Pensioenfonds
Zorg & Welzijn

Position Paper Climate Change, Pollution and Emissions

Release date:
25 August, 2020

1 Introduction

Pensioenfonds Zorg en Welzijn (PFZW) is the pension fund of, for and by the Dutch healthcare and welfare sector. At PFZW, employees and employers jointly aim to ensure a good collective pension in a liveable world. Our primary task is to provide our beneficiaries with the best possible pension. Hence, we first and foremost strive for an optimal risk-adjusted return on our investments. We believe that a good pension is worth more in a liveable word. That is why investing in a sustainable manner is important to us. We are convinced that integrating Environmental, Social and Governance (ESG) issues leads to improved financial performance in the long run. We believe that financial and social return go hand in hand.

The climate is changing. Global temperatures have risen approximately one degree Celsius (1°C) since the pre-industrial period, the baseline for the Paris Agreement. 19 out of the 20 warmest years since the pre-industrial period occurred in the 21st century.[1] Extreme weather is increasingly causing physical damages in many areas. Climate change is considered one of the main threats to society by, among others, the World Economic Forum (WEF).[2]

Among climate scientists, there is now near-universal agreement that anthropogenic (i.e., from human activity) greenhouse gas (GHG) emissions are the main cause of climate change. This is articulated in the United Nations Framework Convention on Climate Change (UNFCCC) definition

1. See (NASA, n.d.): https://climate.nasa.gov/vital-signs/global-temperature/.

2. See (World Economic Forum (WEF), 2020): http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf.

of climate change: *"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"* (UNFCCC, 1992, Article 1).[3] The climate, in turn, is defined as the statistics—mean and variability—of weather over long periods of time, typically decades or longer. Global warming is often used as shorthand for climate change, although it has more dimensions, in particular an increase in the frequency and severity of extreme weather events.

Many of the activities contributing to climate change also cause various forms of pollution. These include, but are not limited to, air pollution (combustion of fossil fuels), soil and water pollution (e.g., in the case of oil spills), and damages to the natural environment. Measures to mitigate climate change should therefore also reduce pollution, although alternatives to fossil fuels, in particular renewable energy, bring their own challenges. For instance, mining raw materials for the production of solar panels and batteries has a significant environmental impact too.

Climate change, pollution and emissions has been a focus area for PFZW for several years. It is one of the key themes for responsible investment in our investment policy 2025. We report on our achievements on a regular basis, for instance through our annual report responsible investment.[4]

This paper serves three purposes:

1. **Being transparent** to our external stakeholders about PFZW's view on environmental, social and governance (ESG) issues related to climate change, pollution and emissions.
2. **Communicating our views** to companies we invest in, with regard to ESG issues related to climate change, pollution and emissions.
3. **Providing guidance** for our asset managers on integrating ESG issues related to climate change, pollution and emissions in investment decisions.

The focus area of climate change, pollution and emissions has direct and indirect linkages with PFZW's other focus theme "people and health". This paper focuses on aspects that can be linked to climate change, pollution and emissions. Aspects that have a better fit with other themes are discussed in position papers covering those themes.

This paper is organised as follows. Chapter 2 explains why we consider climate change, pollution and emissions a key focus area. This is substantiated by insights into the magnitude of the problem and the challenges faced by the solutions. In chapter 3, we discuss how we address the issue in investment decisions and how activities to mitigate the concerns can be employed. Chapter 4 concludes.

3. See (UNFCCC, 1992): https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf.

4. See (PFZW, n.d.): https://duurzaambeleggen.jaarverslagpfzw.nl/ (in Dutch).

Our position on climate change

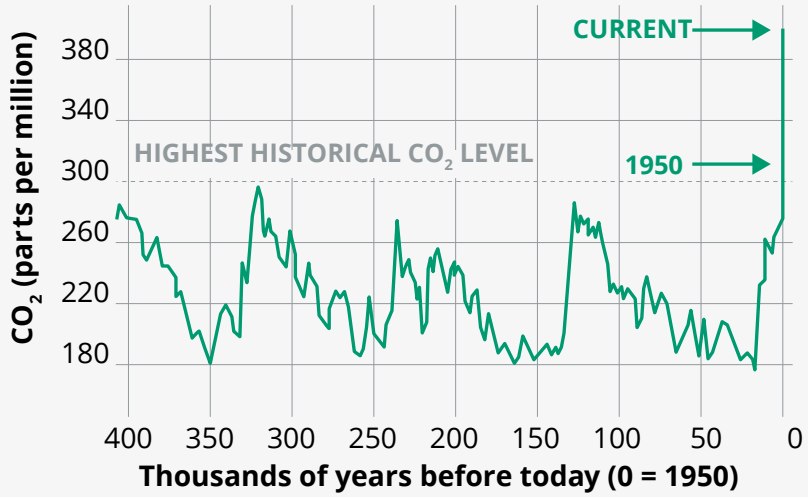
- Climate change is a global threat. It is also a financially material risk to investors, and so are measures to mitigate climate change.
- To mitigate climate change, it is necessary to decarbonise the economy. Putting a price on carbon and other GHGs that reflects their true costs to society is the most effective and fairest way to combat climate change. Such a price will create incentives for more sustainable consumption, create a level-playing field between renewable and non-renewable energies, and create new investment opportunities for financing the energy transition.
- The energy transition requires changes in the supply of as well as the demand for energy. It consists of three main actions: improving energy efficiency, electrifying energy demand, and generating electricity from renewable sources.
- We aim to contribute to the transition to a low-carbon economy by reducing the footprint of our investment portfolios, and by investing in low-carbon solutions. A low-carbon portfolio is not a substitute for action in the real economy: policies to reduce the demand for fossil fuels are equally, if not more, important.
- While we hope for a well below 2°C scenario, and contribute where we can, we cannot base our investment strategy on a single climate scenario alone. Risk management dictates that we prepare for all scenarios that we consider plausible, even if some of them are unwarranted from a socioecological perspective. We expect the same from companies that we invest in.
- Investing is about balancing risks and expected returns. From a financial perspective, similar to other risks, climate-related risks are not avoided per se. Instead, what matters is how these risks are priced, and whether we think that we are rewarded for the risks we take. At the time of writing this position paper, we have indications that markets appear to be underestimating some climate-related financial risks, which is another argument for reducing these risks. As markets become more familiar with the risks of climate change, and policy uncertainty hopefully diminishes, mispricings of risk should shrink and ultimately disappear.
- Technologies such as nuclear energy and CCS are controversial and bring specific environmental risks, but we believe they have a role to play in the energy transition, provided their risks are managed carefully.

2 The Importance of Climate Action

2.1 Causes of Climate Change

The first studies into a possible link between GHG emissions and global temperatures date back to the late 19th century. Concerns about climate change and the influence of GHGs started to mount in the 1950s, when carbon dioxide (CO_2) concentrations in the atmosphere rose above their highest historical levels (Figure 1).

Figure 1. Evolution of CO_2 Concentrations in Atmosphere
Source: (NASA, n.d.)



As evidence of man-made climate change accumulated and calls to address the consequences of climate change and pollution became louder, the Intergovernmental Panel on Climate Change (IPCC) was established in 1988 as a United Nations body for assessing the science related to climate change. The IPCC has since published five assessment reports that describe the state of scientific understanding of climate change, its consequences and mitigation options. In its fifth Assessment Review, the (Intergovernmental Panel on Climate Change (IPCC), 2014) concludes that it is extremely likely that GHG emissions and other human activity caused more than half of the observed increase in global average surface temperatures from 1951 to 2010. Today, there is near-universal agreement that climate change is largely man made and caused by cumulative emissions of GHGs in the atmosphere.

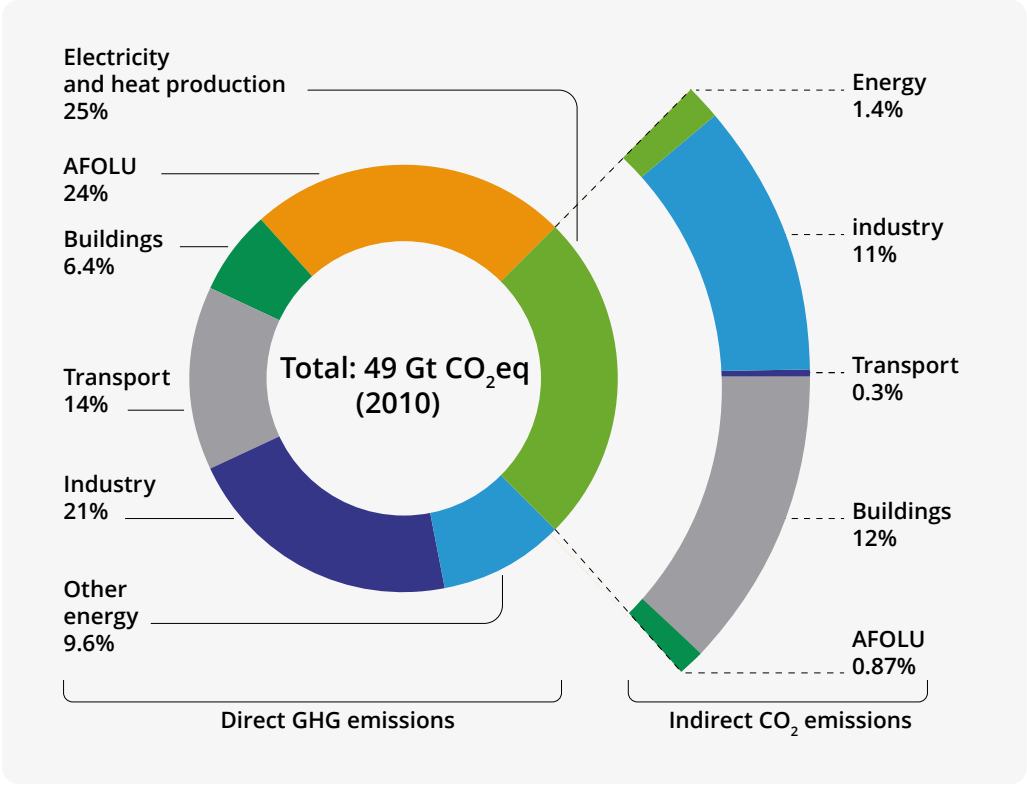
The main, but not the only GHG contributing to climate change is CO_2. Five other GHGs are typically linked to climate change. These are methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs) and sulphur hexafluoride (SF6).[5] These other GHGs are typically converted into "CO_2 equivalents" and simply added. CO_2e or CO_2eq then denotes the sum of CO_2 and other GHGs.[6]

Three quarters of global GHG emissions can be attributed to the use of fossil fuels, with the rest coming from agriculture, forestry, and other land use (AFOLU, Figure 2). Fossil fuels are used primarily for the production of electricity, industrial production, transportation, and in buildings (heating, cooling and cooking). Figure 2 underscores the need for transitioning the energy system from fossil fuels to renewables and other low-carbon alternatives.

5. See (United Nations (UN), sd): https://unfccc.int/process/the-kyoto-protocol.
Sometimes, nitrogen trifluoride (NF3) is added to this list. See, for instance, (Greenhouse Gas Protocol, 2004): http://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf.

6. Often, though, CO_2 is written, where CO_2e is meant.

Figure 2. Emissions per Sector
Source: (Intergovernmental Panel on Climate Change (IPCC), 2014)



Note: The inner circle shows direct GHG emission shares as a percent of total anthropogenic (i.e., man-made) emissions. The pull-out shows how indirect emission shares (scope 2) from electricity and heat production are attributed to sectors of final energy use. "Other energy" refers to emissions in the energy sector other than electricity and heat production.

2.2 Consequences of Climate Change

The exact consequences of climate change are difficult to predict, and depend on society's ability to slow down and eventually halt climate change. For instance, the (Intergovernmental Panel on Climate Change (IPCC), 2014) predicts a rise in sea levels between 60 and nearly 100 cm by 2100 (relative to 1986–2005) in its RCP8.5 (more than 4 degrees) scenario. In its more favourable RCP2.6 (less than 2 degrees) scenario, the expected rise is in the range of 30–50 cm. These are global averages; locally, changes may differ due to gravity, wind and ocean circulation. Lately, a number of studies have been published indicating that sea levels may rise significantly more than previously anticipated.[7] Obviously, such scenarios pose a potential threat to low-lying countries, including the Netherlands.

Some consequences of climate change are already visible. These include sea level rise, damage to ecosystems and biodiversity, freshwater shortages, and declining agricultural productivity.[8] Insurance companies report increasing costs as a result of extreme weather, although these can be mostly attributed to changes in socio-economic and demographic factors, such as higher economic activity in coastal areas and higher asset prices.[9] Different regions are impacted in different ways. Developing countries, especially in low-lying and dry tropical regions, without financial means for adaptation, are most at risk.

7. For instance, (Vousdoukas, et al., 2018) estimate a sea level rise by 2100 (from 2000) up to 172 cm. Based on various peer-reviewed publications, (Sweet, et al., 2017) find support for a global mean sea level rise from 2.0–2.7 m and recommend using a revised upper-bound scenario of 2.5 m by 2100. In his documentary An Inconvenient Truth (Guggenheim, 2006), Al Gore argues that sea levels could rise by as much as 6 m as a result of a collapse of a major ice sheet in Greenland or West Antarctica.

8. See (PBL Netherlands Environmental Assessment Agency, 2015): https://www.pbl.nl/onderwerpen/klimaatverandering/vraag-en-antwoord/wat-zijn-de-gevolgen-van-het-broeikaseffect.

9. See (Hoeppe, 2016) or (International Association of Insurance Supervisors, 2018).

The urgency of climate action was reconfirmed in an IPCC special report on global warming of 1.5°C, published in 2018 at the request of the UNFCCC, following the adoption of the Paris Agreement.[10] The report finds that an additional 0.5°C rise in global temperatures beyond 1.5°C magnifies the impact of climate change, with irreversible damages such as the loss of some ecosystems. There is growing concern that a rise in temperatures beyond 1.5°C can trigger the melting of permafrost in Siberia, which contains hundreds of gigatonnes of CO_2 and methane. The released of such large quantities into the atmosphere may trigger highly non-linear feedback loops on climate change.[11]

Climate change and related risks have been dominating the WEF Global Risks Report for many years. The risk assessments are based on surveys among the WEF's multi-stakeholder communities, the professional networks of its Advisory Board, and members of the Institute of Risk Management. In the 2020 Global Risks Report, climate-related risks account for three of the top five risks by likelihood and four by impact.[12] Respondents express a growing concern that environmental policies will fail, leading to temperature rises well beyond 2°C this century. Moreover, many of the other top risks—such as food and water crises, large scale involuntary migration, spread of infectious diseases, and loss of biodiversity—are intimately related to climate change. Because of these close linkages climate change is often referred to as a *risk multiplier*.

2.3 The Policy Response

In response, global leaders have sought to reduce GHG emissions. In 1992, the UNFCCC was adopted, setting non-binding limits on GHG emissions although lacking an enforcement mechanism. Since 1995, countries meet annually at the Conference of the Parties (COP) to assess progress in dealing with climate change. At the third meeting (COP3) in 1997, the parties adopted the Kyoto Protocol,[13] which sets binding obligations for developed countries to reduce GHG emissions over the period 2008–2012. The Kyoto Protocol entered into force in 2005, and was amended in 2012 (Doha Amendment).[14] During the second period (2013–2020), parties committed to an 18% reduction of GHG emissions below 1990 levels. Ensuring environmental sustainability was one of the eight Millennium Development Goals in 2000.[15]

In 2015, the 21st Conference of the Parties (COP21) agreed to "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (Paris Agreement).[16] The Paris Agreement also reaffirms the obligations of developed countries to support developing countries in building capacities for a low-carbon, climate-resilient future. The Paris Agreement was ratified and entered into force in 2016. It employs a bottom-up approach through the commitments of individual countries—Nationally Determined Contributions (NDCs)—that will be updated every five years.

10. See (Intergovernmental Panel on Climate Change (IPCC), 2018): https://www.ipcc.ch/sr15/.

11. E.g., NASA: https://climate.nasa.gov/news/2785/unexpected-future-boost-of-methane-possible-from-arctic-permafrost/.

12. See (World Economic Forum (WEF), 2020).

13. See (United Nations, 1998): https://unfccc.int/resource/docs/convkp/kpeng.pdf.

14. See (United Nations, 2012): https://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf.

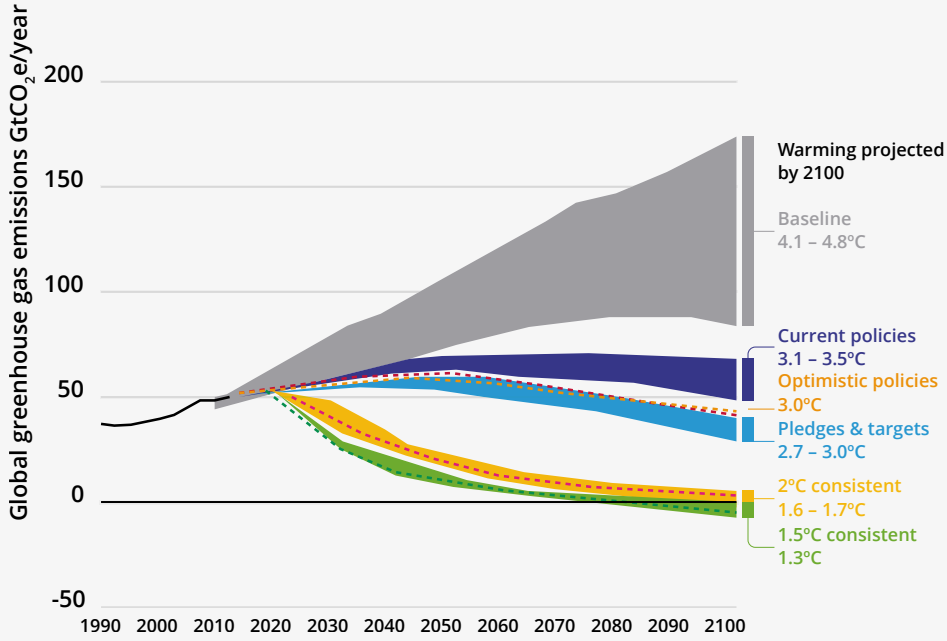
15. See (United Nations, n.d.): https://www.un.org/millenniumgoals/.

16. See (United Nations, 2015): https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

The Paris Agreement is finding its way into national and international policies, such as the European Green Deal that aims for net-zero emissions in the European Union by 2050 and, as an interim step, to reduce carbon emissions by at least 55% by 2030 from their 1990 levels.[17] In the Netherlands, the Climate Agreement provides a roadmap for achieving a similar ambition by 2030.[18] The Agreement includes a financial sector commitment, signed by PFZW. The implications are discussed in chapter 3.

Policies remain, however, are insufficient to keep global warming below 2°C. According to Carbon Action Tracker, current policies will likely result in more than 3°C rise in global temperatures by the end of this century (Figure 3). Current pledges as laid down in countries' NDCs ("pledges & targets" in Figure 3) are somewhat better, but still fall well short of the goals of the Paris Agreement. The European Environmental Agency concludes that the probability of staying below 1.5°C is less than 50%.

Figure 3. Potential Increases in Global Temperatures
Source: (Climate Action Tracker, 2019)



2.4 The Carbon Budget

Views on the "safe" level of GHG concentrations in the atmosphere differ, and depend on the maximum rise in temperatures and—given inherent uncertainties in estimates—on the probability of staying below the maximum. A CO_2 concentration (excluding non-CO_2 GHGs) of 450 ppm is typically considered consistent with a 50% probability of keeping global temperature increases below 2°C.[19] Others have argued for a lower maximum, which would bring the maximum temperature rise down (for the same probability) and increase the likelihood of staying below 2°C. The UN finds that global GHG emissions will have to peak by 2020 and decline rapidly thereafter to limit the increase in global average temperatures to no more than 1.5°C.[20]

17. See (European Commission, 2019b): https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf and (European Commission, 2020).

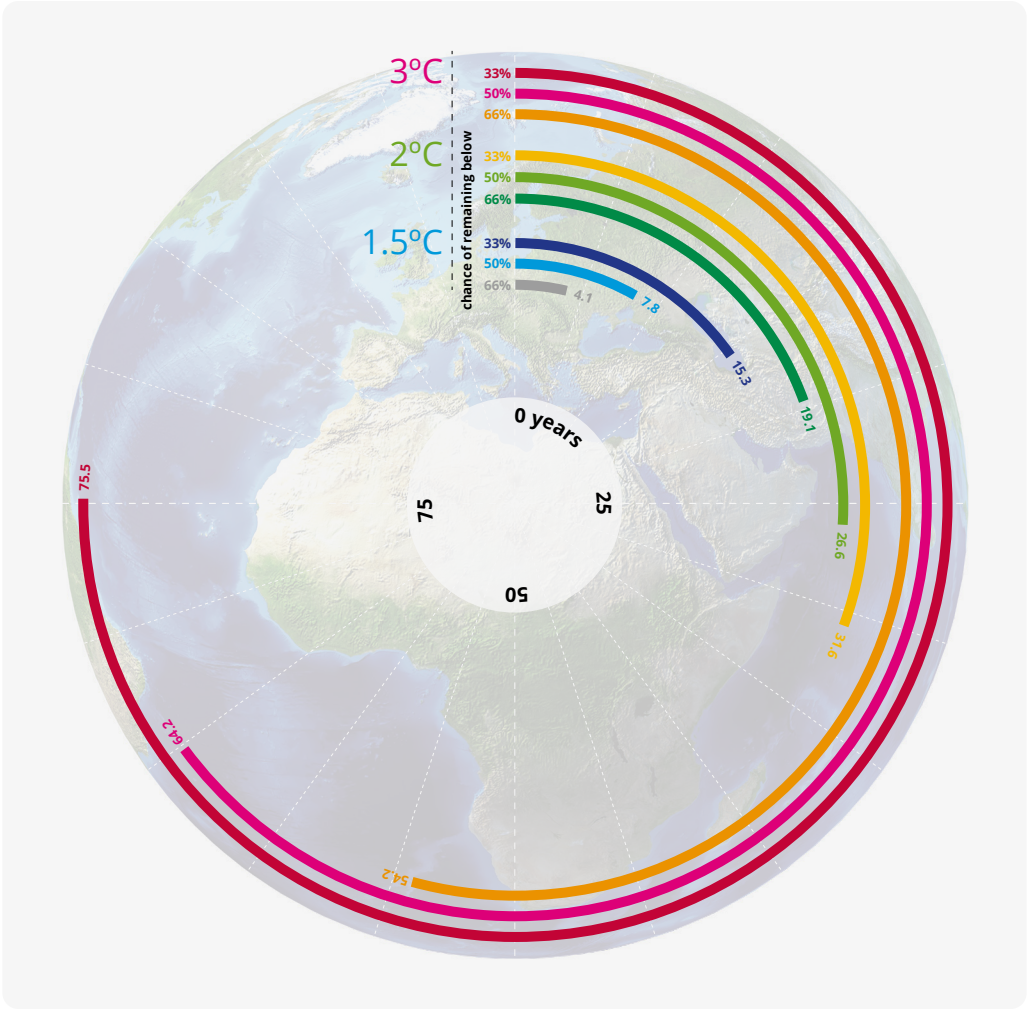
18. See (Government of the Netherlands, 2019).

19. The IEA 450 scenario was named after this ambition level.

20. See (UN Environment, 2018): Emissions Gap Report.

The amount of CO_2 that can still be released into the atmosphere before temperatures exceed a certain level is known as the carbon budget. The concept was introduced by Carbon Tracker in 2011.[21] The size of the carbon budget depends on the ambition level for the rise in temperatures as well as the probability of not exceeding that level. Assuming a certain trajectory for emissions, the carbon budget can be expressed in years. Figure 4 shows the years remaining (from 2017) for different climate change ambitions if emission levels stay unchanged. Note that there is considerable model uncertainty in these estimates. For instance, Figure 4 suggests that we still have more than 7 years to cut emissions (to net zero) to have a 50% chance of staying below 1.5°C, while some argue that we passed that moment several years ago already.[22]

Figure 4. Remaining Carbon Budget in Years from 2017 at Current Emissions
Source: (CarbonBrief, 2017)



21. See (Carbon Tracker, 2011): https://www.carbontracker.org/reports/carbon-bubble/.

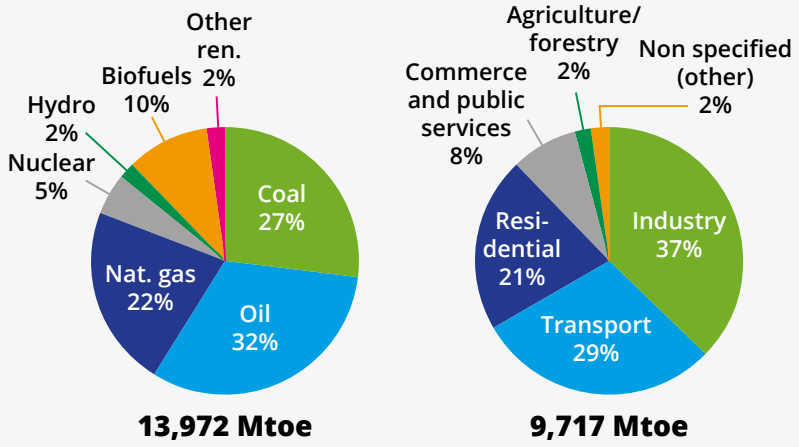
22. (Hausfather, 2018) shows that even among studies based on the same ambition level, there is substantial disagreement about the size of the remaining carbon budget.

2.5 The Energy Transition as a Dual Challenge

The energy transition poses a dual challenge. The challenge is to lower emissions drastically, while at the same time servicing a growing demand for energy. Approximately one billion people globally live without access to electricity.[23] The world population is estimated to grow from 7.6 billion people today to more than 11 billion people by 2100.[24] This implies that an additional nearly 5 billion people will need access to clean, reliable and affordable energy,[25] reinforcing the need for decoupling energy supply from GHG emissions.

This decoupling consists of three main elements: greater energy efficiency, massive electrification of the demand for energy, and scaling up the supply of renewable energy.[26] The latter is already happening. The supply of renewable energy is increasing rapidly (and costs are falling fast), albeit from a low base.[27] As a proportion of primary energy supply, the share of renewables is still small (left chart in Figure 5). Further innovation is still needed to improve the reliability (continuous availability) of renewable energy. Improvements in battery technology and demand management (dynamic pricing) reduce the mismatch between supply and demand, but longer periods without sunshine and wind still require base load power systems. Moreover, renewable energy generation and storage impose significant claims on some raw materials. Recycling and new technologies are needed to support further growth.

Figure 5. Energy Supply and Demand (2017)
Source: (International Energy Agency (IEA), 2019)



Note: Mtoe = Million tonnes of oil equivalents. One tonne of oil equivalent corresponds to 11.7 MWh, or 41.9 GJ. The difference between total supply and total demand is a reflection of conversion losses from generating electricity.

23. See (International Energy Agency (IEA), 2019), World Energy Outlook.

24. See (United Nations (UN), 2017): https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html.

25. This is Sustainable Development Goal 7. See (United Nations, n.d.): https://www.un.org/sustainabledevelopment/.

26. See (Energy Transitions Commission (ETC), 2018).

27. See, for instance, (International Energy Agency (IEA), 2019).

Arguably, the main technological challenges are on the energy demand side. About 20–25% of final energy demand[28] is electricity, which can in principle be generated from renewable sources. The complexity is in the other 75–80%, which today requires energy from fossil fuels.[29] A substantial part of this 75–80% is from harder-to-abate sectors such as heavy industries (cement, steel, plastics) and heavy-duty transportation (trucking, shipping and aviation), where low-carbon technologies are either unavailable or economically unviable.

In a recent report, the (Energy Transitions Commission (ETC), 2018) describes options for decarbonising these harder-to-abate sectors by 2050.[30] All require a combination of approaches that include energy efficiency, recycling, logistics efficiency and low-carbon technologies. For heavy industries, the latter include hydrogen, biomass and carbon capture and storage (CCS), in addition to direct electrification. For heavy-duty transportation, the report distinguishes between trucking on the one hand (electric engines and hydrogen) and shipping and aviation on the other (biofuels, ammonia and possibly hydrogen for shorter distances).

The ETC emphasises the need for supportive public policy, in particular the need for carbon prices that reflect their true cost to society *(social cost of carbon)* and public investments in innovation.[31] Carbon prices are also instrumental in decarbonising the agricultural sector and for creating the right incentives that stimulate negative-emissions technologies, including CCS.

28. Final demand is total demand less demand from power utilities that convert primary energy sources—fossil-based and renewables—into electricity.

29. See (Gates, 2018): https://www.gatesnotes.com/Energy/My-plan-for-fighting-climate-change.

30. The ETC was set up to help identify pathways for change in energy systems to ensure better growth and a better climate. It is led by Adair Turner, amongst others former chair of the UK Financial Services Authority, and brings together experts from energy companies, industry disruptors, investors, equipment suppliers, non-profit organisations, advisors, and academics.

31. The crucial role of the public sector is explained in great detail by (Mazzucato, 2015).

3 Framework to Address Climate Change, Pollution and Emissions in Our Investment Portfolio

PFZW addresses climate change, pollution and emissions from three different (and partially overlapping) perspectives: financial materiality (the way in which climate change, pollution and emissions influence risk and return), positive and negative impact (in terms of societal and environmental changes). Table 1 provides the standards we apply as a framework to assess key issues and risks. Whilst other standards may exist, we feel these standards best enable us to address and prioritise issues. Moreover, we see these standards increasingly finding their way into legislation and regulation.[32]

Objectives	*Relevant standards*
Integrating climate change, pollution and emissions as financially material risks and opportunities in investment decisions	• Sustainability Accounting Standards Board (SASB) materiality map[33] • Task Force on Climate-related Financial Disclosures
Reducing negative social and environmental impacts related to climate change, pollution and emissions	• Paris Agreement • Netherlands Climate Agreement • OECD Guidelines for Multinational Enterprises • UN Guiding Principles on Business and Human Rights (UNGPs)
Increasing positive social and environmental impacts related to climate change, pollution and emissions	• UN Sustainable Development Goals (SDGs)[34] • Netherlands Climate Agreement

3.1 Integrating Financially Material Risks and Opportunities in Investment Decisions

3.1.1 Financial Risks

Climate-related financial risks are typically divided into physical and transition. Physical risks refer to the *consequences* of climate change. Physical risks can be chronic (changes in temperatures and precipitation leading to rising sea levels or droughts) or acute (extreme weather events like hurricanes or floods). Transition risks emerge if the *causes* of climate change—GHG emissions—are reduced or taken away. Proven reserves and companies dependent on those reserves are at risk of being downgraded (*stranded assets*).

In his landmark speech *Breaking the Tragedy of the Horizon*, former Bank of England governor and former chair of the Financial Stability Board Mark Carney discussed a third risk, liability.[35] Liability risk is closely related to physical risk. It emerges as victims of physical damages will seek compensation from others. Carney referred to insurance companies in particular—his speech was delivered at Lloyd's—but liability risks need not be limited to insurance companies. Carbon-intensive companies in particular could also be at risk.[36]

32. E.g. the OECD guidelines are to be translated into regulation and reporting requirements.

33. See SASB (2018): https://materiality.sasb.org/.

34. See UN: https://www.un.org/sustainabledevelopment/.

35. See (Carney, 2015): https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability.pdf.

36. The first lawsuits against energy companies have been filed already, although these refer to rather specific cases, such as misleading investors (New York vs. ExxonMobil) or divesting from fossil fuels (Milieudefensie vs. Shell), rather than seeking compensation for past damages.

Physical and transition risks are not new. Extreme weather events are of all times. However, their frequency and severity increase as a result of climate change. Likewise, transitions happen whenever disruptive companies successfully challenge incumbents that are slow to adapt to new technologies or consumer preferences. The scale of the energy transition is however unprecedented.

In a world that is on a trajectory towards more than 3°C global warming (see Section 2.3), we must prepare for physical as well as transition risks. Physical risks are already materialising (Section 2.2), and so are transition risks, e.g., in power utilities (from coal to gas and renewables) and in automobiles (from internal combustion engines to electrical vehicles).

A key question is how these risks are reflected in valuations. Taking some risk is inherent to investment management and essential to our core task, providing a good pension at acceptable costs. This is true for traditional risks, such as interest rate risk, equity price risk, credit risk, etc. It is also true for climate-related financial risks. In line with, among others, the Network on Greening the Financial System or the Principles for Responsible Investment, we believe that some clime-related financial risks are currently underestimated and, hence, that some assets appear overvalued.[37]

We assess the financial materiality of climate-related risks and opportunities. A summary of a recent assessment can be found in the TCFD report of our asset manager PGGM.[38] Among other things, this risk assessment demonstrates that:

- Climate change affects virtually all sectors we invest in. SASB's Materiality Map confirms that very few sectors and industries are immune to climate change, pollution and emissions;[39]
- At the sector level, transition risks in a 2°C scenario are more pronounced than physical risks in a 4°C scenario. This is because transition risks are expected to happen more near-term and, hence, have a greater impact on net present values. Transition risks are, however, more balanced than physical risks, with some sectors winning and others losing from the transition;
- Sectors that perform well in 2°C scenario tend to underperform in a 4°C scenario, and vice versa.

Physical and transition risks are substantial, but still manageable in a well-diversified portfolio, provided the world is heading for an orderly transition.[40] The two main drivers of this transition are policy and technology. Public policy, in particular carbon prices, creates financial incentives for decarbonisation. Technology is needed to decarbonise hard-to-abate sectors and can facilitate the transition in other sectors without drastic changes in lifestyle.

To manage financially material risks, we need relevant, reliable and comparable information from investee companies. We expect companies to be transparent about their exposures and their approach towards managing them. We encourage them to adopt the framework of the

37. See (Network for Greening the Financial System, 2019) or (Chatterjee, 2019). We note, however, that it is difficult to assess whether and to what extent climate-related risks are adequately reflected in market prices, particularly as the likelihood of various climate scenarios depends on global policy decisions, which are inherently unpredictable. Moreover, mispricings are unlikely to persist: as markets become more familiar with the risks of climate change, and policy uncertainty diminishes, mispricings should eventually disappear.

38. See (PGGM, 2019): Climate-related Risks and Opportunities. More detailed follow-up studies can be found in, amongst others, (Carbon Risk Real Estate Monitor (CRREM), 2019) and (PGGM, n.d.)

39. See (Sustainability Accounting Standards Board (SASB), n.d.). The most relevant factors include all indicators under Environment, and Product Design & Lifecycle Management and Physical Impacts of Climate Change under Business Model & Innovation. At least one of these indicators is considered material for a number of industries in a sector.

40. See also (Schotten, van Ewijk, Regelink, Dicou, & Kakes, 2016), Time for Transition, or (Vermeulen, et al., 2018), An Energy Transition Risk Stress Test for the Financial System of the Netherlands.

Task Force on Climate-related Financial Disclosures (TCFD) and report on governance, strategy, risk management, as well as metrics and targets in relation to climate change.[41] For direct investments in e.g., real estate and infrastructure, we increasingly rely on big data.

3.1.2 Opportunities

Climate change also brings substantial investment opportunities in mitigation (energy transition) and adaptation. Globally, the amount needed for the energy transition is estimated to be at least USD 1 trillion annually (the "clean trillion"),[42] although some put the figure significantly higher. In his influential Review on the Economics of Climate Change, Stern (2006) estimates that the costs of stabilising GHG emissions amount to approximately 1% of GDP, subsequently revised to 2%, or approximately USD 1.5 trillion annually today.[43] The PBL Netherlands Environmental Assessment Agency projects average annual mitigation costs in the range of 1–3% of global GDP for a medium to likely chance of achieving temperature increases of not more than 2°C.[44] The European Commission reports an annual investment gap of nearly EUR 180 billion to achieve EU climate and energy targets by 2030.[45] For the Netherlands, McKinsey (2016) puts the figure at EUR 10 billion annually until 2040.[46]

At the same time, more investments in adaptation are needed to protect against rising sea levels and extreme weather. The majority of climate adaptation is publicly funded, with private investors contributing indirectly through investments in government or municipal bonds. Increasingly, however, governments and others are looking at private investors to contribute more directly to adaptation.[47]

For society, the benefits of mitigation outweigh the costs.[48] This does not imply, however, that all mitigation opportunities are investable. This can be seen, for instance, from a GHG cost abatement curve. Figure 6 shows an early curve (from 2009), introduced by McKinsey. The width of each bar represents the potential carbon reduction of the activity; the height is an estimate of the net cost until 2030. Negative bars (on the left of the chart) imply a cost saving, while positive bars (on the right) represent a net cost. It appears that this particular curve has underestimated the efficiency gains in renewable energy like wind and solar, and in battery technologies.[49] Still, it is clear that many carbon reduction propositions are not investable without some form of public support. This is true, among other things, for CCS and nuclear energy. Higher carbon prices would affect the cost/benefit trade-off of all propositions and make more of them investable.

41. See (Task Force on Climate-related Financial Disclosures (TCFD), 2017): https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf.

42. See (CERES, 2014), Investing in the Clean Trillion.

43. See (Stern, 2006), Review on the Economics of Climate Change.

44. See (Hof, Boot, van Vuuren, & van Minnen, 2014).

45. See (European Commission, 2018): Action Plan: Financing Sustainable Growth.

46. See (Roelofsen, de Pee, & Speelman, 2016):.

47. See e.g., (Climate Action Network Europe, 2013): Climate Change Adaptation and the Role of the Private Sector.

48. Stern (2006) and the PBL, among many others, argue that, in the long run, the benefits of mitigation outweigh the costs. The PBL projects that costs will increase rapidly beyond 2.5°C. Indicative figures are 7% to 25% for a warming of 5°C. Stern and PBL warn, however, that costs and benefits are unevenly distributed among countries.

49. This is readily acknowledged by McKinsey. See (McKinsey & Company, 2017).

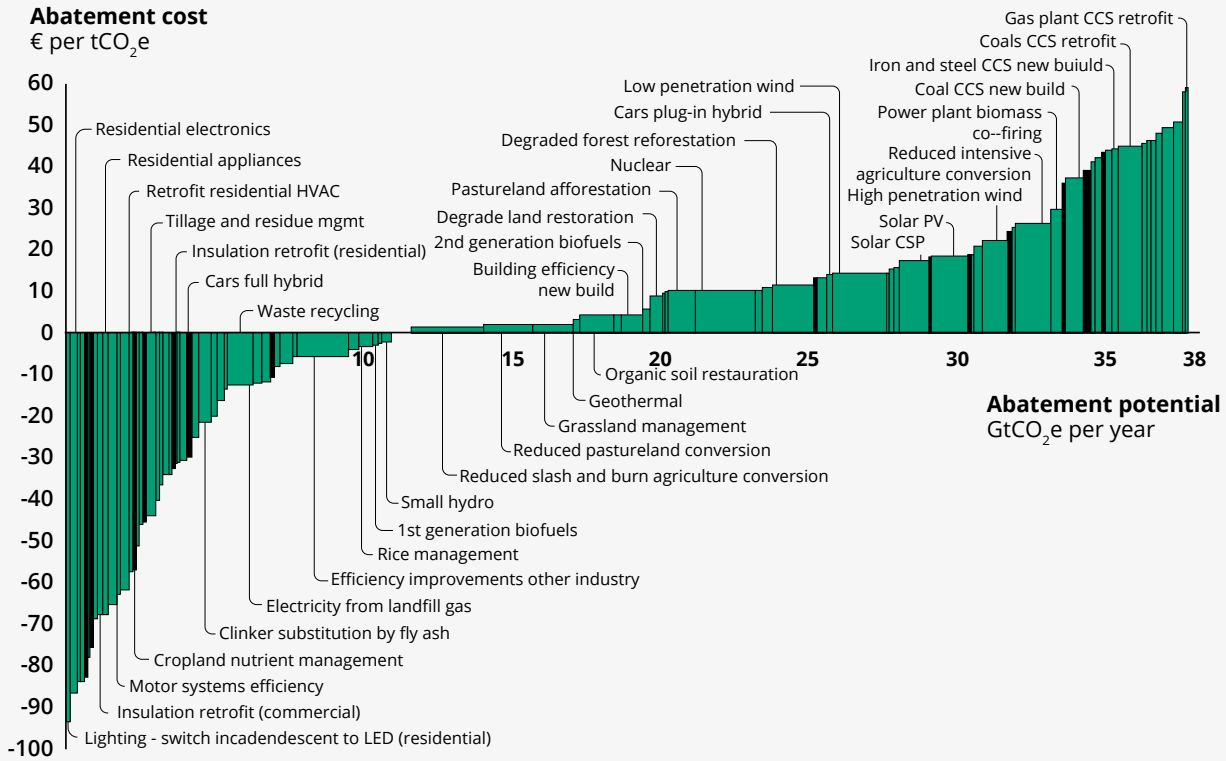


Figure 6. GHG Abatement Cost Curve
Source: (McKinsey & Company, 2009)

3.1.3 Portfolio Resilience

We invest for the long term. Above all, this implies balancing risks and expected returns. We manage our investments not only for the most likely or most desired outcome, but for a range of plausible scenarios. This is true for traditional risk factors such as interest rates, equity prices, inflation, etc. It is also true for climate change scenarios. It is our fiduciary duty to ensure that our portfolio is resilient under all scenarios that we consider plausible, even if those are undesirable from a socioecological perspective.[50]

We acknowledge that climate change poses a systemic risk that potentially compromises financial returns across a broad category of investments.[51] It is thus in our own interest—for financial and socioecological reasons—to avoid worst-case climate scenarios. Through active ownership, we exercise our influence to improve companies and thus reduce the likelihood of such scenarios. We invest in companies that provide solutions. Still, our influence is not unlimited.

Eliminating systemic climate risk—i.e., a tragedy of the commons[52] as much as a tragedy of the horizon—requires collective action. This is best achieved through government intervention such as carbon taxes that increase the cost of pollution, or restrictions on the use of certain products. We support carbon taxes that reflect their socioecological cost, provided they are designed in the right way,[53] and use our influence to encourage governments to implement them. We analyse the potential impact of such taxes on the value of our investments, to ensure that our portfolio is resilient to a sudden rise in carbon prices.

50. One might summarise this strategy as "Hope for the best, but prepare for the worst."

51. See, for instance, (Mercer, 2019): Investing in a Time of Climate Change: The Sequel 2019.

52. See, e.g., (Frischmann, 2018): https://blogs.scientificamerican.com/observations/the-tragedy-of-the-commons-revisited/.

53. This implies, in particular, that governments spend the additional income wisely, e.g., through targeted subsidies on innovative technologies, or lower taxes on income. See e.g., (Parry, 2015): The Right Price. Also, it is important to ensure a level-playing field and avoid a loss of competitiveness if neighbouring countries do

3.2 Reducing Negative Social and Environmental Impact

We aim to reduce the negative impact related to climate change, pollution and emissions through our investment decisions and through active ownership. Since 2016, we have been reducing the carbon footprint of our listed equity investments, with the ambition of halving the carbon intensity by 2020.[54] Within the energy, utilities and materials sectors, we divest from the most carbon-intensive companies, and rebalance into more carbon-efficient companies. Utilities that generate more than 30% of their electricity from coal-fired power plants and energy companies that extract more than 10% of their oil from tar sands are excluded. Through divesting from carbon-intensive companies, we signal to these companies that high emissions are a concern to us, and encourage them to improve.

In 2019, we signed the financial sector commitment to the Dutch Climate Agreement.[55] This commitment involves, among other things, that we will measure and disclose the carbon footprint of all relevant investments, and that we formulate (additional) footprint reduction plans by 2022 at the latest.

In our Responsible Investment Policy,[56] we have committed ourselves to the OECD Guidelines for Multinational Enterprises[57] and the UN Guiding Principles on Business and Human Rights (UNGPs).[58] We expect companies we invest in to take these standards into account in their business practices. We consider human rights, labour rights, health and safety, natural resources and environmental protection important Responsible Business Conduct (RBC) topics.

Human rights, labour rights, health and safety

PFZW's position regarding human rights, labour rights, and health and safety is explained in PFZW's Human Rights Policy.[59] This policy is applicable to all of PFZW's investments.

The energy transition brings specific human rights issues. The transition creates new job opportunities, but workers in the fossil fuel industries may not have the right skills and expertise. We encourage companies making the transition to provide training in order to retain staff and, where this is not possible, to provide a safety net for workers becoming redundant. Also, renewable energy—on-shore wind in particular—can arouse local protests. We expect companies to involve local communities in extensive stakeholder dialogues. These aspects are collectively known as the just transition.

---

not implement similar policies. (Farid, et al., 2016), however, argue that even moving unilaterally may be in many countries' own interests, as improvements in air quality tend to outweigh losses, if any, from reduced competitiveness.

54. See https://www.pggm.nl/english/who-we-are/press/Pages/PFZW-halves-the-CO_2-footprint-of-its-investments.aspx for more details.

55. See (Government of the Netherlands, 2019, pp. 239-240).

56. See PFZW (2014): https://www.pfzw.nl/Documents/Over-ons/verantwoord-beleggen/Beleid_Verantwoord_Beleggen.pdf.

57. See OECD (2011): http://www.oecd.org/daf/inv/mne/48004323.pdf.

58. See UN (2011): https://www.ohchr.org/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf.

59. See PGGM (2016): https://www.pggm.nl/english/what-we-think/Documents/PGGM-Human-Rights-Policy_2016.pdf.

For companies in the mining, oil and gas industries, we see the OECD Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractive Sector as relevant guidance that can help them in avoiding and addressing adverse impacts.[60] Companies in these industries should:

- Integrate stakeholder engagement into project planning and regular business operations through sharing of decision-making power with interested and affected parties;
- Practice stakeholder engagement that is driven by stakeholders through ongoing consultation and follow-through;
- Develop a stakeholder engagement strategy which prioritises most severely affected rather than most influential stakeholders.

Environmental protection

Negative impacts on air, land, soil, water, forests and biodiversity should, to the extent possible, be prevented, minimised and remedied. We encourage companies to reduce GHG emissions where possible, to be efficient in their consumption of energy and natural resources, and to report on their performance. Specifically, we request investee companies to:

- Implement a strong governance framework which clearly articulates the board's accountability and oversight of climate change risks and opportunities;
- Take action to reduce GHG emissions across the value chain;
- Provide enhanced corporate disclosure in line with the recommendations of the TCFD.[61]

The selection of engagement companies and prioritisation of engagement activities is delegated to our asset manager.

3.3 Increasing Positive Social and Environmental Impact

The United Nations have adopted four SDGs with direct links to climate change, pollution and emissions:

- SDG7: Ensure access to affordable, reliable, sustainable and modern energy;
- SDG11: Make cities inclusive, safe, resilient and sustainable;
- SDG12: Responsible consumption and production;
- SDG13: Take urgent action to combat climate change and its impacts.

We have an the ambition to double our positive impact to these and three other focus SDGs, related to our focus themes "people & health" and "climate change", by 2025. This ambition comes on top of our previous ambition to quadruple our investments in solutions, from €5 billion in 2014 to €20 billion in 2020. Through the Dutch Climate Agreement, we have committed, among other things, to invest on a best-effort basis in the energy transition within the constraints posed by the regulatory framework and risk/return constraints.[62]

The energy transition creates investment opportunities to contribute to a low-carbon economy. We invest in energy efficiency and renewable energy through public and private markets. We support and encourage energy producers and users in making the transition from fossil fuels to renewables, in their products and processes. We encourage companies with credible transition plans to issue green bonds that we can invest in. We invest in older real estate with the aim of renovating buildings and making them energy efficient.

As Figure 6 demonstrates, a wide range of investment opportunities exists with a positive societal or environmental impact as well as a market risk-adjusted rate of return. We actively seek investment opportunities that contribute to climate mitigation and at the same time generate a competitive risk-adjusted return. This contribution must be measurable. There are various metrics for measuring climate mitigation. The two most frequently used are renewable energy produced and GHG emissions avoided.

60. See (OECD, 2017): http://www.oecd.org/publications/oecd-due-diligence-guidance-for-meaningful-stakeholder-engagement-in-the-extractive-sector-9789264252462-en.htm.

61. See (Task Force on Climate-related Financial Disclosures (TCFD), 2017).

62. See (Government of the Netherlands, 2019, pp. 239-240).

4 Conclusions and Further Steps

Climate change, pollution and emissions is considered one of the main global risks for society. It also brings financial risks to investment portfolios. We manage these risks through a combination of portfolio reallocation and engagement, in line with industry standards. The energy transition brings new opportunities, many—although not all—investable. Our objective is to have a portfolio that is resilient under various climate scenarios, while at the same time generating positive impact where we can, and avoiding negative impact.

The publication of this policy paper coincides with the conclusion of our investment policy 2020, which had climate change, pollution and emissions as one of its focus themes. In 2014, we formulated strong sustainability ambitions, including the ambition to halve the carbon intensity of our listed equity portfolio and to quadruple our investments in solutions for societal challenges, including climate change. Today, we are proud to have delivered on these ambitions, and nearly succeeded in reaching all of our goals. We are also happy to see that other investors are taking similar steps. At the same time, we must also acknowledge that global emissions are still on the rise, despite a temporary drop due to Covid-19, emphasising the need to coordinated policy action.

Going forward, we continue to explore new opportunities to contribute to the energy transition. A concrete example is a new private equity mandate to invest in sustainable solutions for societal challenges, including climate change, pollution and emissions.

5 References

- Australian Council of Superannuation Investors. (2016). *Fossil Fuel Investments*. Australian Council of Superannuation Investors. Retrieved from https://www.acsi.org.au/images/16FossilFuelInvestments.pdf
- Blitz, D., & Swinkels, L. (2020). Is Exclusion Effective? *Journal of Portfolio Management*, 1–7.
- Carbon Risk Real Estate Monitor (CRREM). (2019). *Stranding Risk & Carbon: Science-Based Decarbonising of the EU Commercial Real Estate Sector*.
- Carbon Tracker. (2011). *Unburnable Carbon: Are the World's Financial Markets Carrying a Carbon Bubble?* Carbon Tracker. Retrieved from https://www.carbontracker.org/reports/carbon-bubble/
- CarbonBrief. (2017, 4 5). *Carbon Countdown*. Retrieved from https://www.carbonbrief.org/analysis-four-years-left-one-point-five-carbon-budget
- Carney, M. (2015). *Breaking the Tragedy of the Horizon – Climate Change and Financial Stability*. London: Bank of England. Retrieved from https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability.pdf
- CERES. (2014). *Investing in the Clean Trillion: Closing The Clean Energy Investment Gap*. Retrieved from https://www.ceres.org/resources/reports/investing-clean-trillion-closing-clean-energy-investment-gap
- Chatterjee, S. (2019). *Markets are Underprepared for Climate-related Policy Risks*. Retrieved from https://www.unpri.org/markets-are-underprepared-for-climate-related-policy-risks/4823.article
- Climate Action Network Europe. (2013). *Climate Change Adaptation and the Role of the Private Sector: Creating Effective Tools for Private Sector Engagement*.
- Climate Action Tracker. (2019, 4 8). *2100 Warming Projections*. Retrieved from https://climateactiontracker.org/global/temperatures/
- De Nederlandsche Bank (DNB). (2018). SDG impact indicators: *A guide for investors and companies*. Amsterdam: DNB.
- DNV GL. (2018). *Energy Transition Outlook 2018: A Global and Regional Forecast to 2050*. DNV GL. Retrieved from https://annualreport.dnvgl.com/2018/#Energy-Transition-Outlook
- Energy Transitions Commission (ETC). (2018). *Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century*. Retrieved from http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf
- European Commission. (2018). *Action Plan: Financing Sustainable Growth*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0097
- European Commission. (2019b). *Communication on The European Green Deal*.
- European Commission. (2020). *State of the Union: Commission raises climate ambition and proposes 55% cut in emissions by 2030*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1599
- European Commission. (n.d.). 2030 *Climate & Energy Framework*. Retrieved from https://ec.europa.eu/clima/policies/strategies/2030_en
- European Environment Agency. (2019, 3 5). *Observed trends in total global greenhouse gas concentrations, including aerosols*. Retrieved from https://www.eea.europa.eu/data-and-maps/daviz/observed-trends-in-total-global-5#tab-chart_3
- Farid, M., Keen, M., Papaioannou, M. G., Parry, I. W., Pattillo, C. A., & Ter-Martirosyan, A. (2016). *After Paris: Fiscal, Macroeconomic and Financial Implications of Global Climate Change*. 16(01). Retrieved from https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/sdn/2016/_sdn1601.ashx
- Frischmann, B. (2018). *The Tragedy of the Commons, Revisited*. Retrieved from https://blogs.scientificamerican.com/observations/the-tragedy-of-the-commons-revisited/
- Gates, B. (2018). *Climate Change and the 75% Problem*. Retrieved from https://www.gatesnotes.com/Energy/My-plan-for-fighting-climate-change
- Government of the Netherlands. (2019). *Climate Agreement*. Retrieved from https://www.klimaatakkoord.nl/binaries/klimaatakkoord/documenten/publicaties/2018/12/21/ontwerp-klimaatakkoord/Ontwerp+van+het+Klimaatakkoord_compleet_web.pdf
- Greenhouse Gas Protocol. (2004). *Corporate Accounting and Reporting Standard*. World Resources Institute and World Business Council for Sustainable Development. Retrieved from http://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf
- Guggenheim, D. (Director). (2006). *An Inconvenient Truth* [Motion Picture].

- Hausfather, Z. (2018). *Analysis: How Much 'Carbon Budget' is Left to Limit Global Warming to 1.5C?* Retrieved from https://www.carbonbrief.org/analysis-how-much-carbon-budget-is-left-to-limit-global-warming-to-1-5c
- Hoeppe, P. (2016). Trends in Weather Related Disasters – Consequences for Insurers and Society. *Weather and Climate Extremes*, 70-79.
- Hof, A., Boot, P., van Vuuren, D., & van Minnen, J. (2014). *Costs and Benefits of Climate Change Adaptation and Mitigation: An Assessment on Different Regional Scales*. PBL Netherlands Environmental Assessment Agency.
- Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment*. Cambridge, UK and New York, USA: Cambridge University Press.
- Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate Change 2014: Synthesis Report*. Geneva: IPCC.
- Intergovernmental Panel on Climate Change (IPCC). (2018). *Global Warming of 1.5°C*.
- Intergovernmental Panel on Climate Change (IPCC), Working Group I. (2013). *Climate Change 2013: The Physical Science Basis*. Cambridge, UK and New York, USA: Cambridge University Press.
- International Association of Insurance Supervisors. (2018). *Issues Paper on Climate Change Risks to the Insurance Sector*. Basel: International Association of Insurance Supervisors.
- International Energy Agency (IEA). (2019). *World Energy Balances: Overview*. International Energy Agency. Retrieved from https://webstore.iea.org/world-energy-balances-2019-overview
- International Energy Agency (IEA). (2019). *World Energy Outlook*. Retrieved from https://www.iea.org/weo2018/
- Mazzucato, M. (2015). The Entrepreneurial State: *Debunking Public vs. Private Sector Myths* (Revised ed.). PublicAffairs.
- McKinsey & Company. (2009). *Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve*. McKinsey & Company. Retrieved from https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Pathways%20to%20a%20low%20carbon%20economy/Pathways%20to%20a%20low%20carbon%20economy.ashx
- McKinsey & Company. (2017). *A Revolutionary Tool for Cutting Emissions, Ten Years on*. Retrieved from https://www.mckinsey.com/about-us/new-at-mckinsey-blog/a-revolutionary-tool-for-cutting-emissions-ten-years-on
- Mercer. (2019). *Investing in a Time of Climate Change: The Sequel 2019*. Mercer.
- NASA. (n.d.). *Carbon Dioxide*. Retrieved from https://climate.nasa.gov/vital-signs/carbon-dioxide/
- NASA. (n.d.). *Global Temperature*. Retrieved from https://climate.nasa.gov/vital-signs/global-temperature/
- Network for Greening the Financial System. (2019). *A Call for Action: Climate Change as a Source of Financial Risk*.
- OECD. (2011). OECD *Guidelines for Multinational Enterprises*. Paris: OECD.
- OECD. (2017). *Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractive Sector*. Paris: OECD. Retrieved from http://www.oecd.org/publications/oecd-due-diligence-guidance-for-meaningful-stakeholder-engagement-in-the-extractive-sector-9789264252462-en.htm
- Olivier, J. G., & Peters, J. A. (2020). *Trends in Global CO_2 and Total Greenhouse Gas Emissions: 2019 Report*. Den haag: PBL Netherlands Environmental Assessment Agency. Retrieved from https://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2018-trends-in-global-CO_2-and-total-greenhouse-gas-emissons-2018-report_3125.pdf
- Parry, I. (2015). The Right Price. *Finance & Development*. Retrieved from https://www.imf.org/external/pubs/ft/fandd/2015/12/pdf/parry.pdf
- PBL Netherlands Environmental Assessment Agency. (2015). *Wat zijn de gevolgen van het broeikaseffect?* Opgehaald van https://www.pbl.nl/onderwerpen/klimaatverandering/vraag-en-antwoord/wat-zijn-de-gevolgen-van-het-broeikaseffect
- Pensioenfonds Zorg en Welzijn (PFZW). (2014, June). Retrieved from Beleggingsbeleid 2020: https://www.pfzw.nl/Documents/Over-ons/PFZW_Beleggingsbeleid_2020.pdf
- Pensioenfonds Zorg en Welzijn (PFZW). (2014, June). Retrieved from Beleid Verantwoord Beleggen: https://www.pfzw.nl/Documents/Over-ons/verantwoord-beleggen/Beleid_Verantwoord_Beleggen.pdf
- PFZW. (2014). *Beleggingsbeleid 2020*.
- PFZW. (n.d.). *Jaarbericht Duurzaam Beleggen*. Retrieved from https://duurzaambeleggen.jaarverslagpfzw.nl/

- PGGM. (n.d.). Retrieved from Investing in solutions: https://www.pggm.nl/english/what-we-do/Pages/Investing-in-solutions.aspx
- PGGM. (n.d.). Retrieved from Impact: https://www.pggm.nl/english/what-we-do/Pages/BiO_Impact.aspx
- PGGM & Munich Re. (2019). *Climate Risk Assessment in Global Real Estate Investing*.
- PGGM. (2016, December 7). Retrieved from Dutch financial sector backs SDGs: https://www.pggm.nl/english/who-we-are/press/Pages/Dutch-financial-sector-backs-the-SDGs.aspx
- PGGM. (2016). Retrieved from Human Rights Policy: https://www.pggm.nl/english/what-we-think/Documents/PGGM-Human-Rights-Policy_2016.pdf
- PGGM. (2019). Climate-Related Risks and Opportunities. Retrieved from https://www.pggm.nl/media/hnhphzlv/tcfd-report_2018.pdf
- PGGM Vermogensbeheer B.V. (2014). *Responsible Investment Implementation Framework*. Zeist: PGGM.
- Roelofsen, O., de Pee, A., & Speelman, E. (2016). *Accelerating the energy transition: cost or opportunity?* Amsterdam: McKinsey & Company. Retrieved from https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Europe/Accelerating%20the%20energy%20transition%20Cost%20or%20opportunity/Accelerating-the-energy-transition-Cost-or-opportunity.ashx
- Schotten, G., van Ewijk, S., Regelink, M., Dicou, D., & Kakes, J. (2016). *Time for Transition: An Exploratory Study of the Transition to a Carbon-Neutral Economy*. Amsterdam: De Nederlandsche Bank.
- Schulten, A., Bertolotti, A., Hayes, P., & Madaan, A. (2019). *Getting Physical*. BlackRock. Retrieved from https://www.blackrock.com/us/individual/literature/whitepaper/bii-physical-climate-risks-april-2019.pdf
- Stern, N. (2006). *Stern Review on the Economics of Climate Change* . Cambridge University Press .
- Sustainability Accounting Standards Board (SASB). (2018). Retrieved from SASB Materiality Map: https://materiality.sasb.org/
- Sustainability Accounting Standards Board (SASB). (n.d.). *Materiality Map*. Retrieved from https://materiality.sasb.org/
- Sweet, W. V., Kopp, R. E., Weaver, C. P., Obeysekera, J., Horton, R. M., Thieler, E. R., & Zervas, C. (2017). *Global and Regional Sea Level Rise Scenarios for the United States*. Silver Spring, MD: NOAA/NOS Center for Operational Oceanographic Products and Services.
- Task Force on Climate-related Financial Disclosures (TCFD). (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. Retrieved from https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf
- UN Environment. (2018). *Emissions Gap Report*. Retrieved from http://wedocs.unep.org/bitstream/handle/20.500.11822/26895/EGR2018_FullReport_EN.pdf
- UNFCCC. (1992). *United Nations Convention on Climate Change*.
- United Nations (UN). (2011). *Guiding Principles on Business and Human Rights*. New York and Geneva: UN.
- United Nations (UN). (2017). *The World Population Prospects: The 2017 Revision*. New York: UN.
- United Nations (UN). (n.d.). *Sustainable Development Knowlegde Platform*. Retrieved from Sustainable Development Goal 2: https://sustainabledevelopment.un.org/sdg2
- United Nations. (1998). *Kyoto Protocol*. Retrieved from https://unfccc.int/resource/docs/convkp/kpeng.pdf
- United Nations. (2012). *Doha Amendment to the Kyoto Protocol*. Retrieved from https://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf
- United Nations. (2015). *Paris Agreement*. Retrieved from https://unfccc.int/sites/default/files/english_paris_agreement.pdf
- United Nations. (2017). *World Population Projected to Reach 9.8 Billion in 2050, and 11.2 Billion in 2100*. Retrieved from https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html
- United Nations. (2019). *Emissions Gap Report*. Retrieved from https://www.globalcarbonproject.org/carbonbudget/18/files/GCP_CarbonBudget_2018.pdf
- United Nations Framework Convention on Climate Change. (1997). *Kyoto Protocol - Targets for the first commitment period*. Retrieved from https://unfccc.int/process/the-kyoto-protocol
- United Nations. (n.d.). 17 *Goals to Transform Our World*. Retrieved from https://www.un.org/sustainabledevelopment/
- United Nations. (n.d.). *Millennium Development Goals*. Retrieved from https://www.un.org/millenniumgoals/

- Vermeulen, R., Schets, E., Lohuis, M., Kölbl, B., Jansen, D.-J., & Heeringa, W. (2018). *An Energy Transition Risk Stress Test for the Financial System of the Netherlands*. Amsterdam: De Nederlandsche Bank.
- Vousdoukas, M. I., Mentaschi, L., Voukouvalas, E., Verlaan, M., Jevrejeva, S., Jackson, L. P., & Feyen, L. (2018). *Global Probabilistic Projections of Extreme Sea Levels Show Intensification of Coastal Flood Hazard*. Nature Communications, 1-12.
- World Economic Forum (WEF). (2018). *The Global Risks Report 2018*. Cologny: World Economic Forum.
- World Economic Forum (WEF). (2020). *Global Risks Report 2020*. Davos: World Economic Forum. Retrieved from http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf

23-12982 February 2023