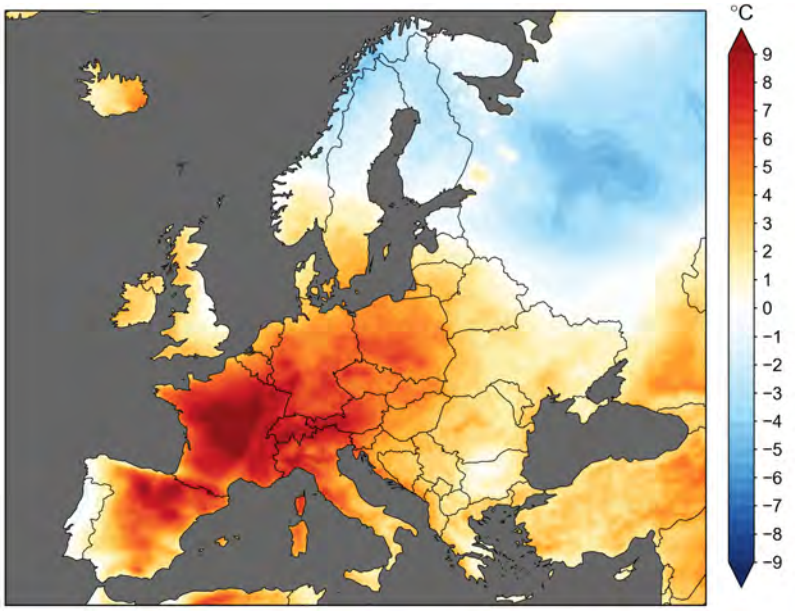
These types of events include severe thunder and hail storms, extreme rainfall (including monsoonal rains) and heatwaves in South Asia, flooding plus likely increased intensity of tropical cyclones/ hurricanes.

Climatological events – extreme temperatures, drought, fires

In 2019 exceptionally early and long periods of heatwave set new temperature records in Europe, resulting in the hottest June on record being reported. Overall, temperatures were an average of 2°C above normal, but temperatures of 6-10°C above normal were experienced across France, Germany, northern Spain, northern Italy, Switzerland, Austria and the Czech Republic.

Figure 8: Average temperature anomaly for 25 - 29 June 2019



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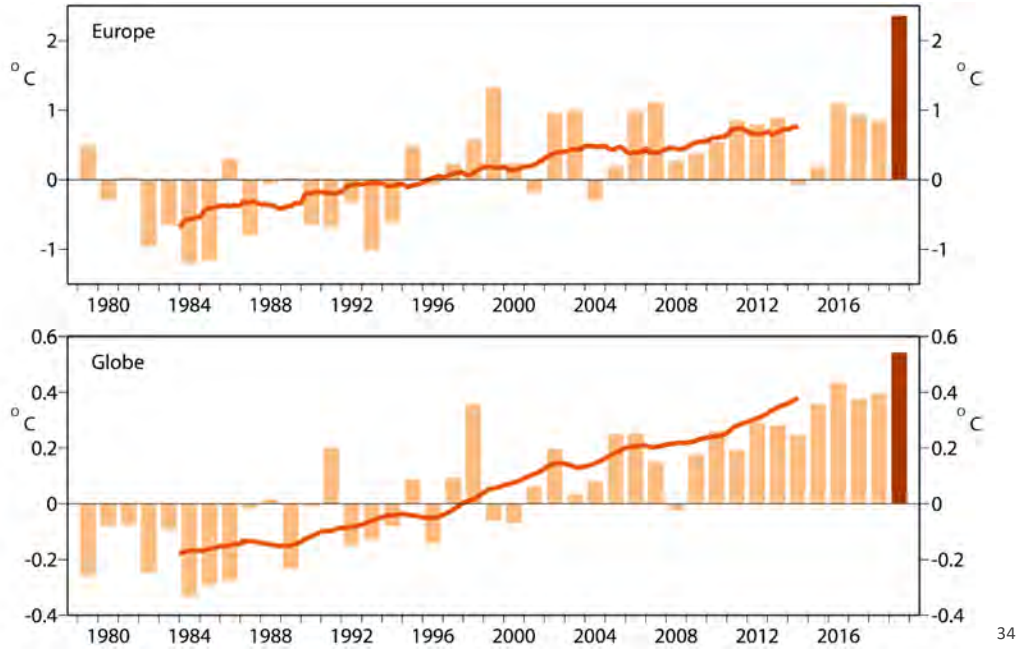
In isolation, individual events are difficult to attribute to a changing climate, however historical records and more complex data modelling can better establish the relationship. For instance, the June heatwave temperatures were in excess of a broad increase in temperatures in Europe of 1.5°C over the past one hundred years.

Episodes of extreme heat pose a major, acute threat to people's health, agriculture and the environment.

Figure 9: June temperature averages and 10 year running average June temperatures (1981-2010)



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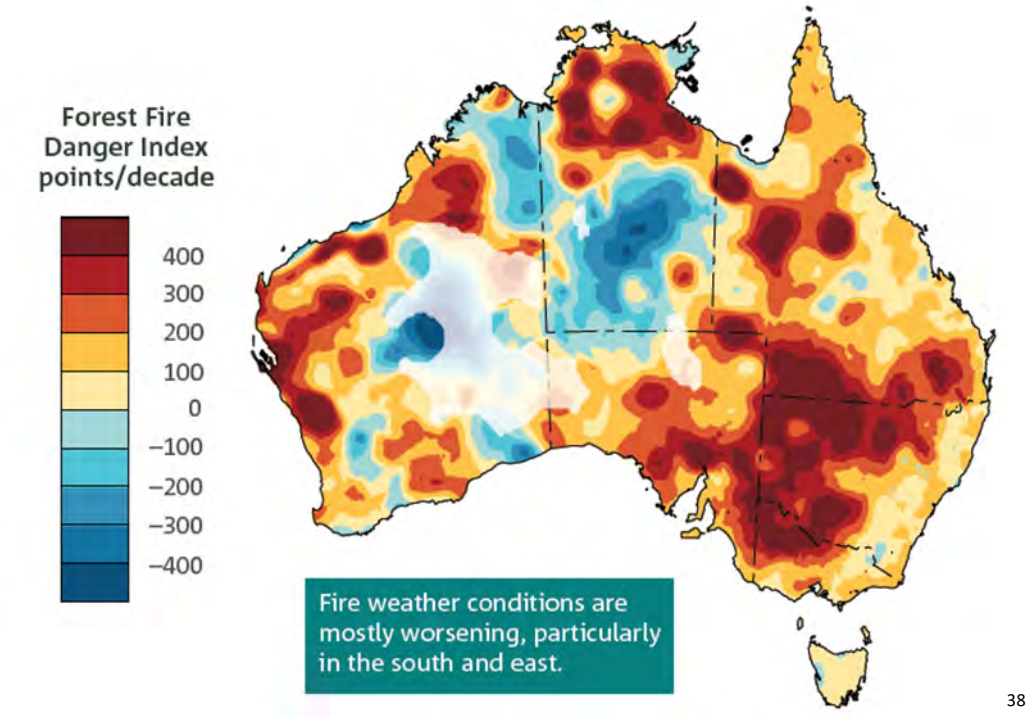
Alongside rising temperatures, other physical impacts of climate change are increased intensity and frequency of droughts. Drought can have a significant impact on agricultural industries and communities, killing livestock, destroying crops and increasing soil erosion, which can all lead to higher food prices.[35] With drought also comes heightened issues of water scarcity and water stress. Combined drought and changing land use, there has been a reported increase in desertification, which further

increases CO_2 in the atmosphere, as a result of decreased vegetation. Additionally, dust storms have also increased in frequency and intensity, which can have negative health implications on humans.[36]

Droughts can result in large areas of dry, dead plants, grasses and trees which can provide fuel for more extreme wildfires. With increased wildfires higher CO_2 emissions result, thus contributing to an increasing cycle of changing climate. It is reported by NASA that the planet is experiencing accelerated fire cycles with wildfires more frequent, lasting for longer and over much larger areas. NASA recognises that fires in populated areas can frequently be caused by humans (e.g. electricity transmission lines in California, USA and Victoria, Australia), however boreal forests and tundra are more frequently caused by lightning strikes. These types of fires are particularly detrimental to the climate as they often burn longer due to lower intervention, given they are less likely to pose an acute threat to human lives. The heat from the fire burns the carbon rich top soil, releasing carbon into the atmosphere. This then allows the permafrost beneath the upper soil to thaw, releasing a huge store of GHG's, including potent methane, into the atmosphere. Research in Canada found that a "single fire season in Canada emitted so much carbon into the atmosphere that it offset half of all the carbon removed from the atmosphere through annual tree growth across all of Canada's vast forests".[37] On average, with a changing climate, wildfires are predicted to occur more frequently, be larger and last longer.

Figure 10: Australian Forest Fire Danger Index - Trends from 1978-2017



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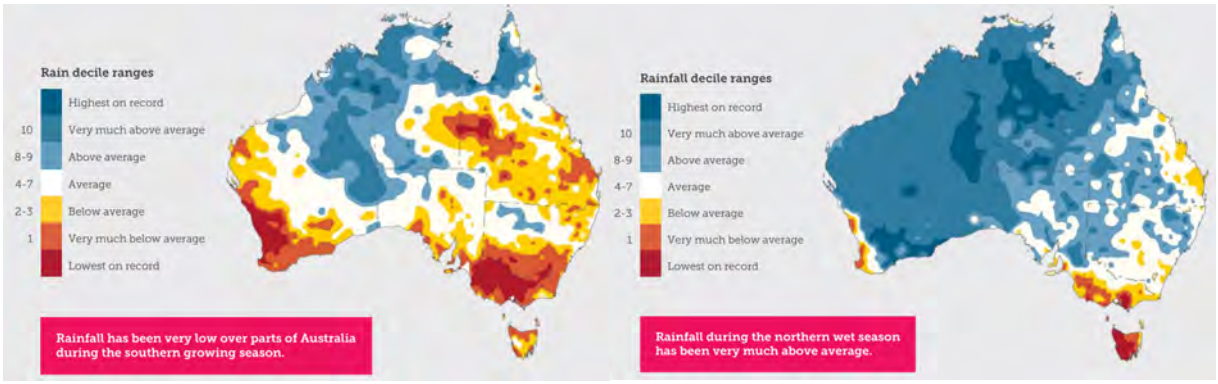
Note: yellow to red colours, are indicative of an increasing length and intensity of the fire weather season.

Rainfall, flooding and storms

Other changes that have been observed through scientific data analysis include "increase in the intensity of heavy precipitation events at a global scale".[39] In Australia rain patterns have been changing in both extremes of intensity and in shifting seasonality.

Figure 11: Rainfall patterns in Australia a) April to October and b) October to April 1995 - 2016



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Scientific research is showing, with increasing likelihood, that there are higher levels of rainfall, wind and sea flooding associated with tropical cyclones. In turn, this is resulting in increasingly catastrophic outcomes of these events.

Additionally, early scientific analysis suggests that the geographical range of tropical cyclones are increasing towards the poles and that there are decadal increases in the proportion of more severe hurricanes / cyclones (category 4 or 5).[41]

Figure 12: Hurricane Dorian, September 2019

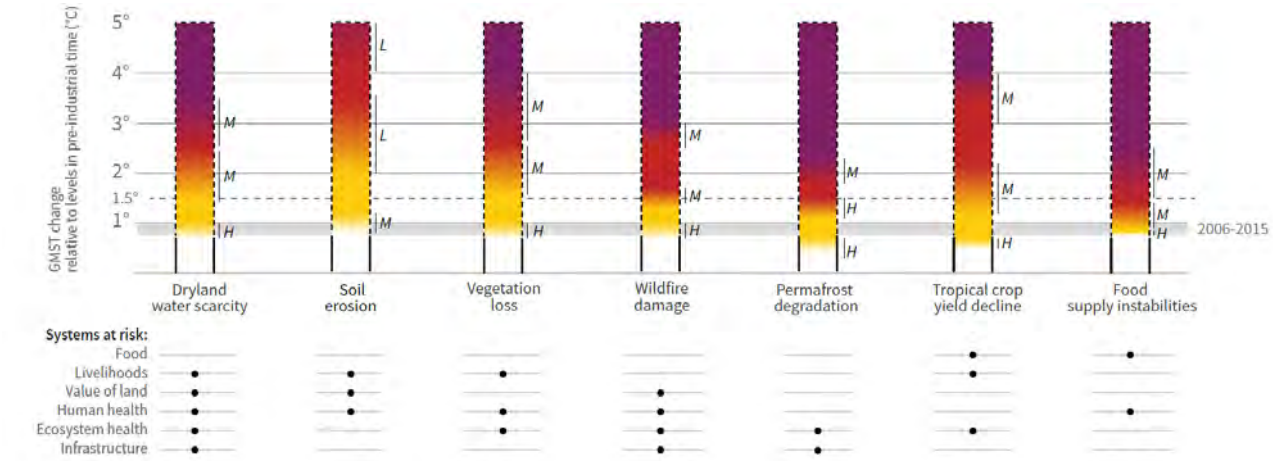
A recent example is Hurricane Dorian, which was the equal most powerful Atlantic hurricane to reach land. Sustained wind levels of 295 km/h were achieved gusting up to 354 km/h.[42]

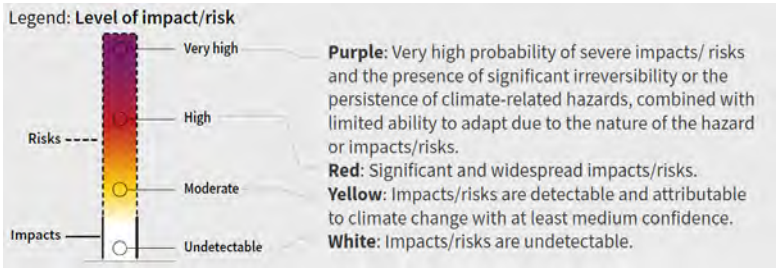
Whilst just a snapshot, these types of physical events are all inextricably linked; drought exacerbates fire; and increases in tropical cyclone winds and rainfall increase waves which, along with sea level rises exacerbate coastal flooding events and coastal erosion.[43] The commonality amongst all these physical events and a changing climate more broadly, are the increasing impact on society and also on the biodiversity and ecology of the planet, where species loss and extinction is likely to increase significantly as average temperatures rise.

Risks from Climate Change beyond 2019

The probability of negative impacts from climate change will continue to increase as temperatures rise. This makes limiting global temperature rise as much as possible so critical, through transitioning to a low carbon economy as rapidly as possible. The physical risks outlined in the section above are all predicted to increase in frequency and / or intensity, although they will not be distributed evenly across the globe.

Figure 13: Modelled risks to humans and ecosystems from a changing climate





As seen above, the risk to a number of systems escalates significantly above 1.5°C of warming. Above 3°C, which is believed to be the earth's current trajectory, most factors are deemed irreversible and provide limited ability to adapt.[44]

The impacts on human health and food security in particular are explored below in more detail.

Economic risks from climate change

There are a range of economic costs from climate change that need to be considered by asset owners. These include:

- **Costs for physical asset damage** - These costs may include potential direct costs from physical risks, events or shocks that are likely attributable to a changing climate. These may include damage from cyclones, flooding or extreme heat;
- **Adaptation costs** – costs incurred to reduce an assets vulnerability to climate change and to seek to minimise damage to an asset from climate related activities. For example:
    - building of new roads, drainage, dams and flood defences,
    - fireproofing assets (such as power transmission lines),
    - raising property (to protect from sea level rise), and
    - infrastructure adaption to accommodate rising temperatures.

- **Transition costs** – including costs that may occur from a sudden change in regulation. This may result in a permanent structural change in a company's profits, particularly where the additional costs cannot be passed on to customers e.g. where there is a cheaper alternative available that does not have to pay for those costs. This may also include mitigation costs, where a cost of polluting or a carbon price is introduced, providing lower emitting businesses with a cost advantage. Additionally, mitigation costs will likely include upfront costs for energy efficiency measures or replacing plant and equipment to emit lower emissions, where payback is likely to be achieved over a period of time.

A selection of these potential economic costs are highlighted in Figure 14 below.

Figure 14: Illustrative examples of the economic costs of climate change

Economic costs of climate change

The economic costs of climate change will likely vary depending on sector, location and business by business, particularly driven by a company's relative preparedness. Costs may be direct or indirect.

Examples of direct costs may include:

- costs for property damage following extreme weather events;
- cost to adapt to a changing climate e.g. flood protection, higher planning and building standard costs;
- increased water costs in high drought areas;
- lower agricultural yields due to higher temperatures and changes in rainfall patterns;
- higher insurance costs.

Indirect costs may incorporate:

- an inability to insure physical assets in higher flood or fire risk areas;
- lower worker productivity e.g. from workers unable to work as hard in higher temperatures, or transportation systems failure in higher temperatures preventing timely commuting;
- cost of higher health impacts and illness rates e.g. due to higher temperatures, extreme storms, secondary impacts of flooding (e.g. water borne diseases such as cholera or e coli following drinking water contamination or other diseases such as malaria, dengue and West Nile Fever).

It remains difficult to predict the costs of potential events or shocks. Whilst frequency of events may increase, the location, magnitude and extent of damage will be much harder to forecast and therefore apply a dollar amount to. Identifying a range of potential cost impacts of climate change and factoring them into asset and company valuation scenarios is an important step for asset owners to start to understand their 'at risk' asset value from climate change.

Costs to mitigate climate change however are easier to attribute through applying the 'polluter pays principle' to some of the heaviest carbon emitters. Described in more detail below, a number of regions have already implemented a cost to companies for their emissions and it is anticipated that this will become increasingly wide-reaching around the globe. Even in the absence of a global or regional price on carbon, a number of corporates widely use an internal shadow carbon price in assessing the potential IRRs of long term capital projects.

From a rational investment perspective, in a transition to a lower carbon economy over time as regulatory and carbon pricing requirements are implemented, the higher carbon intensive businesses will inevitably see destruction in their market value. This must be taken into consideration in due diligence and throughout the life of an investment to ensure that appropriate risk weighted returns are applied to investment portfolios.

On the other side of risks however are the opportunities that will present for industries and investments that contribute to solutions in an emerging low-carbon economy.

Investment risks that need to be considered

Physical risk

As highlighted above there are a range of physical risks that need to be considered in both initial investment analysis but also ongoing asset specific and portfolio risk analysis. Physical risks can present in two ways, long term slow shifts or acute, sudden onset.[45]

The long term presentation of physical risks from changing climate patterns may include the effect of increased temperatures on buildings, changing rainfall patterns including water availability for agricultural businesses, sea level rises on property asset life and supply chain changes due to changing temperatures and weather patterns (for instance on food supply chains). All these factors may result in asset valuation changes, costs for adaptation and operating costs, such as electricity costs for cooling and insurance premium costs as assets are perceived to become more at risk.

The acute, sudden onset of physical risks may result from an extreme weather event, such as the Townsville flooding in early 2019 and Cyclone Debbie in 2017. Forecasting of these risks are extremely complex to undertake given the timing, frequency, magnitude and exact location of extreme weather events are all non-linear and difficult to predict. Methodologies are emerging, particularly driven by the insurance industry, to determine who are most at risk at a larger scale.

Stranded asset risk

Following a carbon intensity assessment of the FSS portfolio by an external data provider in 2014, it was identified that stranded asset risk, particularly within fossil fuel and fossil fuel dependent investments, could increase exponentially. This is particularly pertinent in Australia due to the economy bias towards mining, particularly fossil fuel extraction and export. The impact on other sectors that are dependent upon the fossil fuel sector to support their own returns e.g. through energy and emissions intensive supply chains is also a significant consideration. This therefore creates a multiplier effect of the impact of fossil fuel stranded assets on the value of investment portfolios.

For FSS as exposure to direct, long term ownership of real assets grows, the consideration to potential asset stranding is increasingly important from a potential loss magnitude to members retirement savings, as well as the reputational considerations.

Stranded asset risk considerations:

- the extent to which climate policy and technology adjusts, placing fossil fuel assets at risk;
- consumer trends that may impact on fossil fuel demand;
- the role of geopolitics in fossil fuel asset re-pricing;
- measuring the extent to which the market has priced in these uncertainties;
- the timing of when any further asset re-pricing may occur;
- assumptions around the use of negative abatement (carbon reducing) technologies such as carbon capture and storage;
- the role and interplay of asset values with commodity price movements.

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Transition risk

Guy Debelle, the Deputy Governor of the RBA describes "[t]ransition risk is about the potential effects to businesses as the country and the economy adjusts to the changes in the climate. This includes the adjustment to policy responses required to meet the Paris objectives." [47]

As the economy progresses from high to low-carbon and eventually towards net-zero carbon, risks and opportunities will present throughout the economy. This transition will likely not be linear, with some changes likely occurring gradually and others presenting as a sudden shock to the economy. Additionally, the risks will present differently across different jurisdictions, timescales and sectors and will depend upon the urgency governments and businesses seek to transition. Some of the transition risks that may present include legislation and policy changes. These may include introduction of a carbon tax, shifts in market sentiment and consumer choices which will drive changes in markets, technology changes and rapid uptake of new technologies which could fundamentally change markets, products and services and subsequent reputational impacts that will inevitably occur through these transitionary pathways.[48]

Sudden shocks in transition would likely result in unpredictable and disorderly transition pathways and these could present particular risks to investment portfolio values. Examples of this could include a rapid introduction of a carbon tax being applied to high emitting assets where there was previously none. If carbon pricing scenario analysis had not been undertaken the value of long term infrastructure assets, for instance, may suddenly reduce in an investment portfolio. Also new disruptive technologies may also result in a rapid transition within an industry, leaving old technologies less valuable and early movers on new technologies with rapid upward valuations. Both these examples could also give rise to stranded assets within investment portfolios.

Social risks

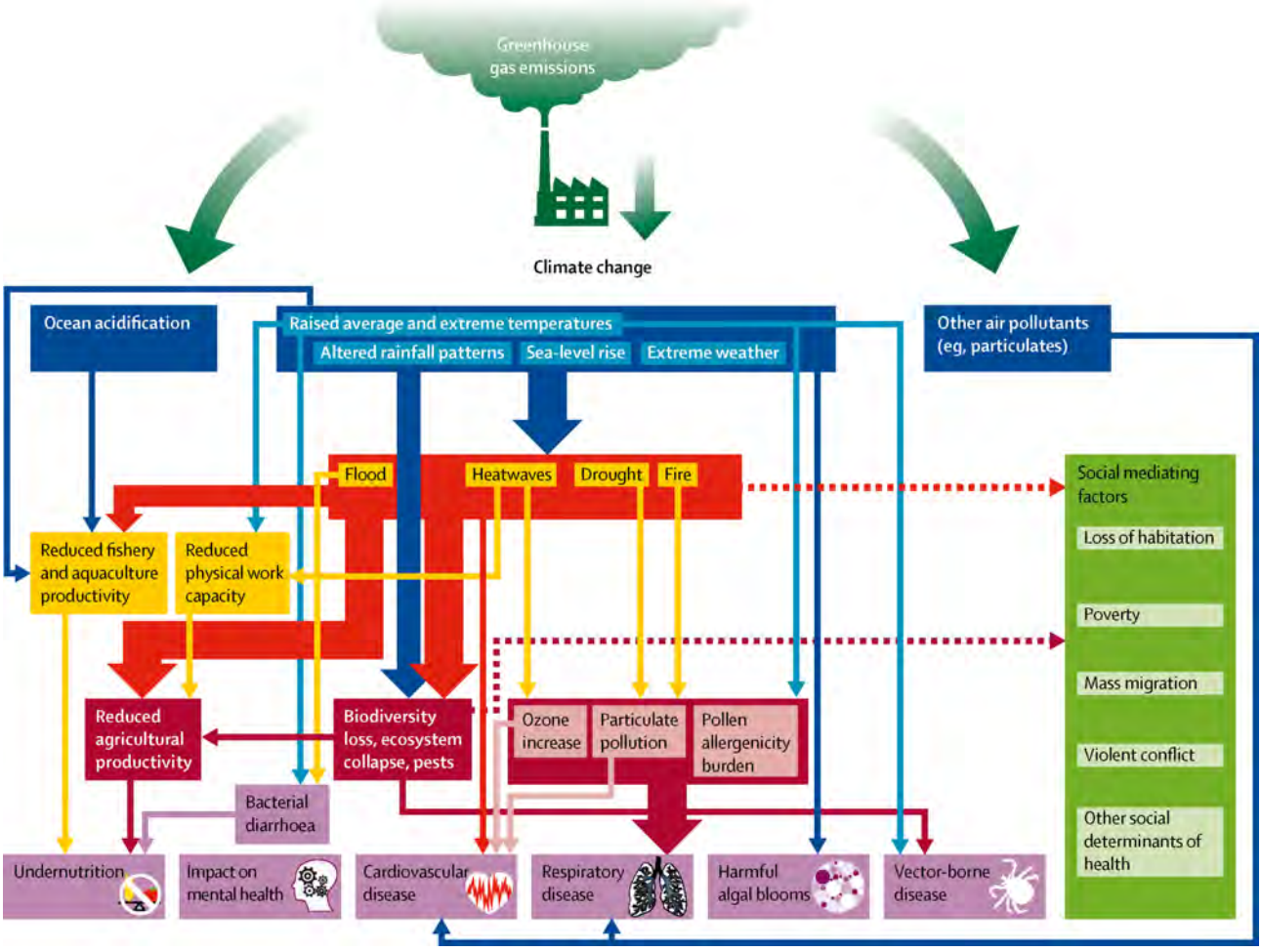
Health impacts

A changing climate has the potential to impact the health of humans throughout the world, regardless of region or socio-economic class. This therefore is a critical element to understand and consider in approach to addressing climate change in the FSS portfolio given the global impacts and the significance to FSS' members, particularly in the health and community sectors.

In September 2019 the Australian Medical Association (**AMA**) declared climate change a 'health emergency' following the equivalent declarations and calls on governments to take urgent action by the American Medical Association and the American College of Physicians in June 2019 and the British Medical Association in July 2019.[49,50] The AMA has called on the Australian government to adopt an Australian emissions reduction target, facilitate a transition from fossil fuels to renewable energy and to establish a specialist sustainable development unit to reduce carbon emissions in the healthcare sector.

Climate change has been strongly linked to a wide range of serious health consequences. These have been summarised by the Lancet in Figure 15 below.

Figure 15: The pathways between climate change and human health



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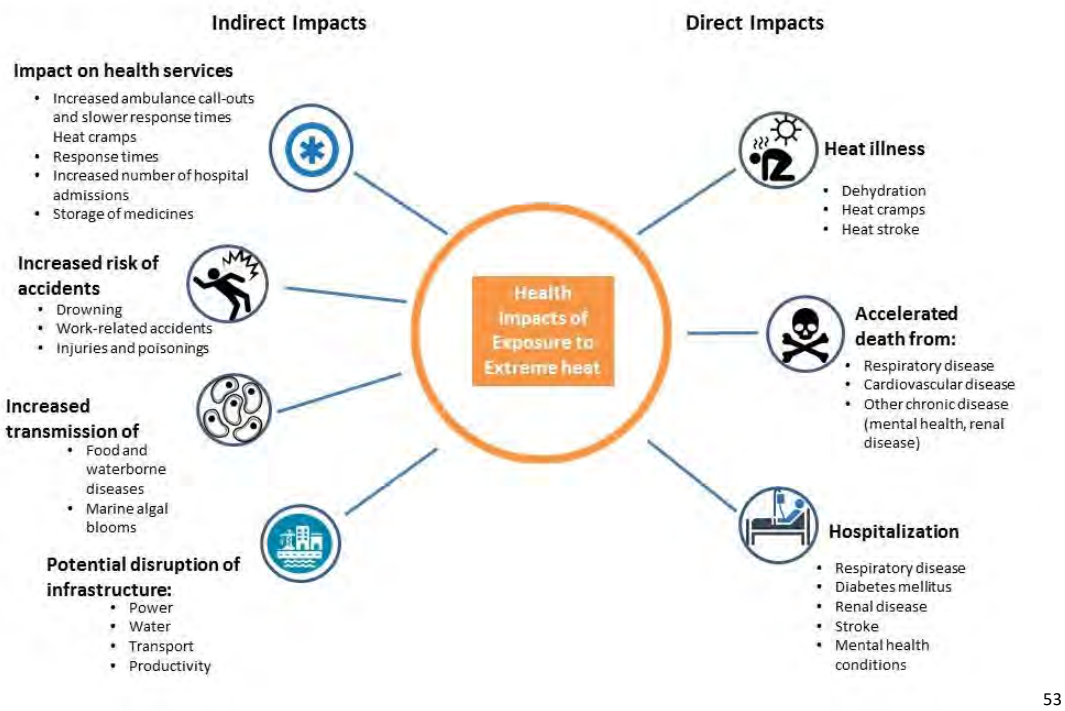
The implications of a changing climate expand across physical and mental health and social spheres are already being reported with high degrees of confidence globally. One of the greatest risks is from periods of extreme heat, particularly for the elderly.[52] Figure 16 graphically denotes the possible direct and indirect effects of heat on human health.

Figure 16: Health impacts of exposure to extreme heat



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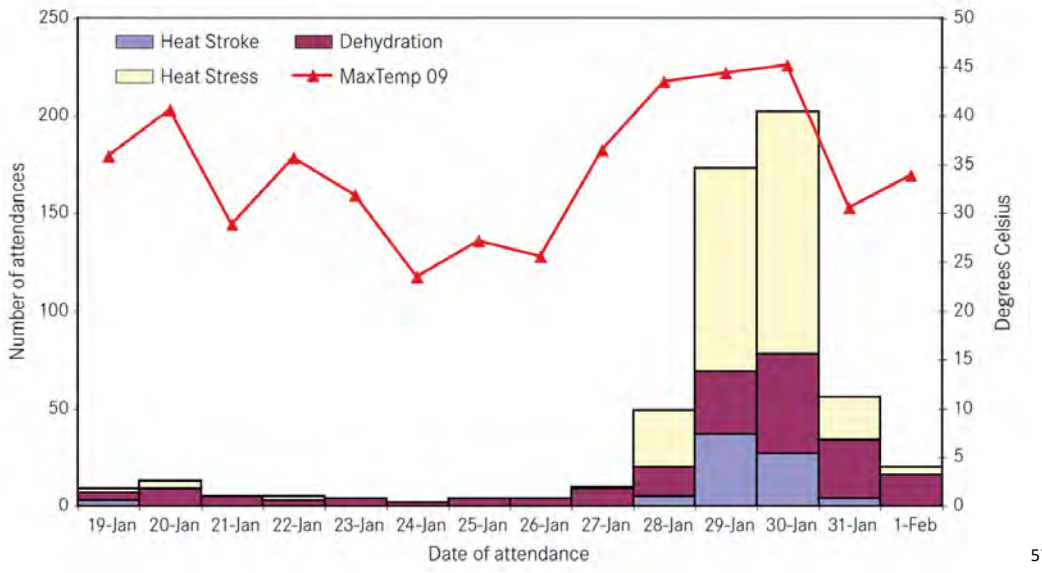
World Health Organization (WHO) data reveals that around 70,000 people died in Europe as a result of a 2003 heatwave and in 2010, 56,000 deaths occurred in Russia due to a 44-day heatwave.[54] The June/July 2019 heatwaves in France resulted in a reported additional 1,500 deaths.[55] An Australian example is from the Victorian heatwave in January 2009 when following 3 consecutive days above 43°C, the deaths of 374 people were directly attributed to the extreme heat. Correspondingly, there was considerable increase in pressure on healthcare services reported. Over the 3 hottest days the Victorian ambulance service saw a 46% increase in emergency cases compared to the same period in the prior year. This represented a 34-times increase in direct heat related conditions and just under a 3-times increase in cardiac arrests. Similarly, GP attendances quadrupled for heat-related conditions and there was an 8-fold increase in heat related hospital emergency presentations during that period also.[56]

Figure 17 exhibits the impact on health not just of high temperatures but of the cumulative effects of prolonged heat. More frequent prolonged periods of extreme heat are predicted to occur with climate change, with consequential acute increase in demands on the health system and health workers.

Figure 17: Ambulance attendances of heat-related illnesses in Metropolitan Melbourne (2009)



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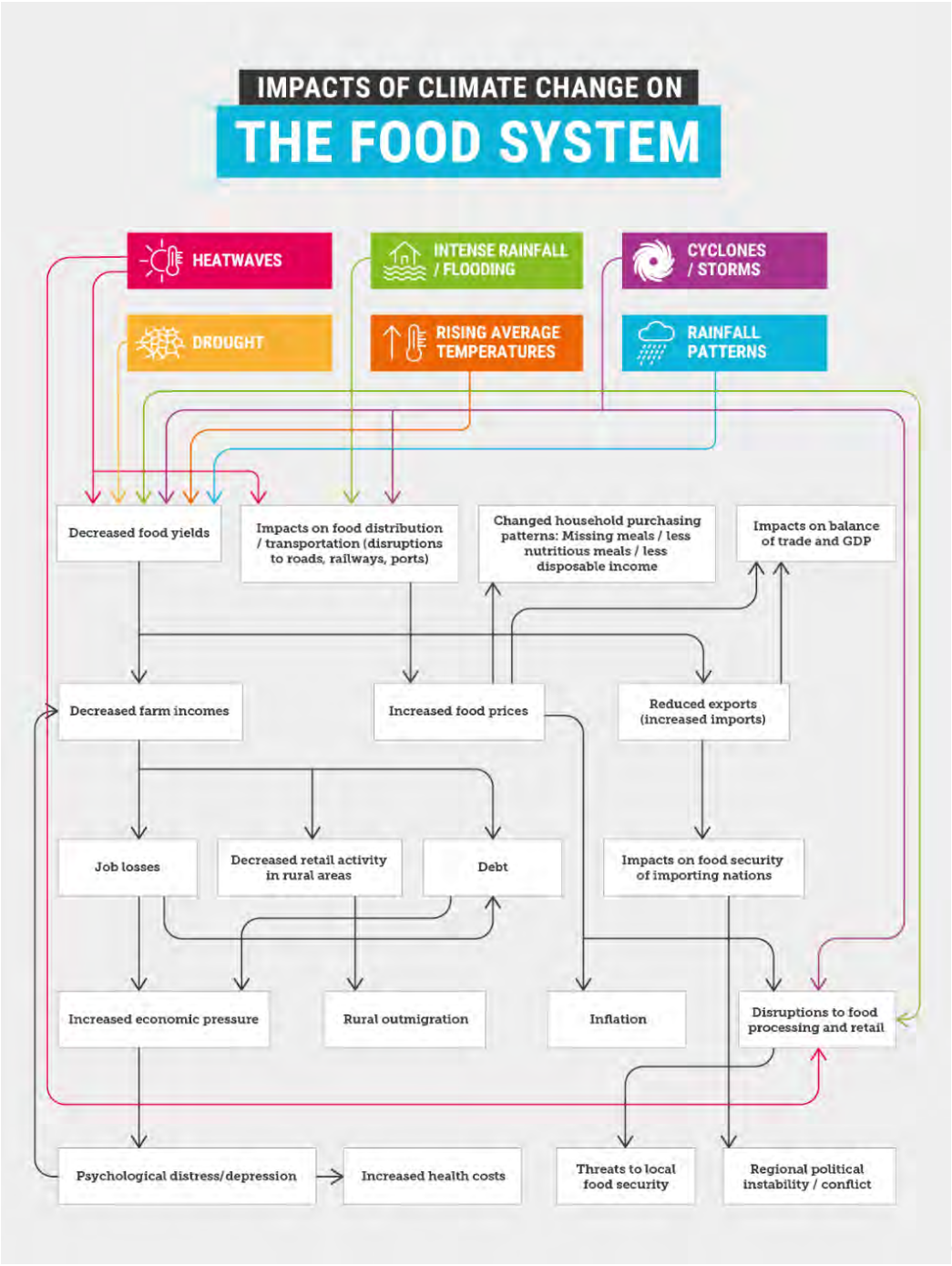
There are a range of roles in climate change adaptation that the health industry will need to play a crucial role in including:

- **education** on heat and how to prevent heat induced diseases;
- **atmosphere and environment** – strengthening air quality monitoring to enable early warning systems. Also, opportunities for health professionals to work with infrastructure developers to incorporate heat reducing measures including trees and plants and increased reflective surfaces;
- **climate extremes and health emergencies** - forming and executing emergency responses and disaster management to reduce health risks related to acute physical events such as extreme weather;
- **water management** – work to enhance water sanitation and hygiene,
- developing a **national strategy for health and climate change**.[58,59]

Food insecurity

The nexus between climate change, health and food has already been inferred in Figure 15 above. Global population growth, along with higher average wealth have increased both the demand for food and demand on the land and freshwater to produce that food. Land use change to accommodate increased agriculture has globally resulted in loss of forests, grasslands and wetlands. In turn this reduces the lands ability to absorb CO_2.[60] A changing climate can be expected to have significant impacts on many facets of agriculture, economics and food security, presented in Figure 18 below.

Figure 18: Impacts of climate change on the food system



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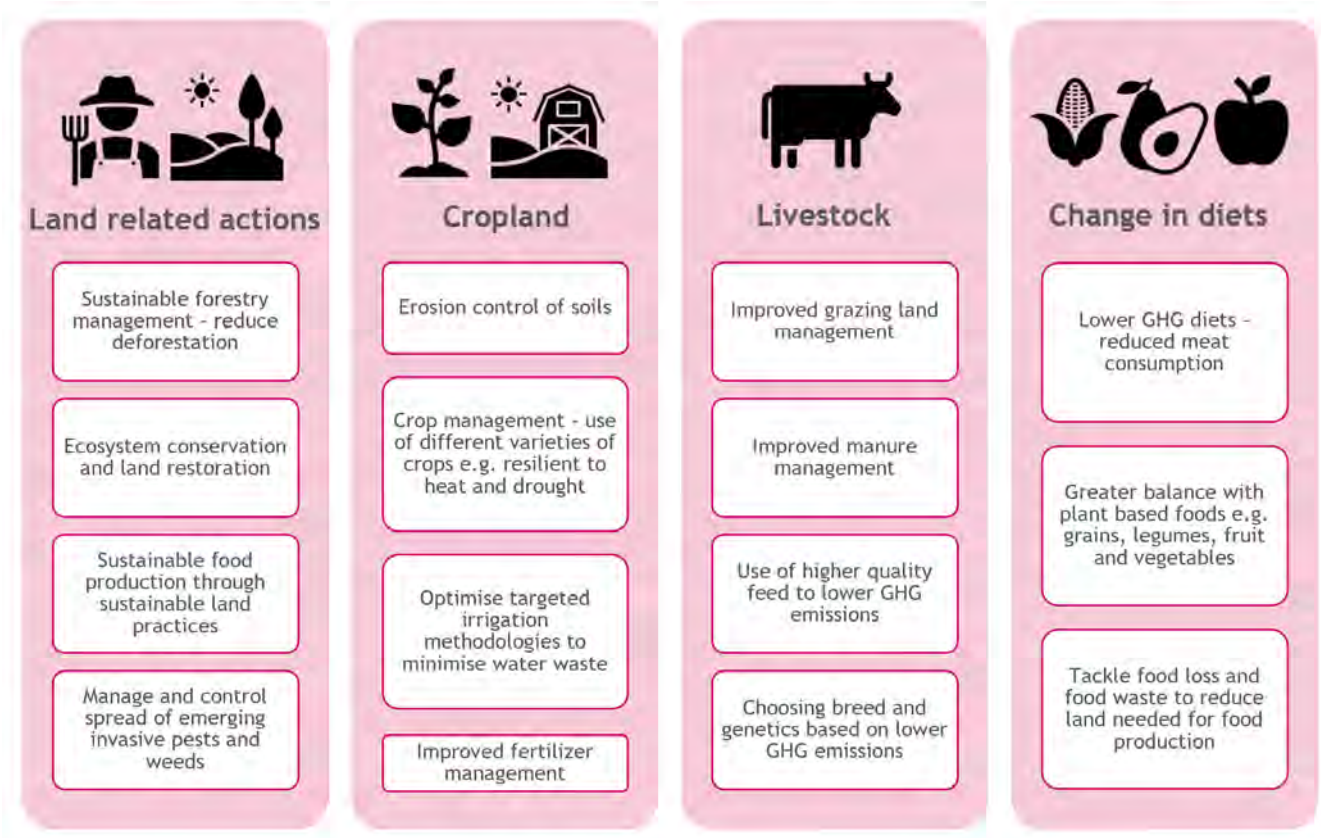
The IPCC reports that "[c]limate change, including increases in frequency and intensity of extremes, has adversely impacted food security".[62] These extremes have included average temperature rises, changing rainfall patterns (e.g. see Figure 11), as well as changing geographical distribution and reach of agricultural pests and diseases. All of these have resultant impacts on agricultural yields, some positive and others negative, and ultimately on global commodity markets too.

Additional food impacts include ocean derived foods, particularly with the effect of increased CO_2 and subsequent acidity in the ocean. This has been seen to affect the ability of some

shellfish to build their shells adequately, resulting over all in smaller size shellfish, both of which would likely reduce supply and increase prices.[63,64] Changes to the ocean temperatures and acidity can also have far-reaching consequences on a range of planktons, which are vital for health of the broader marine food chain, including fish stocks.

Addressing food security issues and agriculture relating to impacts of climate change will require considerable adaptation and mitigation efforts, summarised in Figure 19 below.

Figure 19: Food systems mitigation and adaptation



Adapted from [65]

How the world is responding to climate change?

Since 2015 there have been several key factors focusing the world's attention on the impacts of climate change. The increasingly irrefutable certainty around climate science plus the frequency and magnitude of extreme weather events have all contributed to global economies responding to the threats from climate change with growing urgency. Many corporates, insurance companies, NGOs, farmers and many of the world's countries and regions are seeking ways in which to urgently adapt to and / or mitigate climate change. Equally, some industries, countries and sectors of society have failed to gather momentum on their efforts and indeed continue to resist change. Citing Mark Carney, Governor of the Bank of England, the "costs of ignoring climate change are rising" and "[c]ompanies that don't adapt, including companies in the financial system, will go bankrupt without question and also there will be great fortunes made along this path aligned with what society wants".[66]

Paris Climate Agreement

In December 2015 a significant agreement was reached by the Parties to the 1992 United Nations Framework Convention on Climate Change (**UNFCCC**) to combat climate change and step up action and investment to facilitate the transition of the world to a lower carbon, more sustainable economy.

The stated goal of the Paris Climate Agreement (**Paris Agreement** or **Agreement**) was to limit global temperature rises this century to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 °C. Additional goals include:

- to increase the ability of countries to deal with the impacts of climate change; and
- facilitate "financial flows to be more consistent with a low GHG emissions and climate-resilient pathway"[67]

Under the Agreement, individual countries committed to bespoke long-term goals (to be updated in 2020) called Nationally Determined Contributions (**NDCs**), whereby these goals represent the ambitions by which each country intends to reduce its emissions and adapt to climate change in order to achieve the goals of the Paris Agreement. Progress against these goals needs to be reported periodically to the UN.

The Paris Agreement was a particularly significant acknowledgement by global leaders that climate change is significantly driven by humans and that global action was needed to change its current trajectory. The Paris Agreement provided the framework through which to conduct, measure and monitor that action.

Progress made under the Paris Agreement

The Paris Agreement entered into force in November 2016 and as at August 2019, 186 (including the European Union) of the 197 Parties to the UNFCCC have ratified the Agreement.[68] These Parties represent c.88% of 2016 global GHG emissions.[69] The USA however, which accounted for c.18% of global emissions in 2015, stated its intention in 2017 to withdraw from the Agreement. This is in progress to occur should Donald Trump be re-elected in 2020.

Australia has committed to reducing GHGs by 26-28% below 2005 levels by 2030. In 2018 analysis was undertaken country-by-country on progress towards respective NDCs. Australia was reported as one of the 50% of G20 members where current policies were likely to see "GHG emissions trajectories fall short of achieving their unconditional NDCs".[70]

The United Nations Environment Program (**UNEP**) has warned that the combined committed NDCs are not fit for purpose and have determined that "[p]athways reflecting current NDCs imply global warming of about 3°C by 2100, with warming continuing afterwards".[71] The UNEP believes that global emissions need to peak by 2020 to achieve the temperature targets of the Paris agreement.

A 'Just Transition'

The Parties to the Paris Agreement agreed to "[t]aking into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities".[72]

One interpretation of this is that policies and actions to facilitate a transition to a low carbon economy need to be implemented in a socially responsible manner and, on a net basis, boost prosperity and drive jobs that are relevant in the future economy. It is critical that appropriate consideration is given to the likely challenges faced by individual workers, communities and industries, particularly in the context of job disruption. The UNFCCC estimates as many as 1.5 billion jobs may be affected by a transition to a low carbon economy. Inadequately considering the social costs and implications when endeavouring to drive this transition is much more likely to result in a failure to reduce emissions, thus increasing social inequality. [73]

As investors of retirement savings, superannuation funds not only have a fiduciary duty but an opportunity to contribute to social and economic aspects of climate change. This can be achieved by factoring in considerations of a just transition when making investment decisions and asset management, as summarised in Figure 20 below.

Figure 20: Investing in a 'Just Transition'

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IPCC report

In 2018 the Intergovernmental Panel on Climate Change (**IPCC**) (the UN body responsible for assessing the science of climate change) released a special report entitled "Global Warming of 1.5°C". This report was written at the request of the UNFCCC at the time of its decision to adopt the Paris Agreement in December 2015. In that report, the IPCC call for more ambitious and urgent global action on climate change than was proposed under the Paris Agreement in a bid to limit warming to 1.5°C above pre-industrial levels. [75]

The IPCC modelling determines that to deliver the best prospect of limiting global average temperature rises, human derived CO_2 and other GHG emissions need to be reduced urgently, ultimately down to a net zero. The IPCC's proposed emissions reduction pathway is outlined below in Figure 21.

Figure 21: IPCC emissions reduction pathways

Global temperature rise limited to:	2030 action	2050
1.5°C	Anthropogenic CO_2 emissions levels will need to reduce by 45% from 2010 levels	Anthropogenic CO_2 emissions levels to reach net zero around 2050
2.0°C	Anthropogenic CO_2 emissions levels will need to reduce by 25% from 2010 levels	Anthropogenic CO_2 emissions levels to reach net zero around 2070

Regulatory, legislative and reporting developments

The momentum on regulatory and legislative changes related to climate change outside Australia have been unprecedented over the last five years, in response to both the Paris Agreement and the global recognition of the urgency of action required. On a country by country basis however action has been variable. A small number of examples are provided below, recognising that there are many others not identified here.

Carbon pricing

Placing a price on carbon is theoretically one of the easiest ways to transition to a lower carbon economy and considered to be one of the strongest policy methodologies for enacting a polluter pays principle. Carbon pricing means the highest emitters are penalised for the emissions they generate. Due to pricing signals, end-users of products and services change buying behaviour from a purely economic decision standpoint, as those high emissions products and services become more expensive relative to lower emissions alternatives or substitutes. As described by the World Bank:

> "A price on carbon helps shift the burden for the damage from GHG emissions back to those who are responsible for it and who can avoid it. Instead of dictating who should reduce emissions where and how, a carbon price provides an economic signal to emitters, and allows them to decide to either transform their activities and lower their emissions, or continue emitting and paying for their emissions".[76]

There are many methodologies of placing a price on carbon including Emissions Trading Schemes (**ETS**), Carbon Taxes, Carbon Credit Schemes and Results-Based Climate Financing (**RBCF**) (see Appendix 1 for further explanation around the various types of carbon pricing instruments).

The World Bank reports that 57 of the 185 signatories to the Paris Agreement have either commenced or are committed to using some form of carbon pricing to meet their NDC commitments. A further 39 jurisdictions are considering using a carbon pricing tool. If implemented this could cover over 50% of global emissions. It is estimated that currently c.20% of global GHG emissions are covered by some form of carbon pricing mechanism, however the cost imposed on polluters under the active schemes are significantly below where they need to be to deliver progress under the Paris Agreement.[77] The carbon-

pricing level required to deliver outcomes consistent with achieving the Paris Agreement temperature targets is reported to be at least USD40–80/tCO_2 by 2020 and USD50–100/tCO_2 by 2030.[78] It is worth noting that BP models a USD200/tCO_2 carbon price by 2040 in the OECD (and USD100/tCO_2 elsewhere) in order to achieve its "lower-carbon power" scenario.[79]

It is anticipated that the number of jurisdictions implementing a carbon pricing mechanism over the medium term will increase. Therefore, despite not having certainty around timing or price of these individual schemes, incorporating scenarios around future costs of carbon is an important consideration for future investment decisions.

EU sustainable finance action plan

In 2018 the EU, to support the transition to a low-carbon and more sustainable economy, set up a technical expert's group to develop the following new regulations:

1. An EU Taxonomy – a system to help determine the environmental sustainability of economic activities;
2. An EU Green Bond Standard;
3. Benchmarks for low-carbon investment strategies;
4. Guidance to improve corporate disclosures of climate-related information.[80]

It is intended that the resultant regulations from these activities will help support the EUs efforts to address the UN Sustainable Development Goals (**SDGs**) and the EU's Paris commitments. The EU's 2030 goal to cut GHG emissions by 40% has been estimated to present an investment funding gap of around EUR180 billion per annum to 2030.[81]

The Taxonomy is looking to establish a methodology of classifying investments by their impact in contributing to six environmental areas including:

1. climate change adaptation;
2. climate change mitigation;
3. sustainable use and protection of water and marine resources;
4. transition to a circular economy, waste prevention and recycling;
5. pollution prevention and control;
6. protection of healthy ecosystems.

To qualify for inclusion in the taxonomy, an investment must contribute to a minimum of one of these objectives, as a way of encouraging more capital to move towards sustainable activities. It is intended that the Taxonomy will provide clear signals around which investments contribute to a low-carbon transition and other environmental benefits, enabling investors to specifically target positively contributing investments.[82]

Legal challenges relating to climate change

Corporate culpability for climate change related impact is an increasingly emerging field of law. A recent report found that climate change legal cases have been lodged in 28 countries. Over 75% of cases have been brought in the US (1,023) however 94 cases have been recorded in Australia, the second highest after the US (see Appendix 2 for jurisdictions). The defendants were primarily governments (80%) but increasingly high emitting companies too. Over 80% of the cases have been brought by citizens, corporations and NGOs. Approximately 80% of cases recorded focused on climate change mitigation and the remainder adaptation. The report does highlight however that the impact of litigation is still to be evidenced.[83]

Examples of climate change legal challenges

Juliana Vs. US Federal Government:

Juliana Vs. US Federal Government is currently awaiting a ruling to see if the case can proceed to trial. The case involves 21 young claimants alleging that action by the US Government has impacted their constitutional rights by promoting fossil-fuel consumption, which has advanced climate change. The 21 young claimants are seeking a climate change action plan by the US Government. A further case, Sinnock Vs. Alaska is currently being heard filed by 22 young people with respect to overturning an Alaskan State law which promotes further fossil fuel development on the basis of climate change. Additional challenges are being heard around human rights violations from climate change inaction against both governments and corporates.

The State of New York Vs. Exxon Mobil (Exxon):

On 23 October 2019, Exxon is facing court over a case of climate change fraud charges brought by the New York State. The State is alleging that Exxon knowingly sought to deceive investors around how it is managing its climate change risks, by effectively seeking to confuse the public around scientific consensus on climate change.

Retail Employees Superannuation Trust (REST), Australia:

In 2018 a case was filed against REST in the Federal Court of Australia by Mark McVeigh claiming that REST breached its fiduciary duties by failing to provide information and address risks associate with climate change. The claim is that REST and the Trustee Directors knew or ought to have known about climate change and its physical impacts and transition impacts and the risk posed to the financial position of many of REST's investments. The case is ongoing.

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Climate change reporting, standards and accreditation developments

Globally there continues to be a number of developments in monitoring and reporting around climate change risks, opportunities and company responses. These developments are responding to greater demand for transparency from auditors, regulators, governments, financial institutions and investors. To date however disclosures are not compulsory to include alongside financial filings. Examples of types of reporting include:

GRI Standards[88] – one of the longest standing sustainability reporting standards, which includes environmental and emissions reporting along with social reporting.

Task Force on Climate-related Financial Disclosures (TCFD)[89] – founded by Michael Bloomberg and launched in 2017, the TCFD is a global, voluntary, climate-related financial reporting methodology. Its purpose is to provide clear and comparable climate risks and opportunities data. This should enable debt and equity investors, insurers and other interested parties to more accurately price risks. Additionally, companies should be able to better assess and articulate the risks they may face from a climate perspective and translate this into climate-informed asset allocation and valuation decisions. Whilst still a new reporting methodology support is growing with 867 organisations having expressed support for TCFD reporting as at September 2019, responsible for assets of $118 trillion.

Science Based Targets Initiative (SBT)[90] – Companies have the opportunity to set GHG emissions reduction targets aligned with the goals of the Paris Agreement, to limit warming to well below 2°C and to pursue goals to limit warming to 1.5°C. If the targets align with these goals, they can be considered science-based. Setting these goals via the SBT initiative demonstrates a standard has been achieved in target setting which has been validated by SBT. Companies then report publicly on their progress under these targets. Financial institutions are currently unable to formally set SBTs yet, however a methodology is currently being finalised to enable this. To date 672 companies are looking to set SBT and 276 have approved SBTs.

Climate Bond Standard[91] – The Climate Bond Standard is a set of eligibility criteria to help investors determine the credentials of a green or climate bond. There is also a certification that verifies that a bond has achieved the Climate Bond Standard.

Sustainable Development Goals (SDGs)[92] – The SDGs are a series of 17 goals with specific targets under each goal that aim to provide a plan to tackle global issues affecting both developing and developed nations by 2030. The SDGs were adopted by all UN Member States in 2015 and each country has the opportunity to report on its progress in contributing to the world achieving the SDGs. The SDGs provide a framework for investing and reporting progress against.

Australia's response to climate change

Australia's response to climate change is well documented as having been driven largely by the politics dominating at any given time. For example, Australia signed the Kyoto Protocol however the government at the time refused to ratify it. This meant that whilst the government had preliminarily endorsed the commitment to limiting emissions in 1998, it had no actual legal obligation to deliver against the commitments. It wasn't until 2007 following a change in government that Australia finally ratified the Protocol, e.g. the act which made the signing legally binding in Australia.

The Australian government did ratify the Paris Agreement in November 2016 and committed to targets as outlined in Figure 22 below, alongside Australia's previous commitments.

Figure 22: Australia's climate commitments

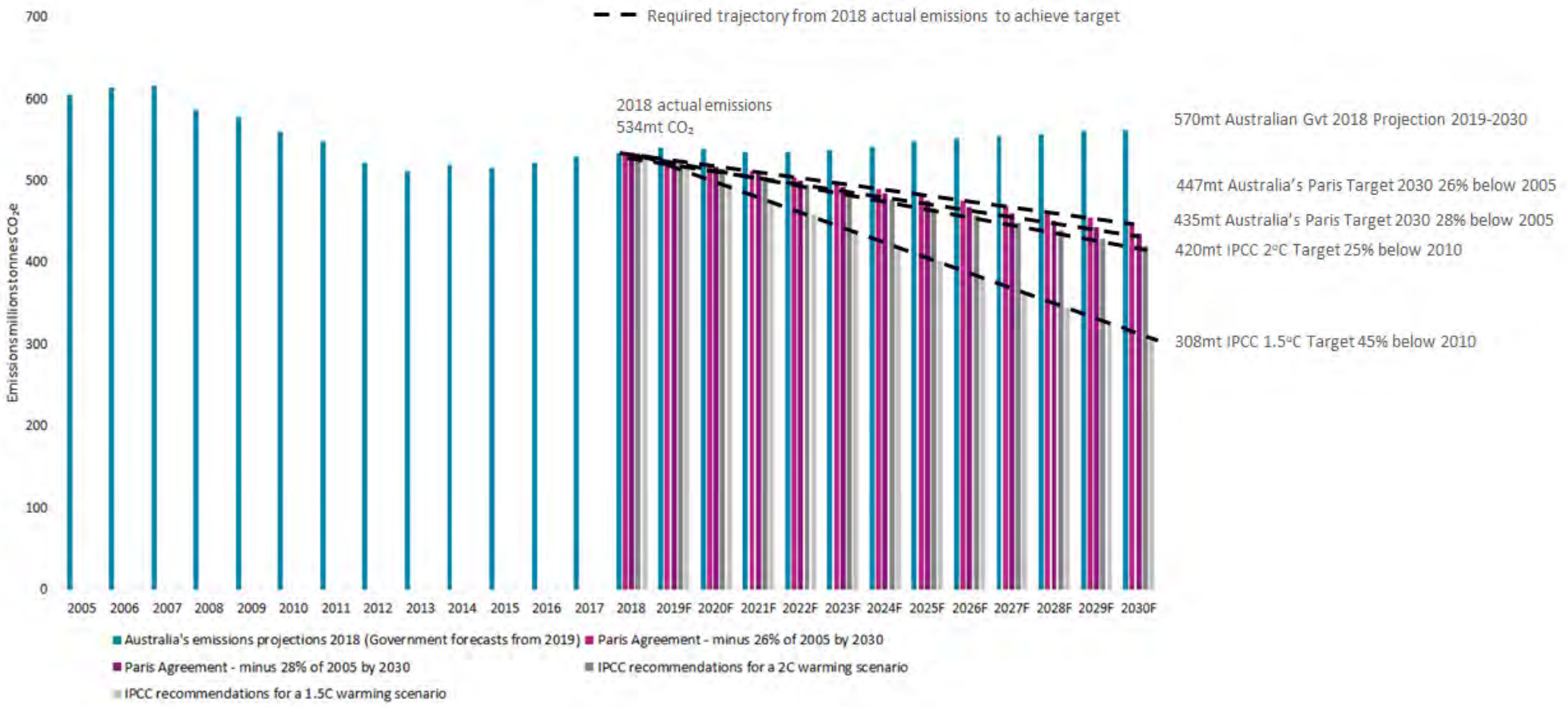
AUSTRALIA	Summary of pledges and targets	
PARIS AGREEMENT	Ratified	Yes
	2030 unconditional target(s)	26–28% below 2005 by 2030 [4–7% above 1990 levels by 2030 excl. LULUCF] [17-19% below 2010 levels by 2030 excl. LULUCF]
	Coverage	Economy-wide, incl. LULUCF
COPENHAGEN ACCORD	2020 target(s)	Unconditional: 5% below 2000 by 2020 [27% above 1990 by 2020 excl. LULUCF] Conditional: 15–20% below 2000 by 2020
	Condition(s)	-15%: global agreement, which implies atmospheric stabilisation at between 510 and 540ppm CO2e -25%: ambitious global deal capable of stabilising levels of greenhouse gases in the atmosphere at 450 ppm CO2e or lower
KYOTO PROTOCOL (KP)	Member of KP CP1 (2008–2012)	Yes
	Member of KP CP2 (2013–2020)	Yes
	KP CP1 target (below base year)	8% above 1990
	KP CP2 target (below base year)	0.5% below 1990
LONG-TERM GOAL(S)	Long-term goal(s)	None

[93] Note LULUCF = Land use, land use changes and forestry

Australia's Paris commitment has been reported by a range of climate commentators and researchers to be less ambitious than other developed countries. This is however difficult to analyse given each country reports off different base years. The Australian Federal Government reports that the targets are "a fair contribution for Australia".[94]

Analysis has been undertaken to show what the commitments translate to in an absolute sense from the most recently reported actual emissions data in 2018. This is shown in Figure 23. Also included on this chart is the Australian Government's own emissions projections out to 2030 and graphical illustration of the emissions reduction required for Australia to achieve the IPCC 2018 emissions reduction targets by 2030.

Figure 23: Australia's emission reduction trajectories



Source: Adapted by FSS Responsible Investments Team from Australian Government data [95, 96, 97]

How the Australian Government intends to achieve the targets

The analysis undertaken in Figure 23 indicates that the Australian Governments own emissions projections are significantly divergent from the commitments made under the Paris Agreement. Despite the Government's own forecasts showing overall emissions increases out to 2030, the Government has stated that it is confident it will "meet its 2030 target 'through policies built on its proven Direct Action approach'". [98]

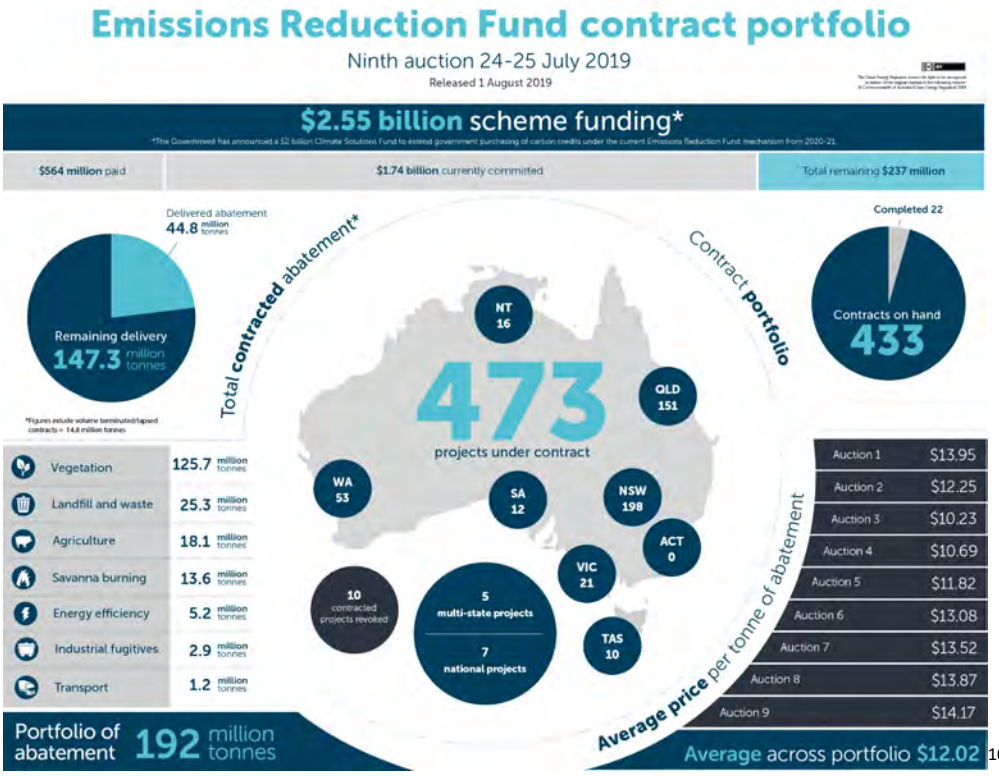
The Direct Action activities include the Emissions Reduction Fund and associated Safeguard Mechanism, described below.

Emissions Reduction Fund, Climate Solutions Fund and the Safeguard Mechanism

Following the Australian Government's repeal of the Carbon Pricing Mechanism in 2014, the Government committed AUD2.5 billion to the Emissions Reduction Fund (ERF) as a methodology to pay for projects that reduce emissions, that are real and additional to business as usual. Activities have included avoided deforestation where prior approval has been given to clear native forest, soil rejuvenation, beef cattle management (e.g. changing diet, reducing weight to age ratio of the herd and reducing unproductive numbers of cattle in the herd), energy efficiency projects and capturing waste gas from coal mine operations thus avoiding that gas from entering into the atmosphere via flaring or generating electricity from it.[99]

Twice yearly the Federal Governments Clean Energy Regulator holds these emissions reduction reverse auctions, where potential projects bid in. The cheapest and most likely to succeed projects are awarded Emissions Reduction Fund contracts to avoid carbon emissions over a nominated time in the future. Figure 24 provides the Governments snapshot of the auctions that have been undertaken to date.

Figure 24: Emissions Reduction Fund auction outcomes



[100]

Whilst recognising the contracts are predicting to abate 192 million tonnes of CO_2 equivalent (**CO_2e**) over the scheme life, to date the scheme is reported to have resulted in 44.8 million tonnes only of avoided CO_2e over its 4 years to date. This has cost the government approximately AUD540 million to pay for these avoided emissions with a further AUD1.7 billion assigned but not yet paid out. In context, Australia's total emission over 4 years[1] from 2015-2018 have been approximately 2,150 tonnes CO_2e.[101] This equates to the ERF projects avoiding emissions equivalent to approximately 2% of Australia's emissions over an equivalent time period only.

In February 2019 the Government announced an additional AUD2 billion to the ERF as part of its 'Climate Solutions Fund' for investment, which it stated would contribute towards achieving Australia's NDC targets.[102] Despite this money committed, the UN reports that Australia is not on target to meet its NDC targets.[103] Additionally, the ERF and Climate Solutions Fund more broadly have been widely criticised as wholly inadequate to achieve meaningful emissions reductions. Key arguments raised include that there is no targeting by the fund towards the highest emitters, including no policy to transition Australia away from high emitting coal power generation. The projects approved under the ERF do not represent pure additionality in emissions avoidance e.g. some of these projects would probably have occurred anyway, such as avoided land clearing. There is also no requirement for permanence in these projects beyond the commitment time. Furthermore, through the Safeguard Mechanism[2] generous GHG emissions allowances given to high emitters are considered likely to offset emissions abated under the ERF.[104] Recent reports indicate that high emitters, including Centennial Coal and Anglo American Coal, have been allowed to increase their baseline emissions, thus avoiding millions of dollars in penalty payments for excess emissions.[105]

Kyoto carryover

The Australian Government has stated it intent to use excess emissions credits previously accrued from its Kyoto Protocol period and carry these over to apply as a theoretical emissions reduction under its Paris Agreement targets.

It has been reported that in order to meet its Paris commitments, Australia would need to reduce its emissions by a cumulative 695 million tonnes, of which 367 million tonnes (approximately 53%) would come from the Kyoto carryover credits. At this stage Australia is the only nation proposing to achieve its Paris targets through using Kyoto carryover credits.[106] The effective result of this would be a real emissions reduction of just 17% to 18% versus 26% to 28% below 2005 levels by 2030 and an estimate that Australia's actual effort would align with a 3 to 4°C temperature warming scenario.[107]

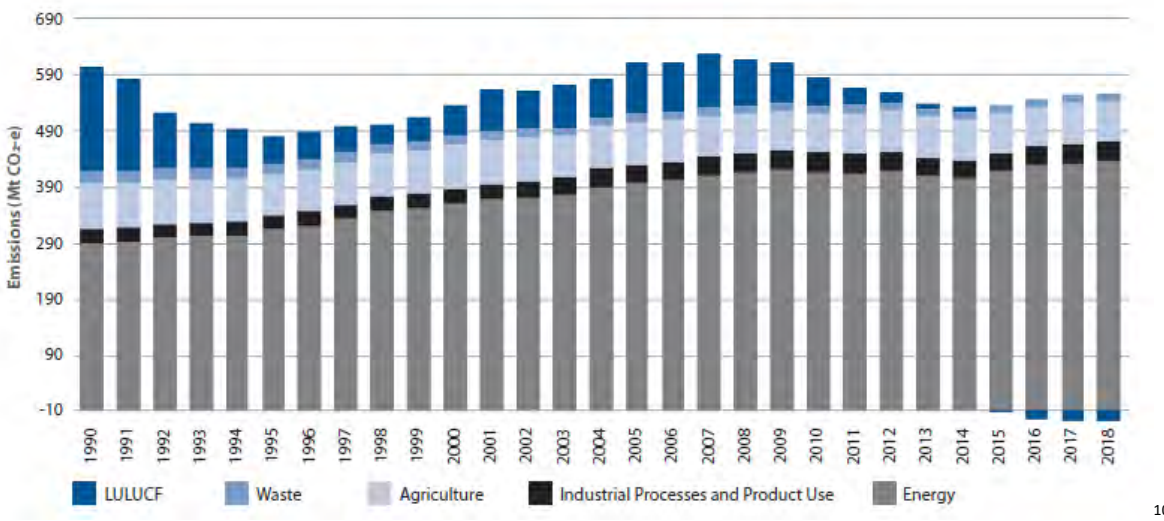
[1] Note this period doesn't align perfectly with the ERF auctions given there is a lag in emissions data release however it's recognising the ERF contracted activities occur over the subsequent years anyway hence this analysis is for illustrative purposes only

[2] The Safeguard Mechanism is applied to the largest emitters in Australia 140 large businesses that have facilities with direct emissions of more than 100,000 tCO2-e a year, approximately 50% of Australia's emissions. Those businesses are responsible for keeping net emissions at or below baseline emissions levels. See here for additional details: https://www.environment.gov.au/climate-change/government/emissions-reduction-fund/publications/factsheet-erf-safeguard-mechanism

Australia's energy sector response to climate change

Despite a lack of policy certainty progress has been made on a number of fronts, however GHG emissions from the energy sector, including transport and electricity generation emissions, continue to rise. This increase can be partially attributed to increased emissions resulting from Australia's LNG industry ramp up.

Figure 25: Net greenhouse gas emissions, by sector, Australia, 1990-2018



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Australia's electricity sector

When considering Australia's electricity generation standalone, the system is undergoing a significant transition as a result of rapid build out of large-scale wind and solar generation, retired and retiring large baseload coal fired power stations, widespread uptake of rooftop solar PV and increasing uptake of corporate PPA's for renewable energy. Whilst this has seen a reduction in electricity sector emissions (see Figure 26), from a systems perspective the energy sector in Australia continues to have a significant transition ahead (see Figure 27).

Figure 26: Australia's electricity sector emissions 2008 – 2018

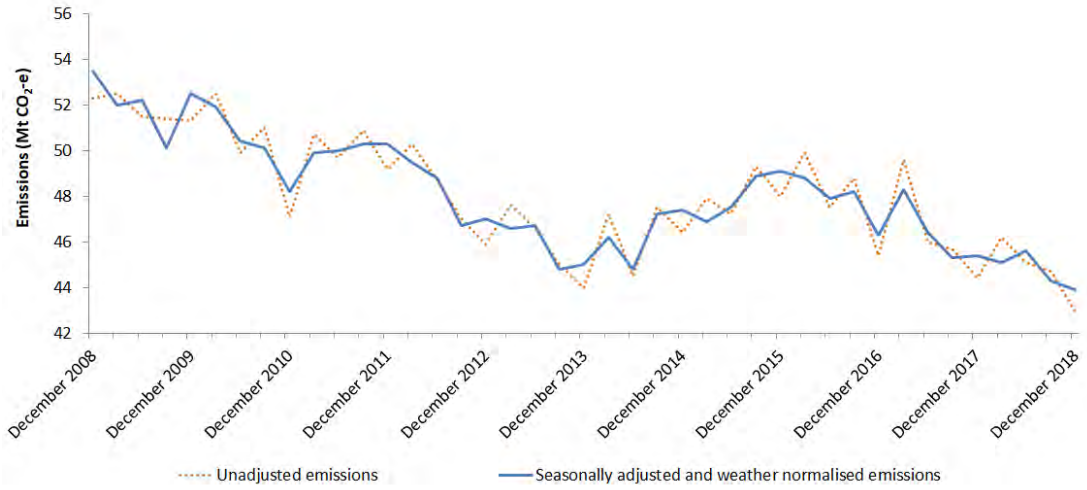

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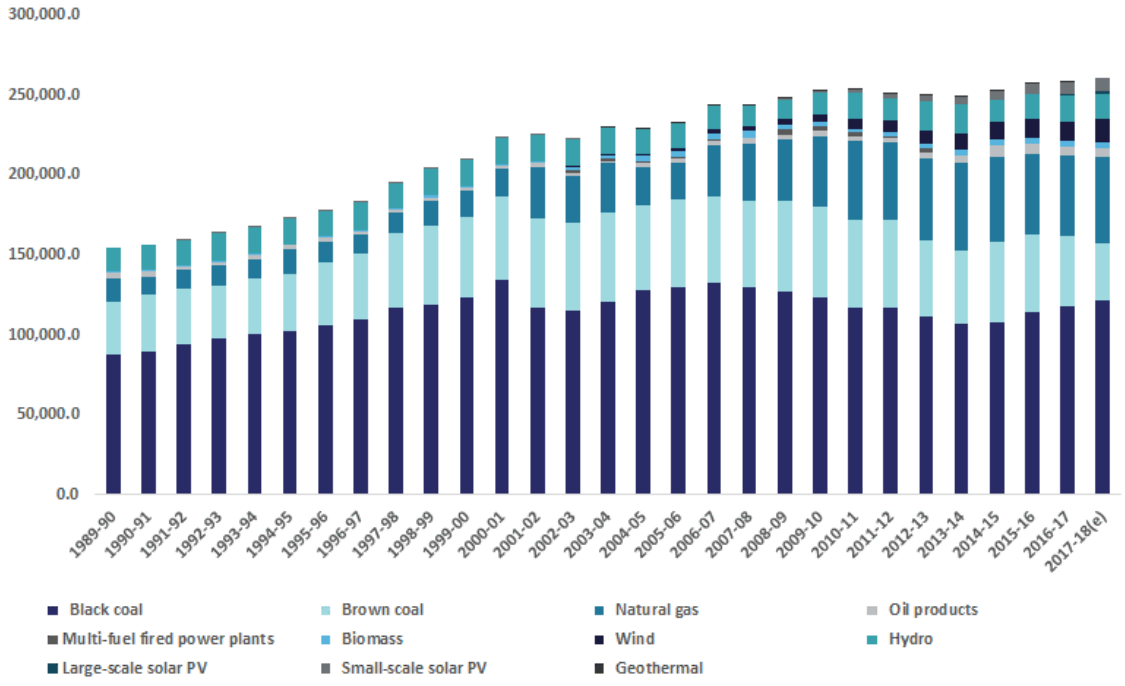
Figure 27: Australian electricity generation by fuel type 1990 - 2018



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The transition ahead will likely include:

- ongoing development of large-scale renewables generation, as the lowest cost new generation to develop;
- fit-for-purpose modernisation of the electricity transmission system;
- the potentially quicker than anticipated exit of large baseload power generators (primarily coal); and
- introduction of electricity storage at a much larger scale into the energy system.

Figure 28: Australia's renewable energy sources in 2018

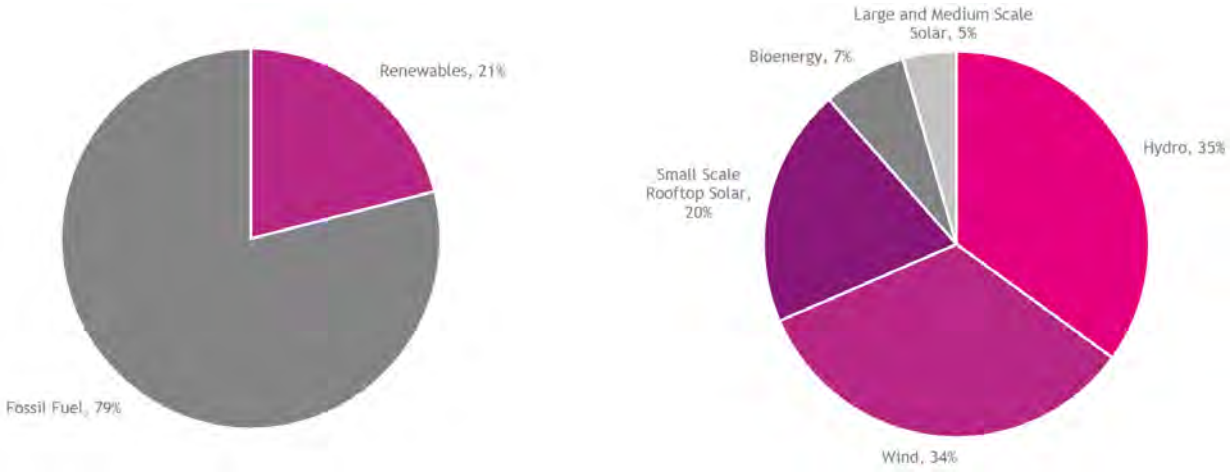

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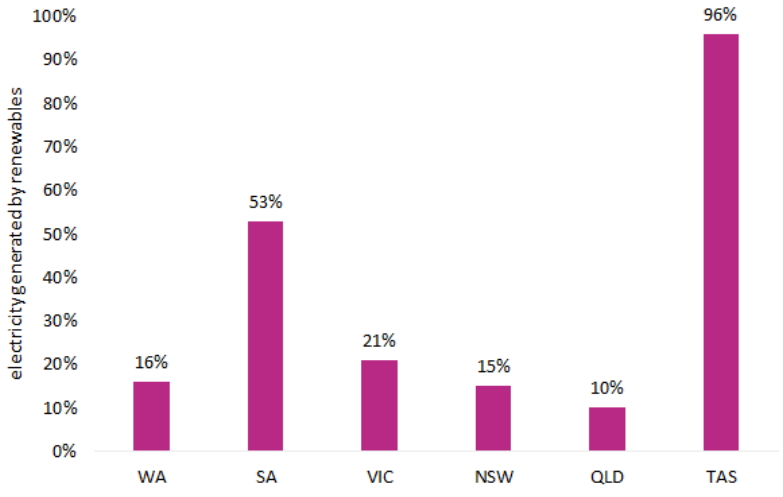
Figure 29: Australia's 2018 renewable generation, by state



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In 2018, 21% of Australia's electricity was generated by renewables. This will increase through new renewable generation already developed or being developed, in addition to ambitious State targets. Targets have been set by the Australian States and Territories in the absence of a Federal target beyond the current and already achieved 2020 Renewable Energy Target (RET) (see Figure 30).

Figure 30: Australia's renewable energy targets State by State

Target	ACT	VIC	QLD	TAS	NT	SA	NSW	WA
Renewable electricity target	100% by 2020	25% by 2020; 40% by 2025 50% by 2030	50% by 2030	100% by 2022	50% by 2030	100% by 2030	-	-
Net zero emissions target	By 2045	By 2050	By 2050	By 2050	By 2050	By 2050	By 2050	By 2050

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In order to progress Australia's energy system there are a range of recommendations that have been made around future proofing of the energy system, including the electricity transmission network, to enable greater penetration of renewables into Australia's energy system.[114] The Climate Change Authority (**CCA**), the Federal Governments advisory group, has recognised that the National Energy Guarantee (**NEG**) was seen as a possible way forward in Australia's electricity sector prior to it being abandoned by the Government in 2018. The CCA has subsequently recommended for the electricity generation sector to "Implement an emissions intensity scheme or a low emissions target in the electricity sector to provide enhanced investor certainty, ensure reliability and drive net zero emissions by 2050".[115] This does not appear to be supported by current Federal Government policy.

Australia's regulatory environment

APRA acts in a supervisory manner around entities it supervises with respect to climate change risks and liabilities. APRA encourages its regulated entities to "consider climate risks within their risk management frameworks" and recognises the TCFD as an established framework that entities can use.[116]

ASIC acknowledges that climate change disclosure for listed entities is an emerging and developing field. A 2018 report released by ASIC made the following recommendations for directors in developing climate disclosure:

- Consider, understand and continually reassess existing and emerging climate risks. ASIC recommends directors and management consider TCFD reporting (noting ASIC states "We do not consider there is any legal or policy impediment to listed companies reporting under the TCFD recommendations provided that the disclosure is not misleading or deceptive");
- Adopt strong and effective corporate governance around disclosing material governance and risk management practices around climate risk;
- Comply with the law whereby should the law require, an Operating and Financial Review to include a discussion of climate risk when it could affect the entity's achievement of its financial performance or disclosed outcomes should be produced;
- On reporting, ASIC recommends that even if TCFD reporting is not undertaken, listed companies should assess and disclose climate risk aligned with the TCFD including physical and transition risk.[117]

By highlighting that companies must comply with the law, this supports the notion that if climate change does present a financial disruption to the business at some future date, however the business has not disclosed it nor seemingly acted to manage its risks, this could render the directors as negligent of their director responsibilities. The ASIC Commissioner, John Price, has specified that companies seemingly providing deliberately misleading and deceptive information around climate risks may be at risk of legal action by ASIC.[118]

In February 2019 the **ASX** released its Corporate Governance Principles and Recommendations, which will come in to effect in January 2020. The ASX highlights companies that may be exposed to transition and / or physical risk should consider reporting under the TCFD framework.[119]

The **Australian Accounting Standards Board** (AASB) and **Auditing and Assurance Standards Board** released a joint statement in December 2018 stating that "entities can no longer treat climate-related risks as merely a matter of corporate social responsibility and should consider them also in the context of their financial statements."[120] The statement concludes that if material disclosure is made with respect to climate risks then the financial impact should therefore be reflected, and hence audited, as part of the financial statements, including in fair value estimates and potential impairments. The statement explains that a failure to undertake this may result in a 'please explain' request. Recognising these guidelines are voluntary at this time, it is considered a first step in formal acknowledgement of climate change risks being reflected in financial statements.

Whilst it is recognised that the **RBA** doesn't regulate financial institutions it is worth noting that the RBA has been increasingly vocal around the physical and transition risks Australian financial institutions face. The RBA has stated that failure to act on addressing climate change mitigation, transition and adaptation poses significant risk to the financial stability of Australia.[121] The RBA is a participant in the Network for Greening the Financial System (**NGFS**), a group of 36 central banks and supervisors from five continents, looking at, amongst other green finance areas, how central banks can facilitate the financial sector to achieving the objectives of the Paris Agreement.

The **Council for Financial Regulators** (**CFR**) which includes APRA, ASIC, the RBA and the Australian Treasury is a working group convened to consider the potential implications of climate change on the financial systems stability, including regulatory gaps and risks in the financial system and reviewing international regulatory development with respect to climate change.[122]

Within Australia it is noted that there is no specific legal methodology for entities to report on their climate change risks and mitigants, instead most bodies recommending that companies undertake the voluntary TCFD reporting. Whilst this will result, most likely, in those already considering climate change to report, the consistent reporting format of the TCFD would enable better comparability of companies for regulators and investors. It is recognised that each body has announced a comparable statement around corporate and director's obligations and reporting adequately on climate change risks. As summarised by Clayton Utz:

> "Boards cannot ignore climate change risks as a factor in corporate decision-making. Under the current regime, directors who fail to proactively turn their mind to climate risks could be found personally liable for breaching their duty of care. A director might also be found to have breached their duty if they do not appropriately disclose climate risks or fail to take steps to address foreseeable risk which causes harm to a company (including reputational harm). The regulators are unanimous in their belief that companies should be considering addressing climate change risks and it may only be a matter of time before we see litigation against a director on this basis."[123]

Australia's legal environment

2019 has seen some unprecedented legal action, particularly in NSW, with respect to climate change. To summarise:

- In February 2019 the NSW Land and Environment Court rejected the application for development of the Rocky Hill metallurgical coal project in the Gloucester Valley. One of the primary reasons for rejection being that the project was at the "[w]rong time because the GHG emissions of the coal mine and its coal product will increase global total concentrations of GHGs at a time when what is now urgently needed, in order to meet generally agreed climate targets, is a rapid and deep decrease in GHG emissions. These dire consequences should be avoided." It was recognised that the project was for metallurgical coal for steel making, however the ruling was unchanged on the basis of scope 3 emissions of the coal in that process.[124]
- In August 2019 the United Wambo Coal Project was approved by the NSW Independent Planning Commission (**IPC**) with the unprecedented position that the coal can only be exported to countries that have ratified the Paris Agreement or have targets and policies for cutting GHG emissions.[125]
- In September 2019, the NSW IPC rejected development consent for the NSW Bylong Coal Project on a number of environmental points but noted that the projects failure to address the projects GHG emissions was a factor.[126]

The precedents set by these NSW cases had the potential to influence planning decision making globally. On October 22, 2019 however the NSW government announced that it was seeking to introduce a Bill in to Parliament to prevent the IPC from considering Scope 3 emissions in its approval process, in order to provide more certainty for mine projects. On October 24, 2019, 47 climate experts released an open

letter urging the NSW Government not to overrule NSW laws nor legislate against its own planning approval body.[127]

As highlighted above in the 'Australia's regulatory environment' section, the role of companies, boards and trustees in identifying and disclosing risks arising from climate change is broadening. In the last twelve months Australia's financial and corporate regulatory and supervisory bodies, including the RBA, ASIC, APRA, AASB and AUASB, have all made statements indicating their increasing awareness and requirements of their supervised entities with respect to climate change. The 2019 updated legal opinion by Hutley and Hartford Davis on "Climate Change and Directors' Duties" outlines how the perceived legal expectations of company directors has changed since their original legal opinion in 2016. As stated in the 2019 opinion "Company directors who consider climate change risks actively, disclose them properly and respond appropriately will reduce exposure to liability".[128] As reinforced by the updated opinion, the regulatory environment has shifted significantly in the last 3 years, despite the legislative and policy responses not yet formally mirroring this shift.

Hutley and Hartford Davis believe that supervisory bodies are setting benchmarks against which directors will be measured when considering climate change related legal proceedings. Their view is that from a legal standpoint the risks of climate change are foreseeable and if directors fail to identify that their business will be impacted by the effects of climate change, this will render company directors to an increasing risk of "climate change litigation". To fulfil their corporate obligations and therefore reduce their individual liability, directors should now be able to demonstrate assessment of:

1. risks to the business if decarbonisation does not occur and what steps would be required for the business to adapt to a 1.5°C warming, within the medium term;
2. what the business impacts are if the economy did decarbonise – e.g. what steps will be required to enable the business to respond to a transitioning economy; and
3. what the impacts are on the business to any physical changes that may occur under either of the above scenarios.[129]

Fiduciary duty for Australian superannuation trustees

From a fiduciary perspective in Australia, APRA has been taking an increasingly well-defined view of how regulated entities should be responding to climate change. For instance:

- APRA has stated its intent to increase supervision and observance of regulated entities in relation to climate change and trustee responses to climate change;
- APRA has called for regulated entities to shift from "gaining awareness of the financial risk to taking action to mitigate against them" for climate change;
- APRA has stated its expectations to see "continuous improvement in how organisations disclose and manage these risks over coming years";
- APRA has a responsibility to ensure financial institutions are alert to issues that could impact their ability to fulfil promises to customers, including impacts of climate change;
- "APRA expects that climate risks be assessed within existing prudential risk management standards CPS 220 and SPS 220, and supervisors will be factoring this into their ongoing supervisory activities", and

- "These risks are material, foreseeable and actionable now. Uncertainty over long-term impacts or policy direction is not an excuse for doing nothing" (Geoff Summerhayes)[130]

A June 2017 legal opinion on "Superannuation Fund Trustee Duties and Climate Change Risk" concluded that:

> "there is an inherent harmony between the financial effect associated with climate change risks and the cardinal requirement of a trustee to act in the best financial interests of beneficiary. It follows that climate change risks can and should be considered by trustee directors to the extent that those risks may intersect with the financial interests of a beneficiary of a superannuation fund." [131]

and

> "APRA will conduct its regulatory functions conferred by the SIS Act on the basis that climate change presents a financial risk. It is the treatment of climate change as a financial risk (as distinct from the treatment of climate change as a environmental, social or governance issue) that trustee directors ought consider in an appropriate case when fulfilling the requirements imposed by the SIS Act."[132]

Whilst the McVeigh Vs. REST case will challenge superannuation trustee's fiduciary duty through the Australian legal system, there is evidence from the outlined commentary that APRA expects climate change to be considered as a financial risk by trustees. The assumption may be inferred that failure to consider climate change as a financial risk, which could subsequently lead to financial diminution, may therefore be considered a failure of trustee fiduciary duty.

Investor responses to climate change

In response to progress in the science, global regulatory and reporting requirements and recommendations, member and societal expectations and some corporate action on climate change, a number of global pension / superannuation funds are increasingly taking action on climate change within their investment portfolios and policies.

Industry bodies continue to facilitate the investor responses and continue to help facilitate the discussions with policy makers, regulators and corporates. For example IIGCC, IGCC and Climate Action 100+, PRI and RIAA. Additionally, measurement and reporting frameworks such as the TCFD, which the UK has announced it will seek to require all listed companies and large asset owners to report under by 2022[133], as well as proposed new standards such as the under-development ISO/ CD 14097, provide frameworks and principles for assessing and reporting investments and financing activities related to climate change.

Tools are also being developed to help assess and monitor climate impacts for instance:

- Investor Energy-Climate Action Toolkit (InvECAT), which is being designed as a collaboration between the UN, WWF and the World Resources Institute to help companies and financial institutions assess how their climate related commitments will contribute to the goals of the Paris agreement; and
- Paris Agreement Capital Transition Assessment (PACTA).

Corporate and sector responses to climate change

Globally, often in spite of governmental, legislative and regulatory responses, many corporates and industry sub-groups are progressing their response to climate change volitionally or by necessity to survive through mitigation, transition or adaptation.

Figure 31: Global CO2 emissions by sector in 2017

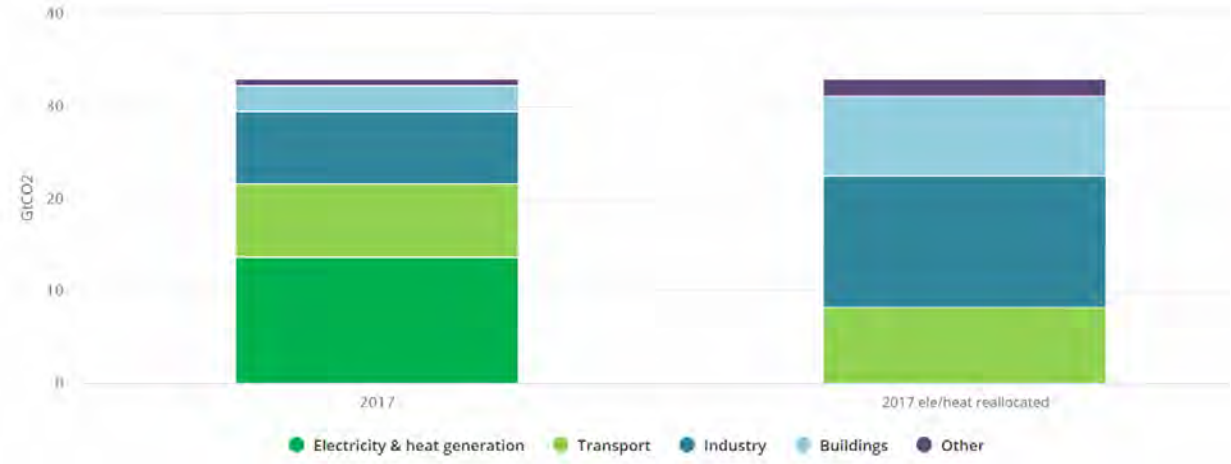

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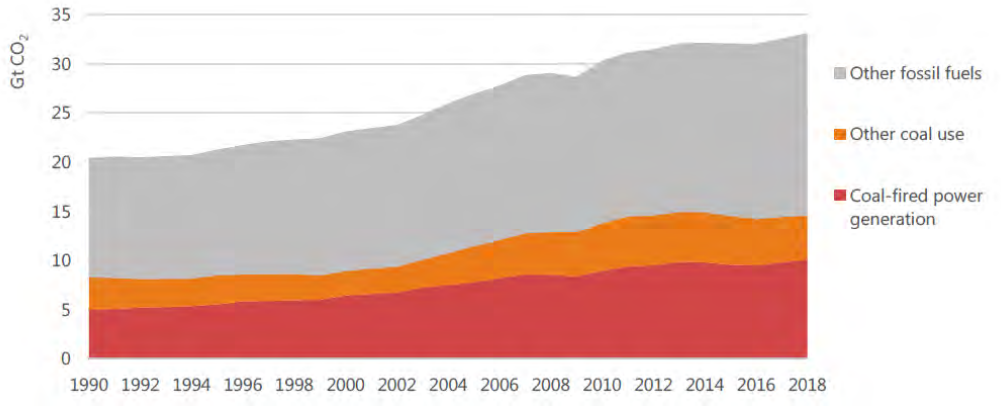
Figure 31 demonstrates on the right hand chart the emissions intensity of the end users primarily as a result of fossil fuel combustion. This therefore highlights the sectors needing to transition to lower emissions energy sources most rapidly. Below is a short summary of the sectors most likely impacted by a low-carbon transition and a snapshot of current changes happening in those sectors around the globe.

Energy

Globally, energy related GHG emissions continue to rise as a result of increased energy demand and continued use of fossil fuel derived energy. This is despite global development of renewable energy sources. CO_2 emissions from energy sources are reported to have risen 1.7% in 2018, continuing the ongoing year-on-year rise in emissions.[135] This rise has been attributed to a strong global economy as well as increased demand for heating and cooling due to weather conditions during the period. Given forecast global population rises and of rising temperatures, these drivers for global energy demand are unlikely to diminish. The IEA reports that investment globally in 2018 for low-carbon energy amounted to USD620 billion. This included investment in energy efficiency, renewable power (USD340 billion), renewables for transport and heat, nuclear, battery storage and carbon capture utilisation and storage. Conversely, investment in oil, gas and coal in 2018 amounted to just over USD800 billion.[136] The IEA recognises that to decarbonise the economy there needs to be a dramatic shift in that investment split and away from fossil fuels.

Figure 32: Global energy-related carbon dioxide emissions by source, 1990-2018



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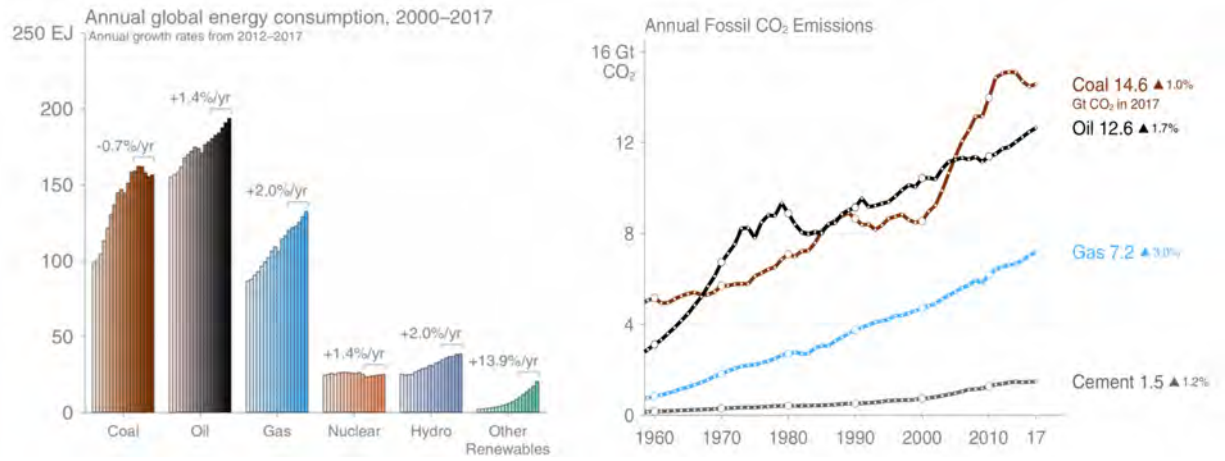
Whilst there has not been a complete decoupling of energy growth and emissions growth, the IEA reported that in 2018 emissions grew by 0.5% for each percentage growth in economic output, noting that in 2018 emissions from energy grew 25% slower than energy demand, as a result of low carbon energy (including renewables and nuclear).[138]

Figure 33: Annual global energy consumption 2000–2017 and fossil fuel emissions 1960-2017



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The left hand chart in Figure 33 displays the rapid increase in renewable energy generation around the world, however it also displays how small in a relative sense the percentage renewable generation accounts for in global energy.

As a consequence, there are a number of potential scenarios for future energy mix. Global energy demand will continue to increase, but its recognised consumers do not specifically seek fossil fuel derived energy, the goal of consumers is as simple as wanting energy. The goal is therefore to supply greater end-use energy with fewer absolute emissions.

Research released in October 2019 indicates that over the period of 1965 to 2017, twenty companies can be attributed to 35% of global carbon emissions during that period, including own fugitive emissions and for the downstream use of the product produced (See Figure 34). It is recognised that all the companies in this list are primarily providing energy to downstream users. The researcher argues that

the impact of fossil fuels on the climate has been known since the mid-1960s hence these companies have knowingly contributed to a worsening climate problem by having "produced and marketed the carbon fuels to billions of consumers with the knowledge that their use *as intended* will worsen the climate crisis". [140]

Figure 34: Top twenty companies responsible for global carbon emissions

Entity	$MtCO_2e$	% of global
1. Saudi Aramco, Saudi Arabia	59,262	4.38%
2. Chevron, USA	43,345	3.20%
3. Gazprom, Russia	43,230	3.19%
4. ExxonMobil, USA	41,904	3.09%
5. National Iranian Oil Co.	35,658	2.63%
6. BP, UK	34,015	2.51%
7. Royal Dutch Shell, The Netherlands	31,948	2.36%
8. Coal India, India	23,124	1.71%
9. Pemex, Mexico	22,645	1.67%
10. Petroleos de Venezuela (PDVSA)	15,745	1.16%
11. PetroChina / China Natl Petroleum	15,632	1.15%
12. Peabody Energy, USA	15,385	1.14%
13. ConocoPhillips, USA	15,229	1.12%
14. Abu Dhabi, United Arab Emirates	13,840	1.01%
15. Kuwait Petroleum Corp., Kuwait	13,479	1.00%
16. Iraq National Oil Co., Iraq	12,596	0.93%
17. Total SA, France	12,352	0.91%
18. Sonatrach, Algeria	12,302	0.91%
19. BHP Billiton, Australia	9,802	0.72%
20. Petrobras, Brazil	8,676	0.64%
Top Twenty	480,168	35.45%
Global	1,354,388	100.00%

[141]

Whether one agrees with this premise or not, given over 50% of fossil fuel and cement CO_2 emissions have been emitted since 1990; on the basis of climate change, a transition away from fossil fuel energy if the world is to successfully tackle climate change, is inevitable.

Coal sector

Thermal coal

The IEA reports that CO_2 emitted from coal combustion alone is the most significant cause of temperature rises and could be responsible for 0.3°C of the 1°C current increase in average temperature above pre-industrial times. Additionally, coal fired power was the largest single emitter of CO_2 in 2018 at approximately 30% of global CO_2 emissions.[142]

Despite the rising absolute emissions from coal, there is a structural shift in the coal sector starting to occur. In 2018, the IEA reported the lowest level of new coal-fired power generation final investment decisions declined by 30% to 22 GW, the lowest level this century, down from just over 100GW in 2010.[143] Potentially related, in the US a number of coal producers have filed for Chapter 11 in recent years. In Australia a recent government report quoted:

> "There are growing challenges for coal projects in Australia and around the world, particularly for thermal coal. There is a growing reluctance to commit to greenfield projects, and an expanding list of lenders have announced they will no longer finance thermal coal projects. Pension and equity funds are also divesting from coal, community opposition is growing, and challenging regulatory conditions are also impacting on investment decisions."[144]

Using Australia as an example, 45% of Australia's thermal coal export revenue in FY19 came from Japan, 16% from China and 15% from South Korea.[145] The forecast predicts that longer term, demand will track lower and prices will remain subdued. Ongoing risks to Australian thermal coal exports include China's future energy mix and the subsequent trade tariffs China may impose and / or annual coal import quotas. Japan is anticipated to continue to restart nuclear reactors currently under planned maintenance and to transition away from coal over time. South Korea has also commenced a rapid transition from coal fired power to LNG, having in FY19 raised coal import taxes to c. USD40 per tonne and reducing LNG import taxes. Japan and South Korea have both cancelled new coal fired power station builds in 2019.[146] Some forecasts predict that the thermal coal export market could more than halve over the next two decades and be completely shut by 2050.[147]

As part of this structural shift, a report in February 2019 found that at that time over 100 financial institutions around the globe had placed lending restrictions on, or had divested from thermal coal.[148] Corporate demonstration of this structural shift in Australia has been seen through Rio Tinto divesting all its coal assets in 2017/2018 and market news in July 2019 that BHP has started looking at exit options for its thermal coal operations.

Metallurgical (coking) coal

Currently approximately 70% of global steel is made using metallurgical coal and approximately 28% is manufactured using electric arc furnaces, which use recycled steel and electricity rather than coal. At this stage however much of that electricity is provided by coal fired power stations.[149] Steel making is an emissions intensive process, producing an estimated 7-9% of global carbon emissions.[150]

Given an acknowledgement of a transition to a lower carbon economy and increasing exposure to 'polluter-pays' emissions pricing, steel makers are investing heavily to develop technologies that allow steel making, at scale, without coal and with significantly lower associated emissions. One methodology being explored is the use of hydrogen as a reducing agent rather than coal. This is believed to have significant potential, however the timeframe for this is uncertain at this stage. Additionally, there is a greater focus on increasing recycling rates of steel, given steel is infinitely recyclable, which would also decrease the requirement for coal in new steel production. Whilst there remains a clear pathway forward for metallurgical coal in steel making, what is less clear is the transition timing to lower emissions technologies. In the event of rapid transition and technology disruption this could pose significant stranded asset risks to metallurgical coal assets and their supply chains.

Carbon Capture, Utilisation and Storage (CCUS)

CCUS is primarily being trialled in various global jurisdictions, including in Australia, as a methodology of capturing CO_2 from fossil fuel combustion and storing it by injecting it deep into underground rock. There are currently 18 operating CCUS facilities globally.[151]

In a practical sense however CCUS continues to be economically problematic to execute at scale. There have been reports of a number of exits from projects including Southern Co in the US, following a reported USD5+ billion cost overrun and Engie and Union from a demonstration project in Holland.[152]

In Australia in 2019 Chevron commenced operations at its Gorgon LNG project CCUS plant. One of the development approval conditions for this project was for Chevron to capture 40% of Australia's largest LNG project's direct emissions. The CCUS element reported to have cost AUD2.5 billion, however has

been delayed by 3 years. Emissions not captured from the project during those 3 years are reported to be approximately equivalent to all the avoided emissions from Australia's large and small scale solar installations. The Federal Government has contributed AUD60 million to the Gorgon CCUS plant.[153]

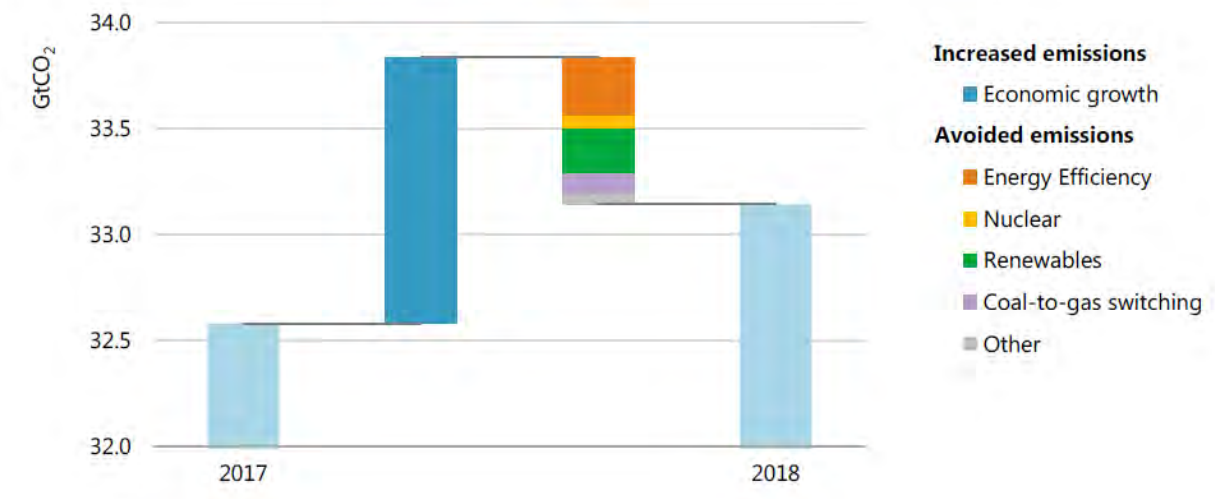
CCUS remains a largely untested technology with currently limited practical application demonstrated. The costs to employ CCUS remains prohibitively expensive and in the absence of a widespread and meaningful price on carbon is highly unlikely to be a viable cost for fossil fuel intensive industries to deploy, particularly in the context of rapidly reducing costs for renewables. It is noted that many net-zero emissions scenarios however factor in use of CCUS as part of the emissions reduction scenarios.[154]

Gas sector

Gas globally, in the form of LNG and in the form of natural gas, is forecast to be part of the energy mix for many years to come. However, the quantum of natural gas and LNG required will be dependent upon the transition pathway taken on a country by country basis.

Coal to gas switching is thought to have helped reduce coal demand and avert c.95Mt CO_2 emissions in 2018 according to the IEA (see Figure 34), however the positive impact of renewables on lowering emission was more pronounced. Additionally, what is not considered are the often unmeasured fugitive emissions from gas and their contribution to global GHG emissions. Approximately two thirds of the renewables emissions savings were originated by China and Europe combined. However, of 1,000TWh increase in electricity demand in 2018, renewables delivered just 45% of that and nuclear just under 10%, but growth in coal fired generation continues, in China and India in particular.

Figure 35: Change in global energy related CO2 emissions and avoided emissions, 2017-18



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Gas has frequently been described as a lower emissions transition fuel to replace baseload coal fired power, however the rapidly declining cost of renewables plus the rapidly developing capabilities of storage is starting to challenge that previously wide held view. Indeed, gas may be replaced in the energy mix much more rapidly than previously anticipated. This may be further expedited by the potential for rapid development of a renewable hydrogen export market, which is described below.

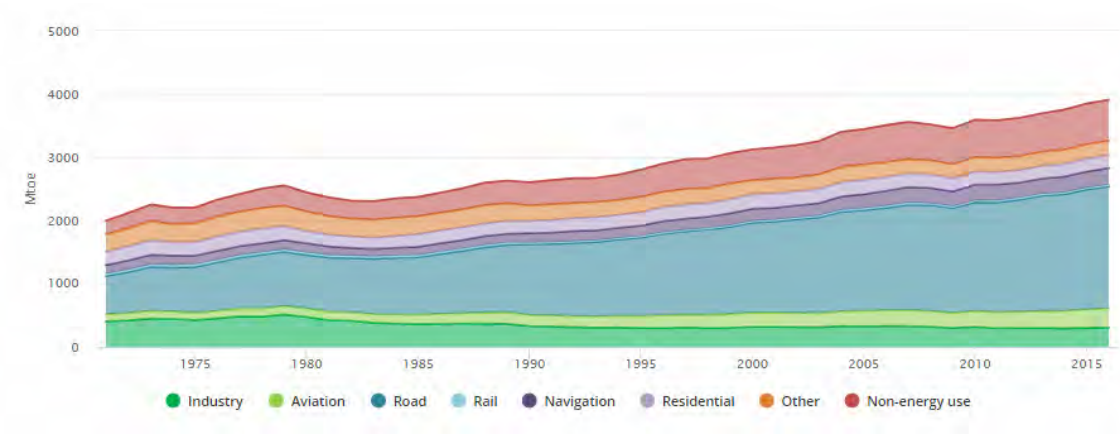
In the US, examples are starting to emerge of an earlier than anticipated transition away from gas as a baseload power source, which is seeing more traditional gas fired power stations increasingly at risk of becoming stranded assets. An example of this is the GE owned Inland Empire plant which has been mothballed only 10 years into its 30 year life due to rapid changes in the Californian grid connected energy sources e.g. increased wind and solar generation which require rapid start firming generation to support its intermittency not larger scale gas turbines.[156] In April 2019, energy regulators in Indiana, US rejected an application to replace a coal fired power station with a new gas fired power station, citing concern that the asset would become obsolete and at risk of being rapidly a stranded asset due to the declining cost of renewables and storage. Additional examples in the US include Arizona placing a hold on any new gas developments.[157] Smaller, more flexible and rapid start gas fired peakers will likely continue to have a role in the transition to a low carbon energy system, however given the rapidly reducing cost of storage technology and the potential role for hydrogen, it is feasible that it is increasingly difficult to attract investment in new gas infrastructure due to uncertainty of how long the infrastructure would remain economic in a rapidly transitioning energy system.

In an Australian context the LNG export ramp up has left Australia with an expensive domestic gas market. While there has been discussion around building LNG import terminals on the Australian eastern seaboard to support the domestic demand for natural gas, it is unclear if these projects would remain economic for long enough given the lower-carbon transitioning in the domestic electricity generation mix.

Oil and transportation sector

Transportation remains hugely oil dependent and will likely continue to be for many decades into the future, in the absence of a significant transportation disruption. Australia has had a low penetration of transport transition to date, in part on account of it being the only developed economy without a fuel economy standard for passenger vehicles, low standards for heavy vehicles and low uptake of public transport. [158]

Figure 36: Oil total final consumption by sector



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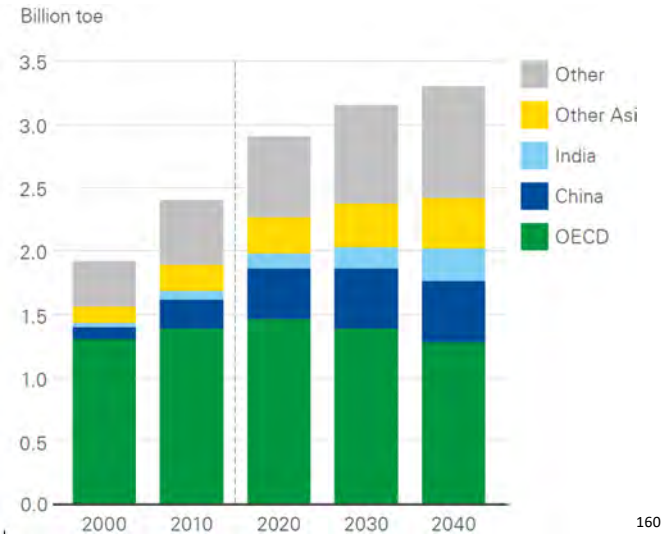
Transportation electrification is occurring, however from an emissions perspective it is reliant on the current electricity generation mix including high emitting coal. To be an effective decarbonisation pathway will require the electricity generation mix to transition to be lower emitting.

Figure 37: Final energy consumption in transportation



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A recent report by BNP Paribas however alleges that transportation disruption through electrification could occur much more rapidly than previously thought from an economic stand point. BNP reports that there is a real option to a significantly more rapid transition to transport electrification. This would be on account of the rapidly declining cost of renewables plus storage relative to the cost to extract, refine, transport oil plus the inefficiencies of heat loss through combustion engines. The report states that today if new projects were to be built to supply energy for transportation e.g. oil extraction versus renewables build, for oil to compete on a cost basis with renewables would require a long-term break-even oil price to be USD9-10/bbl (barrel) rather than the current average USD60/bbl cost and diesel would need to be $17-19/bbl.[161] Whilst still a somewhat hypothetical discussion due to a) a much lower penetration of renewables than would be required to power mass electrified transportation and b) the requirement for mass uptake of electric vehicles, from a cost perspective the future transition and rapid disruption becomes more feasible on the basis of this type of cost analysis.

Hydrogen

The use of hydrogen produced from renewable energy (green hydrogen) as an energy source presents a significant opportunity for the world to reduce emissions. Opportunities present in using hydrogen as a fuel source for transport, a fuel for heating, a way of storing renewable energy and exporting renewable energy. Equally the disruption green hydrogen could present to fossil fuels, in particular metallurgical coal in steel making and as an alternative exportable and cleaner energy source than LNG have the potential to be significant.[162] It is recommended that a separate research project be undertaken on identifying the risks to the current FSS portfolio and the opportunities that a hydrogen market may present for FSS.

Buildings

Buildings and the built environment are responsible for generate approximately 29% of global emissions and are forecast to account for over a third of global energy growth through use of lighting, heating and cooling, as well as from cement and building materials in their original build.[163]

The key factors to tackle these emissions are through lowering carbon of the electricity system, energy efficiency including retrofitting older buildings and expanding a circular economy approach to reuse and recycle materials into new buildings. Additionally, this must be supported by stricter regulation in building energy efficiencies and electrical appliances.[164]

Agriculture

Agriculture has traditionally been considered a difficult sector to measure emissions and transition to a lower carbon economy. Agriculture however is responsible for approximately 13% of global emissions, the second largest emitter after energy. Agricultural emissions primarily originate with methane from cattle and fertilizers. Land use changes such as land clearing also have a negative impact on agricultural emissions. Population growth and changing food habits as nations become wealthier, such as China, continue to drive the emissions from agriculture upwards. Deforestation and land clearing for agriculture, in particular in South America and Asia, are also contributing to global increases in agricultural emissions.

Farmers however are often some of the first people physically impacted by a changing climate, particularly with changes in rainfall patterns and drought, as currently being experienced in many parts of Australia, impacting their productivity and livelihood.

It is recognised that the demands on agriculture and on land use for agriculture will increase significantly with predicted population rises. Agricultural activities and techniques such as herd management through herd genetics and different feeding to reduce methane emissions, as well as cropping techniques such as reduced tillage and crop rotation, regenerative soil management, targeted fertilizer use and irrigation, are being developed and implemented across the globe.

From an emissions perspective it is recognised that agriculture needs to progress measuring of emissions better. From a policy perspective, such as introduction of carbon pricing, however it is important that adequate allowance is provided to enable farmers to continue to provide food for the global population. It is recognised challenges will present due to changes in the climate and there will likely be ongoing need to financially compensate farmers to implement carbon-lowering measures.[165,166]

Insurance industry and banks

The insurance industry, being highly focussed on future risks, has taken a two-pronged approach in its response to climate change:

1. Exiting and flagging exit of insuring coal mines and coal fired power stations;
2. Adjusting insurance premiums on the basis of forward looking modelling of physical risks from a changing climate, including flagging exits from certain high risk regions.

In Australia IAG, Suncorp and QBE have announced restrictions on providing future coal insurance and managed exits from existing insurance policies.

QBE coal insurance

QBE announced in March 2019 that it would cease insuring new thermal coal mines, power stations and thermal coal related transportation networks by July 2019. Additionally, it will cease providing thermal coal underwriting business by 2030.

QBE has confirmed it will continue to invest in and insure metallurgical coal companies given steelmakers continue to have minimal viable alternative in steel production.

Additionally, QBE will continue to invest in and underwrite other fossil fuels, including oil and natural gas producers, subject to further international developments on climate change

IAG fossil fuel insurance

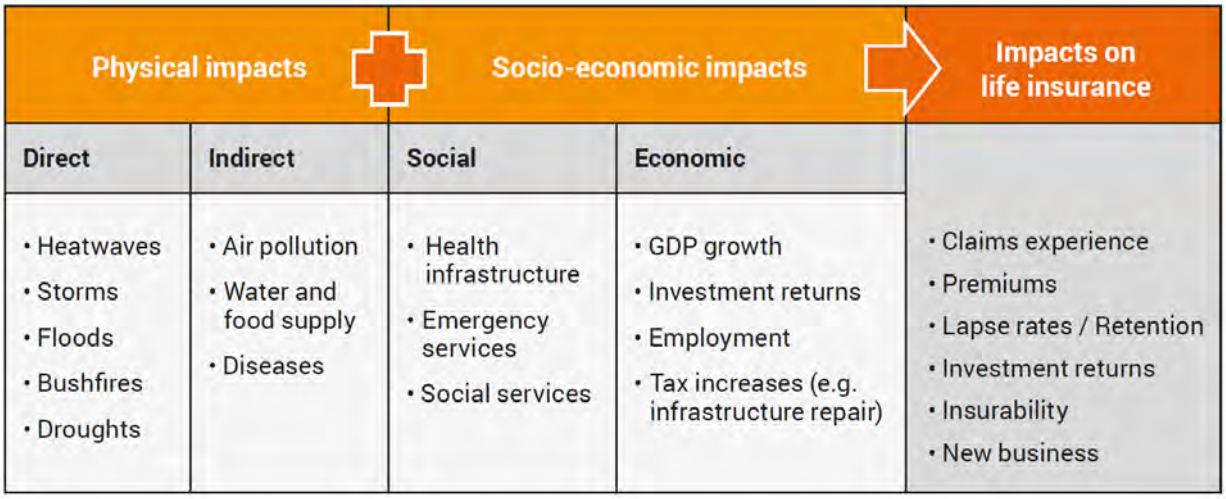
IAG has taken a more aggressive stance than QBE by ceasing all insurance to thermal coal companies and has committed to cease all residual underwriting of fossil fuel companies by 2023. Additionally, IAG has announced that it has reduced its investment portfolio carbon footprint by 60% since 2017

167, 168

Globally a number of other insurers are signalling intent to cease underwriting fossil fuel companies, particularly thermal coal, including 14 global insurers reportedly having ruled out insuring the Adani coal mine, alongside a number of Australian and international banks.

Additionally, life insurers are anticipated to experience increased costs and lower returns on investments as a result of climate change, both of which will increase the costs of providing life insurance products.

Figure 38: Impacts on life insurance from climate change



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Part 2

FSS Portfolio Climate Change Transition Plan

Since the adoption of FSS' Climate Change Adaptation Plan (**CCAP**) in 2015, FSS has made significant progress in its approach to climate change, in particular considering the impacts of climate change in investments, managers and company engagement more broadly. With the overwhelming evidence from the science of climate change and the Paris Agreement commitments, the urgency to deliver rapid climate change adaptation and mitigation has never been stronger. Equally for FSS, the indicator to further enhance its approach to address climate change is increasingly compelling from a fiduciary duty perspective, delivering on being a responsible owner and being a force for good. FSS has a responsibility to deliver the highest investment returns to members where consideration has been placed on the long-term value of those returns. This will include the future impact on the value of those investments from the effects of climate change and the longer term impact of those investments on climate change through their contribution to the solutions versus contribution to the causes.

First State Super's Response to Climate Change to date

The FSS Responsible Investment (**RI**) Team produced and socialised the FSS CCAP, receiving Investment Committee approval in October 2015. The key themes recommended from the 2015 CCAP were:

1. Renewable Energy Investment;
2. Weatherproofing; and
3. Engagement.

From 2015 to present, FSS has progressed these recommendations. Figure 39 and the dialogue following provides a snapshot of actions undertaken to date.

Figure 39: FSS 2015 climate change strategy and summary activities undertaken

Adapted from the 2015 CCAP [170]

Renewables investments

A range of renewables investments have been made since the 2015 CCAP in Australia and globally through FSS fund managers. It must be noted that investing in the Australian renewables market has been challenging over the period since the 2015 CCAP, given significant policy uncertainty and a structurally changing generation market.

Weatherproofing

Listed and unlisted portfolio analysis

In 2014, FSS engaged an external consultancy to undertake a carbon exposure analysis of the Listed Equities portfolio. Additionally, analysis was undertaken to understand the fossil fuel exposure of the portfolio and assess this as a proxy for stranded asset risk.

The result of this analysis was positive from a carbon intensity perspective. Interestingly, at the time of analysis 25.6% of overall global carbon footprint was attributable to just 10 companies and 81% of emissions in the FSS portfolio were attributable to Australia, Europe and the US.

Additionally, the underlying emissions within the portfolio through listed equities reported holding of fossil fuel reserves was assessed. This was to understand the potential embedded future carbon risk in the portfolio should those company holdings exercise their right to realise a portion of those reserves. FSS' exposure to embedded carbon globally (excluding Australia), was 14% higher than the benchmark but at the time was 40% lower in Australia than the ASX300 benchmark. It is recognised this analysis is now 5 years old and while elements will still be relevant, the size of the FSS portfolio has increased and the stocks held will have changed to some degree.

As part of the weatherproofing recommendation, a physical impact assessment was undertaken at December 2017 to assess the physical risks from climate change out to 2030 for assets in the FSS portfolio. The analysis was undertaken on the Infrastructure, Property, Equities, Corporate Fixed Income and Private Equity portfolios. The physical risks analysed included heat stress, water stress, extreme rainfall, sea level rise and hurricanes and typhoons. The output from this work was a matrix showing where future regional hotspots for the various physical risks are. This work has been used with consideration to identify physical risks in existing portfolio assets and in analysing regional risks for potential new portfolio assets.

The results of this analysis have previously been shared with the Investment Committee in mid-2018.

Exclusions / Divestment

While highlighted as a mechanism FSS may use to align its portfolio holdings and / or managers to its CCAP, to date, FSS has not divested any companies or terminated any managers on the basis of approach to climate change.

Engagement

The RI team has been developing and implementing a direct engagement program across select areas of the portfolio. A number of factors may trigger a company held by FSS to be included on the direct engagement program, including climate change exposure. Engagement has focussed on 4 key areas:

1. Listed equities engagement;
2. Climate Action 100+ investor engagements - see case studies;
3. Investment manager engagement;
4. Directly owned asset engagement.

1. Listed equities engagement program

Now in its 3rd year, the RI team has established a proactive engagement program with a range of listed equities in which FSS has holdings. Since late 2018, corporate engagement has been ordered by an internally created priority engagement matrix. This matrix determines whether engagement should be ranked as heavy, light or monitor. This dynamic matrix methodology takes into consideration a range of factors which elevates engagement priority including:

- **Ownership**
- **Proxy voting**: Voted against company resolutions e.g. executive remuneration, a director's reappointment or with a shareholder resolution;
- **Low score across key ESG issues**: including climate change/environmental risk, health & safety, conduct & culture, diversity, data & privacy. These themes are driven by research conducted by the RI team;
- **Long-term Value Creation (LVC)**: Laggard when assessed against FSS' proprietary LVC framework;
- **Red Flags**: Highlighted by external data providers controversies reports;
- **Reputation Risk**: Upcoming shareholder resolutions & controversial member enquiries

Currently climate change is picked up as one of the ESG priority flags. Engagement is undertaken at board and senior executive level.

2. Climate Action 100+

Climate Action 100+ was launched in 2017 as a global initiative through which investors take a proactive role in driving corporate transition to a lower carbon world through engaging with the world's largest corporate GHG emitters. The top 100 emitters account for c.2/3rds of global industrial emissions, however 61 further companies have been added in 2018 that are recognised to be important companies to engage on their transition to lower emitting less carbon. Currently 360 investors with over USD34 trillion under management participate.[171]

FSS has been an inaugural and ongoing participant in the Australia / New Zealand Climate Action 100+ engagement group. Since December 2017, through this commitment, FSS has played an integral role in the engagement program with a number of Australia's highest greenhouse gas emitting companies.

FSS is currently the:

- lead investor for **AGL, Santos, Origin**
- support Investor for **Woodside**

The three key goals as an investor are to advocate with the target companies to

1. implement a strong governance framework;
2. take action to reduce GHG emissions across their value chain; and
3. enhance corporate disclosure, with a particular emphasis on Task Force on Climate-related Financial Disclosures (**TCFD**) reporting.[172]

3. Investment Manager Engagement

FSS RI has been undertaking investment manager ESG assessments since 2014. These assessments evaluate a manager's approach to integrating a wide range of ESG aspects into their investment due diligence. Environmental considerations are currently incorporated into these evaluations. Managers determined to be rated in the lowest quartile of their sector will have a more proactive direct engagement with the FSS RI team, in a bid to improve the various lagging ESG elements.

Whilst climate change has historically been one aspect of consideration, approach to climate change is an increasingly significant element in the manager ESG assessments and face to face meetings.

4. Direct Asset Engagement

Since the implementation of the CCAP in 2015, direct and co-invest asset engagement has been undertaken on a more targeted asset approach. ESG assessments are completed during investment due diligence, when consideration to emissions and climate change risks and mitigation are explored, as applicable.

5. Leadership and policy participation

FSS RI has built and maintained active relationships with a wide range of industry bodies and collaborative forums through which advocacy for climate change leadership and policy progression is conducted. A selection of these interactions are reported below.

- Principals for Responsible Investment (**PRI**) – FSS has been a signatory to the PRI since 2008 and reports annually on FSS' ESG activities annually. Liza McDonald sits on the Australian Network Advisory committee and has presented at the 2019 PRI in Person event as well at a PRI/UNEPFI RI conference and NSSF in China
- Investor Group on Climate Change (**IGCC**) – FSS is an active member of IGCC, participating in working groups, monthly meetings and special events. The focus of IGCC is to address the risks and opportunities of climate change through working towards better government policy and investment practices. Additionally, it is through FSS' membership of IGCC that FSS is an active participant in the CA 100+ initiative, as previously described. FSS together with CBUS commissioned a report through IGCC on a "Just Transition"
- Responsible Investment Association Australasia (**RIAA**) – FSS is also an active member of RIAA, participating in working groups, monthly meetings and special events. RIAA works to progress responsible, ethical and impact investing. RIAA also certifies the FSS Socially Responsible Investment (**SRI**) option

Climate change risks and mitigants in FSS' current portfolio

Portfolio overview

In accepting that urgently lowering global carbon emissions is the underlying first order requirement to mitigate or limit the effects of climate change, a portfolio-wide emissions baseline position is essential. Through the course of researching for this updated climate change transition paper, the current investment portfolio was reviewed and results have been shared with our Board.

Transitioning to a low carbon world

What?

As previously described in Part 1 of this paper, the evidence, debate, global positioning and acknowledged urgency for action on climate change has developed considerably since approval of the 2015 CCAP.

Why?

FSS has long recognised its commitment to invest responsibly and sustainably for the long term benefit of its members and society more widely. As one of the largest asset owners in Australia and in the top 100 asset owners in the world[173], FSS has a genuine ability to influence and take a leadership role in contributing to climate change solutions through its investment decisions and advocacy as part of the global investment community more broadly.

Moving beyond FSS' values alone however, it is acknowledged that FSS has an obligation to invest members superannuation savings through investment processes, as outlined by APRA and other supervisory bodies outlined in Part 1 of this paper, that have taken into consideration the financial risks associated with physical and transitionary risks associated with climate change.[174]

As stated by the RBA Deputy Governor, Guy Debelle, in March 2019 there is an urgent need to think about how the economy "will adapt both to the trend change in climate and the transition required to contain climate change". It is projected that the physical and transitionary impacts and the "scale, persistence and systemic risk" of climate change "are likely to have first-order economic effects". Debelle acknowledged that the rate of response by governments, businesses and individuals to climate change could have "significant effects on future climate trends and can limit or eliminate the ability to mitigate the effect of those trends". [175]

If the economy, including governments, companies, regulatory and financial systems, mobilise quickly towards limiting warming to 1.5°C above pre-industrial levels, there will inevitably be rapid and in some cases dramatic changes in the value of a large number of assets.

Individual companies and some industry sectors may become rapidly devalued and stranded, while others emerge as the leaders and winners from an economic value perspective. This was reiterated by Debelle in his speech;

> "the transition path poses challenges, but it also presents opportunities. Particular industries and particular communities that are especially exposed to the costs of changes in the climate will face lower costs if there is an early and orderly transition. Others will

bear greater costs from the transition to a lower carbon economy. While others still, such as the renewables sector, may benefit from that transition."[176]

Rationally, the longer the delay in transitioning the greater the likely impact of physical risks presenting from climate change through a rapidly changing natural environment. These changes may include extreme heat, sea level rise, increased frequency of bushfires, hurricanes, drought and extreme rain events, with the ensuing negative effects on human health and food systems. Again, in this scenario there will be economy-wide winners who are better able to adapt to these rapid, more severe changes and losers in those who are not.

The magnitude of the impacts of climate change likely will not be experienced in a linear way either geographically or economically. This and the uncertainty of where, when and how the greatest impacts will be felt will inevitably result in individuals, companies and countries calculating the risks differently. This lack of clearly defined certainty has led to some opting for a 'wait and see approach'.

The Precautionary Principle has been adopted as a decision philosophy in many forums including for environmental and health challenges where exact probabilities cannot be assigned. In 1998 the Principle was redefined as "[w]hen an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."[177] The statement went on to define several key elements for consideration to protect human health and the environment including taking preventive action in the face of uncertainty and exploring a wide range of alternatives to possibly harmful actions. There is naturally uncertainty remaining around the impacts of climate change, however the scientific consensus is now such that it's the 'when, where and how much' not 'if' that provides the equivocality.

Applying the Precautionary Principle makes rational sense from an investment perspective too in risk return calculations. For FSS the critical decision point is to be amongst the leaders in the low carbon economywide transition, cutting exposure to those industries that are increasingly likely to become obsolete in the near term and transitioning away from those that are highly likely be superseded by lower-carbon alternatives in the short to medium term. Deploying capital now and retaining capital in potentially future-obsolete assets and industries creates an opportunity cost for FSS' members retirement savings, precluding those same dollars now from being invested in industries and assets that are capable of and already are moving to adapt to a changing climate as well as in assets which are part of the low carbon solution. This opportunity cost potentially means missing investment openings now or having to invest in maturing industries in the future, thus limiting overall investment return.

The 'Why?' moves beyond a values debate of 'doing the right thing', the rationale concludes in the risk and return calculation and the calculated value impact on members retirement savings of a range of different scenarios.

How?

In the following sections are a series of potential options and recommendations for FSS to consider and pursue as part of its transition to a low carbon economy. The overarching theme being to invest in assets that help mitigate climate change and those able to adapt to a changed climate and remain investable in a low carbon economy.

When devising these recommendations strong consideration was given to the pillar of Responsible Ownership under the FSS 4-year strategy, in addition to fiduciary duty and how that may evolve in a changed climate economy.

It is recommended that as part of this transitionary process, FSS must:

- better understand its portfolio carbon emissions and have a measure and monitor process in place;
- continue to increase understanding of the range of potential physical risks and costs faced by the portfolio assets from the impacts of climate change and incorporate this analysis into all future investment due diligence; and
- continually reassess the transition risks and opportunities the portfolio and individual sectors and assets within the portfolio may face in the short, medium and long term, by considering the range of regulatory, market and technology responses that might be seen.

An integral part of the FSS climate change portfolio transition plan is to understand:

- how should FSS invest Members superannuation funds to facilitate Australia and the rest of the world to decarbonise?
- how does FSS transition the investment portfolio from its current emissions intensity to an emissions intensity that is compatible with keeping the world around a 1.5°C temperature rise?
- how can FSS work with other financial institutions, super funds, advocacy groups, regulators, government and policy makers to help advocate for and facilitate a fair and just decarbonisation of the economy?

Figure 40: Proposed FSS Portfolio Transition Plan – summary

Low carbon investments

Activities proposed

1. Advocate for an economy-wide emissions reduction target and implement FSS sector by sector portfolio targets
2. Investigate strategies to lower carbon intensity of FSS' listed equity portfolios and FSS SRI product offerings
3. Measure carbon intensity of FSS' Real Asset Investments and investigate strategies to lower intensity of the portfolio
4. Expand and diversify investment in traditional and emerging renewable energy technologies, clean tech, energy efficiency and other low carbon and carbon-lowering investments, including exploration of green / low carbon bond investment strategy
5. Devise and implement a FSS process to incorporate cost of carbon scenario analysis into investment due diligence and asset analysis for internal purposes

Targets

1. Advocate for a 45% economy wide carbon emissions reduction by 2030, underpinned by underlying FSS portfolio target, incorporating consideration to a 'Just Transition', to support this
2. Implement in the listed equities portfolio a minimum 30% emissions reduction target
3. Measure carbon intensity and determine appropriate emissions reduction targets for FSS' Real Asset Investments
4. Annual portfolio targets to increase FSS investment in renewables, clean tech and transition technologies
5. Incorporate a meaningful shadow price on carbon for all applicable assets and investments

Portfolio Future-Proofing

Activities proposed

1. Embed a "go/no-go investment decision matrix" to enable investment teams to identify early carbon-intensity red-flags
2. Consider an FSS divestment /semi-divestment /exclusion strategy for emissions intensive investments and sectors that will unlikely be capable of transitioning to a low carbon economy

Physical risk, resilience, transition & adaptation

3. Develop and implement a desktop physical risk assessment methodology for all real asset & direct equities investments
4. For high risk or high value assets, engage external consultants to conduct more detailed physical risk assessments as part of due diligence
5. Develop and implement an approach to identify and value potential adaptation and transition requirements, opportunities and costs for relevant new and existing FSS investments

Targets

1. RI and PMs work together on devising a carbon intensity investment red-flag decision matrix
2. Determine if a portfolio-wide divestment /semi-divestment /exclusion strategy is to be implemented for thermal coal related investments

Physical risk, resilience, transition & adaptation

3. Implement physical risk desktop analysis to be undertaken by the RI team on all new direct and co-investment opportunities as part of the ESG assessment
4. Analyse and report costs to engage external consultant as part of the FSS due diligence to undertake a more extensive physical risk assessment on large direct assets
5. RI, in conjunction with the sector PMs, to implement a climate change engagement, adaptation and transition assessment process for all direct assets in the property and infrastructure sectors

Engagement

Activities proposed

1. Continue to advance FSS' listed equities engagement program around climate change adaptation and mitigation
2. Continue to develop the engagement program with FSS external managers, including deeper assessment of portfolio climate change risks and opportunities and climate change reporting obligations
3. FSS commits to be an ongoing participant in the Climate Action 100+ initiative, the Australian Sustainable Finance Initiative and other advocacy groups including the IGCC, ACSI and RIAA. FSS also commits to reporting under the Task Force on Climate-related Financial Disclosures (TCFD)

Targets

1. Continue to roll out the existing listed equities engagement program, with an expansion of the environmental and climate change themes
2. Introduce additional manager questions, engagement and monitoring around approach to climate change
3. Continue advocacy, policy groups and initiatives in the climate change arena. FSS to report under the TCFD

Background to recommendations

Theme 1: Low Carbon Investments

Advocate for an economy wide 45% carbon emissions reduction target

Background:
It is assumed to be accepted that scientific consensus overwhelming ascertains that a rapid, global transition to a lower emissions intensity economy is needed. FSS has already advocated for Governments to accelerate action to "[f]ormulate and communicate long-term emission reduction strategies" and "[s]upport a just transition to a low carbon economy" through its support for the Global Investor Statement to Governments on Climate Change.[178]

To demonstrate action and signal FSS' direct commitment to this in the market, to members and policy makers, FSS has the legitimate opportunity to set meaningful, long-term GHG emissions reductions targets as one methodology to help reduce global emissions and reduce the FSS portfolio risk from experiencing stranded assets longer term.

One course would be for FSS to unequivocally support and advocate for an economy-wide emissions reduction target, where economy-wide targets are defined as:

> "targets communicated on a national level without being assigned to a specific economic sector or policy area. For example, Mexico's General Law on Climate Change commits it to cutting 50% of emissions by 2050, against a 2000 baseline. Economy-wide targets are always expressed as greenhouse gas targets."[179]

If FSS was to advocate for an economy-wide target it is recommended this would support the IPCC emissions reduction targets to limit warming globally to 1.5°C. In order to contribute to this economy-wide target in a meaningful way however, FSS will logically need to implement an underlying portfolio target, across a similar timeframe, to ensure it works to reduce its share of economy-wide emissions. This must be undertaken with consideration within these targets to the potential societal impacts of the transition to a low carbon economy and contributing in a positive way to a 'just transition'.

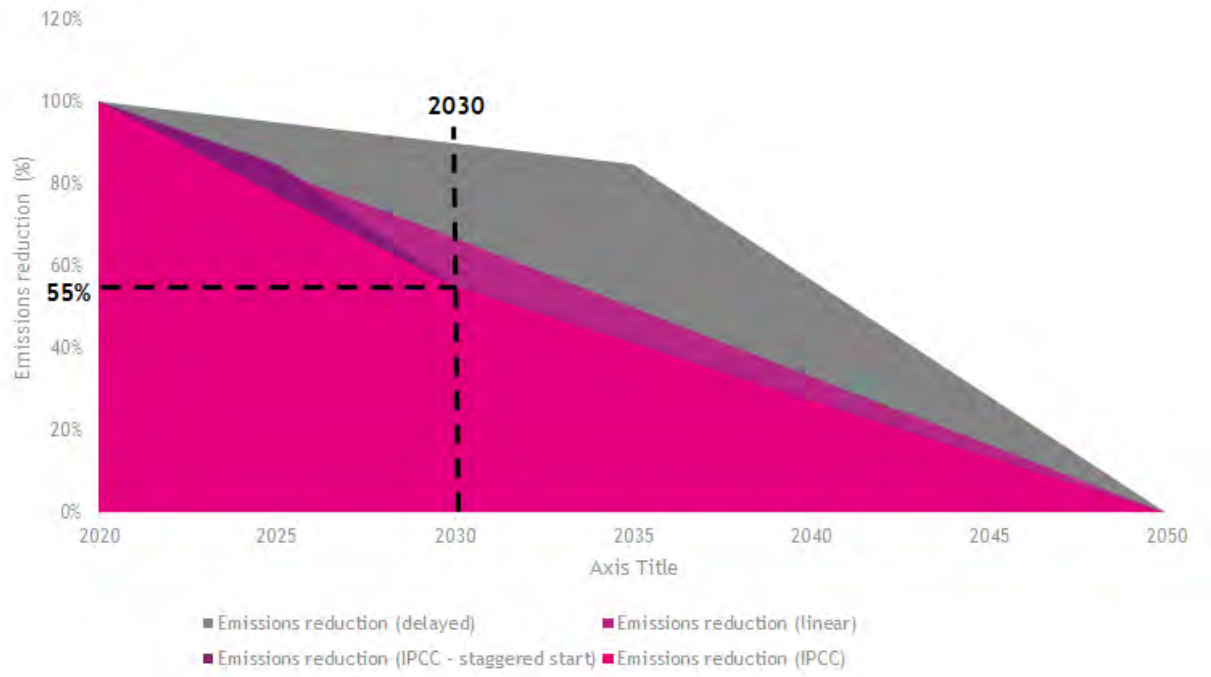
FSS' fund-wide emissions reduction target, should endeavour to be in line with the IPCC goals as closely as possible, recognising the emissions baseline year would need to be set to when emissions data gathering is completed (likely between 2019 and 2021). An underlying sector by sector building blocks approach will be required in its architecture to enable these goals to be measured, monitored and reported internally. As discussed previously, it is acknowledged that each industry sector has its own challenges and opportunities from a changing climate. It is also recognised that some sectors are better able to reduce their carbon emissions and / or adapt to a lower carbon world than others e.g. property and utilities. At a country or portfolio level these sectors will likely set more ambitious targets and earlier than the more challenging sectors e.g. agriculture and long-haul transportation.

Whilst there are opponents of the IPCC emissions reduction targets claiming they are either too ambitious or not ambitious enough, these targets represent a universally acknowledged and relatable goal based on work by scientists around the globe. In the absence of an alternative proposition it is recommended that FSS aligns any approved emissions reduction targets with those recommended by

the IPCC; to limit global temperature rises to around 1.5°C above 2010 levels through working towards achieving net zero portfolio emissions by 2050.

When working to set an emissions reduction target, even in line with the IPCC recommendations, FSS may chose a range of different pathways. The chart in Figure 41, whilst illustrative only, demonstrates that by delaying action to reduce emissions would result in significant increases in the quantum of GHG's emitted into the atmosphere during decarbonisation (represented here by the grey segment), even if the end goal of net zero emissions by 2050 is still achieved. The earth can be thought of as having a finite carbon budget, defined as "the cumulative amount of carbon dioxide (CO_2) emissions permitted over a period of time to keep within a certain temperature threshold".[180] Delaying emissions reduction therefore takes up additional share of the 1.5°C scenario carbon that can be emitted to maintain temperature rises below the 1.5°C e.g. the more you use now, the less there will be available later and the more rapid and extreme the transition will need to be in the future. Delaying emissions reduction for future years is therefore not a judicious option.

Figure 41: Illustrative emissions reduction pathways based on IPCC limiting warming to 1.5°C



Considerations:

1. Cost:

In order to transition the FSS portfolio from its current carbon intensity and enable the setting, measuring and monitoring of meaningful, numerical emissions reduction targets, accurate baseline information is required on the portfolio carbon intensity. There will likely be a cost to FSS to engage an external consultant to help with this work.

2. Targets not achieved:

There is a chance that FSS may not achieve targets it sets. Whilst the aim is to achieve the targets, not reaching ambitious targets is still considered a degree of success. Without any target the likelihood of

making progress towards any decarbonisation strategy would be much more difficult and much less likely.

Recommendation:
It is proposed that approval is sought for FSS to advocate for a 45% economy-wide emissions reduction target by 2030 with internal underlying portfolio sector targets or a portfolio-wide emissions reduction target, in support of the IPCC 1.5°C scenario.

It is proposed that any emissions target be set on the portfolio baseline emissions as at December 2019 for the Listed Equities portfolio. Unlisted holdings however will take more time to establish a baseline emissions measure. This baseline will require external consultant engagement to measure unlisted portfolio emissions and to establish an annual re-evaluation process.

Implement strategies to lower carbon intensity of FSS' listed equities portfolio

Opportunities:
In order to achieve an attributable and targeted portfolio emissions reduction, one approach could be for the Portfolio Managers (**PMs**) to mandate emissions intensity reduction criteria and targets to the FSS' Listed Equities fund managers. Longer term mapping of the sectors, managers and portfolio alongside identifying segments best able to contribute to any decarbonisation targets or strategy the team may implement could be undertaken. It is anticipated that as part of this mapping, external risk and transition scenario analysis may be required.

Additionally, implementation of a specific low-carbon equities portfolio target may be able to achieve targeted emissions reduction in the first instance through either one manager with a mandate addendum or a new targeted mandate.

Finally, the FSS Socially Responsible Investment options currently screen out companies that source more than 20% of their revenues from coal, oil and gas, amongst other negative and positive screens. It is recognised that there may be an automatic trigger to review the SRI fossil fuel target should a decision to divest from or exclude thermal coal from the broader portfolio.

Considerations:
For FSS the key considerations faced in pursuing this strategy include:

1. Cost:
    - to determine, with as much confidence as possible, what the listed asset portfolio emissions are and establish a robust way of monitoring those into the future using external providers if required.
2. Unintended consequences:
    - It is acknowledged that in the short term returns relative to index benchmarks may be negatively impacted. This may depend on the strategies undertaken, as a result of any exclusions or under or over-weight strategies. This may become more significant if governments and regulation transition slowly and other investors remain more passive and fail to address carbon intensity in their portfolios. This could result in short-term relative underperformance in FSS' listed equity returns. Over the medium to longer term however confidence needs to be had that this strategy

would deliver superior returns to FSS through reduced carbon costs and stranded asset risk in the portfolio

- Moving forward, it is suggested that an emissions profile compared to a standalone index benchmark may not provide the best absolute measure and comparison for FSS. A future consideration may be, for simplicity, that emissions per dollar invested be a more useful and practical measure as it would provide continuous and comparable data points even should the portfolio experience a step change in size e.g. in the event of a merger with another super fund. Additionally, FSS would separately need to determine its own absolute net emissions change to monitor portfolio emissions against any target set. Just comparing to the benchmark would not necessarily provide FSS the absolute emissions data and could see FSS improve against the benchmark while portfolio emission per dollar invested actually increased if the benchmark emissions also rose.

Recommendation:
It is proposed that:

- Listed Equities portfolio mapping is completed, including the weighted listed exposures also held through the Fixed Income and Credit Income portfolio holdings, by 30 June 2020
- A minimum 30% reduction in emissions in First State Super's listed equities portfolio be targeted by 2023, which will also incorporate the introduction of a new low-carbon index
- Longer term, absolute emissions reduction targets may be considered for the FSS listed equities portfolio
- Undertake SRI portfolio scenario analysis to determine potential impact of various emissions intensity reduction targets.

Measure carbon intensity and determine appropriate emissions reduction targets for the FSS real asset investment portfolio

As per the listed portfolio, in order to understand emissions from the unlisted assets and to work towards emissions reduction in those assets, current emissions profiles need to be established. It is recognised this is a complex and difficult piece of work, which will require external consultants to assist. Subsequently, there will be costs associated with this initial exercise, and likely on a longer term basis as FSS and its assets develop skills to enable internal emissions reporting.

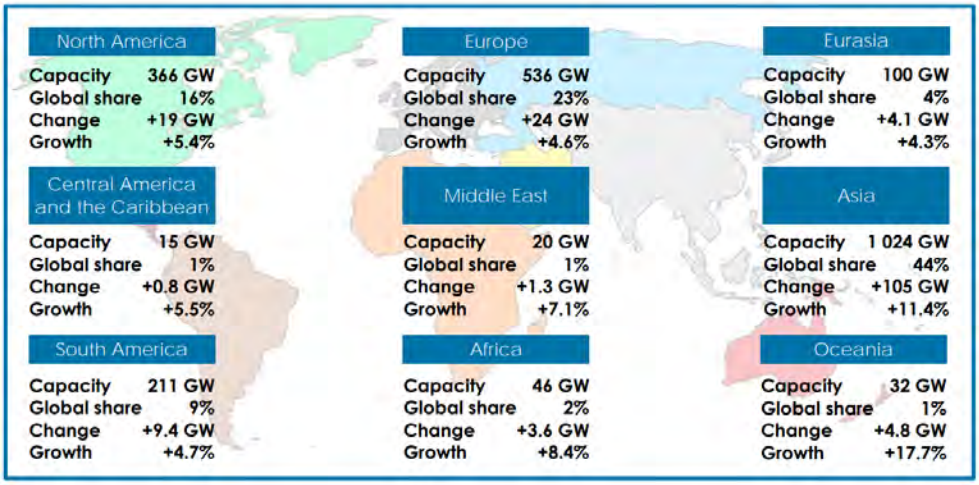
Recommendation:
Undertake analysis to understand costs associated with baseline measurement and then ongoing annual measurement of the unlisted portfolio carbon emissions. It is anticipated that once an advisor has been appointed, unlisted asset emissions measurement will be commenced by December 2020. This activity goal will then be reviewed after that time in the context of timeline for emissions reduction targets to be implemented and associated carbon emission mitigation activities commenced.

Expand and diversify investment in traditional and emerging renewable energy technologies, clean technologies and transition technologies

With CO_2 the most significant contributor to climate change and energy the largest manmade contributor of CO_2 emissions, to make the greatest impact on lowering global emissions from the energy sector, an unreserved increase in renewable energy investment is indicated.

Approximately two thirds of power generation capacity added in 2018 was renewables, with particular increased uptake in emerging markets.[181]

Figure 42: Global renewable energy capacity



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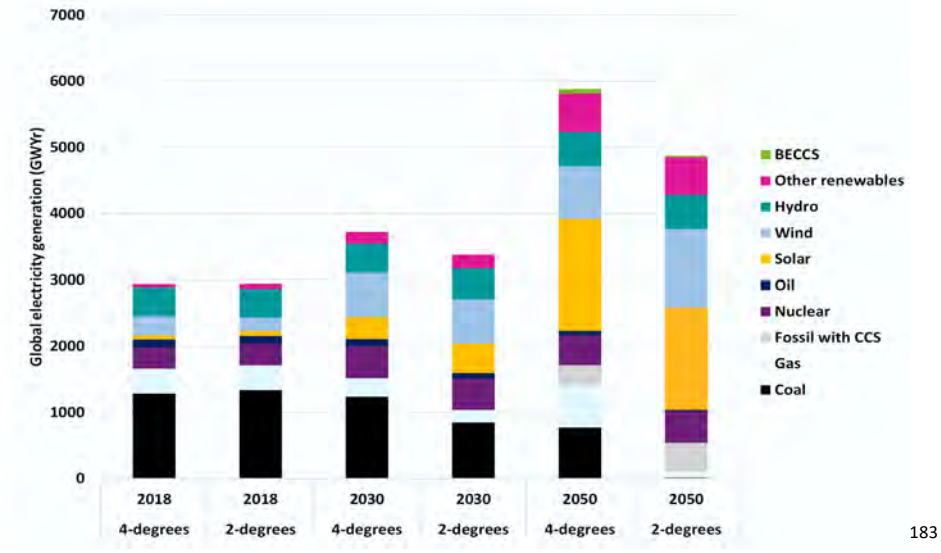
This rapid uptake of renewables has and will continue to create significant investment opportunities for investors. On the flipside, the fast transition of renewables into the electricity system has presenting challenges to developers, regulators and investors alike. It is recognised that from an investment perspective, particularly in Australia, policy uncertainty has created a difficult investment environment for renewable energy.

Figure 43 below shows CSIROs forecast energy mix in a 2 and 4-degree world warming scenarios (noting this analysis was undertaken before the IPCCs 1.5°C scenario was released), showing further increases in renewables, particularly in solar, as oil, coal and gas as fuel sources for electricity generation decline across all scenarios.

Figure 43: Projected global electricity generation mix under the 4 degrees and 2 degrees scenarios



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BECCS = Bioenergy with carbon capture and storage

Opportunities:

Investments that reduce emissions from electricity generation e.g. through direct investments in renewable energy are obviously an important way to reduce atmospheric GHG emissions. It is recognised that future investment in renewables will be different than in the past and there will be a whole raft of ways to invest to reduce emissions and emissions intensity other than large scale renewable energy projects. These may include investing with an emphasis on dispatchable[3], firming[4] renewable technologies, such as battery storage, pumped hydro and concentrated solar thermal alongside variable renewable energy (wind and solar).[184] Additionally, investment opportunities may present in distributed renewable energy resources, including small scale rooftop solar PV units, battery storage, thermal energy storage, electric vehicles and chargers, smart meters and home energy management technologies.[185] In the medium term, it is anticipated opportunities to invest in renewable hydrogen as an emerging renewable energy, particularly for export from Australia, may present.

As part of a transition to a net zero-carbon world there will inevitably be a transition to carbon neutral technologies. There are already a whole range of opportunities for FSS to invest in low carbon and carbon lowering investments across every portfolio sector. Examples of investments may include personal and mass transit electric vehicles, green buildings and technologies that track energy usage.

Additionally, there are likely to be significant numbers of new technologies and solutions invented in response to a transitioning economy, which may present as yet unidentified opportunities for FSS to invest in. By measuring and monitoring investment into these types of assets and proactively targeting lower emissions investments, the FSS portfolio emissions, on a per dollar invested basis can be reduced.

With existing FSS investments, measuring asset emissions and understanding the emissions hot spots will enable targeted retrofitting, relevant to the specific business operations. For instance, for the FSS Property and Infrastructure sectors, buildings can be retrofitted for energy efficiency with LED lighting, renewable energy and storage can be added, lower carbon sources of electricity can be sourced through a B2B renewables PPA, equipment can be upgraded to deliver higher energy efficiency and electric vehicles, or low emissions transportation may be introduced.

Recommendation:

As one of the lowest hanging fruit and most rapid ways to help drive decarbonisation of the economy, increased investment in renewable energy is a logical strategy for FSS. Additionally, increased investment could also make a meaningful contribution to the carbon transition of the FSS portfolio. It is proposed that annual targets be implemented to the relevant FSS sectors to increase investment in renewable energy, clean tech and transition technologies, on an annual basis.

It is recommended that in the short term, the largest directly owned assets in the FSS portfolio undertake a carbon foot printing analysis to enable a greater understanding of the business' emissions intensity and identify carbon-lowering opportunities. Emissions reduction targets can then be set on an asset by asset basis that will contribute to the overall FSS portfolio emissions reduction. In order to achieve this

[3] Energy source that can raise or lower power output on demand

[4] Firming is "a constant level of power outage that a generator can legally or commercially guarantee for a specified time interval"

on an ongoing basis, measuring, monitoring and benchmarking will need to be undertaken to understand and manage transition risk by asset.

By better understanding the emissions intensity of any business FSS is considering investing in and identifying emissions reduction strategies early on, will enable PMs to proactively manage their sector emissions relative to any emissions reduction targets they have agreed. In setting and implementing investment targets however, a key consideration is the diversity of and rapidly changing regulatory environments in every investment jurisdiction.

Green and Sustainability Bonds

Background:
Anecdotal market indicators suggest that the global green bond market is maturing, particularly in the European market. It has been suggested to FSS that there are an increased number of institutional investors seeking green fixed income products for their portfolios, often maintaining a buy and hold strategy with green bonds, resulting in less liquidity on average than the traditional corporate bond market.

The EU is currently considering a voluntary green bond standard, identifying what green investments are allowable under the standard and each bond would need to deliver a minimum of one of the environmental objectives, as defined under the proposed EU Taxonomy Regulation. These objectives may include: (i) climate change mitigation; (ii) climate change adaptation; (iii) sustainable use and protection of water and marine resources; (iv) transition to a circular economy; (v) pollution prevention and control; and (vi) protection of biodiversity and healthy ecosystems, and restoration of degraded ecosystems.[186]

Recommendation:
FSS Fixed Income Team is currently assessing where a specific green or sustainability bond investment allocation may be held in the FSS Fixed Income portfolio. Should this be possible, further investigation will be needed to understand if relative emissions intensity can be assigned for the specific project[s] the bond is proposed to fund. It is recommended that FSS Fixed Income defines a specific green and sustainability bond allocation, if feasible, by June 2021.

A note on nuclear power
It is noted that discussions around nuclear power in Australia have recently been elevated again following the launch of an updated federal government inquiry into nuclear power in August 2019. The scope of the inquiry includes to "establish whether nuclear energy would be feasible and suitable for Australia in the future, taking into account both expert opinions and community views".[187]

FSS has holdings in companies in jurisdictions outside Australia that generate nuclear power, and as such FSS has not selected away from nuclear power on ethical or social grounds historically. In the Australian context when considering building the industry from scratch however, it is worth noting the widely held view that from a levelized cost of energy basis, large scale nuclear power is continuing to increase in cost and time to develop, compared to renewables, which continue to drop in cost.[188] Dr Ziggy Switkowski at the Parliamentary Enquiry in August described large scale nuclear generation plants as getting more expensive, taking up to 5 political cycles to be developed and having "no social licence at this time" in Australia. Dr Switkowski described that small modular nuclear reactors may in the future be beneficial

for small rural communities or remote mine sites, however he conceded that it was unlikely this technology would be commercial for at least 10 years.[189]

It is concluded that in that time period the electricity generation system in Australia will have significantly changed further and that firmed renewables will likely account for the vast majority of generation. This therefore will highly likely negate the need to introduce nuclear into the generation mix in Australia at all. On that basis, in addition to nuclear energy in Australia likely remaining a polarising topic to both politicians and the general population, FSS investing in nuclear energy in Australia is not considered a viable investment for the foreseeable future.

Devise and implement FSS process to incorporate a meaningful shadow price on carbon for all applicable assets and investments

Background:
As a global investor, FSS must understand the potential costs of climate change on the assets and investments it owns or seeks to own. As outlined previously there are a range of potential physical, adaptation and transition costs that increasingly must be incorporated into valuation analysis of the companies and assets FSS owns on behalf of its members.

Considerations:
One of the most significant transition costs likely to be experienced by companies is the incorporation, by regulation, of a price on carbon. The largest active example is the European Union Emissions Trading Scheme, launched in 2005, whereby over time the polluter gradually pays more for their carbon emissions until an effective price to pollute becomes set through a market mechanism. In anticipation of a future carbon pricing mechanism in a greater number of jurisdictions, businesses evaluate their own potential liability under a range of carbon pricing scenarios. This enables appropriate risk return analysis to be undertaken on both existing and new projects and to use as a tool to identify both potential climate transition risks and opportunities.[190] A number of large emitting companies have been incorporating a range of shadow carbon price scenarios into their investment decisions for a number of years e.g. BP since the mid 1990's. Equally, long-term investors use carbon pricing to analyse the potential impact of carbon pricing on their investment portfolios, enabling asset owners and managers to continually reassess investment strategies and capital allocation to lower-carbon or more climate-resilient assets. Whilst in Australia carbon pricing and trading has been politically difficult it is still feasible that a future government will introduce legislation which has a similar effect to placing a price on carbon without introducing a formal carbon market pricing scheme. This would miss out on the allocative efficiencies a market pricing mechanism would bring, however even a regulatory pricing mechanism would provide some acknowledgement of the polluter pays.

Recommendation:
It is proposed that FSS should commence incorporating long term shadow carbon pricing scenarios into initial investment decision analysis, as well as in ongoing internal asset valuation analyses. It is recognised that this will require PMs to have a view on a reasonably accurate emissions intensity of the particular investment. Implementing this process will enable FSS to better understand how economically resilient an asset may be as carbon pricing mechanisms are introduced around the world. Whilst it is acknowledged that implementation timing of these schemes are impossible to predict, given FSS frequently invests for longer durations, undertaking this analysis remains critical to understand long

term asset valuation and which companies will be the winners and which the losers in a decarbonising economy.

It is recommended that by September 2020 a process has been designed to enable incorporation of a meaningful shadow price on carbon to be considered as part of scenario analysis for applicable assets and investments.

Theme 2: Portfolio future-proofing

Embed a "go/no-go investment decision matrix" to enable investment teams to identify early carbon red-flags

Background:
Under the theme of portfolio future-proofing as a long-term investor, investment decisions made now, particularly in the real assets space, will determine the resilience of the portfolio to physical and transitionary risks in the future.

Considerations:
Key considerations when assessing investments from a climate change perspective include whether an asset is future-proof from an emissions perspective or is there a foreseeable scenario where an asset could be obsolete and stranded due to future carbon costs or technology change? Whilst harder to quantify, an important question to also consider is: will a certain investment maintain its social licence to operate in a climate changed world? This should be viewed from both a value and values perspective.

An initial red flags decision matrix may help to highlight potential future underlying climate-related investment risks which may act as a guide for investment teams early during the due diligence process.

Recommendation:
It is recommended that the RI team works with sector PMs to determine how factors identified above, along with other sector pertinent considerations can be incorporated, by June 2020.

Determine if a portfolio-wide divestment /semi-divestment /exclusion strategy is to be implemented for thermal coal investments

Divestment considerations:
The decision to undertake sectoral targeted divestment and future exclusion for certain assets or sectors in the FSS portfolio, as outlined in the 2015 CCAP paper, is not a decision to be undertaken lightly for a number of reasons, including:

Figure 44: Reasons to divest and not divest

Why divest	Why not divest
Reduce risk to portfolio returns in the future e.g. coal likely to be obsolete in the future, uncertainty around when, with external factors including carbon pricing and social licence to operate likely to impact long-term value also	Signalling to industry around **lack of engagement and consideration to transition** and be seen as contributing to the socio-economic impacts of that, rather than contributing to solutions for workers
Signalling that FSS is mindful of the societal, health and environmental implications of certain investments that are unable or unwilling to transition to a low carbon world	**Cost to implement divestment process** – to wind back investments and then reinvest and **Cost to implement future exclusions** – through fund managers or internal manual processes
Reduce portfolio stranded asset risk	**Reduce influence with the company and industry** to encourage adaptation and mitigation activities
Reduce FSS' portfolio climate risk – to help FSS achieve its carbon emissions reductions target as well as reduce portfolio transition risk from assets less willing or able to transition or adapt	**How effective is divestment?** Evidence?

A key consideration therefore is to clearly understand what is the ultimate goal of a particular asset class or individual asset divestment?

When considering divestment or exclusion of an asset or an asset class, it is important to understand from a fiduciary perspective what the economic impact of the decision to either divest or retain the asset in the portfolio is, both now and in the future. This should be undertaken for a range of different scenarios, for example including carbon pricing, rapid economy transition away from fossil fuels or a business as usual (**BAU**) scenario (recognising that longer term BAU is likely to have negative economic consequences on large parts of the economy as a result of changing climate).

Whilst harder to quantify, it is also important to understand how the asset, Investment A, may affect the value or viability of other assets now or in the future. Effectively does Investment A worsen any climate contagion risks on other assets? For instance, excessive or unacceptably high emissions by Investment A and an unwillingness to reduce or mitigate emissions may indirectly create climate change contagion in the future to other assets either in the portfolio or in the broader economy. This concept is currently being tested, for example New York City has filed a lawsuit against five fossil fuel companies for their pro rata contribution to climate change and the cost for the city to protect its residents from the effects of climate change.[191]

Additionally, the opportunity cost of investing in Investment A over another potentially less risky, lower carbon intensive asset from a transition perspective is an important exercise to undertake, even if it is still in the same sector e.g. picking winners and losers within a sector. Figure 45 attempts to visualise these concepts in a simplified way. The opportunity cost of holding investments in one fossil fuel company now may ultimately reduce your value in another investment in the future.

Figure 45: Investment climate contagion considerations

Exclusion considerations:

Considered less complicated to implement in the short term could be a formal exclusion of any new investments, such as thermal coal. It is recognised however that whilst this can be implemented portfolio wide in direct investments and co-investments, manager mandates where FSS investment pre-approval is not required, may require amendment of IMAs. For listed quantitative mandates it is recognised that additional costs may be incurred to implement a change to a mandate. To counter this downside however is that a large number of pension funds and therefore many global investment managers will have implemented this exclusion already.

As FSS progresses its proposed lower carbon portfolio transition, it is pertinent that exposures to other high emitting sectors are reviewed in the context of: Can those investment dollars be moved to invest in lower carbon intensive substitutes and companies? Examples of where this may occur in the future includes as metallurgical coal can be substituted in steel making, oil with greater penetration of electric vehicles and gas as renewables, storage and distributed electricity networks reduce reliance on gas as a transition fuel in electricity generation. A focal point for FSS will be to continually re-evaluate its position on each of these sectors to avoid late mover disadvantage, diminishing value for members in the event of late exit, as well as being perceived as laggard on portfolio transitioning. It is felt that thermal coal is already fully substitutable.

The 2018 Global Investor Statement to Governments on Climate Change[192] signed by 476 investors called on global leaders to phase out thermal coal. Through FSS' commitment to this statement it is deemed appropriate to lead on this matter with FSS' own portfolio of investments. It is recognised that

immediate blunt divestment provides clear signalling to members, stakeholders and corporates. A planned, well-managed divestment process however may achieve better returns for members and a more orderly exit for any larger holdings.

Thermal coal divestment or exclusion is considered the logical starting point given its high emissions intensity, its low probability of being able to transition its business and its heightened risk of obsolescence and stranded asset risk as more meaningful carbon lowering targets are enforced globally. Over 100 global financial institutions are reportedly exiting coal in some form[193] and increasing numbers of asset owners are committing to some form of coal or fossil fuel divestment or restriction. Appendix 3 provides a small sample of summary coal divestment or exclusion policies.

Recommendation:
It is recommended that consideration be given as to whether to divest and / or exclude investments relating to thermal coal exposures from the FSS portfolio. It is proposed this be undertaken by October 2020.

Additionally, it is recommended that at a minimum, annual reviews of FSS portfolio holdings in high emitting sectors be undertaken by RI and the PMs and considered with the relevant sector heads in the context of global progress in feasible substitutes and FSS carbon emissions reduction goals.

Resilience, adaptation and mitigation

Develop and implement a desktop physical risk assessment methodology for all direct and co-investment opportunities as part of the ESG assessment

Background:
As previously outlined a Physical Impact Assessment was undertaken on the FSS portfolio in 2017/8. This useful piece of work provided an in depth snapshot of the portfolio, at that point in time, as well as providing a resultant matrix showing future regional hotspots for various physical risks from a changing climate. As outlined by the Asset Owners Disclosure Project in 2018 "[l]eading asset owners are increasingly prioritising the transitional and physical risks associated with climate change in their risk and investment analysis. Many have also already undertaken first steps in scenario analysis and are integrating key findings into their climate strategies."[194]

Recommendation:
It is proposed that physical risk desk top analysis be undertaken by the RI team on all new direct and co-investment opportunities by June 2020. This would be completed as part of the ESG assessment using a traffic light methodology for key physical risks including risk of flooding, water stress, heat stress, sea level rise and hurricanes. A more formal and in depth external review of the portfolio every 2 to 3 years will also enable identification of emerging red-flag areas and assets, noting there will be a cost for this exercise. For existing FSS assets it is proposed that assets be reviewed periodically and any red-flagged areas be addressed by the FSS PMs with the management team to consider potential adaptation and risk mitigation activities that might be appropriate. It is envisaged that emerging open source tools may enable FSS to undertake more in depth analysis on regions and assets on an ongoing basis.

For high risk or high value assets, engage external consultants to conduct more detailed physical risk assessments as part of due diligence

Recommendation:
For any high value and / or high risk assets, it is recommended that an external consultant be engaged as part of the FSS due diligence to undertake a more extensive physical risk assessment. Examples may include a port deemed at significant risk from sea level rise, a building in high risk flooding or cyclone zones, an agriculture investment in increasingly drought affected areas. It is anticipated that assessment would then enable potential costs to be incorporated for downside investment case scenarios for any risks that can't be mitigated. It is proposed this activity be in progress by June 2020.

Develop and implement, in conjunction with sector PMs, an approach to identify and value potential climate change adaptation and transition requirements, opportunities and costs for all relevant FSS investments

Background:
By failing to incorporate potential climate change physical, adaptation and transition costs into scenario analysis, FSS may experience a range of consequences to its portfolio from gradual asset value decline to sudden value shocks from acute climate or regulatory events.

Considerations:
The ability to adapt and transition in a changed climate world and economy will inevitably result in some companies and sectors that will be winners and some that will be losers from a financial perspective. FSS and other asset owners have a fiduciary duty to their members and investors to evaluate and understand which investments will be the winners and which the losers.

In order to achieve this, FSS must be able to incorporate the potential transition and adaptation costings of climate change into valuation modelling and scenario analysis. This will likely require a third party assessment to undertake a range of scenario analyses and provide an expert opinion on capability and costings to adapt. This exercise will be pertinent for large property and infrastructure assets, particularly for greenfield developments where resilience can be easier built in to site choice and planning practices. For brownfield or retrofits, resilience can still be built in to replaced or upgraded infrastructure.

Where an asset is identified through this process however as having significant challenges from a resilience or adaptation perspective, the adjusted investment risk return may then be deemed by FSS unacceptable.

Recommendation:
It is recommended that RI works in conjunction with the sector PMs and external managers to ensure a climate change adaptation and transition assessment be undertaken and plan devised for all relevant assets commencing this process by December 2020.

Theme 3: Engagement

Continue to advance FSS' Listed Equities engagement program around climate change adaptation and mitigation

Background:
Engagement by the FSS RI team has progressed significantly over the 4 years since the 2015 CCAP was adopted, with the priority engagement matrix capturing important ESG issues to be addressed.

Recommendation:
The recommendation is to continue to roll out the existing listed engagement program, with an expansion of the environmental and climate change criteria. The criteria proposed to be added would flow directly out of other recommendations made through this paper including:

- Being above an emissions intensity threshold. This will be particularly important should FSS implement a carbon emissions reduction target;
- red flagged physical risks from climate change; or
- being identified as having high climate change transition and adaptation risks.

Continue to develop the engagement program with FSS external managers, including deeper assessment of portfolio climate change risks and opportunities and climate change reporting obligations

Recommendation:
RI has a well-established manager review program. It is recommended that targeted additional questions and monitoring be introduced to reflect the efforts, targets and activities FSS will be implementing to address climate change risks and opportunities in its own portfolio by December 2019.

Particularly when a portfolio emissions reduction target is introduced there will be a flow down expectation and need to mirror those targets within the managed portfolios. It is recognised that this will be an extensive and separate piece of work to be undertaken.

FSS commits to be an ongoing participant in the Climate Action 100+ initiative, the Australian Sustainable Finance Initiative and other advocacy groups including the IGCC, ACSI and RIAA. FSS also commits to reporting under the TCFD

Recommendation:
FSS RI has had a prominent position of influence across a wide range of advocacy and policy groups and initiatives in the climate change arena, primarily within Australia. As greater activity and urgency for action on climate change transpires, it is predicted that advocacy and involvement in regulatory and policy forums will become increasingly important for FSS to participate in as a way to help influence the best possible transition pathway.

FSS commits to report under the TCFD by 2020.

Appendix 1: Carbon Pricing Methodologies

A carbon tax puts a direct price on GHG emissions and requires economic actors to pay for every ton of carbon pollution emitted. It thus creates a financial incentive to lower emissions by switching to more efficient processes or cleaner fuels (i.e., less pollution means lower taxes). This approach provides a lot of certainty about price because the price per ton of pollution is fixed; but it offers less certainty about the extent of emissions reduction.

An emission trading system (ETS)—also known as a cap-and-trade system—sets a limit ("cap") on total direct GHG emissions from specific sectors and sets up a market where the rights to emit (in the form of carbon permits or allowances) are traded. This approach allows polluters to meet emissions reductions targets flexibly and at the lowest cost. It provides certainty about emissions reductions, but not the price for emitting, which fluctuates with the market.

Under a crediting mechanism, emissions reductions that occur as a result of a project, by a business or government, or policy are assigned credits, which can then be bought or sold. Entities seeking to lower their emissions can buy the credits as a way to offset their actual emissions. This approach requires a formally recognized third-party verifier to sign off on the emission reduction before it is credited.

Under a results-based climate finance (RBCF) framework, entities receive funds when they meet pre-defined climate-related goals, such as emissions reductions. Like crediting mechanisms, this approach requires the involvement of independent verifiers (in this case, to confirm that a goal has been met). By linking financing to specific results, RBCF facilitates carbon pricing and the creation of carbon markets, helps polluters meet climate goals, and stimulates private sector investment.

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Appendix 2: Number of legal cases by jurisdiction

Australia	94	Austria	1	Belgium	1
Brazil	5	Canada	16	Colombia	2
Czech Republic	1	Ecuador	1	European Union	55
France	6	Germany	5	India	10
Indonesia	1	Inter-American Commission on Human Rights	2	Inter-American Court on Human Rights	1
Ireland	3	Netherlands	2	New Zealand	17
Nigeria	1	Norway	1	Pakistan	2
Philippines	2	Poland	1	South Africa	3
Spain	13	Sweden	1	Switzerland	1
Uganda	1	Ukraine	2	United Kingdom	53
UN Human Rights Committee	1	United States	1,023	**Total**	**1,328**

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Appendix 3: Coal divestment and exclusion examples

Institution	Commitment summary
Norges Bank Investment Management on behalf of the Government Pension Fund	Companies that derive 30% of their revenues from coal may be excluded from the pension fund. Exceptions can be made however if when forward looking the product/fuel mix is transitioning plus considering the use of renewables by the company
New York City Pension Fund	Following Fossil Fuel Divestment Act are seeing to divest portfolio from fossil fuel producers. Divestment methodology is being analysed to divest in a 'responsible way', consistent with fiduciary duties
CalPERS and CalSTERS	Prohibited from making new investments in thermal coal companies (that generate 50% or more of its revenues from the mining of thermal coal)
Zurich Insurance Group	Will divest equity holdings in companies that derive more than 50% of their revenues from mining thermal coal or utility companies that generate over 50% of their energy from coal. Additionally, will not invest in new debt issued by these companies and will run off existing holdings
AXA	Will divest from companies that derive over 30% of revenues from coal, have a coal-based energy mix that exceeds 30%, actively build new coal plants or produce more than 20 million tonnes of coal per year
ING	By December 2025 will no longer finance clients in the utilities sector that have over 5% of coal-fired power in their energy mix. Additionally, ING will only support new clients if their reliance on coal is 10% or less and if they have a strategy in place to reduce their coal reliance to or around 0% by 2025. ING will phase out lending to individual coal-fired power stations by end 2025
LG Super	We will not actively invest in companies that derive 33.3% or more of their revenue from high carbon sensitive activities — including coal mining, oil tar sands and coal-fired electricity generation.
HESTA	'Restricts' exposure to new or expanded thermal coal projects where more than 15% of revenue or net asset value comes from: •thermal coal exploration activities; •development of new 'greenfield', or expansion of existing, thermal coal mining; •transportation of thermal coal.

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Glossary

Acronym and terms	Definition
1.5°C of warming	1.5 degrees Celsius of average global warming above pre-industrial levels is the maximum level recommended by the IPCC to avoid the most dangerous consequences of climate change. Its is recognised that even at an average of 1.5 degrees Celsius, this would likely result in temperature rises much greater in some regions e.g. the poles may be up to 8 degrees Celsius warmer, which would have catastrophic consequences to the ecosystems in those areas
Anthropogenic	Human made or caused
Arctic and Antarctic sea ice/ice sheet	The frozen seawater that floats on the oceans surface. It forms in both the Arctic and Antarctic during winter and partially melts during summer. As the sea ice melts the salinity increases of the surrounding water. The sea ice influences the local environment, ocean circulation, weather and the climate
Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Boreal Forest	Forest growing at higher latitudes, where the ground is frozen for up to 8 months a year such as can be found in Canada, Russia and Alaska. These forests are important to a number of indigenous people as well as indigenous plants and animals. Boreal forests and the permafrost on which it grows are large and important carbon skinks
Carbon intensity	Emissions intensity is the emissions rate of a pollutant per unit of output
Carbon liability	Calculation of the value which as closely as possible estimates the cost to the economy (the economic externalities) of the carbon emissions of a business or an economy
Carbon pricing/ carbon tax	The methodology or instrument that captures the external costs of greenhouse gas (GHG) emissions and places a price on that to be paid by the party responsible for the emissions. This therefore shifts the burden for the damage from GHG emissions back to those who are responsible for it. It is considered a fast and efficient way to economically incentivise changes in emitting behaviours, favouring those who can avoid emissions. This ultimately lowers the economic burden of GHG emissions on society
Carbon sequestration	The process through which carbon is stored, long-term in plants, trees, soils, geological formations or oceans

Carbon sinks	A forest, ocean, or other natural environment viewed in terms of its ability to absorb carbon dioxide from the atmosphere
Circular economy	A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems
Clean Energy Regulator	Australian independent statutory body, established in 2012, responsible for the legislation to reduce carbon emissions and increasing the use of clean energy
Clean tech	Clean technology that enables process, products or services that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities
Climate Action 100+	global initiative through which investors take a proactive role in driving corporate transition to a lower carbon world through engaging with the world's largest corporate GHG emitters
Climate change "health emergency"	Climate change effectively becomes a threat multiplier for people and communities. This will often be felt more intensely by vulnerable people or communities
Climate change adaptation	Means adjustments being made to strengthen resilience and reduce vulnerability to either actual or expected, but unavoidable, consequences of a changing climate. Examples include development of drought tolerant crops, developing water efficient buildings and businesses, building flood defences, tightening rules and regulations on building codes, particularly with respect to flood, heat stress and fire and consideration to land use and land use changes with respect to strengthening biodiversity preservation areas and lowering risks of uncontrolled fire
Climate change mitigation	Activities designed to reduce greenhouse gas emissions either from being emitted (e.g. transitioning to renewable energy from fossil fuel energy and electrification of transportation and industry) or being removed from the atmosphere (e.g. through carbon sinks)
Climate change transition	The process and undertakings through which individuals, industries and the economy will change activities, operations and business models to fully function in a low-carbon and ultimately a net-zero emissions world
Coastal erosion	The loss of coastal land as a result of the removal of sediment or bedrock from the shoreline. This can either occur gradually over time or suddenly as a result of extreme weather
Concentrated solar thermal	A system to generate solar power by using mirrors or lenses to concentrate a large area of sunlight onto a receiver

Decarbonisation	The process of reducing carbon and other GHG emissions through using lower carbon intensity electricity and processes
Deforestation	The clearing of trees over a wide area
Dispatchable energy	Energy source that can raise or lower power output on demand
Distributed renewable energy	Renewable energy units or systems that are commonly located at houses or businesses to provide them with power. Also called "behind the meter", these energy sources include rooftop solar, battery storage and electric vehicles
Ecosystem	An interconnected system and community of organisms and their physical environment
Enhanced greenhouse effect	Where increased levels of both naturally and synthetic GHG concentrations create an “enhanced greenhouse effect” by trapping more of the thermal energy within the earth’s atmosphere, which increases the earth’s average surface temperature over time
EU Emissions Trading Scheme (ETS)	The EU ETS was the worlds first and largest carbon trading market and covers c.40% of the EU's GHG emissions. Based on a 'cap and trade' principle. Cap whereby companies either receive or buy emissions allowances and each year must surrender enough allowances to cover its emissions or pay a fine. With a reducing limit on the number of allowances available this supports the value and the trading aspect means companies cut emissions more rapidly and increases investment in low-carbon technologies
EU Green Bond Standard	“any type of listed or unlisted bond or capital market debt instrument issued by a European or international issuer, defined as meeting the 3 following requirements: - Green bond framework; - Proceeds to green projects; - External verification.”
EU Taxonomy	A classification system created by the EU, establishing a list of environmentally sustainable economic activities. The Taxonomy is regulated by the EU Commission, which was entered into force on 12 July 2020 (Subsequent to the CCPTP publication). The Taxonomy establishes six environmental objectives being: 1) Climate change mitigation 2) Climate change adaptation 3) The sustainable use and protection of water and marine resources 4) The transition to a circular economy 5) Pollution prevention and control 6) The protection and restoration of biodiversity and ecosystems
Extreme weather events	Naturally occurring potentially dangerous weather phenomenon, including heatwaves, rainfall, thunder storms, hail, cyclones, which the magnitude of these occurrences have been seen to increase with rising temperatures of the earth

Fiduciary duty	Where a person or company is required to put another person's interests before their own
Fireproofing assets	Activities or design to provide buildings and structures with additional resistance to fire so that critical structures remain standing in the event of fires. In this context fires most likely occurring as a result of a warming, drying climate. Activities may include fireproofing insulation, additional water tanks and water reserves, power cable insulation, including fire retardant coating for electricity cables and power poles and controls to be placed in fire resistant boxes/rooms
Firming	A constant level of power outage that a generator can legally or commercially guarantee for a specified time interval
Food security	The state of having reliable access to a sufficient quantity of affordable, nutritious food
Fossil fuel combustion	The burning of coal, oil and gas, which results in carbon dioxide and other GHGs, water vapour and energy being produced
Gas fired peakers	Gas powered power generators that typically run on compressed gas, only when demand is high for electricity to help balance the grid
Green & sustainable bonds	Fixed interest instrument where the monies raised are committed to being spent on climate, environmental or sustainability initiatives
Greenhouse effect	The earth takes in energy by absorbing the sun's light rays. The GHGs in the atmosphere effectively act as a blanket, absorbing some of the sun's light rays and re-radiate them back to earth, thus keeping the earth at a habitable temperature. This is the greenhouse effect. Without GHGs the earth temperature would be below 0°C. As GHG concentration increases however the "blanket" reflects more rays back to earth which traps more heat and raises the temperature on earth
Greenhouse gases	Include carbon dioxide (CO_2), methane, water vapour, nitrous oxide and ozone, which occur naturally in the earth's atmosphere and, when in balance, help maintain a habitable temperature on earth. CO_2 is one of the longest lived GHGs however, whilst shorter lived in the atmosphere methane is c.84 x more potent than CO_2
Hydrological cycle	The water cycle that involves the continuous circulation of water in the earth to atmosphere system. The stages include evaporation, transpiration, condensation, precipitation, and runoff
Just Transition	Described as the transition towards a climate-resilient and low-carbon economy that maximizes the benefits of climate action while minimizing hardships for workers and their communities

Kyoto Protocol	The Kyoto Protocol operationalizes the UNFCCC by committing industrialized countries and economies in transition to limit and reduce GHG emissions in accordance with agreed individual targets. Adopted on 11 December 1997, entering into force on 16 February 2005. Currently, there are 192 Parties to the Kyoto Protocol.
Low carbon economy	Defined as an economy that causes low levels of GHG emissions compared with today's carbon-intensive economy, in a bid to lower or limit the negative impacts of a changing climate
National Energy Guarantee	Federal government policy designed in 2017 to impose imposes two obligations on energy retailers, being to require them to supply sufficient quantities of "reliable" power to the market, and an obligation to reduce emissions over the decade between 2020 and 2030. The policy was withdrawn in 2018
Nationally Determined Contributions	Goals required to set by each country who have adopted the Paris Agreement, with the aim of achieving the goals under the Paris Agreement to reduce national emissions and adapt to the impacts of climate change
Net zero emissions	Net zero emissions effectively means a balance between GHG emissions produced and GHG taken out of the atmosphere, thus in a given period of time, being carbon neutral. Emissions will still be created, for instance in manufacturing and aviation, however in a net zero emissions scenario or a net zero economy these emissions are effectively offset through emissions being removed from the atmosphere in natural sinks (e.g. forests, soil and plants) or man-made sinks (e.g. Carbon Capture and Storage). NOTE: Net zero can mean a range of things and the detail is important e.g. is this net zero carbon dioxide or net zero of all GHG's?
NSW Independent Planning Commission	Established in 2018 as a consent authority for state significant development in New South Wales
Ocean acidity	Rising concentration of carbon dioxide in the atmosphere causing ocean acidification
Permafrost	Permafrost is found under a layer of soil and can be up to 1.5km deep. Permafrost stores remains of frozen plants and animals and is made up of ice, rock, soil and sediment and stores up to double the carbon currently held in the atmosphere, making the permafrost one of the most important carbon sinks on earth
Physical impacts or risks of climate change	The actual incidents or effects occurring on the planet, humans, flora, fauna and physical structures, that can be attributed to a warming or changing climate
Polluter pays principle	The practice whereby those responsible for producing pollution bear the costs of managing it to prevent damage to human health or the environment
Precautionary Principle	When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically

Pumped hydro	Hydroelectric energy storage whereby there are two water reservoirs at different elevations. Power is generated or discharged as water moves down through a turbine. This draws power as it pumps water (recharge) to the upper reservoir
Reduced tillage	Minimising soil disturbance in agriculture which allows crop stubble to remain in the soil, lowering the impact of soil and water erosion and to lower GHG emissions by keeping the carbon trapped in the solid
Regenerative soil management	Soil management techniques to enhance natural ecosystem maintenance
Renewable Energy Target	An Australian federal government policy commencing in 2001, designed to ensure that 33,000 GWh of Australia's electricity came from renewable sources by 2020
Science Based Targets Initiative	Climate goals based on science and aligned to the Paris Agreement goals, voluntarily set by companies under the Initiative
Sea level rise	Increase in the sea height, particularly noted at the coast, as a result of higher temperatures. The primary causes of sustained sea level rise are expansion of the ocean as it warms up, secondary to higher temperatures on earth, in addition to melting polar ice sheets increasing the volume of ocean water
Shadow carbon pricing	Shadow or internal carbon pricing is effectively a methodology businesses apply to theoretically analyse the monetary impact a carbon price might have on their business. A business may chose an indicative price, or more likely various pricing scenarios and apply those into business operations and investment decisions, thereby helping the business to understand the impact on their business in a policy or regulatory driven carbon restricted world
SIS Act	Superannuation Industry (Supervisions) Act 1993
Smart meters	An intelligent meter is an electronic meter that is capable of recording and transmitting power consumption data
Stranded assets	An asset that has prematurely become obsolete or lost its value often as a result of an external economic change
Sustainable Development Goals	A series of 17 goals with specific targets under each goal that aim to provide a plan to tackle global issues affecting both developing and developed nations by 2030
Task Force on Climate-related Financial Disclosure	A global, voluntary, climate-related financial reporting methodology

The Paris Agreement	The legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. The Paris Agreements goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels
Transportation electrification	The change from fossil fuel transport to electric transport, including cars, buses, trains and trucks
Tundra	Treeless desert found in high latitudes towards the earth's poles including Canada, Alaska, Russia, Iceland, Greenland, sub-Antarctic islands and Northern Scandinavia. These deserts have very little vegetation and precipitation usually falls only as snow. The soil is low in nutrients and is largely permafrost or frozen

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